



# High-Technology Trade Indicators 2009

An international comparison of the big economic areas and countries

Alexander Loschky

EUR 24096 EN - 2009

The mission of the JRC-IPSC is to provide research results and to support EU policy-makers in their effort towards global security and towards protection of European citizens from accidents, deliberate attacks, fraud and illegal actions against EU policies.

European Commission  
Joint Research Centre  
Institute for the Protection and Security of the Citizen

**Contact information**

Address: Via E.Fermi 2749 TP 361, 21020 Ispra (VA) Italy  
E-mail: Alexander.Loschky@jrc.ec.europa.eu  
Tel.: +39 0332 78 3077  
Fax: +39 0332 78 5733

<http://ipsc.jrc.ec.europa.eu/>  
<http://www.jrc.ec.europa.eu/>

**Legal Notice**

Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use which might be made of this publication.

***Europe Direct is a service to help you find answers  
to your questions about the European Union***

**Freephone number (\*):**

**00 800 6 7 8 9 10 11**

(\* ) Certain mobile telephone operators do not allow access to 00 800 numbers or these calls may be billed.

A great deal of additional information on the European Union is available on the Internet. It can be accessed through the Europa server <http://europa.eu/>

JRC 55698

EUR 24096 EN  
ISSN 1018-5593

Luxembourg: Office for Official Publications of the European Communities

© European Communities, 2009

Reproduction is authorised provided the source is acknowledged

*Printed in Luxembourg*

# **High-Technology Trade Indicators 2009**

**An international comparison of the big economic areas and countries**

**Alexander Loschky**

## Contents:

1.	Introduction .....	2
2.	Concepts and definitions.....	3
3.	Sectoral Approach .....	7
3.1.	World Market Share (Def. 1) – ratio of a country’s exports of its high tech sectors to the world exports of high tech sectors .....	7
3.2.	World Market Share (Def. 2) – ratio of a country’s exports of its high-tech sectors to the world exports .....	12
3.3.	National Market Share (Def. 3) – ratio of a country’s exports of its high-tech sectors to its total exports .....	16
4.	Product Approach .....	19
4.1.	World Market Share (Def. 1) – ratio of a country’s exports of high tech products to the world exports of high tech products.....	19
4.2.	World Market Share (Def. 2) – ratio of a country’s exports of high-tech products to the world exports .....	24
4.3.	National Market Share (Def. 3) – ratio of a country’s exports of high-tech products to its total exports .....	28
5.	Sectoral approach versus product approach.....	32
6.	Detailed analyses of the high-tech product groupings (product approach).....	34
6.1.	Analyses of the export market shares (def. 1) of the different product groups.....	34
6.2.	Share of the exports of R&D intensive product groups in the total exports of the same country (def. 3) .....	40
7.	Per capita high-tech trade .....	43
8.	Ratio of high-tech exports to gross domestic product.....	45
9.	Summary.....	46
	References .....	47
	Annex 1: Manufacturing industries classified according their global technological intensity (ISIC Revision 3).....	48
	Annex 2: High Technology Products List – SITC Rev. 3 (Period 1988-95) .....	49

# 1. Introduction

High-technology is one of the essential actors in the enhancement of economic growth and productivity and high-tech industries are considered as synonymous of high added value and well-paid jobs. The present report gives an overview of the level and development of the foreign trade with high-technology products and by the high-tech industries of the four most important economic areas: the USA, the European Union (EU-27), Japan, and China. In addition to these also the countries participating in the Group of Eight process (G8) – the USA, Japan, Germany, the United Kingdom, France, Italy, Canada, and Russia – are analysed in this report.

For the analyses of the high-tech foreign trade three different definitions of market shares are used: (1) the share of high-tech trade in the world total high-tech trade, (2) the share of high-tech trade in world total trade, and (3) the share of high-tech trade in one country's total trade. For the definition of the high-tech sectors and goods the current classifications of high-tech sectors and product groups of the OECD were applied.

Furthermore, the composition of the high-tech exports and imports of each of the four economic areas is studied and also the per capita high-tech exports and imports as well as the ratio of high-tech exports compared to the gross domestic product (GDP) are examined.

This JRC report on high-technology trade indicators covers the period from the year 2000 to the year 2007 and now includes in the EU figures also data from Bulgaria and Romania, the two countries that joined the European Union in 2007. For this reason and due to new and updated data, the figures from the 2008 JRC report<sup>1</sup> and the current edition are usually not comparable.

---

<sup>1</sup> Loschky, Alexander (2008), High-Technology Trade Indicators 2008 – An international comparison of the big economic areas and countries, Joint Research Centre (JRC): Scientific and Technical Research series.

## 2. Concepts and definitions

Technology is one of the essential actors in the enhancement of economic growth and productivity. Sales of high-tech products are already a vital part of many countries' export performance and high-tech industries are considered as synonymous of high added value and well-paid jobs.

Even if it is actually difficult to estimate countries' performance in developing and commercialising technology, high-tech trade is definitely one important indicator in this direction, as high-tech products are the leading edge of science-based trade and are often the result of considerable R&D investments.

The importance of trading in high-tech products is due to several reasons; for example, it allows a country to carry out R&D, to develop new knowledge, and to transform it into novel advanced goods to be sold in the global market. All such actions are symptoms of an increasing efficiency, supporting a virtuous cycle of learning, enhancing productivity and improving competitiveness.

### Definition of high-technology

Basically, high-tech trade takes into account exports and imports of products requiring a high amount of R&D in their development and / or production.

As not all goods produced by high-tech industries are also high-tech products<sup>2</sup>, two different approaches exist for the calculation of high-tech trade indicators. This report covers both approaches: the product approach and the sectoral approach. The first approach covers the trade of high-tech products as defined by the OECD and the second approach covers the trade of goods by high-tech industries as defined by the OECD (and confirmed in a recent investigation of the JRC<sup>3</sup>).

According to the OECD<sup>4</sup> there are five high-tech industries and nine high-tech product groups:

High-tech industries (sectoral approach):

1. Aerospace
2. Pharmaceutical
3. Computers, office equipment
4. Electronics-communication
5. Precision instruments

High-tech product groups (product approach):

- |   |                             |
|---|-----------------------------|
| 1. Aerospace                                  | 5. Scientific instruments   |
| 2. Computers and office machines              | 6. Electrical machinery     |
| 3. Electronics and telecommunication products | 7. Chemical products        |
| 4. Pharmaceutical products                    | 8. Non-electrical machinery |
|   | 9. Armaments                |

---

<sup>2</sup> A recent study using foreign trade data by enterprise characteristics shows that the share of high-tech goods in the total trade of the high-tech industries is on average only around 34% in Imports and around 47% in Exports. See: Loschky, Alexander and Nuortila, Karo (2009), High-Tech Trade by Enterprise Characteristics, Paper presented at the 2<sup>nd</sup> Meeting of the OECD Working Party on International Trade in Goods and Trade in Services Statistics (WPTGS), 16-18 November 2009 in Paris.

<sup>3</sup> Loschky, Alexander (2008), Reviewing the Nomenclature for High-Technology Trade – The Sectoral Approach, Paper presented at the 1<sup>st</sup> Meeting of the OECD Working Party on International Trade in Goods and Trade in Services Statistics (WPTGS), 22-24 September 2008 in Paris.

<sup>4</sup> OECD Handbook on Economic Globalisation Indicators, 2005. Based on: Hatzichronoglou, Thomas (1997), "Revision of the High-Technology Sector and Product Classification" in: OECD Science, Technology and Industry Working Papers, 1997/2.

## **Data basis**

The trade data was compiled exclusively from the Comtrade Database of the United Nations.<sup>5</sup> Other data used in this report on GDP, population, etc. came also from UN sources.

## **Methodology and Concepts**

As a rule, foreign trade statistics are based on customs declarations but for the EU Member States, the statistical information is provided by the traders' customs declarations (extra-EU trade) and direct enterprise declarations (intra-EU trade). Data is collected by the competent national authorities of the Member States and compiled according to a harmonised methodology established by EU regulations before transmitted to Eurostat and being published in the Comext database<sup>6</sup> (community concept). However, in order to enhance international comparability also for the EU Member States the data from the UN Comtrade database was used.

In order to get an approximation to the Extrastat concept, the exports to other EU Member States were deducted from the total EU exports and the imports from other EU Member States were deducted from the total EU imports. This approach coincides with the methodology proposed by the OECD for the measurement of intra-regional and extra-regional trade.<sup>7</sup> An alternative calculation prepared for last year's report using Comext data for the EU Member States did not show major differences in the percentages compared to the current method. For the non EU countries, data is based on national concepts.

## **Country coverage**

The countries covered in this study are the Member States of the EU-27 (considered as an aggregate), Japan, the USA, and China. Therefore, in this report intra-EU-27 trade figures are omitted and only extra-EU exports are considered when calculating the indicator for the EU-27 as a whole.

In addition, some indicators were calculated for the countries participating in the international forum *Group of Eight (G8)*.<sup>8</sup> In these cases the countries that are EU Member States and G8 members (France, Germany, Italy, and the United Kingdom) show their total trade (the sum of intra-community and extra-community trade).

## **Time coverage**

The indicators are calculated from 2000 to 2007, the latest year where data are available for all countries.

## **Definition of the indicators used**

The analyses carried out in this study focus on import shares and export market shares. The market share is a ratio in which the nominator is the total export of high-tech products from the country under study. Three different denominators can be considered, producing in turn three different indicators:

---

<sup>5</sup> Weblink: <http://comtrade.un.org/>

<sup>6</sup> Weblink: <http://epp.eurostat.ec.europa.eu/newxtweb/>

<sup>7</sup> For details, see OECD Handbook on Economic Globalisation Indicators, 2005, pp. 196-200.

<sup>8</sup> The countries participating in the Group of Eight forum are the Russian Federation and the Group of Seven countries: Canada, France, Germany, Italy, Japan, the United Kingdom, and the USA.

(DEF. 1): ratio of a country's high tech trade to the world high tech trade

This denominator is calculated as the sum of high-tech exports (imports) from all countries. This indicator provides a picture of leading high-tech traders all over the world; leading countries have high percentage of exports (imports) in the high-tech sector with respect to other countries, but no information is provided for non high-tech trading sectors.

Formula:

$$= \frac{\text{high tech trade of country } X}{\text{world high tech trade}}$$

(DEF. 2): ratio of a country's high-tech trade to the world total trade (high-tech and non high-tech)

This denominator is calculated as the sum of exports (imports) over all manufacturing sectors from all countries. This indicator offers information on the country's specialisation in the high-tech sector; leading countries are those having a large percentage of high-tech exports (imports) compared to trade in all sectors (both high and non high-tech).

Formula:

$$= \frac{\text{high tech trade of country } X}{\text{total world trade}}$$

(DEF. 3): ratio of a country's high-tech trade to its total trade

This denominator is the total exports (imports) of the country of interest. This indicator shows the trading performance of a given country, i.e. how much of the country's trading activity is devoted to the high-tech sector. The indicator highlights the most specialised countries in the high-tech sector. This measure is not a measure of market share in the international markets: countries with a high score in DEF 3 could have low scores in DEF 1 and 2.

Formula:

$$= \frac{\text{high tech trade of country } X}{\text{total trade of country } X}$$

Relative trade balance is another indicator of interest. This is obtained by the difference between exports and imports (trade balance) divided by the trade volume (exports plus imports). A positive relative trade balance indicates that exports in the sector under study are higher than imports in the same sector. Dividing the trade balance by the trade volume makes also an international comparison possible.

It must be considered, when interpreting results, that a negative trade balance is not necessarily a negative sign. If a country is experiencing a loss in the domestic production of some goods, a high level of import of those goods can be helpful for the economy, as the knowledge the countries convey can motivate the production of goods in other sectors.



### **Data availability and comparability**

When one of the indicators refers to the world total trade (exports or imports) or the total world trade in high-tech industries (sectoral approach) or with high-tech goods (product approach), it has to be kept in mind that data comparability between years is slightly limited because the number of countries that report their trade to the UN varies over the years and some countries report only on an irregular basis. Hence, the composition and structure of the world total can differ from one year to another. The influence of these variations is however very limited and consequently does not have a significant impact on the assessment of the results.<sup>9</sup>

---

<sup>9</sup> The estimated missing trade of the high-tech industries in the year 2007 is 0.05% of the world total exports and 0.27% of the world total imports of the high-tech industries. The estimated missing trade of high-tech products in the year 2007 is 0.05% of the world total exports and 0.26% of the world total imports of high-tech goods.

### 3. Sectoral Approach

In the sectoral approach, we have used trade data from high-tech sectors as classified in Annex 1 of this report. (The list of high-tech sectors has been updated by the OECD in 2001.<sup>10</sup>) It has to be noted that exports from high-tech industries are not 100% high-tech, but can also include medium-high-tech, medium-tech or low-tech.<sup>11</sup>

#### 3.1. World Market Share (Def. 1) – ratio of a country's exports of its high tech sectors to the world exports of high tech sectors

In the following, the world share for both imports and exports according to definition 1 will be analysed for the four large economic areas (EU-27, USA, Japan, and China) as well as for the G8.

The world market share (Def. 1) is defined as the ratio between the exports of the high-tech industries from the country / area under study and the high tech industries' world export, which is the sum of exports by high-tech industries of all countries (excluding intra EU-27 exports).<sup>12</sup>

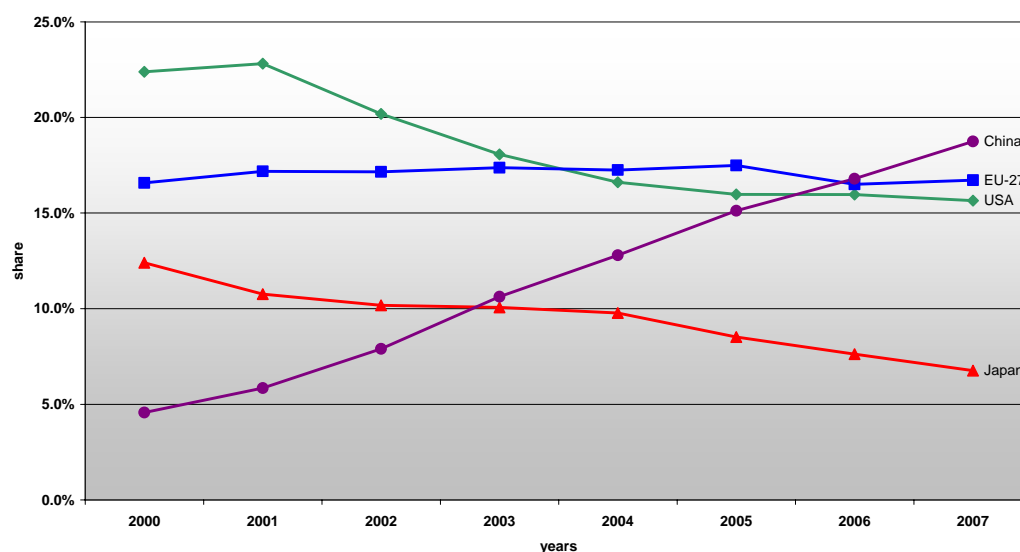
#### EXPORTS

**Table 1: Share of the goods exported by high-tech sectors of the listed countries in relation to the total (world) exports of high-tech sectors (large economic areas)**

	2000	2001	2002	2003	2004	2005	2006	2007
<b>EU-27</b>	16.6%	17.2%	17.2%	17.4%	17.3%	17.5%	16.5%	16.7%
<b>USA</b>	22.4%	22.8%	20.2%	18.1%	16.6%	16.0%	16.0%	15.7%
<b>Japan</b>	12.4%	10.8%	10.2%	10.1%	9.8%	8.5%	7.6%	6.8%
<b>China</b>	4.6%	5.8%	7.9%	10.6%	12.8%	15.1%	16.8%	18.7%
<b>Sum big 4 areas</b>	55.9%	56.6%	55.4%	56.1%	56.4%	57.1%	56.9%	57.9%

**Figure 1**

**World market share of high-tech exports of country X compared to total high-tech exports**



<sup>10</sup> OECD Handbook on Economic Globalisation Indicators, 2005, p. 172.

<sup>11</sup> See Footnote 2.

<sup>12</sup> Due to variations in the number and composition of countries reporting their trade data, the world total can differ (ceteris paribus) very slightly from one year to another.

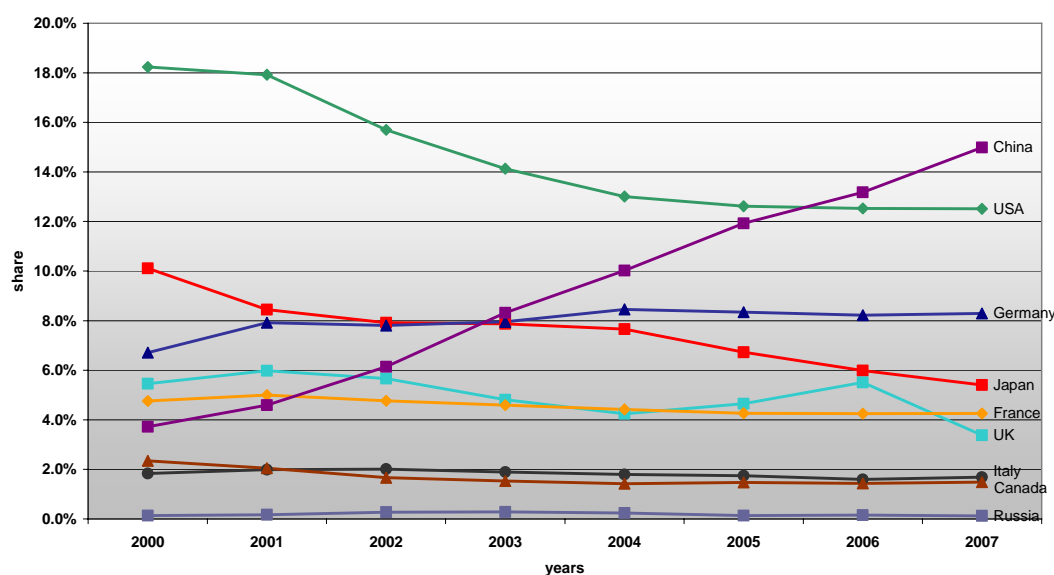
From the Table 1 and Figure 1 it can be seen that the export world market share of high-tech industries in the EU-27 is relatively stable around 17% over the observed period from 2000 to 2007 whilst for the other highly industrialised countries – Japan and the USA – the export world market share of their high-tech industries is declining. China was able to quadruple its market share in the export of goods originating from high-tech industries from less than 5% in the year 2000 to almost 19% in 2007. Summing up, it seems that China was able to increase its market share mainly at the expense of the USA and Japan and did not have a mayor influence on the EU-27.

**Table 2: Share of the goods exported by high-tech sectors of the listed countries in relation to the total (world) exports of high-tech sectors (G8 countries + China)<sup>13</sup>**

	2000	2001	2002	2003	2004	2005	2006	2007
<b>USA</b>	18.2%	17.9%	15.7%	14.1%	13.0%	12.6%	12.5%	12.5%
<b>Japan</b>	10.1%	8.4%	7.9%	7.9%	7.7%	6.7%	6.0%	5.4%
<b>Germany</b>	6.7%	7.9%	7.8%	8.0%	8.5%	8.3%	8.2%	8.3%
<b>United Kingdom</b>	5.5%	6.0%	5.7%	4.8%	4.2%	4.6%	5.5%	3.4%
<b>France</b>	4.8%	5.0%	4.8%	4.6%	4.4%	4.3%	4.2%	4.3%
<b>Italy</b>	1.8%	2.0%	2.0%	1.9%	1.8%	1.7%	1.6%	1.7%
<b>Canada</b>	2.3%	2.0%	1.7%	1.5%	1.4%	1.5%	1.4%	1.5%
<b>Russia</b>	0.1%	0.2%	0.3%	0.3%	0.2%	0.1%	0.2%	0.1%
<b>Sum G8</b>	49.6%	49.5%	45.8%	43.1%	41.2%	40.0%	39.7%	37.1%
China	3.7%	4.6%	6.1%	8.3%	10.0%	11.9%	13.2%	15.0%

**Figure 2**

**World market share of high-tech exports of country X compared to total high-tech exports**



Looking at the G8 and Chinese figures (Table 2), it can be seen that the increase of the Chinese market share in the exports of high-tech industries did not affect much the EU G8 countries France, Germany, and Italy. Germany was even able to increase its market share from 2000 to 2007 (+1.6 percentage

<sup>13</sup> The percentages for the countries shown in this table that are also included in Table 1 (USA, Japan, and China) are lower here, because the world total is defined differently and includes now also the intra-community trade of the EU-27.

points or by 24%). Only the UK recently showed high losses (-38% from 2006 to 2007) after an increase of 30% from 2004 to 2006. The recent decrease is due to the virtual disappearance of the trade with mobile phones (minus 99%). According to HM Customs and Revenue this downturn is the result of a strong decrease in MTIC fraud<sup>14</sup> – a type of VAT fraud – which was triggered by a legislative change<sup>15</sup> introducing the ‘reverse charge’ rule for these goods in December 2006.

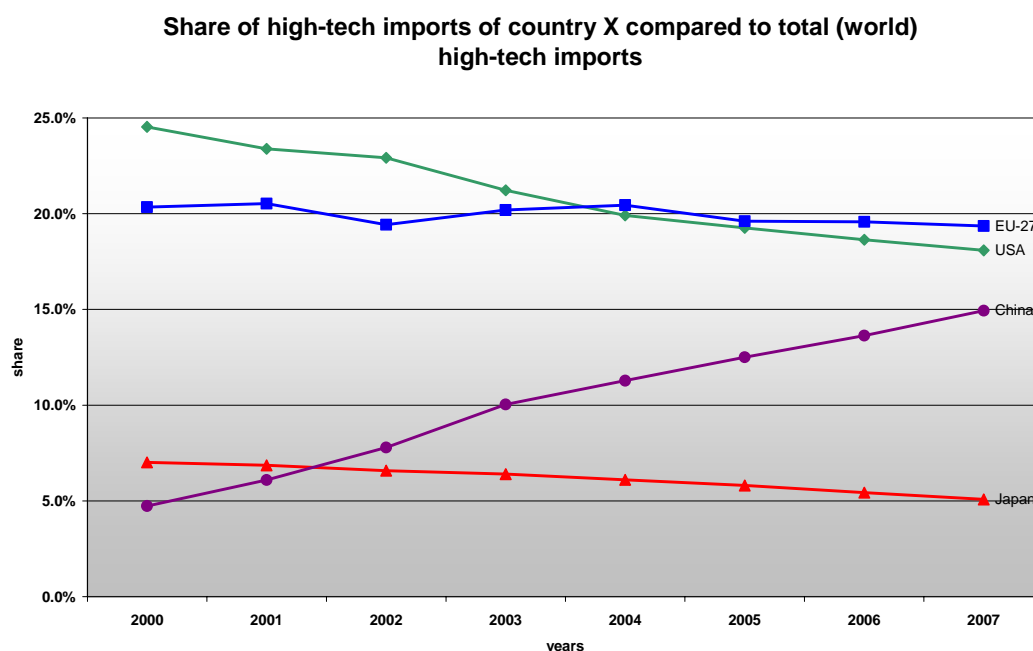
The USA, Japan and to much smaller extent Canada are showing considerable market share losses. In total the G8’s share in the high-tech exports decreased from almost 50% to 37% (-12.4 percentage points or by -25%). At the same time China increased its share 11.3 percentage points (+ 303%).

## IMPORTS

**Table 3: Share of the goods imported by high-tech sectors of the listed countries in relation to the total (world) import of high-tech sectors (large economic areas)**

	2000	2001	2002	2003	2004	2005	2006	2007
<b>EU-27</b>	20.3%	20.5%	19.4%	20.2%	20.4%	19.6%	19.6%	19.4%
<b>USA</b>	24.5%	23.4%	22.9%	21.2%	19.9%	19.3%	18.6%	18.1%
<b>Japan</b>	7.0%	6.9%	6.6%	6.4%	6.1%	5.8%	5.4%	5.1%
<b>China</b>	4.7%	6.1%	7.8%	10.0%	11.3%	12.5%	13.6%	14.9%
<b>Sum big 4 areas</b>	56.6%	56.9%	56.7%	57.8%	57.7%	57.2%	57.3%	57.5%

**Figure 3**



<sup>14</sup> MTIC fraud is largely perpetrated using goods such as mobile phones and computer chips, but also includes other electronic goods. It involves goods imported VAT-free from other EU Member States being sold through contrived business-to-business transaction chains within the importing country, and subsequently exported. The tax loss occurs when the VAT charged on the initial sale of the goods in the importing country is not paid to the tax authorities because the seller disappears. The purchaser can still reclaim the VAT, so the loss crystallises when the trader who exports the goods again makes a repayment claim. Source: Business Brief 10/06 of the HM Revenue & Customs. For more information on MTIC fraud, please refer to the paper by David Ruffles, Geoff Tily, David Caplan, and Sandra Tudor, 2003: “VAT missing trader intra-Community fraud: the effect on Balance of Payments statistics and UK National Accounts” in: *Economic Trends* No. 597, August 2003.

<sup>15</sup> See Business Brief 14/06 of the HM Revenue & Customs:  
[http://customs.hmrc.gov.uk/channelsPortalWebApp/channelsPortalWebApp.portal?\\_nfpb=true&\\_pageLabel=pageVAT\\_ShowContent&id=HMCE\\_PROD1\\_026038&propertyType=document](http://customs.hmrc.gov.uk/channelsPortalWebApp/channelsPortalWebApp.portal?_nfpb=true&_pageLabel=pageVAT_ShowContent&id=HMCE_PROD1_026038&propertyType=document)

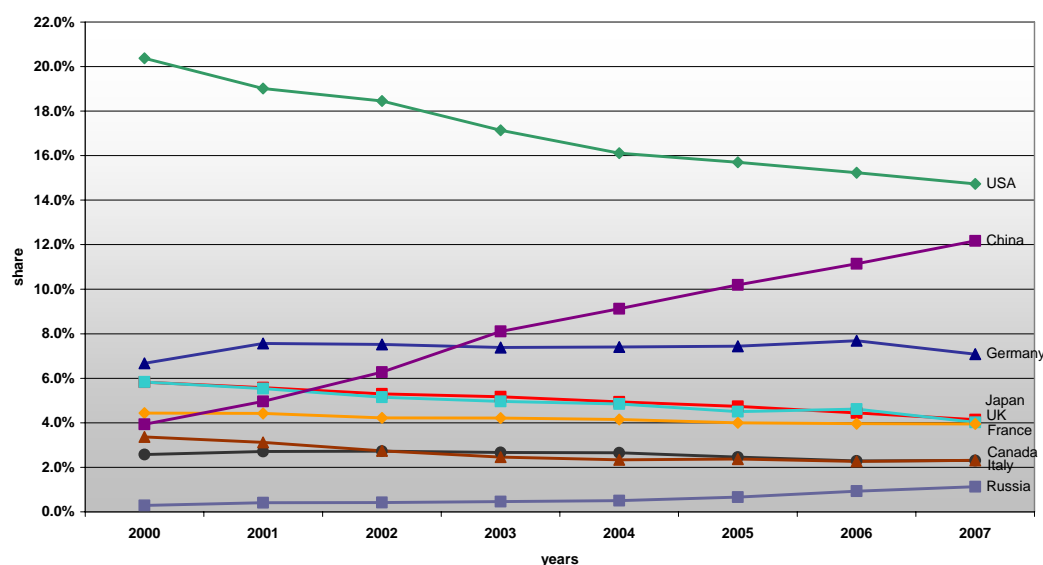
Also on the import side, it can be observed that the world share of imports by high-tech industries in the EU-27 was relatively stable around 20% over the period 2000 to 2007. On the other hand, Japan, and more importantly the USA were experiencing decreasing world shares. Their shares dropped by more than 25% each. China however, was expanding its share from about 5% in the year 2000 to 15% in 2007 and therefore more than tripled its share.

**Table 4: Share of the goods imported by high-tech sectors of the listed countries in relation to the total (world) import of high-tech sectors (G8 countries + China)**

	2000	2001	2002	2003	2004	2005	2006	2007
<b>USA</b>	20.4%	19.0%	18.5%	17.1%	16.1%	15.7%	15.2%	14.7%
<b>Japan</b>	5.8%	5.6%	5.3%	5.2%	4.9%	4.7%	4.4%	4.1%
<b>Germany</b>	6.7%	7.6%	7.5%	7.4%	7.4%	7.4%	7.7%	7.1%
<b>United Kingdom</b>	5.8%	5.5%	5.1%	5.0%	4.8%	4.5%	4.6%	4.0%
<b>France</b>	4.4%	4.4%	4.2%	4.2%	4.1%	4.0%	4.0%	4.0%
<b>Italy</b>	2.6%	2.7%	2.7%	2.7%	2.7%	2.5%	2.3%	2.3%
<b>Canada</b>	3.4%	3.1%	2.7%	2.5%	2.3%	2.4%	2.3%	2.3%
<b>Russia</b>	0.3%	0.4%	0.4%	0.5%	0.5%	0.7%	0.9%	1.1%
<b>Sum G8</b>	49.4%	48.3%	46.5%	44.5%	42.9%	41.9%	41.4%	39.6%
China	20.4%	19.0%	18.5%	17.1%	16.1%	15.7%	15.2%	14.7%

**Figure 4**

**Share of high-tech imports of country X compared to total (world) high-tech imports**



Analysing the G8 + China figures (Table 4), it can be pointed out that Germany slightly increased its share between 2000 and 2007 by 6% and that the United Kingdom lost ground in the high-tech sectors' imports (-1.8 percentage points or -31%). From 2006 to 2007 Germany's share decreased by 8% and the UK's share by 13%. In the latter case this was due to the strong decrease in MTIC fraud which also had an effect on the import side (see page 9). For the non-EU G8 members the downshift was more pronounced and varied from -1.1 percentage points for Canada (31% decrease) and roughly -1.7 percentage point for Japan (29% decrease) to -5.6 percentage points for the USA (28% decrease). Russia quadrupled its share but started in the year 2000 from a very low 0.3%. In total, the share of the imports of the G8's high-tech industries declined 9.7 percentage points from 49.4% in the year 2000 to 39.6%

in 2007 (20% decrease). During the same period China's share increased 8.2 percentage points from 3.9% to 12.2% which means that China tripled its share.

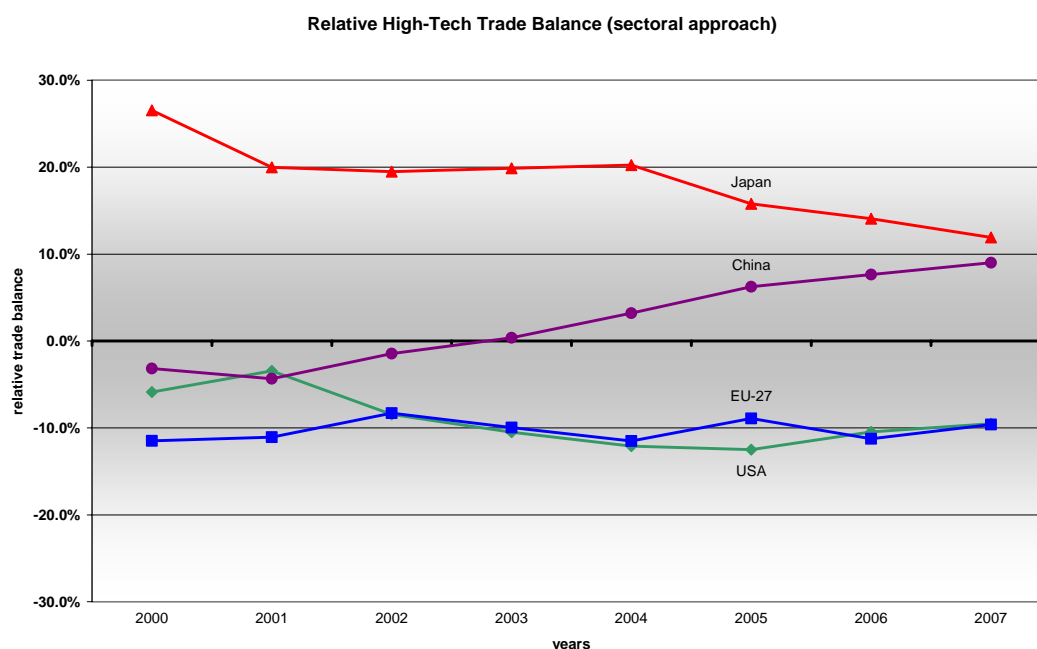
### RELATIVE HIGH-TECH TRADE BALANCE

The relative high-tech trade balance is an indicator which makes it possible to compare the trade balances of different countries / areas. It is calculated by dividing the trade balance (high-tech exports – high-tech imports) with the trade volume (high-tech exports + high-tech imports).

**Table 5: Relative high-tech trade balance of the four large economic areas (negative sign: net importer)**

	2000	2001	2002	2003	2004	2005	2006	2007
<b>EU-27</b>	-11.5%	-11.1%	-8.3%	-10.0%	-11.5%	-8.9%	-11.3%	-9.6%
<b>USA</b>	-5.9%	-3.4%	-8.4%	-10.5%	-12.1%	-12.5%	-10.5%	-9.5%
<b>Japan</b>	26.5%	20.0%	19.5%	19.9%	20.2%	15.8%	14.1%	11.9%
<b>China</b>	-3.2%	-4.3%	-1.4%	0.4%	3.2%	6.2%	7.6%	9.0%

**Figure 5**



The relative high-tech trade balances of the four areas under study show quite different patterns. The USA had a high negative relative trade balance which has been increasing from -3.4% in 2001 to -12.5% in 2005 and then recovered to -9.5% in 2007. The overall development of the US relative high-tech trade balance could be seen as an increasing dependence of the USA on imports from foreign high-tech industries. Also Japan shows a decline in its relative high-tech trade balance although from a starting point with a very positive relative trade balance of close to 27% which declined to about 12% in 2007. The relative trade balance of the EU-27 is quite stable around -10%. However, preliminary figures for 2008 show that the relative trade balance of the EU-27 improved strongly to -2%.

China's relative trade balance became positive in 2003 and is constantly increasing since then. In 2007 China had a positive relative trade balance of 9%. This development could be a sign for an increase in the local value added in the production of high-tech industries, as China becomes an increasingly

integrated part of international production chains in the high-tech industries. Preliminary figures for 2008 indicate that China further improved its relative trade balance to a value between 11 and 12%.

**Table 6: Relative high tech trade balance of the G8 states (negative sign: net importer)**

	2000	2001	2002	2003	2004	2005	2006	2007
<b>USA</b>	-5.9%	-3.4%	-8.4%	-10.5%	-12.1%	-12.5%	-10.5%	-9.5%
<b>Japan</b>	26.5%	20.0%	19.5%	19.9%	20.2%	15.8%	14.1%	11.9%
<b>Germany</b>	-0.1%	1.8%	1.5%	2.8%	5.2%	4.1%	2.6%	6.5%
<b>UK</b>	-3.7%	3.3%	4.4%	-2.4%	-8.1%	0.0%	8.0%	-9.9%
<b>France</b>	3.3%	5.6%	5.7%	3.4%	1.7%	1.7%	2.8%	2.3%
<b>Italy</b>	-17.2%	-15.8%	-15.4%	-17.8%	-20.6%	-18.5%	-18.6%	-16.8%
<b>Canada</b>	-18.3%	-21.2%	-24.8%	-24.1%	-25.7%	-24.8%	-23.1%	-23.0%
<b>Russia</b>	-37.6%	-41.4%	-20.8%	-24.7%	-37.4%	-67.9%	-71.3%	-80.0%

Looking at the G8 (Table 6) it is worthwhile noting that Russia is increasingly becoming dependent on foreign imports in the high-tech industries with a relative trade balance that decreased from an already very negative -21% in 2002 to -80% in 2007. In that year the imports of the Russian high-tech industries were 9 times higher than their exports.

Germany's relative trade balance became positive in 2001 and increased to +6.5% in 2007. The UK's relative trade balance was very volatile. Lately it became negative again. This was due to the effects of the strong decrease in MTIC fraud. Canada's relative high-tech trade balance was relative stable over the whole period at around -23%. Also the relative high-tech trade balances of Italy and France were quite stable between 2000 and 2007 (around -18% and around +3.3% respectively).

Having looked at the exports, imports and relative trade balances we can say that China increased considerably its market share of goods traded by high-tech industries during the observed period mainly to the expense of the USA and Japan. China is becoming more and more an integrated part of the *world supply chain*. This could also mean that China's high market share in the trade of high-tech industries is due to a lot of assembly work in high-tech industries which in fact is mainly a low- or mid-tech work. The increase in the relative trade balance however, might be seen as an indication of an increasing share of local value added.

### **3.2. *World Market Share (Def. 2) – ratio of a country's exports of its high-tech sectors to the world exports***

World market share according to definition 2 is defined as the ratio between the exports of high-tech industries from the country / area under study and total world exports of **all economic sectors** of all countries (excluding intra EU-27 exports).<sup>16</sup> (For imports the definition is analogous.) In other words, we now consider the shares of countries obtained when the denominator is not the total export (import) of high tech industries worldwide, but the total world exports (import) of all industries.

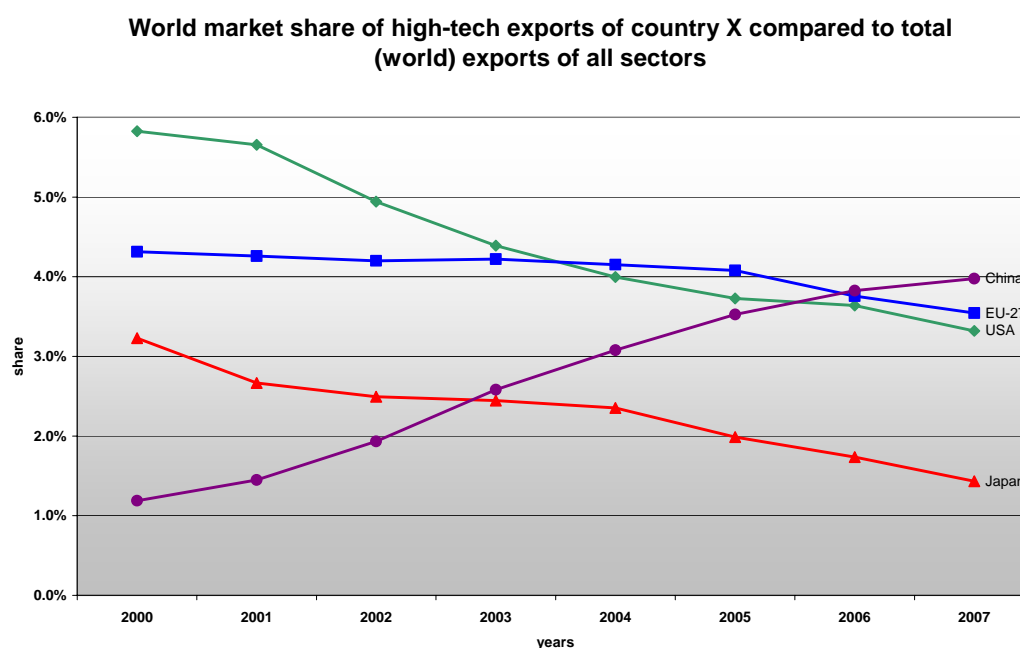
<sup>16</sup> Due to variations in the number and composition of countries reporting their trade data, the world total can differ (*ceteris paribus*) slightly from one year to another.

## EXPORTS

**Table 7: Share of the goods exported by high-tech sectors of the listed countries in relation to the total (world) export of all economic sectors (large economic areas)**

	2000	2001	2002	2003	2004	2005	2006	2007
<b>EU-27</b>	4.3%	4.3%	4.2%	4.2%	4.2%	4.1%	3.8%	3.5%
<b>USA</b>	5.8%	5.7%	4.9%	4.4%	4.0%	3.7%	3.6%	3.3%
<b>Japan</b>	3.2%	2.7%	2.5%	2.4%	2.4%	2.0%	1.7%	1.4%
<b>China</b>	1.2%	1.4%	1.9%	2.6%	3.1%	3.5%	3.8%	4.0%
<b>Sum big 4 areas</b>	14.6%	14.0%	13.6%	13.6%	13.6%	13.3%	13.0%	12.3%
<b>World sum</b>	26.0%	24.8%	24.5%	24.3%	24.1%	23.3%	22.8%	21.2%

**Figure 6**



Looking at the different countries' market shares of the high-tech industries exports in the total world exports (Table 7 and Figure 6) it can be observed that the EU-27's market share was slowly decreasing from 4.3% in 2000 to 3.5% in 2007 (-18%), mainly during the period 2005 to 2007. However, it is still too early to identify this as a clearly decreasing trend.<sup>17</sup>

For the other three economic areas the case seems to be clearer. The USA and Japan were constantly losing market share from 2000 to 2007 (in total -43% for the USA and -56% for Japan). Only China showed a significant increase of its market share which more than tripled from 1.2% in the year 2000 to 4.0% in 2007.

<sup>17</sup> This can also be confirmed by looking at the growth rates of the exports: From 2000 to 2007 the world exports of high-tech industries grew by 70%, the EU exports of high-tech industries (without the intra-community trade) grew by 72% during the same period. However, at the same time the share of world high-tech exports as of the total world exports shrank from 26% to 21%. So although the EU maintained its market share in the exports of high-tech industries according to definition 1 at around 17%, the market share according to definition 2 decreased slightly due to the increase of exports of non-high-tech industries in the world.



**Table 8: Share of the goods exported by high-tech sectors of the listed countries in relation to the total (world) export of all sectors (G8 countries + China)<sup>18</sup>**

	2000	2001	2002	2003	2004	2005	2006	2007
<b>USA</b>	4.4%	4.2%	3.6%	3.2%	2.9%	2.8%	2.7%	2.4%
<b>Japan</b>	2.4%	2.0%	1.8%	1.8%	1.7%	1.5%	1.3%	1.1%
<b>Germany</b>	1.6%	1.8%	1.8%	1.8%	1.9%	1.8%	1.8%	1.6%
<b>United Kingdom</b>	1.3%	1.4%	1.3%	1.1%	0.9%	1.0%	1.2%	0.7%
<b>France</b>	1.1%	1.2%	1.1%	1.0%	1.0%	0.9%	0.9%	0.8%
<b>Italy</b>	0.4%	0.5%	0.5%	0.4%	0.4%	0.4%	0.3%	0.3%
<b>Canada</b>	0.6%	0.5%	0.4%	0.3%	0.3%	0.3%	0.3%	0.3%
<b>Russia</b>	0.0%	0.0%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%
<b>Sum G8</b>	11.9%	11.5%	10.6%	9.6%	9.2%	8.7%	8.6%	7.2%
China	0.9%	1.1%	1.4%	1.9%	2.2%	2.6%	2.8%	2.9%

Analysing the G8 countries and China it can be seen that the market share of the European G8 member Germany was very stable over the entire period. To some lesser extent this is also true for France and Italy. The UK's market share however, decreased strongly from 2006 to 2007 (-45%) because of the decrease in MTIC fraud.

The total market share of all G8 members, was declining from 11.9% in the year 2000 to 7.2% in 2007 (-4.6 percentage points or by -39%). At the same time the market share of China more than tripled from 0.9% to 2.9%.

## **IMPORTS**

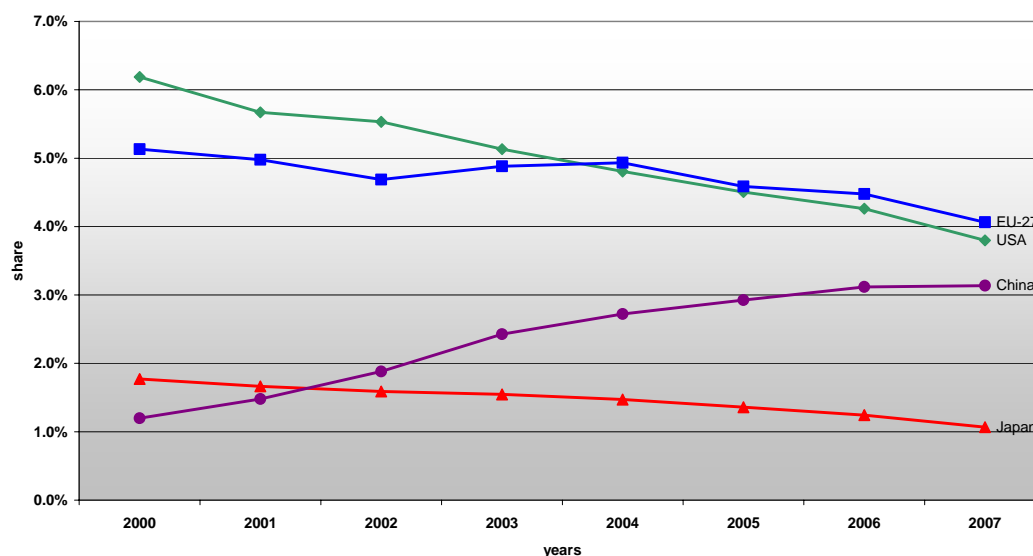
**Table 9: Share of the goods imported by high-tech sectors of the listed countries in relation to the total (world) import of all economic sectors (large economic areas)**

	2000	2001	2002	2003	2004	2005	2006	2007
<b>EU-27</b>	5.1%	5.0%	4.7%	4.9%	4.9%	4.6%	4.5%	4.1%
<b>USA</b>	6.2%	5.7%	5.5%	5.1%	4.8%	4.5%	4.3%	3.8%
<b>Japan</b>	1.8%	1.7%	1.6%	1.5%	1.5%	1.4%	1.2%	1.1%
<b>China</b>	1.2%	1.5%	1.9%	2.4%	2.7%	2.9%	3.1%	3.1%
<b>Sum big 4 areas</b>	14.0%	13.8%	13.7%	14.0%	13.9%	13.4%	13.1%	12.1%

<sup>18</sup> The percentages for the countries shown in this table that are also included in Table 7 (USA, Japan, and China) are lower here, because the world total is defined differently and includes now also the intra-community trade of the EU-27.

**Figure 7**

**Share of high-tech imports of country X compared to total (world) imports of all sectors**



The share of the imports of the high-tech industries in the total world imports was clearly decreasing in Japan (-40%) and in the USA (-39%). With some fluctuations this decreasing trend can also be observed for the EU-27, but to much lesser extent (-21%). Therefore, in 2004 the imports of the EU-27 high-tech industries have passed the US high-tech industries with regards to the imported value. As in the case of the exports, China was also constantly increasing its share of high-tech imports in the world imports from 1.2% in the year 2000 to 3.1% in 2007 (+162%) but without change from 2006 to 2007.

**Table 9: Share of the goods imported by high-tech sectors of the listed countries in relation to the total (world) import of all sectors (G8 countries + China)**

	2000	2001	2002	2003	2004	2005	2006	2007
<b>USA</b>	4.8%	4.3%	4.2%	3.8%	3.6%	3.4%	3.3%	2.9%
<b>Japan</b>	1.4%	1.3%	1.2%	1.2%	1.1%	1.0%	1.0%	0.8%
<b>Germany</b>	1.6%	1.7%	1.7%	1.6%	1.7%	1.6%	1.6%	1.4%
<b>United Kingdom</b>	1.4%	1.3%	1.2%	1.1%	1.1%	1.0%	1.0%	0.8%
<b>France</b>	1.0%	1.0%	1.0%	0.9%	0.9%	0.9%	0.8%	0.8%
<b>Italy</b>	0.6%	0.6%	0.6%	0.6%	0.6%	0.5%	0.5%	0.4%
<b>Canada</b>	0.8%	0.7%	0.6%	0.5%	0.5%	0.5%	0.5%	0.5%
<b>Russia</b>	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.2%
<b>Sum G8</b>	11.6%	11.0%	10.5%	9.9%	9.6%	9.2%	8.9%	7.7%
China	0.9%	1.1%	1.4%	1.8%	2.0%	2.2%	2.4%	2.4%

Looking at the G8 and China (Table 9) it can be observed that from the four EU Member States that are also G8 members only the United Kingdom showed a high decrease in its share (-43% from 2000 to 2007) in the total world imports. France and Italy had decreases of 26% and Germany a decrease of only 12%. The other areas under study – the USA, Canada and Japan – were losing considerably (between 40% and 43%). The countries with the highest gains during the period 2000 to 2007 were Russia which more than tripled its share (from a very low 0.09% to 0.22%) and China with an increase of 1.4 percentage points (which is equal to an increase of 157%).

### 3.3. National Market Share (Def. 3) – ratio of a country’s exports of its high-tech sectors to its total exports

National market share according to definition 3 is defined as the ratio between the exports of high-tech products from the country / area under study and the total exports of **all economic sectors of the same country / area** (excluding intra EU-27 exports). In other words, we now consider the market shares of countries obtained when the denominator is not the total world export of all countries, but the total export of the particular country. This ratio can be seen as an indicator for the high-tech specialisation of an economy’s foreign trade. (For imports the definition is analogous.)

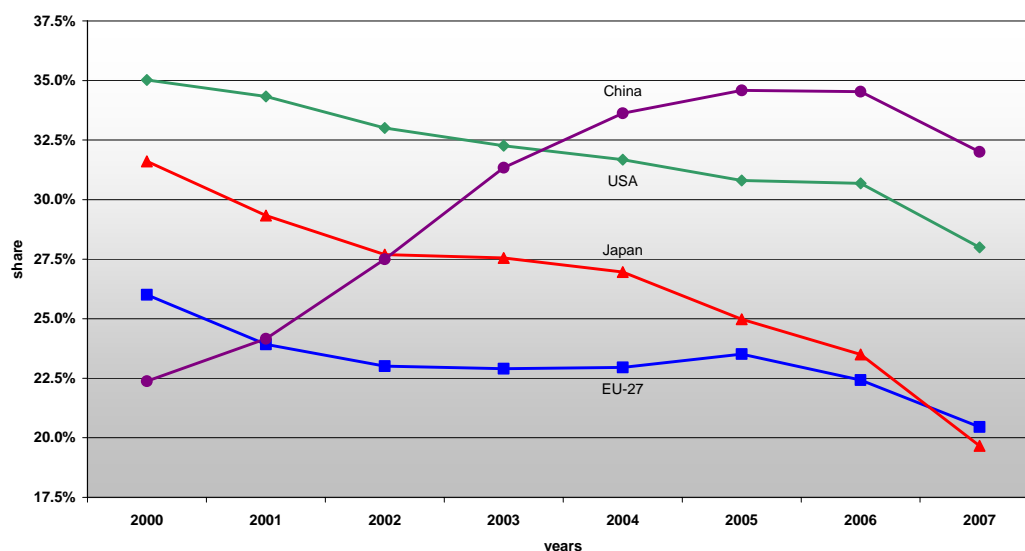
#### EXPORTS

**Table 10: Share of the goods exported by high-tech sectors of the listed countries in relation to the country’s export of all economic sectors (large economic areas)**

	2000	2001	2002	2003	2004	2005	2006	2007
<b>EU-27</b>	26.0%	23.9%	23.0%	22.9%	23.0%	23.5%	22.4%	20.5%
<b>USA</b>	35.0%	34.3%	33.0%	32.3%	31.7%	30.8%	30.7%	28.0%
<b>Japan</b>	31.6%	29.3%	27.7%	27.6%	27.0%	25.0%	23.5%	19.7%
<b>China</b>	22.4%	24.2%	27.5%	31.3%	33.6%	34.6%	34.5%	32.0%
<b>Mean of the big 4 areas</b>	29.9%	28.4%	27.5%	27.7%	28.0%	28.0%	27.5%	25.1%

**Figure 8**

**Market share of high-tech exports of country X compared to the total exports of the same country**



For all big economic areas we can notice a strong decline of the countries’ high-tech share in their total exports between 2006 and 2007 with a mean decrease of 9%. For Japan this decrease was particularly strong with -16%.<sup>19</sup>

In the year 2000, China had the lowest share of high-tech exports in its total exports (22.4%) of all four economic areas analysed. Since then the picture changed dramatically. In 2004 China became the country with the highest share of high-tech exports in its total exports and one year later its share

<sup>19</sup> This is mainly due to a strong decline in the exports of mobile phones, computer parts and telephones.

reached the peak with 34.6% of all Chinese exports coming from high-tech industries. Since then the share declined again.

Since the year 2000 the US share of high-tech exports declined by 20% and reached a share 28% in 2007. Also Japan's share was on the decline (-38% between 2000 and 2007) and in 2007 displaced the EU-27 from the last place. The EU-27's share of exports from high-tech industries declined as well from 26.0% in the year 2000 to 20.5% in 2007 (21% decrease).

**Table 11: Share of the goods exported by high-tech sectors of the listed countries in relation to the total exports of the same country (G8 countries + China)**

	2000	2001	2002	2003	2004	2005	2006	2007
<b>USA</b>	35.0%	34.3%	33.0%	32.3%	31.7%	30.8%	30.7%	28.0%
<b>Japan</b>	31.6%	29.3%	27.7%	27.6%	27.0%	25.0%	23.5%	19.7%
<b>Germany</b>	18.3%	19.4%	18.5%	17.5%	18.5%	18.9%	18.6%	16.2%
<b>United Kingdom</b>	28.9%	30.7%	29.4%	25.9%	24.2%	26.7%	31.4%	20.0%
<b>France</b>	24.2%	24.1%	22.8%	21.2%	21.3%	21.7%	22.5%	20.5%
<b>Italy</b>	11.5%	11.4%	11.5%	10.5%	10.1%	10.3%	9.7%	8.8%
<b>Canada</b>	12.7%	11.0%	9.6%	9.3%	8.9%	9.0%	9.4%	9.2%
<b>Russia</b>	1.9%	2.4%	3.8%	3.5%	2.6%	1.2%	1.3%	0.9%
<b>Mean G8</b>	24.7%	24.1%	22.8%	21.5%	21.0%	20.7%	20.8%	17.7%
China	22.4%	24.2%	27.5%	31.3%	33.6%	34.6%	34.5%	32.0%

For the EU Member States that are G8 members the picture is heterogeneous. Germany and to lesser extent also Italy and France showed below average decreases (G8: -7% from 2000 to 2007) of their shares of exports originating from high-tech industries (Germany: -2% from 2000 to 2007, Italy: -3%, France: -4%). The United Kingdom's exports originating from high-tech industries fluctuated strongly between 2000 and 2007 with -21% between 2001 and 2004, +30% between 2004 and 2006, and -36% from 2006 to 2007. The latter decline is mainly due to the decrease in MTIC fraud.

The USA's high-tech share declined like the G8 on average (-7%). Japan's decline was above average with -12%. The very low share of exports from high-tech industries in Russia is due to the increasing share of Russian low- or medium low-tech exports, mainly oil, gas and its derived products (alone the exports of gas and fuel accounted for 60% in 2007).

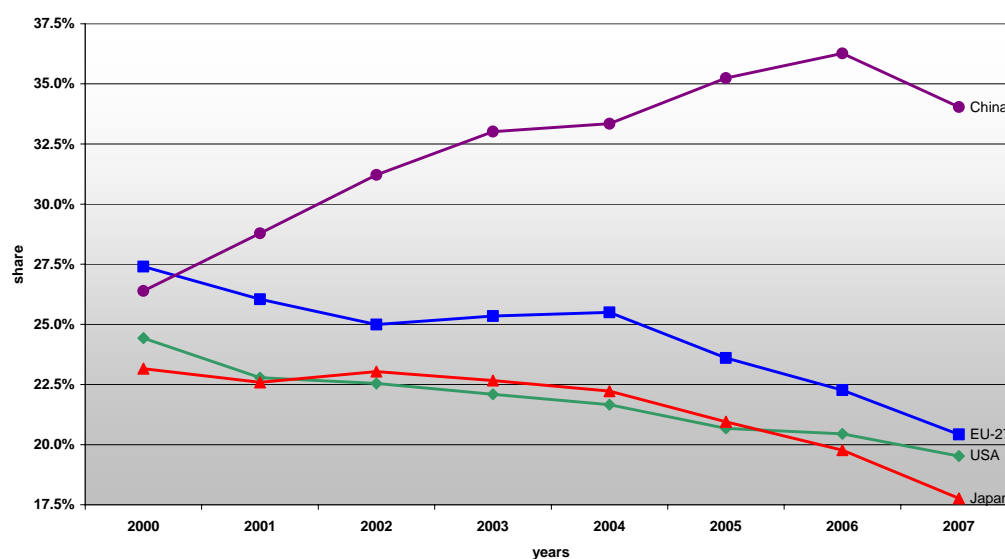
## **IMPORTS**

**Table 12: Share of the goods imported by high-tech sectors of the listed countries in relation to the total imports of the same country (large economic areas)**

	2000	2001	2002	2003	2004	2005	2006	2007
<b>EU-27</b>	27.4%	26.0%	25.0%	25.3%	25.5%	23.6%	22.3%	20.4%
<b>USA</b>	24.4%	22.8%	22.5%	22.1%	21.7%	20.7%	20.5%	19.5%
<b>Japan</b>	23.2%	22.6%	23.0%	22.7%	22.2%	20.9%	19.8%	17.8%
<b>China</b>	26.4%	28.8%	31.2%	33.0%	33.3%	35.2%	36.3%	34.0%
<b>Mean big 4 areas</b>	25.4%	24.4%	24.3%	24.7%	24.7%	23.9%	23.5%	22.1%

**Figure 9**

**Share of high-tech imports of country X compared to the total imports of the same country**



China shows a considerable increase of the share of goods imported by its high-tech industries in the Chinese total imports. This share increased from 26.4% in the year 2000 to 36.3% in 2006 and then declined to 34.0%. Over the entire period 2000 to 2007 the share of Chinese high-tech imports increased by 29%. In the other large economic areas the share of imports by the high-tech industries declined (EU-27: -25%, USA: -20%, Japan: -23%).

**Table 13: Share of the goods imported by high-tech sectors of the listed countries in relation to the total imports of the same country (G8 countries + China)**

	2000	2001	2002	2003	2004	2005	2006	2007
<b>USA</b>	24.4%	22.8%	22.5%	22.1%	21.7%	20.7%	20.5%	19.5%
<b>Japan</b>	23.2%	22.6%	23.0%	22.7%	22.2%	20.9%	19.8%	17.8%
<b>Germany</b>	20.1%	22.0%	22.5%	20.6%	21.1%	21.8%	21.5%	17.9%
<b>United Kingdom</b>	25.9%	23.2%	21.0%	21.2%	21.2%	19.9%	19.6%	17.2%
<b>France</b>	22.0%	21.3%	20.4%	19.5%	19.6%	19.2%	19.2%	17.3%
<b>Italy</b>	16.3%	16.2%	16.2%	15.1%	15.3%	14.6%	13.3%	12.0%
<b>Canada</b>	21.2%	19.9%	18.1%	17.2%	17.5%	17.2%	16.6%	16.2%
<b>Russia</b>	12.7%	13.9%	13.3%	13.5%	13.6%	15.2%	17.4%	15.0%
<b>Mean G8</b>	22.6%	21.7%	21.3%	20.5%	20.4%	19.8%	19.4%	17.6%
China	26.4%	28.8%	31.2%	33.0%	33.3%	35.2%	36.3%	34.0%

The share of imports of high-tech industries compared to the total imports decreased the strongest in the United Kingdom with -34%. The G8 average was -22%. Out of the G8 members only Russia increased its share of high-tech industry imports during the period 2000 to 2007. In the case of Russia this might have been due to the strong increase in the prices of crude oil and natural gas<sup>20</sup> which increased considerably Russia's income allowing for more purchases of high value / high-tech goods from other countries.

<sup>20</sup> E.g. the price of one barrel of Brent oil increased from US\$ 28.52 in the year 2000 to US\$ 72.47 in 2007 or by 154%. Source: [http://tonto.eia.doe.gov/dnav/pet/xls/pet\\_pri\\_spt\\_s1\\_m.xls](http://tonto.eia.doe.gov/dnav/pet/xls/pet_pri_spt_s1_m.xls)

## 4. Product Approach

The product approach supplements the sector approach and opens the way to more detailed analysis of trade and competitiveness. The product approach excludes all the products that are not high-tech, even if they are manufactured by high-tech industries. This approach is therefore more restrictive than the sectoral approach. (However, the product approach covers also high-tech products that are not produced exclusively by high-tech industries.) The list of products classified as high-tech was taken from the OECD<sup>21</sup> and is listed in Annex 2.

### 4.1. *World Market Share (Def. 1) – ratio of a country's exports of high tech products to the world exports of high tech products*

In the following the world market share for both imports and exports according to definition 1 will be analysed for the four large economic areas (EU-27, USA, Japan, and China) and also for the G8 and China.

The world market share is defined in this case as the ratio between the exports of high-tech products from the country / area under study and the world exports of high tech products, which is calculated as the sum of high tech exports of all countries.

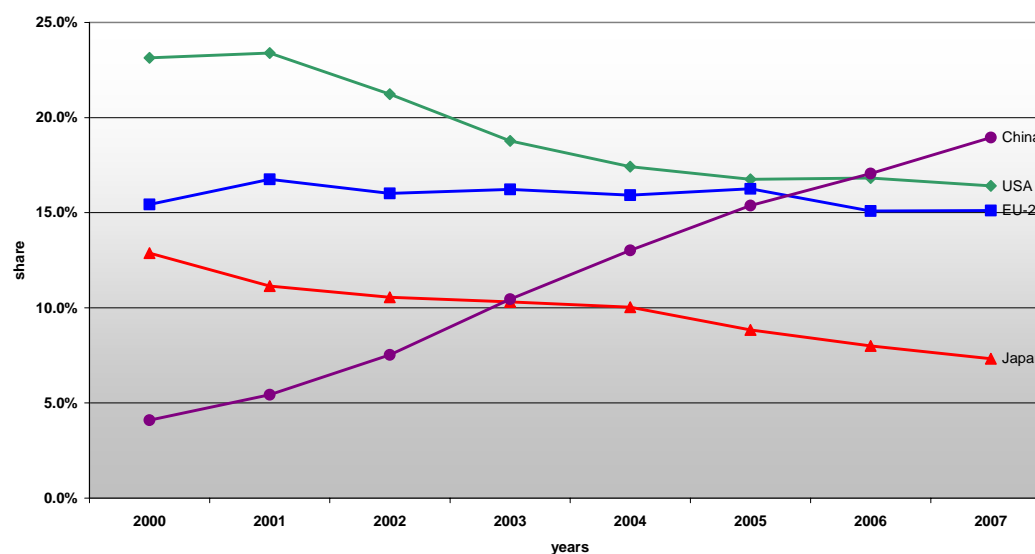
#### EXPORTS

**Table 14: Share of high-tech goods exported by the listed countries in relation to the total (world) export of high-tech goods (large economic areas)**

	2000	2001	2002	2003	2004	2005	2006	2007
<b>EU-27</b>	15.4%	16.8%	16.0%	16.2%	15.9%	16.3%	15.1%	15.1%
<b>USA</b>	23.1%	23.4%	21.2%	18.8%	17.4%	16.7%	16.8%	16.4%
<b>Japan</b>	12.9%	11.1%	10.6%	10.3%	10.0%	8.8%	8.0%	7.3%
<b>China</b>	4.1%	5.4%	7.5%	10.5%	13.0%	15.4%	17.1%	18.9%
<b>Sum big 4 areas</b>	55.5%	56.7%	55.3%	55.8%	56.4%	57.2%	57.0%	57.8%

**Figure 10**

**World market share of high-tech exports of country X compared to total high-tech exports (product approach)**



<sup>21</sup> OECD Handbook on Economic Globalisation Indicators, 2005, p. 173.

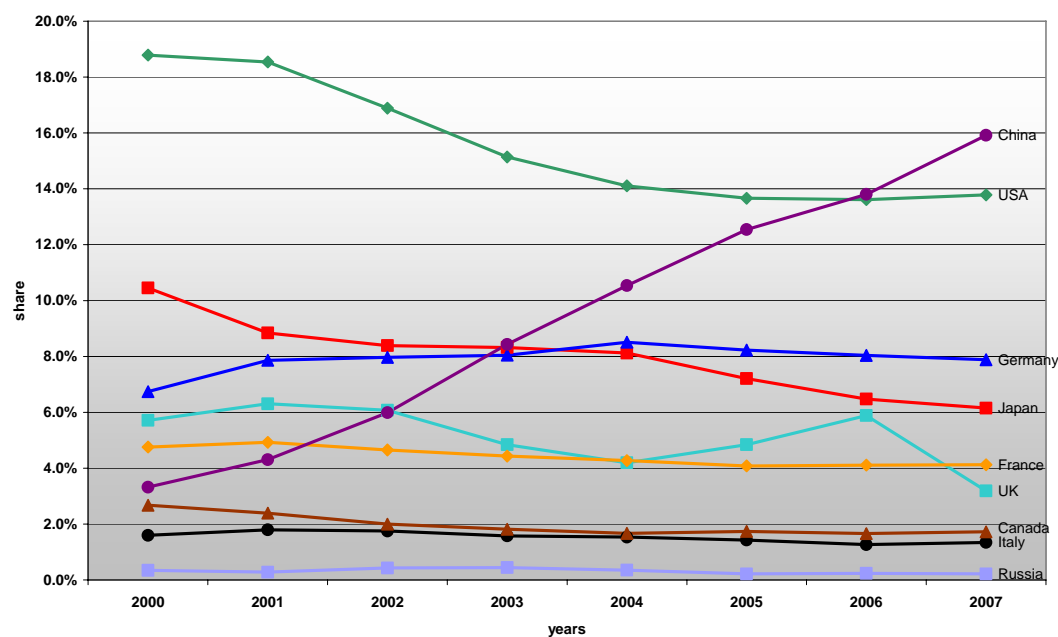
Looking at Table 14 and Figure 10 it can be observed that the market share of the EU-27 high-tech exports was relatively stable around 16% during the period 2000 to 2005. During the years 2006 and 2007 the EU-27's share was stable at 15%. In contrast to that, the market shares of the USA and Japan were declining between 2000 and 2007. Especially the USA showed a pronounced downshift from 23.1% to 16.4% market share which is equivalent to market share loss of 29%. Japan's market share loss was even higher with 43% (from 12.9% market share down to 7.3%). Conversely, China almost quintupled its market share from 4.1% in the year 2000 to 18.9% in 2007. Since 2006 China has the highest market share in the exports of high-tech goods.

**Table 15: Share of exported high-tech goods of the listed countries in relation to the total (world) export of high-tech goods (G8 countries + China)**

	2000	2001	2002	2003	2004	2005	2006	2007
<b>USA</b>	18.8%	18.5%	16.9%	15.1%	14.1%	13.7%	13.6%	13.8%
<b>Japan</b>	10.5%	8.8%	8.4%	8.3%	8.1%	7.2%	6.5%	6.2%
<b>Germany</b>	6.7%	7.9%	8.0%	8.0%	8.5%	8.2%	8.0%	7.9%
<b>United Kingdom</b>	5.7%	6.3%	6.1%	4.8%	4.2%	4.8%	5.9%	3.2%
<b>France</b>	4.8%	4.9%	4.6%	4.4%	4.3%	4.1%	4.1%	4.1%
<b>Italy</b>	1.6%	1.8%	1.8%	1.6%	1.5%	1.4%	1.3%	1.3%
<b>Canada</b>	2.7%	2.4%	2.0%	1.8%	1.7%	1.7%	1.7%	1.7%
<b>Russia</b>	0.3%	0.3%	0.4%	0.4%	0.4%	0.2%	0.2%	0.2%
<b>Sum G8</b>	51.1%	51.0%	48.2%	44.6%	42.8%	41.4%	41.3%	38.4%
China	3.3%	4.3%	6.0%	8.4%	10.5%	12.5%	13.8%	15.9%

**Figure 11**

**World market share of high-tech exports of country X compared to the total high-tech exports (product approach)**



Analysing the G8 and Chinese figures (Table 15), it can be seen that Germany's market share remained stable around 8% between 2001 and 2007. France and Italy were losing slightly market share, whereas the United Kingdom was showing ups and downs. The UK's pronounced downturn from 2006 to 2007 (-44%) is due to the decrease in MTIC fraud. The USA was losing considerably market share

(-5 percentage points which is equal to a decrease of 27%) whereas China almost quintupled its market share and is now the biggest exporter of high-tech goods. In total, the G8 lost 12.7 percentage points in the high-tech export market and China gained 12.6 percentage points.

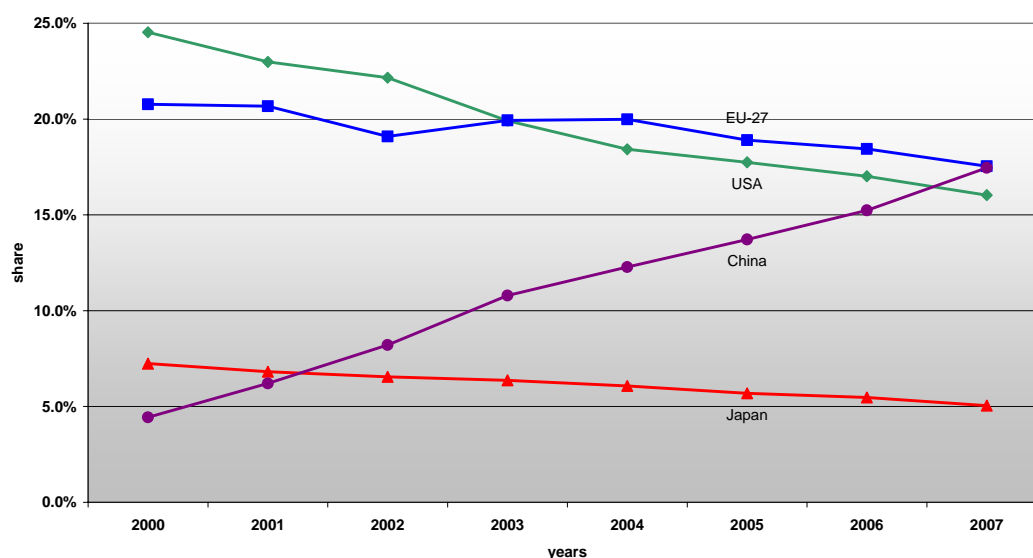
## IMPORTS

**Table 16: Share of high-tech goods imported by the listed countries in relation to the total (world) import of high-tech goods (large economic areas)**

	2000	2001	2002	2003	2004	2005	2006	2006
<b>EU-27</b>	20.8%	20.7%	19.1%	19.9%	20.0%	18.9%	18.4%	17.5%
<b>USA</b>	24.5%	23.0%	22.2%	19.9%	18.4%	17.7%	17.0%	16.0%
<b>Japan</b>	7.2%	6.8%	6.6%	6.4%	6.1%	5.7%	5.5%	5.0%
<b>China</b>	4.4%	6.2%	8.2%	10.8%	12.3%	13.7%	15.2%	17.5%
<b>Sum big 4 areas</b>	57.0%	56.7%	56.0%	57.0%	56.8%	56.0%	56.2%	56.1%

**Figure 12**

**Share of high-tech imports of country X compared to total high-tech imports (product approach)**



On the import side it can be observed that between 2000 and 2007 all economic areas except China were losing shares in the import of high-tech goods. The EU-27, with a decrease of 16% (-3.2 percentage points), lost relatively little compared to the USA with a decrease of 35% and Japan with a loss of 30%. Therefore, since 2004 the EU-27 is the largest importer of high-tech goods. China expanded considerably its share with a plus of 13 percentage points which is equivalent to a quadruplication of its share since the year 2000 and in 2007 equalised the EU-27's share.

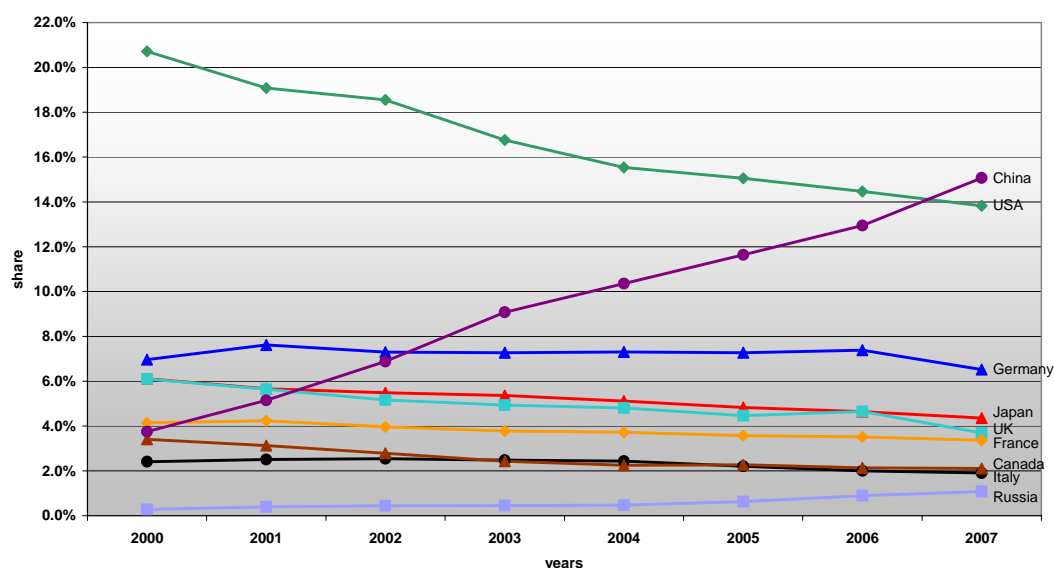


**Table 17: Share of the goods imported by high-tech sectors of the listed countries in relation to the total (world) import of high-tech sectors (G8 countries + China)**

	2000	2001	2002	2003	2004	2005	2006	2007
<b>USA</b>	20.7%	19.1%	18.6%	16.8%	15.5%	15.1%	14.5%	13.8%
<b>Japan</b>	6.1%	5.7%	5.5%	5.4%	5.1%	4.8%	4.6%	4.4%
<b>Germany</b>	7.0%	7.6%	7.3%	7.3%	7.3%	7.3%	7.4%	6.5%
<b>United Kingdom</b>	6.1%	5.6%	5.2%	4.9%	4.8%	4.5%	4.7%	3.7%
<b>France</b>	4.1%	4.2%	4.0%	3.8%	3.7%	3.6%	3.5%	3.4%
<b>Italy</b>	2.4%	2.5%	2.5%	2.5%	2.4%	2.2%	2.0%	1.9%
<b>Canada</b>	3.4%	3.1%	2.8%	2.4%	2.2%	2.3%	2.1%	2.1%
<b>Russia</b>	0.3%	0.4%	0.4%	0.4%	0.5%	0.6%	0.9%	1.1%
<b>Sum G8</b>	50.1%	48.3%	46.2%	43.5%	41.7%	40.3%	39.7%	36.9%
China	3.8%	5.2%	6.9%	9.1%	10.4%	11.6%	12.9%	15.1%

**Figure 13**

**Share of high-tech imports of country X compared to total high-tech imports (product approach)**



Between the years 2000 and 2007 all EU G8 members were losing shares in the world high-tech imports but with different magnitude. Only Germany had minor loses of 6%, while France and Italy lost around 20% and the UK almost 40%. The USA showed also a pronounced decrease in the high-tech imports with a loss of about 33% (-7 percentage points), while China quadrupled its share and gained 11 percentage points.

It is interesting that also Russia almost quadrupled its share, but from a very low 0.3% to 1.1%. This growth was probably due to the increased revenues from its oil and gas exports.

### **RELATIVE TRADE BALANCE**

In the year 2000 all economic areas except Japan (+26%) showed negative relative trade balances (see Table 18). Especially the EU-27 showed a large negative balance (-17.1%), followed by China (-6.5%) and the USA (-5.3%). This picture has changed dramatically. Japan's positive balance was declining steadily to now +15.9%. China shows positive relative trade balances since 2005 and therefore became

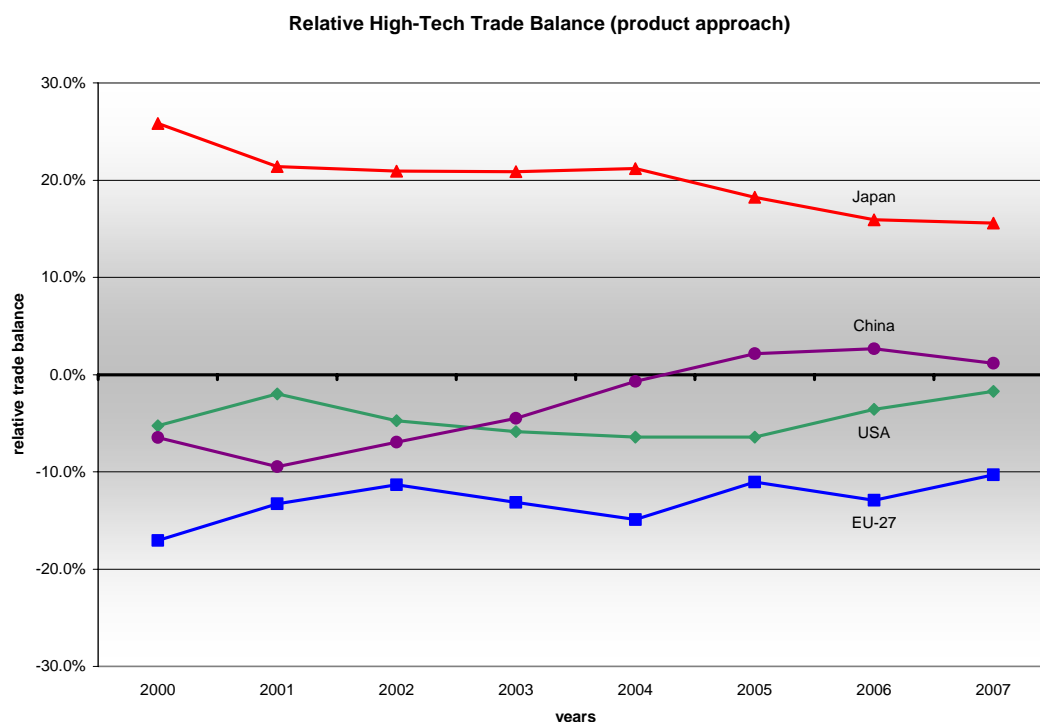
a net exporter of high-tech goods. The other economies, the EU-27 and the USA, have reduced their negative balances.

Preliminary data shows that in 2008 the USA has reached almost a positive relative trade balance (-0.8%) and that also the EU-27 is approaching zero with -3.4% for 2008.

**Table 18: Relative trade balance of the four large economic areas (negative sign: net importer)**

	2000	2001	2002	2003	2004	2005	2006	2007
<b>EU-27</b>	-17.1%	-13.3%	-11.3%	-13.1%	-14.9%	-11.0%	-12.9%	-10.3%
<b>USA</b>	-5.3%	-2.0%	-4.7%	-5.9%	-6.4%	-6.4%	-3.6%	-1.7%
<b>Japan</b>	25.8%	21.4%	20.9%	20.9%	21.2%	18.2%	15.9%	15.6%
<b>China</b>	-6.5%	-9.5%	-6.9%	-4.5%	-0.7%	2.2%	2.7%	1.2%

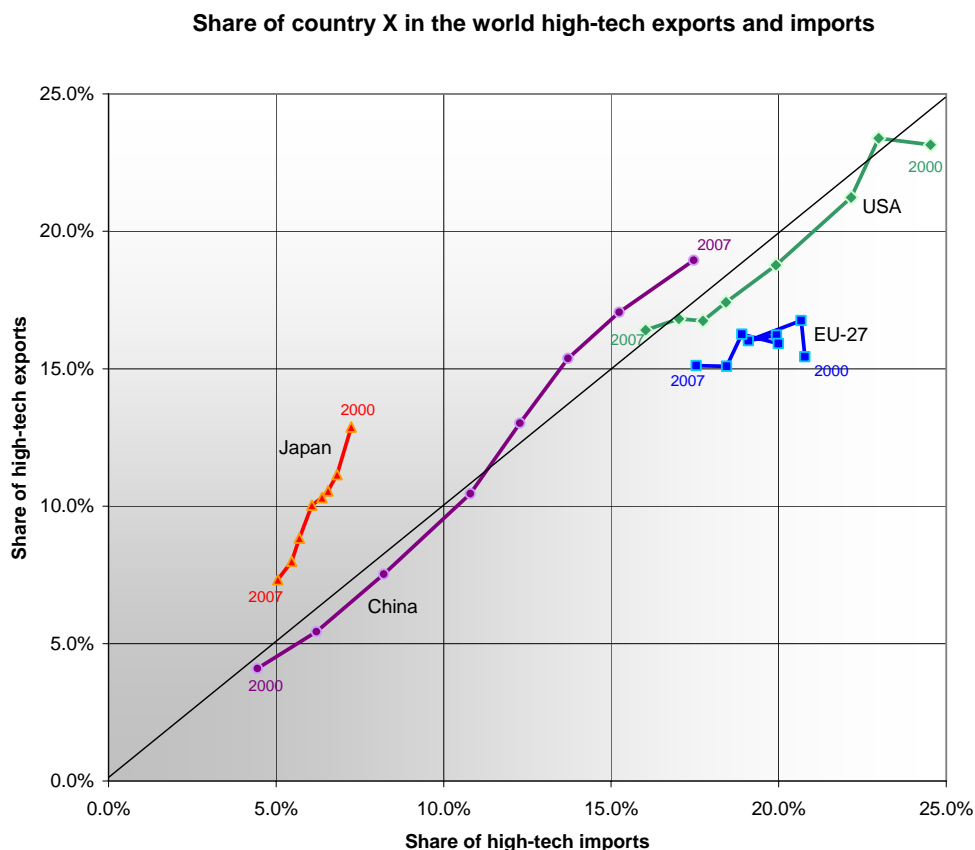
**Figure 14**



However, also the relative high-tech trade balance does not give a complete picture of the relation of a country's high-tech exports to its high-tech imports. A possibly better representation of this relationship could be the graphical representation in Figure 15 showing the country's share of high-tech exports in the world high-tech exports compared to the country's share of high-tech imports in the world high-tech imports.

Here one can observe e.g. that even though the US relative high-tech trade balance was always negative during the period 2000 to 2007, in the years 2001 and 2007 the share of the US high-tech exports in the world high-tech exports was higher than the corresponding share on the import side.

Figure 15



**4.2. World Market Share (Def. 2) – ratio of a country’s exports of high-tech products to the world exports**

World market share according to definition 2 is defined as the ratio between the exports of high-tech products from the country / area under study and the total world exports of **all products** of all countries (excluding intra EU-27 exports). (For imports the definition is analogous.) In other words, we now consider the market shares of countries obtained when the denominator is not the world total export (or import) of high-tech goods, but the world total export (or import) of all goods.

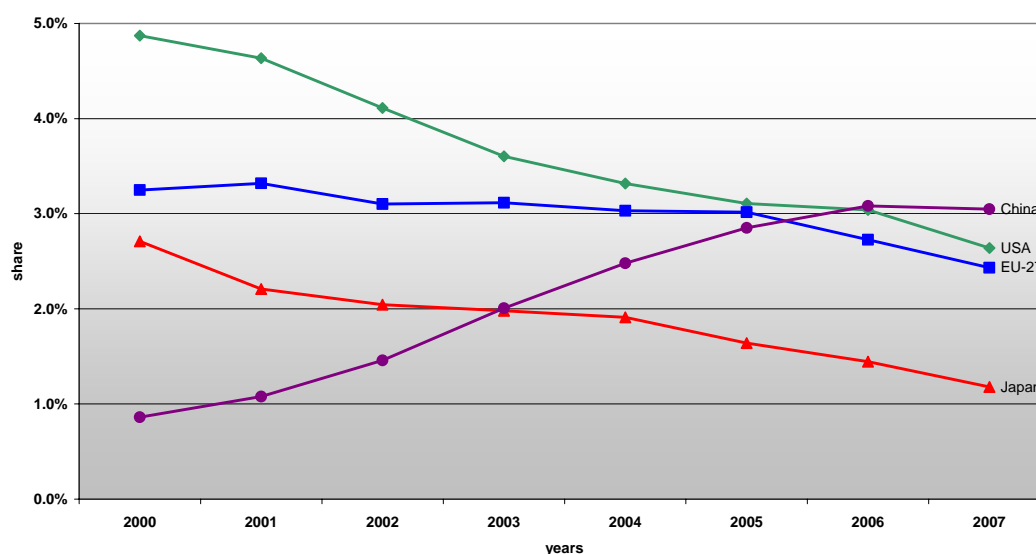
**EXPORTS**

**Table 19: Share of the high-tech goods exported of the listed countries in relation to the total (world) export of goods (large economic areas)**

	2000	2001	2002	2003	2004	2005	2006	2007
<b>EU-27</b>	3.2%	3.3%	3.1%	3.1%	3.0%	3.0%	2.7%	2.4%
<b>USA</b>	4.9%	4.6%	4.1%	3.6%	3.3%	3.1%	3.0%	2.6%
<b>Japan</b>	2.7%	2.2%	2.0%	2.0%	1.9%	1.6%	1.4%	1.2%
<b>China</b>	0.9%	1.1%	1.5%	2.0%	2.5%	2.9%	3.1%	3.0%
<b>Sum big 4 areas</b>	11.7%	11.2%	10.7%	10.7%	10.7%	10.6%	10.3%	9.3%

Figure 16

World market share of high-tech exports of country X compared to the world total exports (product approach)



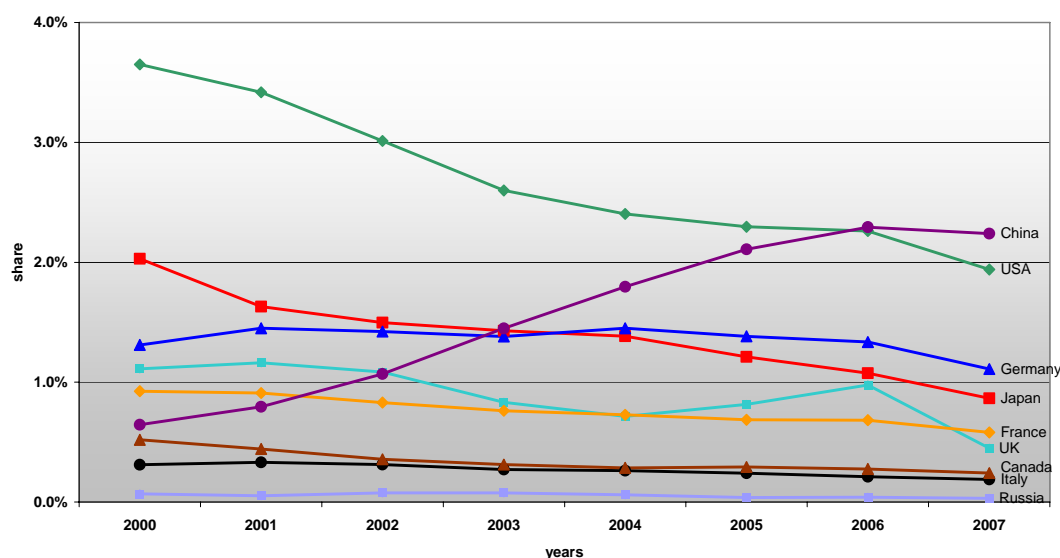
Except for China, all economic areas lost market shares in the period 2000 to 2007. The USA's market share dropped 46% (from 4.9% share to 2.6% share) and Japan's market share decreased 57% (from 2.7% to 1.2%). The EU-27's market share loss was smaller with -25% (from 3.2% to 2.4%). Only China's share increased and in fact more than tripled from 0.9% to 3.0%. In 2007 China became clearly the top exporter of high-tech goods. The total market share of high-tech exports of all countries compared to the total trade of all countries dropped from 21.0% in the year 2000 to 16.1% in 2007. This is equivalent to a 24% decline.

Table 20: Share of the high-tech goods exported by the listed countries in relation to the total (world) export of goods (G8 countries + China)

	2000	2001	2002	2003	2004	2005	2006	2007
<b>USA</b>	3.7%	3.4%	3.0%	2.6%	2.4%	2.3%	2.3%	1.9%
<b>Japan</b>	2.0%	1.6%	1.5%	1.4%	1.4%	1.2%	1.1%	0.9%
<b>Germany</b>	1.3%	1.5%	1.4%	1.4%	1.4%	1.4%	1.3%	1.1%
<b>United Kingdom</b>	1.1%	1.2%	1.1%	0.8%	0.7%	0.8%	1.0%	0.4%
<b>France</b>	0.9%	0.9%	0.8%	0.8%	0.7%	0.7%	0.7%	0.6%
<b>Italy</b>	0.3%	0.3%	0.3%	0.3%	0.3%	0.2%	0.2%	0.2%
<b>Canada</b>	0.5%	0.4%	0.4%	0.3%	0.3%	0.3%	0.3%	0.2%
<b>Russia</b>	0.1%	0.1%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%
<b>Sum G8</b>	9.9%	9.4%	8.6%	7.7%	7.3%	7.0%	6.9%	5.4%
China	0.6%	0.8%	1.1%	1.4%	1.8%	2.1%	2.3%	2.2%

Figure 17

World market share of high-tech exports of country X compared to the world total exports (product approach)



Out of the G8 members only Germany had a relative small loss in its market share of high-tech exports (-15%). All other G8 members showed considerable losses in the range of -37% to -60%. China expanded its market share considerably from 0.6% in the year 2000 to 2.2% in 2007 (+247%). The strong loss of the United Kingdom from 2006 to 2007 (-54%) is due to the decrease in MTIC fraud.

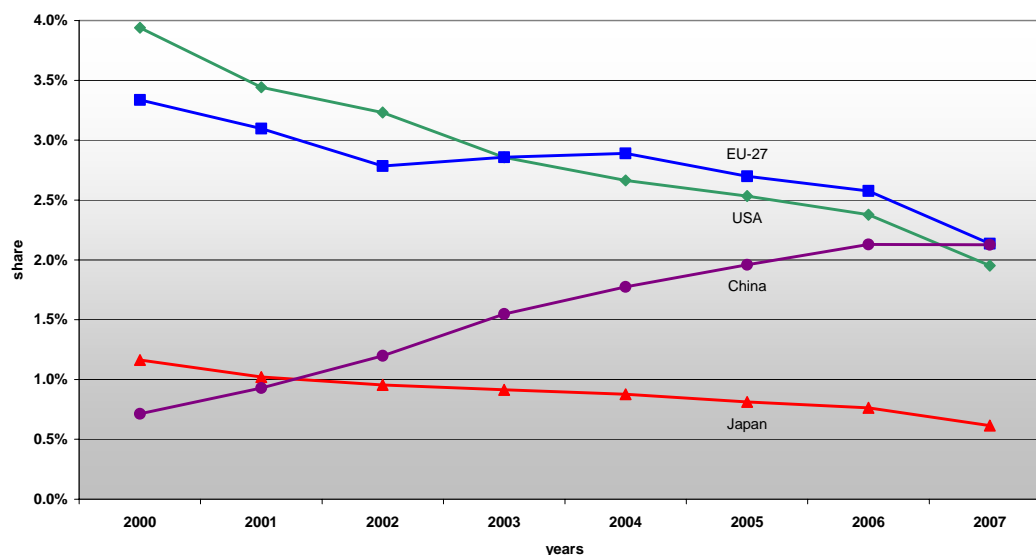
**IMPORTS**

Table 21: Share of the goods imported by high-tech sectors of the listed countries in relation to the total (world) import of all economic sectors (large economic areas)

	2000	2001	2002	2003	2004	2005	2006	2007
EU-27	3.3%	3.1%	2.8%	2.9%	2.9%	2.7%	2.6%	2.1%
USA	3.9%	3.4%	3.2%	2.9%	2.7%	2.5%	2.4%	2.0%
Japan	1.2%	1.0%	1.0%	0.9%	0.9%	0.8%	0.8%	0.6%
China	0.7%	0.9%	1.2%	1.5%	1.8%	2.0%	2.1%	2.1%
Sum big 4 areas	9.2%	8.5%	8.2%	8.2%	8.2%	8.0%	7.8%	6.8%

Figure 18

Share of high-tech imports of country X compared to world total imports (product approach)



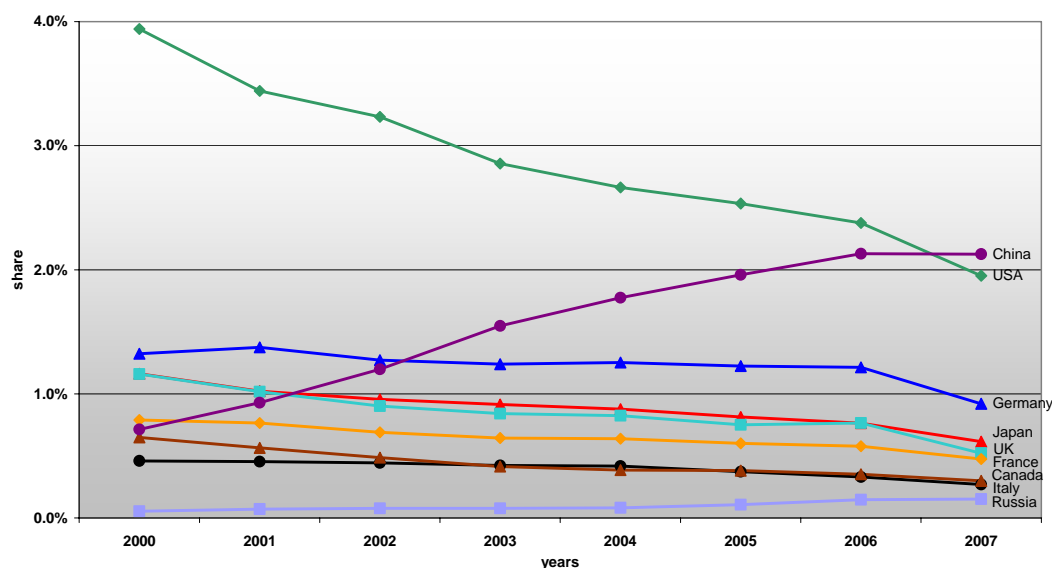
From the data above (Table 21) it can be observed that in 2004 the EU-27 passed the USA and since then has the highest ratio of high-tech imports compared to the world imports. However, the import shares of both, the EU-27 and the USA were declining since the year 2000. China on the other hand increased dramatically its share (+198%) and finally matched in 2007 the EU-27's market share.

**Table 22: Share of high-tech goods imported by the listed countries in relation to the total (world) import of all goods (G8 countries + China)**

	2000	2001	2002	2003	2004	2005	2006	2007
<b>USA</b>	3.9%	3.4%	3.2%	2.9%	2.7%	2.5%	2.4%	2.0%
<b>Japan</b>	1.2%	1.0%	1.0%	0.9%	0.9%	0.8%	0.8%	0.6%
<b>Germany</b>	1.3%	1.4%	1.3%	1.2%	1.3%	1.2%	1.2%	0.9%
<b>United Kingdom</b>	1.2%	1.0%	0.9%	0.8%	0.8%	0.8%	0.8%	0.5%
<b>France</b>	0.8%	0.8%	0.7%	0.6%	0.6%	0.6%	0.6%	0.5%
<b>Italy</b>	0.5%	0.5%	0.4%	0.4%	0.4%	0.4%	0.3%	0.3%
<b>Canada</b>	0.6%	0.6%	0.5%	0.4%	0.4%	0.4%	0.4%	0.3%
<b>Russia</b>	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%
<b>Sum G8</b>	9.5%	8.7%	8.1%	7.4%	7.1%	6.8%	6.5%	5.2%
China	0.7%	0.9%	1.2%	1.5%	1.8%	2.0%	2.1%	2.1%

**Figure 19**

**Share of high-tech imports of country X compared to world total imports (product approach)**



The G8's share of high-tech goods in the total world imports declined from 9.5% in the year 2000 to 5.2% in 2007, which is equivalent to a decrease of 45%.

Looking at Table 22, it can be pointed out, that apart from Russia which – departing from a low level – almost tripled its share of high-tech imports (+186% from 0.05% in 2000 to 0.015% in 2007) all other G8 states had declining shares. Germany had the lowest decrease in its share of high-tech imports with -30%. The USA, Canada, and the UK had the highest losses with -50% or more.

### 4.3. National Market Share (Def. 3) – ratio of a country’s exports of high-tech products to its total exports

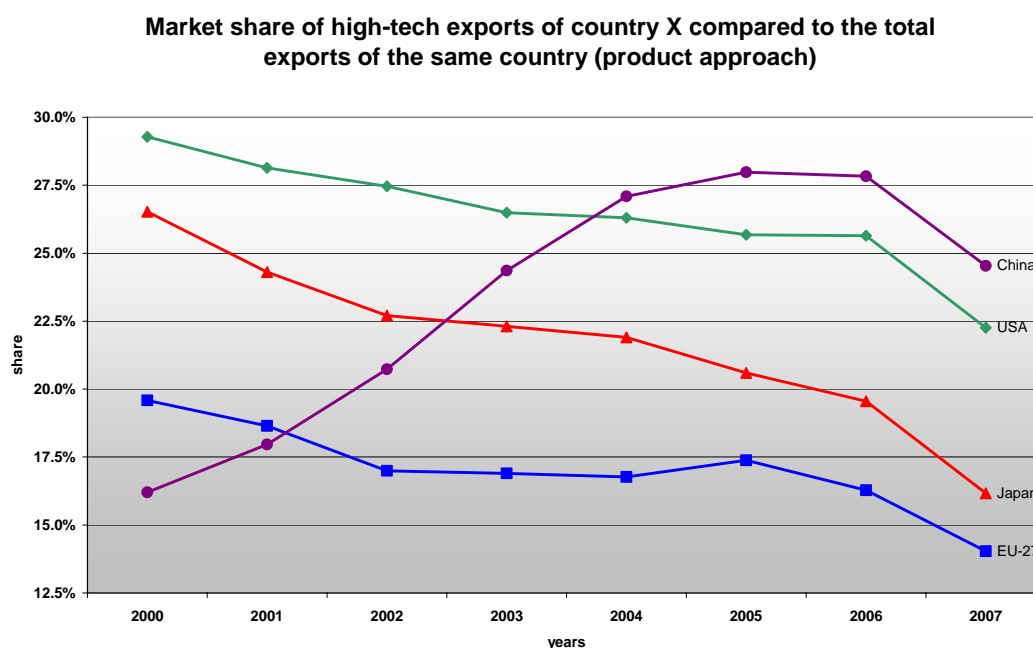
Market share according to definition 3 is defined as the ratio between the exports of high-tech goods from the country / area under study and the total exports of all goods of the same country / area (excluding intra EU-27 exports). In other words, we now consider the market shares of countries obtained when the denominator is not the total world export of all countries, but the total export of the particular country. (For imports the definition is analogous.)

#### EXPORTS

**Table 23: Share of high-tech goods exported by the listed countries in relation to the country’s total export (large economic areas)**

	2000	2001	2002	2003	2004	2005	2006	2007
<b>EU-27</b>	19.6%	18.6%	17.0%	16.9%	16.8%	17.4%	16.3%	14.0%
<b>USA</b>	29.3%	28.1%	27.5%	26.5%	26.3%	25.7%	25.6%	22.3%
<b>Japan</b>	26.5%	24.3%	22.7%	22.3%	21.9%	20.6%	19.6%	16.2%
<b>China</b>	16.2%	18.0%	20.7%	24.4%	27.1%	28.0%	27.8%	24.5%
<b>Mean of the big 4 areas</b>	24.0%	22.8%	21.8%	21.8%	22.1%	22.3%	21.9%	19.0%

**Figure 20**



Except for China, all economic areas show a negative trend in the share of high-tech exports in the total national exports. Japan was the country with the highest relative loss (-39% from 26.5% share in the year 2000 to 16.2% share in 2007) followed by the EU-27 with -28% (from 19.6% to 14.0%), and the USA with -24% (from 29.3% to 22.3%).

China showed an increase until the year 2005 and since then is decreasing again.<sup>22</sup> Taking as a reference the entire period from 2000 to 2007, the Chinese share of high-tech exports increased by 51% and in 2004 China passed the USA becoming a highly specialised economy in the trade of high-tech goods.

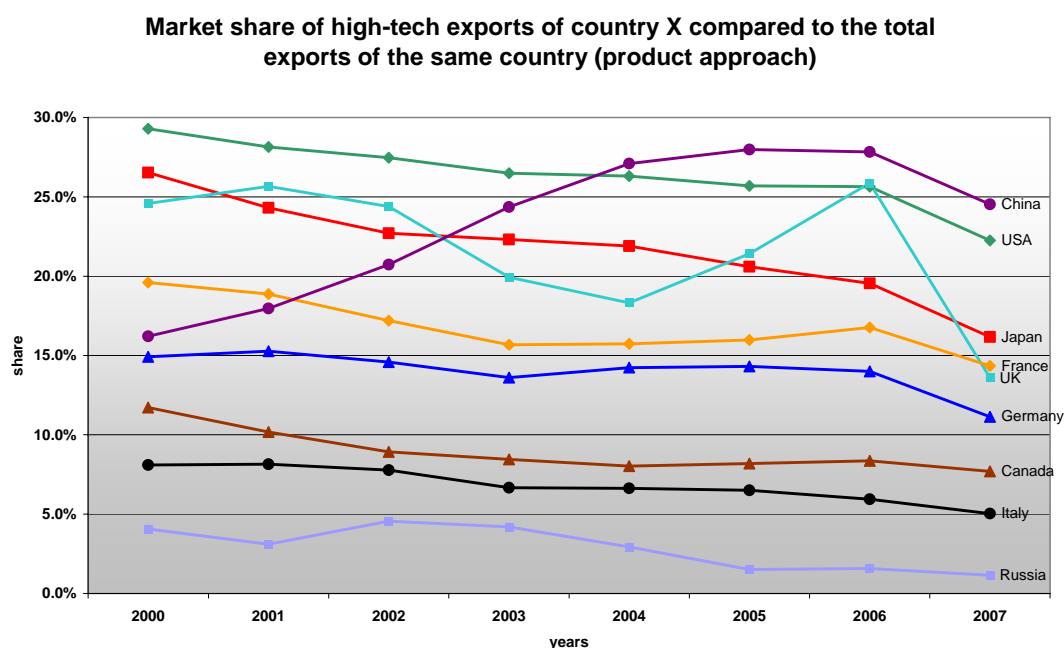
<sup>22</sup> Preliminary figures for the year 2008 confirm the latest downward trend for the USA (2008: 20.3% share) and China (2008: 23.5% share). For the EU-27 the downward trend might be stopped (2008: 13.9% share). (There was no data available for Japan at the time of writing.)

However, this high percentage of high-tech exports (and high-tech imports, see Table 25) might be the result of China becoming a more integrated part in the international production chains, where many unfinished high-tech products are imported by China to be assembled by the low-cost workforce and then exported as finished high-tech goods.

**Table 24: Share of high-tech goods exported by the listed countries in relation to the country's total export (G8 countries + China)**

	2000	2001	2002	2003	2004	2005	2006	2007
<b>USA</b>	29.3%	28.1%	27.5%	26.5%	26.3%	25.7%	25.6%	22.3%
<b>Japan</b>	26.5%	24.3%	22.7%	22.3%	21.9%	20.6%	19.6%	16.2%
<b>Germany</b>	14.9%	15.3%	14.6%	13.6%	14.2%	14.3%	14.0%	11.1%
<b>United Kingdom</b>	24.6%	25.7%	24.4%	19.9%	18.3%	21.4%	25.9%	13.6%
<b>France</b>	19.6%	18.9%	17.2%	15.7%	15.7%	16.0%	16.8%	14.3%
<b>Italy</b>	8.1%	8.2%	7.8%	6.7%	6.6%	6.5%	5.9%	5.0%
<b>Canada</b>	11.7%	10.2%	8.9%	8.5%	8.0%	8.2%	8.4%	7.7%
<b>Russia</b>	4.1%	3.1%	4.5%	4.2%	2.9%	1.5%	1.6%	1.2%
<b>Mean G8</b>	20.7%	19.7%	18.6%	17.0%	16.7%	16.5%	16.7%	13.2%
China	16.2%	18.0%	20.7%	24.4%	27.1%	28.0%	27.8%	24.5%

**Figure 21**



The mean G8 share of high-tech exports in the G8 total exports dropped from 20.7% in the year 2000 to 13.2% in 2007 or by 36%.<sup>23</sup> However, this trend was not uniform among the G8 members. Some showed relatively low losses, like Germany (-25%) or the USA (-24%). Others had losses higher than the mean, like Japan (-39%), Italy (-38%), and the UK (-45%). The UK had a peak of relative elevated high-tech shares in their exports in 2005 and 2006, which were mainly due to MTIC fraud. The relative strong drop for Russia (-72%) can be explained by the increasing share of fossil fuel exports due to the increased crude oil and natural gas prices.

<sup>23</sup> At the same time China increased its share of high-tech exports in their total exports by 51% (from 16.2% in 2000 to 24.5% in 2007 with a peak of 28.0% in 2005).



Preliminary figures for 2008 show that the downward trend might be reversed in the cases of Italy (+0% from 2007 to 2008) and France (+6%) and all others show only minor losses (ranging between -6% to -9%) compared to the big losses from 2006 to 2007 (G8 mean: -21%).

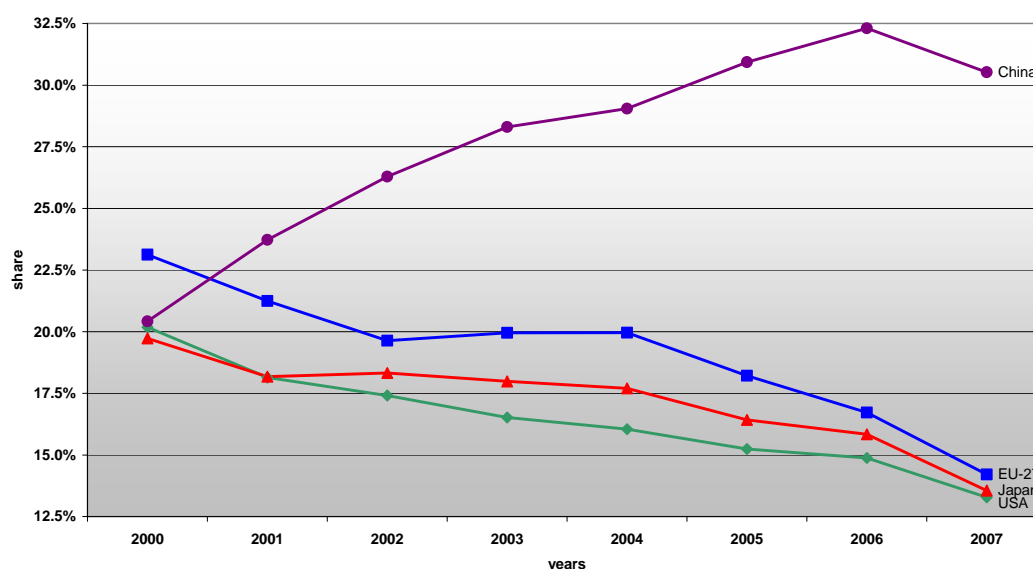
## IMPORTS

**Table 25: Share of high-tech goods imported by the listed countries in relation to the country's total import (large economic areas)**

	2000	2001	2002	2003	2004	2005	2006	2007
<b>EU-27</b>	23.1%	21.2%	19.6%	19.9%	20.0%	18.2%	16.7%	14.2%
<b>USA</b>	20.2%	18.1%	17.4%	16.5%	16.0%	15.2%	14.9%	13.3%
<b>Japan</b>	19.7%	18.2%	18.3%	18.0%	17.7%	16.4%	15.8%	13.6%
<b>China</b>	20.4%	23.7%	26.3%	28.3%	29.0%	30.9%	32.3%	30.5%
<b>Mean big 4 areas</b>	21.1%	19.7%	19.2%	19.4%	19.5%	18.7%	18.3%	16.6%

**Figure 22**

**Share of high-tech imports of country X compared to the total imports of the same country (product approach)**



The EU-27, Japan, and the USA show decreasing shares of high-tech imports in their total imports during the period from 2000 to 2007. The highest decline was registered for the EU-27 with a loss close to -39% (from 23.1% share in 2000 to 14.2% in 2007). China, on the other hand, increased the share of high-tech imports from 20.4% in the year 2000 to 32.3% in 2006 but then declined slightly to 30.5% in 2007. Overall the increase of China's high-tech imports was +49% from 2000 to 2007. In 2006 China's high-tech share was almost 16 percentage points higher than the share of its runner-up, the EU-27.

**Table 26: Share of high-tech goods imported by the listed countries in relation to the country's total import (G8 countries + China)**

	2000	2001	2002	2003	2004	2005	2006	2007
<b>USA</b>	20.2%	18.1%	17.4%	16.5%	16.0%	15.2%	14.9%	13.3%
<b>Japan</b>	19.7%	18.2%	18.3%	18.0%	17.7%	16.4%	15.8%	13.6%
<b>Germany</b>	17.0%	17.6%	16.8%	15.5%	16.0%	16.4%	15.8%	11.9%
<b>United Kingdom</b>	22.0%	18.7%	16.2%	16.1%	16.2%	15.2%	15.1%	11.5%
<b>France</b>	16.7%	16.2%	14.7%	13.4%	13.5%	13.2%	13.1%	10.7%
<b>Italy</b>	12.4%	11.9%	11.6%	10.7%	10.8%	10.1%	8.9%	7.2%
<b>Canada</b>	17.4%	15.8%	14.1%	13.0%	12.9%	12.7%	12.0%	10.7%
<b>Russia</b>	10.1%	10.5%	10.7%	10.0%	9.9%	11.2%	12.8%	10.5%
<b>Mean G8</b>	18.6%	17.2%	16.3%	15.3%	15.2%	14.7%	14.3%	11.8%
China	20.4%	23.7%	26.3%	28.3%	29.0%	30.9%	32.3%	30.5%

Analysing the G8 member states, it can be seen, that Germany and Japan with drops of -30% and -31% respectively had by far the lowest decreases compared to the mean loss of the G8 countries of -36%. Only Russia had an increase of +3% between 2000 and 2007. Of the other G8 members Italy and the UK had decreases significantly worse than the mean (-42% and -48% respectively).

## 5. Sectoral approach versus product approach

In this section the results of the market shares according to definition 1 for the sectoral and the product approach are compared, in order to see if they correspond and if changes across time in one approach are reflected also in the other approach. In the two plots below – one for exports (Figure 23) and one for imports (Figure 24) – we can see the product approach being confronted with the sectoral approach. Each country is plotted in a different colour.

For the eight years under consideration the trend is very similar in the two approaches, so that we can say that there are no substantial differences between them (with sample correlation coefficients  $r > 0.99$ , except for the EU-27 with  $r=0.84$  for exports and  $r=0.91$  for imports). From these plots it is easy to see how strong the expansion of China was. The EU-27 and also the USA were at the highest levels, but the EU-27 was more stable than the USA.

For the definitions 2 and 3 similar scatter plots were drawn but they do not show any substantial differences to the plots of definition 1. Also for definitions 2 and 3 the results correlated quite well (all sample correlation coefficients were  $> 0.9$ ), although the points were usually below the diagonal, meaning that the market shares were higher with the sectoral approach than with the product approach.

These plots are helpful in order to have a complete picture of the two approaches for all countries and all years at the same time. But to know if the trend of a given country is increasing or decreasing, we have to refer to the previous graphs as the points in the scatter plots are not necessarily in chronological order.

Figure 23

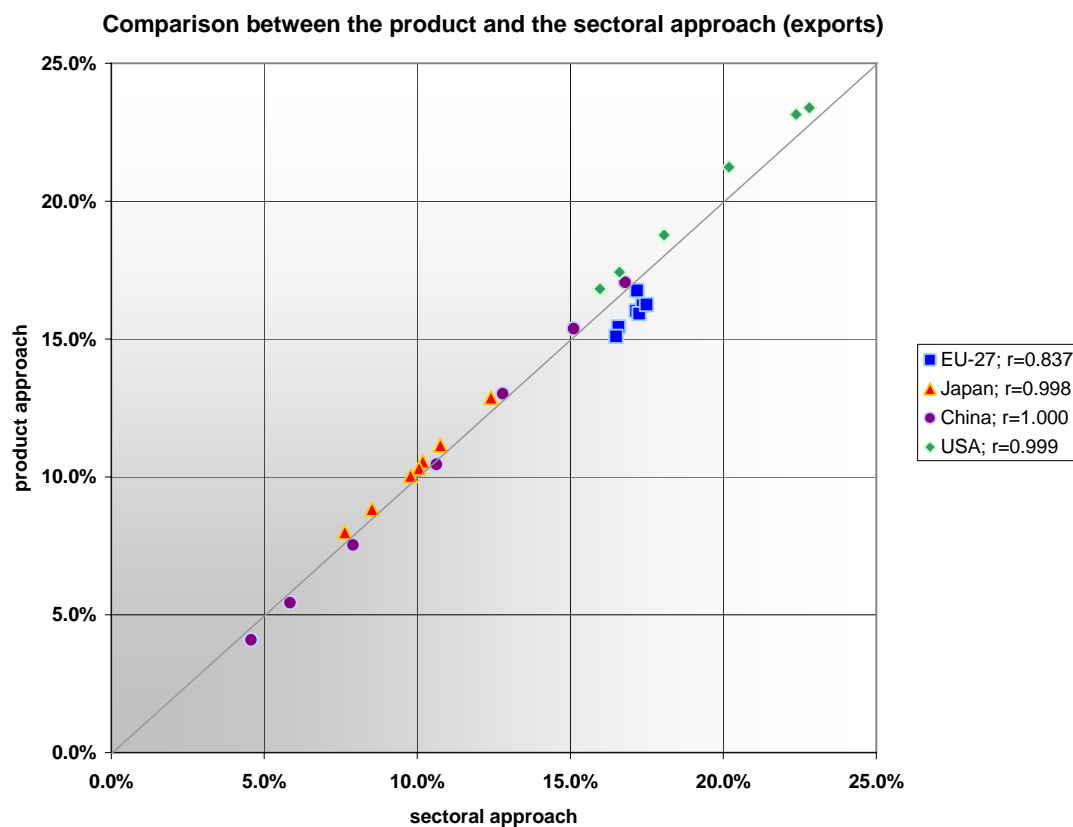
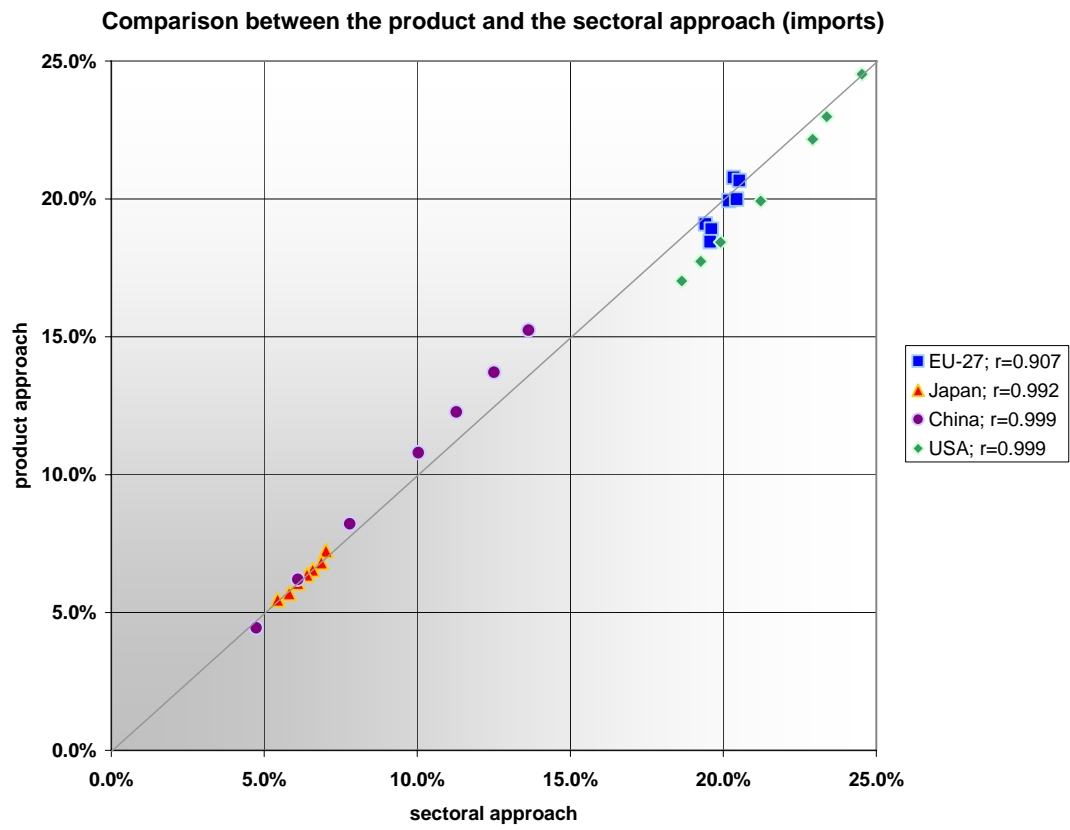


Figure 24



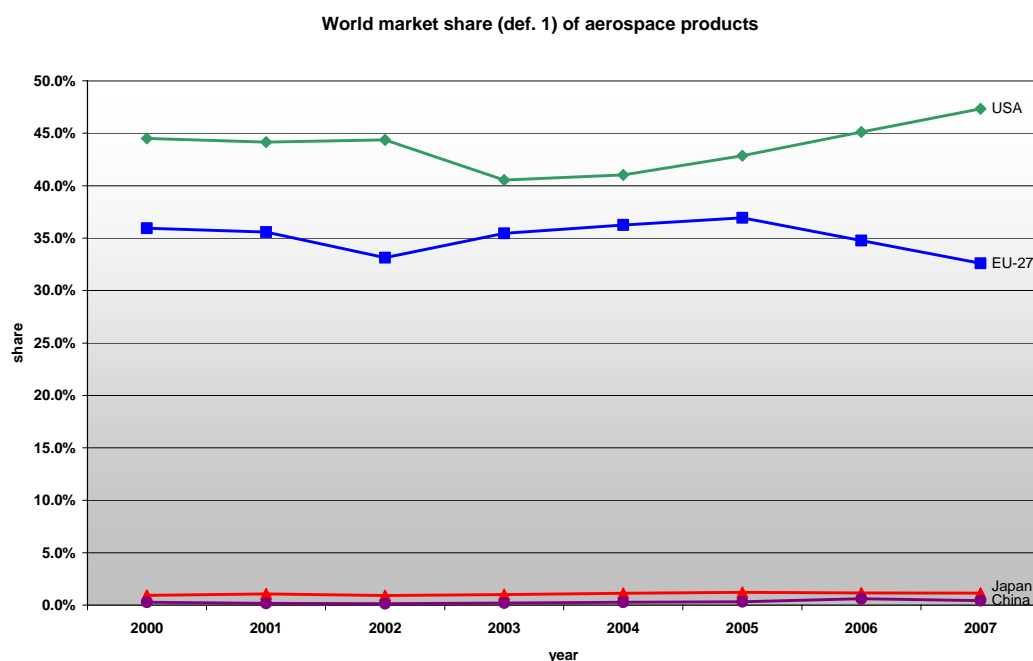
## 6. Detailed analyses of the high-tech product groupings (product approach)

### 6.1. Analyses of the export market shares (def. 1) of the different product groups.

World market shares of the exports of aerospace products

The USA had the highest share in the world exports of aerospace products with 41% to 47% during the years 2000 to 2007 (see Figure 25). The EU-27 (excluding intra-community trade) had also very high shares with 33% to 37% during the same period. China and Japan did not have relevant shares in the export of aerospace goods.

Figure 25



Including intra-community exports (graph not shown), France was in second place (around 17% market share during the period 2000 to 2007) behind the USA (around 36% market share<sup>24</sup>). Germany – the second largest European manufacturer of aerospace products – was third with a share of around 15%.

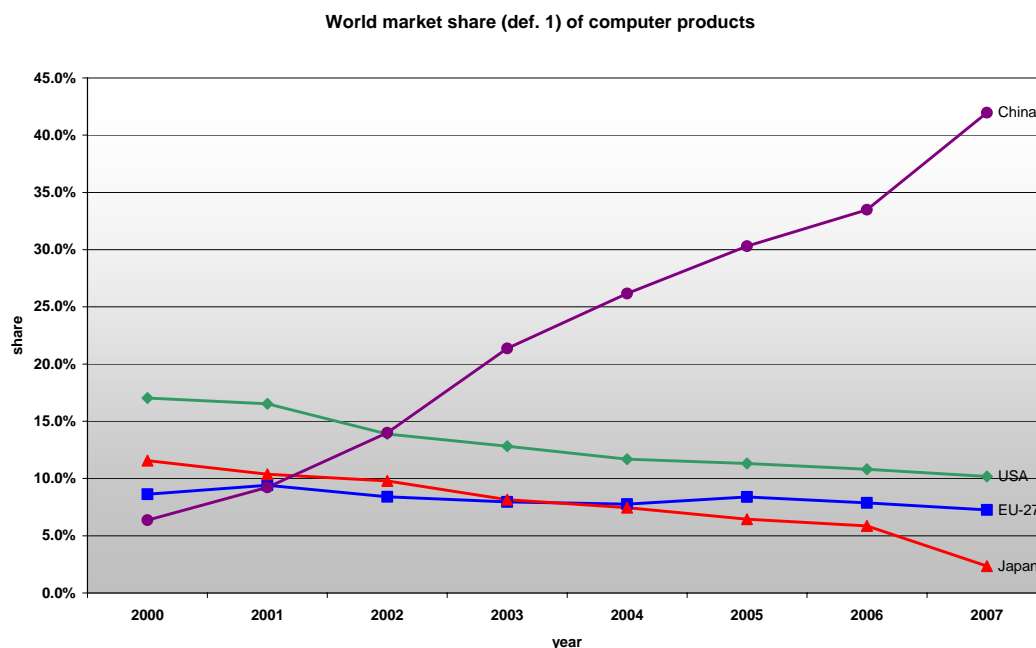
With respect to the imports of aerospace products (graph not shown), in 2007 the EU-27 had the highest share with 27.8%, followed by the USA with 21.0%. Since 2006 China's share is higher than Japan's share. In 2007 they accounted for 8.3% and 6.6% respectively.

World market shares of the exports of computer products

The USA and Japan are dramatically losing ground in the market share of computer products with average negative growth rates of -8% yearly for the USA and -19% for Japan (see Figure 26). China on the other hand is growing very fast (on average 30% yearly) and quintupled its market share from the year 2000 to 2007. China now accounts for 42% of the total computer high-tech exports. The EU-27 remains more or less stable at around 8%.

<sup>24</sup> The USA account for around 36% in this comparison as the world market in aerospace exports now also includes intra-community trade.

Figure 26



Analysing the G8 figures (including intra-community trade, graph not shown), in 2007 the G8 countries accounted in total for 20% of the world computer exports. This is considerably less than China's share of 34%. The USA and Germany were the biggest exporters of computer products with 8% and 5% respectively.

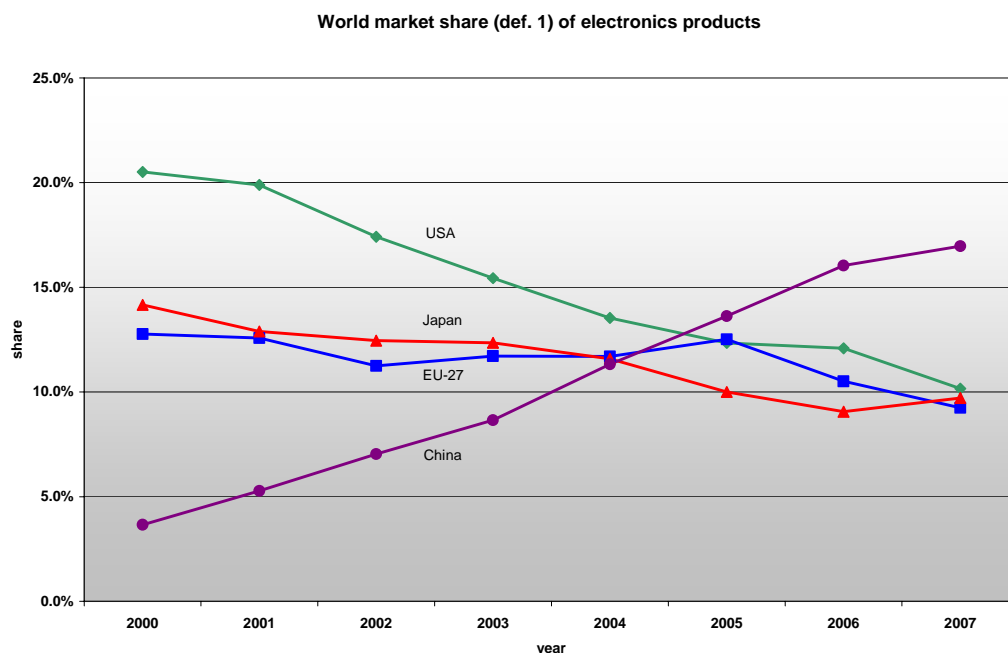
World market shares of exports of **electronics and telecommunications** products

In the exports of electronics and telecommunications products (see Figure 27) the USA has lost half of their market share between 2000 and 2007. The losses in market share of Japan and the EU-27 were lower but also reached around -30%.

In contrast to the other big economic areas, China has steadily increased its market share from 3.7% in 2000 to 17.0% in 2007. The average yearly growth rate between 2000 and 2005 was 30% but since then decreased and dropped to only 6% for 2006/2007. Since 2005 China is the country with the highest market share in the exports of electronics and telecommunication products.

On the import side (graph not shown) similar trends can be observed. The USA's share dropped to half between 2000 and 2007 and now accounts for 10%. Japan lost 28% (now at 4% share) and the EU-27 lost 21% (now at 13%). China has tripled its share and accounts now for more than 21%.

**Figure 27**

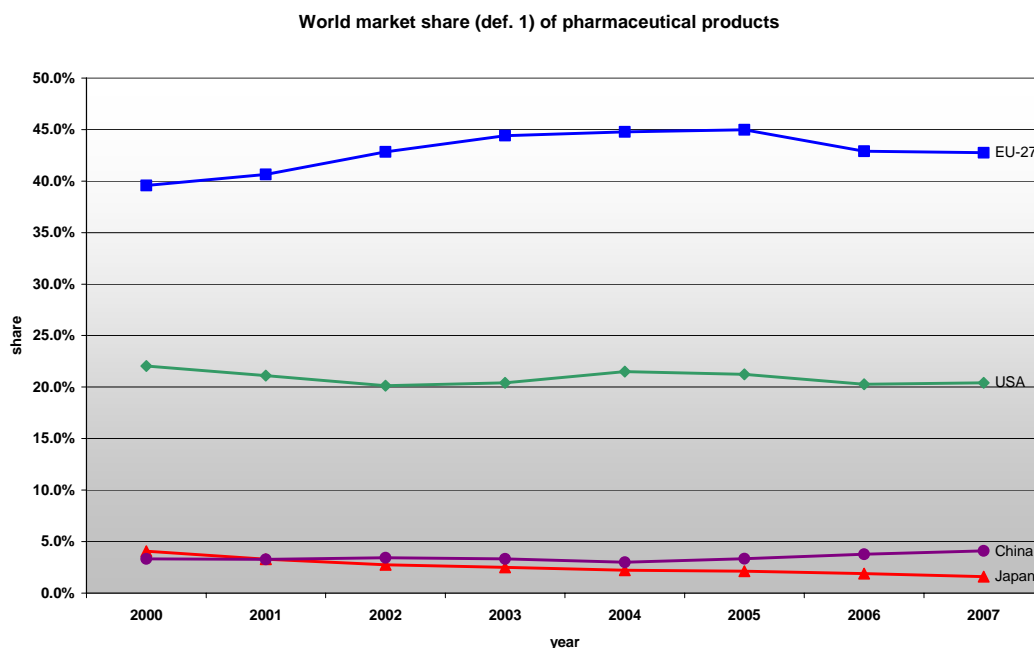


World market share of exports of **pharmaceutical** products

The EU-27 is by far the world's largest exporter of pharmaceutical products and even increased its market share from 40% in the year 2000 to 43% in 2007 (see Figure 28). The EU-27 is followed by the USA with a market share of 20% in 2007, roughly half of the EU-27's market share. Japan and China lack behind with market shares of less than 2% and 4% respectively.

Looking at the G8 and including the intra-community trade of the EU (graph not shown) it can be observed that the USA (14% market share in 2007) and Germany (12% market share) are the largest exporters of pharmaceutical products.

**Figure 28**

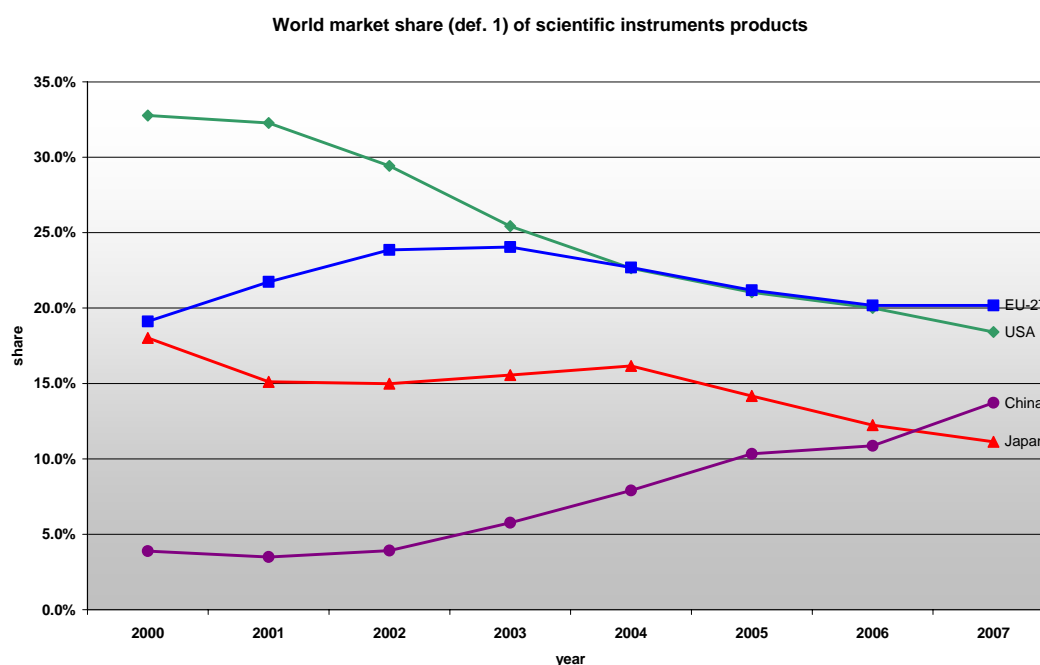


### World market share of exports of scientific instruments products

In the year 2000 the USA was clearly leading the exports of scientific instruments with a market share of 33% but since then has lost dramatically market share and now accounts for only little more than 18% (see Figure 29). The EU-27 has improved its market share during the years 2000 to 2003 from 19% to 24% but since then has lost again some market share and is now stable at 20%. Nonetheless, since 2004 the EU-27 has the largest market share always slightly above the USA. Japan has lost 38% of its share since the year 2000 and in 2007 accounted for 11% of the exports of scientific instruments. China more than tripled its market share from 4% in the year 2000 to almost 14% in 2007.

Looking at the G8 members (graph not shown), it can be pointed out that the USA still leads with a market share of more than 15% in 2007. However, the USA have lost more than 10 percentage points or 43% of its share since the year 2000. Germany is in second place with a stable market share of almost 13%. In 2007 Japan had a share of 9% and China of 12%. Hence, in 2008 China might be in second place.

**Figure 29**

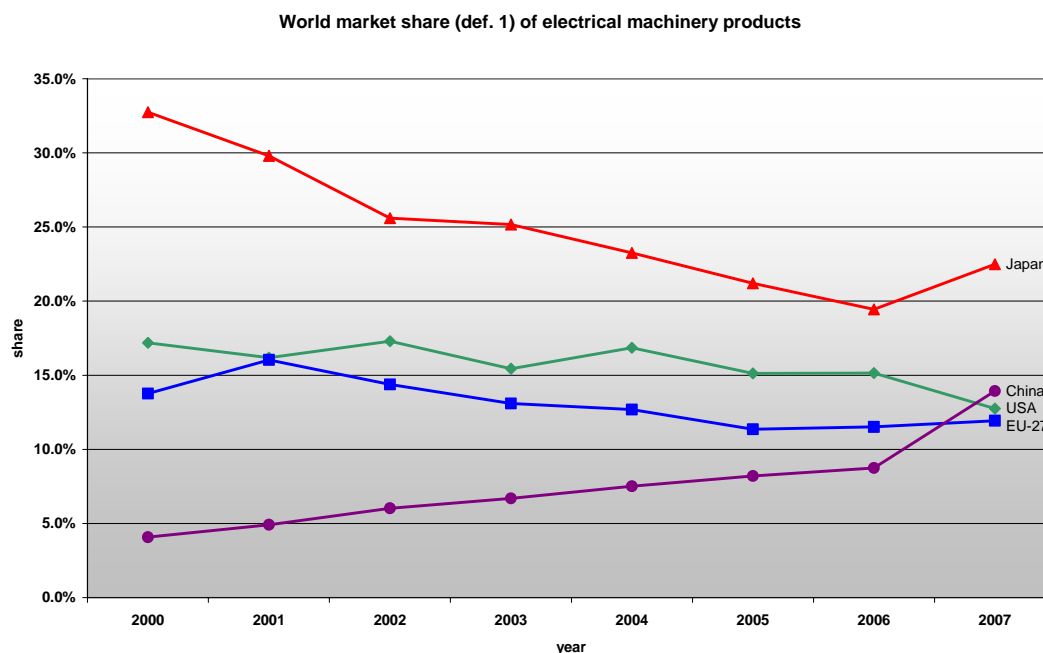


### World market share of exports of electrical machinery products

Japan – although having lost 10 percentage points of market share in the exports of electrical machinery between 2000 and 2007 – is still the leader in the export of these high-tech goods (see Figure 30). From 2006 to 2007 it could even expand again its share from 19% in 2006 to 22% in 2007. Japan is followed by the USA. This country was more or less stable around 16% but lately lost market share and is now at 13%. The EU-27 was showing a slightly declining market share from 2000 to 2005 but then slowly recovered. In 2007 the EU-27's market share was 12%. Between 2000 and 2006 China doubled its export market share of electrical machinery products with an average yearly growth rate of 14%. From 2006 to 2007 however the share grew strongly by 60% to a market share of now 14.4%.



**Figure 30**

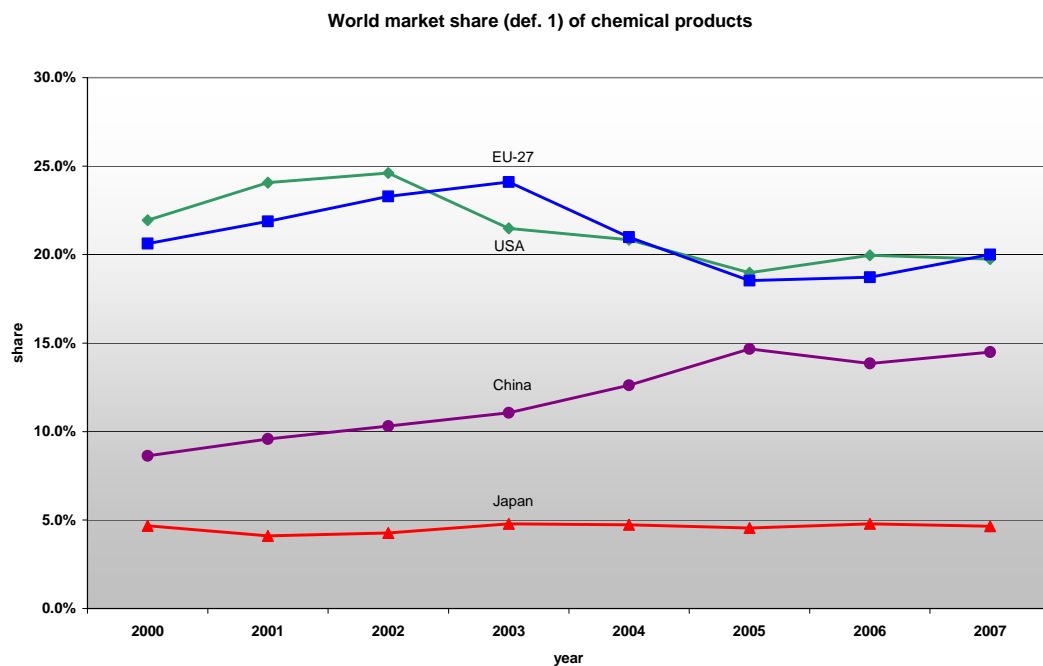


Looking at the G8 members (graph not shown), it can be pointed out that EU Member States United Kingdom and France halved its market shares (to 3.5% and 0.9% respectively in 2007) while Germany and Italy were able to increase their market shares (from 7.5% in 2000 to 8.7% in 2007 for Germany and from 0.8% to 1.2% for Italy).

World market share of exports of **chemical** products

The EU-27 and the USA are swapping places in the lead of the exports of chemicals. Both economic areas have lost market shares since 2000, but in 2007 were still strong with ca. 20% market share (see Figure 31). Between 2000 and 2005 China increased strongly its market share in the exports of chemicals from 8.6% to 14.7% or by 70%, but since than seems to stabilise at roughly 14.5%. Japan was stable around 4.6% during the whole period.

**Figure 31**

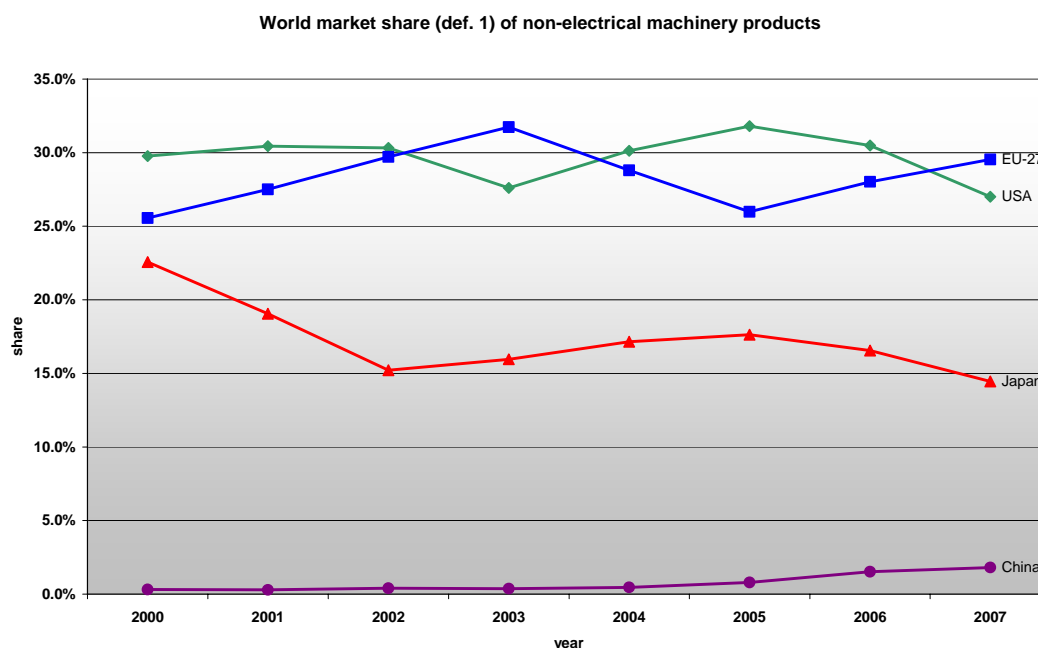


Looking at the G8 and Chinese figures (including intra-community trade, graph not shown) it can be noticed that China is now the second largest exporter of chemicals (10.9% market share in 2007) and passed Germany and France (9.2% and 10.3% market share respectively). The USA is in the lead with 14.9%.

World market share of exports of **non electrical machinery** products

The USA and the EU-27 are swapping places in the lead and show average market shares in the export of non-electrical machinery of around 30% and 28% respectively (see Figure 32). Japan lost more than a third of its market share between 2000 and 2007. China does not have a relevant exports market share in non-electrical machinery but nonetheless quintupled its share since the year 2000 and reached a share of 1.8% in 2007.

**Figure 32**



Looking at the G8 figures (graph not shown) it can be noted, that Germany was stable around 14% market share (including intra-community trade) and has now passed Japan which has lost 40% of its market share since the year 2000. The USA stays in the lead with 21% export share. Finally it is noteworthy that China has a lower export share than Russia (1.4% compared to 2.1%).

On the import side, Japan lost half of its share since the year 2000 reaching 3.4% in 2007. The share loss of the USA and the EU-27 was more moderate with -32% and -23% respectively. The EU-27 was always the largest importer of non-electrical machinery and had a share of 22% in 2007.

World market share of exports of **armaments** products

The exports of armaments were not analysed as the JRC assumes that a lot of exports of armaments are not declared as such in the national statistics due to nondisclosure and that therefore the figures to be presented here would probably be underestimated and meaningless.

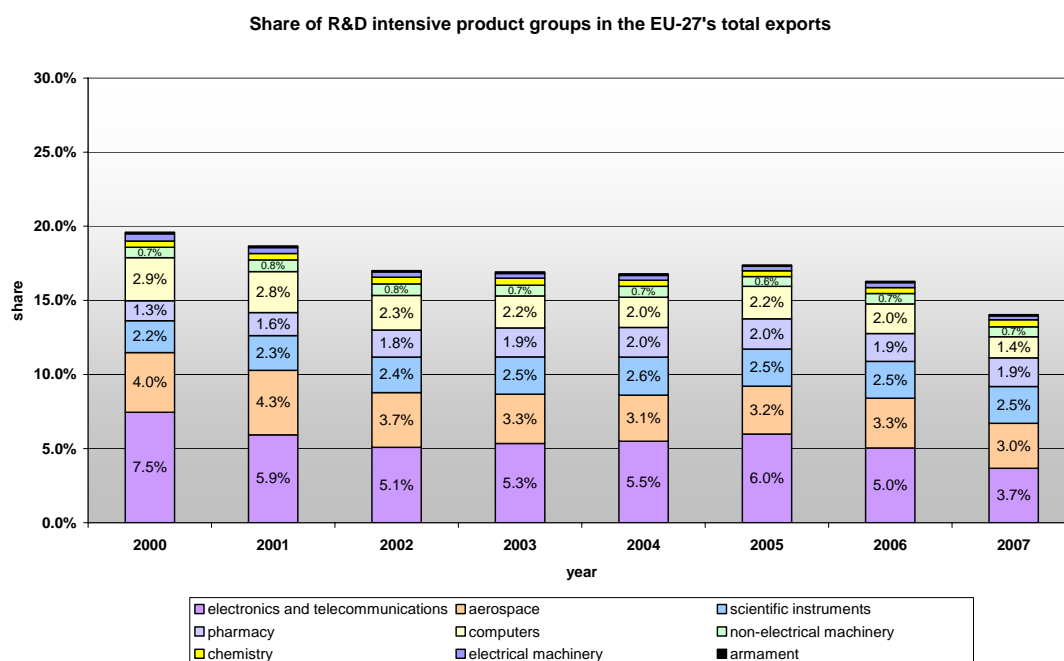
The analyses of the market shares in the exports of the nine high-tech product groups (def. 1) shows that in most product groups the market shares of the EU-27 remained relatively stable. The analyses also reveals that the USA maintained an important position although it was losing ground in some product groups and it also shows that Japan is losing market shares in almost all sectors. China on the other hand is clearly gaining export market share in most sectors.

## 6.2. Share of the exports of R&D intensive product groups in the total exports of the same country (def. 3)

### EU-27:

Among the four big economic areas – EU-27, USA, Japan, and China – the EU-27 has the lowest share of high-tech products being exported in its total exports (excluding intra-community trade). As it can be seen in Figure 33 the share was only 14% in the year 2007. Almost 90% of the exported high-tech products came from five of the nine high-tech product groups under study. The five groups with the highest shares in the EU-27's total exports were: electronics and telecommunications, aerospace, scientific instruments, pharmaceutical products, and computers. This order was quite stable during the period 2000 to 2007 except for the pharmaceutical products which passed from 5<sup>th</sup> to 4<sup>th</sup> place in 2007.

**Figure 33**

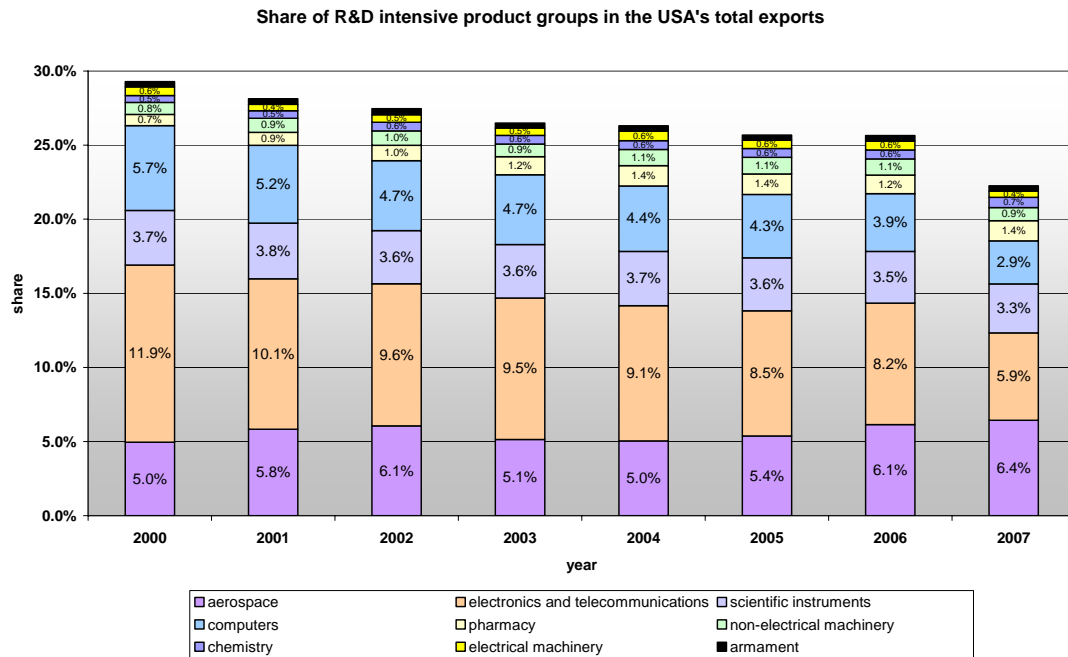


### United States of America:

The USA is the economic area with the second highest share of high-tech exports in its total exports after China. The share of the high-tech products was above 22% in 2007 (see Figure 34). Also in the case of the USA five product groups accounted for roughly 90% of the total high-tech exports. The main high-tech product groups in the US exports were: aerospace, electronics and telecommunications, scientific instruments, computers, and pharmaceutical products. These are the same product groups as for the EU-27. The ranking of the most exported US high-tech products changed over time. In the year 2000 electronics and telecommunication products were clearly in first place with almost 12%, followed by computer products. In the meanwhile electronics and telecommunication products dropped to 6% (2<sup>nd</sup> place). Also the share of the computer products declined. These products were on 2<sup>nd</sup> place in 2000

and dropped to 4<sup>th</sup> place in 2007. On the other hand, aerospace products – which were on 3<sup>rd</sup> place in the year 2000 – are now the largest high-tech group in the US exports.

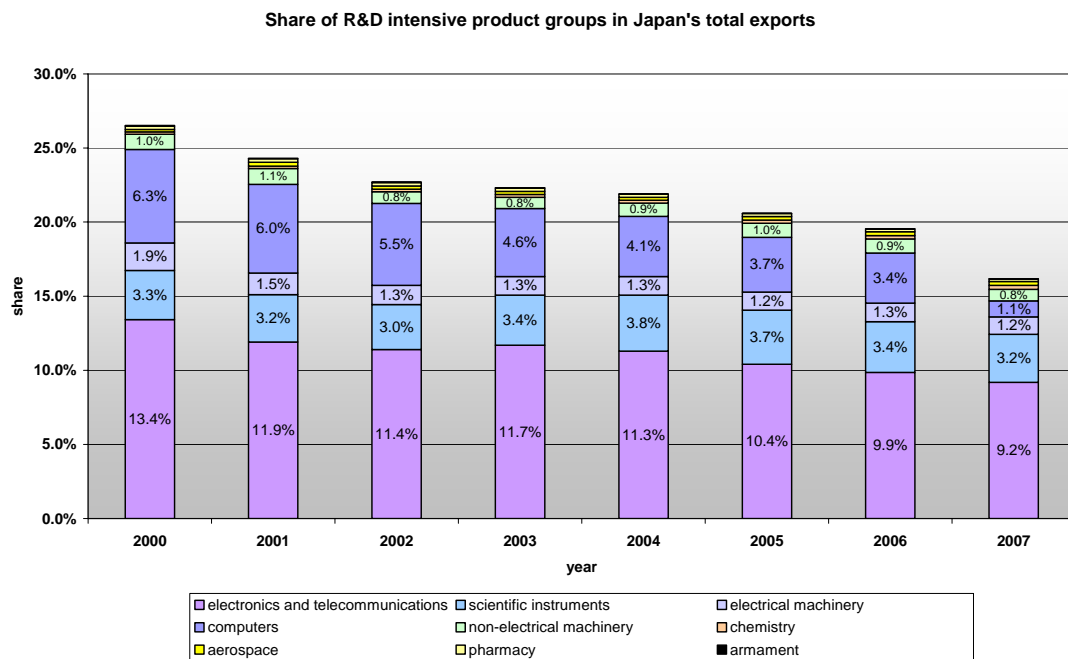
**Figure 34**



## Japan

Japan is third among the four economic areas under study concerning the share of high-tech exports in its total exports. The share was just above 16% in 2007 (see Figure 35). The high-tech exports of Japan are concentrated in only four high-tech product groups which together account for 91% of all high-tech exports: electronics and telecommunications, scientific instruments, electrical machinery, and computers. The latter were on 2<sup>nd</sup> place in the year 2000 with over 6% but the share of the computer products deteriorated heavily especially from 2006 to 2007

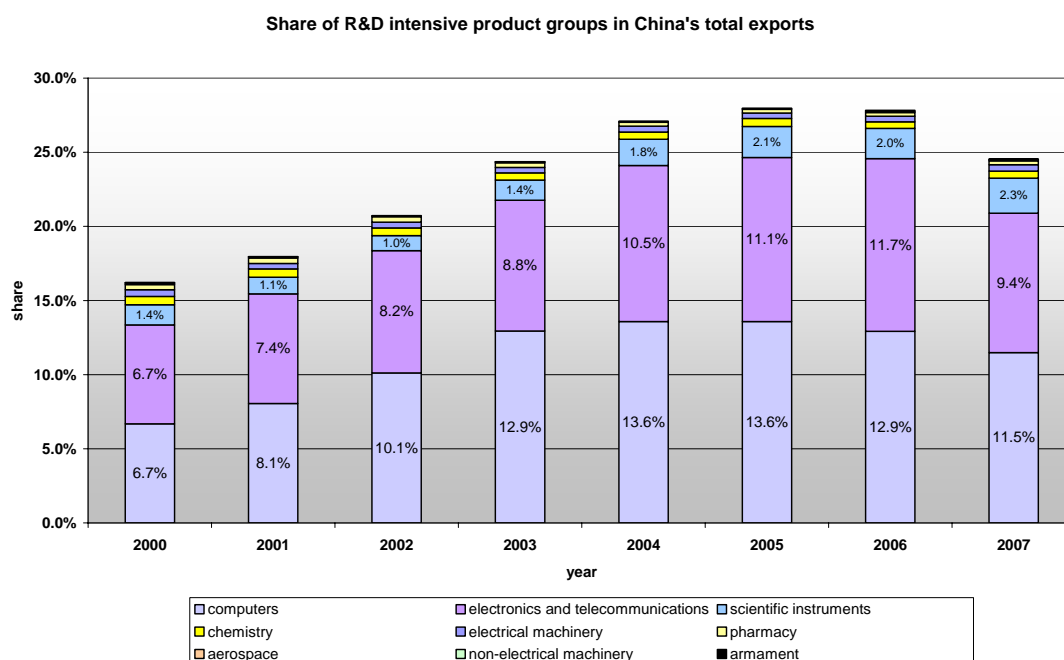
**Figure 35**



## China:

China shows the highest ratio between high-tech exports and total exports of the four economic areas under study. The share of high-tech products was between 24 and 25% in 2007 (see Figure 36). Compared to the other economic areas the high-tech exports of China are the most concentrated as two high-tech product groups account for 85% of all high-tech exports. If the third largest high-tech group is also taken into account then these three high-tech groups account for 95% of all high-tech exports. The main high-tech product groups in China's exports are: computers, electronics and telecommunication products, and to much lesser extend also scientific instruments. The importance of the latter has increased lately but the scientific instruments still account only for less than 10% of all Chinese high-tech exports, whereas computers and electronics and telecommunication products account for 47 and 38% respectively. In the year 2000 these two groups were still equally important for the Chinese high-tech exports but since then the importance of computer products has increase considerably while the importance of electronics and telecommunication products has decreased slightly.

**Figure 36**



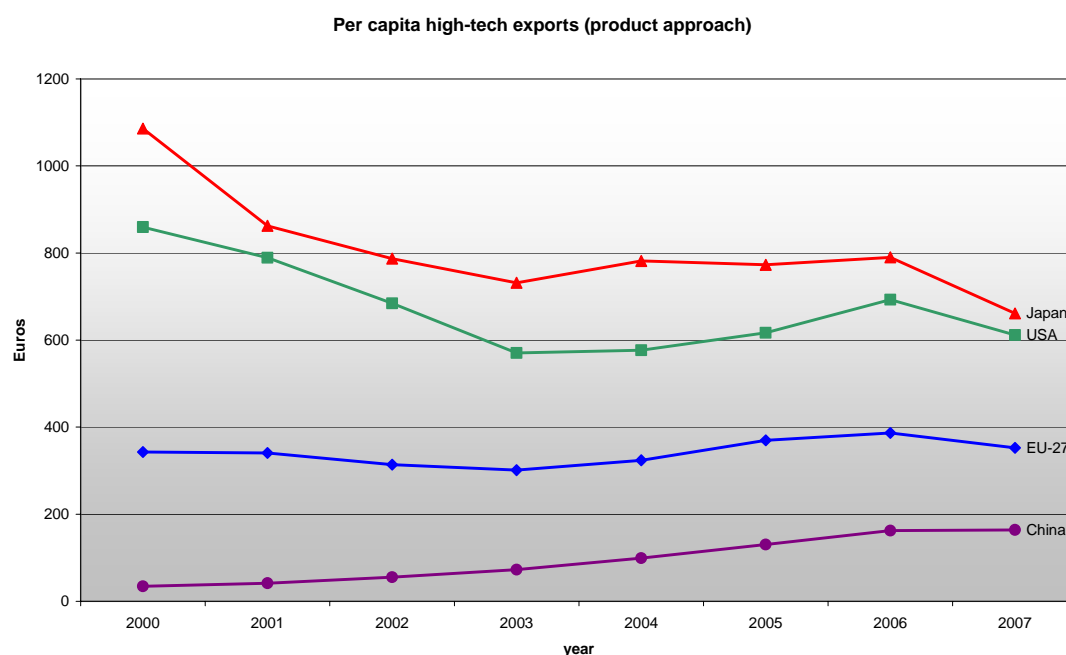
## 7. Per capita high-tech trade

A different indicator that can be calculated for each economic area or country is the amount of exports (imports) of high-tech products per capita<sup>25</sup>. This provides the magnitude of high-tech trade in relation to the population of the country considered.

**Table 27: Per capita high-tech exports (product approach) in Euros**

	2000	2001	2002	2003	2004	2005	2006	2007
<b>EU-27</b>	343	341	314	301	324	370	387	353
<b>USA</b>	860	789	685	571	577	617	693	612
<b>Japan</b>	1086	863	787	732	782	773	790	662
<b>China</b>	35	42	56	73	99	131	163	164

**Figure 37**



Apart from China, which almost quintupled its per capita high-tech exports from the year 2000 to 2007, only the EU-27 was able to increase slightly its per capita exports (+3%, calculated in Euros). The USA as well as Japan were showing decreasing per capita high-tech exports (-29% and -39% respectively), especially during the years 2000 to 2003. However, if calculated in US-Dollars, the per capita high-tech exports were actually increasing by 6% in the case of the USA and decreased only by 10% in the case of Japan. (When calculating US-Dollars, the EU-27 shows an increase of 53% and China more than septupled its per capita high-tech exports.) So the informational value of the per capita high-tech exports is somewhat limited or at least partially bound to the exchange rate development of the Euro towards the US-Dollar, which improved for the Euro by 48% between the years 2000 and 2007.

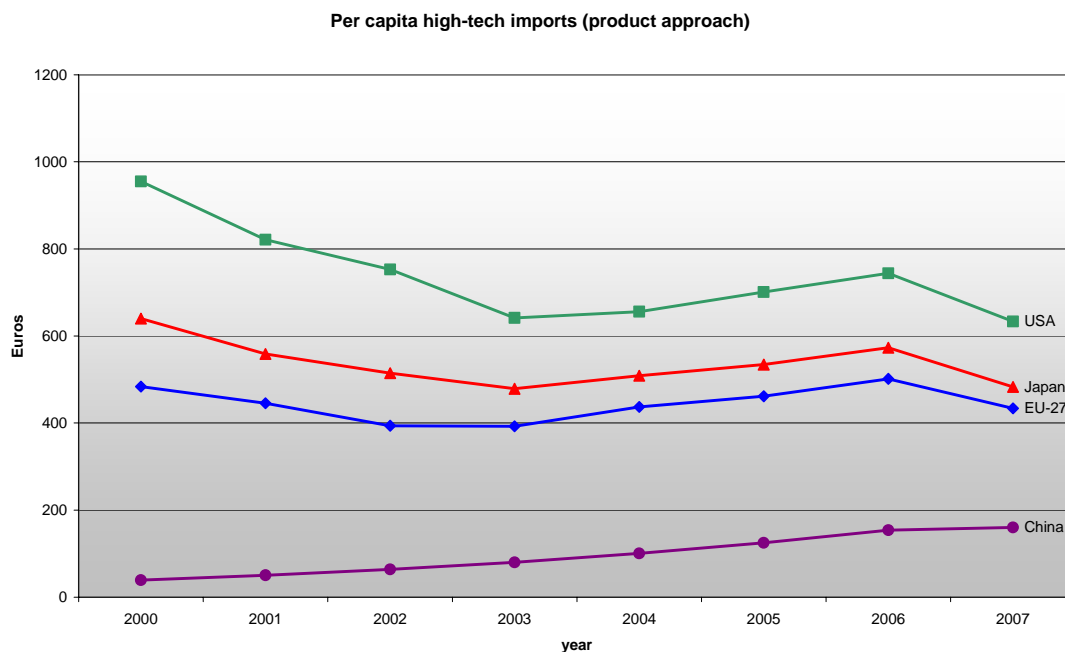
Besides of these limitations, it can be pointed out that Japan is the highest per capita exporter of high-tech goods, closely followed by the USA. In contrast to these values, the EU-27 shows per capita high-tech exports which are only half as high as in Japan. And lastly, China is clearly behind with per capita high-tech exports which represent only a quarter of the Japanese values.

<sup>25</sup> The population figures come from the United Nations Annual interpolated mid-year population estimates 1997 - 2007; Source: UN Demographic Yearbook 2007.

**Table 28: Per capita high-tech imports (product approach) in Euros**

	2000	2001	2002	2003	2004	2005	2006	2007
<b>EU-27</b>	484	445	394	392	437	462	501	434
<b>USA</b>	955	821	753	642	656	701	744	633
<b>Japan</b>	640	559	515	479	509	534	573	483
<b>China</b>	39	51	64	80	101	125	154	160

**Figure 38**



On the import side the picture is different. Here the USA dominates the per capita imports of high-tech goods (measured in Euros) and is followed by Japan and the EU-27 who have a per capita high-tech import at the magnitude of 76 to 68% of the USA's per capita high-tech imports. China is relatively far behind but has quadrupled its per capita high-tech imports between 2000 and 2007.

Measured in Euros the USA, Japan, and the EU-27 showed decreasing per capita high-tech imports from 2000 to 2003 and increasing per capita imports for 2003 to 2006. From 2006 to 2007 the per capita high-tech imports dropped for all three areas around 15%.

Also in the case of the per capita high-tech imports the exchange rate of the Euro towards the US-Dollar influences the results. While calculated in Euros the per capita high-tech imports of the EU-27 and Japan decreased between 2000 and 2007, they increased when calculated in US-Dollars.

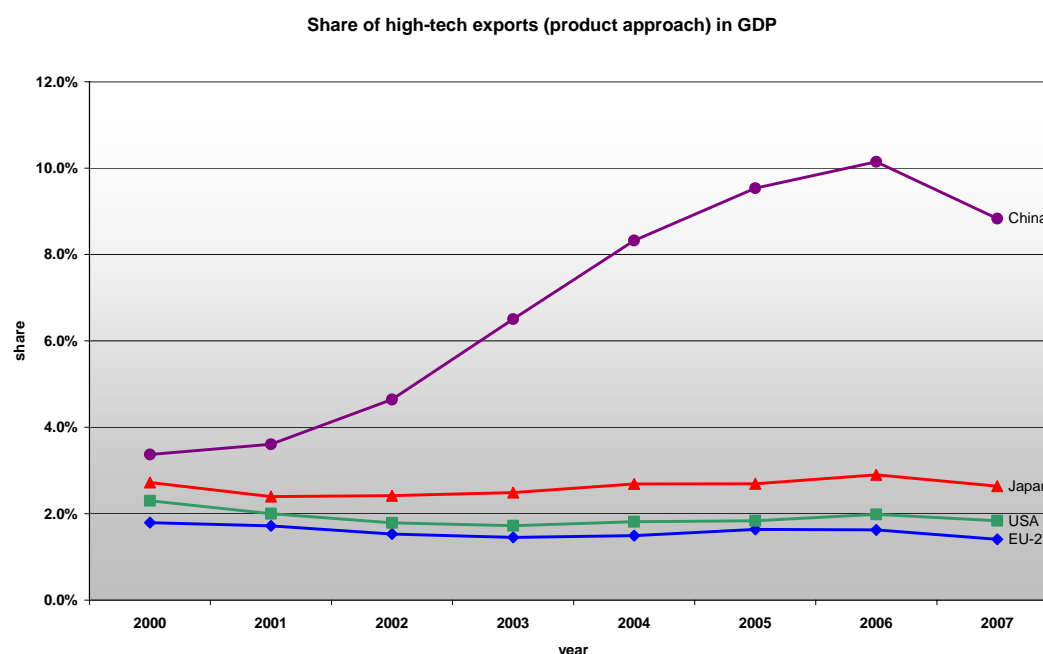
## 8. Ratio of high-tech exports to gross domestic product

The ratio of total trade to the gross domestic product (GDP) is probably the most frequently used indicator of trade integration since it provides a measure of the degree of dependence of domestic producers on foreign markets. In this section an indicator is used which is derived from this indicator: the ratio of high-tech exports to GDP. An increasing ratio of high-tech exports to GDP means that the exports of high-tech products grow faster than the GDP. A decreasing ratio of high-tech exports to GDP means that the exports of high-tech products grow slower than the GDP.

**Table 29: Ratio of high-tech exports to GDP<sup>26</sup>**

	2000	2001	2002	2003	2004	2005	2006	2007
<b>EU-27</b>	1.8%	1.7%	1.5%	1.4%	1.5%	1.6%	1.6%	1.4%
<b>USA</b>	2.3%	2.0%	1.8%	1.7%	1.8%	1.8%	2.0%	1.8%
<b>Japan</b>	2.7%	2.4%	2.4%	2.5%	2.7%	2.7%	2.9%	2.6%
<b>China</b>	3.4%	3.6%	4.6%	6.5%	8.3%	9.5%	10.1%	8.8%

**Figure 39**



Looking at Figure 39 it can be observed that the ratio of high-tech exports to the gross domestic product (GDP) was stable for Japan at around 2.6%. In the cases of the EU-27 and the USA this ratio declined by roughly 20% between the years 2000 and 2007.

The development of this ratio for China was exceptional: Between 2000 and 2007 the Chinese exports of high-tech products increased on average with a rate of 34% yearly, this is more than twice the average growth rate of the GDP (+16% yearly). At the same time the non-high-tech exports grew only with a rate of +24% yearly. This resulted in an increase of the share of high-tech exports in the GDP from 3.4% in the year 2000 to 8.8% in 2007 (with the peak of this ration in 2006: 10.1%).

<sup>26</sup> GDP data was extracted from the IMF World Economic Outlook Database, October 2009 Edition.



## 9. Summary

The EU-27 shows a stable development in its market shares of the total high-tech trade. Although the EU-27 does not have a particularly important share of high-tech products in its total trade (only about 20.5% of the exports and of the imports come from high-tech industries) the European Union is the largest importer and after China the second largest exporter of high-technology.

The analysis of the nine high-tech product groups (def. 1) shows that the export market shares of the EU-27 remained relatively stable in most product groups and that the EU-27 had an especially strong position in aerospace products, pharmaceutical products, chemical products, scientific instruments, and non-electrical machinery.

The analysis of the high-tech product groups also reveals that the USA maintained an important position although it was losing ground in some product groups and it also shows that Japan is losing market shares in almost all sectors. China on the other hand is clearly gaining export market share in most sectors.

The USA and Japan are losing ground while China is increasing strongly its position in the total world high-tech trade. China is or is becoming the top-player. Especially in computer products and electronics and telecommunications products China is already in the lead. Analysts say that China is pressing its domestic companies to move up the value chain but that a large portion of the Chinese high-tech trade is still due to processing.<sup>27</sup>

When putting the Chinese high-tech trade in relation to its population, it can be observed that this country is still clearly behind the other big economic areas. Compared to Japan (662 Euro per capita), the Chinese per capita high-tech exports represent only 25%.

The USA have per capita high-tech exports which are close to the Japanese values. In contrast to this, the EU-27 shows per capita high-tech exports which are only half as high as for Japan.

---

<sup>27</sup> “China's Increasingly High Technology Trade”: Discussion co-sponsored by the Carnegie Endowment and the John L. Thornton China Center of the Brookings Institution, September 26, 2007. Weblink: <http://www.carnegieendowment.org/events/?fa=eventDetail&id=1064>

## References

- Hatzichronoglou, Thomas (1997), "Revision of the High-Technology Sector and Product Classification" in: OECD Science, Technology and Industry Working Papers, 1997/2. Weblink: [http://www.oecd.org/LongAbstract/0,3425,en\\_2649\\_34443\\_1885085\\_119684\\_1\\_1\\_1,00.html](http://www.oecd.org/LongAbstract/0,3425,en_2649_34443_1885085_119684_1_1_1,00.html)
- Loschky, Alexander (2008), High-Technology Trade Indicators 2008 – An international comparison of the big economic areas and countries, Joint Research Centre (JRC): Scientific and Technical Research series. Weblink: <http://statind.jrc.ec.europa.eu/jrc%20reports/Report%20on%20High%20Tech%20Trade.pdf>
- Loschky, Alexander (2008), Reviewing the Nomenclature for High-Technology Trade -- The Sectoral Approach, Paper presented at the 1<sup>st</sup> Meeting of the OECD Working Party on International Trade in Goods and Trade in Services Statistics (WPTGS), 22-24 September 2008 in Paris. Weblink: [http://www.ois.oecd.org/olis/2008doc.nsf/linkTo/std-ses-wptgs\(2008\)9](http://www.ois.oecd.org/olis/2008doc.nsf/linkTo/std-ses-wptgs(2008)9)
- Loschky, Alexander and Nuortila, Karo (2009), High-Tech Trade by Enterprise Characteristics, Paper presented at the 2nd Meeting of the OECD Working Party on International Trade in Goods and Trade in Services Statistics (WPTGS), 16-18 November 2009 in Paris. Weblink: [http://www.ois.oecd.org/olis/2009doc.nsf/linkTo/std-ses-wptgs\(2009\)7](http://www.ois.oecd.org/olis/2009doc.nsf/linkTo/std-ses-wptgs(2009)7)
- Ruffles, David; Tily, Geoff; Caplan, David; and Tudor, Sandra; 2003: "VAT missing trader intra-Community fraud: the effect on Balance of Payments statistics and UK National Accounts" in: *Economic Trends* No. 597, August 2003: [http://www.statistics.gov.uk/articles/economic\\_trends/ETAug03Ruffles.pdf](http://www.statistics.gov.uk/articles/economic_trends/ETAug03Ruffles.pdf)
- IMF World Economic Outlook Database, October 2009 Edition. Weblink: <http://www.imf.org/external/pubs/ft/weo/2009/02/weodata/index.aspx>
- Eurostat Comext Database, Weblink: <http://epp.eurostat.ec.europa.eu/newxtweb/>
- OECD Handbook on Economic Globalisation Indicators, 2005. Weblink: [http://www.oecd.org/document/44/0,3343,en\\_2649\\_34443\\_34957420\\_1\\_1\\_1\\_1,00.html](http://www.oecd.org/document/44/0,3343,en_2649_34443_34957420_1_1_1_1,00.html)
- UN Comtrade Database. Weblink: <http://comtrade.un.org/>
- UN Demographic Yearbook 2007. Weblink: <http://unstats.un.org/unsd/demographic/products/dyb/dyb2007/AnnexI.pdf>

## **Annex 1: Manufacturing industries classified according to their global technological intensity (ISIC Revision 3)**

### **High-technology**

1. Aerospace	353
2. Pharmaceuticals	2423
3. Computer, office equipment	30
4. Electronics-communication	32
5. Precision instruments	33

### **ISIC Revision 3**

### **Medium-high-technology**

6. Electrical Machinery	31
7. Motor vehicles	34
8. Chemicals (except pharmaceuticals)	24 (excl. 2423)
9. Other transport equipment	352 + 359
10. Machinery and equipment	29

### **Medium-low-technology**

11. Petroleum refining	23
12. Rubber and plastic products	25
13. Non-metallic mineral products	26
14. Shipbuilding	351
15. Basic metals	27
16. Fabricated metal products (except machinery and equipment)	28

### **Low-technology**

17. Other manufacturing industry	36 + 37
18. Wood and furniture	20
19. Paper printing	21 + 22
20. Textiles, clothing, leather	17 + 18 + 19

Source: OECD Handbook on Economic Globalisation Indicators, 2005, p. 172.

## **Annex 2: High Technology Products List – SITC Rev. 3 (Period 1988-95)**

---

1. Aerospace	[7921 + 7922 + 7923 + 7924 + 7925 + 79293 + (714 - 71489 - 71499) + 87411]
2. Computers-office machines	[75113 + 75131 + 75132 + 75134 + (752 - 7529) + 75997]
3. Electronics-telecommunications	[76381 + 76383 + (764 - 76493 - 76499) + 7722 + 77261 + 77318 + 77625 + 7763 + 7764 + 7768 + 89879]
4. Pharmacy	[5413 + 5415 + 5416 + 5421 + 5422]
5. Scientific instruments	[774 + 8711 + 8713 + 8714 + 8719 + 87211 + (874 - 87411 - 8742) + 88111 + 88121 + 88411 + 88419 + 89961 + 89963 + 89967]
6. Electrical machinery	[77862 + 77863 + 77864 + 77865 + 7787 + 77884]
7. Chemistry	[52222 + 52223 + 52229 + 52269 + 525 + 57433 + 591]
8. Non-electrical machinery	[71489 + 71499 + 71871 + 71877 + 72847 + 7311 + 73131 + 73135 + 73144 + 73151 + 73153 + 73161 + 73165 + 73312 + 73314 + 73316 + 73733 + 73735]
9. Armament	[891 -]

---

Source: OECD Handbook on Economic Globalisation Indicators, 2005, p. 173.

European Commission

**EUR 24096 EN – Joint Research Centre – Institute for the Protection and Security of the Citizen**

Title: High-Technology Trade Indicators 2009 – An international comparison of the big economic areas and countries

Author: Alexander Loschky

Luxembourg: Office for Official Publications of the European Communities

2009 – 50 pp.

EUR – Scientific and Technical Research series – ISSN 1018-5593

**Abstract**

The present report gives an overview on the level and development (years 2000 to 2007) of the high-technology foreign trade of the four big economic areas and countries of the world: the USA, the EU-27, Japan, and China. In addition to these economic areas and countries also the countries participating in the Group of Eight process (G8) – the Canada, France, Germany, Italy, Japan, Russia, the United Kingdom, and the USA – are analysed. For the analyses of the total high-tech trade three different definitions of market shares are used: high-tech trade in world high-tech trade, high-tech trade in world total trade, and high-tech trade in one country's total trade. For the definition of the high-tech sectors and goods the current classifications of high-tech sectors and product groups of the OECD were applied.

Furthermore, the composition of the high-tech exports and imports of each of the four big economic areas and countries was studied and the per-capita high-tech exports and imports as well as the share of high-tech exports in the gross domestic product (GDP) were examined.

### **How to obtain EU publications**

Our priced publications are available from EU Bookshop (<http://bookshop.europa.eu>), where you can place an order with the sales agent of your choice.

The Publications Office has a worldwide network of sales agents. You can obtain their contact details by sending a fax to (352) 29 29-42758.

The mission of the JRC is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of EU policies. As a service of the European Commission, the JRC functions as a reference centre of science and technology for the Union. Close to the policy-making process, it serves the common interest of the Member States, while being independent of special interests, whether private or national.

