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GLOBALISATION OF INDUSTRIAL ACTIVITIES:

A CASE STUDY OF THE CONSUMER ELECTRONICS SECTOR

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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This study forms part of the analytical and sectoral work carried out under the auspice of the Industry Committee and Trade Committee of the OECD, aiming to deepen understanding of globalisation. Under the procedures agreed by those two committees, this study was derestricted on 5 May 1994.

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Summary and Conclusions

The consumer electronics industry mainly produces mass consumption audio and video products which require a relatively low degree of customisation. The industry is dominated by a few companies which produce and market globally, and engage in world-wide rivalry. The patterns of globalisation can be well traced by observing the strategies of the global leaders. With the exception of Philips, which has pursued an international strategy very early on in its history, all the major competitors have done so only more recently. Two principal driving forces seem to have characterised the process of global siting of production, although in opposing geographical directions. On the one hand the economics of production has encourages the dispersal of manufacturing activities in search of efficiency maximisation. On the other hand growing trade competition has engendered some strong protectionist pressures which have induced the relocation of some manufacturing operations, above all from Asia to Europe and North America.

The industry is highly scale intensive, with rapidly decreasing unit production costs. Sales are in general very price-sensitive and global companies are constantly vying for market shares in order to minimise costs and ensure profitability. This implies that they are fiercely competing in all the three major markets -- Europe, North America and Asia. Barriers to market access, including structural ones, may have a significant impact on companies strategies and performances.

The consumer electronics industry is of vital importance as a technology driver for the electronics industry as well as for the economy as a whole, contributing both to innovation and the development of commercial applications. In this light the dominant world position acquired by Japanese companies has led other countries to make significant use of trade policy measures. The latter have generally proved ineffective at a time when competition between leading companies was shifting from being mainly international trade-based to being global in production and marketing strategies.

International trade has continued to grow, but it has become more concentrated within the three main regions noted above, as a result of foreign investments. And it has been partly replaced by local production-cum-international sourcing, with the effect of substituting some trade in end-products for trade in components, which is showing a rising trend. In particular the relative decline of inter-regional trade in consumer electronics products, especially from East Asia and Japan toward both Europe and North America, is in large measure attributable to the parallel increase in investment flows and the establishment of regional production operations.

Consumer electronics products tend to incorporate an increasing number of high-tech components, such as microprocessors, memory devices and other forms of digital circuitry. Consumer electronics companies are often vertically integrated manufacturers, which design, produce and sell a number of electronic

components. Consumer electronics may thus be considered a quite R&D and capital intensive industry, above all at the high end of the market. Automation has been spreading and has led to substantial productivity gains.

The rising costs of product development and of capacity building have increased the barriers to entry in the industry. These trends have contributed to growth in the number and importance of international collaboration agreements, adding a new dimension to the leading firms' global strategies. They allow companies to share the costs and the risks of pursuing expensive R&D programs and reduce product lines, thus ensuring a high degree of competitiveness by concentrating on their core competencies.

In the consumer electronics industry the main players consider the world as their reference market and have developed very sophisticated global strategies aimed at taking advantage of the best production and technological opportunities available globally in terms of locations and of inter-firm collaboration. But on the other hand their strategies remain quite constrained and strongly influenced by factors such as the macroeconomic environment, including in particular relative exchange rates, and public policies, especially trade and technology policies.

I. Introduction: scope of the industry

The emergence of the consumer electronics industry can be traced back to the second quarter of the century with the development and widespread sale of radio sets and gramophones. A fundamental technological breakthrough came about with the discovery of the transistor by a group of scientists at the AT&T Bell laboratories in New Jersey. This discovery made possible substantial reductions in product dimensions, improved quality and decreased prices. The transistor technology has also paved the way for an endless stream of innovations and of new products, from televisions to computers, from compact discs to cellular telephones which have had a profound impact on economic and social systems.

Consumer electronics is one of the three main segments of the electronic industry, the other two being industrial electronic equipment, which includes computers and communications systems, and electronic components and devices. The consumer segment is generally considered to encompass audio products, such as hi-fi systems, compact disk players (CDs), portable audio equipment, in-car entertainment systems and video products, such as television receivers (TVs), video cassette recorders (VCRs), CD video and video camera recorders (camcorders). The bulk of the industry’s production value is represented by colour TVs and VCRs.

Some professional items, including telephone and facsimile sets, CD-based information systems as well as personal computers, are becoming increasingly "consumerized", and are considered in some statistical sources already as part of the consumer electronics segment (1). On the other hand it is noteworthy that innovations, such as high definition TV (HDTV) and flat panel displays, which were initially conceived for the consumer segment, have subsequently found widespread industrial and even military applications. These trends underscore a very important characteristic of the industry, above all in a forward-looking perspective, namely the blurring and cross-fertilisation between the segments of personal and business products, which builds upon the increasing convergence between the technologies and applications of the computer, telecommunications, consumer electronics, entertainment and publishing industries in what are now called "multimedia" and "interactive" systems.

II. Trends in growth and structure

1. Production

World-wide electronics production is estimated to represent around USD 700 bn (Figure 1) and it represents one of the largest sectors of industrial activity on its way to overtaking other large sectors such transport equipment, chemicals and food products. In terms of its share in GDP it represents around 5% in Europe, 5.5% in Japan and over 6% in the US. Consumer electronics production accounts for over USD 80 bn, or around 11.5% of the whole industry (Table 1). Japan, accounting for over 40% of total output, is by far the largest producer, followed by South Korea, the US, Germany, Malaysia, Singapore and the U.K. The overall EC share is around 15%. The annual growth of the industry, although still recording double-digit rates during the 1980s, has shown a decreasing trend (Figure 2).

The economics of production and the competitive conditions of individual product markets may differ substantially. In general the production process for consumer electronics products is subject to significant scale economies. Very high volumes of production, often exceeding the domestic market potential, are needed to achieve international competitiveness. For instance, in the production of colour TVs, scale economies derive from the fixed investment in tooling, automated assembly equipment, testing equipment and specialised equipment for coil winding and other operations required for sub-assemblies of the television set. Production process efficiency is thus a key facor of success in this high-volume industry.

From one perspective, the consumer electronics industry could be viewed as an assembly business, adding a relatively small value to the parts and components incorporated into the end-product. Components (2) in fact make up a large part of the production costs (3) and if purchased separately in small lots, would typically cost more than the final product. Part and component manufacturing and final assembly are often carried out in different locations or countries by different companies. But in light of the strong production and technological interlinkages and integration between components and end-products manufacturers, it is often useful to consider them in a more comprehensive fashion.

To a varying degree all manufacturers, depending on the level of vertical integration, need to purchase some components on the open market. The possibility of sourcing components in a timely way and with the required specifications and characteristics of quality and price is thus a key factor of competitiveness. The production of components also benefits from substantial economies of scale. The consumer electronics manufacturers are very large volume purchasers of components (Figure 3) creating interdependencies in the supply chain. The minimum efficient scale of component production is often so high that vertically integrated consumer electronic manufacturers still have to sell part of their components on the open market. This has proved to be a very successful strategy for Japanese manufacturers.

Anyway the increasing spread of digital technology in consumer applications makes it increasingly possible to use the same components for both professional and consumer equipment, thus increasing the economies of scale and scope. This development also tends to reduce the cost of producing professional products, which may sometimes migrate to the consumer market. There are an increasing number of products which are becoming "consumerized", such as personal computers, camcorders, mobile phones, home fax and home copiers.

Noteworthy is the trend towards reducing the number of parts and components, thanks to the greater integration of functions into single components (integrated circuits) and to miniaturisation, thus increasing productivity in the assembly phase. For instance, since 1984, technological improvements have allowed Philips to reduce the number of parts in its CD player by 75% and in its VCRs by 55%.

Labour cost is still quite important at the low end of the market in the assembly stage but it is becoming increasingly less so due to automation (4). In Japan, for instance, labour accounts for only around 5-10% of overall direct

cost of production of consumer electronics products. But depending on the production method or in specific stages of the production process, labour can still represent a larger share of costs.

The "lean" production system, more common among auto manufacturers, is also making some inroads in the consumer electronics industry. Sony, for instance, has been adopting it in its domestic video production with positive results in terms of flexibility, assembly time savings, quality improvements and reduction of production costs. In order to be a successful strategy lean production requires a high degree of integration in the production process, and of co-ordination with components suppliers, which may prove somewhat more difficult in an industry characterised by short product cycles.

2. Consumption

Consumer electronics products are in general mass consumption products which need a relatively low degree of customisation. The size of the consumer electronics market has been growing in parallel with the diffusion of "boom" products: Black and white TVs and stereo hi-fis in the 1960s; colour TVs, cassette decks and video games in the 1970s; and VCRs, CD players, Walkmans, and camcorders in the 1980s. The EC, the US and Japan are the three most important markets, accounting respectively for around 33, 25 and 20% of consumption in 1991 (Table 2 and Figure 4).

But their markets for TVs and VCRs appear to be saturated or approaching that stage, with sales falling off in recent years. TV penetration of households in the US and Japan is over 99%, while it exceeds 90% in most of the EC. More than 50% of American homes already own 2 or more TVs. VCR penetration is over 75% in both the US and Japan, while still somewhat lower in the EC. The life-cycle of consumer products usually shows a rapid increase of sales when the item is launched, followed by a decline until manufacturers target a larger group of consumers by adding new features and/or offering lower price variations. Once the majority of households own the product, the market becomes dependent on replacement sales, a stage now reached by TVs and rapidly approaching for VCRs and CD players. On the other hand in some markets, such as the US, sales of TVs and VCRs remain at a high level, driven by demand for upgrades and, in many households, for a second or third set.

Thus, notwithstanding brand loyalty that manufacturers pursue at great cost, and a continuous research of product differentiation and innovation, price competition is becoming increasingly more important. In addition, consumption is quite income-elastic, which partly explain the problems that many manufacturers are facing in the current recessionary phase. In Japan consumers tend to be more sophisticated, seeking products of high quality and performance. This has meant that new product and market development are taking place primarily in Japan. The medium-term outlook for the consumer electronics market seems to be one of moderate growth, waiting for technological improvements to make available new "hit" products, which will probably be based on digital technology. Various new products, such as personal digital assistants, digital audio tape recorders, digital compact cassettes and mini-discs have been already launched, but it is still unclear what their

market potential is. The Electronics Association of Japan estimates that the global market for such "multimedia" products could eventually be worth Y325 000bn a year.

3. Employment

As mentioned, automation and the ensuing productivity growth has brought about a decline in employment levels in the consumer electronics industry of most OECD countries. In addition manufacturers have tried to take advantage of low-wage off-shore labour (5) through both procuring labour-intensive products and sub-assemblies from developing countries and moving labour-intensive operations there (Table 3).

For instance, employment in the EC dropped from 250,000 in 1978 to 119,000 in 1990, while the US, which in 1966 had 100,000 production workers in the TV segment, was left in 1990 with 22,500 production workers (and a total employment of 30,800) in the whole consumer electronics industry. In Japan, the consumer electronics segment employed in 1990 over 290,000 workers (down from 316 000 in 1987) or 14.6% of total employment in the electric and electronic appliances industry and 2.5% of total manufacturing employment.

4. Research and development

Despite its high-volume, low-profit character, consumer electronics is now a source of critical innovations and is strongly driving high-tech electronics, also thanks to the technological convergence with the computer and telecommunications sectors. It is thus becoming one of the dominant forces exercising control over the underlying technological base (6). But given the pervasiveness of the electronics technology, its role as a driver is increasingly felt in the whole economy (7).

This is the result of large R&D expenditures by the industry leaders (Table 4). Over the period 1986-1990, the average R&D spending as a percentage of sales was above 7% for Sony, Matsushita and Philips, and above 5% for Sharp, JVC and Thomson. Although these levels are quite common in the electronics industry, which in same segments is even more R&D intensive, they compare well with the Japanese averages for manufacturing (over 3.3%) and for electric and electronic machinery (over 5.8%). But given that the majority of the large consumer electronics manufacturers are also active in the production of industrial electronic equipment and components, the evaluation of the consumer electronics-specific R&D intensity becomes more complicated. The production of components often requires larger R&D expenditures, and in fact most of the technology incorporated in consumer electronics products is due to high-tech components. Anyway R&D costs have become extremely important for leading edge firms. The substantial and risky investments (8) involved in developing new processes and products are unavoidable to stay competitive, and at the same time create strong barriers to entry.

The driving and critical value of the technology which is being developed in the consumer electronics industry allows for substantial spill-overs and synergies of the R&D programs undertaken for individual product groups. The ensuing economies of scope partially mitigate the high R&D costs. They may induce a strategy of vertical integration.

5. Capital investment

Consumer electronics is an high-volume industry which, at the high end of the market is also technology- and capital-intensive, with a high rate of equipment renewal. Manufacturers need to make heavy investments to reach large volumes, which, thanks to production efficiencies (steep learning curve) involved, can decrease costs and achieve higher yields. In turn the cost reduction allows for the setting of lower prices and the expansion of sales. In this way manufacturers may be able to recoup the large development costs and to gain profits, albeit on smaller margins. First-comer advantages may be particularly important given the short consumer electronics products life cycles and the often higher profitability of the initial period of a new product's life-cycle. The time between the introduction and the maturity of products has decreased from 3 to 4 years to something in the order of 18 to 24 months.

As is the case for high R&D costs, the high investment costs incurred in setting up production facilities constitute a substantial barrier to entry and to exit, given the large amount of sunk costs involved. Pricing strategies are in turn largely influenced by this industry characteristic.

The heavy capital and R&D investments (9) have brought about large improvements in productivity (10). But there appear to be large differences between companies and countries. For instance in 1990 sales per employee at Philips were less than half those at Sony and Matsushita. In a recent study (11) Japan emerged to be 15 and 28% more productive in consumer electronics than the US and Germany, respectively.

6. Concentration and competition

The industry is characterised by a high degree of concentration. Japanese corporations dominate the market world-wide, with Philips and Thomson as the only global challengers. Taking into account also the ownership of foreign production facilities, Japanese companies control around 55% of world production, accounting for over 99% of domestic production, and respectively 27 and 20% of production in Europe and the US. The EC industry represents nearly 20% of world production. After Thomson's acquisition of RCA, there are no US-owned companies among the industry leaders (Tables 4 and 5). The Finnish multinational Nokia, through a series of acquisitions in France and Germany, has become a third European company of major size. As for developing country firms, Korea's Samsung and Goldstar can be considered global players.

In Japan, five companies control three quarters of the TV and VCR markets. High degrees of market concentration are also evident in other product markets (Table 6). Five companies make up for almost 60% of the US TV market (Table 7). In order to improve productivity and respond to fierce competition from Asian manufacturers, the European industry has undertaken a wide-ranging process of industrial restructuring. The result has been an extremely high level of concentration. For instance in France six groups currently account for 92% of the radio and TV industry's total turnover and employ 91% of its work force, while in 1963 25 enterprises accounted for 83 and 81% of turnover and employment, respectively (12). The Korean market also appears very concentrated, with the three major groups sharing the total VCR and over 80% of the TV markets (Table 8).

Another outstanding characteristic of the sector is the high degree of vertical integration of all the major companies, and particularly the Japanese ones. They are in fact important players in the components markets as well as in the industrial equipment sector. The technology spin-offs which arise from R&D programs in the telecommunication, computer and semiconductor fields have proven quite important. In addition to being vertically integrated, Japanese companies are able to take advantage domestically of a network of thousands of high-quality components makers, which greatly contribute to their innovative capacity and productivity. Recently, with a view of achieving new synergies, both Sony and Matsushita have acquired a strong position in the "software" (13) side of the business through the acquisition of major US entertainment companies. Philips also owns the British company Polygram, one of the world's largest record firms.

Fierce competition characterises the industry. The once prosperous US industry was largely displaced in the audio segment during the 1950s, and in the TV segment during the 1960s and 1970s by Japanese and later south-east Asian manufacturers. The European industry, which managed to remain sheltered from foreign competition somewhat longer, at least since the 1970s has been subjected to stiff competition as well. It is now experiencing strong pressures both at the low end of the market from south-east Asian manufacturers, which still enjoy substantial labour cost advantages, and at high end of the market from Japanese companies, thanks to their mastering of product and production technologies.

7. Pricing

Price competition is intense in the consumer electronic market, with retailing prices showing a declining trend (Figure 5) in the face of overall consumer prices increases and both the improvements in quality and the incorporation of more advanced features into products (Tables 9 and 10). This has meant that, in general, much of the productivity gain has been passed on to the consumers. In particular for more "mature" products, such as TVs and increasingly VCRs, profit margins tend to be fairly small.

Pricing strategies are quite complex in the high-volume consumer electronics industry. In order to recover high development costs, manufacturers may want to command premium prices at least in the initial period after introducing a new product, but without limiting sales volume which allows for

economies of scale, scope and learning. On the other hand, to realise these economies, manufacturers may be even induced to practice "forward pricing", namely pricing at less than marginal cost, in the expectation that such low prices would generate enough volume to eventually cut production costs and generate profits.

Non-price competition also plays an important role. Product differentiation strategies through product innovation, design, quality and service are actively pursued. The Japanese manufacturers in particular are renowned for their extraordinary rate of new product development. Brand loyalty and strategic control of distribution allow a broader range of pricing options, including price discrimination, which may lead to larger profit margins (14). Besides, through their own network of retailers, some manufacturers have the advantage of maintaining close contact with their customers and of being able to provide pre- and after-sale services (15). Recently the manufacturers' control over distribution has been somewhat weakened by the growing role of mass merchandisers and buying groups.

Access to distribution channels has proved very important to penetrate foreign markets. Stencil brands (standardised products labelled with the buyer's brand) were largely used in the US. For instance, the possibility of marketing monochrome TVs through Sears Roebuck proved for several Japanese manufacturers very effective in gaining a large share of the US market.

III. International Trade

1. General trends

International trade in consumer electronics has been growing fast, with above-average rates during the 1980s (Table 18). Total exports now stand at around USD 45 bn (16). With a share of over 30% in 1991 (Table 11), Japan is definitely the prominent source of exports globally, but it is fiercely contested by both European and far-east Asian manufacturers (Tables 12 and 13). Although new digital technology applications may provide a window of opportunity for a come-back, the US industry has been relegated to a secondary role.

An important component of Japan's post-war industrial development policy has been played by the strategy of export expansion in the consumer electronic industry. The ratio of exports to production in fact steadily grew, reaching 77.5% in 1985. But after this spectacular expansion up to the mid-1980s a declining trend has set in (Table 14), which has been more than compensated by the growth of other segments of the electronics industry. The export composition has thus substantially shifted. The consumer segment, which accounted for 39.1% of total electronics exports in 1985, decreased in 1992 to only 20%, while both the industrial equipment and the component segments have shown an increase, quite large for the latter rising from 30.6 in 1985 to 47.4 in 1992. This change may be attributable to macroeconomic factors such as the rise of the yen which, inter alia, has induced a substantial migration off-shore of production facilities, as well as to the increasing international competition in the segment, especially from south east Asian countries.

Import penetration (17), although rising in recent years, remains in Japan at very low levels as compared to those registered in other OECD countries. From 2.1% in 1985, it reached 5.8% in 1990 and 9.4% in 1992. Some of this increase is the result of shipments from Japanese foreign subsidiaries, which may also partly explain the increase in components trade.

The geographical distribution of Japanese consumer electronics exports is very balanced, with Europe accounting for 33.3% of the total, North America 32.2% and Asia 28.2% (Table 15). On the contrary imports, while steadily rising, still remain in absolute terms at a quite low level, and are very concentrated in Asia, which accounts for 84% of total imports (Table 16). Also quite concentrated in Asia appears to be the export of components, with a share of 43%. Both these trends seems to be again explainable, at least in part, by the extensive Japanese investments in this area.

Both the US and the EC have large and structural trade deficits. Import penetration is also high, well over 50% and 60% respectively in the EC and the US. Japan is the first exporter to both markets, followed by south-east Asian countries, such as South Korea in particular and, recently, also China (Tables 12 and 13). As for the US, Mexico is the second largest supplier, but much of the export flows originate from maquiladora plants of US, Japanese and South Korean ownership. EFTA countries, and in particular Austria, represent an important trade partner for the EC. As is the case in Asia, international trade has grown more concentrated regionally also within Europe and North America (Table 17). Foreign investments seem to have played an important role by substituting inter-regional trade, mainly from Asia towards Europe and North America, with regional production and trade.

The consumer electronics industry has proved very important also for the economic development of developing countries, which have substantially increased their share in world consumer electronics trade (Table 18). DAEs, Mexico and China have been particularly successful. They have recorded very positive trade performances thanks, above all, to their competitiveness as low-cost manufacturers of standard products, but also to the economic policies pursued by their governments. Both these factors have contributed to induce numerous export-oriented investments from OECD countries.

2. Trade in intermediate products and international sourcing

Components are essential for the production of consumer electronics items. But since electronic components find their way into consumer products as well as industrial electronic equipment, automobiles and numerous other products ranging from photographic to medical equipment, it is not easy to estimate where the component’s industry output is used. Similarly it is hard to evaluate the international trade flows of electronic components related to the production of consumer electronics items. One estimate assigns to consumer electronics around 18% of total component demand (18). Total world exports of parts and components mainly incorporated in audio and video products (19), which anyway do not include all those used, accounted in 1991 for almost USD 24 bn. Japan represented a 20% of the total.

The availability of quality components is extremely important for the competitiveness of consumer electronics producers. Large manufacturers, in particular Japanese, are typically vertically integrated in the design and production of various components, thus enjoying substantial technological spin-offs. Their vertical integration is considered a quite important competitive advantage. On the contrary the excessive reliance of both US and European manufacturers on external sourcing has been sometimes blamed as a source of "hollowing out". Furthermore, dominating the supply of a key component gives an important leverage in downstream product markets. These considerations have provided some of the rationales for the introduction of de jure or de facto local content rules.

An extensive network of procurement relations links the major consumer electronics companies. Some of them have established a series of component production facilities and/or international purchasing offices, above all in the Asia-Pacific region. Again Japanese companies have spearheaded the process. For example, through co-operating firms, a Japanese company can procure resistors made in Korea, condensers made in Taiwan, transformers made in Hong Kong, magnetic heads and integrated circuits made in Malaysia and TV cathode-ray tubes made in Singapore, and assemble them in Singapore or Malaysia for markets in Asia, the US or Europe (20). These relations are by no means only restricted to the Asia-Pacific region. For instance Korea’s Goldstar TV plant in Italy uses picture tubes made by Finland’s Nokia.

A particularly intense form of collaboration between companies, which gives rise to large flows of trade in components, is represented by the "Original Equipment Manufacturer" (OEM) arrangements. OEMs build products to their customers’ specifications for sale under their customers’ label. OEMs located in developing countries usually import a large share of the components. For instance over 99% of the components used in Mexico’s electronics maquiladoras are imported (21). OEMs in turn sometimes subcontract part of the manufacturing process. As a result, the origin of consumer electronics products becomes increasingly more difficult to ascertain.

Subcontracting, also known as contract electronics manufacturing (CEM), has grown very intensely to be projected as a USD 22 bn global business by the mid-1990s and it is quite important also for the consumer segment. Industry leaders, such as Sony and Matsushita, are making use of CEM as part of their global strategies to foster international competitiveness. CEM is considered to provide fast response time, flexibility, quality and cost-effectiveness. CEM clearly entails flows of both components and intermediate products.

3. Intra-firm trade

Intra-firm trade (IFT) is defined as the international exchange of goods and services within a multinational enterprise (MNE) (22). IFT accounts for a little over a third of total US merchandise trade (23). It is particularly difficult to calculate the share of IFT in US trade in consumer electronics due to classification problems.

In the category which includes Radio, TV and Communication (RTC) equipment (23), IFT accounts for less than 10 per cent of total US trade. It is impossible, unfortunately, to separate trade in communication equipment, such as transmitters, receivers and antennas, where IFT is probably less important, from trade in consumer electronics, where IFT could be higher.

In the category which includes electrical household appliances (25), data are available for US firms abroad, but not for foreign firms in the US. It is possible to estimate, however, that at least a third -- and perhaps as much as half -- of US trade in appliances, is IFT.

IFT in either sector does not appear to have increased in the 80s. These figures exclude wholesale and related activities, in which the US has seen a large increase in inward foreign direct investment in the 80s (26).

Most of the intra-firm trade in the RTC sector consist of US affiliates of Japanese and European firms importing into the US. Intra-firm trade by US affiliates of foreign firms is twice as large as IFT by US-based multinationals in the sector.

US-based multinationals in the radio, TV and communication (RTC) sector export as much as they import intra-firm. While their intra-firm exports are highly concentrated -- 85 per cent go to Canada, with most of the rest going to Latin America --, their intra-firm imports are more diversified -- coming from East Asia, Latin America, Canada and Europe.

US-based multinationals in the household appliance sector export more than they import intra-firm. Both intra-firm exports and imports are highly diversified geographically.

4. Intra-industry trade

Intra-industry trade (IIT) is defined as the exchange by two countries of goods and services within the same product category. IIT is generally a function of product differentiation and may or may not be intra-firm trade. IIT indices provide another tool for analysing trade patterns as they may show the extent of international linkages for a given industry (27).

IIT indices for US trade in consumer electronics (28) are considerably below the average for all manufacturing, due to the large US trade deficit in that sector. US IIT indices for trade in consumer electronics decreased from about 30 per cent in the early 80s, to about 20 per cent in the early 90s.

Bilateral IIT indices are highest with Europe, but there is relatively little transatlantic trade. US bilateral indices with Mexico and Canada are close to the average for the sector. IIT indices with Canada decreased sharply in the 80s, as US imports went down, increasing the US trade surplus with Canada in that sector. IIT indices with Mexico were relatively stable in the 80s. The US went from a net exporter to a net importer from Mexico, as US imports increased substantially. Bilateral indices with Japan, South Korea and other East Asian countries are extremely small, due to the large US sectoral trade deficit with those countries.

IIT indices for Japanese trade in consumer electronics have increased in the 80s, but are still below the Japanese average for all manufacturing -- which, in turn, is quite low for OECD standards. Japanese sectoral IIT went from less than 5 per cent in the early 80s to more than 10 per cent in the early 90s. This was mostly due to the increase in Japanese imports from the rest of East Asia, which reduced the overall Japanese trade surplus in that sector.

Japan's bilateral IIT indices are extremely low with North America and Europe, due to the large Japanese trade surplus. They are higher with South Korea -- between 50 and 60 per cent --, where Japan has a sectoral trade deficit and where trade is more balanced. Bilateral IIT indices for consumer electronic trade with other DAEs -- excluding South Korea -- have seen the largest increase in the 80s, going from less than 15 to more than 30 per cent. This was due to the increase in Japanese imports from those countries, which considerably reduced the Japanese trade surplus with that region.

IIT indices for European trade are large -- between 60 and 70 per cent -- but somewhat below the the average for all manufacturing sector. Although intra-European trade has high IIT indices, the overall European trade deficit in the sector -- mostly with East Asia -- reduces the indices.

IV. Foreign direct investment and inter-firm networks

1. Foreign direct investment

Foreign direct investment has been actively pursued by all the major players in the consumer electronics industry. Unfortunately no aggregate FDI data on the industry seem to be available, hence the following review focuses on firm experiences. Philips, a company over one hundred years old, has probably the longest history as a foreign investor in the sector. Already in the 1930s it was present in the US and now the company manufactures in around 60 countries. Philips has also various participations in Japan, including the subsidiary Marantz Japan Inc. Confronted with stiff competition initially mainly from Japan, many of the large European manufacturers have started to invest in the low-wage countries of south-east Asia, but also in Mexico and very recently in Eastern Europe. For instance Thomson has now 39 industrial operations in 17 countries, in addition to 7 research centres.

More recently the innovation in production methods, through the use of labour-cost-reducing and labour-quality-augmenting automation equipment, are even inducing some manufacturers to relocate the production of low-end products in developed countries. Nokia, for instance, in order to cut costs and improve quality has recently shifted production of its small-screen TVs from Singapore to Germany.

The Japanese companies began investing abroad much later than Philips. In general they have done so also less intensively. The industry leader, Matsushita, albeit admittedly a quite "conservative firm", has been particularly slow to shift production abroad, at least until the mid-1980s. Still in 1985 its overseas production accounted for only about 12% of its world-wide sales and has now reached 18%.

After a gradual increase in the 1960s, the 1970s saw an expansion of Japanese investments, above all in the neighbouring Asian countries, in order to take advantage of low-wage labour. And still today more than half of the overseas production facilities of Japanese companies are in Asia (Table 19). The successful export performance in the US and Europe, which elicited protectionist responses in both markets, is at the basis of a second vintage of "defensive" investments in Europe and the US during the 1970s and afterward.

In the EC, as a result, by 1987 there were 32 Japanese plants making or assembling colour TVs and other items, 18 of which were in the U.K. After being the target of various trade policy measures, Korea's "big three" -Goldstar, Samsung and Daewood- followed suit during the second half of the 1980s. In 1991 there were 68 Japanese and Korean plants in the EC, as opposed to 108 European, employing around one-sixth of the total work force. The U.K. remains the preferred location, followed by Germany, Spain and France.

A quite similar pattern can be detected in the US. In 1972, Sony was the first Japanese company to manufacture TVs in the US. It was subsequently followed by all other major companies. Then, starting with Goldstar in 1981, the three Korean companies have set up shop in the US. Since 1976, the Taiwanese electronics company Tatung has also been manufacturing colour TVs in the US. Practically all the FDI in Mexico is related to the US market, so that all the major TV manufacturers that sell in the US have Mexican assembly facilities. Philips has based half of its North American production in Mexico.

It may be argued that most of the Japanese "defensive" investments in Europe and the US were probably regarded as second best solutions, mainly motivated by market access considerations. But after the initial start-up difficulties were overcome production cost differentials between overseas and Japanese operations seem to have levelled off (29). It is noteworthy that one Japanese-owned US manufacturer has recently begun exporting large-screen TVs to Japan, incorporating picture tubes also made in the US.

Japanese companies have recently been confronted with various developments, including the appreciation of the yen in the mid-1980s, increased competition of DAEs manufacturers and the near saturation of some markets. These factors together with the rapid innovation in both product and production methods, have contributed to the emergence of a more coherent strategy of "global specialisation" based on an intra-firm division of labour along two main lines.

First, the production process may be divided into sub-processes to be located where they can be carried out most efficiently. For instance the yen appreciation led less productive, small- to medium- sized part and component manufacturers to shift production to other Asian countries. Second, geographical specialisation by product lines is pursued. "Commoditazed" items including radios, tape recorders and small and medium TVs (30), which require a standardised technology and a large amount of labour, are produced in Asian developing countries, such as Malaysia, Thailand and recently China, as well as Mexico, mainly to serve the US market (31), while more high technology and high value-added products, such as some VCRs and large-screen TVs, are manufactured either in Japan or in other developed countries. In this respect a strategic choice is made whether to retain the production in Japan. For CD players (32),

laser discs or camcorders, which have not quite reached the peak of the product cycle, there is still some reluctance to transfer production overseas. Thus this global specialisation strategy has also the beneficial effect of allowing Japanese firms to concentrate domestically on higher value-added, more knowledge-intensive and higher income upscale products. A similar pattern applies in general to the manufacture of components.

Transportation costs and physical qualities of products are also an element in the firms production location decisions. TVs' fragility in fact increases with the monitor size as do transportation costs. On the contrary these factors are much less important for audio products or for the majority of components such as printed circuit boards, which are cheap and easy to transport.

Thus it appears clear that in the consumer electronics industry exchange rates, trade policies, production and product characteristics, and technological developments have a momentous impact on companies' strategies and, specifically, on the ratio of exports to overseas production as well as of imports -from foreign affiliates- to domestic production.

Some new developments in the business are again somewhat modifying the global strategies of the industry leaders. The importance of keeping product developers and manufacturers in contact with consumers, the mounting pressure to "localise" by increasing local content, which also entails some local component development, and the growing difficulty of managing world-wide operations from a centralised home base have given rise to a tendency towards a "regionalisation" of overseas operations. More management decisions, product development and manufacturing operations are undertaken in each of the main regions, increasingly seen as self-contained.

To this end, for instance, both Thomson and Matsushita have adopted a tripolar system of headquarters (Europe, North America and Asia), while Sony has separated the management of the domestic operation from that of its three main markets, giving responsibility for Asia to the regional headquarters in Singapore. But quite clearly, at the management level, the "regionalisation" trend is countered by the necessity to take strategic decisions centrally, in part because some of the most important consumer electronics products are essentially "global" ones, such as the Walkman personal stereos, CD players or video cameras.

Finally the importance for manufacturers of keeping in touch with leading-edge research and innovation centres needs to be underscored. This is one of the motivations which has led practically all the major Japanese manufacturers to establish significant wholly-ownwed R&D facilities in the US (33) and often in Europe as well. This development represents an important element in the global strategies of "network" multinationals which aim to take advantage of the "best" elements of each of their many locations, in terms of technological, production and marketing capabilities. At the same time it seems still possible to argue that, unlike European companies, the bulk of Japanese R&D is done at home. Overseas R&D centres concentrate on adapting technology to local requirements, such as different voltages or broadcasting systems, while development of new technologies and products is still rare. One example is the digital video recorder which was developed by Sony in the U.K.

2. International acquisitions and minority participations

International acquisitions are an important weapon in the consumer electronics companies' globalisation strategy arsenal. Both US and European market structures have been largely affected by international acquisitions. Virtually all US manufacturers, with the exception of Zenith, have been taken over by either Japanese or European competitors. And even Zenith has recently sold a 5% participation to Korea's Goldstar. In 1974 Matsushita acquired the TV division of Motorola and its brand Quasar; in the same year Philips purchased Magnavox and in 1980 it bought the Sylvania and Philco brands; in 1977 Sanyo acquired Worwick; in 1987 Thomson acquired the consumer electronic division of General Electric, which had absorbed RCA a year earlier. Already by 1980 of the 27 US TV producers existing in 1960, only 3 remained - RCA, GE and Zenith.

Recently, both Sony and Matsushita have invested heavily in the US entertainment industry, which is considered to be strategically complementary to consumer electronics. The former bought CBS record company in 1988 and Columbia Pictures in 1989, while the latter purchased MCA the following year. Toshiba has acquired a 6.25% stake in Time Warner, the media conglomerate. The role of the entertainment "software" seems to be particularly important in view of the new digital technology which will remove the differences between the various information media -video, text, sound-, merging them into the framework of "multimedia". This will mean the introduction of "multimedia" systems, based on the combination of consumer electronics, telecommunications, computers and entertainment products and services. To face this new challenge various Japanese companies have been investing in small but leading-edge US companies which are already developing these new systems and the related multimedia software. The only European firm active in the entertainment business is Philips which owns the record company Polygram.

Over the past fifteen years European manufacturers have engaged in extensive restructuring to face the stiff competition of Japanese and south east Asian companies and, more recently, in preparation for the completion of the Single Market program. After taking over GE's consumer electronics activities in Spain in 1974, Thomson acquired, between 1978 and 1983, Nordmende, Saba, Dual and Telefunken in Germany and in 1987 the consumer electronics division of Thorn EMI, the leading TV maker in the U.K., under the brand name of Ferguson. In 1979 Philips purchased a minority stake in Grundig, which it increased to a controlling interest in 1984. In 1990 it also bought a minority stake in the Danish company Bang and Olufsen. Since 1987 Finland's Nokia has become the third European consumer electronics company through its acquisitions of the Electrolux group's shareholding in Oceanic in France and of the ITT subsidiary in Germany.

According to one source (34) in the aggregate between 1988 and 1992 there were 73 acquisitions totalling over USD 1,1 bn. The countries more active in purchases were the U.K. (with 12 operations involving USD 284 mn), Hong Kong (5 and 274 mn), Japan (6 and 236 mn), Korea (1 and 140 mn) and the US (8 and 104 mn). The top seller countries were the US (17 operations involving USD 531 mn), Japan (3 and 236 mn), the U.K. (11 and 216), Germany (10 and 148 mn) and France (7 and 20 mn). If compared to other sectors the total amount recorded in the database does not seem to indicate a strong acquisition activity in the period of observation, which is consistent with the high degree of concentration already reached by the industry.

Again in relative terms and for the period 1988-1992, minority participations and joint ventures totalling USD 388 mn appear to have been even less important. Countries with companies more frequently involved in international operations of this kind were Japan, the Netherlands, Germany, the US and France. Countries most frequently hosting these transactions were the US, Japan, Germany, the U.K. and Malaysia.

Although the aggregate outlays involved may not be particularly large, some ventures certainly have a strategic value when, for instance, are geared towards developing key technologies, or technology-intensive components. An example could be the recent joint venture between Philips and Thomson in the field of active matrix liquid crystal displays, a very important component for HDTV systems. Japanese manufacturers appear to have formed several joint ventures in Europe as a way, inter alia, to ease trade frictions. Agreements, such as the joint venture between Thomson and JVC, have allowed EC companies to reduce the technological gap (35), while making available their marketing strengths to their Japanese partners. Joint ventures may also still be a very important vehicle to invest in developing countries.

3. Market shares of foreign-controlled firms

In 1990 the European market was supplied for over 50% by imports and for another 17% by local production carried out by manufacturers under foreign control, which represented almost one third of total European production (Table 20). But in Europe substantial differences in market shares exist depending on the specific product market and country. The TV market is dominated by the three major European manufacturers, which share around 45% of sales. In some countries local producers, such as Finlux in Finland (until Nokia’s acquisition in 1992) and Seleco in Italy, still keep a substantial share in the national market, while in others, for instance the U.K., virtually all domestically produced colour TVs and VCRs are made by foreign-owned firms. As for VCRs in general, Philips and Thomson share less than 20% of the market, while the rest is dominated by Japanese manufacturers (Table 21).

In the US, Zenith is the only remaining US-owned TV manufacturer. In 1990 it held a 12-13% share of the domestic market. The rest of the US production of TVs is shared by foreign-controlled companies. In the same year EC- and Japanese-owned companies each held 35% of the US market, with Korean and Taiwanese manufacturers sharing the remaining 17%. In 1992, Zenith closed its US plants and relied entirely on its factories in Mexico, thus practically leaving no domestic TV production made by US-owned firms. With virtually no domestic sources of the main components, almost no VCRs, camcorders, tape players, recorders, radios, phonographs, or CD players are produced in the US.

In Japan, the market share of foreign-controlled firms in the consumer electronics sector is negligible.

4. International collaboration agreements

As mentioned above, OEM and subcontracting arrangements are quite common among consumer electronics manufacturers. They are often used to take advantage of developing countries' comparative advantage in terms of labour costs. But they are also increasingly employed for the fabrication of technology-intensive items. For instance all the camcorders marketed by Philips are actually produced by other manufacturers on a OEM basis and Matsushita's new high definition laser disc player is procured from Sony through a OEM agreement. This reliance on collaboration between firms, possibly emphasised in a recessionary period, may be due, inter alia, to the increasing costs needed to develop new technologies and products.

The same rationale could motivate the use of other forms of collaboration between corporation, generally referred to as "international alliances". In the aggregate over the period 1964-1992, consumer electronics manufacturers seem to have made recourse to alliances less frequently than firms in other sectors. In general large manufacturers from France, Germany, the Netherlands, the U.K., the US and Japan have been the most active. The most important aims have been production and development followed by marketing (36).

More recently the digital technology which is merging computing, communication and video functions into consumer (and professional) products has been spurring a number of alliances. They involve consumer electronics manufacturers and computer, software and telecommunication companies such as AT&T, Texas Instruments and Apple.

A related motivation is the desire to avoid costly "standard wars" similar to that which pitted Philips, Sony and JVC/Matsushita against each other over the VCR standard. So great are the economic stakes involved that manufacturers are increasingly entering into risk-hedging arrangements. For instance Matsushita, Pioneer, Sanyo, Sony and Toshiba have all agreed on the standard for high definition laser disc players. Sony and Philips, which are strongly pushing respectively their Mini Disc and Digital Compact Cassette (DCC) systems, have at the same time signed an agreement to share the Mini Disc know-how in exchange for a DCC licence.

In an industry characterised by innovation, high R&D spending and proprietary technology, licensing agreements are strategically important. For instance the possibility of widely licensing from the technological leaders -RCA and Philips- clearly facilitated the Japanese successes in TV manufacturing. The general but not universal willingness to license may in part be explained by the technological interlinkages existing in complex products which incorporate many components covered by patents belonging to different companies. In addition, to gain the industry acceptance for its standard, a company may be induced to let other companies produce through licensing. This was Matsushita and JVC's decision which secured the victory of their VHS format for VCRs in the battle against Sony's Betamax format.

Together with sharing technological and manufacturing capabilities collaboration agreements may allow a company to profit from another's local marketing expertise and distribution strength. In a data base of strategic alliances for the period 1980-89 more than half of those recorded gave market access and market restructuring as the main motives (37).

V. Government policies

1. Standards and regulation

Standards can open up new market opportunities or can stifle product sales, can remove trade barriers or create them, can promote or inhibit innovation all with great economic consequences. Standards may emerge from market-place rivalry, when one competing standard manages to muster enough support in the market to become the industry standard. The current confrontation between the Mini Disc and the DCC systems is a case in point.

In other areas, such as TV broadcasting, the standard setting process is reserved to public authorities, both national and international. The fact that in Europe two standards, different from that adopted in the US and Japan, were chosen, together with the refusal of the patent holders to grant licenses to non-European companies, significantly restricted access to the European market until the early 1970s. It is thus clear that the selection of a common or multiple standard for HDTV will have a very large impact on the consumer electronics industry. HDTV sales are now projected to reach 5 mn units by 2001 and more than double that level by 2003.

HDTV is a major technical improvement over the existing system based on the PAL and SECAM standards in Europe and the NTSC standard in the US and Japan. It will allow visual images to be transmitted with much greater clarity, especially if used with large, flat-screen panel displays. When integrated into a "multimedia" system, it also holds the promise of making available to the consumers a wide range of video and data services through their TVs. HDTV makes use of a large variety of technologies with related standard issues. The HDTV signal contains much more information than the signals used today, which means that the transmission system and equipment and the programming format as well as the TV sets need to be able to convey and receive it.

Consumer electronics manufacturers are heavily involved in HDTV research in Japan as well as in Europe and the US. In Europe and Japan the two respective systems, HD-MAC and MUSE, developed with the substantial assistance of public funds, are both based on basically analogue technology and thus becoming obsolete, as digital technology is rapidly advancing. This has prompted the recent EC's move toward supporting digital technology. Japan is also reviewing its policy. In the US there are presently four digital systems under consideration by the Federal Communications Commission (FCC), which has already indicated its preference for the digital technology. The four systems have been developed by three consortia which involve US and European-controlled companies. Recently they have agreed to form one alliance to co-operate technologically and to share the future licensing fees.

The importance of using environment-friendly products and production methods has started to be felt also in the consumer electronics industry. Aside from the growing consumer preference for "green products", manufacturers have also to comply with new legislation in the field. For instance Germany has recently introduced a law requiring equipment manufacturers to take back used TVs and other electronic items for recycling. Five European companies, supported by the German Ministry for Research and Technology are currently pursuing a project for the design of a "green TV" which could be easily disassembled and recycled.

2. Industry and technology policies

In general the consumer electronics sector has enjoyed little direct support in OECD countries. Government assistance and guidance have played an important role in the development of the Japanese electronics industry. Already in 1955 MITI had formed a Computer Research Committee, specifically entrusted with promoting transistor research, which has proved to be a winning strategy for the development of the whole electronics industry. In the following years other initiatives were taken to foster the growth of the sector. In particular government support focused on research and development activities and was carried out under "The Law on Extraordinary Measures for Promotion of the Electronics Industry" of May 1957. Since 1968, under the guidance of MITI and the Ministry of Posts and Telecommunications, the Japanese broadcasting Corporation (NHK) has been researching and developing its HDTV system, MUSE. This early start has meant that Japanese manufacturers are already supplying some niche markets in industrial TV systems, film-making, electronic publishing, medical training and supercomputer graphics.

Some EC member countries have tried to support the consumer electronics industry mainly with the view of preserving employment, with mixed results. Much more important appears to be the EC technology policy organised around various co-operative research programs, such as Jessi, Eureka, Esprit and Race. They cover various areas, from semiconductor to telecommunications, which all have a potential beneficial effect on the consumer electronics sector. In particular since 1986 the EC and the leading European companies have devoted great efforts to the development of an analog HDTV system under the framework of the Eureka 95 project. The much smaller Eureka 256 project is engaged in the definition of a digital HDTV transmission standard. In July 1993, the EC Council also approved 228 mn ecus action plan to aid the European broadcasting industry to produce and transmit wide-screen programmes which are an important element towards the introduction of HDTV.

The strategic importance of HDTV technology was clearly felt also in the US, both because of the interlinkages with the semiconductor and computer industries and because of its military applications, such as military aircraft displays in cockpits (38). The approach chosen has been to make available a limited amount of public funds for precompetitive research on generic technologies. The Department of Defense, and in particular the Defense Advanced Research Projects Agency, has provided some funding to industry to finance the development of HDTV flat-panel displays. The National Institute of Standards and Technology has also allocated some resources to HDTV projects.

Government support policies have been instrumental to the success of the consumer electronics industries in some south east Asian countries and notably in Korea and Taiwan. Trying to upgrade its electronics industry Korea has recently set up a HDTV development plan which provides for a jointly funded partnership between electronics corporations and public research institutes.

Eligibility requirements for participation in publicly-sponsored programs seem to be quite restrictive everywhere, begging the question of how to define the nationality of foreign-controlled subsidiaries which engage in substantial local production and R&D activities.

Finally it should be noted that some of the large consumer electronics manufacturers are also very active in the telecommunication and data processing sectors where public regulation and procurement may have provided some protection and economic advantages beneficial to the overall performance of the companies.

3. Foreign investment policies

Europe, south east Asian countries and the US have been the major recipients of foreign investment flows. Until the early 1970s some EC member countries (39) maintained a negative posture towards Japanese inward investments. Thereafter, instead, with some exceptions, they have been actively competing to attract inward investments. The U.K. has been particularly successful, making ample use of EC regional aid funds.

Japan does not seem to have specific foreign investment policies in the sector. The very low presence of foreign investors parallels low activity in other sectors and might be viewed as an indication that some structural impediments exist in the market.

After a period of import substitution policies, which somewhat constrained foreign investments in the form of joint ventures, some south east Asian countries have adopted more liberal policies toward FDI. This has clearly facilitated the flow of investments. Some restrictions still remain. For instance in Korea, while foreign companies are allowed to manufacture parts and components, they cannot fabricate final electronics products. Starting in the second half of the 1980s, Malaysia and Thailand have been particularly successful in attracting foreign investments, thanks both to their good economic performances and to their more consistent FDI promotion policies. Export processing zones have been an effective instrument of investment promotion in Malaysia but also in Mexico, the only non-Asian developing country to have achieved a substantial development in the consumer electronics sector.

In the US inward investments in consumer electronics do not appear to have ever encountered any restriction. But the "national security" implications of the production of many electronics components and of HDTV system might require that foreign companies wanting to make an acquisition in these sectors file an Exon-Florio notice and possibly undergo a CFIUS investigation. As for investment promotion, mainly State Governments have provided incentives for foreign investors, such as low-interest financing.

4. Trade policies

In both the US and the EC trade policy instruments have been actively used to try to protect domestic producers mainly from Japanese and later Korean competition. Starting in the 1950s in the audio market and in the 1960s and 1970s in the video market the US manufacturers rapidly lost market shares to the Japanese companies. Although a series of management miscalculations led to a substantial loss of competitiveness, US manufacturers also alleged unfair trade practices on the part of the Japanese competitors.

From the 1960s onward a number of anti-dumping actions were pursued, albeit with little success also due to protracted litigation. Meanwhile in 1977 an Orderly Market Agreement was negotiated with Japan. Both the OMA and the AD actions proved ineffective in affording relief to local producers partly because the Japanese manufacturers moved some production and assembly operations to the US, through greenfield investments and acquisitions (40), and increased their exports of components (41). Furthermore exports from countries not covered by the OMA went up, prompting the negotiation of similar agreements with Korea and Taiwan. They all lapsed in 1982. Ultimately OMAs may have had the effect of allowing the foreign manufacturers involved to command higher prices and to enjoy larger profits. In 1984 stiff AD duties were imposed against Korean and Taiwanese colour TVs. Together with an AD order against colour TVs from Japan, they are still in place to date. In 1989 Zenith charged Asian manufacturers with circumventing the AD measures by shifting production away from headquarters countries. After one year monitoring the US Department of Commerce decided not to open an AD investigation. In September 1991 steep AD duties were imposed on Japanese producers of active-matrix liquid crystal displays, accused of engaging in predatory pricing. The duties were strongly criticised by both Japanese manufacturers and US downstream users, especially portable computers producers. In November 1991 Apple Computer filed an appeal with the US Court of International Trade, questioning the AD duties, claiming that injury to US producers could not be substantiated, as allegedly no US producer could supply displays of the quantity and quality necessary. The duties were subsequently lifted, but in the meantime had induced some US companies to move assembly operations off-shore to gain access to lower-priced supplies.

An important trade policy instrument, which may also constitute an incentive for foreign investments, is the provision of subheading 9802.00.80 which sets forth tariff treatment for eligible imported goods that contain US-made components. Under this provision the duty is applied to the full value of the imported article, less the value of the US components. As for TV receivers, the share of total imports accounted for by imports under subheading 9802.00.80 almost tripled during 1985-88, from 14 to 41%. In 1988 the share of total imports entered under this subheading was also a substantial 10% for other commodity groups such as tape recorders (including VCRs), radio receivers and related parts. The main source of imports was Mexico, followed by Canada, Taiwan and Malaysia (42). On the contrary the somewhat similar EC "outward processing arrangements" play a negligible role in the consumer electronics sector. EC imports after outward processing are more significant for some components and in particular semiconductors.

The EC and its member states have also made ample use of trade policy instruments, such as quotas, VERs, AD duties and high tariffs on particular products to protect European consumer electronics manufacturers from the competition of Japanese and Far Eastern producers. Aside from causing the European consumers a substantial loss (43), these measures have clearly induced Japanese, South Korean and Taiwanese companies to invest in Europe and to increasingly "localise" their operations in terms of components procurement (44) and later, partly, also of R&D. But they do not seem to have allowed any substantial improvement in the competitiveness of European manufacturers (45). For instance in the case of CDs, Philips, notwithstanding its initial technological lead and the subsequent tariff hike and imposition of AD duties, has not been able to prevail in the EC market.

In Japan tariff protection is generally low, for instance, 4% ad valorem for TVs as compared to 5% in the US and 14% in the EC. But market access problems of a structural nature have often been alleged. The largely captive and regulated distribution system is considered as creating an effective barrier against import penetration. Foreign manufacturers view this impediment as particularly damaging because it denies them the access to one of the three major world markets with ensuing losses in terms of economies of scale and learning, which are particularly important in a high-volume sector such as consumer electronics.

5. Protection of intellectual property

Consumer electronics is a technology-intensive sector where intellectual property rights (IPRs) represent an important source of income for many companies. For instance RCA, one of the most successful innovator, has been receiving roughly USD 100 mn annually since the 1970s in consumer electronics licence fees.

The strengthening of IPR protection both unilaterally and through bilateral or multilateral negotiations, including those undertaken in the framework of WIPO and GATT, should be considered beneficial for global companies with dispersed operations. Better IPR protection can in fact lessen the concerns that companies may have when engaging in technology transfers.

Rising R&D costs and technological interlinkages have been inducing companies to increase their recourse to technological tie-ups, but they have also spurred an increase in patent litigation which in turn may contribute to pushing corporations into collaborative agreements. The stake in high-technology patent litigation may be very high, as in the on-going dispute between Eastman Kodak and Sony over the alleged Sony’s infringement of Kodak’s patent on the recording technology used in high-end VCRs and camcorders.

Consumer electronics products may be a vehicle of copyright infringement when they allow pirate recording of video or audio proprietary materials. The issue came up with the introduction of the dual-deck VCR, and again recently when the advancement in digital recording technology was embodied in a new product jointly developed by Philips and Sony - the Digital Audio Tape (DAT) -, which could both play and record digitally. The strong opposition of music publishers, which refused to make available DAT versions of their music titles, substantially contributed to the commercial failure of the product. In 1989 the

industry representatives agreed on a device, called the Serial Copy Management System, which only allows the recording of digital copies from which no further digital copies can be made, through the encoding of a special signal. A similar problem will arise when digital VCRs become available.

6. Competition policy

The development of the consumer electronics industry has posed a series of very important competition policy issues. Although US plaintiffs have not been able to prove any antitrust violations, protracted litigation has focused the attention on the alleged collusive practices prevailing in the Japanese market. Indeed in its investigations in the late 1950s and 1960s the Japanese Fair Trade Commission had found evidence that companies had engaged in horizontal and vertical price fixing (46).

The relations between alleged collusion in one market and international trade was clearly put forward by the US producers, when they charged that Japanese dumping practices were all part of a larger attempt to monopolise the US market. In 1970, National Union Electric Corporation and in 1974, Zenith alleged that seven Japanese manufacturers and their subsidiaries had engaged in a predatory pricing conspiracy including the use of a cartel arrangement in Japan to charge supra-competitive prices there and to cross-subsidise, with the ensuing profits, below-cost predatory prices in the US. After lengthy litigation, in 1986, the US Supreme Court ruled that the Court of Appeals, which had in general supported the plaintiffs, had not applied the proper legal standards in evaluating the supporting evidence for antitrust conspiracy (47). More recently a small US company -Go-Video- alleged that the Japanese companies had conspired against its attempt to bring the dual-deck VCR to the market, for which it holds a patent, by pooling their numerous patents it would need to licence in order to manufacture the end-product, and refusing to deal (48). The case foundered on procedural grounds.

The general argument of collusion in the Japanese domestic market, while strongly disputed by the Japanese companies, is also often mentioned in trade policy discussions and in anti-dumping litigation. The low import penetration, allegedly partly due to the vertical integration into distribution, and the ensuing lack of import competition, is also considered an important factor in allowing collusion in the domestic market, which, in turn, may foster dumping. In addition, the importance of import competition seems to be clear in the European context, where impediments to parallel imports may be considered responsible for the still widely diverging prices in various national markets.

The strong entry barriers and the high degree of concentration in the industry both in national markets and world-wide may also be a cause of some concern. At least on one occasion the merger of two companies was blocked on competition grounds. The German cartel office considered unacceptable the proposed merger of Thomson and Grundig because it would have represented a 55% share of the domestic market. Finally strategic alliances and other co-operation arrangements have been regarded by competition authorities as being generally pro-competitive, particularly when they allow synergies in the innovation efforts of different companies. On the other hand monitoring remains important as they could become a vehicle for collusion.

Notes

1. This classification problem may create some difficulty when comparing different statistical sources.

2. The key components may be classified according to their main functions. They are: capture: optics, electro-optics, charge-couple device, microphones, sensors; processing: magnetic tape and disc, optical disc, CD, printers, semiconductor memory; transmission cable, satellite, optical fibre, microwave; display; cathode ray tube, flat-panel (LCD, EL, plasma).

3. One estimate puts the cost breakdown of TV assembly in the US at USD 90 for labour, 70 for overhead and 225 for components. A typical cost breakdown of manufacturing a colour TV in the EC is 22% overhead, interest etc., labour 10%, 40% colour picture tube, and 28% other materials and components.

4. "In a factory where Matsushita Electric makes Panasonic VCRs, a robot winds wire a little thinner than a human hair 16 times through a pinhole in the video head, and than solders it. There are 530 of these robots in the factory and they wind, and they wind some more 24 hours a day. They do it five times faster and more reliably than the 3,000 housewives who, until recently, did the same job with microscopes on a subcontract base in Japan's countryside. The robot even inspect their own work. ... Matsushita invented and custom-made all the 530 wire-winders to gain a competitive edge." A. Tanzer and R. Simon, "Why Japan Loves Robots and We Don't", *Forbes*, April 16, 1990, p.148.

5. The US hourly wage in consumer electronics in 1991 was USD 10.97 as compared for instance with USD 1.09 in a Mexican electronics maquiladora. See Office of Technology Assessment (1992), *US-Mexico Trade: Pulling Together or Pulling Apart ?*, US Government Printing Office, Washington, D.C., p. 164.

6. Several are the examples: "Miniature TV has been a driving force in display technology. Digital audio tape is a leader in storage technology. Compact discs are driving laser technology, digital signal processor design, and optical storage techniques. Camcorders are at the frontier in making demands on silicon chip processing power, and in miniaturisation technologies", see statement of Dr. Ian M. Ross, President Emeritus, AT&T Bell Laboratories before the Committee on Science, Space and Technology, Subcommittee on Technology and Competitiveness, U.S. House of Representatives, October 3, 1991.

7. "Today's technology is not being driven by the Strategic Defence Initiative. It is being driven by Sony Camcorders." Statement by Mr. W. Spencer, head of the US Sematech consortium, quoted in *Fortune*, May 6, 1991, p. 32.

8. For instance RCA spent USD 300 mn to develop its commercially unsuccessful Selecta Vision system (videodisc).

9. In the US consumer electronic industry the capital stock per labour hour has increased from USD 2.75 to 14.50 (1972 USD) between 1960 and 1985.

10. "If a Rolls-Royce had achieved the same productivity gains as the TV industry, a Rolls would cost today as a bicycle". The statement by the head of business development at a European electronics group is quoted in "How to stand out in a crowd", *Financial Times*, September 10, 1993, p. 17.

11. See McKinsey Global Institute (1993), *Manufacturing Productivity*, Washington, D.C.

12. See *EIU Marketing in Europe*, March 1993, p. 62.

13. In this context the term "software" refers to entertainment which runs on consumer products, such as films, TV program, recorded music etc.

14. See *Financial Times*, "Price flows undermining EC's single market hopes", August 3, 1992. In Europe for instance most of the major consumer electronics companies have wholly or majority owned distributors in each of the large markets to handle the distribution up to the point of wholesaler or retailer.

15. In Japan the major consumer electronics companies maintain large networks of "keiretsu" retail stores. Matsushita owns around 25,000 retailers; Toshiba 12,500; Hitachi 10,000; Sanyo 6,000. But the number of stores is steadily declining. See *Tokyo Business Today*, September 1990, p. 35.

16. There may be some differences in trade data depending on the differing aggregations used in the various statistical sources.

17. Import penetration is calculated as import over apparent consumption in value terms.

18. Quoted in The Economist Intelligence Unit (1990), *The International Electronic Industry*, London, p. 18.

19. SITC Rev. 2 subgroup 776.1 and items 764.92, 764.93 and 764.99.

20. See UNIDO (1990), *Industry and Development Global Report 1990/91*, Vienna, p. 81.

21. Products such as complete TV receivers or sub-assemblies manufactured in maquiladoras may enter the US under special classification provisions, subheading 9802.00.60 or 9802.00.80, of the HTS. Under these subheadings, US duty is applied only on the value of the imported product minus the value of the US content. See infra par. 100.

22. There are few sources of data on IFT, as information on the subject is not generally available in traditional trade statistics. Data on IFT are mostly available through firm surveys which involve the preparation of questionnaires by national authorities. This section is based on information provided by the US Department of Commerce, which conducts surveys of foreign affiliates of US companies and US affiliates of foreign companies. Relevant data is not available for other countries. For an explanation of the availability and problems with data on IFT, see OECD (1993).

23. See OECD (1993).

24. The US Department of Commerce uses the International Surveys Industry (ISI) classification in its surveys. There is a category for "household audio and video , and communications, equipment" (ISI 366), which includes electronic equipment for home entertainment, such as radio and television sets, video recorders, and compact disc players; auto radios, tape players, public address systems, and music distribution apparatus; phonograph records, pre-recorded magnetic tapes, and compact discs; radio and television broadcasting and communication equipment, such as cable television equipment, studio equipment, transmitters, transreceivers, receivers, and communication antennas; telephone and telegraph apparatus; and other communication equipment such as burglar and fire alarm apparatus, highway and railroad signals, etc.

25. Category ISI 363, which includes household cooking equipment, electric and nonelectric; household refrigerators and home and farm freezers; household laundry equipment, electric and nonelectric; electric housewares and fans, including household humidifiers; household vacuum cleaners; sewing machines; and other appliances such as dishwashers, water heaters, food waste disposal units, air space heaters and household floor washers.

26. There has been a large increase in investment in wholesale activities in the US. This trade is technically IFT, but different in character from the case where investment takes place in assembly operations. The figures above exclude IFT due to wholesale activities.

27. Intra-industry trade can be readily calculated for any given product category, as only the traditional bilateral trade statistics for that product category are needed. The interpretation of IIT data depends however, on how one defines that category, as the choice of the classification system and of the level of aggregation may strongly influence the results. For the analysis below, the Standard International Trade Classification Revision 2, at the four digit level,

was used. In the calculation of an IIT index, if exports are equal to imports, IIT is 100; on the other hand, if either imports or exports are equal to zero, IIT is zero. For a discussion of the theory and measurement of IIT, see Grubel and Lloyd (1975).

28. SITC Rev2 761, 762 and 763; television receivers, radio-broadcast receivers, gramophones, dictating machines, and other sound recorders and reproducers.

29. See Cowson and Holmes (1971, 174) and National Research Council (1992, 41)

30. Overall offshore production of colour TVs by Japanese manufacturers has exceeded domestic production since 1988.

31. Electronics maquiladoras usually produce finished items with high labour content and low profit margins, such as small and medium-sized TVs and telephones, and labour intensive components or subassemblies, such as circuit boards and subassemblies for large-screen TVs, to be shipped to the US to be incorporated into final products.

32. In 1992 the domestic production was well over 11 mn units, which compared with a overseas production of less than 5,000.

33. See D. Eleanor Westney (1993), "Cross-Pacific internationalisation of R&D by US and Japanese firms", *R&D Management* 23, 2, p. 171 et seq.

34. Data on international acquisitions, joint ventures and minority participations were kindly provided by KPMG Peat Marwick.

35. See J. McCormick and N. Stone (1990), "From National Champion to Global Competitor: An Interview with Thomson's Alain Gomez", *Harvard Business Review* (May-June), p. 130.

36. The INSEAD Collaborative Agreement Database, covering some 2565 agreements in all regions of the world and all industries, but with a focus on manufacturing, contains 108 agreements in the consumer electronics sector. Professor Deigan Morris, INSEAD, designed and developed the data base and holds the rights to it.

37. Quoted in *The Economist*, "Survey of Multinationals", March 27th 1993, p. 20.

38. HD imaging and displays has been included in the list of "National Critical Technologies" established by the National Critical Technologies Panel.

39. For instance British manufacturers persuaded the Government not to offer regional assistance to Hitachi in 1973. See W. Eltis and D. Fraser (1992), "The Contribution of Japanese Industrial Success to Britain and to Europe", *National Westminster Bank Quarterly Review* (November), p. 2 et seq.

40. A 50% local content requirement was imposed on these transplant operations.

41. The anticircumvention provisions of the 1988 Omnibus Trade and Competitiveness Act represent an attempt to eliminate this problem.

42. See USITC (1989), *Production Sharing: U.S. Imports under Harmonized Tariff Schedule Subheadings 9802.00.60 and 9802.00.80, 1985-1988*, Washington, D.C.

43. See National Consumer Council (1993), *International Trade - The Consumer Agenda*, London, p. 95-100.

44. Although there are no statutory local content rules, in order to skirt frictions some Japanese investors have aimed at reaching a 50% local content ratio which is similar to EC-owned companies' ratio. Because particular components may not be available in Europe, some Japanese companies have encouraged their main Japanese components suppliers to establish operations in Europe. As for radios, TVs and audio tape recorders specifically, Commission Regulations 2632/70 (OJ 1970 L279/35) and 861/71 (OJ 1971 L95/11) provide that these items acquire in general the origin of the country where the assembly or the incorporation of components attains at least 45% of their ex-works invoice price. This rule of origin has been regarded as a useful local content guideline for various consumer electronics products. The EC also mantains a 14% tariff rate against critical semiconductor componenets, such as D-Rams, used in many consumer electronics products. With almost no production capacity in Europe many downstream manufacturers consider this barrier damaging.

45. "In Europe, trade regulation may protect short-term profitability, but in the long run, productivity gap with the word leading-edge companies will increase. Protection designed to sustain a so-called "domestic" industry or protect existing jobs is done at the cost of high consumer prices, often much more expensive than the cost associated with the loss of jobs." See McKinsey Global Institute (1993), *Manufacturing Productivity*, Washington, DC., p.15.

46. See Matsushita Electric Industrial Co. v. Zenith Radio Corp., 475 U.S. 574 (1986).

47. See K. Yamamura and J. Vandemberg (1986), "Japan's Rapid-Growth Policy on Trial: The Television Case", in G. Saxonhouse and K. Yamamura (eds.), *Law and Trade Issues of the Japanese Economy*, University of Washington, Seattle.

48. See In re Dual-Deck Video Cassette Recorder, 1990-2 Trade Cas. (CCH) par. 69,141 (D. Ariz. July 25, 1990).

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Table 1

PRODUCTION, 1991
(millions of US Dollars)

Country	Consumer Electronics Products		Total Electronics Products
Austria	1 174		3 385
Belgium	698		5 457
Denmark	146		1 739
Finland	181		2 503
France	1 960		29 650
Germany	4 163		50 810
Ireland	15		5 113
Italy	1 040		22 610
Netherlands	95		8 449
Norway	7		1 432
Spain	1 222		7 395
Sweden	109		6 136
Switzerland	2 304		6 987
UK	2 511		28 418
Western Europe Total	15 624	(19.2%)	180 084
USA	6 162	(7.6%)	199 398
Canada	339		9 016
Japan	37 141	(45.7%)	207 489
South Korea	6 657	(8.2%)	25 484
Hong Kong	2 824		8 292
Malaysia	2 925		9 105
Singapore	2 045		16 850
Taiwan	1 712		15 594
Thailand	1 149		5 404
DAEs Total	17 312	(21.2%)	
Australia	135		2 752
Brazil	2 263		12 663
India	1 165		3 737
Indonesia	647		1 646
Philippines	156		2 222
Israel	170		2 358
South Africa	203		1 303
Total	81 317		696 395

Note : In brackets are the shares of total consumer electronic production
Source: Yearbook of World Economic Data 1993, Elsevier Science Publisher, Ltd., UK, Vol.1 and 2.

Table 2

MARKETS, 1991
(millions of US Dollars)

Country	Consumer Electronics Products		Total Electronics Products
Austria	669		4 378
Belgium	611		7 076
Denmark	343		2 516
Finland	293		3 133
France	3 460		34 581
Germany	8 009		58 303
Ireland	150		3 176
Italy	3 638		30 248
Netherlands	1 422		13 230
Norway	240		2 747
Spain	2 526		13 695
Sweden	747		7 157
Switzerland	777		7 062
UK	3 442		32 847
Western Europe Total	26 327	(35.1%)	220 150
USA	19 508	(26.0%)	216 669
Canada	1 880		15 710
Japan	16 407	(21.9%)	140 778
South Korea	2 287	(3.0%)	15 785
Hong Kong	703		5 866
Malaysia	370		4 529
Taiwan	859		9 111
Thailand	457		3 686
Singapore	690		8 913
DAEs total	5 366	(7.1%)	
Australia	821		6 913
Brazil	2 203		14 786
India	1 161		4 019
Indonesia	577		2 605
Israel	188		2 486
Philippines	122		979
South Africa	324		3 027
Total	74 885		676 011

Note : In brackets are the shares of total consumer electronics market
Source: See Table 1

Table 3

THOMSON CONSUMER ELECTRONICS

Locations	Hourly labour cost	Production	Work-force	Share of work-force	Share of sales
France	100	Headquarter, research, large-screen TVs, components	5 400	10%	10%
Western Europe	60-120	Large-screen TVs, components	7 200	13%	29%
America			19 200	36%	56%
US	45-90	US market			
Mexico	6-12	US market			
Asia			18 200	34%	3%
China	2	Radios, radio alarm-clocks			
Malaysia	5	Radios, radio alarm-clocks			
Singapore	22	Small TVs, VCRs			
Other			4 000	7%	2%
Poland	11	Small TVs			
Total			54 000	100%	100%

Source: J. Arthuis (1993), *Les délocalisations et l'emploi*, Paris, Les Editions d'Organisation, p. 68.

Table 4

MAJOR CONSUMER ELECTRONIC MANUFACTURES, 1991

Company	Location	Total Electronic sales (US$ mn)	(% change)	Total sales (US$ mn)	Net income (US$mn)	Return on equity	R&D as a % of sales	Foreign sales %	Fiscal year ended
Matsushita	Japan	36 638	4.0	56 014	999	3.8	5.6	48.0	3/92
Toshiba	Japan	26 602	0.0	35 507	297	3.3	6.7	29.0	3/92
Hitachi	Japan	25 169	3.8	58 388	959	4.4	6.7	24.0	3/92
Philips	Netherland	23 784	2.4	30 487	525	7.4	6.8	94.4	12/92
Sony	Japan	22 959	5.8	28 734	903	7.8	6.3	75.0	3/92
Thomson	France	12 640	-2.9	12 640	-124	-3.5	6.1	69.0	12/91
Mitsubishi	Japan	12 510	0.0	25 137	271	4.4	5.0	21.0	3/92
Sharp	Japan	9 704	0.3	11 691	294	5.2	6.5	50.0	3/92
Samsung	South Korea	7 131	9.4	7 131	94	6.9	8.5	58.0	12/91
Sanyo	Japan	6 060	7.2	11 933	127	2.3	5.2	41.0	11/91
Goldstar	south Korea	5 025	16.0	5 025	25	0.5	3.2	51.0	12/91
Pioneer	Japan	4 609	2.2	4 609	214	8.6	4.3	59.0	3/92
Nokia	Finland	3 010	-27.5	3 813	-149	-7.6	6.0	62.3	12/91

Notes: Electronic sales: Either a published figure or an Electronic Business estimate of revenue earned by each company from sales of electronics products and services; Net Income: Income from continuing operations after taxes and before extraordinary items or charges. Includes minority interest; Return on Equity: Net Income after taxes as a percentage of shareholders equity (preferred stock, capital stock surpluses, and retained earnings at the company’s year end); R&D: Company-sponsored research and development expenses; Foreign sales: Includes the country of origin’s sales to other regions as e percentage of total sales.

Source: "The Electronic Business International 100", Electronic Business, December 1992, p. 84-85.

Table 5

CONSUMER ELECTRONICS TURNOVER OF MAJOR COMPANIES IN 1989

(Bn ECUs)

Matsushita	19.5	
Sony	10.7	
Philips	10.1	
Toshiba	7.1	
Hitachi	6.1	
Thomson	5.0	
JVC	4.9	
Mitsubishi	4.1	
Samsung	3.4	
Goldstar	3.1	
Sharp	2.7	
Pioneer	2.6	(1988)
Sanyo	2.3	
Grundig	1.4	
Nokia	1.2	(1988)
Zenith	1.2	

Source: BIS-Mackintosh, reproduced in European Communities (1991b), p. 7.

Table 6

MARKET SHARE OF THE FIVE LEADING PRODUCERS OF AUDIO AND VIDEO PRODUCTS IN JAPAN (% 1987-88)

Colour TV sets 1988		VCRs 1988		Camcorders 1987	
Matsushita	24.0	Matsushita	24.0	Matsushita	23.0
Sharp	15.5	Victor JVC	15.5	JVC	20.0
Toshiba	15.0	Hitachi	13.0	Sony	20.0
Hitachi	10.5	Toshiba	11.0	Sharp	10.0
Sony	10.5	Sharp	11.0	Toshiba	9.0
Total	75.5	Total	74.5	Total	82.0

CD players 1987		Car stereos 1987	
Sony	30.0	Clarion	18.2
Columbia	12.0	Matsushita	17.3
Pioneer	10.0	Fujitsu	12.0
Matsushita	10.0	Pioneer	11.0
JVC	8.0	Sanyo	6.5
Total	70.0	Total	65.0

Source: Keizai Koho Centre, *Japan 1990: An International Comparison*, quoting Nikkei Sangyo Shimbun, June 15, 1989, for 1988 data and Tokyo Keizai for 1987 data, reproduced in the The Economist Intelligence Unit (1990), p. 69.

Table 7

US MARKET SHARE
(percent)

Producer	Brands	1986	1990
Thomson	GE, RCA	24	22
Philips	Magnavox, Philips, Sylvania	10	12
Zenith	Zenith	16	12
Sony	Sony	6	7
Matsushita	Panasonic, Quasar	8	5

Note: Shares are of sales to US dealers

Source: Television Digest, August 6, 1990, p. 10, reproduced in USITC (1992), p. 2.

Table 8

PRODUCTION SHARE OF MAJOR ELECTRONIC COMPANIES IN KOREA AS OF 1988
(percent)

	Rank & Share			
	1st	2nd	3rd	TOTAL
C-TV	SS (33.0)	GS (31.7)	DW (17.5)	82.2
B/W TV	GS (32.2)	SS (23.9)	DW (8.7)	64.8
VTR	SS (46.9)	GS (38.3)	DW (14.8)	100.0

Note: SS: SAMSUNG; GS: GOLD-STAR; DW: DAEWOO

Source: KIET, The Competitiveness and the Structural Change of Korea’s Electronic Industries, 1990.3, reproduced in Bark (1991) p. 32.

Table 9

	US Consumer price index (1986=100)		**US Producer price index** (1986=100)
Year	All items	TV receivers	
1986	100.0	100.0	100.0
1987	103.6	95.8	99.0
1988	107.9	93.3	95.3
1989	113.1	91.4	95.8
1990	119.3	89.7	94.6

Source: USITC (1992), p. 5.

Table 10

EVOLUTION OF RETAIL PRICE INDICES IN FRANCE, 1990-91 (1980=100)

	Annual average 1990	Annual average 1991	% change 1991/90
Total (index of 296 items)	184.0	189.9	3.2
Bread	186.0	192.7	3.6
Cars	178.3	182.2	2.3
Television sets	92.9	89.8	-3.3
Radios	83.5	80.5	-3.6
Recording & playing apparatus	76.3	72.2	-5.4

Source: INSEE, reproduced in EIU, Marketing in Europe, March 1993, p. 72.

Table 11

TRADE IN CONSUMER ELECTRONICS

SITC Rev.2 761+762+763 (in billions of US$)

MAJOR EXPORTERS	1980 Value (bill US$)	1980 Share (%)	1991 Value (bill US$)	1991 Share (%)	Principal Destinations of Exports (1991)
Japan	8.45	50.0	13.99	31.5	USA (28.9%);Hong Kong (8.8%);Germany (8.5%);China (6.3%).
Korea	0.84	5.0	4.41	9.9	USA (27.6%);Germany (7.3%);Japan (5.6%).
Singapore	1.01	6.0	4.23	9.5	USA (22.2%);Germany (12.5%);Hong Kong (7.1%).
Germany	1.65	9.8	2.80	6.3	France (18.1%);Italy (16.8%);UK (9.0%);Netherlands (8.2%).
China	0.00	0.0	2.31	5.2	Hong Kong (86.1%);USA (2.7%).
Taiwan	0.19	1.1	2.20	4.9	USA (39.2%);Germany (12.2%);Netherlands (5.8%).
UK	0.42	2.5	2.04	4.6	Germany (32.0%);France (14.8%);Italy (10.1%);Netherlands (9.4%).
USA	0.79	4.7	1.38	3.1	Canada (32.8%);Mexico (22.1%);Taiwan (6.6%).
Belg-Lux.	0.63	3.7	0.95	2.1	France (17.8%);Germany (17.6%);Netherlands (17.5%);Italy (12.5%).
Hong Kong	0.88	5.2	0.47	1.1	Germany (23.1%);USA (21.3%);France (9.1%).
Rest of the World	2.02	12.0	9.66	21.7	
WORLD	16.89	100.0	44.45	100.0	

MAJOR IMPORTERS	1980 Value (bill US$)	1980 Share (%)	1991 Value (bill US$)	1991 Share (%)	Principal Origins of Imports (1991)
USA	3.74	24.9	11.41	24.9	Japan (36.8%));Mexico (15.6%);Malaysia (10.9%);Korea (10.8%).
Germany	1.71	11.4	5.77	12.6	Japan (24.1%);UK (10.3%);France (8.7%); Korea (8.4%).
Hong Kong	0.49	3.3	4.42	9.6	China (53.9%);Japan (32.4%);Singapore (7.3%).
France	0.98	6.5	2.66	5.8	Japan (20.1%);Germany (13.6%);UK (11.4%).
Singapore	0.46	3.1	2.58	5.6	Malaysia (50.9%);Japan (35.5%).
Italy	0.87	5.8	2.39	5.2	Germany (20.1%);Belg.-Lux. (10.6%);UK (10.5%);Netherlands (9.8%).
UK	1.14	7.6	2.35	5.1	Japan (26.0%);Germany (10.9%);Singapore (8.2%).
Netherlands	0.80	5.3	1.68	3.7	Japan (22.0%);Germany (14.7%);Belg.-Lux. (13.1%);UK (9.8%).
Saudi Arabia	0.57	3.8	NA	NA	
Rest of the World	4.27	28.4	12.66	27.6	
WORLD	15.03	100.0	45.90	100.0	

Source: UN Comtrade

Table 12

CONSUMER ELECTRONICS

EC STRUCTURE OF IMPORTS AND EXPORTS, 1991

(mn ECUs)

	Exports from EC	Imports to EC	X/M (%)
Japan	40	5 960	0.7
South Korea	16	1 046	1.5
China	2	870	0.2
Austria	319	867	36.8
Singapore	48	853	5.6
Malaysia	9	707	1.3
USA	287	690	41.6
Taiwan	27	422	6.4
Hong Kong	38	307	12.4
Thailand	7	251	2.8
Turkey	40	202	19.8
Brazil	13	98	13.3
Total extra-EC	2 200	12 743	17.3
of which, from EFTA	995	1 111	89.6

Source: EC, Panorama of EC Industry, 1993.

Table 13

U.S. TRADE PATTERNS IN 1991
HOUSEHOLD AUDIO AND VIDEO EQUIPMENT
(SIC 3651, mn US$, percent)

	Exports			**Imports**	
	Value	Share		Value	Share
Canada & Mexico	1 163	51.0	Canada & Mexico	1 633	12.4
European Community	351	15.4	European Community	170	1.3
Japan	159	7.0	Japan	6 161	46.8
East Asia NICs	267	11.7	East Asia NICs	5 051	38.4
South America	153	6.7	South America	66	0.5
Other	186	8.2	Other	73	0.6
World Total	2 279	100.0	World Total	13 154	100.0

TOP FIVE COUNTRIES

	Value	Share		Value	Share
Mexico	589	25.9	Japan	6 161	46.8
Canada	574	25.2	Mexico	1 558	11.8
Japan	159	7.0	South Korea	1 265	9.6
Taiwan	111	4.9	Malaysia	1 118	8.5
Germany	99	4.3	China	904	6.9

Source: US Department of Commerce (1993), p. 36-13.

Table 14

PRODUCTION AND TRADE OF JAPANESE ELECTRONICS INDUSTRY

(billion yen)

	1960	1970	1980	1985	1990	1992
Consumer Electronics						
Production	241.3	1473.3	2932.1	4911.6	4436.2	3758.4
Exports	57.2	587.0	2047.1	3805.5	2617.8	2257.5
Imports	0.2	4.9	38.2	23.7	113.0	156.0
Industrial Electronics						
Production	107.5	1030.1	3396.0	7614.1	11341.6	10531.0
Exports	3.2	137.3	1049.1	2918.9	3442.7	3691.6
Imports	6.1	121.5	297.5	397.6	692.4	633.3
Electronic Components						
Production	142.5	893.3	2677.1	6027.0	8373.3	7985.3
Exports	13.1	138.2	1461.8	2970.8	4933.3	5360.6
Imports	2.9	68.9	367.5	613.3	1195.0	1256.2
Total Electronics						
Production	491.3	3396.7	9005.3	18552.7	24151.0	22274.6
Exports	73.5	862.5	4558.0	9695.1	10993.9	11309.8
Imports	9.2	195.3	703.1	1034.6	2000.5	2045.6

Source: Electronic Industries Association of Japan (1992) and Urata (1991).

TABLE 15

JAPAN'S ELECTRONICS EXPORTS BY DESTINATION

(1992; Yen million; percent change 92/91)

	Total consumer electronic equipment	Color televisions	Video tape recorders	Industrial electronic equipment	Electronic components & devices	Electroncs industry Total
Asia	636 485	190 105	48 729	702 215	2 304 413	3 643 113
(percent)	-3.2	13.8	-17.3	3.4	11.2	6.8
Europe	752 916	12 213	285 138	1 157 477	1 118 961	3 029 354
	-24.0	-60.6	-20.0	0.6	-3.5	-8.2
(EC)	658 061	5 932	263 605	1 064 504	1 043 953	2 766 520
	-20.2	-51.5	-19.2	2.0	-2.7	-5.9
North America	727 756	5 020	194 503	1 647 245	1 721 581	4 096 581
	-17.9	-16.2	-36.7	10.1	6.0	2.3
(USA)	672 759	4 826	178 384	1 582 129	1 675 391	3 930 279
	-17.6	-14.5	-36.9	11.5	5.4	2.8
Latin America	65 570	4 693	10 633	78 782	147 262	291 614
	-8.2	37.5	-25.5	17.4	6.0	5.1
Africa	18 999	3 032	4 622	31 411	12 079	62 489
	-35.2	-40.1	-30.7	-2.5	-21.2	-18.7
Oceania	55 787	5 093	12 069	74 501	56 366	186 654
	-8.8	21.3	-24.7	-10.3	1.5	-6.6
TOTAL	2.257 514	220 156	555 694	3 691 630	5 360 663	11 309 806
	-16.3	1.6	-26.9	5.2	5.8	0.3

Source: Electronic Industries Association of Japan (1993).

Table 16

JAPAN'S ELECTRONICS IMPORTS BY ORIGIN

(1992; Yen million; percent change 92/91)

	Consumer electronic equipment	Industrial electronic equipment	Electronic components & devices	Electronic industry Total
Asia	130 838	124 045	559 459	814 342
(percent)	12.6	-3.8	4.6	4.4
Europe	7 603	89 599	83 738	180 939
	7.8	17.9	2.3	9.7
(EC)	5 480	79 847	77 755	163 082
	4.5	21.5	4.2	12.0
North America	17 546	395 551	597 756	1 010 853
	42.1	-12.6	-8.3	-9.5
(USA)	16 624	390 413	581 577	988 613
	46.6	-12.9	-8.7	-9.8
Latin America	37	12 449	12 532	25 019
	-12.4	-36.2	-24.6	-30.8
Africa	1	1	13	15
	-98.3	-99.4	50.7	-90.7
Oceania	15	11 688	2 731	14 434
	-50.1	14.7	147.0	27.4
TOTAL	156 041	633 332	1 256 228	2 045 601
	15.0	-7.9	-2.3	-3.0

Source: See table 15.

Table 17

INTRA-REGIONAL TRADE: CONSUMER ELECTRONICS (SITC Rev2 761,762,763)
DATA IN BN OF CURRENT US $

1981

Importer/Exporter	US/Can	E As	EUR	RofW	Total
US/Canada	0.20	0.07	0.12	0.50	0.89
East Asia	4.90	1.57	4.40	3.38	14.24
EC+EFTA	0.11	0.06	2.87	0.66	3.70
World					19.18

Importer/Exporter	US/Can	E As	Eur	RofW	Total
US/Canada	1.0%	0.4%	0.6%	2.6%	4.6%
East Asia	25.5%	8.2%	22.9%	17.6%	74.3%
EC+EFTA	0.6%	0.3%	14.9%	3.5%	19.3%
World					100.0%

Importer/Exporter	US/Can	E As	Eur	RofW	Total
US/Canada	22.2%	8.3%	13.6%	55.8%	100.0%
East Asia	34.4%	11.0%	30.9%	23.7%	100.0%
EC+EFTA	3.0%	1.6%	77.5%	18.0%	100.0%
World					100.0%

1991

Importer/Exporter	US/Can	E As	Eur	RofW	Total
US/Canada	0.52	0.23	0.16	0.55	1.46
East Asia	9.38	8.35	8.66	5.16	31.55
EC+EFTA	0.13	0.12	9.78	0.84	10.87
World					44.45

Importer/Exporter	US/Can	E As	Eur	RofW	Total
US/Canada	1.2%	0.5%	0.4%	1.2%	3.3%
East Asia	21.1%	18.8%	19.5%	11.6%	71.0%
EC+EFTA	0.3%	0.3%	22.0%	1.9%	24.5%
World					100.0%

Importer/Exporter	US/Can	E As	Eur	RofW	Total
US/Canada	35.5%	15.7%	11.0%	37.8%	100.0%
East Asia	29.7%	26.5%	27.4%	16.3%	100.0%
EUR	1.2%	1.1%	90.0%	7.7%	100.0%
World					100.0%

Source: UN Comtrade -- East Asia includes Japan, S. Korea, Taiwan, Hong Kong, ASEAN countries and China, EUR includes EC+EFTA

Table 18

EXPORT STRUCTURE
(at the SITC Rev. 2, 3-digit group level,
ranked by average 1989-1990 values)

	1980-1981			1989-1990			Growth rates (% 1980-1990)	
	Value (thousands of US$)	% of the grouping total	% of world	Value (thousands of US$)	% of the grouping total	% of world	Value	Difference from world
WORLD								
761 Television receivers	5 456 338	0.27	100	14 460 571	0.45	100	11.8	0
762 Radio broadcast receivers	5 975 891	0.30	100	10 828 156	0.34	100	6.6	0
763 Sound recorders, phonograph	6 765 895	0.34	100	15 155 896	0.48	100	10.5	0
DEVELOPED MARKET ECONOMY COUNTRIES								
761 Television receivers	4 541 235	0.36	83.22	8 749 838	0.38	60.48	8.1	-3.7
762 Radio broadcast receivers	4 108 214	0.33	68.75	4 344 266	0.19	40.06	1.4	-5.1
763 Sound recorders, phonograph	6 115 147	0.49	90.17	11 290 353	0.50	74.49	8.6	-1.9
DEVELOPING COUNTRIES								
761 Television receivers	902 201	0.16	16.54	4 972 158	0.77	34.67	21.1	9.3
762 Radio broadcast receivers	1 843 557	0.33	30.85	5 134 540	0.80	47.52	10.4	3.8
763 Sound recorders, phonograph	576 991	0.10	8.71	3 721 990	0.58	24.56	21.0	10.5

Note : Total growth rate 1980-90: 5.2%
Source: UNCTAD (1993), Handbook of International Trade and Development Statistics 1992, New York.

Table 19

NUMBER OF OVERSEAS ELECTRONICS PRODUCTION FACILITIES

OF JAPANESE CORPORATIONS IN 1992

	Consumer electronic equipment	Industrial electronic equipment	Electronic components and devices	Total
U.K	14	18	23	50
Germany	11	7	20	37
France	11	10	4	24
Spain	5	1	3	8
Ireland	--	2	5	6
Belgium	1	--	2	3
Netherlands	--	2	2	4
Italy	3	2	1	6
Others	1	--	2	4
Europe	46	42	62	142
U.S.A	34	45	78	141
Canada	3	--	5	7
Puerto Rico	1	--	2	2
North America	38	45	85	150
Taiwan	21	12	67	93
Malaysia	37	13	83	121
Republic of Korea	7	9	52	62
Singapore	20	9	47	71
Thailand	21	11	36	63
China	8	13	26	42
Hong Kong	3	4	16	22
Philippines	5	3	9	16
India	4	1	1	6
Indonesia	8	1	6	14
Others	1	--	3	4
Asia	135	76	348	514
Brazil	7	6	13	24
Mexico	7	3	15	23
Others	10	1	2	11
Latin America	24	10	30	58
Oceania	3	3	1	6
Africa	4	1	--	4
Total	**250**	**177**	**524**	**874**

Source: See table 15.

Table 20

STRUCTURE OF THE EUROPEAN CONSUMER ELECTRONICS MARKET IN 1990

(sales in bn ECUs)

European market	23
European production	13
under European control	9
under foreign control	4
of which under Japanese control	3.3
Imports	12
from Japan	5
from South Korea	1
Exports	2

Source: Bloom (1993), pg. 223

Table 21

MARKET SHARES IN VIDEOCASSETTE RECORDERS
(by country, 1988, percentages)

Source of product	**United States**	**European Community**	**Japan**	**Other**	**World**
Japanese firms:					
Japanese operations	73.8	23.7	98.1	72.1	66.3
Offshore operations	6.0	0.4	0.0	10.2	16.3
US operations	1.9	0.0	0.0	0.0	0.0
EC operations	0.0	49.5	0.0	0.0	0.0
Non-Japanese suppliers in:					
Korea	17.5	9.1	1.9	13.4	12.2
Taiwan	0.8	0.0	0.0	2.5	0.8
United States	0.0	0.0	0.0	0.0	0.0
European Community	0.0	17.3	0.0	1.8	4.3
Total	100.0	100.0	100.0	100.0	100.0

Source: Japan Electronics Almanac 1989, reproduced in Tyson (1992), p. 235.