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# The Dynamics of Structural Change – The European Union's Trade with China

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*July 2009*

**Abstract**

Sino-European trade relations have been controversially discussed mainly, if not only, because of the increasing European Union's bilateral trade deficit with China. As from the European perspective trade with China becomes more important, the structural adjustment process of the Chinese economy from inter-industry to intra-industry trade is not as intensively discussed. We show how the emergence of China on the world markets has affected European comparative advantages over time. The change in bilateral trade is compared to the overall development of European comparative advantages to highlight the features of the structural change in China. We show that China is increasingly specialising in technology intensive goods. This development is absolutely in accordance with the historical perspective on country's upgrading in technology while integrating into the world economy. Technology intensive Schumpeter goods are either of a mobile or an immobile type based on the selection criterion of separating research and production process. While China predominantly focuses on the mobile type of Schumpeter goods, the European Union maintains its comparative advantages in immobile technology intensive goods, which are harder to imitate. Based on technology intensity, the second issue presented in the paper focuses on the Chinese integration into the world-wide value-added chain, which has been fragmented across borders in recent years. Not least due to increasing FDI, intra-industry trade has become more prevalent in bilateral trade relations with China.

Key words: Comparative advantage, Intra-industry trade, Fragmentation, EU, China

JEL-classification: F11, F14

**Outline**

## 1 Introduction

While increasing research has been undertaken in analysing North-South intra-industry trade, trade with China receives rather limited attention. Sino-European trade relations have been controversially discussed for many years mainly, if not only, because of the increasing European Union's bilateral trade deficit with China and the similarly huge US bilateral trade deficit with the dragon. In both cases, China has been accused to use unfair trade practises as well as currency manipulations. However, none of these allegations stands closer scrutiny. Instead, some observers see the deficit as the result of an intertemporal calculus on both sides. Whereas this view is rather convincing for a general imbalance in the current account, it does not hold for bilateral deficits or surpluses.

One may rather see the imbalances as a sign of global structural change, which is the subject of this paper. In particular, two aspects are of interest for us. The first question is how the emergence of China on the world markets has affected European comparative advantages over time. With regard to its main trading partners, the foreign trade pattern of the European Union has changed since the end of the last century. As highlighted in table 1, trade with China becomes more important and it should not be surprising that China ranks first among the main trading partners in the European import statistics in 2008. However, while imports have grown substantially, China has also become one the five most important destinations for European exports. Due to the integration of the Chinese economy in the international division of labour, the enormous increase in exports from China is accompanied by a global structural change. In the European case, trade deficits with Russia, South Africa and other countries were diminishing or disappeared with the emergence of the trade deficit with China (Freytag 2008).

Another pattern of structural change can be shown by a sectoral breakdown of the European Union's net external trade flows from and to China. Table 2 demonstrates the development of the EU-27 bilateral trade balance with China according to product groups classified by SITC one-digit codes. Interestingly, China has emerged as net importer of crude materials (SITC 2, except fuels), where the European Union's trade balance shows an increasing surplus while in all other industries with a higher degree of processing the European Union runs a trade deficit with China.[1] Particularly in machinery and transport equipment industries (SITC 7), the deficit is increasing rapidly. Evidently, the sectoral structure of trade with China changed much more than the structure of total EU-trade.

[1] These industries include manufactured goods (SITC 6), machinery and transport equipment (SITC 7) and miscellaneous manufactured articles (SITC 8).

Both the evidence that China is a substitute for other trading partners and that Europe has not changed so much lead to the second question, namely what are the features of the structural change in China? Although from the European perspective, trade with China becomes more important, the obvious structural adjustment process of the Chinese economy from inter-industry trade to intra-industry trade has not been analysed by previous studies.

We want to fill the gap while focussing on intra-industry trade and the factor content approach as well. The remainder of the paper is organised as follows: in section 2, the issue of comparative advantages is discussed from the European perspective. The change in comparative advantages in bilateral trade is compared to the overall development of European comparative advantages. The third section is dedicated to an analysis of Sino-European trade patterns with a focus on intra-industry and inter-industry trade. The role of FDI in this context also has to be analysed. The paper concludes with cautious policy implications.

## 2 Trade with China and the dynamics of European comparative advantages

### 2.1 Theory and methods

As has been mentioned before, Chinese imports have replaced imports from other emerging economies in the years after 1999 (Freytag 2008). To show that this development is in line with economic theory, we analyse how the European Union's comparative advantage have developed between 1999 and 2008. It is most interesting to see whether the European Union's general pattern is matching its bilateral trade pattern with China. If this is not the case, one can expect that China's development is special. To draw significant conclusions about the competitiveness of enterprises in the European Union, the RCA-indicator,

$$RCA_i = Ln\left[\left(X_i/M_i\right)\Big/\left(\sum_i X_i/\sum_i M_i\right)\right], \qquad (1)$$

following the concept of revealed comparative advantages introduced by Balassa (1965), is applied to the European bilateral trade with China as well as on its overall trade. The empirical concept is based on the theoretical consideration that a country will specialise on production of those commodities for which it has a comparative advantage based on its technological (Ricardo) or relative factor endowments (Heckscher-Ohlin). The indicator represents the proportion of a country's share of exports in industry $i$ relative to its share of imports in the same industry. Therefore, the comparative advantage of that country (the European Union) will be revealed by a more than proportional net export compared to total trade or, in the case of a negative trade balance, by a less than proportional net import in a product group. Thus RCA-values greater than zero indicate a comparative advantage. However, appropriate measurements of comparative advantages are subject of an extensive

discussion by Vollrath (1991, p. 269) who argues that comparative advantages arise in the neoclassical context because of nonuniformities in supply and demand. By incorporating the demand side due to the consideration of imports, comparative advantages will also be shaped by differences in both tastes and preferences. In addition, the traditional indicator may be biased by cross country heterogeneous occurrence of protectionist measures e.g. subsidies and quotas (Balassa 1965). Thus, Vollrath (1991) proposes a more comprehensive indicator, the revealed competitive advantage which builds upon two global trade measures.

To calculate the relative trade advantage

$$RTA_{ij} = RXA_{ij} - RMP_{ij} \tag{2}$$

and the revealed competitiveness

$$RC_{ij} = Ln\left(RXA_{ij}\right) - Ln\left(RMP_{ij}\right), \tag{3}$$

these indicators subtract the relative import penetration

$$RMP_{ij} = \left(M_{ij} / M_{n-i,j}\right) \Big/ \left(M_{i,w-j} / M_{n-i,w-j}\right) \tag{4}$$

from the relative export advantage

$$RXA_{ij} = \left(X_{ij} / X_{n-i,j}\right) \Big/ \left(X_{i,w-j} / X_{n-i,w-j}\right) \tag{5}$$

and represent alternative definitions of revealed comparative advantage. To fully exploit comparative advantages, the firm in question has to be competitive. The term competitiveness deserves a few thoughts as it can be interpreted in different ways and leaves room for political manoeuvre. By competitiveness we understand the ability of companies or industries to sell their products in their home country and abroad.[2]

In addition to the RCA index which is used to analyse the European Union's comparative advantage in total external trade, the advanced indicator, the revealed competitiveness $RC_{ij}$ based on the relative trade advantage $RTA_{ij}$, allows for a clear distinction between a specific industry $i$ and all other industries $(n-i)$ as well as between a specific country $j$ and the rest of the world $(w-j)$ when calculating the relative import penetration $RMP$ and the relative export advantage $RXA$. It thus enables us to assess European comparative advantages in bilateral trade with China. By excluding the trading partner and the industry under analysis, double counting in world trade will be avoided. Thus, the advanced indicators allow a clearer look at bilateral trade with China. As argued by Vollrath (1991), both indicators may come closer to measure true comparative advantage. For both

[2] We do not use the term in relation to trade balances as such. A trade balance does not tell anything about competitiveness as defined above (Krugman, 1994).

indicators, a positive value reflects a comparative advantage, while a negative value reveals a comparative disadvantage for the European Union.[3]

Additionally, in order to gain insight into the quality of bilateral trade with China, the analysis of comparative advantage will be deepened by using the factor content approach which has been convenient to cluster product groups according to their mostly incorporated input factors. The product life cycle hypothesis in the seminal paper of Vernon (1966) states that by entry in standardised phase of the product life cycle, production processes of goods become relatively more labour-intensive. Therefore, it seems to be obvious that outsourcing of labour-intensive production processes will be efficient for highly developed countries since, according to international trade theory, they have comparative advantages in the production of technology intensive goods. On the contrary, less developed countries specialise on raw material-intensive "Ricardo-goods" as well as on labour- and capital-intensive "Heckscher-Ohlin-goods".

### 2.2 Evidence: China is changing faster than Europe

To start with China, many studies confirm that Chinese trade patterns have changed fundamentally in the last decades with increasing comparative advantages in low- and medium-technology products. According to Lall and Albaladejo (2004), the technological content of Chinese exports has upgraded in the period from 1990 until 2000. From a high share in low-technology products, China moves rapidly into high technology products.[4] Van Assche et al. (2008) and Cui and Syed (2007) argue that China moves up the value chain with processing exports playing an important part of China's export growth. Moreover, Amiti and Freund (2008) show that Chinese export growth between 1992 and 2005 is connected with a move from agriculture products into the machinery and transport equipment sector. The shift in China's export composition is associated with increasing skill content which is driven by processing exports making up a large share of China's manufacturing export. This means that imported inputs account for an increasing share of the value-added in export. Accordingly, only a part of the value of Chinese exports is represented by value-added production

[3] The indicator $RC$ is highly sensitive to small values of exports or imports and will be favoured at high levels of industry aggregation. Noteworthy, if two-way trade does not occur, the revealed competitiveness is not defined (in the case of no imports) or equal to zero (in the case of no exports). In this case, the relative trade advantage $RTA$ is preferred as at a low level of industry aggregation it does not require the existence of a country's exports and imports within the same industry. These considerations are important in the case of European trade with China where trade flows are characterised by a relatively high level of import when export is low (e.g. SITC 63, 81-89, 75, 76) and otherwise. To evaluate the respective trade indicators for consistency reasons all indicators in the European Union's bilateral trade with China are reported in table 4b.

[4] According to Lall and Albaladejo (2004) high technology products include electronic products, precision instruments, chemicals and pharmaceuticals which call for large R&D investment while low technology products include textiles, garments, footwear, leather products etc. compared to Lall and Albaladejo (2004) we will consider low technology products as labour intensive. See also Hinloopen and Marrewijk (2004) and Batra and Khan (2005) for a change in Chinese comparative advantages.

originating in China.[5] This observation is in line with an emerging role of china as an assembly hub Freytag (2008) and an increasing stock of FDI from Chinese trade partners. Li (2008) illustrates the trade interdependence between China and selected European countries and argues that China's open door policy and drive towards market economy has led to a change in Chinese comparative advantages.[6]

This development should also be reflected in the European Union's external trade with China and, furthermore, should reveal European Union's comparative disadvantages respectively. Tables 3 and 4 reveal an interesting trade pattern. The classification of industries according to factor intensities presented in table 3 provides an overview of the European Union's trade with China compared to total external trade (with the rest of the world) for 1999 and 2008 on the two digit SITC level.[7] The evolution of the European Union's external trade structure and the revealed competitiveness indicators in bilateral trade with China over time (1999 – 2008) is shown in less detail in tables 4a and 4b. The European Union's competitiveness in trade with the rest of the world is presented in table 4c.

According to table 3, in total external trade, high import shares of ***primary products*** and ***resource intensive goods*** illustrate that Europe is relatively less resource abundant. Accordingly, the negative RCA index is indicating a comparative disadvantage for the European Union (table 4c). These products are less important in bilateral trade with China, although, a positive and increasing competitiveness in ***primary products*** is still present (table 4b). The import of ***labour intensive goods*** from China (30 per cent in 2008) is more than twice as high as in total external trade. More interestingly, while imports of labour intensive products in total external trade slightly increases since 1999, the import share from China decreased by around 10 percentage points, suggesting that China is slowly reducing its level of specialisation in labour intensive sectors. Still, its dominant position in these industries is obvious in trade with Europe. Accordingly, a comparative disadvantage in ***labour intensive products*** is evidenced by relatively high negative values. The classification scheme

[5] Feenstra and Hong (2007) also mentioned the high relevance of processing export in terms of employment gains. They show that the rise in domestic demand generated employment gains which are three times larger than those accounted for export growth.

[6] While China is losing its comparative advantages in resource-intensive goods export growth in labour intensive in human capital intensive products has resulted in increasing comparative advantage in these industries respectively. Moreover, Li (2008) points out that China's comparative advantages have evolved close to other newly industrialising economies and follow the general industrialisation process which is evident in its export structure.

[7] While in 2008, the European Union's import contains almost a quarter of petroleum products and related (SITC 33.3, 33.4) this part is absent in trade with China. In order to set a more comparable external trade structure for the evaluation of the European Union's China trade we exclude these sub-sectors from the calculation of the industries export and import shares.

differentiates between unskilled labour and ***human capital*** as seen from tables 3 and 4. While the export share of unskilled labour is still decreasing, human capital intensive goods play an increasing role in trade with China. Export as well as import shares are rising to around 20 per cent.

As the European Union has its comparative advantage in the production of ***technology intensive goods*** (see table 4b and 4c); exports to China (66 per cent in 2008) are dominated by products in these industries as well (see table 4a). This is much higher than the export share of technology in total external trade of the European Union.[8] More interestingly, the export share of ***technology intensive products*** has slightly declined in trade with China while it remains more or less constant in total external trade (with the rest of the world). To the contrary, imports of technology intensive goods become more important (47 per cent in 2008) as they are well above the European Union's import share from the rest of the world. In trade with China, the European Union has a comparative advantage in technology intensive "high tech" products. The production of these research-intensive Schumpeter-goods can be subdivided into mobile and immobile goods.

According to the selection criterion of separating research and production processes, mobile Schumpeter goods offer limited complementary relations between research and production. Therefore, mobile Schumpeter goods are easier to imitate than immobile Schumpeter goods because separation represents no barrier for knowledge transfer (Klodt 1987, Heitger et al. 1992). Splitting up the technology intensive products classified by Hinloopen and Marrewijk (2004), the overall result is in line with the results presented before.

As seen from table 5 on the European Union's trade pattern clustered by mobility of technology in 2008, around 70 per cent of exports to China in technology intensive industries contain research-intensive Schumpeter goods, of which the largest proportion belongs to the immobile type of Schumpeter-goods (more than 50 per cent of the total).[9] Moreover, trade with China in all subsections of the immobile research-intensive industries is characterised by positive RCA-values which indicate that the European Union holds comparative advantages in these industries. As shown by the decomposition of trade data, these include nearly all product groups of the machinery and transport equipment section (SITC 7). Noteworthy, strong European competitiveness in bilateral

[8] The European Union has a comparative advantage with RCA values exceeding one in most of the industries in the machinery and transport equipment sector. Contrarily, in SITC 8 (miscellaneous manufactured articles) especially textiles and clothing the comparative advantage of Chinese products on the European market is continuously present as it has been in the year 1999.

[9] Compared to 1999, Europe predominantly focus on the export of the immobile type, the export share has increased. Accordingly, exports of mobile Schumpeter industries has dropped, while the import from China has risen, indicating that China gains comparative advantages in the production process, so that Europe exploit efficiency gains by locating parts of the production process to China.

trade with China in product groups belonging to SITC 7 is documented by high RCA-values exceeding the value of one. This holds despite the fact that net exports from China result in a rapidly increasing bilateral deficit of the European Union. To the contrary, the European Union's comparative disadvantages are as well revealed in the bilateral trade data. Accordingly, labour-intensive goods are characterised by high negative RCA-values. Overall, the composition of the European bilateral trade with China is shown in figure 1. Since 1999, the share of European imports from China in research-intensive Schumpeter-industries is increasing. Moreover, insights can be drawn from the type of technology which is subject to outsourcing activities. Especially, rising import shares in the *mobile type* of research-intensive goods outperform the traditional imports of labour-intensive products. While China specialises on products of the mobile type, the main exports of the European Union to China belong to the *immobile type* of technology intensive goods. These industries are more difficult to imitate. Separating production processes from research and development leads to an outsourcing of the labour intensive parts of the mobile type of technology intensive goods to China, and a proportional rise of imports in Europe.

Interestingly, while in bilateral trade with China the RCA-value is decreasing (table 4b), the competitiveness of the European Union in total external trade of technology intensive goods has slightly increased until 2008 (table 4c). However, the main difference between the European Union's competitiveness towards China versus the one towards the rest of the world lies in a bilateral comparative advantage in primary goods and a strong comparative disadvantage in labour intensive goods with respect to China. In general, the changes in competitiveness are much more acute when it comes to bilateral trade, translating a more radical evolution of the trade patterns with China in recent years.

In bilateral trade with China, all three indicators tend to develop in the same direction. While the advanced indicators, the revealed trade advantage $RTA$ and the revealed competitiveness $RC$, clearly show a value above one in the beginning of the reference period, the traditional Balassa $RCA$ indicator reveals a weaker competitiveness in technology intensive products for the European Union. The competitiveness of European firms is also shown in figure 2, which maps the RCA-values calculated at the SITC three-digit-level for the years 1999 and 2008 in bilateral trade with China. Accordingly, while technology intensive industries are mainly present in the top right quarter, products of labour intensive industries are located in the bottom left quarter. Except for some outliers, the figure indicates on the one hand that in the year 2008 the European Union was able to sustain its competitive position on the Chinese market in most of those product groups in which it had a comparative advantage before (1999). Product groups with negative RCA-values in 2008,

indicating European comparative disadvantages (primarily labour intensive industries), on the other hand, are characterised by a negative RCA-value in the past (1999) as well. After dividing technology intensive subsectors into mobile and immobile Schumpeter industries, figure 3 shows that the European Union has especially strengthened its competitiveness in industries of the immobile type. The top right quarter predominantly contains these product groups, whereas products of the mobile Schumpeter industries, which are easier to imitate, are located in the bottom quarter. As these industries are subject to increasing Chinese comparative advantages, the integration of the Chinese economy in the international division of labour is accompanied by technological upgrading, which is apparent in trade flows. The European Union maintains its strong international competitiveness in high technology sectors on the Chinese market.

The structural change of the Sino European trade pattern is affected by the integration process of the Chinese economy into the world market. Based on a relatively low labour cost compared to Europe, the production of labour intensive products still occurs in China. In parallel, bilateral trade of technology intensive products has been increasing steadily. Although labour intensive products are still dominant, the ongoing specialisation process of the Chinese economy indicates that China is reaching the next level. With large imports of machinery and other technology intensive products, China has been upgrading its technological capabilities to be able to export in technology intensive industries as well. Accordingly, the European Economies have lost comparative advantages in some technology intensive products, mainly of the mobile type of Schumpeter industries (e.g. the telecommunications industry).[10]

Whereas the European Union's trade pattern with China has changed, the overall European trade pattern between 1999 and 2008 did not change as much. In table 4a, the trade shares of the different product groups did not change very much (as opposed to bilateral trade shares). This is an indication that the European Union was not affected heavily by global structural change until 2008. When total trade shares change, it is often contrary to the development in bilateral trade with China. This can be seen when looking at the declining share of total imports in technology intensive goods from 49 per cent in 1999 to 41 per cent in 2008. Technology intensive goods accounted for 38 per cent of total imports from China in 1999 and for 47 per cent in 2008. Two trends can be derived from this. Firstly, the European Union's competitiveness in technology intensive products is slightly declining towards China, but remains stable towards the rest of the world. Secondly, China is

[10]While the reversal of the trade flows in the telecommunications industry (SITC 76) resulted in a loss of competitiveness in the respective product group, the European Union strengthen its comparative advantage in industries producing scientific and controlling instruments (SITC 87).

emerging as a value-added trading partner. This evidence is in line with Freytag (2008) who argues that Chinese exports replace exports from other countries.

Obviously, Chinese exports to Europe are increasingly taking place in the same industries where imports occur. In other words, bilateral trade seems to be increasingly intra-industry trade (IIT). This interpretation is reinforced as the Chinese specialisation in trade with Europe is subject to change. Table 6 reveals that in 1999 more than 70 per cent of the European Union's exports to China occurred in industries with a RCA index exceeding one. In 2008, exports from those industries with a comparative advantage ( $RC > 1$ ) accounted for only 56 per cent of total exports. Accordingly, the export share of industries where the RCA value is around zero has increased. This implies that in 1999 the European Union was successfully exploiting gains from trade due to specialisation according to comparative advantages, but that China is now successfully emerging as a competitor and gaining comparative advantages. Therefore, European exports decreasingly occur in industries with high RCA values. The overall loss of European competitiveness towards China is predominantly driven by a loss in technology intensive sectors. While exports from technology intensive industries with a comparative advantage are decreasing, exports of products in human capital intensive industries with RCA indices above one are slightly increasing. The European Union's export specialisation in trade with China seems to be decreasing as China is gaining comparative advantages in some technology intensive sectors as well. In contrast, the European Union's import specialisation is slightly rising, suggesting that it is achieving resource efficiency gains by importing products with comparative disadvantages. By 2008, the European Union had predominantly focused on industries subject to a comparative disadvantage ( $RCA < -1$ ) when importing from China (70 per cent of total imports). Not surprisingly, the share of imports that is subject to a comparative advantage decreased over the same period by around 5 percentage points.

The changing trade pattern is in line with the product life cycle theory developed by Vernon (1966), which states that developing countries catch up in technological capabilities. Noteworthy, as labour cost is the main determinant in the production process, developed countries maintain their competitiveness because they are able to locate labour intensive segments of the production chain in low cost countries.

## 3 China's structural change – An example of increasing intra-industry trade

### 3.1 Theory and methods

The European Union's trade with China is subject to change as the Chinese economy is integrating into the world economy. While in total external trade the European Union remains competitive in

technology intensive products, China emerges as a main trading partner in higher value-added products. Due to technology upgrading of the Chinese economy, trade with the European Union occurs increasingly in the same product groups. This type of trade is defined as intra-industry trade. As theoretical models formerly focus on horizontal intra-industry trade and explain the trade pattern between developed countries,[11] theoretical models of vertical intra-industry trade focus on the trade pattern between industrialised and developing countries. Falvey (1981), Falvey and Kierzkowski (1987) and Flam and Helpman (1987) show how trade in vertically differentiated products occurs between countries with different factor endowments and per capita income. Vertical differentiation on the supply side is therefore caused by differences in the capital-labour ratios. High quality products refer to more capital- and technology intensive products, while their low quality counterparts refer to labour intensive products. High quality products yield higher prices than low quality products. On the demand side, it is argued that each individual consumer prefers only one type of differentiated product according to his level of income. Based on these assumptions, Falvey (1981) and Falvey and Kierzkowski (1987) show that relatively high-income and capital-abundant countries specialize in relatively high quality products, whereas the relatively low-income and labour-abundant countries focus on the production of low quality products. As also indicated by the models of inter-industry trade, the trade pattern of vertical intra-industry trade is determined by comparative advantages as well. The theoretical results of these models above can be summarized as a story of the quality ladder.

By contrast, Jones et al. (2002) argue that intra industry trade is also the result of international fragmentation in vertically integrated product chains where the splitting of the production process into several production steps allows the location of parts of the production process beyond national borders. First introduced by Jones and Kierzkowski (1990), the framework for analysing fragmentation builds upon services link costs (e.g. telecommunication, transportation, and coordination cost) to connect production steps in different locations.[12] As these costs are decreasing due to technological advances, fragmentation of production processes across national borders arises as a new opportunity of specialisation pattern. The exchange of products in fragmented production processes are not necessarily happening in the same product subsection. Trade of intermediate goods and final goods belonging to different subsections of the same industry is also considered as an example of vertically fragmented production processes. The increasing fragmentation of production chains in the global economy suggests that countries often trade components and other intermediary products.

[11] See Spence (1976), Dixit and Stiglitz (1977), Krugman (1979, 1980, 1981), Lancaster (1979), Helpman (1981), and Helpman and Krugman (1985).
[12] See also Deardorff (2001) and Arndt and Kierzkowski (2001).

These dynamics can be analysed through intra-industry trade indices. While the comparative advantage indices highlight competitiveness between two trading countries, they miss the complementary links that often drive trade within industries. Intra-industry trade, as opposed to inter-industry trade, measures the degree to which a country exports and imports mostly in the same industries. A low level of intra-industry trade between two countries means that their bilateral trade is not actively competing with each other, but rather specialising in goods from different industries. The most common formula for measuring intra-industry trade dates back to Grubel and Lloyd (1975) as they define intra-industry trade between two countries in product category $i$ as total trade $\left(X_i + M_i\right)$ minus inter-industry trade $\left(X_i - M_i\right)$.[13] The Grubel-Lloyd index

$$IIT_i = 100\left[1 - \frac{\left|X_i - M_i\right|}{X_i + M_i}\right] \tag{6}$$

represents the level of intra-industry trade in industry $i$ measured by the difference between exports $X_i$ and imports $M_i$ in industry $i$ on total trade. Accordingly, to give an overall measure of intra-industry trade across industries, Grubel and Lloyd (1975) propose a weighted IIT index

$$IIT_i = 100\left[1 - \frac{\sum_k \left|X_{ik} - M_{ik}\right|}{\sum_k (X_{ik} + M_{ik})}\right]. \tag{7}$$

taking into account the flows in each sub-sectors $k$ at a given level of aggregation. This intra-industry trade index $IIT_i$ sums the values of all sub-sectors $k$ and aggregates them at the industry level $i$. For the analysis of the Sino-European trade, $X_{ik}$ represents European exports to China in sub-sector $k$ of industry $i$ and $M_{ik}$ denotes the European Union's imports from China in sub-sector $k$ of industry $i$. The index assumes values between zero and 100, with lower values indicating a low level of IIT (or high level of inter industry specialisation) and high values indicating a high level of IIT. From the theoretical considerations stated above it is important to separate between vertical and horizontal intra-industry trade when examining trade between industrialised and developing (or transition) countries by looking at quality differences in trade flows. Horizontal intra-industry trade is often recognised as trade between countries of the same level of development. When considering trade between industrialised and developing countries, vertical intra-industry trade is often present and denotes a higher value added production from one of the trading countries, predominantly the higher developed country.

[13] Fontagné and Freudenberg (1997) and Fontagné et al. (1997) propose an alternative approach which builds upon the breakdown of total trade flows into one-way trade, vertical IIT and horizontal IIT. Moreover, one-way trade is distinguished from intra-industry trade by the use of a certain range of overlapping values of exports and imports in a given subsection while vertical and horizontal IIT are identified by some range of unit-price-differentials between exports and imports in a given subsection.

With regard to the existing European Union's trade deficit in bilateral trade with China, it is noteworthy to mention that Grubel and Lloyd argue that their measurement of IIT will be biased by the size of the overall trade imbalance. They suggest that the indicator above may be adjusted by expressing IIT as a proportion of total trade minus the trade imbalance. Aquino (1978) adjusts the industry indices for multilateral imbalances based on the assumption that the effect is proportional to all industries. Moreover, it is criticised in the literature to adjust for trade imbalance when measuring IIT. Greenaway and Milner (1981) argue that substantial distortions may be introduced by applying the adjustment principle as it is a matter of a priori knowledge on the nature and effects of adjustment forces initiated by imbalances. Thus, other studies focus on measures to reflect changes in intra-industry trade rather than the degree or the level of intra-industry trade. Brülhart (1994) proposes a dynamic version of the IIT index, which decomposes the structure of changes in exports and imports into proportions which can be attributed to intra- and inter-industry trade. It is argued that due to a reallocation within industries, adjustment cost in terms of factor substitution is relatively low compared to adjustment cost due to a reallocation between industries. As argued by Thom and McDowell (1999), the dynamic index is able to assess the importance of intra-industry trade during an adjustment process induced by trade liberalisation; it is rather of limited use to distinguish between vertical IIT and inter-industry trade.[14]

### 3.2 Evidence: Intra-industry trade and structural change

A majority of empirical studies on intra-industry trade have been conducted on industrialised economies as it is commonly argued that intra-industry trade is rather a phenomenon of highly developed countries. Although North-South trade primarily consists of inter-industry trade, recent studies show that a growing proportion of trade takes place within industries. Empirical studies which increasingly focus on North-South IIT mainly concentrate on determinants of IIT between groups of developed and developing countries (e.g. Tharakan, 1984, Manrique, 1987, Balassa and Bauwens, 1987, Ray, 1991, Balance et al., 1992, Tharakan and Kerstens, 1995); trade with China receives rather limited attention. Although, from the European perspective, trade with China becomes more important, the structural adjustment process of the Chinese economy which can be shown in the trade development from inter-industry trade to intra-industry trade has not been analysed in detail. We consider the European Union as a single market and analyse one, two and three-digit industries by calculating flows in five-digit sub-sectors of SITC data taken from the Eurostat database.

[14] See also Greenaway et al. (1994) for discussion of appropriate empirical investigation of adjustment implications of intra-industry trade.

As outlined in table 7, the overall level of intra-industry trade between the European Union and China is relatively low but increasing. As it accounts for slightly more than 19 per cent of total trade in 2008, it could be concluded that more than 80 per cent of trade between the European Union and China is subject to inter-industry trade explained by traditional trade theories of specialisation according to comparative advantages. Additionally, the table presents the share of intra-industry trade on the one digit level of industry aggregation (calculated from five digit industries as well). In the first five sectors (food and live animals (SITC 0), beverages and tobacco (SITC 1), crude materials (SITC 2), mineral fuels (SITC 3), animal and vegetable oils (SITC 4)), which are considered as primary products and resource intensive manufactures, the intra-industry trade is relatively low and partly decreasing. Product groups with a higher degree of processing (chemicals (SITC 5), manufactured goods (SITC 6), and machinery and transport equipment (SITC 7)) are subject to higher values of intra-industry trade. Trade in chemicals and related products displays the highest level of intra-industry trade, reaching around one third of sectoral trade. Particularly in chemicals and manufactured goods, intra-industry trade increased significantly between 1999 and 2008. Not surprisingly, miscellaneous manufactured articles (SITC 8) which are predominantly considered as labour intensive account for the lowest share of IIT (except for mineral fuels (SITC 3) which are insignificant in bilateral trade with China).

While the low level of IIT in resource intensive industries may be explained by differences in endowments, the specialisation pattern in labour intensive industries is quite obvious. Using the factor intensity approach provided by Hinloopen and Marrewijk (2004), table 8 shows the bilateral intra-industry trade level in product groups for selected labour intensive and technology intensive industries on two and three digit levels. Paralleled with the relatively high revealed competitiveness of Chinese products, it is expected that trade in labour intensive industries is predominantly of inter-industry type. The IIT index in labour intensive industries is thus relatively low. On the contrary, in technology intensive industries where the European Union has its comparative advantages in leading industries, the overall level of IIT is still higher. Moreover, higher levels of IIT seem to correspond to lower levels of comparative advantages (e.g. SITC 58 plastics in non-primary forms, SITC 74 general industrial machinery).

With a more dynamic approach, diminishing levels of comparative advantages between 1999 and 2008 nearly always correspond to increasing levels of IIT (e.g. SITC 72 specialised machinery, 88.3 photographic supplies). Similarly, increasing levels of comparative advantages are often matched by diminishing levels of IIT (e.g. SITC 75 computers, 79.2 aircraft and equipment). Only four industries in table 8 move into the opposite direction of this relation, three of which are in the sector of

chemicals. This general trend clearly highlights the structural change underway in the trade flows between the European Union and China. The phenomenon is particularly apparent in the industry of telecommunications equipment (SITC 76.4). Followed on a yearly basis, this industry presents a textbook example of a shift from a European to a Chinese comparative advantage since 1999. As shown in figure 5, during this shift, the level of IIT increased substantially, before dropping abruptly again as the Chinese competitiveness materialised. The relatively high level of IIT in 1999 suggests that the process was already underway before the starting year of the data set. Plainly, with a shifting RC and a falling IIT, trade patterns of cell phones are starting to look like those of t-shirts. Yet, the structural change observable in telecommunications equipment testifies of a wider realignment of economic specialisation, slowly reallocating resources across sectors and opening new opportunities for foreign firms. Indeed, several industries also show tendencies towards an increased comparative advantage in favour of the European Union (e.g. organic and inorganic chemicals (SITC 51-52), scientific instruments (SITC 87)).

To draw significant conclusions, the relationship between the level of intra-industry trade and comparative advantages is shown in figure 4. In industries with relatively high comparative advantages either for the European Union or China, the level of IIT seems to be lower, while a low level of competitiveness seems to go hand in hand with a higher level of IIT which are increasingly subject to an exchange of similar products. The same applies in figure 5 for the evolution of relative competitiveness and IIT in the industry of telecommunications equipment. The shape of the curve follows a path similar to that of figure 4, highlighting the dynamic of the structural change underway in Sino-European trade.

When splitting up the technology intensive products in mobile and immobile Schumpeter-industries presented in table 9, the intra-industry trade tends to occur in immobile Schumpeter industries, which are less easy to imitate and where the European Union is maintaining its competitiveness. Accordingly, the mobile type of Schumpeter industries is subject to increasing Chinese comparative advantages. Thus, except for the chemical industry, intra-industry trade seems to be less important.

The results on the European Union's intra-industry trade with China seem to be similar to those of other studies on Chinese intra-industry trade to some extent. Most of these studies are concerned with determinants explaining the rising share of Chinese overall IIT or they primarily consider either a group of developed countries or a group of industries. As shown above, the IIT level in the European Union's trade with China has slightly increased since 1999; it is still higher than the level of IIT in Chinese US trade but lies below the level in Chinese trade with Japan (e.g. Hellvin, 1996, Xing, 2007).

According to the study of Hellvin (1996) on Chinese trade with OECD countries, the proportion of trade within single product categories was already rising since the early 1980s. Based on an analysis of the manufacturing sector (including SITC 5 to 8), Hellvin (1996) reports an overall IIT level of around 21 per cent in 1992.

The highest level of IIT in Chinese trade can be observed with Japan, followed by selected European Countries (e.g. United Kingdom, Italy, Germany, and France) and the United States respectively. According to the variation across industries in Chinese trade in the early 1990s, the OECD-average IIT level in the chemical industry (SITC 5) is considerably high, followed by machinery and transport equipment (SITC 7) and manufactured goods (SITC 6). It is also shown that the Chinese economy used to specialise in miscellaneous manufactured articles (SITC 8) such as clothing and apparel, toys, sporting goods and footwear as the IIT level with OECD Countries is the lowest in these industries. Hellvin's (1996) results of high IIT levels in chemical products and low IIT levels in labour intensive manufactured articles are comparable to our results. Xing (2007) focuses in his analysis on the Chinese bilateral trade with two of its main trading partners, namely Japan and the US. Regarding the country variation in the level of IIT, the results are similar to that of Hellvin (1996). While in trade with Japan the level of IIT has doubled since the early 1990s to around one third in the year 2004, Chinese intra-industry trade with the US remained nearly constant at a relatively low level of less than 10 per cent of total trade. In Chinese trade with the US, the chemical industry dominates with 50 per cent of sectoral trade being subject to intra-industry trade. Contrary to our results for the European Union, Xing (2007) also reports that the exchange of primary products (food and live animals in SITC 0) between China and the US is characterised by a high level of IIT while all other industries are overwhelmingly one-way trade. This is also in contrast to Chinese trade with Japan, where the level of IIT is relatively high in all selected industries. In addition to the low level of industry disaggregation on three digit level used for the calculation, Xing's study does not consider the relative quality of traded products. Hu and Ma (1999) disentangle horizontal and vertical intra-industry trade for China in manufacturing industries (including SITC 5-8) with major trading partners in 1995.[15] They found out that vertical IIT dominates Chinese intra-industry trade so that trade is more differentiated by quality than preferences between similar products.[16]

[15] Hu and Ma (1999) are using the adjusted IIT index (which subtracts the trade imbalance from total trade volume) so that they conclude that the overall IIT level with the US is as high as in trade with Japan. It is also argued by Xing (2007) that if a trade deficit is present as in the case of China-US trade, the IIT index which does not adjust for trade imbalances underestimates the level of IIT. Accordingly, Hu and Ma (1999) adjusted for the trade imbalance and show that the IIT level in trade with the US is still higher as shown by Hellvin (1996) and Xing (2007). See Greenaway and Milner (1981) for discussion of adjustment for trade imbalances in intra-industry trade.

[16] The intra-industry trade between China and the US and other East Asian economies as well is subject to Zhang's (2006) paper. The same conclusions can be drawn for the machinery and transport equipment (high

### 3.3 Digression: The role of FDI

To explain the rising share of intra-industry trade in China-Europe trade relations, a considerable amount of studies focus increasingly on FDI flows as a determinant of vertical IIT and production networks. According to Li (2008), who considers the changing comparative advantages in Europe China trade relations, the investment pattern in the Chinese economy is complementary and corresponds to the pattern of revealed comparative advantages. Consequently, classified by factor intensity, the investment distribution of total FDI in Sino-foreign joint ventures was highest in human capital intensive and technology intensive sectors accounting for more than one third of FDI flows each. Okubo (2004) shows that the presence of Japanese FDI in China and its East Asian neighbours is promoting technology transfer and leads to increasing intra-industry trade. Interestingly, Andreosso-O'Callaghan and Bassino (2001) analyse the relationship between Japanese FDI and EU-ASEAN intra-industry trade and show that in the case of the chemical industry FDI flows from Japan play an important role. Lemoine and Ünal-Kesenci (2007) also argue that the presence of foreign owned firms and multinationals in China have been responsible for the structural change in Chinese export composition. According to Gaulier et al. (2005), the high tech intensity of foreign affiliate's exports is larger than that of Chinese firms. While the presence of foreign owned firms leads to technology transfers, upgrading the technological capabilities in China supports a sustainable integration of the Chinese economy in the world market. In its integration process, China follows the standard way of other countries such as Europe and Japan after World War II. From the perspective of the European Union, it could be argued that the integration of the Chinese economy in the world market and the technological upgrading lead to vertical production sharing and outsourcing processes, which in turn helps European firms to maintain their competitiveness on the world markets.

## 4 Conclusions

European trade with China in the last decade shows some interesting and relevant characteristics. Firstly, China is increasingly specialising in technology intensive goods. This has lead to changing Chinese comparative advantages and rising intra-industry trade, not only but also with the European Union. This development is absolutely in accordance with past developments of countries such as Japan and Germany. Still, the European Union maintains its comparative advantages in immobile technology intensive goods, which are harder to imitate by foreign competitors. Secondly, China is increasingly integrated into the world-wide value added chain, which has been sliced and fragmented across borders in recent years. This is documented by the increasing share of vertical intra-industry

vertical IIT) as well as for the chemical industry (high horizontal IIT). Related studies on Chinese intra-regional trade with its neighbouring trading partners include Azhar et al. (2008) and Ando (2006). Chinese bilateral intra-industry trade with developed and developing countries is considered in Zhang et al. (2005).

trade in China as well as by rising foreign direct investments from developed countries, including European partners. Jointly, this implies that Chinese exports have become more dependent on its imports (processing exports), which in turn makes it very unlikely that China will take recourse in aggressive protectionist measures in the wake of the global crisis. Thirdly, the European Union is not changing as much as China. Its structure of comparative advantages in trade with the world did not change much between 1999 and 2008, although the pattern of bilateral trade with China changed during this period. Intra-industry trade has become more prevalent in bilateral trade relations with China, not least due to increasing FDI and the presence of foreign owned firms in China. This is in line with the observation that Chinese exports have replaced foreign competitors from other emerging markets.

Thus, a European policy response to the Chinese development has to take into account the structural evolution of bilateral trade. The Sino-European trade relations are in line with economic theory and historical evidence. This makes for another argument against trade barriers as a policy reply to increasing import penetration from China or the trade deficit, which has nothing to do with competitiveness. The trade deficit with China mainly replaced respective deficits towards other emerging markets. Quite the opposite reaction to trade barriers is correct: European policymakers should welcome increasing international competition on the import side (as it raises quality and reduces prices of goods for European consumers and prices of inputs and machinery for European producers). In addition, intra-industry trade driven linkages between exports and imports with China affect European production as well.

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**Appendix**

Table 1: Main trading partner of the European Union

| | Exports | | | | Imports | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 1999 | 2008 | | | 1999 | 2008 |
| | EU-27 ext. trade | Bn. Euro | 683 | 1309 | EU-27 ext. trade | Bn. Euro | 743 | 1551 |
| Rank 2007 | **Trading partner** | Rank 1999 | in % of total trade | | **Trading partner** | Rank 1999 | in % of total trade | |
| 1 | USA | 1 | 27.4 | 19.1 | PR China | 4 | 7.1 | 16.0 |
| 2 | Russia | 8 | 2.5 | 8.0 | USA | 1 | 22.3 | 12.0 |
| 3 | Switzerland | 2 | 9.3 | 7.5 | Russia | 5 | 4.8 | 11.2 |
| 4 | PR China | 6 | 2.9 | 6.0 | Norway | 6 | 4.1 | 5.9 |
| 5 | Turkey | 5 | 3.2 | 4.1 | Switzerland | 3 | 7.4 | 5.2 |
| 6 | Norway | 4 | 3.5 | 3.3 | Japan | 2 | 10.1 | 4.8 |
| 7 | Japan | 3 | 5.2 | 3.2 | Turkey | 9 | 2.1 | 3.0 |
| 8 | UAE | 19 | 1.4 | 2.4 | Rep. Korea | 8 | 2.8 | 2.5 |
| 9 | India | 16 | 1.6 | 2.4 | Brazil | 10 | 1.9 | 2.3 |
| 10 | Brazil | 10 | 2.1 | 2.0 | Lybia | 24 | 0.9 | 2.2 |

Source: Eurostat (2009), own compilation and calculations.

Table 2: EU-27 trade balance with China in different product groups (in Mio. Euro)

| **SITC product group** | **1999** | **2001** | **2003** | **2005** | **2006** | **2007** | **2008** |
|---|---|---|---|---|---|---|---|
| 2 Crude materials (except fuels) | -181 | -247 | 165 | 900 | 2,393 | 2,525 | 2,399 |
| 5 Chemical products | -536 | -409 | -69 | 2 | -171 | -192 | -780 |
| 6 Manufacture goods classified by material | -4,175 | -6,070 | -5,773 | -11,956 | -17,571 | -27,578 | -27,483 |
| 7 Machinery and transport equipment | -4,261 | -11,974 | -21,985 | -44,062 | -55,940 | -63,501 | -68,074 |
| 8 Miscellaneous manufactured articles | -22,953 | -30,814 | -35,896 | -51,828 | -58,213 | -68,467 | -73,379 |
| **Total** | **-32,938** | **-51,335** | **-64,747** | **-108,486** | **-131,051** | **-159,621** | **-169,191** |

Source: Eurostat (2009), own compilation and calculations.

Table 3: EU-27 external trade pattern according to factor intensities*

| | 2008 | | | | 1999 | | | |
|---|---|---|---|---|---|---|---|---|
| | **EU-27 China trade** | | **EU-27 ext. trade** | | **EU-27 China trade** | | **EU-27 ext. trade** | |
| | Export | Import | Export | Import | Export | Import | Export | Import |
| **Primary products**[a)] | **8.9** | **3.0** | **9.1** | **21.6** | **7.8** | **5.3** | **9.0** | **16.6** |
| **Resource intensive**[b)] | **4.1** | **3.1** | **4.8** | **6.9** | **3.7** | **2.7** | **5.1** | **6.2** |
| **Labour intensive**[c)] | **2.6** | **30.1** | **7.6** | **13.6** | **3.2** | **39.4** | **9.4** | **13.1** |
| **Human Capital intensive** | **19.0** | **16.7** | **24.5** | **16.2** | **13.6** | **15.1** | **22.1** | **15.2** |
| 53 Dyeing, tanning, colouring materials | 0.5 | 0.2 | 0.8 | 0.3 | 0.8 | 0.2 | 0.9 | 0.4 |
| 55 Oils and resinoids, perfume materials | 0.5 | 0.2 | 1.5 | 0.5 | 0.2 | 0.1 | 1.4 | 0.5 |
| 62 Rubber manufactures | 0.5 | 0.6 | 0.7 | 0.7 | 0.3 | 0.3 | 0.7 | 0.6 |
| 64 Paper, paperboard | 0.7 | 0.5 | 1.6 | 0.6 | 1.5 | 0.5 | 1.8 | 0.9 |
| 67.2 - 67.9 Iron and steel | 3.4 | 2.8 | 3.5 | 2.8 | 1.9 | 0.2 | 2.1 | 1.0 |
| 69 Manufactures of metals | 2.1 | 4.6 | 2.8 | 2.4 | 2.0 | 4.2 | 2.5 | 1.9 |
| 76.1 - 76.3 Monitors, reception apparatus, sound recording | 0.2 | 3.3 | 0.4 | 1.2 | 0.1 | 3.2 | 0.2 | 1.2 |
| 78 Road vehicles | 9.3 | 1.4 | 10.4 | 4.9 | 5.1 | 0.6 | 9.1 | 5.5 |
| 79.1 Railway vehicles | 1.2 | 0.0 | 0.3 | 0.1 | 0.6 | 0.0 | 0.2 | 0.1 |
| 88.5 Watches and clocks | 0.1 | 0.5 | 0.2 | 0.4 | 0.1 | 1.5 | 0.2 | 0.6 |
| 89.2. 89.6 - 89.9 Miscellaneous manufactured articles | 1.1 | 2.6 | 2.5 | 2.3 | 1.1 | 4.0 | 3.0 | 2.5 |
| **Technology intensive** | **65.5** | **47.1** | **54.0** | **41.6** | **71.7** | **37.5** | **54.3** | **49.0** |
| 51 Organic chemicals | 2.5 | 1.3 | 3.2 | 2.8 | 2.5 | 1.5 | 3.8 | 2.5 |
| 52 Inorganic chemicals | 0.5 | 0.5 | 0.6 | 0.7 | 0.3 | 0.5 | 0.5 | 0.5 |
| 54 Medicinical and pharmaceutical products | 2.4 | 0.6 | 6.4 | 3.5 | 1.5 | 0.8 | 4.4 | 2.4 |
| 56 Fertilizers | 0.1 | 0.0 | 0.3 | 0.4 | 0.4 | 0.0 | 0.1 | 0.2 |
| 57 Plastics in primary forms | 2.6 | 0.2 | 1.6 | 0.9 | 1.4 | 0.1 | 1.3 | 0.8 |
| 58 Plastics in non-primary forms | 0.7 | 0.2 | 0.8 | 0.5 | 0.4 | 0.1 | 0.7 | 0.5 |
| 59 Chemical materials and products | 1.4 | 0.5 | 1.7 | 1.0 | 1.5 | 0.7 | 1.7 | 1.0 |
| 71 Power-generating machinery, equip. | 6.1 | 1.0 | 4.8 | 2.8 | 5.6 | 1.1 | 4.6 | 3.7 |
| 72 Machinery for particular industries | 9.0 | 0.9 | 6.4 | 1.8 | 11.4 | 0.4 | 5.7 | 2.1 |
| 73 Metalworking machinery | 3.7 | 0.3 | 1.3 | 0.7 | 2.9 | 0.2 | 1.1 | 0.8 |
| 74 General industrial machinery | 12.2 | 3.8 | 7.9 | 3.3 | 9.3 | 2.0 | 6.2 | 3.3 |
| 75 Office machines, data-processing machines | 1.4 | 13.7 | 2.1 | 5.8 | 2.0 | 10.3 | 3.3 | 9.3 |
| 76.4 Telecommunications equipment | 1.8 | 9.8 | 2.8 | 5.3 | 14.4 | 4.0 | 4.0 | 3.6 |
| 77 Electrical Machinery, Apparatus | 11.2 | 11.1 | 7.0 | 7.1 | 9.4 | 10.0 | 7.6 | 8.8 |
| 79.2 Aircraft | 5.5 | 0.0 | 2.7 | 1.4 | 5.4 | 0.3 | 4.8 | 4.9 |
| 87 Professional, scientific and controlling instruments | 3.7 | 1.0 | 3.0 | 2.4 | 2.5 | 1.1 | 2.8 | 2.7 |
| 88.1 - 88.4 Photographic, Cinematographic and optical goods | 0.3 | 0.5 | 0.5 | 0.5 | 0.5 | 1.4 | 0.9 | 1.0 |
| 89.1. 89.3 Miscellaneous manufact. | 0.5 | 1.5 | 0.9 | 0.8 | 0.3 | 2.8 | 0.8 | 0.8 |
| Excluded: 33.3 - 33.4 Petroleum oils | 0.2 | 0.0 | 6.1 | 28.1 | 1.2 | 0.0 | 2.0 | 9.9 |
| Excluded: not specified[d)] | 2.3 | 0.5 | 3.6 | 5.1 | 4.4 | 0.2 | 1.9 | 2.4 |
| Total (bn. EUR) | 78.4 | 247.6 | 1,308.6 | 1,550.7 | 19.7 | 52.6 | 683.1 | 743.3 |

*Export and Import in per cent of total trade. Classification of products according to factor intensity is based on Hinloopen and Marrewijk (2004). SITC 33.3 and 33.4 (Petroleum and Oils obtained from bituminous minerals) and not specified items are excluded from calculation. a) Primary products include: SITC 0, 1, 2, 3 (excl. 33.3, 33.4), and 4. b) Resource intensive products include: SITC 52.5, 61, 63, 66.1, 66.2, 66.3, 66.7, 67.1, and 68. c) Unskilled labour intensive products include: SITC 65, 66.4, 66.5, 66.6, 79.3, 81, 82, 83, 84, 85, 89.4, and 89.5. d) Not specified SITC sub-sectors include SITC 19.9, 29.9, 39.9, 49.9, 59.9, 60.0, 66.0, 69.0, 70.0, 79.9, and 80.0.
Source: Eurostat (2009), own compilation and calculations.

Table 4a: Evolution of the European Union's external trade structure*

| **EU27 Total Exports** | **1999** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** |
|---|---|---|---|---|---|---|---|---|---|---|
| Primary products | 9.0 | 8.5 | 8.3 | 8.5 | 8.5 | 8.2 | 8.2 | 8.6 | 8.6 | 9.1 |
| Resource intensive | 5.1 | 5.5 | 5.2 | 5.3 | 4.9 | 4.9 | 5.0 | 5.2 | 5.2 | 4.8 |
| Labour intensive | 9.4 | 9.1 | 9.2 | 9.2 | 8.7 | 8.2 | 7.8 | 7.8 | 7.8 | 7.6 |
| Human capital intensive | 22.1 | 22.1 | 22.2 | 23.4 | 24.1 | 24.2 | 24.0 | 24.4 | 24.6 | 24.5 |
| Technology intensive | 54.3 | 54.9 | 55.1 | 53.7 | 53.8 | 54.5 | 54.9 | 54.1 | 53.7 | 54.0 |
| | | | | | | | | | | |
| **EU27 Exports to China** | | | | | | | | | | |
| Primary products | 7.8 | 7.6 | 6.2 | 5.5 | 5.6 | 6.3 | 8.3 | 9.5 | 9.4 | 8.9 |
| Resource intensive | 3.7 | 4.6 | 4.1 | 4.1 | 3.8 | 4.0 | 4.2 | 4.7 | 4.6 | 4.1 |
| Labour intensive | 3.2 | 2.9 | 3.0 | 2.8 | 2.8 | 2.8 | 2.5 | 2.3 | 2.5 | 2.6 |
| Human capital intensive | 13.6 | 13.3 | 15.7 | 18.4 | 22.3 | 17.4 | 16.8 | 18.6 | 19.2 | 19.0 |
| Technology intensive | 71.7 | 71.6 | 71.0 | 69.2 | 65.5 | 69.5 | 68.2 | 65.0 | 64.2 | 65.5 |
| | | | | | | | | | | |
| **EU27 Total Imports** | **1999** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** |
| Primary products | 16.6 | 16.4 | 17.7 | 17.7 | 18.1 | 17.5 | 18.1 | 19.1 | 19.0 | 21.6 |
| Resource intensive | 6.2 | 6.7 | 6.5 | 6.2 | 5.8 | 6.4 | 6.6 | 7.7 | 8.2 | 6.9 |
| Labour intensive | 13.1 | 12.7 | 13.0 | 13.8 | 14.4 | 13.9 | 14.1 | 14.1 | 13.8 | 13.6 |
| Human capital intensive | 15.2 | 13.9 | 14.0 | 14.7 | 15.3 | 15.8 | 15.5 | 16.0 | 17.2 | 16.2 |
| Technology intensive | 49.0 | 50.3 | 48.8 | 47.6 | 46.4 | 46.4 | 45.7 | 43.1 | 41.8 | 41.6 |
| | | | | | | | | | | |
| **EU27 Imports from China** | | | | | | | | | | |
| Primary products | 5.3 | 4.7 | 4.9 | 3.9 | 3.7 | 3.8 | 3.4 | 3.1 | 3.0 | 3.0 |
| Resource intensive | 2.7 | 2.8 | 2.9 | 2.5 | 2.3 | 2.6 | 2.7 | 3.1 | 3.4 | 3.1 |
| Labour intensive | 39.4 | 36.0 | 34.6 | 33.8 | 32.2 | 29.2 | 31.5 | 29.6 | 29.6 | 30.1 |
| Human capital intensive | 15.1 | 15.1 | 14.8 | 15.4 | 14.8 | 14.9 | 14.9 | 15.6 | 18.2 | 16.7 |
| Technology intensive | 37.5 | 41.3 | 42.8 | 44.4 | 47.0 | 49.6 | 47.6 | 48.7 | 45.8 | 47.1 |

Table 4b: Evolution of the European Union's competitiveness in bilateral trade with China*

| **RCA** | **1999** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** |
|---|---|---|---|---|---|---|---|---|---|---|
| Primary products | 0.4 | 0.5 | 0.2 | 0.3 | 0.4 | 0.5 | 0.9 | 1.1 | 1.2 | 1.1 |
| Resource intensive | 0.3 | 0.5 | 0.3 | 0.5 | 0.5 | 0.4 | 0.4 | 0.4 | 0.3 | 0.3 |
| Labour intensive | -2.5 | -2.5 | -2.4 | -2.5 | -2.4 | -2.3 | -2.5 | -2.5 | -2.5 | -2.5 |
| Human capital intensive | -0.1 | -0.1 | 0.1 | 0.2 | 0.4 | 0.2 | 0.1 | 0.2 | 0.1 | 0.1 |
| Technology intensive | 0.6 | 0.6 | 0.5 | 0.4 | 0.3 | 0.3 | 0.4 | 0.3 | 0.3 | 0.3 |
| | | | | | | | | | | |
| **RTA** | | | | | | | | | | |
| Primary products | 0.6 | 0.6 | 0.5 | 0.4 | 0.5 | 0.6 | 0.9 | 1.0 | 1.0 | 0.9 |
| Resource intensive | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.5 | 0.6 | 0.5 | 0.5 |
| Labour intensive | -5.0 | -4.6 | -4.1 | -3.8 | -3.3 | -3.0 | -3.6 | -3.3 | -3.6 | -4.0 |
| Human capital intensive | -0.4 | -0.6 | -0.4 | -0.3 | -0.1 | -0.3 | -0.3 | -0.3 | -0.4 | -0.3 |
| Technology intensive | 1.6 | 1.4 | 1.3 | 1.1 | 0.6 | 0.8 | 0.7 | 0.3 | 0.4 | 0.3 |
| | | | | | | | | | | |
| **RC** | | | | | | | | | | |
| Primary products | 1.2 | 1.3 | 1.2 | 1.3 | 1.4 | 1.6 | 2.0 | 2.3 | 2.4 | 2.4 |
| Resource intensive | 0.6 | 0.8 | 0.6 | 0.8 | 0.8 | 0.8 | 0.9 | 1.0 | 0.9 | 0.8 |
| Labour intensive | -2.8 | -2.8 | -2.7 | -2.7 | -2.5 | -2.3 | -2.6 | -2.6 | -2.6 | -2.6 |
| Human capital intensive | -0.6 | -0.7 | -0.5 | -0.4 | -0.1 | -0.4 | -0.4 | -0.3 | -0.4 | -0.4 |
| Technology intensive | 1.3 | 1.2 | 1.0 | 0.8 | 0.5 | 0.5 | 0.5 | 0.2 | 0.3 | 0.2 |

Table 4c: Evolution of the European Union's competitiveness in total external trade*

| RCA | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|
| Primary products | -0.6 | -0.6 | -0.7 | -0.8 | -0.7 | -0.8 | -0.8 | -0.8 | -0.8 | -0.9 |
| Resource intensive | -0.2 | -0.2 | -0.2 | -0.2 | -0.2 | -0.2 | -0.3 | -0.3 | -0.4 | -0.4 |
| Labour intensive | -0.3 | -0.3 | -0.3 | -0.3 | -0.4 | -0.5 | -0.5 | -0.6 | -0.6 | -0.6 |
| Human capital intensive | 0.4 | 0.4 | 0.5 | 0.5 | 0.5 | 0.5 | 0.4 | 0.4 | 0.4 | 0.4 |
| Technology intensive | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.3 |

* Classification based on Hinloopen and Marrewijk (2004), see notes on table 3 for industries included. SITC 33.3 and 33.4 (Petroleum and Oils obtained from bituminous minerals) and not specified items are excluded from calculation. The revealed competitiveness indicators refer to the following formula: $RCA_i = Ln\left[\left(X_i/M_i\right)\Big/\left(\sum_i X_i/\sum_i M_i\right)\right]$, $RTA_{ij} = RXA_{ij} - RMP_{ij}$ and $RC_{ij} = Ln\left(RXA_{ij}\right) - Ln\left(RMP_{ij}\right)$ with $RXA_{ij} = \left(X_{ij}/X_{n-i,j}\right)\Big/\left(X_{i,w-j}/X_{n-i,w-j}\right)$ and $RMP_{ij} = \left(M_{ij}/M_{n-i,j}\right)\Big/\left(M_{i,w-j}/M_{n-i,w-j}\right)$.

Source: Eurostat (2009), own compilation and calculation.

Table 5: EU-27 trade pattern and competitiveness in technology intensive industries*

| | 2008 | | | | | | 1999 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EU-27 China trade | | | EU-27 ext. trade | | | EU-27 China trade | | | EU-27 ext. trade | | |
| | Export | Import | RCA | Export | Import | RCA | Export | Import | RCA | Export | Import | RCA |
| **Raw material-intensive** | **10.6** | **2.9** | **1.3** | **8.6** | **18.3** | **-0.8** | **8.7** | **4.5** | **0.7** | **8.0** | **14.4** | **-0.6** |
| **Labour-intensive** | **12.2** | **43.3** | **-1.3** | **20.4** | **26.9** | **-0.3** | **13.1** | **56.6** | **-1.5** | **23.0** | **26.4** | **-0.1** |
| **Capital-intensive** | **5.1** | **3.0** | **0.5** | **7.5** | **6.1** | **0.2** | **3.1** | **1.4** | **0.8** | **6.7** | **4.4** | **0.4** |
| **Mobile Schumpeter-industries** | **19.7** | **40.5** | **-0.7** | **18.9** | **25.6** | **-0.3** | **30.5** | **30.4** | **0.0** | **22.1** | **28.0** | **-0.2** |
| 51 Organic chemicals | 2.5 | 1.3 | 0.6 | 3.2 | 2.9 | 0.1 | 2.5 | 1.5 | 0.5 | 3.8 | 2.5 | 0.4 |
| 52 Inorganic chemicals | 0.6 | 0.5 | 0.2 | 0.8 | 1.0 | -0.2 | 0.4 | 0.6 | -0.5 | 0.7 | 0.7 | -0.1 |
| 58 Plastics in non-primary forms | 0.7 | 0.2 | 1.1 | 0.8 | 0.5 | 0.5 | 0.4 | 0.1 | 1.2 | 0.7 | 0.5 | 0.4 |
| 59 Chemical materials, products | 1.4 | 0.5 | 1.0 | 1.7 | 1.1 | 0.4 | 1.5 | 0.7 | 0.8 | 1.8 | 1.0 | 0.6 |
| 75 Office machines, data-processing machines | 1.4 | 13.7 | -2.3 | 2.1 | 6.0 | -1.0 | 2.0 | 10.3 | -1.7 | 3.3 | 9.4 | -1.1 |
| 76 Telecommunication, sound recording,, reprod. apparatus | 2.0 | 13.1 | -1.9 | 3.2 | 6.7 | -0.7 | 14.4 | 7.2 | 0.7 | 4.2 | 4.9 | -0.2 |
| 77 Electrical machinery, apparatus | 11.2 | 11.1 | 0.0 | 7.0 | 7.4 | -0.1 | 9.4 | 10.0 | -0.1 | 7.6 | 9.0 | -0.2 |
| **Immobile Schumpeter-industries** | **52.4** | **10.3** | **1.6** | **44.6** | **23.1** | **0.7** | **44.5** | **7.1** | **1.8** | **40.2** | **26.7** | **0.4** |
| 54 Medical and pharmaceutical products | 2.4 | 0.6 | 1.4 | 6.4 | 3.6 | 0.6 | 1.5 | 0.8 | 0.6 | 4.4 | 2.4 | 0.6 |
| 71 Power-generating machinery | 6.1 | 1.0 | 1.8 | 4.9 | 3.0 | 0.5 | 5.5 | 1.1 | 1.6 | 4.6 | 3.8 | 0.2 |
| 72 Machinery specialized for particular industries | 9.0 | 0.9 | 2.3 | 6.4 | 1.9 | 1.2 | 11.4 | 0.4 | 3.3 | 5.7 | 2.1 | 1.0 |
| 73 Metal working machinery | 3.7 | 0.3 | 2.5 | 1.3 | 0.7 | 0.6 | 2.9 | 0.2 | 2.7 | 1.1 | 0.9 | 0.3 |
| 74 General industrial machinery | 12.1 | 3.8 | 1.2 | 7.9 | 3.5 | 0.8 | 9.3 | 2.0 | 1.5 | 6.2 | 3.3 | 0.6 |
| 78 Road vehicles | 9.3 | 1.4 | 1.9 | 10.4 | 5.1 | 0.7 | 5.0 | 0.6 | 2.1 | 9.1 | 5.6 | 0.5 |
| 79 Other transport equipment | 6.1 | 1.2 | 1.6 | 4.3 | 2.9 | 0.4 | 6.4 | 0.7 | 2.2 | 6.4 | 5.8 | 0.1 |
| 87 Scientific, controll. instrum. | 3.7 | 1.0 | 1.3 | 3.0 | 2.9 | 0.2 | 2.5 | 1.1 | 0.8 | 2.8 | 2.8 | 0.0 |
| **Total (Bn. Euro)** | **78.4** | **247.6** | | **1,308.6** | **1,550.7** | | **19.7** | **52.6** | | **683.1** | **743.3** | |

*Exports and imports in per cent of total trade. SITC 33 and 34 (Petroleum and Oils obtained from bituminous minerals) and not specified items are excluded from calculation. $RCA > 0$ indicates a comparative advantage. The formula for RCA-values for commodity group $i$ is: $RCA_i = Ln\left[\left(Ex_i/\mathrm{Im}_i\right)\Big/\left(\sum_i Ex_i/\sum_i \mathrm{Im}_i\right)\right]$.

Source: Eurostat (2009), own compilation and calculations.

Table 6: Exploiting specialisation- and efficiency gains in bilateral trade with China*

| | | Exports | | | | Imports | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1999 | | 2008 | | 1999 | | 2008 | |
| | | % of total | % of sector | % of total | % of sector | % of total | % of sector | % of total | % of sector |
| | Total | 100.0 | | 100.0 | | 100.0 | | 100.0 | |
| | RC > 1 | 72.9 | | 56.2 | | 10.1 | | 5.4 | |
| | RC < -1 | 5.5 | | 8.1 | | 68.0 | | 69.8 | |
| | -1 < RC < 1 | 21.6 | | 35.7 | | 21.9 | | 24.8 | |
| of which: | | | | | | | | | |
| | Total | 7.8 | 100.0 | 8.9 | 100.0 | 5.3 | 100.0 | 3.0 | 100.0 |
| Primary products | RC > 1 | 6.8 | 86.9 | 8.3 | 93.2 | 1.3 | 24.0 | 0.9 | 30.8 |
| | RC < -1 | 0.1 | 1.2 | 0.1 | 1.0 | 1.6 | 30.2 | 1.1 | 36.1 |
| | -1 < RC < 1 | 0.9 | 11.9 | 0.5 | 5.8 | 2.4 | 45.9 | 1.0 | 33.1 |
| | Total | 3.7 | 100.0 | 4.1 | 100.0 | 2.7 | 100.0 | 3.1 | 100.0 |
| Resource intensive | RC > 1 | 3.0 | 80.4 | 3.5 | 85.3 | 0.6 | 22.2 | 0.8 | 25.5 |
| | RC < -1 | 0.3 | 7.4 | 0.3 | 7.0 | 1.6 | 58.3 | 1.7 | 56.2 |
| | -1 < RC < 1 | 0.5 | 12.2 | 0.3 | 7.7 | 0.5 | 19.5 | 0.6 | 18.2 |
| | Total | 3.2 | 100.0 | 2.6 | 100.0 | 39.4 | 100.0 | 30.1 | 100.0 |
| Labour intensive | RC > 1 | 0.6 | 18.0 | 0.0 | 0.0 | 0.1 | 0.3 | 0.0 | 0.0 |
| | RC < -1 | 1.4 | 44.5 | 1.6 | 63.3 | 38.1 | 96.6 | 29.1 | 96.7 |
| | -1 < RC < 1 | 1.2 | 37.4 | 0.9 | 36.7 | 1.2 | 3.0 | 1.0 | 3.3 |
| | Total | 13.6 | 100.0 | 19.0 | 100.0 | 15.1 | 100.0 | 16.7 | 100.0 |
| Human Capital intensive | RC > 1 | 8.8 | 64.8 | 11.4 | 60.1 | 0.3 | 1.9 | 1.0 | 6.0 |
| | RC < -1 | 1.9 | 14.0 | 2.6 | 13.9 | 12.2 | 81.2 | 11.7 | 70.5 |
| | -1 < RC < 1 | 2.9 | 21.2 | 4.9 | 26.1 | 2.5 | 16.9 | 3.9 | 23.5 |
| | Total | 71.7 | 100.0 | 65.5 | 100.0 | 37.5 | 100.0 | 47.1 | 100.0 |
| Technology intensive | RC > 1 | 53.8 | 75.0 | 33.0 | 50.4 | 7.8 | 20.8 | 2.7 | 5.6 |
| | RC < -1 | 1.8 | 2.5 | 3.5 | 5.3 | 14.5 | 38.6 | 26.1 | 55.4 |
| | -1 < RC < 1 | 16.1 | 22.5 | 29.0 | 44.3 | 15.2 | 40.6 | 18.3 | 38.9 |

*Adjusted European Unions trade pattern excluding trade of products in SITC 33.3 and 33.4 „Petroleum oils and oils obtained from Bituminous Minerals“. The revealed competitiveness is calculated based on the following formula: $RC_{ij} = Ln\left(RXA_{ij}\right) - Ln\left(RMP_{ij}\right)$ with $RXA_{ij} = \left(X_{ij} / X_{n-i,j}\right) \Big/ \left(X_{i,w-j} / X_{n-i,w-j}\right)$ and $RMP_{ij} = \left(M_{ij} / M_{n-i,j}\right) \Big/ \left(M_{i,w-j} / M_{n-i,w-j}\right)$.

Source: Eurostat (2009), own compilation and calculations.

Table 7: Evolution of intra-industry trade between the European Union and China

| | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 Food and live animals | 10.9 | 11.9 | 13.5 | 14.3 | 12.9 | 13.0 | 13.1 | 14.5 | 13.5 | 13.6 |
| 1 Beverages and tobacco | 29.8 | 29.5 | 32.6 | 44.0 | 28.4 | 12.7 | 9.9 | 11.3 | 9.0 | 9.0 |
| 2 Crude materials, inedible, except fuels | 10.3 | 11.0 | 10.3 | 11.6 | 12.2 | 12.3 | 9.7 | 9.5 | 9.5 | 9.5 |
| 3 Mineral fuels, lubricants | 4.5 | 6.9 | 4.0 | 1.7 | 2.3 | 1.9 | 2.6 | 6.4 | 3.5 | 3.8 |
| 4 Animal and vegetable oils, fats and waxes | 4.2 | 7.5 | 8.7 | 13.6 | 26.1 | 25.5 | 20.3 | 10.8 | 10.2 | 9.1 |
| 5 Chemicals and related products | 26.7 | 27.9 | 28.8 | 31.6 | 29.4 | 30.2 | 32.5 | 33.3 | 33.6 | 32.8 |
| 6 Manufactured goods | 15.7 | 15.6 | 17.1 | 19.3 | 19.9 | 21.3 | 20.1 | 20.3 | 20.7 | 21.6 |
| 7 Machinery and Transport equipment | 24.3 | 27.2 | 28.1 | 23.0 | 21.2 | 21.7 | 22.4 | 21.6 | 22.2 | 23.6 |
| 8 Miscellaneous manufactured articles | 4.7 | 5.0 | 5.9 | 6.1 | 6.4 | 7.5 | 6.6 | 7.2 | 7.6 | 8.0 |
| 9 Commodities and Transactions | 72.4 | 69.1 | 44.4 | 64.6 | 54.3 | 55.8 | 50.0 | 44.7 | 37.3 | 40.2 |
| Total | 15.8 | 17.8 | 19.2 | 17.5 | 16.9 | 17.9 | 17.7 | 17.9 | 18.3 | 19.2 |

Source: Eurostat (2009), own compilation and calculations.

Table 8: EU-27-China intra-industry trade according to factor intensities

| | 2008 | | | | 1999 | | | |
|---|---|---|---|---|---|---|---|---|
| | Export | Import | RC | IIT | Export | Import | RC | IIT |
| **Primary products**[a)] | **8.9** | **3.0** | **2.4** | **10.3** | **7.8** | **5.3** | **1.2** | **10.8** |
| **Resource intensive**[b)] | **4.1** | **3.1** | **0.8** | **17.4** | **3.7** | **2.7** | **0.6** | **13.2** |
| **Labour intensive**[c)] | **2.6** | **30.1** | **-2.6** | **4.3** | **3.2** | **39.4** | **-2.8** | **3.6** |
| 65 Textiles yarn, fabrics, made-up articles | 1.0 | 2.3 | -0.9 | 16.9 | 1.2 | 2.9 | -0.9 | 13.4 |
| 66.4 Glass | 0.2 | 0.3 | -0.7 | 26.3 | 0.4 | 0.1 | 1.0 | 30.0 |
| 66.5 Glassware | 0.1 | 0.3 | -2.1 | 14.1 | 0.1 | 0.2 | -2.5 | 20.7 |
| 66.6 Pottery | 0.0 | 0.4 | -4.3 | 1.4 | 0.0 | 0.8 | -5.6 | 0.6 |
| 79.3 Ships, Boats | 0.0 | 1.0 | -3.5 | 2.5 | 0.4 | 0.3 | -0.5 | 49.4 |
| 81 Prefabricated buildings, sanitary, plumbing, heating | 0.2 | 1.3 | -3.1 | 5.2 | 0.3 | 1.6 | -2.7 | 5.0 |
| 82 Furniture and parts thereof | 0.5 | 2.8 | -2.2 | 8.8 | 0.3 | 1.6 | -2.3 | 10.2 |
| 83 Travel goods, handbags | 0.1 | 1.9 | -4.0 | 2.5 | 0.0 | 4.3 | -6.3 | 0.2 |
| 84 Articles of apparel and clothing accessories | 0.3 | 11.0 | -2.7 | 1.9 | 0.3 | 14.7 | -3.2 | 1.2 |
| 85 Footwear | 0.1 | 2.4 | -2.8 | 2.5 | 0.1 | 2.9 | -3.7 | 1.6 |
| 89.4 Baby carriages, toys, games and sporting goods | 0.1 | 6.2 | -4.2 | 0.7 | 0.1 | 9.4 | -4.2 | 0.6 |
| 89.5 Office and stationery supplies | 0.0 | 0.2 | -1.5 | 10.0 | 0.1 | 0.3 | -0.9 | 21.0 |
| **Human capital** | **19.0** | **16.7** | **-0.4** | **22.6** | **13.6** | **15.1** | **-0.6** | **13.6** |
| **Technology** | **65.5** | **47.1** | **0.2** | **25.7** | **71.7** | **37.5** | **1.3** | **24.9** |
| 51 Organic chemicals | 2.5 | 1.3 | 0.6 | 38.1 | 2.5 | 1.5 | 0.1 | 35.4 |
| 52 Inorganic chemicals | 0.5 | 0.5 | 0.5 | 31.8 | 0.3 | 0.5 | -0.5 | 19.4 |
| 54 Medicinical and pharmaceutical products | 2.4 | 0.6 | 0.9 | 12.5 | 1.5 | 0.8 | 0.0 | 25.2 |
| 56 Fertilizers | 0.1 | 0.0 | 2.5 | 8.7 | 0.4 | 0.0 | 7.1 | 0.1 |
| 57 Plastics in primary forms | 2.6 | 0.2 | 2.4 | 23.8 | 1.4 | 0.1 | 2.2 | 15.3 |
| 58 Plastics in non-primary forms | 0.7 | 0.2 | 0.6 | 70.6 | 0.4 | 0.1 | 0.8 | 69.5 |
| 59 Chemical materials and products | 1.4 | 0.5 | 0.6 | 34.2 | 1.5 | 0.7 | 0.2 | 18.3 |
| 71 Power-generating machinery, equip. | 6.1 | 1.0 | 1.5 | 48.9 | 5.6 | 1.1 | 1.5 | 42.2 |
| 72 Machinery for particular industries | 9.0 | 0.9 | 1.2 | 37.4 | 11.4 | 0.4 | 2.5 | 13.1 |
| 73 Metalworking machinery | 3.7 | 0.3 | 2.2 | 32.9 | 2.9 | 0.2 | 2.6 | 19.0 |
| 74 General industrial machinery | 12.2 | 3.8 | 0.4 | 48.4 | 9.3 | 2.0 | 1.0 | 30.7 |
| 75 Office machines, data-processing machines | 1.4 | 13.7 | -1.9 | 5.8 | 2.0 | 10.3 | -0.7 | 12.3 |
| 76.4 Telecommunications equipment | 1.8 | 9.8 | -1.4 | 10.4 | 14.4 | 4.0 | 1.4 | 41.7 |
| 77 Electrical Machinery, Apparatus | 11.2 | 11.1 | -0.1 | 31.4 | 9.4 | 10.0 | 0.1 | 24.8 |
| 79.2 Aircraft | 5.5 | 0.0 | 4.7 | 50.7 | 5.4 | 0.3 | 2.9 | 30.1 |
| 87 Professional, scientific and controlling instruments | 3.7 | 1.0 | 1.2 | 48.5 | 2.5 | 1.1 | 0.8 | 29.6 |
| 88.1 Photographic apparatus | 0.0 | 0.0 | -1.2 | 25.5 | 0.1 | 0.8 | -1.8 | 7.8 |
| 88.2 Photographic and cinematographic supplies | 0.2 | 0.0 | 1.7 | 17.6 | 0.1 | 0.1 | 0.9 | 16.5 |
| 88.3 Cinematographic film | 0.0 | 0.0 | 0.7 | 70.9 | 0.0 | 0.0 | 0.8 | 82.7 |
| 88.4 Optical goods | 0.1 | 0.4 | -1.3 | 14.1 | 0.2 | 0.6 | -1.0 | 8.6 |
| 89.1 Arms and Ammunition | 0.0 | 0.0 | -0.7 | 14.1 | 0.0 | 0.0 | -0.4 | 31.2 |
| 89.3 Articles n.e.s. of plastics | 0.4 | 1.5 | -1.5 | 16.5 | 0.3 | 2.8 | -2.5 | 7.3 |
| Total (bn. EUR) | 78.4 | 247.6 | - | - | 19.7 | 52.6 | - | - |

Export and Import in per cent of total trade. The revealed competitiveness is based on the following formula: $RC_{ij} = Ln\left(RXA_{ij}\right) - Ln\left(RMP_{ij}\right)$ with $RXA_{ij} = \left(X_{ij} / X_{n-i,j}\right) \Big/ \left(X_{i,w-j} / X_{n-i,w-j}\right)$ and $RMP_{ij} = \left(M_{ij} / M_{n-i,j}\right) \Big/ \left(M_{i,w-j} / M_{n-i,w-j}\right)$.

The intra-industry trade index is calculated on the five-digit level based on the formula: $IIT_i = 100\left[1 - \frac{\sum_k |X_{ik} - M_{ik}|}{\sum_k (X_{ik} + M_{ik})}\right]$

Source: Eurostat (2009), own compilation and calculations.

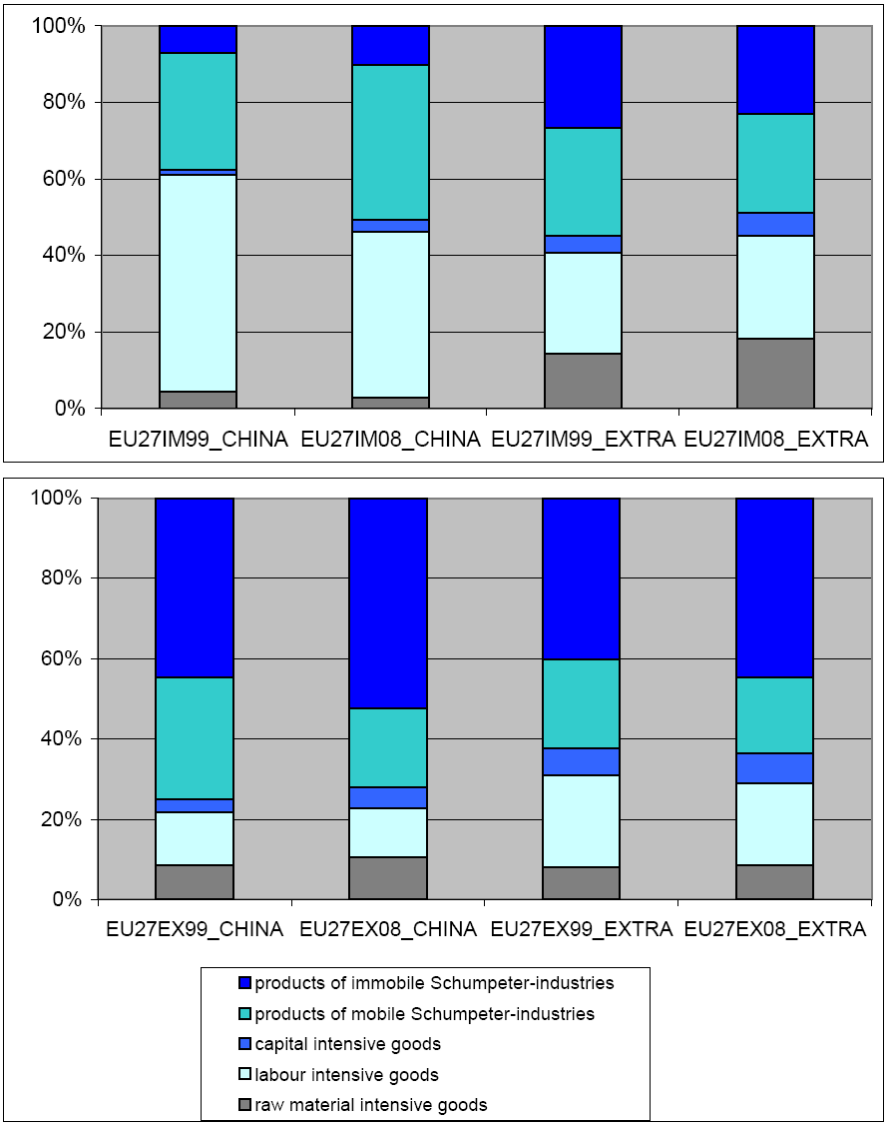
Table 9: EU-27-China Intra-industry trade in technology intensive industries

| | 2008 | | | | 1999 | | | |
|---|---|---|---|---|---|---|---|---|
| | Exports (%) | Imports (%) | RC | IIT | Exports (%) | Imports (%) | RC | IIT |
| **Mobile Schumpeter-industries** | | | | | | | | |
| 51 Organic chemicals | 2.5 | 1.3 | 0.7 | 38.1 | 2.5 | 1.5 | 0.1 | 35.4 |
| 52 Inorganic chemicals | 0.6 | 0.5 | 0.5 | 31.8 | 0.4 | 0.6 | -0.4 | 19.4 |
| 58 Plastics in non-primary forms | 0.7 | 0.2 | 0.7 | 70.6 | 0.4 | 0.1 | 0.8 | 69.5 |
| 59 Chemical materials and products | 1.4 | 0.5 | 0.7 | 34.2 | 1.5 | 0.7 | 0.3 | 18.3 |
| 75 Office machines, data-processing machines | 1.4 | 13.7 | -1.8 | 5.8 | 2.0 | 10.3 | -0.7 | 12.3 |
| 76.1 Monitors and projectors | 0.1 | 1.9 | -3.1 | 2.5 | 0.03 | 0.1 | -0.8 | 14.4 |
| 76.2 Reception apparatus for radio-broadcasting | 0.0 | 0.4 | -1.7 | 4.2 | 0.02 | 2.4 | -2.4 | 0.7 |
| 76.3 Sound recording, reproducing apparatus | 0.1 | 0.9 | -1.5 | 5.5 | 0.01 | 0.7 | -2.2 | 1.3 |
| 76.4 Telecommunications equipment | 1.8 | 9.8 | -1.4 | 10.4 | 14.4 | 4.0 | 1.4 | 41.7 |
| 77 Electrical machinery, apparatus | 11.2 | 11.1 | -0.1 | 31.4 | 9.4 | 10.0 | 0.1 | 24.8 |
| **Immobile Schumpeter-industries** | | | | | | | | |
| 54 Medicinical and pharmaceutical products | 1.7 | 0.5 | 1.0 | 12.5 | 1.5 | 0.8 | 0.0 | 25.2 |
| 71 Power-generating machinery, equipment | 5.5 | 0.9 | 1.6 | 48.9 | 5.5 | 1.1 | 1.5 | 42.2 |
| 72 Machinery for particular industries | 9.7 | 0.9 | 1.2 | 37.4 | 11.4 | 0.4 | 2.5 | 13.1 |
| 73 Metalworking machinery | 3.4 | 0.2 | 2.3 | 32.9 | 2.9 | 0.2 | 2.6 | 19.0 |
| 74 General industrial machinery | 10.8 | 3.7 | 0.4 | 48.4 | 9.3 | 2.0 | 1.0 | 30.7 |
| 78 Road vehicles | 8.7 | 1.3 | 1.4 | 31.2 | 5.0 | 0.6 | 1.6 | 16.3 |
| 79.1 Railway vehicles | 0.5 | 0.0 | 2.4 | 25.5 | 0.6 | 0.0 | 4.3 | 10.9 |
| 79.2 Aircraft and equipm. | 5.5 | 0.0 | 4.7 | 50.7 | 5.4 | 0.3 | 2.9 | 30.1 |
| 87 Professional, scientific and controlling instruments | 3.6 | 1.0 | 1.3 | 48.5 | 2.5 | 1.1 | 0.9 | 29.6 |

Export and Import in per cent of total trade. SITC 33.3 and 33.4 (Petroleum and Oils obtained from bituminous minerals) and not specified items are excluded from calculation. The revealed competitiveness is based on the following formula: $RC_{ij} = Ln\left(RXA_{ij}\right) - Ln\left(RMP_{ij}\right)$ with $RXA_{ij} = \left(X_{ij} / X_{n-i,j}\right) \Big/ \left(X_{i,w-j} / X_{n-i,w-j}\right)$ and $RMP_{ij} = \left(M_{ij} / M_{n-i,j}\right) \Big/ \left(M_{i,w-j} / M_{n-i,w-j}\right)$. The intra-industry trade index is calculated on the five-digit level based on the formula: $IIT_i = 100\left[1 - \frac{\sum_k |X_{ik} - M_{ik}|}{\sum_k (X_{ik} + M_{ik})}\right]$

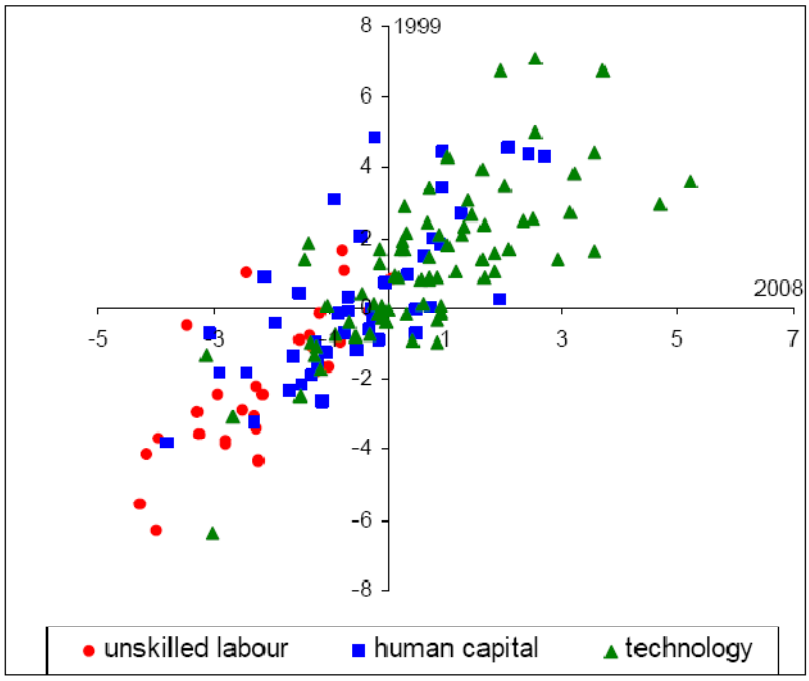
Source: Eurostat (2009), own compilation and calculations.

Figure 1: EU-27 external trade according to factor intensities - 1999 and 2008 compared*



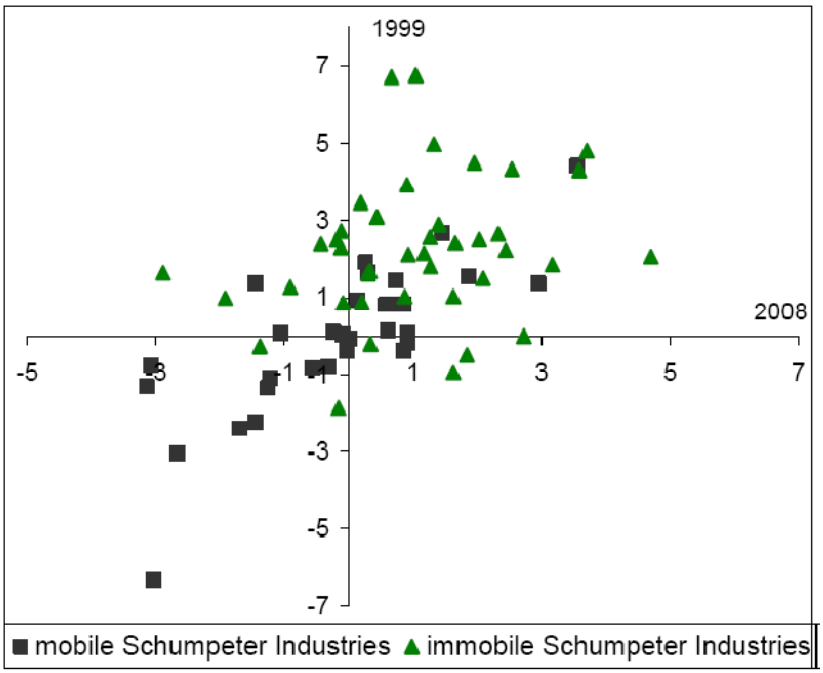

*Adjusted European Unions trade patterns excluding trade of products in SITC 3 „Mineral fuels, lubricants and related materials“.
Source: Eurostat (2009), own compilation and calculations.

Figure 2: EU-27 revealed competitiveness in trade with China*



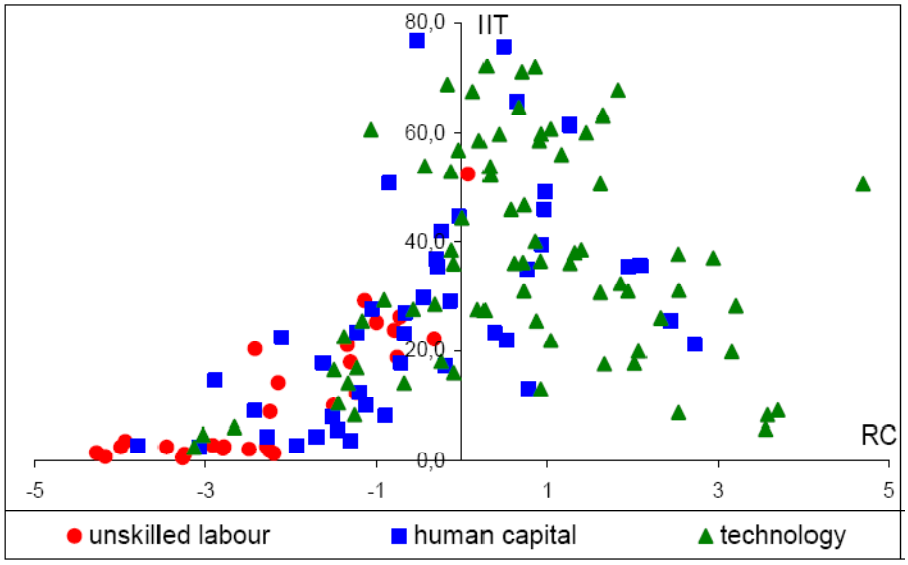

According to the classification of factor intensity based on Hinloopen and Marrewijk (2004) used in table 4b, mapping of RC-values based on UN Standard International Trade Classification SITC (Rev. 4) are broken down on sections and division of commodity groups on 3-digit-level-codes for the year 1999 and 2008.
Source: Eurostat (2009), own compilation and calculations.

Figure 3: EU-27 revealed competitiveness in technology intensive industries*



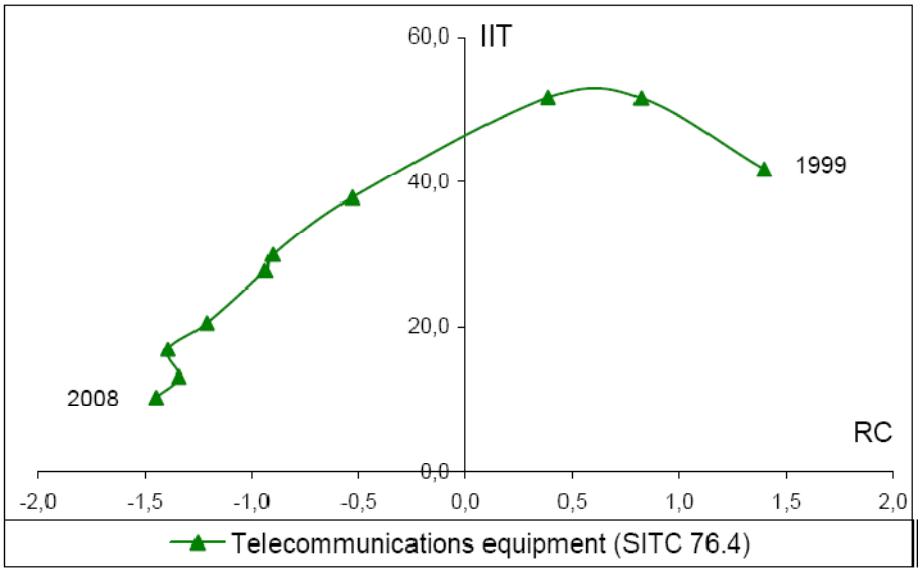

*According to table 5 the mapping of RCA-values based on UN Standard International Trade Classification SITC (Rev. 4) are broken down on sections and division of commodity groups SITC 6-8 on 3-digit-level-codes for the year 1999 and 2008.
Source: Eurostat (2009), own compilation and calculations.

Figure 4: EU-27-China intra-industry trade and revealed competitiveness in 2008*




*According to table 8 the mapping of RC-values and IIT-levels based on UN Standard International Trade Classification SITC (Rev. 4) are broken down on sections and division of commodity groups SITC 6-8 on 3-digit-level-codes.
Source: Eurostat (2009), own compilation and calculations.

Figure 5: Evolution of the EU-27-China RC and IIT in the telecommunications industry




Source: Eurostat (2009), own compilation and calculations.