

# CHINA'S INTEGRATION INTO ASIAN PRODUCTION NETWORKS AND ITS IMPLICATIONS

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## SUMMARY

The paper analyses the rapid progress and the consequences of China's participation in the international segmentation of production processes and of its integration in Asian production networks. A first section points out how globalisation provides new opportunities for latecomers to enter international trade through production sharing, which has been an especially widespread phenomena in Asia. A second section investigates how China has taken advantage of the globalisation process and assesses the consequences of its integration into Asian production networks on bilateral trade imbalances. The in-depth analysis of trade flows, based on China's customs statistics, leads to the following conclusions: international processing activities, based on inputs imported from Asian countries, have been the engine of China's trade expansion, allowing for a rapid diversification of its manufacturing export capacities; foreign affiliates have been responsible for a major and ever-growing part of China's export growth, especially with Asian countries; China's position in "triangular" trade is characterised by growing deficits with Asia in intermediate goods, especially in parts and components, and by rising surpluses with "Western" countries in final goods, mainly consumption goods but also capital goods; imports of parts and components from Asia have been the major channel of technology transfers, which have helped China to rapidly improved the high-tech content of its foreign trade. However the technological upgrading of China's trade has remained quite circumscribed to foreign firm production and export bases. A third section focuses on the changes in Asian country trade pattern over the last twenty years. It highlights the intensification of intraregional trade in intermediate goods and the rise of late-comers (China and ASEAN countries) as suppliers of final goods both to the region and to the rest of the world. China's participation in the Asian division of labour follows a pattern which appears to be quite similar to that of ASEAN countries, but the size of China's economy gives the country a trade potential which has considerably affected "triangular" trade: Chinese exports to Western markets have displaced Japan's and NIEs' exports at an accelerated pace, in sectors such as electrical and electronic goods. China's emergence thus carries the mechanisms of triangular trade to extremes. Since in the late nineties, the exports of the second tier of new industrialised economies (ASEAN countries excluding Singapore) have levelled off, suggesting that the latter may be crowded out of these markets by China's competitors. The fourth section sketches out the implications of China's rise in triangular trade for Asian regional integration and for international trade imbalances.

## ABSTRACT

The paper analyses the rapid progress and the consequences of China's integration in Asian production networks. International processing activities, based on Asian inputs and mainly carried out by Asian affiliates have been the engine of China's trade expansion in the nineties. China's position in « triangular trade », characterised by deficits with Asia in intermediate goods and surpluses with "Western" countries in final goods, is similar to that of ASEAN countries. But the size of China's economy carries the mechanisms of triangular trade to extremes, as China's exports are displacing those of other Asian economies in Western markets at an accelerated pace.

Key words — China, Asia, technology transfer, trade specialisation, FDI, international production sharing

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## INTRODUCTION<sup>2</sup>

Since 1980, China's foreign trade has expanded at an outstanding pace (almost 15% per year) and its share in world trade rose from less than 1% to about 5% in 2002<sup>3</sup>. Most remarkable have been the rapid expansion and the diversification of its industrial manufactured exports which have risen at the rate of 20% a year, driven by textile products in the 1980s, and by electrical and electronic products during the 1990s. China's manufactured exports accounted for almost 90% of its total exports in 2002, against 40% in 1980, and represented 7% of international trade. The accelerated growth of China's exports in 2003 (+35%) and its widening trade surpluses with the US and Europe, have led to international pressures for a reevaluation of the yuan. China's emergence has also raised concerns both in developing and in advanced economies, as the former are faced with the risk of being crowded out of world markets for labour intensive products, while the latter fear that China's technological catch-up may endanger their comparative advantages in high-value added activities.

The present study tries to qualify these assessments. The analysis of China's involvement in the international segmentation of production processes and of its integration in Asian production networks helps to understand how China has achieved such outstanding trade performance and brings to the fore the factors underlying China's competitiveness in world markets.

The first section of the paper points out how globalisation provides new opportunities for latecomers to enter international trade through production sharing, a phenomena which has been especially widespread in Asia. A second section provides an in depth analysis of China's trade flows. Based on the detailed data available from China's customs statistics, it assesses the role international processing activities and of foreign affiliates in China's trade, the impact of production sharing with Asian countries on China's geographic and commodity trade patterns and on the technological content of traded goods. A third section focuses on the changes which have occurred over the last twenty years in East Asia countries' trade patterns both within the region and with rest of the world. The fourth section sketches out the implications of China's rise in triangular trade for the Asian regional integration and for international trade imbalances.

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<sup>3</sup> Average of exports and imports (source CEPII-CHELEM).

## 1. GLOBALISATION AND ASIAN PRODUCTION NETWORKS

### 1.1. The International Segmentation of Production Processes

International production sharing, which has been observed for a long time, was not taken into account in the traditional theories of international trade. In Ricardo's and Heckscher-Ohlin's models, countries specialise in final goods in which they have a comparative advantage. They export these goods and import products for which they have a comparative disadvantage and which they cease to produce. Foreign trade makes it possible to economise factors of production and thus leads to gains relatively to a situation of autarky. In this traditional approach, the domestic production processes are not interrupted by international trade.

The globalisation process, *i.e.* the reorganisation of production on a world-wide basis, has been existing for long, but has deepened since the eighties, giving rise to a rapid growth of trade in intermediate goods. Trade in intermediate products, which results from the interruption of the domestic production processes, has justified a rewriting of the international trade theory. As production processes become internationally fragmented, firms located in different countries take part in the production of a commodity but at different stages of the value-added chain. The value-added chain is split-up across different countries and firms, and international trade involves evermore flows of goods belonging to a single industry but at different stages of production. The international segmentation of production processes is fostered by the search of cost minimisation and economies of scale which arise through expanding markets.

This evolution results from several factors. First, the possibility of breaking up production processes depends on the techniques of production of industries. The segmentation of production takes place in industries in which production processes can be broken down into technologically separate and independent operations providing intermediate inputs to be assembled in the final product (*Lassudrie-Duchêne, 1985*). A segment of production is thus defined as the operations which produce a "finished" goods used as an input for the following segment (*Fontagné, 1991*). When the different segments take place in production units (subcontractors or affiliates) which are located in different countries, we are in presence of an international segmentation of production processes. Each segment is characterised by a technique of production which may change over time. As manufactured products are becoming more and more technologically sophisticated, the number of stages of production increases and the productivity at the different stages changes rapidly; in this context a country tends to specialise only in individual segments.

Second, trade corresponding to an international segmentation of production processes has been enhanced by multinational firm strategies. Firms have developed sourcing policies which rely on foreign, and even distant suppliers; they have localised the production of components in different countries, with the aim of a better utilisation of different countries' comparative advantages. Outsourcing, *i.e.* the import of

intermediate inputs (from low-wage countries) by domestic firms (in developed countries) has increased and can be interpreted as a response to import competition (*Feenstra and Hanson, 1995 and 1996*). Such strategies are often associated with the rise of intra-firm trade, but this is not always the case: reorganisation of production across countries' boundaries often takes place within processing trade operations, subcontracting activities, which do not imply equity relationship between firms involved in the same production process (*Fukasaku and Kimura, 2001*). The international segmentation of production processes has led to changes in the structure of international trade and in countries specialisation pattern. "A limited number of standardised semi-assembled goods are produced on a large scale and then combined to produce a large variety of final products" (*Fontagné, Freudenberg and Ünal-Kesenci, 1996*). This splitting-up of the value added chain allows for an evermore deep specialisation. The different stages of production correspond to different production functions so that a country may have a comparative advantage in one stage of production and a comparative disadvantage in other stages. It is thus useful to distinguish two types of specialisation: when a country has a comparative advantage in the whole process of production of a given product, from upstream to downstream stages of production, we are in the presence of a so-called "horizontal" specialisation. If comparative advantages can be found only in some stages of production, whereas others are disadvantaged, this is referred to as "vertical" specialisation. This specialisation along the production chain implies specific gains<sup>4</sup>.

Assembly trade is a crucial element in the international segmentation of production processes. Assembly may be a rather complex operation or in the contrary a simple operation, depending on industries. Its characteristics are likely to change more rapidly than those of other stages of production. Recent theoretical and empirical studies suggest that trade in intermediate goods is an important channel of the transmission of technology (*Coe and Helpman, 1995; Coe, Helpman and Hoffmaister, 1995; Keller, 2001*). For emerging economies, imports of components for assembly may become the easiest way to acquire high-technology and benefit from technological spillovers which allows for an increase in total factor productivity.

Finally a country's trade policy may influence its involvement in the international fragmentation of production processes, as the tariff structure determines the degree of effective protection. It has been shown that exemptions or tariff reductions on imported inputs increases the effective protection enjoyed by the assembling activities as it reduces its costs of production. On the contrary a rise in tariff on intermediate goods reduces the protection of the downstream segments of production, as it appears as a duty applied to assembling activities (*Grubel and Johnson, 1971*).

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<sup>4</sup> Note that the notions of "horizontal" and "vertical" specialisation have a different meaning when they refer to product differentiation: the former concerns similar products of different varieties, the latter different qualities.

## 1.2. Asian Production Networks

International production sharing is an especially widespread phenomenon in East Asia and has become an important factor determining trade patterns in the region. Asian production and trade networks result from the strategies of firms which have shifted from exports to international production and reorganised their business activities across different countries in order to reduce costs and improve their capacities to react to technological changes and market requirements.

These cross-border production and trade networks explain the rapid increase of both trade and FDI flows between Asian countries, the far-reaching changes in countries' commodity trade pattern and specialisation. Empirical studies have shown that international production networks account for a significant share of flows of most countries of the region, are spread over a large number of countries and involve both intra-firm and arm's-length trade (*Ando and Kimura, 2003*).

Several factors have contributed to the expansion of Asian production networks: besides geographic proximity, the heterogeneity of the Asian economies has stimulated the international segmentation of production processes since the different countries had different comparative advantages (*Zysman, Doherty and Schwartz, 1996*). At the end of the 80s, currency revaluations, which have affected the competitiveness of manufacturing industries in the most developed countries of the region, have played a catalytic role in accelerating the relocation of their labour intensive production in the low-wage countries of the region (*Naughton, 1997*). Finally the changes in the development strategies and trade policies implemented in Asian countries from the mid-eighties have also decisively contributed to the expansion of international production networks (*Ando and Kimura, 2003*).

There is no comprehensive relevant statistics which allow for precisely measuring the role of international production and trade networks, however, indirect evidence can be drawn from the analysis of trade flows and of the strategies of firms.

Empirical studies of international trade flows have put forwards the increasing vertical specialisation (the splitting up of the value added chain) and shown the growing importance of intermediate goods, and especially of "parts and components" in intra-Asian trade flows. As the possibility (and costs) of splitting up production processes into two or more steps depends on the technique of production, the forces driving to vertical specialisation have been stronger in some industries, such as machinery and electrical machinery (*Ando and Kimura, 2003; Ng and Yeats, 2003; Masuyama, 2004; Fukao, Ishido and Ito, 2003*).

Analysis of Asian firm strategies has underlined that their foreign direct investment (FDI) has been an important component in the development of international production networks in Asia (*Ando and Kimura, 2003; Masuyama, 2004; Fukao, Ishido and Ito, 2003*). Investigating the different motivations that drive foreign direct investment, *i.e.*

market orientation versus export orientation, the studies generally find that FDI in the region is more efficiency-seeking and export oriented than FDI in other parts of the world.

Recent analysis of Japanese firms' strategies confirms that they follow a specific strategy in East Asia, compared both to the strategies of US firms in the region and to the strategies of Japanese firms in other parts of the world. Japanese investment is more oriented towards East Asia (and relatively more on ASEAN than on China) than American investment (*Ando and Kimura, 2003; Masuyama, 2004*). Japanese affiliates in East Asia are concentrated in manufacturing industries, and hence differ from Japanese affiliates in North America or Europe. Compared to Japanese firms investing in North America or in Europe, those investing in East Asia include a relatively large number of small and medium enterprises (SMEs), have less capital-intensive technology and less R&D expenditure. The analysis of the local content of sales by Japanese affiliates in the region indicates that the activities of Japanese firms have shifted from Japan to Asia (as local value added has increased compared to Japanese inputs).

According to Ando and Kimura (2003), sales by Japanese affiliates located in East Asia are more export-oriented than those located in other parts of the world and concentrate their exports in the region (Asian countries and Japan), while their sales to North America are small. This confirms the existence of strong intra-regional production networks, but contradicts the popular view that Japanese firms use export platform in the region to sell to the US.

The development of production networks has contributed to the rise of successive waves of “new industrialised economies” in Asia and especially the emergence of the latest tiers of new industrialised economies (Thailand, Malaysia, Philippines, then China and Vietnam). Since the mid eighties the firms of the most industrialised economies (Japan, South Korea, Taiwan, Singapore, Hong-Kong) have gradually moved their production capacity in low-tech, labour intensive sectors to overseas export platforms located in low-wage countries, through foreign direct investment and out-processing operations. This migration has helped South East Asian countries and then China, to develop their comparative advantages in manufacturing industries and to progressively upgrade their industrial capacities and exports. Asian production networks have thus contributed to the “Recycling comparative advantages” which has thus been at the core of East Asian industrialisation.

The evolution of the specialisation patterns of East Asian countries confirm the « flying gees model » developed by Akamatsu (1961), who observed that “diffusion of new techniques to rising industrial nations proceeds rapidly, and these nations approach the technological level of advanced nations” and that “the underdeveloped nations are aligned successively behind the advanced industrial nations in the order of their different stages of growth in a wild-flying geese pattern”.

However, the changes in the global economy, together with the development in technology and production techniques have precluded homogeneous trajectories. Although late-comers may export similar products as the leaders did in earlier stages, their structures of production are quite different (*ESCAP, 1991; Bernard and Ravenhill, 1995; OECD, 1999; Guerrieri, 2000; UNCTAD, 1996*). In fact, while Japan has developed a strong indigenous innovative base, prior to the increase of its global economic presence in the 1950s, Taiwan and Korea have remained dependant on imported technology, components and equipment from industrialised economies (mainly Japan). The late-comers, South-East Asian countries, have industrial structures which are characterised by the lack of a domestic manufacturing tradition, their high dependence on foreign controlled firms, a high import content of exports and limited backward linkages with local component suppliers.

The benefits that low-wage countries derive from their participation in international production sharing may be smaller than suggested by trade figures. The gains may be unequally spread between the firms involved in the value-added chain. Also, taking part in the labour-intensive stages of production does not automatically lead to the technological spillovers needed to move up the production chain and to ensure a sustainable trajectory of economic development (*UNCTAD, 1999 and 2002; Kaplinsky and Morrus, 2002; OECD, 1999*).

Asian production networks have given rise to “triangular trade pattern”: Japan and NIEs export capital goods and sophisticated intermediate goods (especially parts and components) to the less developed countries of the region (ASEAN and China) which process them for exports destined to the US and Europe<sup>5</sup>.

### **1.3. The Emergence of China**

China appears as a late comer in the international division of labour in Asia. China's case further illustrates how the splitting-up of the value-added chain between different locations (countries) and the development of firms' cross-border production networks are driving the process of industrial growth and integration in Asia (*UNCTAD, 1996 and 2002; Borrus, Ernst & Haggard, 2000*). China's case also highlights how a latecomer can enter globalisation and carve out its place in the international division of labour. Since the mid eighties China has been involved in international production sharing with Asian economies, as firms from Hong-Kong, Taiwan Japan, South Korea, and other Asian countries have relocated their labour intensive industries in the mainland (*Naughton, 1996 and 1997*). The rapid expansion of China's foreign trade has been closely associated with an on-going reorganisation of production in Asia driven by export-oriented investment in the mainland (*Lemoine and Ünal-Kesenci, 2002 and 2004; Masuyama, 2004; Fukao, Ishido and Ito, 2003*).

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<sup>5</sup> NIEs: Hongkong, Singapore, South Korea and Taiwan. ASEAN\* = ASEAN Countries excluding Singapore.

The analysis of FDI investment in China points out the outstanding amount of capital inflows, coming mainly from Asian countries, and concentrated in manufacturing industries. The motivations for investment in China differ according to the country of origin of parent firms (*Zhang, 1995; Tso, 1998; Masuyama, 2004*). Surveys have shown that Asian firms are motivated by cost considerations and tend to invest more than others in export-oriented activities. American and European investment is driven by market expansion strategies rather than by cost considerations. Their investment in China is more directed in capital-intensive sectors producing for the domestic market (*Wei and Liu, 2001*).

Recent studies confirm that the first motivation of Japanese FDI in China (like in ASEAN\* countries) is cost reduction (*Fung, Izika, Kim and Siu, 2004; Masuyama, 2004*). Japanese foreign affiliates in China export more than half of their production. The strategy of Japanese firms has evolved as their affiliates have strengthened their links with local firms and increased local procurements (vs. imports). However, Japanese firms tend to lag behind other foreign investors and to face strong competition both from other foreign affiliates and from the local producers in the domestic market.

For Korean firms, China has overtaken the US as the first host country for their FDI in 2001. In a first stage, Korean investment in China has been driven by cost considerations and has been mostly export-oriented. However in the late nineties a new wave of FDI has been driven by large corporations (Chaebols) aimed at China's domestic market. The recent rise of Korean FDI in relatively capital and technology-intensive industries and in capital goods has raised the fear that the Korean manufacturing industry may be facing the risk of hollowing out, as it has happened in Taiwan (*Lee and Kim, 2004*).

Taiwanese investment in China has been export oriented, concentrated in labour-intensive industries, and led by small and medium sized enterprises (SMEs). However recent trends show an evolution towards larger and more technology and capital intensive projects. In electronic industries, Taiwanese firms have extensively relocated their production in China. In 2002, almost half of Taiwan's information technology products are produced in the mainland (*Fung, Iizaka and Kim, 2004*).

The benefits that China has derived from becoming a production base for Asian industrial firms include large FDI inflows and a rapid rise of exports which have contributed to its outstanding economic growth, the modernisation of its industrial capacities and the building up of new industries (electrical and electronic industries) (*Lardy, 2002; Lemoine, 2000; Wu, 1999; Naughton, 1997; Huchet, 1997*).

However, as other latecomers, China has developed a specialisation in low value-added production, based on its almost unlimited supply of low-cost labour. Its rise in international trade is heavily dependant on foreign affiliates which have developed limited backward and forward linkages (*Zhang, 1999; Sung, 2000; Wu, 1999; Lemoine and Ünal-Kesenci, 2004*).

## **2. CHINA IN THE INTERNATIONAL DIVISION OF LABOUR IN ASIA**

### **2.1. China's Selective Trade Policy**

Trade policy is an important factor determining a country's involvement in the international splitting-up of the value-added chain. Tariff structure may affect the degree of effective protection of the different sectors as tariff exemptions and reductions on imported inputs increase the effective protection enjoyed by the assembly activities using these inputs, as it reduces their costs of production (*Grubel and Johnson, 1971*).

Most Asian economies have followed a "dual track" trade policy, which combined protection of the domestic industries through relatively high customs tariffs, and export promotion, through tariff exemptions on imported inputs for export production (*Ando and Kimura, 2003*).

China provides an outstanding case of such policy. Since the mid-eighties, the Chinese authorities have used different instruments to promote exports (*Lardy, 2002; Lemoine and Ünal-Kesenci, 2002a; Ianchovichina, Martin and Fukase, 2000; Naughton, 1996*). Duty exemptions have been granted to selected categories of imports in order to promote export-oriented industries and to stimulate inflows of capital and technology through foreign direct investment. Intermediate products imported to be used in production of exports have been the most important category benefiting from tariff exemptions. Concessionnal import duties have also been granted to equipment imported by foreign firms as a contribution to initial investment in affiliates in China.

Although China reduced its average customs tariff from 41% in 1992 to 16.8% in 1998-2001, the advantage derived from tariff exemptions has remained significant and this selective trade policy has proved very successful in creating export-oriented industries based on imported inputs. The large gap between nominal tariff rates and collected tariff rates provides evidence of the extensive use of tariff exemptions (*Lemoine and Ünal-Kesenci, 2004*).

The following analysis shows how China's selective trade liberalisation has led to an accelerated expansion of international processing activities, which have been the engine of the rapid diversification of its manufactured exports. The effective protection enjoyed by processing activities has favoured strong productive links between China and its Asian partners. China's integration in the production and trade networks of Asian firms has been at the core of its foreign trade expansion.

This analysis suggests that the selective trade policy has strongly determined the commodity and geographic pattern of China's trade in the nineties.

Three different approaches are used to assess how China's integration in Asian production networks has influenced China's commodity and geographic trade patterns.

The in-depth investigation of China's foreign trade will focus on 1) the importance of international processing operations in China's foreign trade 2) the prominent role taken by foreign firms affiliates located in China 3) the structure of China's trade by stage of production.

## **2.2. Processing Trade: the Most Dynamic Component of China's Exports**

China's dual track policy has resulted in a highly fragmented trade sector. Four broad segments can be distinguished in China's foreign trade:

- 1) Ordinary trade encompasses imports which are subjected to general tariff rates, *i.e.* imports aimed at the domestic market (for investment or consumption) and exports mainly based on local inputs.
- 2) Processing trade encompasses imports of goods to be assembled or transformed in China and re-exported, within international assembly and subcontracting operations. These imported inputs (intermediate goods and components) are exempted from customs tariffs. Neither these intermediate imported products, nor the finished goods normally enter China's domestic market.
- 3) Imports of goods by foreign invested firms as part of their initial investment. These imports are exempted from customs duties and concern mainly equipment and machinery.
- 4) Other exports and imports, which are not subject to the general tariff regime (compensation trade, international aid, warehousing and entrepot trade).

Trade figures corresponding to these different trade segments are available since 1992. Within each category it is possible to identify the respective contributions of domestic (wholly Chinese) firms and of foreign firm affiliates since 1994.

China's foreign trade expansion has relied mainly on processing operations. As early as 1992, processed exports made up 46% of total exports. This share rose to 55% in 1996 and has represented more than half of China's exports since then (**Figure 1**). During the Asian crisis (1998-1999), exports of processed goods performed better than other categories of exports, and this resilience can be explained by their high import content which makes them less vulnerable to the effects of a real appreciation of the exchange rate (*Dées and Lemoine, 1999*).

Correspondingly, imports for processing have increased rapidly since 1992 and their share in total imports rose from less than 40% to almost 50% to 1997-1998 (**Figure 1**). Since 1998 they have lagged behind ordinary imports which registered a strong rise partly due to the anti-smuggling measures implemented by the government but also, more substantially, to a rapid decline in the level of tariff rates in the late nineties. However, even in 2003, ordinary imports account for less than half of total imports.

### *The Reorganisation of Production in Asia*

The positions of major trade partners in China's different trade regimes reflect the reorganisation of industrial activities within Asia (**Table 1**).

The pattern of China's imports by partners and by customs regimes shows that the weight of Asian countries in China's total imports results from their strong involvement in processing trade. In 2002, almost 60% of China's imports from the Three Dragons (Hongkong, South Korea, Taiwan) and 40% of its imports from Japan (against 35% in 1993) were not aimed at domestic demand but at supplying inputs for exporting industries. The strong intensity of Asian exports to China can thus be explained by the international splitting-up of the value-added chain within the region. As a result, Japan and the Three Dragons were by far the major source of inputs for China's processing activities, providing almost 60% of these imports: 40% of China's imports for processing came from the Three Dragons, and one-fifth from Japan.

By contrast European and American firms contributed only marginally to the supply of goods for processing: taken together, they accounted for less than 10% of imports for processing in 2002. Their weak presence in this segment of China's imports partly explains their relatively low export intensity to China compared to Asian countries (*Lemoine and Ünal-Kesenci, 2002a*). Supplies of inputs for processing accounted for a relatively small fraction of their exports: respectively 15% and 22% of China's imports from the EU and the US in 2002. Comparison with 1993 does not show major changes.

Processed exports also account for a large share of Chinese exports to Asian countries (up to 60% in 2002, against 50% in 1993), Asian firms re-import a growing part of the production they relocated in the mainland.

However, China's processed exports are much less concentrated on Asia than corresponding imports. Less than half of exports after processing is directed to the Three Dragons and Japan in 2002 (as in 1993), a share which is still overstated since the largest part of processed exports recorded as going to Hongkong is in fact aimed at the US and the European markets (*EC, 1997*). The US and the EU account for a much larger share in China's exports after processing (40% in 2002) than in its imports for processing (10%), and the importance of these "Western" markets would be even larger if exports transiting through Hongkong were reallocated to their final destination. The asymmetric pattern of China's processing trade reflects the strategies of Asian firms which have expanded production bases in China to improve their competitiveness in world markets, but is also the result of outsourcing policies of American and European firms, which organise processing activities in China, based on Asian inputs.

As a result, Chinese processed exports have a high content of imported Asian goods: ten dollars of processed exports incorporate four dollars of intermediate goods supplied by Japan and the Three Dragons.

Regional trade balances show that China records its largest processing trade surplus with its “Western” partners. Processing activities are responsible for the large China's trade surpluses with Europe and the US. Without processing trade, China's trade with the EU would record a deficit, its trade with the US would be almost balanced. In 2002, processing trade with Japan and the Three Dragons has also become an important source of China's trade surplus, while it was a source of deficit in 1993, and still in 1997. This indicates that since the end of the nineties Asian firms have changed their relocation policies and have more extensively used China as a production base for supplying their domestic markets.

### *Commodity Changes in Processing Trade*<sup>6</sup>

The rapid expansion of China's processing trade has been associated with outstanding structural changes (**Table 2**).

1) There was a relative decline of processing trade in the most traditional industries (textile and garments, leather and shoes). The share of these sectors declined both on the export and import sides: taken together they accounted for more than 40% of total processed exports in 1993 and for only 15% in 2002. On the import side the corresponding shares were 30% and 17%.

2) The commodity composition of international processing operations shifted towards machinery and electrical machinery: the share of these two sectors taken together rose from 29% to 56% of imports for processing and from 24 to 53% of total processed exports.

3) Chemical products accounted for an important part of imported inputs (15%) but for a small part of exports, indicating that most of imported chemical materials are incorporated in the production of goods belonging to other sectors.

### **2.3. Foreign Affiliates: the Engine of China Trade Expansion**

Foreign affiliates play an important and growing part in China's foreign trade. In 2003, they accounted for more than 55% of exports and imports (against respectively 20% and 30% in 1992) (**Figure 2**). On the export side, processing activities accounted for most foreign affiliates' export growth, and they represent 80% of their total exports in 2003. In fact foreign affiliates are responsible for most of the expansion of China's processed exports and they held a dominant share (almost 80%) in these activities in 2003. On the import side, processing activities play a less prominent part but account nevertheless for more than half of foreign affiliates imports. Foreign affiliates have also significantly expanded their « ordinary » imports, which represented in 2003 one fourth of their total imports and 30% of China's total imports for the domestic market.

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<sup>6</sup> For sector classification see Appendix 1.

Foreign affiliates play an especially important part in China's trade with Asian countries (**Table 3**). In 2002 they accounted for between 60% and 67% of China's imports from Japan, and from NIEs, and for more than 60% of China's exports to Japan, Hongkong and Singapore. China's bilateral trade with these countries is likely to be dominated by intra-firm trade. The accelerated increase of foreign affiliate trade activities between 1993 and 2002 came from wholly-foreign firms which took a dominant part compared with that of joint-ventures in 2002.

By contrast foreign affiliates represent less than half of Chinese imports from Europe and the US. However, their share considerably increased in China's exports to Europe and the US, reflecting both the increased competitiveness of Asian production bases in China and the outsourcing strategies of Western firms.

In 2002, foreign affiliates were responsible for about one third of China's trade surplus. They realised their surpluses on the "Western" markets (with the US and to a lesser extent with Europe) while they record large deficits with most Asian partners. In fact, their surplus with Hongkong should be eventually attributed to their trade with Europe and the US.

#### **2.4. China's Trade by Stage of Production<sup>7</sup>**

The composition of exports and imports by stage of production confirm China's position in the international division of labour, which is characterised by a strong export specialisation in consumption goods, associated with large structural deficits in intermediate goods, and small structural deficits in capital goods and in primary goods.

China's imports are heavily dominated by intermediate products which amounted to almost two-thirds of its total imports in 2002 (**Table 4**). Within this category, parts and components constitute by far the most dynamic imports (27% in 2002), although imports of semi-finished products are still more important (36%).

On the export side, final goods are by far the most important category (60% in 2002), within which consumer goods take an overwhelming share (40%), but capital goods are rising more rapidly (from 12% in 1997 to 20% in 2002). In exports of final goods a shift has occurred away from consumption goods towards capital goods, which suggests that China is upgrading its export capacities towards more technology-intensive products. Moreover parts and components make up an increasing share of exports (16% in 2002).

China's participation in the international division of production takes place in technologically advanced sectors, in which China specialises in processing and assembly semi-finished products and components. The rapid increase in exports, imports and deficits of parts and components indicates a deepening participation in the

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<sup>7</sup> For the definition of the stages of production used in this section see Appendix 2.

international division of production processes. This finding is in line with the conclusions of studies on production sharing in East Asia (*Ng and Yeats, 1999 and 2003*), showing that trade in components has been the most dynamic part of East Asian trade in the nineties. Following the distinction proposed by the authors between the producers of components (countries having a positive trade balance in components) and the assembly countries (countries having a negative trade balance in components), China clearly stands as an assembly country, a position similar to that of other low-wage Asian countries (Indonesia, Thailand, Malaysia).

China's trade in intermediate goods is heavily concentrated on Asia, confirming that production sharing is above all a regional process (**Table 5**). More than 80% of intermediate imports (semi-finished products and parts and components) come from Asia and more than 60% of exports of parts and components are directed to Asia. With Asia, China records its largest structural deficit<sup>8</sup> in intermediate goods, a smaller deficit in capital goods, and a large surplus in consumption goods. With the rest of the world, China's trade surpluses stem from consumption goods, and also from capital goods in its trade with North America, due to a rapid rise of exports of computer equipment.

## 2.5. Production Sharing and Technological Catch-Up

How production sharing with Asian countries has enhanced China's technological catch up? This point is investigated by looking at the technological content of China's exports and imports. The analysis uses the CEPII high-tech product classification based on OECD and Eurostat studies which make a distinction between products with high technology content and other products, at a detailed level of classification (HS, 6 digits)<sup>9</sup>.

**Table 6** presents the pattern of China's trade by technology content and stages of production. As could be expected given its level of development, China's imports have a higher technology content than its exports. In 2002, imports of high-technology products accounted for 15% of China's imports and for 12% of its exports (against respectively 11% and 7% in 1997). High-tech products hold an unexpectedly large share in China's trade, compared to other developing economies (*Lemoine and Ünal-Kesenci, 2004*) and which increased rapidly since 1997<sup>10</sup>.

The high-tech content of China's exports can be explained by its high-tech imports: the bulk of China's imports of high-tech products (more than half) consists of parts and components, which, to a large extent, are incorporated in exports. Interestingly, most exports of high-tech products take place in parts and components, illustrating the deepening of the international division of labour.

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<sup>8</sup> Structural deficit (surplus) is measured by the Indicator of contribution to trade balance, see Appendix 5.

<sup>9</sup> For the classification of high-tech products, see Appendix 4.

<sup>10</sup> In 1997-1999, high-tech products represented 2% of Turkey's exports, 4% of India's exports and 8% of China's exports (*F. Lemoine and D. Ünal-Kesenci, 2003*).

The overwhelming share of China's high tech imports originates from Asia (**Table 7**). This share reached 70% in 2002 (56% in 1997). The US and Europe thus lost ground in the supply of high-tech products to China. The pattern of China's high-tech exports is stable: in 2002, as in 1997, more than half is going to Asia, one fourth to America and one sixth to Europe.

Production sharing with Asia has thus been an important factor stimulating technological transfer and favouring the upgrading of China export capacity. However, looking more in depth into the channels of technology transfer raises questions about its broad impact on the diffusion and assimilation of foreign technology by Chinese industry.

**Table 8** clearly shows that in 2002 most imports of high-tech products were carried out by foreign affiliates. Chinese firms accounted for only one third of high-tech imports, while wholly-foreign firms accounted for almost half of these imports and joint venture for one fifth. China's high-tech imports from Asia were even more dependent on foreign affiliates, which took up to three fourth of these imports, with wholly-foreign firms accounting for almost 60%. The distribution of high tech imports from the US and Europe is much less biased in favour of foreign affiliates. Chinese affiliates realise more than half of these imports, and the rest is more or less evenly distributed between joint-ventures and wholly-foreign firms. Transfer of high technology from Europe and America follows a more traditional pattern as capital goods are the main channel of high-tech imports.

In China's high-tech exports, foreign affiliates play an even more dominant part (**Table 9**). Production sharing with Asian partners has hence undoubtedly raised the technological level of China's exports and imports. But this upgrading seems to have remained strictly circumscribed to the production and export bases created in the mainland by Asian firms.

### **3. CHANGES IN ASIAN COUNTRIES' TRADE PATTERNS 1980-2002**

This section considers how China's rise has led to a redistribution of trade powers in Asia. It shows how China's integration in Asian production networks, described in the above section, has affected the position of other Asian countries in intra-regional trade and in trade with the rest of the world.

#### **3.1. The Rise of East Asia<sup>11</sup> in World Trade**

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<sup>11</sup> Japan, NIEs (HK, Taiwan, Korea, Singapore), ASEAN\* (Indonesia, Malaysia, Philippines, Thailand, Vietnam, Lao, Cambodia, Brunei).

From 1980 to 2002, the contribution of East Asia to world trade increased considerably. The share of East Asia in world exports rose from 13% to 23% and in world imports from 13% to 19% (**Table 10**). Except Japan and Hongkong, all East Asian economies contributed to this rise but China alone accounted for half of the registered increase.

The distribution of East Asian exports (imports) by country of destination (origin) has dramatically changed since the beginning of the eighties (**Figure 3**). From 1980 to 2002, on the export side, trade pattern switched in favour of China, whose rise in East Asian exports (from 6% to 25%) almost completely compensated the relative fall of Japan (from 50% to 30%). The weight of NIEs remained almost stable, at about one fourth of regional exports. ASEAN\* exports registered a relative decline during the eighties and a revival in the nineties which puts its share of regional exports in 2002 at the same level as in 1980 (20%).

On the import side, the major change also came from the contraction of Japan's share (from 48% to 27% of the regional total), which was compensated by the rise of China, whose share rose from 8% to 21%. The weight of NIEs also increased. The gain recorded by ASEAN\* occurred in the nineties (from 16% to 18% of regional imports).

Over the last two decades, there was thus a convergence in the positions of the different countries/groups of countries in the region's trade. On the export side, China with one fourth of the region's trade in 2002, is catching up with Japan (29%), and with the NIEs (26%). ASEAN\* is also on a catching up process (20% of the regions's exports in 2002), although at a slower pace than China.

On the import side, a similar convergence of intra-regional trade powers is taking place. Since the beginning of the nineties, the NIEs (34% of regional imports in 2002), have overtaken Japan (27%). In 2002 China (21%) has overtaken ASEAN\* (18%).

### **3.2. Asian Trade by Stages of Production**

The increase in Asian intra-regional trade has been a long term trend. The degree of intra regional concentration of trade in the three major zones, America, Europe+Africa<sup>12</sup>, Asia+Oceania shows that the share of intra-regional trade in Asian total trade rose from less 40% in the seventies to more than 50% in 2002. Intra regional trade is however still less important in Asia than in America or Europe (**Figure 4**).

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<sup>12</sup> This region includes Western and Eastern Europe, the former USSR, Africa and the Middle East.

Focusing on East Asia, four main stages of production are distinguished<sup>13</sup>: Primary goods, Intermediate goods, Capital goods and Consumption goods. Different trends are observed in countries' trade.

Over the 1980-2002 period, Japan and NIEs show similar trends, while China and ASEAN\* share common features. Over the last ten years, Japan and NIEs significantly reoriented their trade flows towards East Asia, both on the export and import sides (**Figure 5** and **Figure 6**). East Asia rose from about 25% to more than 40% in total Japanese exports. The figures are about the same on the import side. Similarly, East Asia rose from about 30% to more 50% in NIEs' total exports and from about 45% to over 50% in their imports. Regional trade now account for more than half of NIE global trade.

Japan's exports to East Asia have been driven by intermediate and capital goods. By contrast, Japanese exports to the rest of the world appear to be biased in favour of consumption goods. Japanese imports of manufactured goods (consumption, capital and intermediate goods) have increasingly come from East Asia.

Japan is the only country which displays a trade surplus in capital and intermediate goods within the region, indicating that it has kept its comparative advantage in these two sectors, despite the change in the regional division of labour. However, since the mid 90s, these surpluses have declined while its deficit in consumption goods has enlarged, as the result of re-imports of consumption goods from production bases located in low-cost countries (China). With the rest of the world, Japan records a surplus in all stages of manufacturing production.

Similarly, the increased concentration of NIE trade within the region stems from trade in intermediate and capital goods. On the export side there was a strong reorientation of intermediate good sales towards the region, reflecting their increasing specialisation in the upstream stages of production processes within the region. NIE exports to the rest of the world switched away from consumption goods (as they lost ground to low-cost Asian suppliers) and towards capital goods. On the import side, most of intermediate and capital good imported by the NIEs come from East Asia. NIEs record trade deficits in all production stages within East Asia. Their largest and most rapidly growing deficit is located in consumption goods, as they have followed the same path as Japan in the regional division of labour. With the rest of the world they record their largest and fastest rising surpluses in capital goods, while their surplus in consumption goods has levelled off in the nineties, due to the rise of other Asian suppliers.

Over the last twenty years, China's and ASEAN\* countries' trade have shared several common features (**Figure 7** and **Figure 8**). First, the fall of their exports of primary products which reflects their rapid industrialisation. Second the opposite trends which characterised their exports and imports: East Asia played an increased part in their

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<sup>13</sup> For the classification of stages of production used in this section see Appendix 3.

supplies, but the rest of the world played an increasing part as a market<sup>14</sup>. This provides a first evidence of their central position in “triangular” trade, which is confirmed by the composition of their trade by stage of production.

In China’s imports, the share of East Asia rose from 35% to over 55% and this increased dependence was due to intermediate and capital goods. China’s exports were redirected to the rest of the world (from 45% to almost 70% of its total exports). The largest markets for Chinese consumption and capital good exports are located outside East Asia.

Similarly, the rise of East Asia in ASEAN\* imports was due to intermediate and capital goods. In their exports to East Asia, these two categories of products also took a growing part. In 2002, East Asia was the largest market for ASEAN\* exports of intermediate goods, while the rest of the world was still more important as a market for final good exports (consumption and capital goods).

China and ASEAN\* are thus in similar position in triangular trade, importing intermediate goods mainly from Asian partners and exporting mainly final goods (capital and consumption goods) mainly to the rest of the world. But China’s exports are much more oriented towards the rest of the world than ASEAN\* countries’ exports.

ASEAN\* displayed a deficit with East Asia in capital and intermediate goods, but has begun to record a surplus in consumption goods in the late nineties. By contrast, its trade with the rest of the world was marked by enlarged trade surpluses in consumption goods since the late eighties and in capital goods since the late nineties.

China’s position was characterised by similar trends: growing deficits with the region in intermediate goods, and to a lesser extent in capital goods, which were not compensated by rising surpluses in consumption goods. With the rest of the world, China’s surplus in consumption goods has exploded since the mid eighties, while its surplus in capital goods has occurred since the end of the nineties.

### **3.3. Substitution and Competition in World Markets**

The evolution of Asian exports to Western markets (the US and the EU-15) shows that China’s integration in Asian networks has considerably affected the triangular trade pattern, as China's skyrocketing exports have displaced Japan’s and NIEs’ exports at accelerated pace. Moreover, ASEAN\* countries’ exports have levelled off since the late

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<sup>14</sup> The reorientation of China exports towards extra-regional partners may be a natural stage in a typical opening-up process. At the initial stage of its opening, a country's export flows (which are still small) tend to be concentrated towards neighbour partners, and in a following stage, as the range of its internationally competitive products increases, the degree of regional concentration of its trade flows tends to decline; its specialisation increases and competitive exports are sold world-wide. In the next stage, the country shifts to regional trade in differentiated products. China (as well as ASEAN\*) would be situated in the upward segment of the U shaped curve linking openness and regionalisation of exports; NIEs being located in the downward segment.

nineties, which suggests that they may have begun losing ground to China's competitors.

The cases of Asian exports of electrical and electronic goods to the US and Europe provide evidence of these trends.

The tremendous rise of China's exports of electrical goods to the US since the end of the eighties was followed by a relative stagnation of exports by Japan and the NIEs since the mid nineties (**Figure 9**). As a result Chinese exports overtook NIE and Japanese exports in the late nineties; ASEAN\* exports continued to rise up to the end of the nineties and have declined since. In electronic goods, the differences in market shares of the different exporters to the US were much wider up to the early nineties. NIE and Japanese exports have stagnated since the mid-nineties while China's and ASEAN\* exports continued their accelerated growth. Since 2001, following the drop of other Asian exporters, China has caught up the NIEs as the largest exporter of electronic goods to the US.

Similar trends are observed in Asian exports to the EU (**Figure 10**). In electronic and electrical goods, the steady rise of China's exports was accompanied by the drop or the levelling of Japan and NIE exports in the late nineties. As a result of this substitution effect, China's has become the major Asian supplier of electrical goods to the EU, and has almost caught up Japan. ASEAN\* exports in both sectors continued to increase rapidly up to 2000 and have fallen since.

The contribution of the different Asian countries or group of countries to US trade deficit reflects the displacement of Japan and NIE exports to China's exports. In the nineties, the share of Japan and NIEs in US trade deficit declined significantly, while China was responsible for an increasing share of this deficit (**Figure 11**).

Although China's participation in the Asian division of labour follows a pattern which appears to be quite similar to that of ASEAN\*, the size of China's economy gives the country a trade potential which dwarfs that of the other late-comers. China's emergence in Asia carries the mechanisms of triangular trade to extremes.

#### **4. TRIANGULAR TRADE AND EXCHANGE RATES POLICIES IN ASIA**

##### **4.1. Is Triangular Trade Sustainable?**

China's emergence has considerably accentuated the "triangular" trade pattern, speeding up the withdrawal of the most advanced Asian economies from the production and exports of labour intensive products (consumption goods) and enlarging trade of sophisticated intermediate goods within Asia. The structural factors underlying the triangular trade pattern will remain strong in the coming years.

China is likely to maintain a long-lasting specialisation in labour-intensive products. Its huge labour supply, and the expected migration of its labour force from agriculture to

industry in the coming years will maintain the country's comparative advantage in this field. China's gains in market share, which have come primarily at the expense of the advanced economies of the region, will continue to be an incentive for the latter to move up the value-added chain. China will displace the NIEs in labour intensive industries that they relinquish, just as in an earlier period the NIEs displaced Japan in these industries (*Fernald, 2004*). The main threat is to the less advanced Asian economies which face China's competition in labour intensive products. It is not clear whether they can move up the quality and technology ladder to keep a competitive edge over China (*Lall, 2004*).

The analysis of trade in high-technology products suggests rather complementarity than competition between China and the Asian advanced economies (*Lall, 2004*). The present study has shown that most of China's trade in high-tech products is handled by firms from Japan and NIEs. The technological upgrading of China's exports will remain dependent on FDI. The distribution of FDI between China and ASEAN\* countries will be an important determinant of the evolution of their respective specialisation in the future.

However, several factors are likely to play in favour of a reduction of trade imbalances associated with triangular trade. Recent trends in China's foreign trade indicate that the country is not only an export base but more and more a market for foreign firms. China has considerably cut its tariff rates since the late 1990s and this has led to an accelerated growth of imports for the domestic market (ordinary imports). The further reductions in tariff rates which have been scheduled in China's agreement with WTO in 2001, combined with the economic growth which has accelerated since 2002, resulted in an outstanding growth of imports for domestic use in 2002 and 2003. The opening of its potentially huge market has reduced China's global trade surplus in 2003, and turned it into a deficit in the first quarter of 2004. As European and US firms have a relatively strong position on this "domestic segment" of China's imports, and as their economies show strong complementarity with China's economy, they should benefit from the enlarged access to this market. Most studies on the consequences of China's accession to WTO conclude that developed countries will benefit from most of the gains linked with China's opening up (*Janichovichina, Martin and Fukase, 2001; Fan and Zheng, 2000; Lejour, 2000; Lemoine and Ünal-Kesenci, 2002b; Wang, 1999*). However as barriers to entry into this market are lowered, the competition also increases, as more and more countries will be able to bear the costs of entry.

Moreover, as advanced Asian economies are increasing their imports from China, this will reduce the dependence of China's exports on Western markets. The positive balance that China has recently recorded in its processing trade with these economies indicates that their firms' production bases in China are more and more oriented towards supplying their domestic markets.

#### **4.2. China's Exchange Rate Policy**

Accelerated growth of China's exports in 2003 and its widening trade surpluses with its Western partners (the US and EU) have raised a strong international pressure for the reevaluation of the yuan and for more flexibility in China's exchange rate regime.

The above analysis has amply shown that China's bilateral trade deficits with the US and the EU are for their largest part the result of the on-going reorganisation of production within Asia. The most dynamic components of China's exports stem from the relocation on the mainland of industrial capacities of advanced Asian economies. China is thus the final stage of the international division of labour in Asia. China's exports to the US and Europe reflect the indirect exports of Asia countries, through their production platforms in China.

This "triangular trade" has strong implications for the discussion on China's exchange rate policy. There are several reasons for which the re-evaluation of the yuan would have limited effect on the US trade deficit (*Bénassy-Quéré, Larhèche-Révil and Lemoine, 2003*). First, a reevaluation of the yuan may hinder the international division of labour in Asia and eventually result in an increase of direct exports to the US by Asian firms, at the expense of indirect exports (by Asian affiliates in China), but it would not alter US overall deficit with Asia.

Second, simulations of a reevaluation of the yuan on US-China bilateral trade generally come to the conclusion that it would hardly reduce US deficit with China. A model developed by the CEPII show that a 10% real appreciation would have no impact on the value of US imports of Chinese goods: imports volume would fall (by 10%), but the unit value of imports would rise (by 10%) (*Bénassy-Quéré and Lahrèche-Révil, 2003*). A turnaround in the US trade balance could only come from a rise of US exports, whose competitiveness on the Chinese market would rise by 10%. But China accounts for only 4% of US exports, which would therefore increase by only 0.4% (assuming the aggregate price elasticity of export volumes is also equal to 1). Only if other Asian countries would follow China's example and devalue their currencies, would the impact be significant. As Asia, excluding China account for 20% of US exports, a 10% real appreciation of all currencies in this region would lead to a 2% increase of US exports.

In fact the US current account deficit is due less to a lack of competitiveness of its manufacturing sector, than to the structural weakness of private and public savings.

In a more general way, the impact of a variation of the yuan nominal exchange rate on China's trade should not be over-estimated. There is evidence that several factors may cushion the impact of a nominal re-evaluation on Chinese relative prices. First, not only wages are low in China but they are also flexible downwards, given the abundant supply of labour. The effect of a re-evaluation could thus partly be offset by a fall in Chinese wages. The real appreciation of the yuan in 1998, in the wake of the collapse of other Asian currencies, led to fall in wages in export-oriented enterprises. Furthermore, half of China's exports comes from foreign subsidiaries set up in China whose exports have a large import content, which limits the sensitivity of their exports to exchange rate

movements (*Dées and Lemoine, 1999*). More generally, the low level of average wages in China corresponds to a low level of labour productivity. However productivity is much higher in foreign firm affiliates, where it may be close to that prevailing in industrialised economies. Foreign affiliates have thus especially low unit labour costs, and a competitive advantage over Chinese-owned companies. This advantage explains the strong rise of their exports, relative to Chinese firm exports (section 2). In such a situation, the yuan may be strongly undervalued for multinational companies but not necessarily for indigenous firms. A re-evaluation would not affect foreign subsidiary competitiveness, but would affect mostly the performance of local firms.

### **4.3. Regional Monetary Cooperation?**

The strong productive integration that characterises the East Asia raises the question of a monetary cooperation between the countries of the region.

It is largely recognised that the stability of relative prices is a factor favourable to trade and investment relations between countries. Monetary cooperation between Asian countries would help to stabilise intra-regional exchange rates and to coordinate their adjustment with the rest of the world.

The main findings of research work conducted at the CEPII in this field are the following (*Bénassy-Quéré and Lahrière-Révil, 2003*): together with traditional gravity variables exchange rate regimes are a significant determinant of Asian exports; the effect is higher for Asian exports to OECD than for intra-Asian trade. The lower sensitivity of intra-Asian exports to changes in real exchange rates can be explained by the intra-regional productive integration (a significant part of trade correspond to intra-firm transactions, less sensitive to exchange rates because pricing in dollars or using transfer prices). Thus a change in the real exchange rates affects Asian exports mainly through the changes in their competitiveness on third markets. Another finding is that China's exports are less sensitive to a variation of the exchange rates of its Asian partners, than they are to the exchange rate variations of the yuan. China has thus less economic interest in regional monetary cooperation than the other Asian countries. China's support for regional monetary cooperation may come from political reason and its willingness to reassert its role in the region's economic stability.

## **CONCLUSION**

The emergence of China has had far-reaching implications on the East Asian economies.

It has accelerated the reorganisation of production in Asia and the expansion of Asian trade both within the region and with the rest of the world. The international division of labour within the region has expanded and intensified, as firms have developed production and export bases on the mainland. Production of labour intensive goods has moved to China, which has expanded its share in Western markets at the expense of the

advanced Asian countries. The latter have accelerated their exports of sophisticated intermediate goods to China. In this triangular trade pattern, the US and the EU trade deficits with China have widened, while their deficits with Japan and the NIEs have narrowed.

China has become a major partner in the development of Asian production networks, and hence its trade performance has also become highly dependant on the investment of Asian firms. Trade data show that Asian firms (together with other foreign firms) have decisively contributed both to the accelerated increase of China's exports and to their rapid technological upgrading over the last ten years. Foreign firms handle the bulk of China's trade in high-tech products, which raises the question of their dynamic impact on the upgrading of the domestic industrial capacities. The prospects of China's technological catch-up will depend on its ability to disseminate foreign technology into the local industrial sector and to develop its own innovative capacities.

The opening up of China's domestic market, since its WTO accession, combined with its sustained economic growth rate, should lead to a reduction of trade imbalances, as evidenced by recent trends in China's trade. Strong domestic demand will boost imports of capital goods as well as of sophisticated consumption goods from industrialised countries. It will also raise imports of raw materials and agricultural commodities which mainly come from developing or emerging countries, as shown by the recent increase of China's imports from ASEAN\*.

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**Table 1**  
**Breakdown of China's Trade by Main Partner and Customs Regimes**  
**(in % of total trade and \$ bn)**

<b>Imports</b>						
	World	3 Dragons*	Japan	EU 15	USA	ROW
<b>1993</b>						
Imports by all custom regimes	100	28	22	15	10	25
Ordinary imports	37	3	8	8	5	13
Imports for processing	35	18	8	2	2	6
Other custom regimes	28	7	7	6	3	6
<b>2002</b>						
Imports by all custom regimes	100	26	18	13	9	33
Ordinary imports	44	7	6	8	5	17
Imports for processing	41	16	8	2	2	12
Other custom regimes	15	3	3	3	2	4
<b>Exports</b>						
	World	3 Dragons	Japan	EU 15	USA	ROW
<b>1993</b>						
Exports by all custom regimes	100	29	17	13	18	22
Ordinary exports	47	12	10	7	6	13
Processed exports	48	16	7	7	13	6
Other custom regimes	5	0	0	0	0	4
<b>2002</b>						
Exports by all custom regimes	100	25	15	15	21	24
Ordinary exports	42	8	6	7	7	15
Processed exports	55	16	9	8	14	8
Other custom regimes	3	1	0	0	1	1
<b>Trade Balance</b>						
	World	3 Dragons	Japan	EU 15	USA	ROW
<b>1993</b>						
All custom regimes	-12.2	-2.4	-7.5	-3.5	6.3	-5.1
Ordinary trade	5.2	8.0	0.7	-2.	-0.0	-1.5
Processing trade	7.9	-3.8	-1.3	4.2	9.7	-1.0
Other custom regimes	-25.2	-6.6	-6.9	-5.8	-3.4	-2.6
<b>2002</b>						
All custom regimes	30.4	3.2	-5.0	9.7	42.7	-20.2
Ordinary trade	7.1	3.4	1.1	-3.1	6.7	-1.0
Processing trade	57.7	5.9	3.1	19.6	39.9	-10.9
Other custom regimes	-34.4	-6.1	-9.3	-6.8	-4.0	-8.2

\* 3 Dragons: Hongkong, South Korea, Taiwan.

Source: China's Customs Statistics, authors' calculations.

**Table 2**  
**Processing Trade: Sectoral Breakdown in 1993 & 2002**

Sectors*	Processed exports			Imports for processing	
	1993	2002		1993	2002
Electrical machinery	17	38.9	Electrical machinery	18	30
Chemical products	17	14.6	Machinery	6	22
Fibber and cloths	23	10.6	Wearing Apparel	20	8
Machinery	3	9.0	Toys & miscellaneous manuf. prod.	12	7
Metallurgy	11	8.1	Leather and shoes	15	6
Precision instruments	4	5.2	Chemical products	5	5
Wood and paper products	5	3.4	Precision instruments	5	4
Leather and shoes	6	2.8	Wood and paper products	4	4
Toys & miscellaneous manuf. prod.	4	2.2	Fibber and cloths	5	3
Raw agricultural products	1	1.3	Metallurgy	4	3
Raw materials & fuels	3	1.2	Other transport equipment	1	2
Wearing Apparel	1	0.9	Motor Vehicles	1	1
Building materials	1	0.9	Food products	1	1
Metal products	1	0.3	Metal products	1	1
Food products	1	0.3	Raw agricultural products	1	1
Motor Vehicles	1	0.2	Raw materials & fuels	1	1
Other transport equipment	0	0.0	Building materials	1	1
<b>Total</b>	<b>100</b>	<b>100.0</b>	<b>Total</b>	<b>100</b>	<b>100</b>

\* See Appendix 1 for sector classification.

Source: China's Customs Statistics, authors' calculations.

**Table 3**  
**Foreign Affiliates in China's Trade With Major Partners, 1997 & 2002**

		1997							
		World	EU_15	USA	Japan	Hong Kong	Singapore	Korea	Taiwan
<b>All Export Flows (% total flows)</b>		<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>
FA Total Exports		41	38	52	50	42	45	34	47
	<i>JV</i>	24	21	25	31	28	25	17	22
	<i>WFOF</i>	17	18	27	20	13	20	17	25
FA Processed exports		35	33	47	40	37	40	28	39
	<i>JV</i>	19	16	21	24	24	21	12	17
	<i>WFOF</i>	16	17	26	17	12	18	16	22
<b>All Import Flows (% total flows)</b>		<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>
FA Total Imports		55	55	47	67	63	63	64	69
	<i>JV</i>	35	45	33	41	38	40	36	30
	<i>WFOF</i>	20	10	14	27	25	23	28	39
FA Imports for Processing		33	12	21	44	52	37	48	53
	<i>JV</i>	19	8	12	25	30	20	24	23
	<i>WFOF</i>	15	4	9	19	22	17	24	30
<b>Overall Trade Balance (bn US\$)</b>		<b>40.4</b>	<b>4.6</b>	<b>16.4</b>	<b>2.8</b>	<b>36.8</b>	<b>-0.1</b>	<b>-5.8</b>	<b>-13.0</b>
FA Total Trade Balance		-2.8	-1.5	9.3	-3.5	13.9	-0.9	-6.4	-9.7
	<i>JV</i>	-5.7	-3.8	2.7	-2.0	9.8	-0.7	-3.8	-4.2
	<i>WFOF</i>	2.9	2.3	6.6	-1.5	4.1	-0.2	-2.6	-5.6
FA Processing Trade Balance		16.2	5.5	11.9	0.2	12.5	0.1	-4.6	-7.4
	<i>JV</i>	8.4	2.3	4.9	0.4	8.5	0.1	-2.5	-3.2
	<i>WFOF</i>	7.8	3.2	7.1	-0.2	4.0	0.0	-2.1	-4.2
		2002							
		World	EU_15	USA	Japan	Hong Kong	Singapore	Korea	Taiwan
<b>All Export Flows (% total flows)</b>		<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>
FA Total Exports		52	50	58	62	63	65	49	57
	<i>JV</i>	23	21	21	30	27	34	21	15
	<i>WFOF</i>	30	28	37	32	36	31	27	42
FA Processed exports		41	40	48	47	54	54	35	45
	<i>JV</i>	16	15	15	21	21	28	14	10
	<i>WFOF</i>	25	25	33	26	33	26	21	35
<b>All Import Flows (% total flows)</b>		<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>
FA Total Imports		54	49	48	67	63	61	63	67
	<i>JV</i>	23	31	21	30	28	20	28	16
	<i>WFOF</i>	31	18	27	37	36	41	36	52
FA Imports for Processing		32	12	21	39	53	36	41	49
	<i>JV</i>	11	6	6	16	23	11	15	11
	<i>WFOF</i>	21	7	15	23	30	25	26	39
<b>Overall Trade Balance (bn US\$)</b>		<b>30.4</b>	<b>9.7</b>	<b>42.7</b>	<b>-5.0</b>	<b>47.7</b>	<b>-0.1</b>	<b>-13.0</b>	<b>-31.5</b>
FA Total Trade Balance		9.7	5.0	27.4	-6.0	30.2	0.2	-10.5	-21.9
	<i>JV</i>	4.6	-1.8	8.8	-1.5	12.7	0.9	-4.6	-5.0
	<i>WFOF</i>	5.2	6.8	18.5	-4.5	17.5	-0.7	-5.9	-16.9
FA Processing Trade Balance		40.5	14.5	27.8	2.2	26.0	1.2	-6.2	-15.8
	<i>JV</i>	19.0	4.9	8.7	1.8	10.1	1.2	-2.1	-3.4
	<i>WFOF</i>	21.5	9.6	19.1	0.4	15.9	0.1	-4.1	-12.4

FA: foreign affiliates; JV: joint venture; FFOF: wholly foreign owned firm.

Source: China's Customs Statistics, authors' calculations.

**Table 4**  
**China's Trade Pattern and Comparative Advantage\***  
**by Stage of Production, 1997-2002**

	Breakdown of Imports		Breakdown of Exports		Contribution to Trade Balance*	
	1997	2002	1997	2002	1997	2002
Primary goods	10.6	10.3	5.1	2.9	-27	-37
Intermediate goods	65.9	63.3	33.4	37.1	-160	-131
<i>Semi-finished goods</i>	47.0	35.9	25.3	21.6	-107	-71
<i>Parts &amp; components</i>	18.9	27.5	8.2	15.5	-53	-60
Final goods	23.5	26.3	61.5	60.0	187	168
<i>Consumption goods</i>	4.4	5.1	48.9	40.3	219	176
<i>Capital goods</i>	19.1	21.2	12.6	19.7	-32	-8
Total	100.0	100.0	100.0	100.0	0	0

\* See Appendix 5 for the indicator of contribution to trade balance.

Source: China's Customs Statistics, authors' calculations.

**Table 5**  
**China's Trade Pattern by Regions and Stages of Production, 2002**

	Primary Goods	Semi-finished Goods	Parts & components	Capital Goods	Consumpti on Goods	Total
<b>Contribution to Trade Balance*</b> (in thousands of total trade)						
WORLD	-37	-71	-60	-8	176	0
Asia-Oceania	-5	-62	-53	-16	72	-64
Western Europe	-2	-2	-9	-6	25	6
America	-9	-1	1	11	60	62
Others	-21	-6	1	4	18	-4
<b>Export Breakdown</b> (% of World Total)						
WORLD	3	22	16	20	40	100
Asia-Oceania	2	12	10	9	17	51
Western Europe	0	3	2	4	6	15
America	0	4	3	6	13	26
Others	0	2	1	1	4	9
<b>Import Breakdown</b> (% of World Total)						
WORLD	10	36	27	21	5	100
Asia-Oceania	3	25	20	12	3	63
Western Europe	1	3	4	5	1	14
America	2	4	3	3	1	13
Others	4	3	1	0	0	9

\* See Appendix 5.

Source: China's Customs Statistics, authors' calculations.

**Table 6**  
**The Pattern of China's High-tech Trade by Stages of Production**  
**(% Total Flows)**

	Imports		Exports	
	1997	2002	1997	2002
Semi-Finished Products	1	1	1	1
Parts & Components	6	8	2	6
Capital Goods	4	6	2	5
Consumption Goods	0	0	0	0
Total	11	15	7	12

*Source:* China's Customs Statistics, authors' calculations.

**Table 7**  
**Breakdown of China's Trade in High Technology Products**  
**by Production Stages and Major Zones, 2002 (in %)**

<b>Imports</b>					
	Asia-Oceania	Western Europe	America	Others	World
Semi-Finished Products	3	1	1	0	5
Parts & Components	40	5	6	1	52
Capital Goods	27	5	8	1	42
Consumption Goods	0	0	0	0	1
Total	70	11	15	3	100
<b>Exports</b>					
	Asia-Oceania	Western Europe	America	Others	World
Semi-Finished Products	5	2	2	1	9
Parts & Components	33	5	8	1	47
Capital Goods	17	8	14	2	41
Consumption Goods	1	1	1	0	3
Total	56	15	25	5	100

*Source:* China's Customs Statistics, authors' calculations.

**Table 8**  
**China's High Technology Imports by Region, Firm Type & Production Stage, 2002**  
 (% World Total)

<i>Partner</i>	<i>Production Stage</i>	<i>Firm Type</i>	Chinese	JV	FFOF	Total
<b>Asia-Oceania</b>	<b>Total</b>		<b>17</b>	<b>15</b>	<b>39</b>	<b>70</b>
	Semi-Finished Products		1	1	1	3
	Parts & Components		7	9	24	40
	Capital Goods		8	5	14	27
	Consumption Goods		0	0	0	0
<b>Western Europe</b>	<b>Total</b>		<b>6</b>	<b>4</b>	<b>2</b>	<b>11</b>
	Semi-Finished Products		0	0	0	1
	Parts & Components		2	2	1	5
	Capital Goods		4	1	1	5
	Consumption Goods		0	0	0	0
<b>America</b>	<b>Total</b>		<b>8</b>	<b>3</b>	<b>4</b>	<b>15</b>
	Semi-Finished Products		0	0	0	1
	Parts & Components		2	2	3	6
	Capital Goods		6	1	1	8
	Consumption Goods		0	0	0	0
<b>Other</b>	<b>Total</b>		<b>2</b>	<b>0</b>	<b>0</b>	<b>3</b>
	Semi-Finished Products		0	0	0	0
	Parts & Components		1	0	0	1
	Capital Goods		1	0	0	1
	Consumption Goods		0	0	0	0
<b>World</b>	<b>Total</b>		<b>33</b>	<b>22</b>	<b>45</b>	<b>100</b>
	Semi-Finished Products		2	1	1	5
	Parts & Components		12	13	28	52
	Capital Goods		19	8	16	42
	Consumption Goods		0	0	0	1

*Source:* China's Customs Statistics, authors' calculations.

**Table 9**  
**China's High Technology Exports by Region, Firm Type & Production Stage, 2002**  
**(% World Total)**

<i>Partner</i>	<i>Stage</i>	<i>Firm Type</i>			<i>Total</i>
		Chinese	JV	FFOF	
<b>Asia-Oceania</b>	<b>Total</b>	<b>11</b>	<b>16</b>	<b>28</b>	<b>56</b>
	Semi-Finished Products	3	1	0	5
	Parts & Components	4	7	22	33
	Capital Goods	4	8	5	17
	Consumption Goods	0	0	0	1
<b>Western Europe</b>	<b>Total</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>15</b>
	Semi-Finished Products	1	1	0	2
	Parts & Components	1	1	3	5
	Capital Goods	2	4	2	8
	Consumption Goods	0	0	0	1
<b>America</b>	<b>Total</b>	<b>8</b>	<b>5</b>	<b>12</b>	<b>25</b>
	Semi-Finished Products	2	0	0	2
	Parts & Components	1	1	6	8
	Capital Goods	4	4	5	14
	Consumption Goods	0	0	0	1
<b>Other</b>	<b>Total</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>5</b>
	Semi-Finished Products	1	0	0	1
	Parts & Components	0	0	1	1
	Capital Goods	1	1	0	2
	Consumption Goods	0	0	0	0
<b>World</b>	<b>Total</b>	<b>24</b>	<b>29</b>	<b>47</b>	<b>100</b>
	Semi-Finished Products	7	2	1	9
	Parts & Components	6	9	32	47
	Capital Goods	11	17	13	41
	Consumption Goods	1	1	1	3

\* JV: Joint venture; FFOF: Fully foreign owned firm.

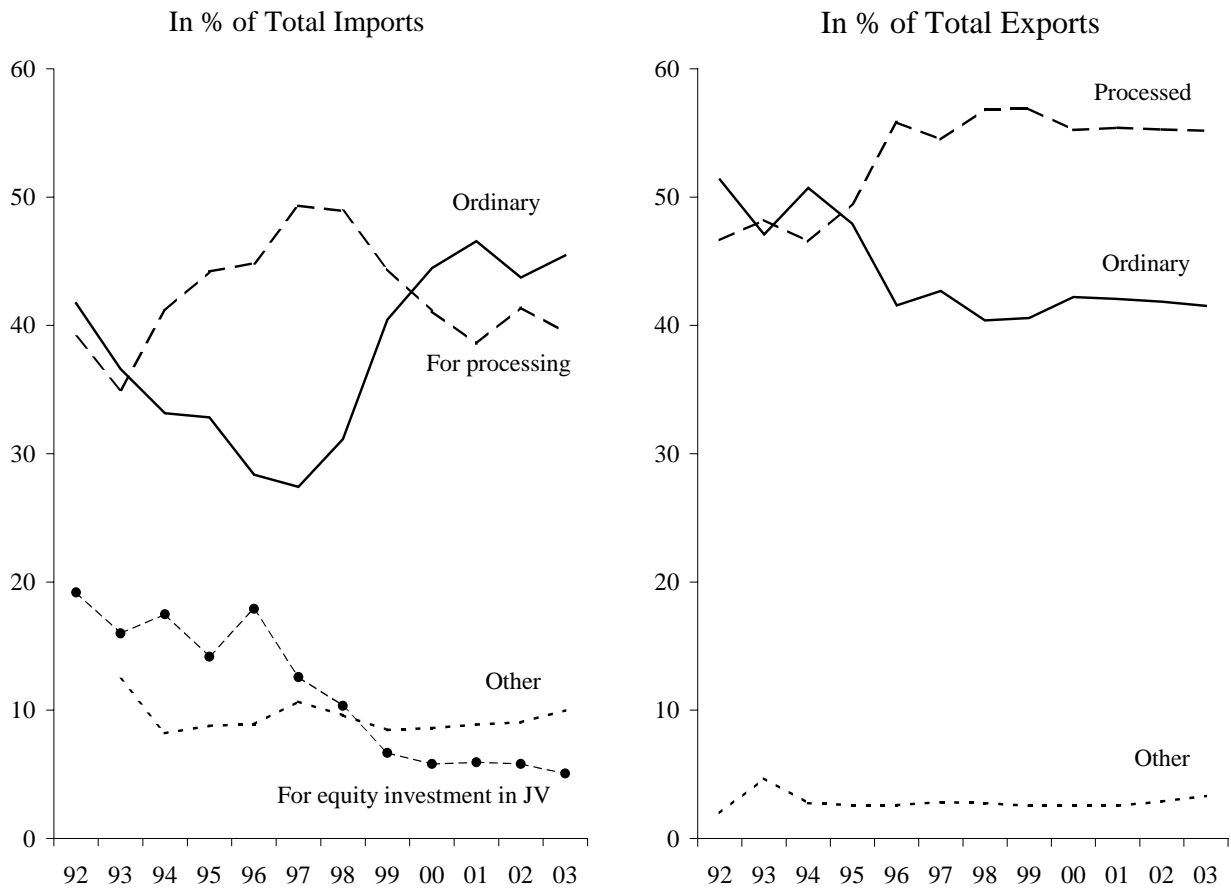
Source: China's Customs Statistics, authors' calculations.

**Table 10**  
**Share in World Trade**

	<b>Exports</b>			<b>Imports</b>		
	1980	1990	2002	1980	1990	2002
Japan	6.6	8.6	6.7	6.3	6.2	5.0
China	0.9	1.7	6.0	1.1	1.3	4.1
Asian NIEs	3.2	5.9	6.1	3.8	6.1	6.4
South Korea	0.9	1.9	2.6	0.8	1.2	1.1
Taiwan	1.0	2.0	2.1	1.1	1.5	1.3
Singapore	0.7	1.1	1.1	1.1	1.9	2.3
Hong Kong	0.7	0.9	0.3	0.8	1.5	1.7
ASEAN (without Singapore)	2.8	2.7	4.7	2.0	2.6	3.5
Malaysia	0.7	0.9	1.6	0.5	0.7	1.1
Thailand	0.3	0.6	1.1	0.4	0.9	0.9
Indonesia	1.2	0.8	1.0	0.6	0.6	0.6
Philippines	0.3	0.3	0.6	0.4	0.4	0.6
Vietnam, Cambodia, Laos	0.1	0.1	0.3	0.1	0.0	0.3
Brunei Darussalam	0.2	0.1	0.1	0.0	0.0	0.0
East Asia	13.4	18.8	23.4	13.2	16.2	18.9

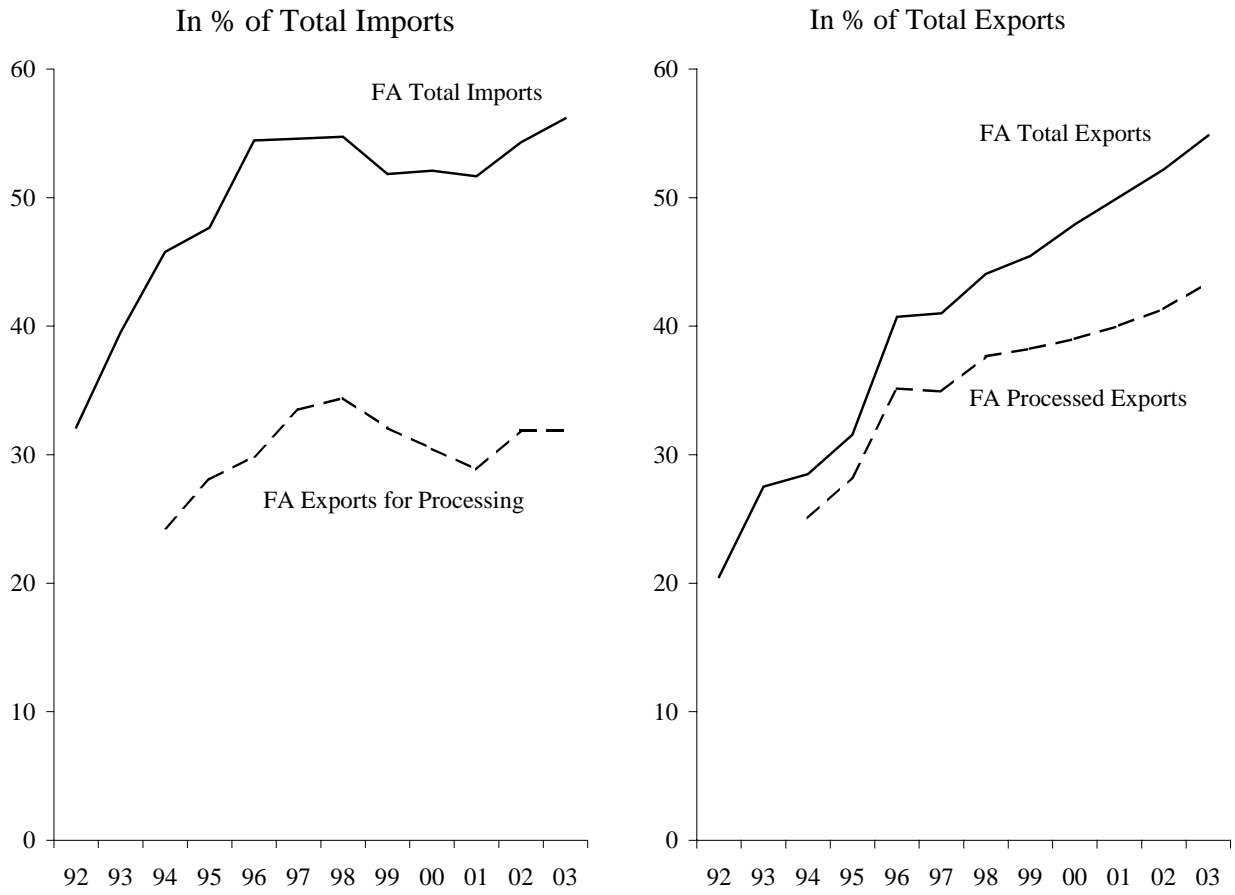
*Source:* CEPII-CHELEM data base, authors' calculations.

**Figure 1**  
**Breakdown of China's Trade by Customs Regimes, 1992-2003**



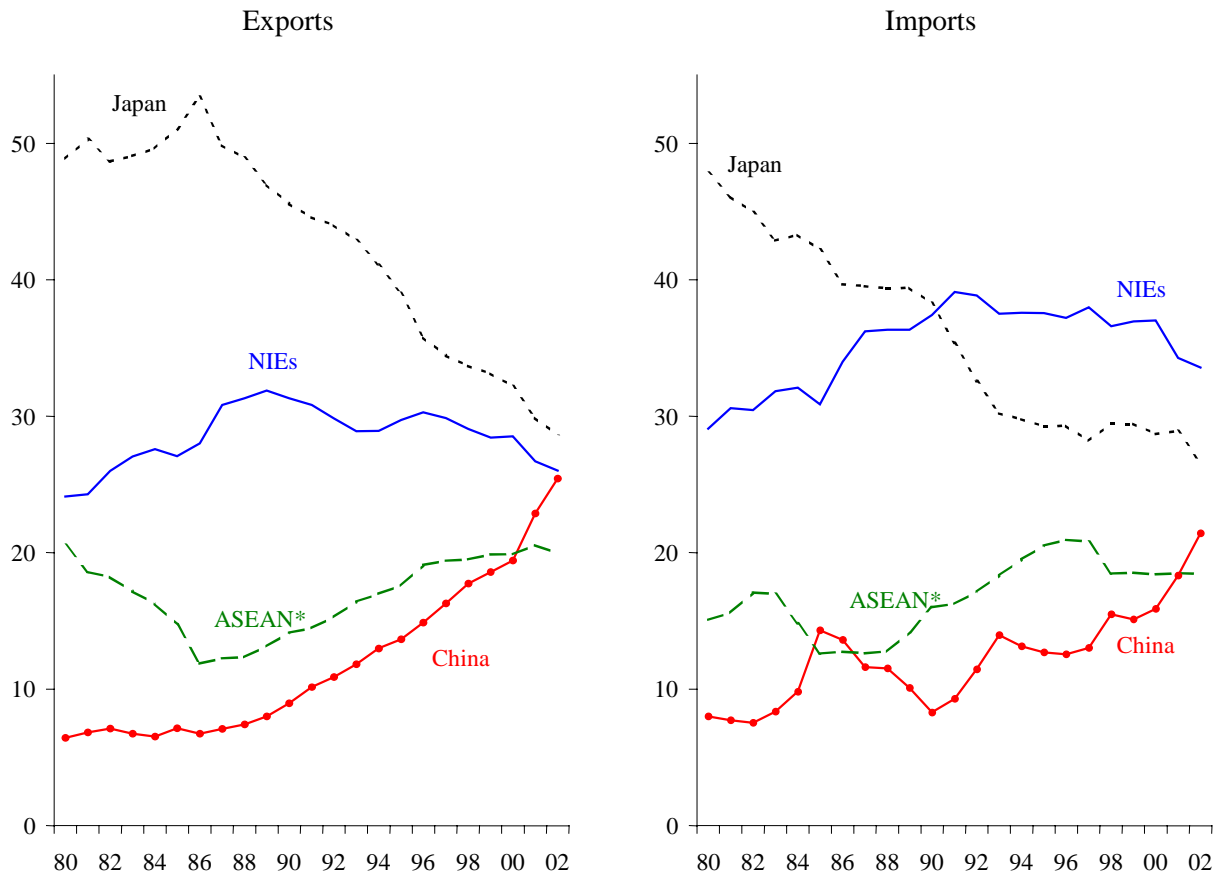
Source: China's Customs Statistics, authors' calculations.

**Figure 2**  
**Share of Foreign Affiliates Firms (FA) in Total China's Trade, 1992-2003**



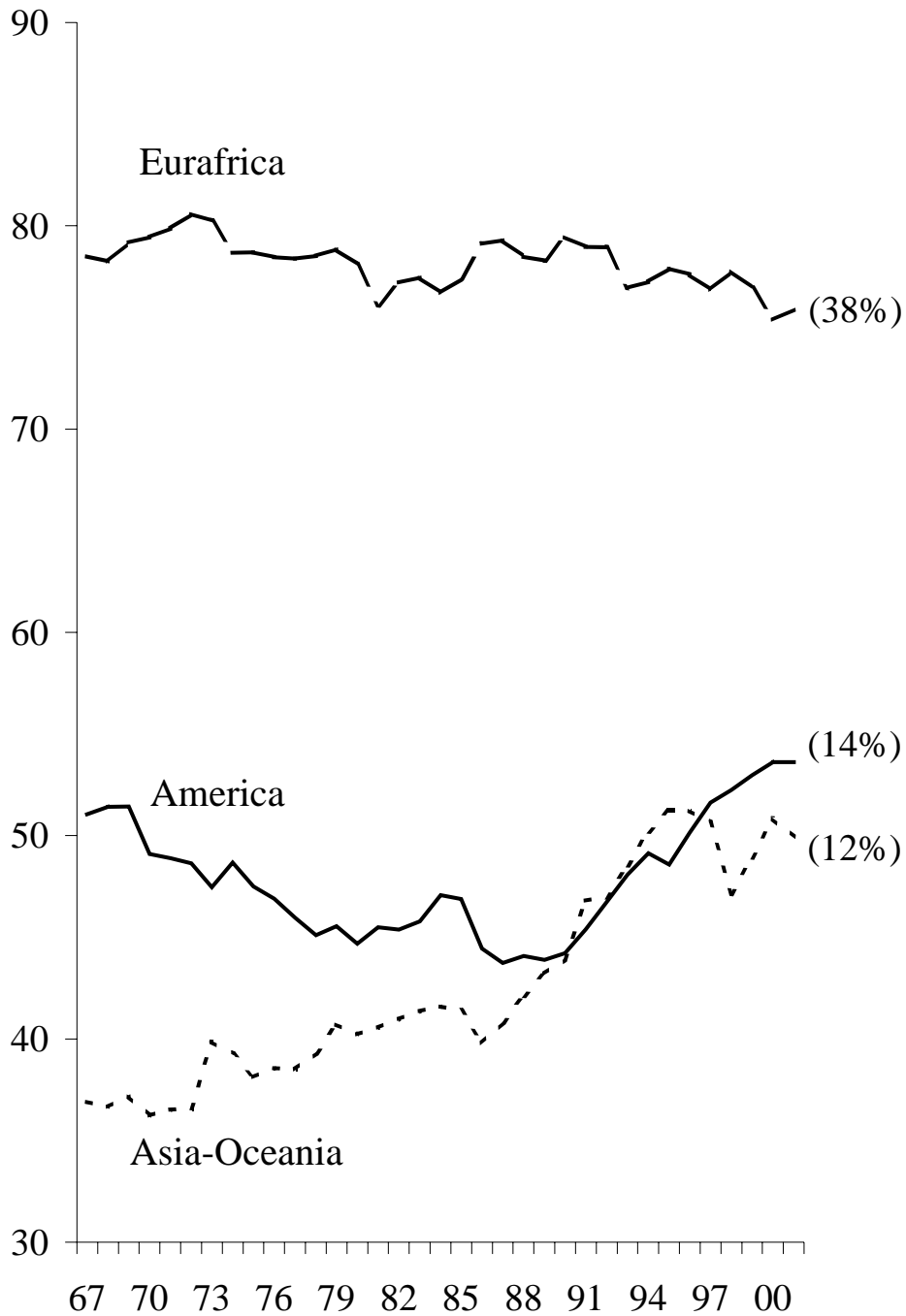
Source: China's Customs Statistics, authors' calculations.

**Figure 3**  
**Share of East-Asian Countries in Regional Trade**  
**(% of Total East-Asian Trade)**



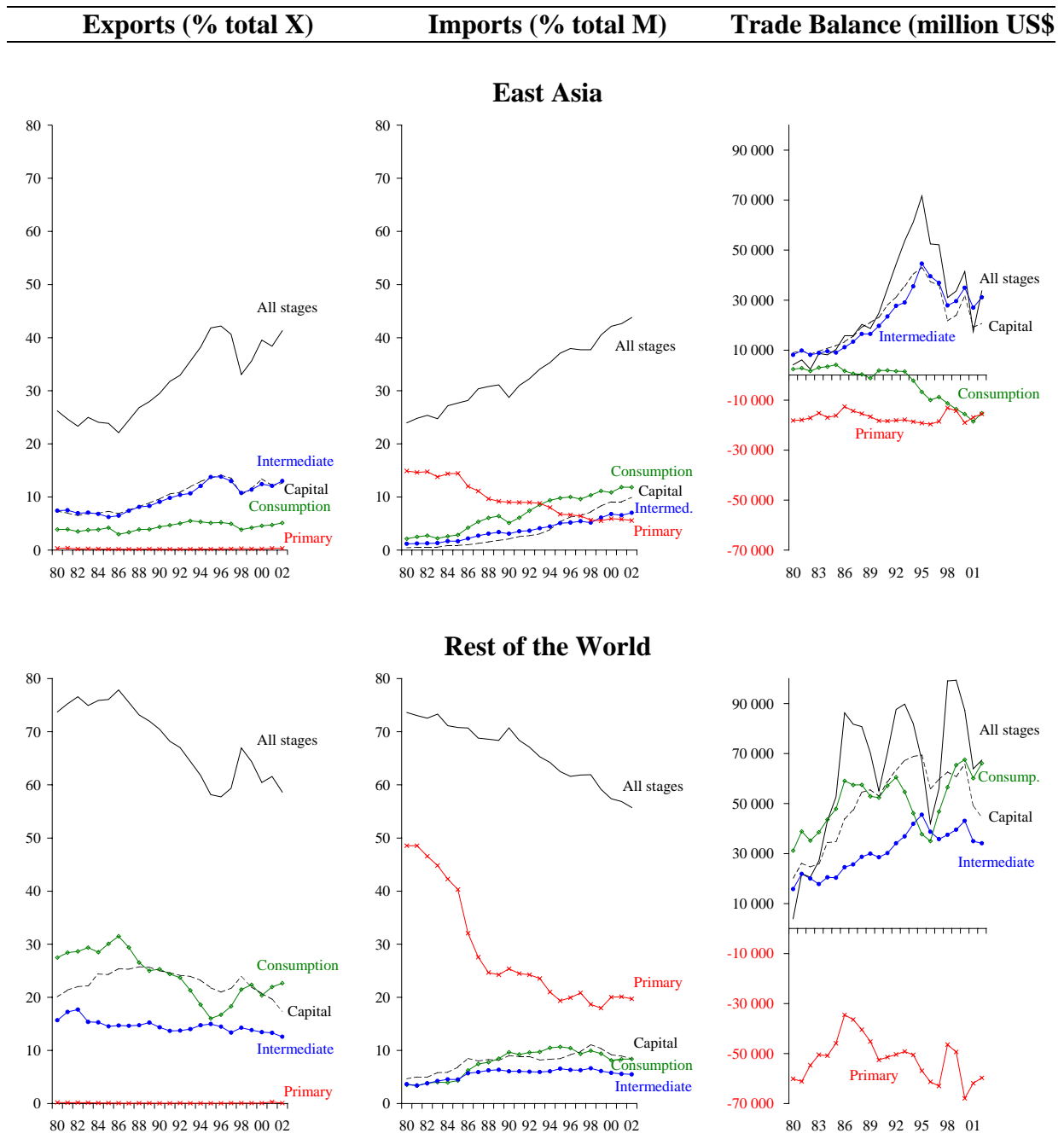
*Note:* NIEs: Hong Kong, Singapore, South Korea, Taiwan; ASEAN\*: ASEAN countries excluding Singapore.  
*Source:* CEPII-CHELEM data base, authors' calculations.

**Figure 4**  
**Share of Intra-Regional Flows in Total Trade\* (%)**



\* Intra-regional flows / [(total exports + total imports)/2]. Figures in brackets display the share of intra-regional flows in world trade in 2001. Eurafrica region is composed by Western and Eastern Europe, Former USRR, Africa and Middle-East.  
 Source: G. Gaulier, S. Jean, D. Ünal-Kesenci, 2004.

**Figure 5**  
**Trade of Japan With East Asia and Rest of the World by Production Stages, 1980-2002**



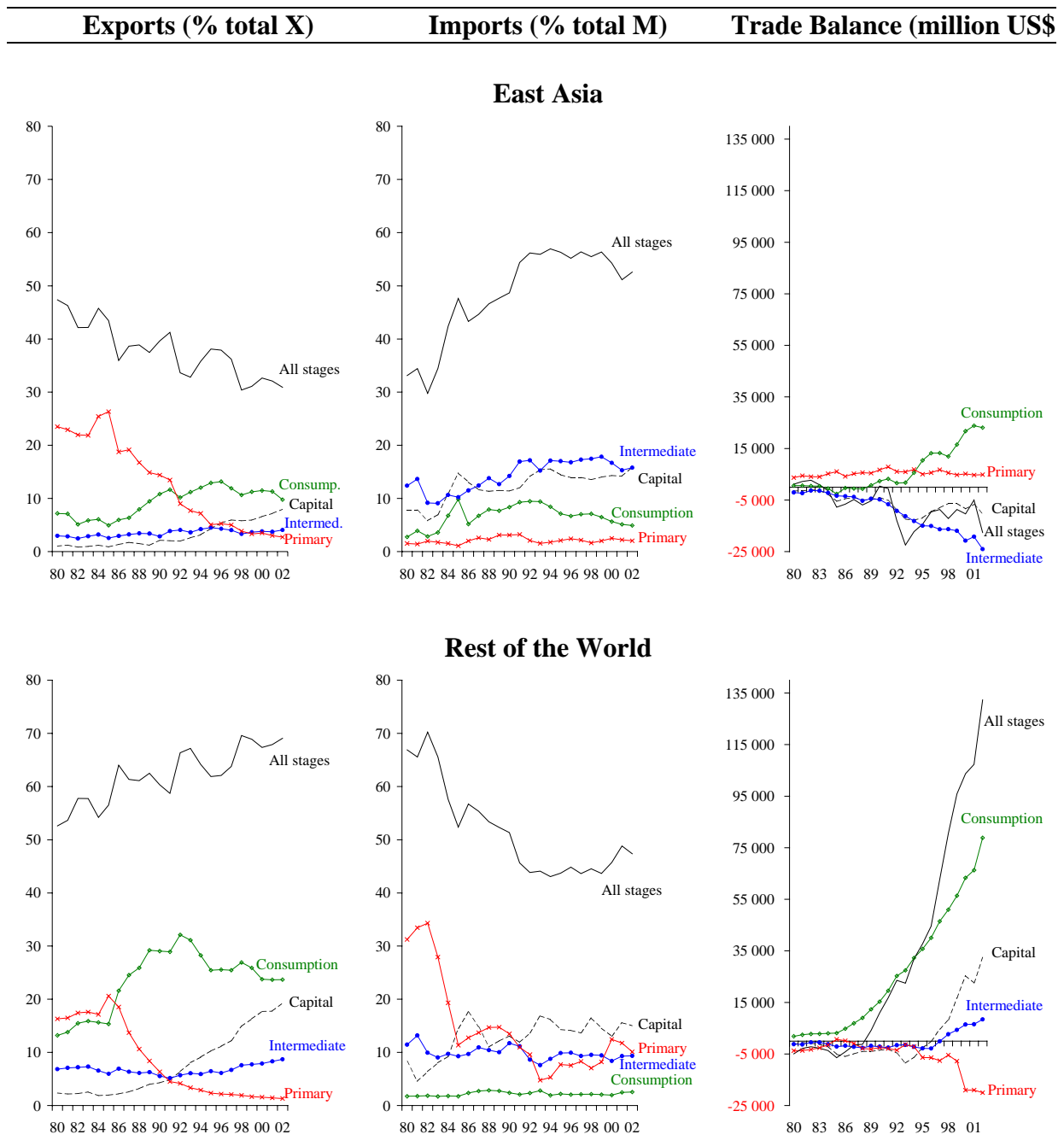
Source: CEPII-CHELEM data base, authors' calculations.

**Figure 6**  
**Trade of NIEs With East Asia and Rest of the World by Production Stages, 1980-2002**



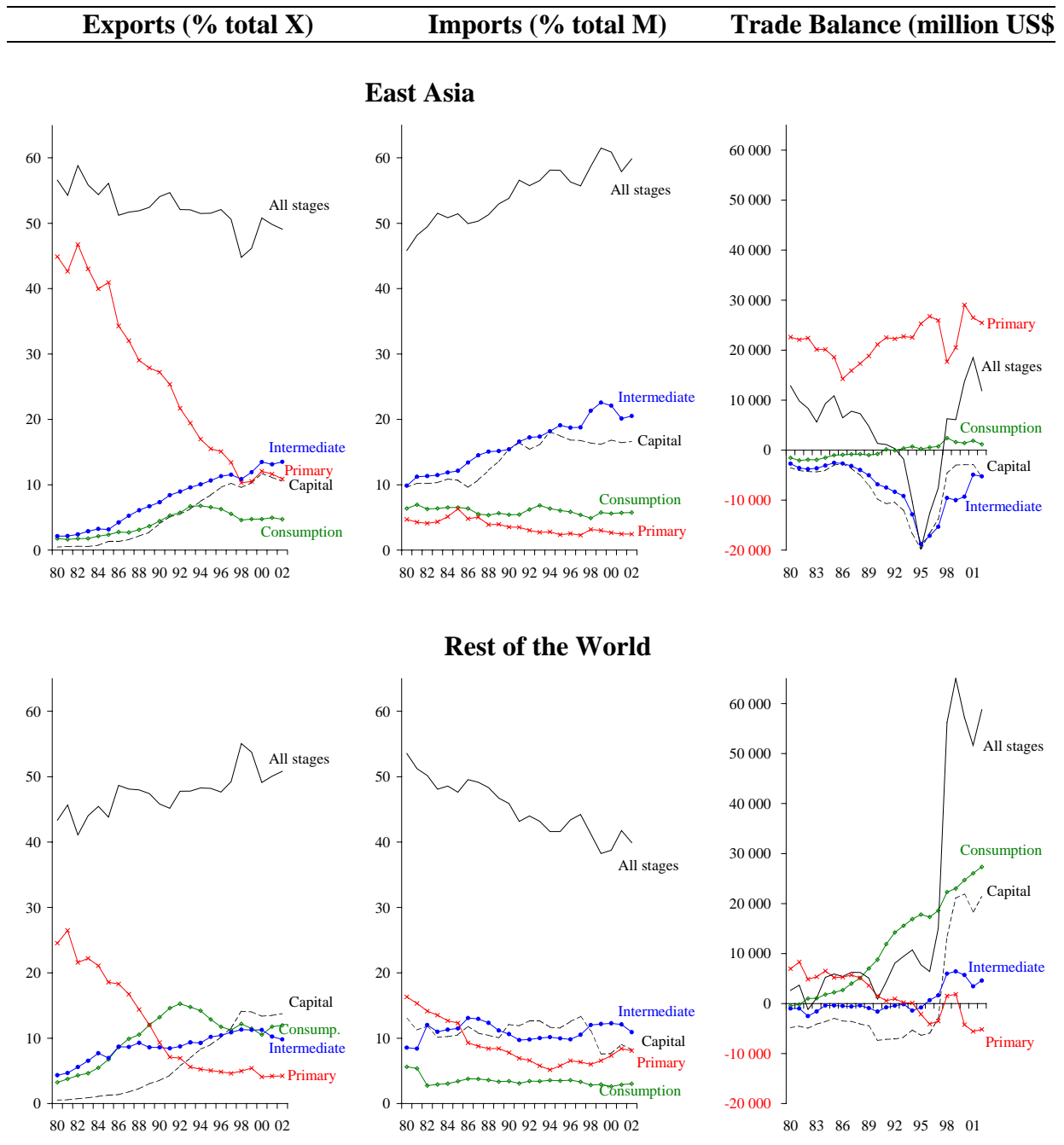
Source: CEPII-CHELEM data base, authors' calculations.

**Figure 7**  
**Trade of China With East Asia and Rest of the World by Production Stages, 1980-2002**



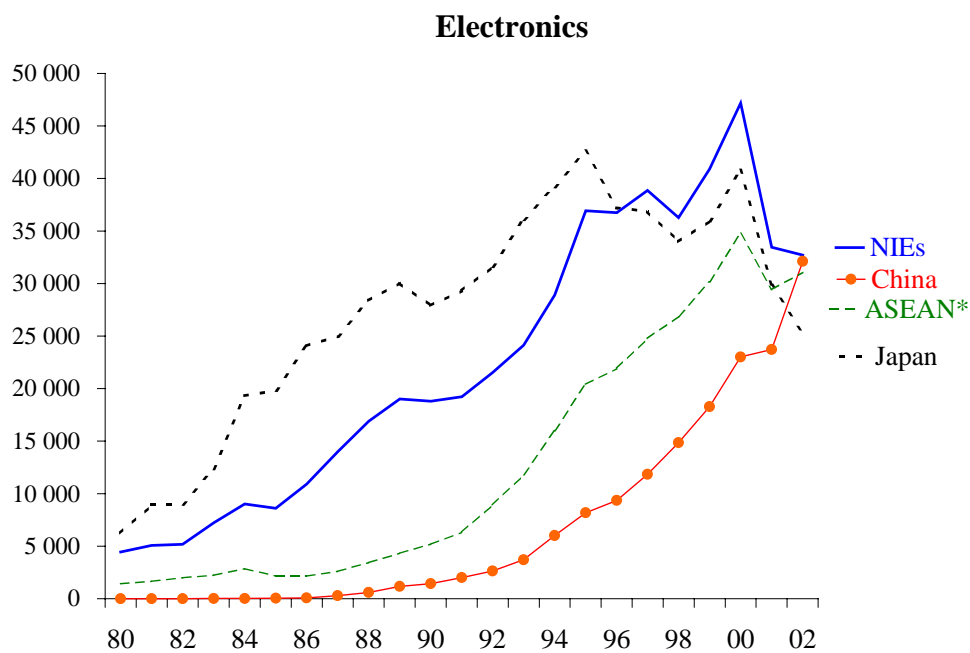
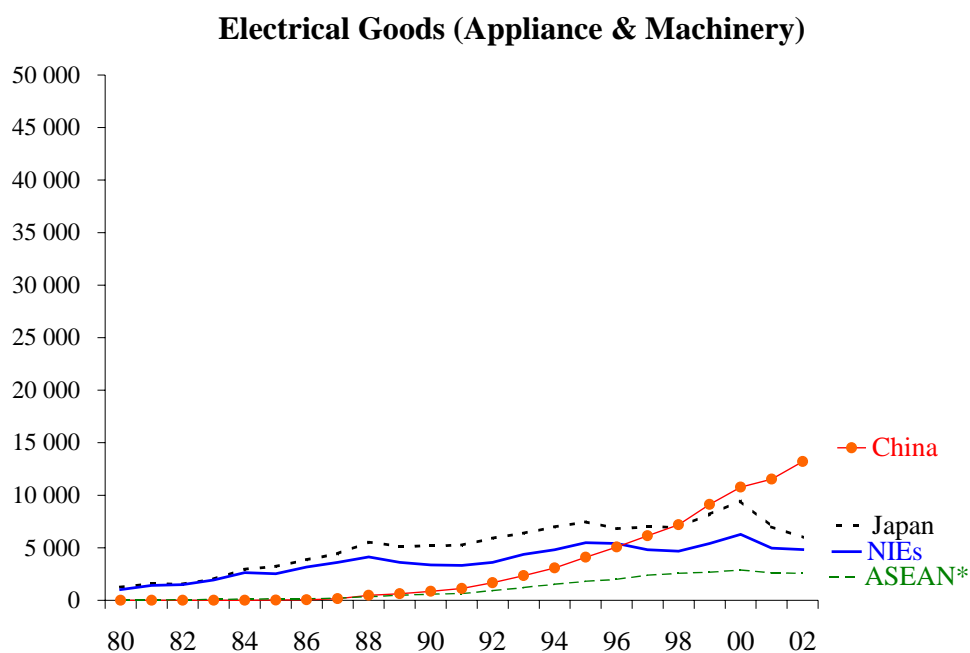
Source: CEPII-CHELEM data base, authors' calculations.

**Figure 8**  
**Trade of ASEAN (excluding Singapore) With East Asia and Rest of the World by**  
**Production Stages, 1980-2002**



Source: CEPII-CHELEM data base, authors' calculations.

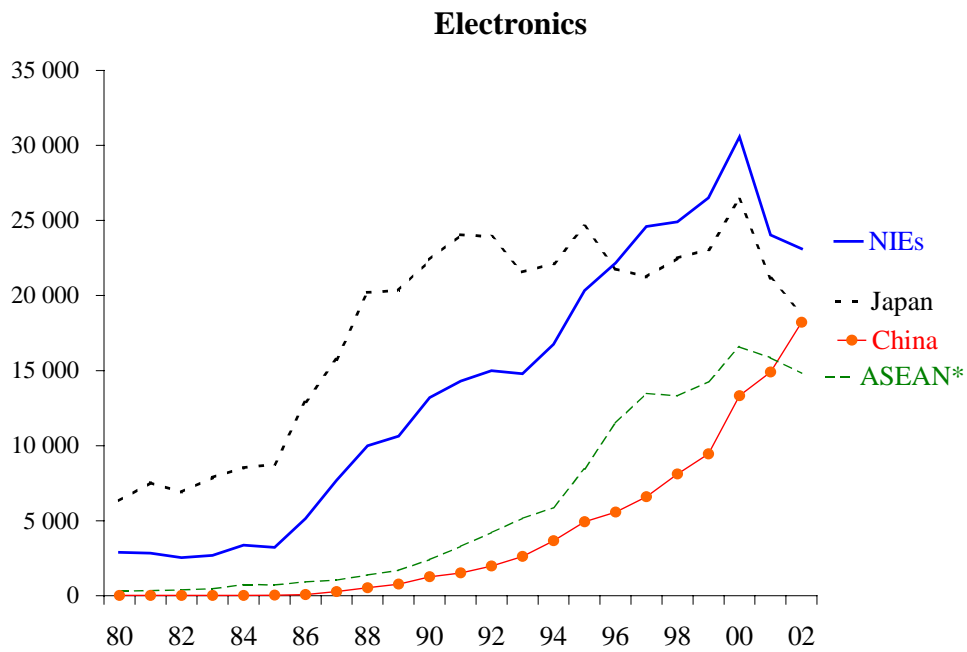
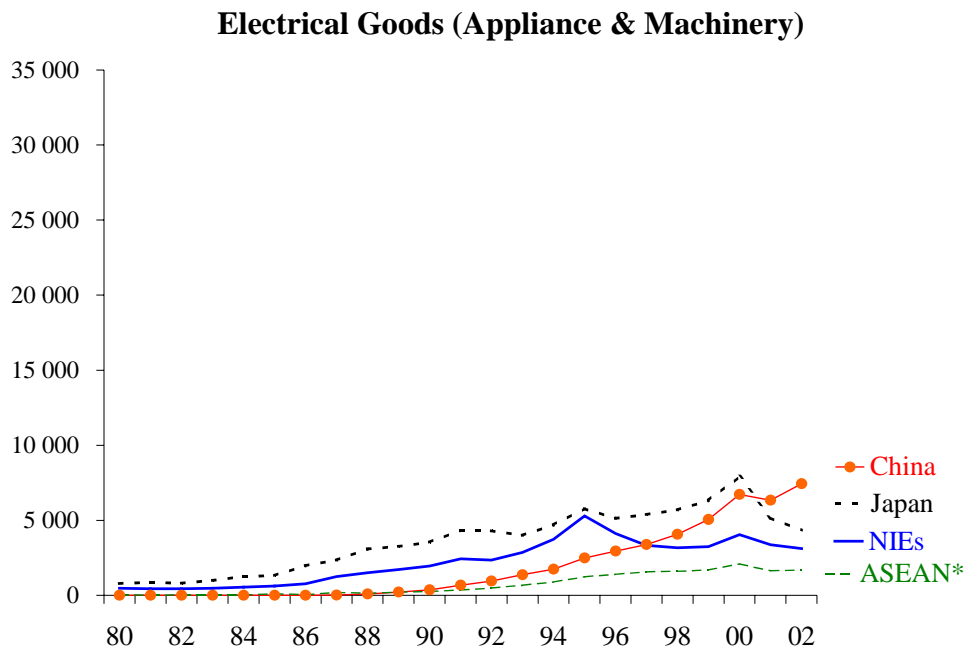
**Figure 9**  
**US Imports from East-Asia, 1980-2002 (thousand US\$)**



*Note:* NIEs: Hong Kong, Singapore, South Korea, Taiwan; ASEAN\*: ASEAN countries excluding Singapore.

*Source:* CEPII-CHELEM data base, authors' calculations.

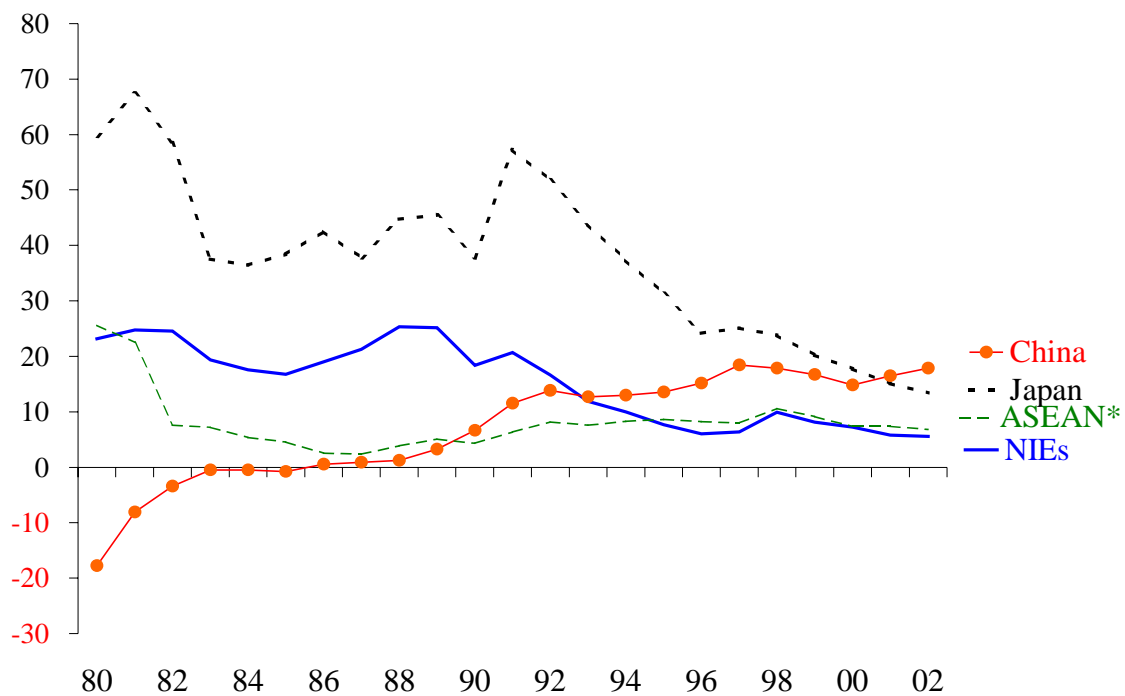
**Figure 10**  
**EU-15 Imports from East-Asia, 1980—2002 (thousand US\$)**



*Note:* NIEs: Hong Kong, Singapore, South Korea, Taiwan; ASEAN\*: ASEAN countries excluding Singapore.

*Source:* CEPII-CHELEM data base, authors' calculations.

**Figure 11**  
**The Share of East Asia in Total US Trade Deficit**  
**(% of US Total Trade Balance)**



*Note:* NIEs: Hong Kong, Singapore, South Korea, Taiwan; ASEAN\*: ASEAN countries excluding Singapore.

*Source:* CEPII-CHELEM data base, authors' calculations.

## APPENDICES

### 1. Sector Classification

SECTORS	HS2	HS2 TITLE	
Raw agricultural products	01	Live animals.	
	02	Meat and edible meat offal.	
	03	Fish & crustacean, mollusc & other aquatic invertebrate	
	05	Products of animal origin, nes or included.	
	06	Live tree & other plant; bulb, root; cut flowers etc	
	07	Edible vegetables and certain roots and tubers.	
	08	Edible fruit and nuts; peel of citrus fruit or melons.	
	10	Cereals.	
	12	Oil seed, oleagi fruits; miscell grain, seed, fruit etc	
	13	Lac; gums, resins & other vegetable saps & extracts.	
	14	Vegetable plaiting materials; vegetable products nes	
	Food products	04	Dairy prod; birds' eggs; natural honey; edible prod nes
		09	Coffee, tea, mat- and spices.
		11	Prod mill indust; malt; starches; inulin; wheat gluten
15		Animal/veg fats & oils & their cleavage products; etc	
16		Prep of meat, fish or crustaceans, molluscs etc	
17		Sugars and sugar confectionery.	
18		Cocoa and cocoa preparations.	
19		Prep of cereal, flour, starch/milk; pastrycooks' prod	
20		Prep of vegetable, fruit, nuts or other parts of plants	
21		Miscellaneous edible preparations.	
22		Beverages, spirits and vinegar.	
Raw materials & fuels	23	Residues & waste from the food indust; prepr ani fodder	
	24	Tobacco and manufactured tobacco substitutes.	
	25	Salt; sulphur; earth & ston; plastering mat; lime & cem	
Chemical products	26	Ores, slag and ash.	
	27	Mineral fuels, oils & product of their distillation;etc	
	28	Inorgn chem; compds of prec met, radioact elements etc	
	29	Organic chemicals.	
	30	Pharmaceutical products.	
	31	Fertilisers.	
	32	Tanning/dyeing extract; tannins & derivs; pigm etc	
	33	Essential oils & resinoids; perf, cosmetic/toilet prep	
	34	Soap, organic surface-active agents, washing prep, etc	
	35	Albuminoidal subs; modified starches; glues; enzymes.	
	36	Explosives; pyrotechnic prod; matches; pyrop alloy; etc	
	37	Photographic or cinematographic goods.	
Wood and paper products	38	Miscellaneous chemical products.	
	39	Plastics and articles thereof.	
	40	Rubber and articles thereof.	
	44	Wood and articles of wood; wood charcoal.	
	45	Cork and articles of cork.	
	46	Manufactures of straw, esparto/other plaiting mat; etc	
	47	Pulp of wood/of other fibrous cellulosic mat; waste etc	
	48	Paper & paperboard; art of paper pulp, paper/paperboard	
Leather and shoes	49	Printed books, newspapers, pictures & other product etc	
	94	Furniture; bedding, mattress, matt support, cushion etc	
	41	Raw hides and skins (other than furskins) and leather.	
	42	Articles of leather; saddlery/harness; travel goods etc	
	43	Furskins and artificial fur; manufactures thereof.	
64	Footwear, gaiters and the like; parts of such articles.		

SECTORS	HS2	HS2 TITLE
Fibber and cloths	50	Silk.
	51	Wool, fine/coarse animal hair, horsehair yarn & fabric
	52	Cotton.
	53	Other vegetable textile fibres; paper yarn & woven fab
	54	Man-made filaments.
	55	Man-made staple fibres.
	56	Wadding, felt & non woven; yarns; twine, cordage, etc
	57	Carpets and other textile floor coverings.
	58	Special woven fab.; tufted tex fab; lace; tapestries etc
	59	Impregnated, coated, cover/laminated textile fabric etc
Wearing Apparel	60	Knitted or crocheted fabrics.
	61	Art of apparel & clothing access, knitted or crocheted.
	62	Art of apparel & clothing access, not knitted/crocheted
	63	Other made up textile articles; sets; worn clothing etc
Building materials	68	Art of stone, plaster, cement, asbestos, mica/sim mat
	69	Ceramic products.
	70	Glass and glassware.
Metallurgy	72	Iron and steel.
	73	Articles of iron or steel.
	74	Copper and articles thereof.
	75	Nickel and articles thereof.
	76	Aluminium and articles thereof.
	78	Lead and articles thereof.
	79	Zinc and articles thereof.
	80	Tin and articles thereof.
	81	Other base metals; cermets; articles thereof.
Metal products	82	Tool, implement, cutlery, spoon & fork, of base met etc
	83	Miscellaneous articles of base metal.
Machinery	84	Nuclear reactors, boilers, mchy & mech appliance; parts
	93	Arms and ammunition; parts and accessories thereof.
Electrical machinery	85	Electrical mchy equip parts thereof; sound recorder etc
Motor Vehicles	87	Vehicles other than railw/tramw roll-stock, pts & accessories
Other transport equipment	86	Railw/tramw locom, rolling-stock & parts thereof; etc
	88	Aircraft, spacecraft, and parts thereof.
	89	Ships, boats and floating structures.
Precision instruments	90	Optical, photo, cine, meas, checking, precision, etc
	91	Clocks and watches and parts thereof.
	92	Musical instruments; parts and access of such articles
Toys & miscellaneous manuf. prod.	65	Headgear and parts thereof.
	66	Umbrellas, walking-sticks, seat-sticks, whips, etc
	67	Prepr feathers & down; arti flower; articles human hair
	71	Natural/cultured pearls, prec stones & metals, coin etc
	95	Toys, games & sports requisites; parts & access thereof
	96	Miscellaneous manufactured articles.
	97	Works of art, collectors' pieces and antiques.
98	Special Classification Provisions	

## 2. Classification of Production Stages from BEC Classification

In this study, the data from China's Customs statistics available at 6 digits of Harmonised System were aggregated according to the BEC classification of production stages. The classification by Broad Economic Categories of the United Nations reclassifies the Standard International Trade Classification (SITC, Rev. 3) headings on the basis of the principal use of the products. It converts foreign trade data into categories of final or intermediate use, such as capital goods, intermediate goods or consumer goods, following the usage in the System of National Accounts (SNA). We grouped BEC items in five stages as following:

3 stages	5 stages	Code BEC	Title BEC
Primary goods		111	Food and beverages mainly for industry
		21	Industrial supplies, n.e.s., primary
		31	Fuels and lubricants, primary
Intermediate goods	Semi-finished goods	121	Food and beverages, processed, mainly for industry
		22	Industrial supplies, n.e.s., processed
		322	Fuels and lubricants, processed
	Parts & components	42	Of capital goods, except transport equipment
		53	Of transport equipment
Final goods	Capital goods	41	Capital goods except transport equipment
		521	Other industrial transport equipment
	Consumption goods	112	Food & bev., primary, mainly for household consumption
		122	Food & bev., primary, processed, for house. consumption
		51	Passenger motor cars
		522	Other non-industrial transport equipment
		53	Parts and accessories of transport equipment
		61	Durable consumer goods n.e.s.
		62	Semi-durable consumer goods n.e.s.
		63	Non-durable consumer goods n.e.s.

### 3. Classification of Production Stages from CEPII-CHELEM Data Base

PRODUCTION STAGE	CODE	SHORT TITLE	PRODUCTION STAGE	CODE	SHORT TITLE
PRIMARY GOODS	HA	Iron ores	CAPITAL GOODS	FD	Agricultural equipment
	HB	Non ferrous ores		FE	Machine tools
	HC	Unprocessed minerals n.e.s.		FF	Construction equipment
	IA	Coals		FG	Specialized machines
	IB	Crude oil		FH	Arms
	IC	Natural gas		FI	Precision instruments
	JA	Cereals		FN	Telecommunications equipment
	JB	Other edible agricultural prod		FO	Computer equipment
	JC	Non-edible agricultural prod.		FQ	Electrical equipment
BASIC MANUFACTURING	BA	Cement		FR	Electrical apparatus
	BB	Ceramics	FU	Commercial vehicles	
	BC	Glass	FV	Ships	
	CA	Iron Steel	FW	Aeronautics	
	CC	Non ferrous metals	MIXED PRODUCTS	DE	Leather
	GA	Basic inorganic chemicals		ED	Printing
	GC	Basic organic chemicals		GH	Plastic articles
IG	Coke	IH		Refined petroleum products	
		II		Electricity	
INTERMEDIATE GOODS	CB	Tubes	KB	Fats	
	DA	Yarns fabrics	KC	Meat	
	EA	Wood articles	KF	Sugar	
	EC	Paper	KG	Animal food	
	FA	Metallic structures	CONSUMPTION GOODS	DB	Clothing
	FB	Miscellaneous hardware		DC	Knitwear
	FC	Engines		DD	Carpets
	FL	Electronic components		EE	Miscellaneous manuf. articles
	FS	Vehicles components		FJ	Clock making
	GB	Fertilisers		FK	Optics
	GD	Paints		FM	Consumer electronics
GG	Plastics	FP		Domestic electrical appliances	
GI	Rubber articles (incl. tyres)	FT		Cars and cycles	
NEC	NA	Jewellery, works of art		GE	Toiletries
	NB	Non-monetary gold		GF	Pharmaceuticals
	NV	N.e.s. products	KA	Cereal products	
		KD	Preserved meat/fish		
		KE	Preserved fruits		
		KH	Beverages		
		KI	Manufactured tobaccos		

### 4. The CEPII's List of High-tech Products

The definition of high-tech products used in CEPII studies comes from *Fontagné, Freudenberg and Ünal-Kesenci (1999)*. They derived a list of 252 products at the 6 digits level of the Harmonised System from a joint list published by Eurostat and the OECD.

Originally, *OECD (1980, 1983)* used to classify sectors according to a U.S. list. Then OECD (1984) decided to measure the direct content in R&D for each sector and published a list entailing three levels of technology (high, medium, low): this classification identified 6 sectors of high-technology: aerospace, office machinery,

pharmaceuticals, electronic and telecommunications, precision tools, and electric machinery. This classification has been extensively used in order to examine the high-technology sector over 1970-1980. More recently, the *OECD (1995)* issued a new classification, according to the direct and indirect technological content. This classification is based on the ISICrev2, and is articulated with trade data using the SITC rev3.

This classification of sectors being done, OECD considers products belonging to the high-technology and medium-technology sectors, minus the automobile industry, plus weapons. Inside these sectors, the Fraunhofer Institut selected a list of products having a high content in R&D at the 3-digit level of the SITC. These positions of the SITC 3-digit account for 230 products at the 5-digit level of the same nomenclature (a list here referred to as OECD-1995-product). Hence, there is no correspondence between the high-technology sector (as referred to in OECD publications) and the list of high-technology products here defined. It has to be noted that this methodology introduces a slight selection bias, since it examines whether products are of a high-technology nature or whether they are not, only in sectors that themselves are considered high-technology: potentially existing high-technology products in non technological sectors do not figure in the OECD-Eurostat list, and are thus implicitly considered as non-technological.

In order to launch a joint list with Eurostat, it was necessary to go further in detail in order to match 5-digit SITC positions with 6-digit HS ones. However, compared to this joint list, both Eurostat and OECD then made a certain number of modifications. Some 6-digit items of HS, belonging to 5-digit items of the SITC, cannot be considered as high-technology, and were thus excluded of the 6-digit HS list by Eurostat. In total, there is a joint list, a modified Eurostat list, and a modified OECD list.

*Fontagné, Freudenberg and Ünal-Kesenci (1999)* decided to define high-technology products as those belonging at least to one of these latter lists, yielding 279 items of HS 6 digits. But, each year, at such a level of desegregation, items appear and disappear: as a result, 26 items in the joint list plus 1 over the 7 added by Eurostat are without any observation in 1996. Hence, since they use a nomenclature corresponding to the year 1995, only 252 over the 279 items of the joint list correspond to trade data in 1996. Finally, these 252 products at the 6-digit level of HS are disaggregated into about 500 items at the 8-digit level of the CN, under the assumption that all 8-digit positions belonging to a "high-tech" 6-digit one are also high-technology products.

## **5. Indicator of Contribution to Trade Balance**

To measure China's revealed comparative advantages, we used the indicator of "contribution to the trade balance" (*Lafay, 1994*). The idea is to measure comparative advantages (largo sensu) under an assumption of balanced trade.

$$CTB_{ij}^k = 1000 * \left[ (X_{ij}^k - M_{ij}^k) - \sum_k \sum_j (X_{ij}^k - M_{ij}^k) \left( \frac{X_{ij}^k + M_{ij}^k}{\sum_k \sum_j (X_{ij}^k + M_{ij}^k)} \right) \right]$$

with i for the declaring country (China), j for its partner and k for the products.

If there were no comparative advantage or disadvantage for any product k, then the country's total trade balance (surplus or deficit) should be distributed across all industries according to their share in total trade. The "contribution to the trade balance" is the difference between the observed and this theoretical balance. Here, these "contributions" are weighted by total trade of the China.

A positive contribution is interpreted as a "revealed comparative advantage" for that industry. By definition, the sum over all industries and partners is zero. The indicator is additive: thus the values for products or industries can be aggregated to any desired level.

Contribution to the trade balance is a structural indicator which tries to eliminate business cycle variations -by comparing an industry's performance to the overall one- and, unlike many other indicators, a symmetrical indicator in the sense that it focuses not only on exports, but also on imports.