China's New Industries and the East Asian Production Networks

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I. INTRODUCTION

The main purpose of this study is to examine the pace and pattern of development of China's new industries, as they may bear on the regional production networks in East Asia. Two new industries are selected for the study. First is the electronics and information technology (IT) industry, and second is the automobile industry. Both industries are considered new and have experienced accelerated application of new technologies supplied from abroad, which until the late 1980s were almost totally alien to the Chinese industrial system.

The other major characteristic is that these new industries cater substantially to an entirely new spectrum of clientele. Thus, while just a few years ago, saloon cars were still far beyond the dreams of private individuals; they now have rapidly come into the realms of possibility for hundreds of thousands of urban households, similar to the case of colored television, video recorders, and refrigerators, from the mid-1980s onwards, or air-conditioners since the early 1990s.

The two new industries are selected for study mainly because they seem poised to significantly affect the industrial setting of the neighboring East Asian economies in the years to come. Specifically, the Chinese electronics and IT industry has, within a few years of its debut in the late 1980s, swiftly established itself to be a highly export-oriented undertaking and threatened to erode the global market shares of such star forerunners as Taiwan, South Korea, Malaysia, and Singapore and in fact even more remarkably that of Japan as well. Likewise, there are clear signs that the Chinese automobile industry, by virtue of the enormous advances made in the domestic market in the past several years, is now on the threshold of targeting the export market in Asia and other parts of the world. Hopefully, Thailand–the most important car manufacturing and exporting country in Southeast Asia, will be able to withstand the expected Chinese foray in the future.

The study attempts therefore to trace the development of the two Chinese industries, focusing on the role of FDI and their exports records or export potentials. The relative strengths of the Chinese electronics and IT industry as an exporter will be estimated in detail, specifically vis-à-vis that of the neighboring economies. The estimation applies the familiar revealed comparative advantage (RCA) methodology, and concentrates on the United States market, which is the single most important export destination for all East Asian exporters. The analysis will generally cover the period from the mid-1990s to 2004. This will hopefully help to shed some light on the changing competitiveness of the Chinese electronics and IT industry, as it may impinge upon similar industries in other parts of the region. It should also be of great interest to see how the smaller neighboring economies cope with the impact from China and exploit the niches offered by the emerging new regional production networks. In more positive terms, the question posed is what may possibly become the new pattern of regional economic cooperation, and what may be the practical implications of all such changes for regional trade and investment flows in the foreseeable future.

The analysis about the Chinese automobile industry will largely be confined to the production and sales of passenger cars in China; and it will be kept in relative brevity, given that the industry has yet to start testing the Asia Pacific waters for exporting its maturing array of

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vehicles. The two new Chinese industries are to be examined, to a certain extent, as case studies on the regional economic impact of China's accession to the World Trade Organization (WTO) since 2001. There are three aspects to this complex problem.

First, is how under the WTO's free trade regime (continuous tariff concessions and import quota reductions), the comparative advantages (or disadvantages) of the Chinese industries, in terms of factor endowment or technological attainment, may come into full play. This is bound to trigger, by virtue of the sheer size of the Chinese economic potentials, a wide-ranging realignment of trade and capital flows, both within East Asia and with respect to the region's external economic relationship.

Second, as a new member of WTO, China is being strongly drawn into the process of globalization, with major transnational corporations repositioning their FDI strategy towards China to take advantage of the WTO's regime of investment liberalization and technology transfer. The upshot is likely a continuous migration of labor-intensive manufacturing industries to China, concomitant industrial restructuring or upgrading, as well as increased industrial and labor market dislocations in the affected East Asian economies.

Third, is for China to bear the "intrusion" of foreign industrial conglomerates. The impact, however, may differ from industry to industry, in terms of employment, income, investment, output, and technological development.

The problems involved are therefore multifaceted and complex. We cannot tackle all of them in a single paper. What we propose to do is to first look at the salient aspects of changes and development in the two selected Chinese industries. This will provide a basis for examining the export performance. Before we proceed, however, an integrated view about the major differences of the two industries should be briefly sketched, so that the comparative analysis and assessment of the two industries under study may be kept in proper perspective.

First of all, the Chinese electronics and IT industry clearly represents a leapfrog from "import-substitution" to "export-oriented" FDI. This is very much in line with the successful Chinese strategy of courting FDI. It is, however, very much at variance with the experience of other Asian industrializing countries, in which FDI normally started with targeting the output at the domestic demand (i.e., to substitute for imports of similar products), before aiming at the export markets. By contrast, the Chinese automobile industry is still at the stage of import-substitution, catering exclusively to domestic users. It is also strongly dominated by FDI especially with respect to the new-born passenger car industry.

Second, exports of the Chinese electronics and IT industry are essentially a matter of processing trade. Export sales may therefore be generally considered as "pre-guaranteed." This greatly enables foreign investors to earn foreign exchange (by exporting their products) to balance their own hard currency outlay (on imported inputs for processing), as strictly required by the Chinese government. However, by the very nature of the automobile industry, it is apparently difficult for foreign carmakers to meet this "foreign exchange balance requirement" (as is commonly known by foreign investors in China). This is in fact considered by Mr. Wang Rongjun, the former Managing Director of the Shanghai Volkswagen joint venture, as a prohibitive factor for many global automobile giants, notably the Japanese ones, for investing in China, prior to the country's accession to the WTO (personal interview with Mr. Wang; see Acknowledgments for background information).

Third, under the WTO accord, trading in electronics and IT products is subject to liberalization at a quicker pace than that of vehicles. Based on the Information Technology Agreement (ITA) accepted by China (i.e., upon WTO accession) all IT product quotas were to be abolished immediately. By 2005, the country's import tariffs for all IT products, including semiconductor-manufacturing equipment, are to be slashed from an average of 13.3 percent to zero from the year 2000 onwards. By contrast, however, car import quotas will not be phased out until 2005, and car import tariffs will still remain at 25 percent (down from the pre-WTO accession high of 80-100 percent) by 2006. Obviously the Chinese automobile industry is considered as more or less an infant industry which has not yet reached the mature stage of its life cycle to be able to compete internationally.

Fourth, given that the electronics and IT is a totally new industry in China implanted from abroad with FDI and foreign technology, the net economic gains accruable may actually be regarded as "absolute" or "perfect" (i.e., without any opportunity costs incurred to the country). Specifically, the foreign-sponsored industry helps to generate employment, train unskilled labor, create income, earn foreign exchange, and upgrade production technology. This is all done in an environment that is inundated with masses of unemployed workers, and in a country which is very much in need of both foreign technological know-how and hard currency to support the modernization drive. The situation in the automobile industry is mixed, however. While FDI also helps to ease the country's capital constraint and bring in new foreign car-making technology, it has, nevertheless, threatened to render redundant a great number of existing small and inefficient Chinese automobile manufacturing or assembly plants (Kueh, 2002). The labor displacement and industrial restructuring involved could be quite painful. Moreover, profit expatriation from such import-substitution FDI also implies a potential drain on the country's foreign exchange reserves. However, an expanded and more efficient automobile industry in China, as driven by FDI and advanced western technology, may help to strengthen many other associated industries and create new jobs as well.

Taken together, however, China's accession to the WTO, coupled especially with the signing of the ASEAN 10+1 (China) Free Trade Area agreement in November 2002, is bound to forcefully trigger a process of mutual adaptation among the various relevant East Asian economies. To the extent that all are highly export-oriented and depend at the same time on the advanced western economies for the supply of the necessary technology, the process may result in increased regional specialization, and hence a signifi cant reshuffling of the East Asian production networks. Against this background we now proceed to look at the experience of the Chinese electronics and IT industry and examine how the automobile industry may draw on the experience in the course of its development in the years to come.

II. THE CHINESE ELECTRONICS AND IT INDUSTRY

A. A High-Tech Perspective

High technology industries as defined in China comprise the manufacture of (1) medical and pharmaceutical products, (2) aircraft and spacecraft, (3) electronic and telecommunications equipment, (4) computers and office equipment, and (5) medical equipment and meters. Categories (3) and (4) come under the scope of this study.

Taken as a whole, the various high-tech industries represent the fastest growing industrial branch in China. As shown in Table 1, from 1995 to 2001, the growth rates of their combined gross value of industrial output (GVIO) amounted to an annual average of 24 percent, compared to only 12 percent for all manufacturing industries. The share in the national GVIO, at

constant 1990 prices, increased markedly from 11 percent in 1995 to 21 percent in 2001, or from 8 percent to 15 percent, at current prices. High-tech industries have now become the largest industrial branch in China, surpassing metallurgy and machine-building to be the pivot of the entire Chinese industrial system.

Several important points emerge from Table 1:

First, the value of exports (or "export delivery" at ex-factory prices) of the high-tech industries tended to increase even faster than GVIO from 1995 to 2001, namely at an average of 25 percent per year, compared to only 13 percent for the all-industry measure. As a result, their share in total exports for all manufacturing industries increased from 15 percent in 1995 to a hefty 26 percent in 2001. High-tech industries have indeed rapidly replaced the textile industry to be the largest foreign exchange earner for the country a few years ago.

Table 1: The High-tech Industries in China: Major Measures of Economic Trend and Shares in Combined Total for All Manufacturing Industries, 1995 – 2001

(in hundred million Yuan and percent)

Year	No. of enterprises	Employ-ment (person)	GVIO (Current prices)	GVIO (1990 prices)	Value added	Sales revenue	Profits	Exports
1995	18,834	4,484	4,098	4,713	1,081	3,917	178	1,125
	(4.08)	(6.34)	(8.41)	(11.37)	(8.85)	(8.48)	(14.53)	(14.92)
1996	18,909	4,610	4,909	5,580	1,272	4,497	207	-
	(4.28)	(0.70)	(9.57)	(12.80)	(9.36)	(9.81)	(27.20)	
1997	17,411	4,305	5,972	7,163	1,540	5,618	309	-
	(4.13)	(0.67)	(9.96)	(13.58)	(9.77)	(10.35)	(27.81)	
1998	9,348	3,927	7,111	9,055	1,785	6,580	311	2,042
	(6.25)	(0.27)	(11.92)	(6.75)	(11.70)	(11.96)	(32.50)	(19.45)
1999	9,492	3,845	8,217	10,878	2,107	7,820	432	2,413
	(8.86)	(0.81)	(12.85)	(17.87)	(12.50)	(13.06)	(26.18)	(21.51)
2000	9,758	3,900	10,411	14,111	2,759	10,034	673	3,388
	(6.58)	(0.85)	(13.86)	(19.76)	(14.00)	(13.99)	(24.62)	(23.87)
2001	10,479	3,983	12,263	17,083	3,095	12,015	688	4,282
	(6.68)	(0.88)	(14.53)	(20.80)	(13.87)	(14.96)	(22.04)	(26.96)
Growth (% per annum)	(9.31)	(1.96)	20.04	23.94	19.16	20.54	25.27	24.95

Sources: China Statistical Yearbook on High Technology Industry (CSYBHTI), 2002

Second, as compared with the increases in total sale revenue, which stood at a relatively high rate of 21 percent per year in 1995-2001, the higher growth rate of the export value at 25 percent per year, seems to imply that an increasingly larger share of the marginal output of high-tech industries was being exported rather than sold in the domestic markets.

Third, quite remarkably, the size of employment by the high-tech industries declined over the same period in both absolute terms (from 44.84 million persons in 1995 to 39.83 million in 2001), and relative to total employment by all manufacturing industries combined (share down from more than 6 percent to less than one per cent over the same period).

Fourth, and equally interesting is the absolute decline in the number of high-tech enterprises, from some 18.83 thousand in 1995 to 10.48 thousand in 2001. A higher degree of decline is in fact observed with the total number of enterprises for all manufacturing industries.

The upshot is an increased share in this respect for the high-tech enterprises from 4.1 percent to 6.7 percent over the same period[2].

Taken together, the last two points suggest that an overall industrial restructuring has taken place quite strongly in China, in favor of expanding scale economies. In the process, high-tech enterprises have moved towards a higher degree of capital-intensity (versus labor-intensity) in operation. This has occurred considerably faster than that for the non-high-tech enterprises. However, being a modern industry and late-comer, high-tech enterprises were already operating at a comparatively larger scale by the mid-1990s (average employment of 239 persons per enterprise against 153 for all industries in 1995). This may explain the fact that, as observed in Table 1, the decline in the number of enterprises in the high-tech industry (or rather, the process of consolidation and conglomeration through merger and acquisition or else), appears not to be as pronounced as that for the all-industry measure.

The same sources of statistics also reveal that the fixed assets owned per high-tech enterprise (at original purchase prices) increased by more than twofold from the average of 10.39 million Yuan in 1995 to 38.33 million Yuan in 2001. Being highly export-oriented, high-tech industries are clearly compelled by global competition to enhance competitiveness by constantly enhancing scale economies and product efficiency. What is said above of the high-tech industries as a whole, certainly applies even more forcefully to the electronics and IT industry, given that the two categories (3) and (4) of high-tech industries referred to, have seen the combined output share increasing most impressively, from 62 percent in 1995 to 74 percent in 2001, at the expense of the other three categories (See Table 2).

Table 2: The Rising Share of Electronics and Information Technology in Total Output of the High-tech Industries in China, 1995-2001

(in percent, based on GVIO at current prices)

Year	Medical and pharmaceutical products	Aircraft and spacecraft	Electronics and telecom equipment	Computer and office equipment	Medical equipment and meters
1995	23.46	6.56	53.24	8.65	8.09
1996	23.45	5.83	51.01	11.83	7.87
1997	21.14	5.24	53.12	13.35	7.15
1998	19.31	4.55	54.11	15.76	6.28
1999	18.22	4.05	57.31	14.65	5.78
2000	17.11	3.72	57.45	16.11	5.61
2001	16.64	3.83	56.27	17.94	5.32

Sources: CSYBHTI 2002

B. Output Trend and Composition of the Industry

The two broad categories of the Chinese electronics and IT industry (i.e., “electronic and telecommunications equipment” and “computers and office equipment”) cover a large number of subcategories for their various products. Table 3 gives an overview of the production trends and the changing output composition from 1995 to 2001. Several important points may be made.
First, taken together, the combined output of the two broad categories increased most remarkably by an average annual rate of 28 percent in the period under study. The growth of

[2] A reclassification of the enterprises seems to have taken place in 1998, with a great number of enterprises being excluded from the new definition for some reasons. However, as the reclassification applies to both high-tech and non-high-tech enterprises, albeit perhaps somewhat differently, this should not affect our comparative analysis to any great extent.

the "computers and office equipment" branch, by 35 percent per year, is especially noteworthy. Thus, by the end of 2000, users of computer networks in China had already soared to 22.5 million (from a mere 7000 in 1995); and earlier in that year, Legend, one of the country's electronics giant has surpassed IBM and Compaq to become the largest PC producer in the Asia Pacific region (Kueh, 2002).

Second, "household audiovisual equipment" as a branch, which includes colored TV, DVD, VCD, VCR, Hi-fi stereo and the like, remained a bright point of growth for the industry. Although its GVIO share dropped from 28 percent in 1995 to 22 percent in 2001 (Table 3), the average annual rate of growth still stood at a high of 24 percent for the period (as can be estimated from the underlying figures). The continuous high growth has in fact resulted in an enormous supply glut in China of colored TV, among other similar products, to trigger a fierce price competition among major producers in the past couple of years[3]. It is against this background that, by 2002/2003 Chinese colored TV sets have started to flood the overseas markets, prompting the United States to eventually introduce sanctions in November 2003 against the four Chinese electronics giants, Changhong, Xiahua, TCL, and Konka for "dumping"[4].

Third, likewise, for the other two subcategories, "electronic apparatus" and "electronic components," while their combined GVIO share basically remained unchanged from 1995 (at 35 percent) to 2001 (32 percent), their absolute output value increased, nonetheless, by an average of 22 percent per year in 1995-2001. The two subcategories comprise such products as electronic vacuum apparatus, semiconductor separated parts, integrated circuits (ICs), and various electronic components. Amongst these, output of ICs–dubbed the "food grain" of the electronic industry, grew fastest, by 25 percent per year, again in terms of GVIO at constant prices. However, by 2001, China's ICs production (6362.88 million physical units) (CSYB 2003, pp.510-3), was at best at par with Thailand's (7,070 million in 2000 or 4,400 million in 2001) (Alpha Research Co. Ltd. p.439). In terms of both output and exports, the country lags far behind Malaysia, Korea, Taiwan, and Singapore as well.

Table 3: Output Trends and Composition of the Electronics and IT Industry in China, 1995-2001

(in hundred million Yuan and percent)

Items	1995	1996	1997	1998	1999	2000	2001	Growth (% p.a.)
Electronic and telecommunications equipment								
Telecom equipment	27.76	29.94	30.20	32.58	32.21	36.42	42.65	35.21
Radar and peripheral equipment	5.00	1.42	0.95	0.69	0.68	0.63	0.72	- 15.20
Broadcast and TV equipment	0.83	0.81	0.55	0.55	0.46	0.58	0.50	5.95
Electronic apparatus	16.04	15.40	13.52	13.10	14.15	15.89	13.04	22.87
Electronic	18.68	17.84	17.27	17.73	18.28	17.56	17.43	21.22

[3] By 2002, every urban household in China had 1.26 color TV on the average. In the rural areas, the rate was 60.45 per 100 households; see ZGTJNJ 2003, p.342).

[4] China Securities Times via www.xinhuanet.com, 26 November 2003. The sanction was formally endorsed by the US Department of Commerce on 14 May 2004; see Ta_Kung Pao, 15 May 2004.

components								
Household audiovisual	88.24	31.96	33.89	31.83	30.58	24.39	21.86	24.33
Others	3.45	2.63	3.62	3.51	3.61	4.52	3.80	21.47
GVIO (C)	2,181.67	2,504.21	3,172.01	3,847.27	4,708.52	5,981.38	6,900.45	
GVIO (F)	2,598.80	2,945.84	3,982.01	5,158.11	6,619.58	8,482.42	10,286.38	25.77
Computer and office equipment								
Computers	40.11	33.04	29.45	39.45	42.48	40.87	42.65	33.63
Peripheral equipment	51.11	56.08	61.19	47.89	45.53	48.15	47.68	37.24
Office equipment	8.78	10.88	9.37	12.66	12.00	10.99	9.67	38.37
GVIO (C)	354.46	580.94	796.95	1,120.60	1,203.49	1,676.95	2,199.80	
GVIO (F)	484.07	730.77	1,026.29	1,543.59	1,642.36	2,407.18	2,985.00	35.42

Note: GVIO is given at both fixed (F) 1990 prices and current (C) prices. Figures for percentage shares are based on GVIO (C)
Source: CSYBHTI 2002

Fourth, and by far the largest sector in the Chinese electronic and IT industry is the subcategory "telecommunications equipment," which comprises transmission, exchange and terminal equipment. It scored a spectacular growth rate of 35 percent per year over the period 1995-2001, and by the end of the period has already taken up 43 percent of the GVIO of the "electronic and telecommunications equipment" branch. This amounts to nearly one-third of the GVIO of the entire electronics and IT industry as defined, "computers and office equipment" included. The records reflect clearly the massive efforts made by the Chinese government to build up, at maximum speed, the national infrastructure for telecommunications. Notice that the annual sales of program-controlled switchboards in China increased from 11.04 million lines in 1995 to 93.97 million lines in 2001 (CEIYB, 2001/2002), annual output of telephone sets from 99.56 million in 1995 to 118.92 million in 2002, and that of mobile phone, respectively, from 12.13 million sets to 121.46 million sets (CSYB 2003, pp. 510-3).

The changes in the output composition of the Chinese electronics and IT industry may yet be looked at from another, simplified perspective. The share of producer electronics has steadily increased from 22 percent in 1993 to 38 percent in 1998, and 49 percent by 2001, at the expense of consumer electronics, for which the share has been curtailed from 44 percent to 34 percent and then 26 percent; the balance being the share of electronic components and apparatuses at 34 percent, 28 percent, and 25 percent respectively (CIDR 1999, p.184 and CYBDHNTI 2002, p. 646-8). This underscores the increased importance of the electronics industry in China's attempt to catch up with technological advances in the West, upgrading conventional industries through electromechanical integration, application of computer-added modeling and simulation testing, and by increased adoption of electronically-controlled fuel injection in car manufacturing, for example (Howe, Kueh, & Ash, p. 152) Meanwhile, the supply glut in consumer electronics, and the spillover to the global markets also clearly imply that increased domestic competition has continuously prompted the industry to improve product quality and enhance technological sophistication, as well as export competitiveness.

C. FDI and Technology Transfer

The high-tech industries in China are heavily dominated by foreign direct investment. In 1996, FDI already took up a 26 percent share in the total fixed assets of the industries. By 2001, the share moved up to 45 percent. If electronics and IT industry (as defined to comprise the two major categories of electronic and communication equipment, and computers and office

equipment) is taken separately, the FDI share is even more remarkable, standing at 42 percent in 1996 and 63 percent in 2001 (CSYBHTI, 2002, pp. 107 & 223).

Table 4 shows more details about the growing size of FDI, in absolute terms, as well as relative to total fixed assets accumulated by the Chinese electronics and IT industry in 1996-2001. Several interesting points may be made.

First, FDI has clearly concentrated much more on the manufacturing of "electronic apparatuses and components" (which represents the basic inputs for any electronics assembly industry), rather than consumer electronics (as represented by the "household audiovisual equipment" sector). Note that the FDI contribution to fi xed capital stock of the former sector amounted to 14,854 million Yuan in 1996. This is only double the size of its contribution to the latter sector. However, by 2001, the comparable FDI contribution in the former sector has increased most remarkably to a total of 88,372 million Yuan, representing nearly six times its contribution to the latter.

Table 4: The Contribution of FDI to Fixed Assets of China's Electronics and IT Industry, 1996-2001

(in million Yuan and percent)

Items	1996		1998		2000		2001	
	Stock	Share	Stock	Share	Stock	Share	Stock	Share
Electronic & telecom equipment								
Telecom equipment	14,511	61.8	14,022	53.8	14,822	52.4	31,054	63.2
Electronic apparatus & components	14,854	32.4	34,874	52.9	54,774	60.4	88,372	67.0
Household audiovisual equipment	6,292	42.9	9,992	49.8	15,546	58.3	15,621	51.8
Total	36,214	40.6	59,237	50.1	87,276	54.4	138,378	62.6
Computers & office equipment								
Computers	3,231	53.4	1,886	30.8	1,588	29.1	3,785	58.3
Peripheral equipment	1,386	47.7	4,064	69.5	8,546	85.4	9,871	71.4
Office equipment	495	55.3	791	67.1	1,576	77.9	2,756	87.2
Total	5,112	51.9	6,723	51.1	11,710	66.9	16,412	69.9

Notes: The stock figures refer to FDI contributions to total (year-end) fixed assets of the respective categories of the electronics and IT industry.

Sources: China Statistical Yearbook on High Technology Industry (CSYBHT), 2001

Second, the increased "scissors differential" as observed, implies that foreign investors are able to take advantage of their technological strengths to expand the scale of production for electronics devices and components. However, over the years, domestic producers have also become comparatively better equipped for assembling the final products for consumer electronics. As a matter of fact, since the late 1990s, quite a few Chinese electronics giants, such as Changhong, Konka, Haier, Haixin, TCL, Legend, and Great Wall, have rapidly developed to be national brand names for colored TVs, VCDs, and personal computers as well and have indeed begun to erode substantially the market shares of major foreign brands (CIDR 1999, p.189). The same holds for Bird, TCL, and Amoi as Chinese manufacturers of mobile phones. These are all absolutely late-comers in the market, but within a few years, they have nonetheless been able to deeply cut into the market shares of Nokia, Motorola, and Sony-Ericsson in China, as the author was told by Mr. Yenho Tree, Managing Director-Asia of

Centurion Electronics (Shanghai) Ltd. during a personal interview in Shanghai (see Acknowledgments for background information)[5].

Third, similar to the "electronic apparatuses and components" sector, the "computers and office equipment" sector is also heavily dominated by FDI in terms of the stock of fixed assets. This is especially true with the sub sector "peripheral equipment of computer." Interestingly, the fi gures in Table 4 also reveal that between 1996 and 2000 the FDI share in the "computers" sub sector declined quite substantially from 53 percent in 1996 down to 31 percent in 1998 and 29 percent in 2000, before reverting to 58 percent in 2001; whereas the comparable share in the "peripheral equipment" sub sector increased even more remarkably from 47 percent in 1996 to 69 percent in 1998 and further to 85 percent in 2000, before being curtailed to 71 percent in 2001. This drastic exchange of the FDI shares between the "computers" and "peripheral equipment" sub sectors seems to underscore once again that foreign investors are poised to concentrate more on the manufacturing of critical electronic parts and components, for which they control the core technology. Investments in mere assembling plants for final products with lower profit margin are to be left to domestic Chinese manufacturers, who have become increasingly better equipped and indeed most aggressive in attempting to slice off a share in the value chain of the entire electronics industry (CIDR 1999, p. 187).

The point made is borne out by information shared by Mr. Tree during the interview. Mr. Tree enlightened the author with the experience of the three Chinese mobile phone manufacturers referred to above. Bird, for example, started out with simply "pasting" its own brand name onto finished mobile phone sets purchased from outside (which may perhaps be dubbed "reversed" original equipment manufacturing (OEM) – a specific term referring to the widespread practice in China and other East Asian industrializing countries being commissioned by importers of advanced western countries for OEM according to required specifications, which are then labeled with the brand name of the importing conglomerates rather than that of the manufacturers). This was then followed by modifying the front cover of the phone sets. However, through aggressive R&D, they are now able to design their own modules, with the chips and other key components being supplied by other upstream manufacturers. Mr. Tree's own company, which is part of the U.S.-based Centurion Wireless Technologies, Inc. supplies 45 percent of the mobile phone antennae needed by TCL.

A hierarchy of production technology and networking has therefore emerged in the Chinese electronics and IT industry. Accelerated Chinese exports to the world market have led to a marked realignment in the regional production networks in East Asia as well. Before more is said on this point, we should briefly give a more complete quantitative picture of the significant contributions of FDI in this respect.

Table 5 reveals that by any significant economic measures used – number of firms and employment, GVIO, investment completed annually, total fixed assets accumulated, sales revenue, and exports, the shares of foreign investors in the Chinese electronics and IT industry have increased remarkably in the past decade or so. The FDI share in Chinese electronics exports is especially noteworthy, rising from 38 percent in 1993 to a startling high of 79 percent

[5] Mr. Tree also informed the author that Bird (or Bodao in Chinese, which is tied up with Siemens of Germany and Seagam of France), TCL, and Amoi taken together, now account for about 50% of total sales of mobile phones in China. According to Shanghai Daily, 8-9, and10 May 2004, Bird clamshell phones are well received in both Europe and the United States. The Ningbo-based Bird Mobile Communications Co. Ltd has lately signed a coorperation agreement with AT & T, the largest telecom operator in the United States. In 2004, Bird Mobile expects to export 2 million cell phones, over four times more than the previous year, and most will be clamshell.

in 2001. Over half of the industry's GVIO is now accounted for by foreign investors, as compared with just one-fifth in 1993. Most interestingly, while total investments made in the industry tended to have leveled off in 2001, the share of FDI has nonetheless continued to rise most substantially to 31 percent in 2001 from 14 percent a year ago. This seems to suggest that while local producers were being overwhelmed by insurmountable excess capacity and hence attempted to curtail further investment (CIDR 1999, pp. 185-186), the highly export-orientated foreign investors (which cater to the more refined global markets), could still see some bright spots overseas; against the backdrop of an industry which has become increasingly mature and sophisticated as a result of enhanced domestic competition in China.

Table 5: Share of FDI in China's electronic industry by major economic indicators, 1993-2001

(industry total in million Yuan and share in percent)

Items	1993		1995		1999		2001	
	Total	Share	Total	Share	Share	Share	Total	Share
No. of firms (unit)	3,393	12.6	3,502	22.2	2,839	26.0	3,062	28.3
Employees (100 persons)	17,067	6.80	17,002	12.8	-	-	15,664	31.1
GVIO	111,721	21.3	188,084	41.0	467,867	47.3	844,870	54.0
Investment completed	10,827	14.0	14,486	30.2	30,717	10.1	40,310	31.2
Fixed assets	47,865	19.7	119,558	35.2	141,823	38.5	199,932	43.4
Sales revenue	119,283	20.8	178,627	41.1	457,828	47.7	827,483	51.6
Exports	18,942	37.8	62,855	74.5	125,410	73.9	273,320	78.8
Gross profits	4,303	32.1	9,683	64.0	-	-	48,900	51.0

Notes: The FDI shares cover both wholly-foreign owned enterprises and Sino-foreign (equity and cooperative) joint ventures, and include a large number combined proportion by investors from Hong Kong, Macao, and Taiwan. GVIO refers to Gross Value of Industrial Output at current prices. Investments completed include both basis investment and investment in technological innovation for 1995. For 1999 these seem to lumped into a single category titled "long-term investment". Figures for fixed assets (at original purchase prices) and exports for 1995 are not available. The 1996 figures are used instead.

Sources: China Electronics Industry Yearbook (CEIYB), various years.

The technological implications of foreign investments in China on electronic and IT industry are multifaceted. We should, first of all, distinguish between at least four layers of the technological hierarchy for ease of explanation. On top of the ladder stands the design of semiconductors (i.e., more specifically, the integrated circuits or the chips). This represents the core technology for any electronic industry. Next is the "fabrication" or manufacturing of the chips which in turn requires design of the most appropriate and most cost-saving manufacturing technology. What follows is the design and manufacturing of various apparatus or devices and electronic components. The technology of assembling the final products, as well as the techniques of assembling itself stands at the bottom of the hierarchy, together with the standard and process of quality control and management.

As a Chinese expert puts it, citing personal computer manufacturing as a reference, "[The] PC industry is a clear case of global labor division. U.S. manufacturers monopolize the core technology for chips and operating system, thus reaping the most substantial parts of the profits. Japan, Korea, the Taiwan province, and others, share the second layer of profits from memory and hard disks. China and many other developing countries are left with the meager profits for the assembling and packaging jobs (for the final products)" (CIDR 2001, p. 157). This, of course, is a simplified version of the global fragmentation of production and the value chain.

According to Dr. Steven S. L. Lee, Taiwan is actually quite advanced with ICs design, and is second only to the United States. In many respects, his company's VIA's chips, globally applied under the brand name C3, is also popularly known in China as "China chip" (zhongguo xin), especially for the variant "Anter" (Hanteng) which is widely used for mobile computing and communications equipment. Dr. Lee regards the Mainland's IC design industry as still lagging behind the Taiwanese counterparts by five to eight years. Nonetheless, he also notes that the Mainland's chip manufacturing technology is rapidly catching up with that of Taiwan, Japan, and even the United States. The gap between the Mainland and Taiwan in this respect has been narrowed down to one to one-and-a-half generations (i.e., just about two years, generally speaking). This has, to a great extent resulted from the continuous relocation of major Taiwanese foundries to the Mainland. The major points of the transcription of the interview is given in Box 1 below to provide further interpretative perspectives for looking at the evolving regional production networks, especially in the context of trade and investment flows.

BOX 1: IC design and manufacturing in East Asia (Interview with Dr. Steven S. L. Lee, VIA Technologies Inc.)

About VIA:

It is a world leading ICs design house. Its business in China covers CPU, graphics, telecommunications, and system designs. VIA's CPU – dubbed the "China chip", is characterized as "high-performance with low-power consumption". The chip distinguishes between three variants: the first is globally known as C3, used for desktop personal computers. Second is named Eden, normally applied to industry PC, "thin clients", and multimedia portable devices – all embedded application of fanless technology. The third one is popularly known in China as Antar (or Hanteng in Chinese), used in mobile computing/telecommunications equipment.

Center of gravity shifting:

The global center of the industry was in the United States in the1970s. It shifted to Japan in the 1980s, and subsequently to both Korea and Taiwan from the 1990s onwards. China is now rapidly emerging as a new center as well. However, the industry in the Far East emphasizes, generally speaking, more on semiconductor manufacturing rather than ICs design. The United States is still most advanced in IC design. Taiwan is second only to the US, in terms of IC design capability. Japan focuses on high-end IC design, and has increasingly moved away from manufacturing, in favor of outsourcing to Taiwan and Mainland China.

Regional specialization:

In the IC design industry Taiwan enjoys a particular capability "unparalleled by any other countries" in extending the advanced US technologies to commercial application. The development of SOC (systems-on-chip) is a good case in point, which involves enormous brain powers for integration. Taiwan is also exceptionally strong with both OEM and ODM (see text), done either in the Island itself or by manufacturers of Taiwan origin located on the Mainland. As a rule, semiconductor design and pilot manufacturing are conducted in Taiwan, but mass production in the Mainland, obviously for cost-saving reasons.

Korea is better equipped for design and manufacturing of electronic devices (as represented by Samsung especially), and manufacturing technology for mobile phones (Samsung and LG). Samsung is in fact famous for surpassing Sony in TFT (thin-film-transistor) technology for manufacturing large display units. The country is also well-known for such IT devices as FLASH and DRAM (Dynamic Random Access Memory), used for computers and mobile phones. A particular strength of the country is that unlike Taiwan, in many cases, it has been able to develop its own national brands in IC design and manufacturing.

Singapore is not poised to develop any IC design industry. The country used to be relatively advanced as a high-tech assembly house, for hard disk drive, for example. It focuses now essentially on the semiconductor manufacturing business; all on an OEM basis like Taiwan in the past. Under the highly

competitive pressures from neighboring exporting rivals, Singapore hopes to be able to move to high-end ICs manufacturing. The situation in Malaysia (hitherto a major OEM-based ICs manufacturing exporting country) is similar. However, the country is poised to increasingly loose it manufacturing cost advantage to such other ASEAN countries as Vietnam, Indonesia and the Philippines.

The technological gap:

The IC design industry in the Chinese Mainland lags behind that of the United States by 10 to 15 years, and Taiwan by 5 to 10 years (or perhaps less). In terms of IC manufacturing, however, It probably lags behind Taiwan, Japan, and the United States by as little as one to one and a half generations only; i.e. not more than four years. This is primarily a result of massive investments from Taiwan in the industry. The Taiwanese investors have brought along not only cash capital, but proven technology, machine, expertise, and professional manpower as well. At present, Taiwan is still more advanced in IC manufacturing technology, especially in the development of processing technology. Mainland Chinese still lack the capability for such development, but they possess enormous technical skills in copying and adopting the inventions.

In this context an important point should be made about the potential impact of China's entry into the WTO and acceptance of the TRIMs (i.e., the global agreement of Trade-related Investment Measures) and the TRIPs (Trade-related Aspects of Intellectual Properties). Both agreements preempt any forced technology transfer, mandated offsets, local content requirements, and other similar restrictive measures. Coupled with import tariffs being reduced to zero by 2005 for all IT products, the country has indeed already seen a continuous influx of foreign technologies, as embedded in advanced semiconductor-manufacturing equipment, for example. In the circumstances, it should be clear that the Chinese manufacturers would find it increasingly not worth the while to initiate or engage in any major, costly R&D activities. If proven correct, then the Chinese electronics and IT industry may be expected to be further subjected to western technological supremacy. Viewed this way, the given global or regional hierarchy of technology would clearly help to perpetuate the existing pattern of regional specialization within the East Asian production networks for many years to come.

Nonetheless, in light of the enormous pool of manpower, skilled or unskilled, and an ever enlarging stream of technicians and university-level specialists, China is bound to become a global manufacturing centre for electronics and IT products. We may now proceed to examine how it works and how it may affect the industry in the neighboring economies.

III. THE CHINESE ELECTRONICS AND IT INDUSTRY

A. The Coastal Bias

The Chinese electronics and IT industry, being overwhelmingly dominated by export-oriented FDI, is marked by two highly outstanding and closely related features. First, is that the majority of the manufacturing plants are located in the coastal region and in fact in two relatively narrowly defined areas: the Pearl River Delta (PRD) and the Yangzi River Delta (YRD). The second feature is that by any measure, the industry is most representative of the export-processing trade. We look first at the coastal bias in the regional distribution of the industry.

By year 2000, 55 percent of the electronics and IT product exported from China originated from the PRD, while YRD (comprising Shanghai and the adjacent parts of Jiangsu and Zhejiang provinces) took up 24 percent (CEIIAR 2001, pp. 186-189). Both Dongguan municipality (just north of Shenzhen which borders Hong Kong) and Suzhou city in Jiangsu province (just to the west of Shanghai) have from the late 1990s, rapidly emerged to be the global bases of PC manufacturing. Briefly, the global market shares of Dongguan are: 40

percent for magnetic head, computer case, and semi-fabricated products; 30 percent for copper-plated board and driver unit; 25 percent for semi-conductor grade capacitor and transformer; 20 percent for scanner and micro-motor; 16 percent for keyboard; and 15 percent for mother board. Basically over 95 percent of components and accessories needed for processing and assembling the computers are available in Dongguan in the PRD (CIDR 2001, p. 157). The municipality has indeed already become a major global outsourcing centre for IBM and Compaq (CEITPERR 2001, pp. 176-178). IBM has subsequently handed over its manufacturing bases in Japan, Melbourne, and Korea to the Shenzhen-based Great Wall IT International Inc. Likewise, Intel has also relocated its manufacturing plants in Malaysia and Ireland to Shenzhen as well (Huang, p. 7)

For Suzhou in the YRD, which is globally known for its Singapore-sponsored Industrial Park, the comparable global market share for its computer manufacturing industry is 65 percent for mouse, 13 percent for scanner, 10 percent for mother board, and 10 percent for keyboard (CIDR 2001, p. 157).

Both Dongguan and Suzhou are well known nationally as the important bases of Taiwanese investment in China. Especially in the aftermath of the disastrous earthquake of 20 September 1999 in Taiwan, many highly capital and technology-intensive large electronics and IT enterprises relocated their manufacturing plants across the straits to the Mainland to avoid further risks, together with a large number of affiliated firms producing components and accessories. Thus, within a year, a complete industrial chain headed by the Taiwanese investors emerged swiftly in Suzhou and neighboring Kunshan municipality to produce various notebook computers, mobile phones, and digital cameras (CIDR 2001,
p. 157).

Virtually all Chinese semiconductor giants are also located in the YRD region, especially in the Pudong New Zone in Shanghai. These include Huahong Microelectronics (with technology support from Japan's NEC), SMIC (Semiconductor Manufacturing International Corporation; Toshiba technology[6]), and Shanghai Grace Semiconductor Manufacturing (funded jointly by a number of international high-tech conglomerates; Oki Telectric technology). Similarly, Konka is based in Shenzhen, and Haier in Qingdao (in Shandong province), the notable exception being Changhong in Sichuan province.

B. Exports as a Processing Trade

The figures in Table 6 reveal why the Chinese electronics and IT industry bears all the hallmarks of an export processing trade. Before we comment on the statistical tabulation, a few words are in order about the two different types of export processing. For simplicity, they are respectively referred to as the LL and JL types of export-processing. For the LL type, foreign partners supply the whole or parts of raw and supplementary materials, parts and accessories, packaging materials, and if necessary, machine and equipment as well; and the Chinese side processes the "supplies from outside" (Lai Liao in Chinese) according to specified requirements. The finished and properly packed products are to be delivered to the foreign partners for export on their own account, whereas the Chinese side earns the agreed processing fees. Foreign partners will also be compensated for the costs of supplying the machine and equipment with

[6]This is a joint venture with the globally known Taiwan-based Worldwide Semiconductor Manufacturing Corporation (WSMC). SMIC–now the largest semiconductor manufacturer in China was floated in both the Hong Kong Stock Exchange and New York Stock Exchange in March 2004. It is billed as China's answer to Taiwan's WSMC and United Microelectronics Corporation.

the processing fees earned. For reason of this element, this type of export processing is also commonly known as “compensation trade.”

As for the JL type, the basic difference is that the “imported inputs” (Jin Liao) and exports of the finished or semi-finished products are both for the own account of the Chinese export-manufacturers. The processing may or may not involve input of materials and parts from domestic sources.

Both LL and JL types of export-processing are entitled to a rebate of value-added taxes. However, for the imported inputs, a “bonded” system is in place as prescribed by the government, in order to oblige the manufacturers involved to export the fi nal products, although in most cases, the system appears to be merely a matter of book-keeping (i.e., without involving any real cash deposits with the Chinese Custom Service) (CEITPERR 2001).

Several interesting points may now be made from Table 6. First, and the most startling point is that at least since 1995, LL and JL types of export processing combined have made up between 86 percent to 91 percent of China’s total electronics and IT exports. That is to say, “general trade” (as opposed to processing trade), or namely exports of truly Chinese origin, accounted consistently for just around 10 percent, or at most 14 percent (as in 1995) over the years.

Second, the value-added margin for the export-processing (i.e., the ratio of net exports to total imports), seems quite substantial. For the period 1995-2001, it averages to 0.68 for the LL type and 0.63 for the JL type (i.e., for every one U.S. dollar worth of input imported, the net export value earned is 68 cents and 63 cents respectively).

Table 6: The Chinese Electronics and IT Industry as an Export-Processing Trade, 1995-2001

(in hundred million US dollar and in percent)

Year	JL-type exports	LL-type exports	JL+LL exports	Total E/IT exports	(JL+LL exports) / (Total E/IT exports) (percentage)
1995	10,492	3,802	14,294	16,532	86
1996	14,904	4,635	15,538	21,498	91
1997	18,815	5,367	24,183	26,929	89
1998	17,173	5,820	22,993	25,671	89
1999	25,759	9,062	34,821	38,352	91
2000	38,672	10,886	49,558	55,161	89
2001	47,110	11,380	58,490	65,020	90

Notes: See text for definition of JL and LL types of electronics and IT exports.

Sources: China Electronics and Information Technology Products Exports – Research Report (CEITPERR), 2001 for 1995-2000
CEIYB 2002 for 2001

Third, the share of the LL type (which strictly speaking is the prototype of export processing) in the combined total of the relevant exports, tended to decline over the years, from 30 percent in 1995 down to 19 percent in 2001 in favor of the JL type. The decline may have been prompted by the higher value-added margin, albeit slightly, for the LL type, in that domestic Chinese enterprises have found it increasingly more profitable to conduct export-processing on their own account, rather than on behalf of the foreign partners.

The nature of the electronics and IT industry as a processing trade is also clearly reflected in the composition of imports and exports of the industry. Thus, as shown in Table 7, electronic apparatus and devices needed for export-processing made up nearly one-thirds of total imports in 2001 for the industry, as against only 7.63 percent for exports. The same goes basically for imports and exports of electronic components (i.e., 16 percent versus 13 percent). The smaller magnitude of difference (as compared to the difference between imports and exports of apparatuses and devices) can obviously be explained by the fact that China imports the key expensive components, while exporting increasingly a large amount of low-grade ones.

By contrast, however, finished electronic or electrical home appliances made up 24 percent of total exports versus only 8 percent for imports. And for computers, the shares are respectively 34 percent for exports (almost all are minicomputers) and 22 percent for imports (essentially large and medium sized advanced computers, which the country is not capable of producing). As a matter of fact, China as a global electronics manufacturing center still depends on Intel processors to make computers and Texas Instruments chips to churn out mobile phones. Such semiconductors are simply still beyond the design and manufacturing capabilities of the country, as one observer noted recently (SCMP, 20 March 2004, p.B3).

Table 7: Imports and Exports of the Chinese Electronics and IT industry by Major Products, 2000 and 2001

(in percent)

Items	Exports 2000	Exports 2001	Imports 2001
Household electronics	21.9	23.88	8.29
Electronic components	15.6	12.88	16.07
Electronic materials	1.2	0.99	2.49
Telecommunications equipment	12.4	14.19	13.55
Computers	31.8	34.28	21.57
Electronic instruments	4.8	4.53	6.31
Electronic apparatus	9.3	7.63	31.05
Broadcast & television equipment	3.0	1.62	0.67

Sources: CEITPERR 2001 for exports
CEIYB 2002 for imports

In absolute terms, total imports of electronic apparatus and components, plus electronic materials and electronic instruments and equipment, amounted to USD 31.05 billion as against only 17.04 billion for exports in 2000. The imbalance between imports and exports has indeed remained most crucial for integrated circuits – the “food grain” of the electronics industry, as shown below:

Items	1996	1997	1998	1999	2000	2001	2002
Imports, (USD billions)	2.72	3.64	4.78	7.92	13.80	17.00	26.38
Exports, (USD billions)	0.60	0.93	1.15	2.06	2.94	2.63	4.32

In the same vein, the import supply sources and export destinations of the Chinese electronics and IT industry also clearly point to the nature of the industry as an export-processing trade. Take again integrated circuits as an example; one-third of China’s imports in 2000 came from Japan, a quarter from Taiwan, and the rest from South Korea, the United States, Malaysia and Singapore. As for IC exports, Hong Kong remained the largest outlet not because of any substantial local demand but because of it being the most important entrepot for China.

Table 8 shows the major sources of import supply and export destinations for the Chinese electronics and IT industry taken as a whole during 2000-2001. Thus, Hong Kong took up a hefty 26 percent of total exports as against only 5 percent as an import source. Obviously it is because Hong Kong is most instrumental in channeling the bulk of China's consumer electronics exports to the United States and other major western countries. Even without considering re-exports from Hong Kong, the United States itself still represents the single most important destination of China's electronics exports, taking up a total 21 percent, as against 14 percent as an import supplier for the Chinese electronics and IT export-processing.

Table 8: Major Import Sources and Export Destinations for China's Electronics and IT Processing trade, 2000/2001

(in percent)

Countries	Exports 2000	Exports 2001	Imports 2001
Hong Kong	24	25.60	5.02
United States	23	20.99	13.53
Japan	12	12.60	21.16
The Netherlands	5	4.86	-
Germany	4	4.25	3.75
Singapore	4	3.52	-
South Korea	4	4.10	8.97
Malaysia	-	-	4.85
United Kingdom	3	-	-
Taiwan	2	-	12.57
France	2	-	-
Others	17	24.62	30.15

Sources: CEITPERR 2001 and
CEIYB 2002

C. Export Composition and Trend

Rapid and sustained technological upgrading and diversification over the past decade or so has enabled the Chinese electronics and IT industry to swiftly penetrate the world market with a rather complex array of new export commodities. By the early 2000s, capital-intensive and high-technology products such as program-controlled switchboard and minicomputer have already increasingly dominated the export structure, alongside the large-scale supply of colored TV sets, DVD, VCR, Hifi stereo, and the like. The advancements appear especially impressive if set against the background of the 1980s, when the industry was literally made up of nothing more than labor-intensive and low-value-added assembling of radio, cassette-recorder, and electronic watch for example.

The Chinese export strategy for the electronics and IT industry has basically followed that of the "four little dragons." Most of the producer enterprises are engaged in "original equipment manufacturing" (OEM) on behalf of global conglomerates. That is to say, the exported products are normally labeled with globally known brand names, rather than the producer's own trademarks. Unlike the "little dragons," however, China, with a virtually unlimited supply of the necessary labor, can always fall back on the vast hinterland to continue with labor-intensive manufacturing whenever the more advanced coastal areas are compelled by increased labor costs to promote capital–intensive technological upgrading. In other words, the "flying geese pattern" of regional specialization can take place within China itself, as has indeed been the case since the mid-1990s or so. As a result, one may expect that for many years to come, the country's electronics and IT exports will continue to be shared by both capital and labor-intensive products.

Table 9 shows the export commodity composition of the Chinese electronics and IT industry by broad category. Several important points emerge:

Table 9: Export composition of China's electronics and IT industry by broad product category, 1991-2000 (realized) and 2001-2005 (forecast)

(in hundred million US dollar and in percent)

Year	E/IT Exports total	Computer and peripheral equipment		Telecom products		Consumer electronics		Electronic apparatus and components		Integrated circuits	
	Value	Value	%	Value	%	Value	%	Value	%	Value	%
1991	49	4.5	9.2	1.4	2.9	13.9	28.4	-	59.5	0.04	0.08
1992	61	10.7	17.5	6.7	11.0	28.7	47.4	-	24.1	0.00	0.00
1993	81	15.6	19.3	7.3	9.0	31.7	39.1	-	32.6	0.8	0.93
1994	124	28.0	22.6	14.6	11.8	51.2	41.3	-	24.3	1.6	1.29
1995	165	49.6	30.1	20.8	12.6	51.8	31.4	-	25.9	4.3	2.63
1996	215	64.7	30.1	89.4	41.6	44.8	20.8	-	7.5	12.6	5.86
1997	269	87.3	32.5	99.7	37.1	45.0	16.7	-	13.7	19.4	7.21
1998	258	68.9	26.7	130.2	50.5	38.7	15.0	-	7.8	12.0	4.65
1999	390	122.9	31.5	39.7	10.2	87.9	22.5	-	35.8	18.9	4.85
2000	551.6	175.3	31.8	68.5	12.4	120.9	21.9	170.4	28.7	19.7	4.36
2001	634.3	210.4	33.2	85.6	13.5	133.0	21.0	196.0	30.9	22.7	3.58
2002	729.5	252.4	34.6	107.0	14.7	146.3	20.1	225.4	30.9	26.1	3.58
2003	838.9	302.9	36.1	133.8	15.5	160.9	19.2	259.2	30.9	30.0	3.58
2004	964.8	363.5	37.7	167.2	17.3	177.0	18.3	298.0	30.9	34.5	3.58
2005	1,109.5	436.2	39.3	209.0	18.8	194.7	17.5	342.7	30.9	39.6	3.58

Sources: CEITPERR 2001

First, by 2000, computers and peripheral equipment have already taken up the largest share, nearly one-third of China's total electronics and IT exports. The increases appear indeed quite consistently over the years since the early 1990s, when the comparable share amounted to only around 10 percent. While the exports tend to be dominated by hardware manufactures, especially minicomputers, they cover nevertheless a wide range of products, including card, printer, display unit, hard disk drive, floppy disk drive, computer case, keyboard, floppy and hard disk, etc.

Second, by contrast, the share of "consumer electronics," which include colored TV, Hifi stereos, radio and cassette recorder, laser disc, video recorder, and the like, has declined also quite consistently from a high of 47 percent in 1992 to around 20 percent in 2000 and it is forecast to be reduced further in the years to come in favor of the share of computer and peripheral equipment.

Third, similar to the category of "computer and peripheral equipment," exports of "telecommunications equipment," which include notably, telephones, program-controlled switchboards, mobile phones, optical fiber and optical cables, also increased quite drastically in the 1990s, to a high of 50 percent in 1998 as a share in total electronics and IT exports. However, the share tended to stabilize at just a little more than 10 percent by the early 2000s; and it is forecasted to increase in the next few years to only half the size of that of the "computer and peripheral equipment" category.

Last but not least of interest, is the export share of the category "electronic components and apparatus," which includes, among other things, printed circuit board, capacitor, transistor

tube, and most importantly, integrated circuits as well. Notice that by 2000, for the entire category taken as a whole, the share in total electronics and IT exports stood at around 30 percent, which is comparable to that of "computer and peripheral equipment." The accelerated increases in IC exports are especially noteworthy. It points to the fact that with increased technological upgrading, producer electronics is poised to assume a greater role in the country's electronics and IT exports. This is already clearly reflected in the shift, in relative terms, from "consumer electronics" as a category to "computer and peripheral equipment."

As a matter of fact, all major categories of electronics and IT exports have shown massive growth over the past fifteen years or so. Thus, as may be estimated from the data given in Table 9, the annual average rate of growth from 1991 to 2000 for "computers and peripheral equipment" is 50 percent, "telecommunications equipment" at 31 percent, "consumer electronics" at 27 percent, and that for IC (for 1996-2002) at 39 percent. These are all phenomenal growth by any international standards.

More remarkable is the fact that accelerated expansion in production and exports has rapidly turned China to be a net exporter for a wide range of electronics and IT products. As revealed in Table 10, the net export position is most pronounced with both colored TV and telephone sets but it is also clearly the case with facsimile equipment, minicomputers, display units, keyboards, printers, and others. However, the reverse is true with IC technology, for which the country is a very substantial net importer and as it presently stands, there still is no sign for any reversal to take place in the foreseeable future. In other words, the country will likely have to rely on advanced western countries for core technology to sustain its electronics and IT industry for many years to come.

Table 10: Exports and Imports of Selected Electronics and IT products, 1996-2002
(in million US dollar)

Items	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**Annual Growth %**
Computers								
Total								
Exports	369,63	536,37	706,79	792,19	109,9475	1,309,62	2,013,48	43.54
Imports	2	1	7	5	451,644	5	3	38.23
Exports/Imports	96,520 3.83	113,45 2 4.73	181,01 0 3.91	325,33 3 2.44	2.43	498,150 2.63	673,328 2.99	
Small PC								
Exports	-	-	-	12	266	184	736	-
Imports	6,697	3,268	4,609	11,869	19,334	24,238	23,747	23.48
Exports/Imports	-	-	-	0.001	0.001	0.008	0.031	
Mini PC								
Exports	9,669	12,255	20,397	16,669	69,364	33,143	96,499	46.73
Imports	2,283	4683	75,84	6,282	7,422	5,214	2,913	4.15
Exports/Imports	4.24	2.62	2.69	2.65	9.35	6.36	33.13	
Display Unit								
Exports	85,465	121,48	173,77	256,46	338,567	352,378	572,666	37.30
Imports	8,051	5	7	1	15,236	26,479	55,767	592.67
Exports/Im	10.62	10056	8,182	9,077	22.22	13.31	10.36	

ports		12.08	21.24	8.25				
Printer								
Exports	65,355	80,930	97,839	108,98	160,032	212,163	260,701	25.93
Imports	3,377	7504	23,262	2	59,081	65,280	74,627	67.52
Exports/Im	19.35	10.78	4.21	43,027	2.71	3.25	3.49	
ports				2.53				
Keyboard								
Exports	24,696	40,431	52,726	64,856	71,653	70,308	77,788	21.67
Imports	1,809	1686	1,958	3,774	4,623	4,590	6,824	24.77
Exports/Im	13.65	23.98	26.93	17.18	15.50	15.32	11.40	
ports								
Diskette								
Exports	15,698	9,568	8,263	7,385	6,122	7,714	7,725	-11.15
Imports	2650	2263	7,968	9,908	3,625	4,959	22,638	42.98
Exports/Im	5.92	4.23	1.03	0.75	1.69	1.56	0.34	
ports								
Word								
processor	10,390	3,965	4,055	4,343	23,69	1,368	1,252	- 29.72
Exports	-	93	376	668	685	-	-	
Imports		42.65	10.78	6.50	3.46			
Exports/Im								
ports								
Color								
television	62,206	50,554	52,590	63,782	111,848	143,350	220,608	23.49
Exports	277,20	17,016	13,040	14,266	5,919	3,386	3,515	- 27.52
Imports	7	2.97	4.03	4.47	18.90	42.34	62.76	
Exports/Im	2.57							
ports								
Television sets								
Exports	86,470	94,796	130,41	152,20	169,283	140,968	140,457	8.42
Imports	1,563	2,337	2	1	1,550	2,042	1,964	3.88
Exports/Im	55.32	40.56	1,659	4,168	109.22	69.03	71.52	
ports			78.61	36.52				
Cassette								
recorder	201,73	214,88	221,09	205,32	243,869	223,442	267,058	4.79
Exports	3	3	7	8	3,814	2,191	3,374	- 12.15
Imports	7,339	3,823	3,025	4,216	63.94	101.98	79.15	
Exports/Im	27.49	56.21	73.09	48.70				
ports								
Video camera		,						
Exports	3,207	5633	9,856	143,05	354,20	54,803	98,552	76.98
Imports	838	1,685	1,626	4,854	7,261	8,575	11,363	54.42
Exports/Im	3.83	3.34	6.06	2.95	4.88	6.39	8.67	
ports								
Speak cabinet								
Exports	44,072	59,081	66,874	90,123	96,533	93,764	115,312	17.39
Imports	8869	9,080	8,561	14,014	15,673	14,996	17,987	- 12.51
Exports/Im	4.97	6.51	7.81	6.43	6.16	6.,25	6.41	
ports								
Others								
Integrated								
Circuits	59,455	93,180	115,00	205,80	293,799	262,852	431,602	39.15
Exports	272,20	364,17	4	3	1,379,98	1,699,92	2,637,83	46.01
Imports	7	8	477,82	792,37	3	4	2	
Exports/Im	0.22	0.26	4	6	0.21	0.15	0.16	
ports			0.24	0.26				

Carrier communications equipment	1,121	1,125	5,451	11,628	30,867	50,969	86,402	106.29
Exports	19,086	10,671	66,280	87,183	172,108	282,737	148,650	40.79
Imports	0.059	0.105	0.082	0.133	0.179	0.180	0.581	
Exports/Imports								
Fax machine								
Exports	23,804	23,435	17,725	20,889	31,651	44,270	50,610	13.40
Imports	2,475	1,475	1,215	48,35	5,706	6,414	9,748	25.67
Exports/Imports	9.62	15.89	14.59	4.32	5.55	6.90	5.19	

Sources: China Foreign Economic and Trade Yearbook (CFETYB), various years

Notice also from Table 10 that the strong export growth has persisted through the early 2000s for virtually all major electronics and IT products. Exports of "computer and peripheral equipment" taken as a category posted an annual average growth rate of 44 percent from 1996 to 2002, which is much higher than the 20 percent growth predicted in Table 9[7]. The same goes for colored TV, video camera, carrier communications equipment, and ICs as well; although for the relatively more mature products such as telephones, fax machines, cassette recorders, and perhaps speaker cabinets as well, the export growth tended to stabilize, to a greater or smaller degree, towards the later years (See Table 10).

D. Major Export Markets

For exports of the electronics and IT industry taken as a whole, the distribution among the major destinations are already highlighted under section C above. It is sufficient to refer to a couple of representative products to examine how they are tailored to the overseas markets. Several important points may be made from Table 11.

First, the United States, European Union, Japan, and Hong Kong all remain, generally speaking, the largest markets for China's exports of electronics and IT commodities. However, the respective shares tend to vary from year to year, and indeed from product to product. Thus, the U.S. share in China's exports of both colored TV sets and mobile phones increased from 6 percent in 2001 to 26 percent in 2002 for the former, and from 12 percent to 31 percent for the latter. In absolute terms, the increases are by any measure also spectacular, by 528 percent (from some USD91 million in 2001 to USD569 million in 2002) for the former, and by 221 percent for the latter (from USD505 million to USD1618 million). For exports to Japan, the share in colored TV sets declined from 45 percent in 2001 to 30 percent in 2002; but the absolute amount still kept on increasing nevertheless, albeit slightly from USD650 million to USD654 million.

Second, in the case of the European Union, as represented by five major countries (the United Kingdom, Germany, France, Italy, and the Netherlands), it should be interesting to note that the share in China's electronics and IT exports varies from product to product very substantially, rather than from year to year for the same product. Thus, while for colored TV sets the share stood at the negligible low of 1.8 percent in 2001 and 2.5 percent in 2002, it amounted to a high of 40 percent and 33 percent respectively for computer display units, or 24 percent and 21 percent for the broader category of "computers and components." The comparable EU-5

[7] The coverage of the two statistical series in Tables 9 and 10 differs to a certain extents. They are therefore not exactly comparable.

share for mobile phones was also quite substantial, remaining at 22 percent in 2001 and 20 percent in 2002. Notice also that for the European Union as a whole, the share in China's mobile phones exports for 2001 amounted to 24 percent (i.e., only two-percentage points higher than the 22 percent given for the EU-5). This seems to suggest that there still is considerable room for China to expand its exports to the other EU countries.

Third, even within the EU-5, the shares for most product categories tend to vary greatly between countries in a manner that is entirely disproportionate to the population and income size of the countries involved. Thus, for "computers and components," or the narrower category of "display units," the share of the Netherlands for 2001 stood respectively at 14 percent and 21 percent, and for 2002 at a comparable 12 percent and 18 percent. These are all absolutely much higher than the shares for the other major EU countries, which range from 0.7 percent to 4.6 percent for "computers and components," or 0.9 percent to 10 percent for the "display units" category. Does the Netherlands merely serve as an entrepot for the other EU countries, or is it because the country is the home base of Philips – the global electronics giant? We really do not know for sure. In the same vein, Germany alone took up a hefty share of 17 percent in China's exports of mobile phones in both 2001 and 2002, while the other four EU countries' shares range from 0.02 percent to 1.75 percent for the two years. Is the Chinese "handi" (as the German refer to a mobile phone) of any particular appeal to the German, or is it because Siemens is made in China on an OEM basis and shipped backed to Germany for sales? The same question may be raised with the disproportionately large share of Chinese electronics and IT exports to Finland, in relation to its gigantic neighbor, the Russian Federation (See Table 11). Is it because the Finns are particularly fond of Nokia (their globally known national brand name), despite of the fact that the mobile phone sets may all be made in China?

Fourth, Hong Kong tells a story similar to that of the EU-5, in that its share in China's electronics and IT exports also varies from product to product: an average of 21 percent for "computers and components," as against only 4.6 percent for "display units." Notice that for both the United States and the Netherlands; exactly the reverse is true, although the discrepancy may not appear to be as substantial. Likewise, Hong Kong's share in China's exports of mobile phones stood at 37 percent in 2001, or 25 percent in 2002, as against a negligible 4 percent for colored TV sets.

Fifth, for the ASEAN-5 taken as a whole, the share in China's electronics and IT exports seems to be biased downwards, consistently across the different products despite the entrepot role played by Singapore (which takes up quite consistently a higher share for most of the product types). Perhaps the small shares for the ASEAN-5 combined conceal the fact that parts of their imports from China are also channeled through Hong Kong, because such imports are, by international custom statistical practice, treated as exports from Hong Kong rather than China. However, the bulk of Hong Kong's re-exports of Chinese origin are normally destined to the United States and Europe, rather than Japan and the ASEAN countries. If correct, then here again, the share of the ASEAN-5 in China's electronics and IT exports seems to be disproportionately low, compared with that of Australia and New Zealand, in relation to the size of the countries.

Table 11: Share of Major Overseas Markets in China's Exports of Representative Electronics and IT Products, 2001-2002

(in million US dollar and in percent)

Countries	Computers		Display units		Mobile phones		Color Television	
	2001	2002	2001	2002	2001	2002	2001	2002
World total	13096	20134	3524	5727	4121	5280	1434	2206

North America								
USA	26.66	28.04	28.39	36.76	12.25	30.65	6.32	25.79
Canada	0.53	0.76	1.00	1.03	-	0.11	0.37	0.60
European Union								
United Kingdom	3.49	2.66	3.97	3.92	2.66	0.24	0.11	0.66
Germany	4.50	4.61	10.46	8.67	16.86	6.90	1.09	1.02
France	1.44	1.35	2.16	0.94	1.44	1.75	0.31	0.29
Italy	0.66	0.74	1.61	1.58	0.07	0.02	0.14	0.24
Netherland	14.22	11.71	21.38	17.83	0.80	1.23	0.13	0.31
Belgium	0.84	0.57	0.96	0.78	-	-	0.27	0.30
Finland	0.39	0.28	0.97	0.61	1.15	0.96	3.82	2.53
Russia	0.11	0.29	0.30	0.91	-	-	1.11	1.34
Japan	11.26	15.31	5.24	7.75	0.23	0.13	45.40	29.66
Korea	2.47	1.38	2.72	1.41	7.28	5.94	0.64	0.36
Taiwan	1.77	2.85	1.11	1.98	0.01	0.06	0.45	0.72
Hong Kong	20.62	20.40	4.61	4.60	37.41	24.82	5.06	3.43
ASEAN-5	4.01	3.43	3.15	2.63	11.60	7.39	10.12	7.32
Indonesia	0.14	0.08	0.28	0.18	0.00	-	5.29	1.84
Malaysia	0.44	0.72	0.35	0.42	7.26	1.85	0.53	1.31
Thailand	0.31	0.26	0.52	0.41	1.55	2.73	0.42	0.47
Philippines	0.31	0.28	0.62	0.41	0.66	0.36	0.49	0.59
Singapore	2.81	2.09	1.38	1.21	2.13	2.45	3.39	3.11
Australia	1.08	1.21	2.12	2.01	0.55	0.48	4.28	5.04
N. Zealand	0.11	0.11	0.26	0.25	0.11	-	0.74	0.65
Others	5.82	4.30	9.6	6.27	7.54	9.30	19.71	19.76

Sources: China Custom Statistical Yearbook (various years) for mobile phones, and CFETYB (various years) for computers (including peripheral equipment), display units (sum part of computers as above), and color TV.

Several points of interest or conclusions may be drawn from the above observations:

The first relates to the volatility of the shares for some major markets or block of countries in China's electronics and IT exports across the years, and the disproportionate discrepancy between importing economic entities of different sizes in the shares for different categories of products imported from China. The circumstances clearly suggest that there still exist substantial market potentials overseas that Chinese exporters may continue to exploit in the years to come.

The next point concerns the remarkably high share for Japan in China's exports of colored TV sets (45 percent in 2001 and 30 percent in 2002). This truly flies in the face of the kingdom of consumer electronics, which has for decades dominated the global supply of TV sets. The fact, however, is that not only all the familiar Japanese brand names sold in China today are all manufactured in the country, but those available in the domestic Japanese markets are also increasingly imported from China as well. Notice that all the Japanese electronics giants have established their own manufacturing plants in China: Sony in Shanghai, Matsushita (National and Panasonics) in Jinan (Shandong province), Toshiba in Dalian (Liaoning), Sharp in Nanjing (Jiangsu), Hitachi in Fuzhou (Fujian), and Sanyo in Shenzhen (Guangdong); alongside Korea's LG (in Shenyang in Liaoning) and Samsung (Tianjin), and the Dutch-based conglomerate, Philips (Suzhou in Jiangsu). Obviously, the exceedingly high intake rates by the United States of China's exports of mobile phones (31 percent in 2002), computer and components (28 percent in 2002), and display units (37 percent in 2002), may be similarly explained by the Motorola investment in Tianjin and by IBM and Compaq resorting to the Dongguan municipality (the single largest computer manufacturing center in China) as their global outsourcing base.

The third point is that while the United States, European Union, and Japan are all being swiftly flooded with Chinese electronics and IT products, the day may not really appear to be far away for a similar Chinese foray into the neighboring ASEAN countries as well.

A primary point of concern for the present study is how the emerging Chinese new industries may impinge upon the broader regional industrial setting in East Asia. For this purpose, we should now look at how, in the first place, the massive Chinese electronics and IT export expansion into the advanced western countries-the United States in particular, may bear on the rival exporting economies in the region.

E. Market Shares and Revealed Comparative Advantage in the United States and Japan

Specifically, we estimate the revealed comparative advantage (RCA) index for China and the other major East Asian economies for their electronics and IT exports to the United States (i.e., the single largest market for all), with a view to examining to what extent China may have eroded the export capability of its rivals over the past decade or so. Five major custom entities (viz., Japan, Korea, Taiwan, Malaysia, and Singapore) are selected for the comparative analysis with China. These are all important manufacturers-cum-exporters of electronics and IT commodities.

The RCA formula to be used for the estimation is familiar, as follows,

$$R_{ij}^{(k)} = \frac{X_i^k}{\sum_j Y_{ij}^k} \div \frac{\sum_i X_i^k}{\sum_i \sum_j Y_{ij}^k} = \frac{X_i^k}{\sum_i X_i^k} \div \frac{\sum_j Y_{ij}^k}{\sum_i \sum_j Y_{ij}^k}$$

Where i stands for the traded goods, j the exporting country, k the importing country (in this case the United States), X_i^k the sum total of i imported by k from the country under study, and Yijk the sum total of i imported by k from j.

The U.S. Custom statistics, which apply the HS (Harmonized Commodity Description and Coding System) classification method, are used for the estimation. The following major electronics and IT commodities are included, which represent different degrees of disaggregation:

HS Code	Commodity (short reference to be used here-in- after)
8471	computers & components, data processing machine, magnetic reader, etc. (computers and components)
8471-60010	display units, nesoi (display units)
8471-60020	display units, incorporating liquid crystal devices (LCD)
8471-603000	display units, not incorporating a cathode-ray-tube (CRT), having a visual display diagonal not exceeding 30.5 cm (display units A)
8471-604580	display units, nesoi, not incorporating a CRT (display units B)
8471-606400	printers, nesoi, ink jet (printers)
8517	electric apparatus for line telephone, etc; parts (telephone sets)
8521	video apparatus (video apparatus)
8525	transmission apparatus for radio-telephone, etc., TV camera & recorders (TV camera and recorders)
8528-1200	color TV sets with/without radios or players, recorders (color TV sets)
8542	electronic integrated circuits and microassemblies, and parts (integrated circuits)

Before examining the estimated RCA indices, we should, however, look at the size contributions of the six East Asian economies to total imports of the United States for all goods combined, as well as for the various major categories as classified above. In other words, we are looking at both the denominator and numerator for the RCA formula, in order to gauge the relative magnitude of the East Asian 6, taken both as a whole and separately, in the relevant U.S. import measures. The figures in Table 12 give some very important information.

Table 12: Shares of China and Other East Asian Economies in Electronics and IT Imports by the United States, 1995-2004

(in percent)

Year	All goods							8471						
	C	J	K	T	M	S	Sum	C	J	K	T	M	S	Sum
1995	6.13	16.62	3.25	3.9	2.35	2.5	34.75	3.67	29.43	4.23	10.25	7.04	23.82	78.44
1996	6.51	14.56	2.86	3.78	2.25	2.57	32.53	3.64	23.75	4.93	10.4	6.97	25.99	75.68
1997	7.19	13.95	2.66	3.75	2.07	2.31	31.93	4.59	22.79	4.93	11.42	7.07	21.97	72.77
1998	7.79	13.35	2.62	3.62	2.08	2.00	31.46	6.37	21.11	4.05	10.61	6.82	21.04	70.00
1999	7.98	12.82	3.05	3.43	2.09	1.77	31.14	9.33	19.23	7.50	10.20	7.51	16.96	70.73
2000	8.22	12.05	3.31	3.33	2.10	1.58	30.59	11.29	16.69	8.74	11.83	8.33	12.37	69.25
2001	8.96	11.08	2.93	2.93	1.96	1.31	29.17	12.53	12.44	6.62	12.08	10.14	11.94	65.75
2002	10.28	10.46	2.77	2.77	2.07	1.27	29.62	18.31	9.07	5.54	12.60	13.77	10.44	69.73
2003	12.10	9.37	2.51	2.51	2.02	1.20	29.71	29.36	6.54	4.12	8.85	14.96	9.52	73.35
2004	13.38	8.83	3.14	2.36	1.92	1.05	30.68	40.97	5.34	2.70	5.59	14.06	7.47	76.13

Year	8471-603000							8471-604580						
	C	J	K	T	M	S	Sum	C	J	K	T	M	S	Sum
1995	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	0.02	82.95	2.20	5.79	1.50	0.29	92.75	0.11	74.65	6.88	6.96	0.04	0.01	88.65
1997	0.29	71.78	2.37	11.06	0.06	0.56	86.12	0.22	63.27	12.80	13.37	4.53	0.97	95.16
1998	0.76	77.38	0.87	6.84	0.02	0.28	86.15	0.14	77.53	8.14	8.91	0.06	0.15	94.93
1999	0.56	76.38	1.57	9.64	0.01	0.11	88.27	0.21	48.08	31.14	15.08	0.09	0.19	94.79
2000	1.00	75.93	0.69	11.52	0	0.14	89.28	3.57	28.15	39.86	25.03	2.02	0.07	98.70
2001	4.31	57.98	6.58	18.16	0.20	0.54	87.77	8.63	18.47	31.05	26.04	3.71	0.01	87.91
2002	19.01	39.49	10.00	19.38	0.03	0.73	88.64	29.83	11.47	23.53	16.18	0.96	0.04	82.01
2003	46.52	22.24	5.77	14.97	0.12	0.71	90.33	49.21	5.02	13.42	10.95	2.07	0.04	80.71
2004	47.37	17.14	7.78	15.36	0.11	0.42	88.18	65.00	2.52	10.77	7.03	1.09	0.06	86.47

Year	8471-606400							8517						
	C	J	K	T	M	S	Sum	C	J	K	T	M	S	Sum
1995	-	-	-	-	-	-	-	9.35	26.8	1.77	4.09	7.56	2.88	52.45
1996	4.43	20.48	5.00	0	3.86	56.63	90.40	13.23	17.4	1.21	4.74	10.48	0.85	47.91
1997	9.97	14.93	4.74	0	0.60	61.76	92.00	13.86	15.69	1.00	5.00	7.67	0.38	43.60
1998	9.44	16.73	4.55	0	6.92	40.44	78.08	15.96	16.31	1.04	6.83	6.02	0.35	46.51
1999	12.46	8.58	1.75	0	20.68	20.26	63.73	14.46	16.33	0.67	4.47	4.89	1.19	42.01
2000	12.31	2.25	1.78	0.14	26.06	23.22	65.76	11.71	12.34	0.77	4.33	5.11	0.97	35.23
2001	19.39	1.88	3.78	0.08	24.06	23.13	72.32	16.85	11.23	0.87	5.88	6.14	0.73	41.70
2002	22.06	1.76	3.13	0	44.69	13.5	85.14	20.21	4.70	0.94	5.10	10.2	1.89	43.04
2003	21.95	0.19	0.02	0.02	55.73	10.08	87.99	21.14	4.31	1.12	3.78	16.51	0.11	46.97
2004	33.26	1.51	0.01	0.00	46.00	5.00	85.78	22.62	4.62	1.29	2.55	15.62	1.00	47.7

Year	8521							8525						
	C	J	K	T	M	S	Sum	C	J	K	T	M	S	Sum
1995	7.32	30.86	16.51	0.39	20.72	5.44	81.24	3.22	39.75	7.35	4	6.4	0.3	61.02
1996	8.60	31.57	9.54	0.46	21.64	4.70	76.51	4.35	41.83	4.66	6.25	2.57	0.52	60.18
1997	8.13	34.86	3.48	0.49	19.57	2.80	69.33	5.25	38.32	6.24	8.64	2.03	0.91	61.39
1998	11.50	38.79	5.40	0.26	16.84	0.56	73.35	4.71	35.79	9.36	8.23	2.00	0.7	60.79
1999	17.36	35.02	7.31	0.51	15.59	0.90	76.69	5.06	31.52	15.09	8.26	3.88	1.00	64.81
2000	27.44	24.48	10.12	0.57	16.26	0.93	79.80	5.74	24.19	16.00	6.04	6.31	0.75	59.03
2001	42.95	13.33	10.98	1.13	13.79	0.65	82.83	6.45	17.81	21.90	3.83	7.84	0.88	58.71

2002	53.84	8.88	11.62	0.61	6.80	0.93	82.68	12.73	19.31	21.25	2.66	6.45	0.56	62.96
2003	60.42	8.97	7.35	0.59	5.02	0.67	83.02	18.19	17.12	24.07	2.9	7.39	0.77	70.44
2004	63.03	7.71	6.59	1.04	4.01	0.49	82.87	25.92	14.09	27.23	2.65	5.91	1.68	77.48

Year	8528-1200							8542						
	C	J	K	T	M	S	Sum	C	J	K	T	M	S	Sum
1995	-	-	-	-	-	-	-	0.28	26.72	19.26	7.76	12.82	7.54	74.38
1996	0.72	2.95	0.55	0.09	12.46	0.18	16.95	0.42	22.85	18.27	8.14	13.66	8.5	71.84
1997	0.38	1.27	0.76	0.15	10.96	0.05	13.57	0.48	20.13	15.57	8.9	13.93	7.3	66.31
1998	0.42	0.69	1.01	0.11	8.34	0.02	10.59	1.07	16.28	17.34	9.5	12.42	6.69	63.3
1999	1.04	0.61	1.66	0.11	11.59	0.09	15.1	1.43	16.03	19.52	10.44	13.00	5.78	66.2
2000	1.69	0.86	1.27	0.26	11.81	0.06	15.95	1.15	15.78	17.99	11.4	12.84	7.68	66.84
2001	2.25	2.33	2.38	0.24	10.66	0.25	18.11	1.57	13.45	13.07	12.32	15.44	6.41	62.26
2002	7.7	4.79	2.73	0.47	13.78	0.04	29.51	1.98	9.5	14.98	12.8	16.65	5.35	61.26
2003	8.74	6.15	5.86	2.49	9.27	0.19	32.7	2.54	8.84	15.57	13.43	14.65	5.84	60.87
2004	8.36	5.51	6.02	5.21	5.24	0.11	30.45	4.03	9.58	17.00	15.56	13.63	6.26	66.06

Notes: C stands for China, J Japan, K Korea, T Taiwan, M Malaysia, S Singapore

Sources: Global Trade Information Services, Inc., World Trade Atlas 1993-2004, (Internet version accessed via Business Infocenter of Hong Kong Trade development Council). Original data are given in Appendix Table A (available upon request).

First, the combined share of the East Asian 6 in total U.S. imports amounted to a hefty 31 percent in 2004, although it has declined consistently from the high of 35 percent in 1995.

Second, except perhaps for HS 85281200 (colored TV sets), the shares of the East Asian 6 in U.S. imports of all the other eight major categories of electronics and IT products taken separately, are all exceedingly high, compared to the "all goods" measure. That is to say, exports of the East Asian Six to the United States have been overwhelmingly dominated by electronics and IT goods over the years. Notice, however, that even for colored TV sets, the share has continuously increased from 17 percent in 1996 to 30 percent in 2004, which is now above the average for all goods exported by the East Asian 6 to the United States.

Third, virtually all display units (HS 8471-603000 and -604580 combined) and printers (HS 8471-606400) imported by the United States are of East Asian origin. The same goes basically for video apparatus (HS 8521), and to a lesser extent, TV cameras and recorders (HS 8525) as well. Over half of the ICs (HS 8542) imported by the U.S. are also from the East Asia Six.

Viewed against this overall context of the East Asian electronics exports to the United States, it should be of great interest to see how as a result of the accelerated Chinese export expansion over the past decade, there might have come to a redistribution of the export shares among the East Asian 6 in the U.S. market in favor of China. Several important points emerge from Table 12.

First, China's share in total U.S. imports (all goods combined) has doubled from 6 percent in 1995 to 13 percent in 2004, while that of Japan has continuously been reduced from a high of 17 percent to 9 percent in the same period. The other East Asian Four—Korea, Taiwan, Malaysia, and Singapore, have indeed all seen their shares curtailed as well, to a greater or lesser degree.

Second, for the various categories of electronics and IT exports, the Chinese shares have increased even more substantially, compared with the average for "all goods". The country has thus rapidly replaced Japan across the board, to be the largest exporter to the United States. By 2004, 63 percent of the video apparatuses (HS 8521) imported by the United States

are of Chinese origin, up from merely 7 percent in 1995. For computer-display units (HS 8471-60300 and -604580 combined), over half of the U.S. imports are now also from China, while just three or four years ago, the Chinese share was virtually zero. The same goes basically for printers (HS 8471-606400), telephone sets (HS 8517), and TV camera and recorders (HS8525) as well, for which China now makes up between 23 percent and 33 percent of total U.S. imports, as against only 3 percent to 9 percent respectively in 1995 or 1996. Notice also that with only one or two exceptions, the Chinese shares for all the last three types of exports to the United States are also larger than that of the other East Asian economies.

Third, out of the nine major categories of exports under study, only in the case of colored TV sets (HS 8528-1200) and integrated circuits (HS 8542) did China not command any particular competitive edge. Interestingly, despite accelerating its export drive in recent years, the country's share in U.S. imports of colored TV sets stands at a mere 8 percent. And for integrated circuits, the share (scarcely 4%) falls indeed well behind that of all the other East Asian Five, especially Korea (17%), Taiwan (16%), and Malaysia (14%), as is also shown in Table 12.

Fourth, notice also that for U.S. imports of printers, Malaysia commands an exceedingly large share of 56 percent in 2003, and 46 percent in 2004, compared to 22 percent (33%) and 10 percent (5%) respectively for China and Singapore. Likewise, Korea's share in U.S. imports of TV cameras and recorders in 2004 are also quite impressive, standing at 27 percent, as against 26 percent for China, or 14 percent for Japan. These discrepancies seem to suggest that despite increased overall Chinese dominance in East Asian exports to the U.S. market, there may still be room for other exporting economies to carve out their own niche in the trade.

All said, the particular Chinese strengths in exports to the U.S. or other major markets overseas, should, nevertheless, not be interpreted in oblivion of the important background that they are essentially built upon FDI and technology transfer from the United States, Japan, Taiwan, and increasingly Korea as well, with or without assuming the prevalent practice of OEM, ODM, or others. With this important qualification, we may now look at the estimated RCA indices, in order to more exactly gauge the comparative advantages of China in electronics and IT exports.

The standards for assessment adopted as an empirical rule are as follows: when the estimated RCA index is > 2.5, the commodity concerned is considered to be highly competitive; 1.25 - 2.5 comparatively competitive; 0.8 - 1.25, of average competitiveness; and < 0.8, comparatively less competitive (Jin Pei, p.147)

The estimated RCA indices are given in Table 13. The major findings may be summarized as follows:

Table 13: Estimated RCA indices for China and other East Asian economies in their electronics and IT exports to the United States, 1995-2004

Year	HS 8471						8471-603000					
	C	J	K	T	M	S	C	J	K	T	M	S
1995	0.60	1.77	1.30	2.63	3.00	9.53	-	-	-	-	-	-
1996	0.56	1.63	1.72	2.75	3.10	10.11	0.00	5.70	0.77	1.53	0.67	0.11
1997	0.64	1.63	1.85	3.05	3.42	9.51	0.04	5.15	0.89	2.95	0.03	0.24
1998	0.82	1.58	1.55	2.93	3.28	10.52	0.10	5.80	0.33	1.89	0.01	0.14
1999	1.17	1.51	2.46	2.98	3.59	9.58	0.07	5.96	0.51	2.81	0.00	0.06
2000	1.37	1.39	2.64	3.55	3.97	7.83	0.12	6.30	0.21	3.46	0.00	0.09

2001	1.40	1.12	2.26	4.12	5.17	9.11	0.48	5.23	2.25	6.20	0.10	0.41
2002	1.78	0.87	2.0	4.55	6.65	8.22	1.85	3.78	3.61	7.00	0.01	0.57
2003	2.43	0.70	1.64	3.55	7.41	7.93	3.85	2.37	2.30	5.96	0.06	0.59
2004	3.06	0.60	0.86	2.37	7.32	7.11	3.54	1.94	2.48	6.51	0.06	0.40

Year	8471-604580						8471-606400					
	C	J	K	T	M	S	C	J	K	T	M	S
1995	-	-	-	-	-	-	-	-	-	-	-	-
1996	0.02	5.13	2.41	1.84	0.02	0.00	0.68	1.41	1.75	0	1.72	22.04
1997	0.03	4.54	4.81	3.57	2.19	0.42	1.39	1.07	1.78	0	0.29	26.74
1998	0.02	5.81	3.11	2.46	0.03	0.08	1.21	1.25	1.74	0	3.33	20.22
1999	0.03	3.75	10.21	4.40	0.04	0.11	1.56	0.67	0.57	0	9.89	11.45
2000	0.43	2.34	12.04	7.52	0.96	0.04	1.50	0.19	0.54	0.04	12.41	14.70
2001	0.96	1.67	10.60	8.89	1.89	0.01	2.16	0.17	1.29	0.03	12.28	17.66
2002	2.90	1.10	8.49	5.84	0.46	0.03	2.15	0.17	1.13	0	21.59	10.63
2003	4.07	0.54	5.35	4.36	1.02	0.03	1.81	0.02	0.01	0.01	27.59	8.4
2004	4.86	0.29	3.43	2.98	0.57	0.06	2.49	0.17	0.00	0.00	23.96	4.76

Year	8517						8521					
	C	J	K	T	M	S	C	J	K	T	M	S
1995	1.53	1.61	0.54	1.05	3.22	1.15	1.19	1.86	5.08	0.10	8.82	2.18
1996	2.03	1.20	0.42	1.25	4.66	0.33	1.32	2.17	3.34	0.12	9.62	1.83
1997	1.93	1.12	0.38	1.33	3.71	0.16	1.13	2.50	1.31	0.13	9.45	1.21
1998	2.05	1.22	0.40	1.89	2.89	0.18	1.48	2.91	2.02	0.07	8.10	0.28
1999	1.81	1.27.	0.22	1.30	2.34	0.67	2.18	2.73	2.40	0.15	9.46	0.51
2000	1.42	1.02	0.23	1.30	2.43	0.61	3.34	2.03	3.06	0.17	7.74	0.59
2001	1.88	1.01	0.30	2.01	3.13	0.56	4.79	1.20	3.75	0.39	7.04	0.50
2002	1.97	1.45	0.34	1.84	4.93	1.48	5.24	0.85	4.19	0.22	3.29	0.73
2003	1.75	1.46	0.45	1.51	8.17	0.09	4.99	0.96	2.93	0.24	2.49	0.56
2004	1.69	0.52	0.41	1.08	8.14	0.95	4.71	0.87	2.10	0.44	2.09	0.47

Year	8525						8528-1200					
	C	J	K	T	M	S	C	J	K	T	M	S
1995	-	-	-	-	-	-	-	-	-	-	-	-
1996	0.67	2.87	1.63	1.65	1.14	0.20	0.11	0.20	0.19	0.02	5.54	0.07
1997	0.73	2.75	2.35	2.30	0.98	0.39	0.05	0.09	0.29	0.04	5.29	0.02
1998	0.60	2.68	3.57	2.27	0.96	0.35	0.05	0.05	0.39	0.03	4.01	0.01
1999	0.63	2.46	4.95	2.41	1.86	0.56	0.13	0.05	0.54	0.03	5.55	0.05
2000	0.70	2.01	4.83	1.81	3.00	0.47	0.21	0.07	0.38	0.08	5.62	0.04
2001	0.72	1.61	7.47	1.31	4.00	0.67	0.25	0.21	0.81	0.08	5.44	0,19
2002	1.24	1.85	7.67	0.96	3.12	0.44	0.75	0.46	0.99	0.17	6.66	0.03
2003	1.50	1.83	9.59	1.16	3.66	0.64	0.72	0.66	2.33	0.99	4.59	0.16
2004	1.94	1.60	8.67	1.12	3.08	1.60	0.63	0.62	1.92	2.21	2.73	0.10

Year	8542					
	C	J	K	T	M	S
1995	-	-	-	-	-	-
1996	0.06	1.57	6.39	2.15	6.07	3.31
1997	0.07	1.44	5.85	2.37	6.73	3.16
1998	0.14	1.22	6.62	2.62	5.97	3.35
1999	0.18	1.25	6.40	3.04	6.22	3.27
2000	0.14	1.31	5.44	3.42	6.11	4.86
2001	0.18	1.21	4.46	4.20	7.88	4.89
2002	0.19	0.91	5.41	4.62	8.04	4.21
2003	0.21	0.94	6.20	5.35	7.25	4.87

2004	0.30	1.08	5.41	6.59	7.10	5.96

Notes: C stands for China, J Japan, K Korea, T Taiwan, M Malaysia, S Singapore

Sources: Global Trade Information Services, Inc., World Trade Atlas 1993-2004_(Internet version accessed via Business Infocenter of Hong Kong Trade Development Council). Original data are given in Appendix Table A (available upon request)

First, out of the nine categories of electronics and IT exports to the United States by 2004, China has five, namely HS 8471 (computers and components) with breakdowns for -603000, -604580 (both display units), -606400 (printers), and HS 8521 (video apparatus), which are all ranked as "highly competitive" (RCA > 2.5). Notice again that both Chinese computer-display units (RCA around 4) and video apparatus (RCA 5) appear to be particularly appealing to the U.S. market. Two categories, i.e. HS 8517 (telephone sets), and HS 8525 (TV camera and recorders) fall within the range of "comparatively competitive" (RCA 1.25 - 2.50). The remaining two, HS 8528-1200 (colored TV) and HS 8542 (integrated circuits) are ranked "comparatively less competitive" or not competitive at all, with their RCA indices being as low as 0.63 and 0.31 respectively. These figures all bear out the points made earlier about the net import-export balances for the various groups of electronics and IT commodities, as well as the discussion on the changing Chinese market shares in the United States.

Second, the pace with which the various Chinese RCA values are upgraded to "highly" or "comparatively" competitive over the past several years appears indeed most remarkable. This is clearly discernible in Table 13 and needs no further elaboration. The only notable exception concerns HS 8517 (telephone sets), for which the RCA index has more or less remained the same from 1995 to 2003 and is indeed consistently lower than that of Malaysia over the years.

Third, despite the accelerated Chinese foray into the U.S. market, Malaysia and other East Asian economies have still been able to maintain or even improve their competitive edge for some categories of electronics and IT exports to the United States in terms of the estimated RCA indices.

The last point made brings us to the question of how the emergence of China as electronics and IT "giant" may bear on the East Asian production network for the industry. Before we turn to this broader regional issue, however, let us briefly look at the Chinese performance in the Japanese market.

As shown in Table 14, within nine years from 1995 to 2004, China's share in total Japanese imports (of all goods combined) has doubled from around 11 percent to 21 percent. Among the various groups of electronics and IT exports to Japan, China's share for "computers and components" (HS 8471) increased most substantially from hardly 3 percent in 1995 to 48 percent in 2004. By comparison, the increases in the country's share in U.S. imports of the same commodity group, from 4 percent to 41 percent in the same period (See Table 12) appears to be somewhat more modest. The same goes for the Chinese exports of colored TV sets (HS8528-1200) to Japan. The share in Japan's imports increased equally remarkably from hardly 10 percent in 1995 to 48 percent in 2003, although it then slowed down to 37 percent in 2004; whereas the comparable share in U.S. imports rose by merely 8 percentage points from 1 percent in 1995 to 9 percent in 2003, or 8 percent in 2004. As a result, the RCA indices for China in the related Japanese markets have all increased consistently and in fact most substantially, namely all from near-zero in 1995 to "highly competitive"(> 2.5) or "comparatively competitive"(1.25 - 2.5) by 2003 or 2004 (see Table 14).

Table 14: China's market share and RCA indices in Japan's imports – total and by major

electronics and IT commodities, 1995-2004
(in percent and in ratio)

Year	All goods	HS 8471		8471-60010		8471-60020		HS 85281200	
		Share	RCA	Share	RCA	Share	RCA	Share	RCA
1995	10.72	2.52	0.24	-	-	-	-	-	-
1996	11.58	3.63	0.31	1.14	0.10	4.39	0.38	9.57	0.83
1997	12.36	4.12	0.33	0.03	0.00	22.26	1.80	13.84	1.12
1998	13.22	3.99	0.30	0.05	0.00	25.61	1.94	23.08	1.75
1999	13.82	4.25	0.31	0.56	0.04	30.25	2.19	24.15	1.75
2000	14.51	6.42	0.44	0.98	0.07	38.28	2.64	24.78	1.71
2001	16.57	12.49	0.75	5.93	0.36	47.96	2.89	34.47	2.08
2002	18.30	12.57	1.51	30.72	1.68	49.91	2.73	43.32	2.37
2003	19.70	41.61	2.11	42.75	2.17	56.55	2.87	48.08	2.44
2004	20.72	47.63	2.30	68.52	3.31	56.82	2.74	36.45	1.76

Notes: "All goods" refers to China's total exports to Japan as a share in total Japan's imports from the world.
Sources: Global Trade Information Services Inc., World Trade Atlas 1993-2004. (Internet version accessed via Business Infocenter of Hong Kong Trade Development Council. Original data are given in Appendix Table B (available upon request).

However, the accelerated increases in China's electronics and IT exports to Japan seem for the most part represented by exports manufactured in China by the various Japanese electronics giants located across the country, as alluded to earlier. The exceedingly large Chinese share (or "Japanese share-in disguise") in Japan's total imports of colored TV sets relative to that in the U.S. import market (i.e., 36% versus 8% or 9%), may be explained by the fact that the Japanese market is simply more restrictive (by virtue of consumers preferring their own national brand names) than the vast multi-racial U.S. market, which allows for a greater degree of diversification of import sources.

F. Implications for the Regional Production Network

Let us revert to the discussion about the changing RCA values among the East Asian 6. The figures given in Table 13 should be scrutinized with care, in conjunction with Table 12.
First of all, let us look at the broad category of "computers and component" (HS 8471). Interestingly, in 1995-2004, the RCA index for Malaysia has consistently increased from 2.99 (already "highly competitive") further to the remarkable high of 7.32; whereas for China it has moved from 0.60 ("comparatively less competitive") to 3.06 ("comparatively competitive"). This has taken place against the backdrop of a drastic increase in the Chinese share in U.S. imports of the same commodity group from 3.67 percent in 1995 to the startling high of 40.97 percent in 2004. Notice, however, that by comparison the Malaysian share has increased quite modestly, from only 7.04 percent to 14.06 percent in the same period (See Table 12).

A word or two should be said about the two seemingly conflicting quantitative trends between China and Malaysia: In light of the enormous Chinese foray into the U.S. market for "computers and components" (HS 8471), Malaysia was being increasingly compelled to divert its effort to other types of exports either within or outside the same HS 8471 category. The statistics in both Tables 12 and 13 reveal indeed that Malaysia has moved out of both types of computer "display units" (HS 8471-60300 and -604580) to make room for China, in order to rigorously concentrate on manufacturing of "printers" (HS 8471-606400) for exporting to the U.S. market. The upshot for Malaysia to increasingly specialize on export of "printers" (which constitute parts of the broader "computers and components" (HS 8471) category is not only that Malaysia-made "printers" now, surprisingly, account for nearly half of total U.S. imports (with a RCA index standing at as high as 23.96), but it has also helped to raise the RCA for the

“computers and components” (HS 8471) category taken as a whole to the high value of 7.32 as referred to above. Notice that by virtue of the RCA formula, given a more or less stable share of a country in total U.S. imports (of all goods), an increased concentration on a particular group of commodity will understandably help to raise the share and hence the RCA index of that country in the relevant U.S. imports.

Similar changes have taken place with the other East Asian economies, one way or the other. For example, Taiwan and Korea have made a relative shift towards both types of “display units” (A and B), but not “printers.” The real losers appear to be Singapore and Japan in particular. Singapore has seen its share in U.S. imports of printers curtailed from a high of 57 percent in 1995 to a dwindling 5 percent in 2004 in favor of Malaysia, with its RCA index declining from 22.04 to 4.76 accordingly. Taking “computers and components” (HS 8471) as a whole, Singapore appears, nevertheless, still to be quite resilient in the U.S. market, being still able to maintain a 7.47 percent share and a RCA index of 7.11 in 2004.

In the case of Japan, however, both its shares and RCA indices in the U.S. market for “computers and components,” including both types A and B display units and printers, have been drastically reduced across the board (See Tables 12 and 13). Notice especially that while in the mid- or late-1990s, Japan-made display units still absolutely dominated the U.S. import market; it now appears that they would soon be all replaced by similar products from China. Here again, the same caveat as alluded to earlier must be given; that is, China-made display units sold in the U.S. may essentially represent exports of “Japanese origin in disguise,” or for that matter, exports that are similarly manufactured by Taiwanese and Korean firms that are based on mainland China.

Similar observations may be made relating to the sample subcategories of HS 85, which is broadly defined to include “electrical machinery and equipment and parts thereof; sound recorders and reproducers, TV image and sound recorders and reproducers; and parts and accessories of such articles.” Thus, as is also revealed in Table 12, as a result of the massive increases of the Chinese share in U.S. imports of HS 8521 (video apparatus) from 7 percent in 1995 to 63 percent in 2004 (which deeply cut into the shares of all other East Asian exporters), Malaysia has strongly shifted its focus to the exports of HS 8517 (telephone sets), raising its share in U.S. imports from 7 percent in 1995 to 16 percent in 2004. Notice that Malaysia has since the mid-1980s become the single largest country in Southeast Asia to host Japanese investment in the electronics industry. Most of the Sony telephone sets sold in the region or globally, for instance, are made in Malaysia. This probably explains why the country has been able to swiftly resort to its established competitive edge to expand exports of telephone sets to the United States.

Likewise, Korea has been able to rapidly raise its share in U.S. imports of HS 8525 (TV camera and recorders) from 7 percent in 1995 to 27 percent in 2004, in order to compensate for its losses to China in exports of HS 8517 (telephone sets) to the United States. Taiwan has in turn managed to increase its share in U.S. imports of HS 8542 (integrated circuits) from 6 percent to 7 percent respectively.

Notice, in particular, also from Table 12, that the increases in the respective shares for Malaysia (8517), Korea (HS 8525), and Taiwan (HS 8542) are all wrought singularly at the expense of Japan, which has seen the relevant shares drastically curtailed across the board over the years under study.

Increased concentration by Malaysia, Taiwan, and Korea on the respective HS 85 subcategories of exports has also greatly helped to raise their RCA indices, given that their overall shares in total U.S. imports (of all goods) remain more or less the same for the period concerned. Thus, as shown in Table 13, the respective RCA indices for all three exporting economies have increased most substantially from 1995 to 2004: Malaysia's for HS 8517 (telephone sets) from 3.22 to 8.14, Korea's for HS 8525 (TV camera and recorders) from 1.63 to 8.67, and Taiwan's for HS 8542 (integrated circuits) from 2.15 to 6.59. These increases compare indeed very favorably with that of China, increasing respectively from 1.53 to 1.69, 0.67 to 1.94, and 0.06 to 0.30. If anything, these suggest that amidst the overwhelming competition from China in the exports of HS 8521(video apparatus) to the United States, Malaysia, Korea, and Taiwan have all been able to redivert their focus to alternative lines of exports for which they each command a particular competitive edge. We may call this as the "diversion effect" to refer to the gains obtained through increased intra-industrial specialization in exporting to third country.

As a matter of fact, for both Korea and Taiwan, the absolute shares in U.S. imports of HS 8525 and HS 8542, respectively, have remained consistently larger than that of China from 1995 through 2003. In other words, both Korea and Taiwan remain absolutely more competitive than the Chinese mainland in this respect. As for Malaysia, the "diversion effect" has at least helped the country to maintain its absolute share in U.S. imports of HS 8517, or prevent it from being further eroded.

Finally, let us look at the HS 8528-1200 (colored TV sets) category. This seems to be the only category of East Asian exports to the United States in which accelerated Chinese exports have not "crowded out" or substituted for the shares of the other East Asian exporters. That is to say, the "substitution effect," as observed with the other HS categories between China and the other East Asian rival exporters did not take place. Rather, with the minor exception of Malaysia, all the others have seen their shares in U.S. imports of this particular HS category (comprising colored TV sets and other similar products) increasing in 1995-2003 alongside that of China (See Table 12). However, it is also very clear that the simultaneous increases are accounted for by an unusually heightened import demand by U.S. consumers for colored TV sets from the East Asian 6, at the expense of the rest of the World. Notice that the combined share of the East Asian 6 in U.S. imports of HS 8528¬1200 has doubled from 17 percent in 1996 to around 30 percent in 2004.

Note also that even for Malaysia, after its share in U.S. imports of HS 8528-1200 was reduced from 13 percent in 1995 to 9 percent in 2003 or 5 percent in 2004, (compared to 9% (or 8%) for China), its corresponding RCA index has nevertheless remained remarkably high at 4.59 in 2003, or 2.73 in 2004 (compared to the extremely low of 0.72 (0.73) for China.

The case of HS 8528-1200 stands therefore in sharp contrast to at least six of the other eight HS categories, for which the combined shares of the East Asian six have been consistently reduced, albeit marginally (See Table 12). This seems to imply that as it presently stands and as long as U.S. import demand is not unduly constrained for any reasons there may still be room for export expansion simultaneously by all East Asian six.

The special case of HS 8528-1200 notwithstanding, our statistical analysis about the impact of China on the regional production networks for the electronics and IT industry from 1995 to 2004 may be summarized as follows:

First, the “substitution effect” by China has generally triggered a “diversion effect” on the part of the other affected East Asian economies–notably Malaysia, Korea, and Taiwan; resulting in a higher degree of intra-industrial specialization in the region in exporting to the United States.

Second, despite the overwhelming competition from China, virtually all the affected East Asian economies have gained from the “diversion effect,” in absolute terms of the (percentage) shares in U.S. imports of the particular lines of products on which they have increasingly focused their exports. As a matter of fact, the absolute size of the exports in which the respective economies specialize, have also increased in response to heightened U.S. import demand.

Third, relative to the overall share in total U.S. imports (of all goods), the gains from the “diversion effect” for the affected economies with respect to their special lines of exports, are of course even more pronounced; hence resulting in a highly enhanced competitive edge, in terms of the estimated RCA indices in many cases.

Fourth, obviously as a result of the “substitution effect” by China, the overall shares in U.S. imports (of all goods) of the other East Asian Five have all declined. Nonetheless, except for Japan and Singapore, the absolute value magnitude of total exports by Malaysia, Korea, and Taiwan to the United States have all recorded increases over the period under study.

Fifth, Japan and Singapore turn out to be the biggest losers amidst the ongoing process of regional industrial realignment. Both countries have registered considerable losses in total exports (of all goods) to the United States, not only relative to increases in total U.S. imports, but in terms of absolute volume as well. In the case of Japan, the losses incurred across virtually all HS categories under study and appear indeed to be most substantial in both absolute and relative terms. For Singapore, the various HS shares have also either declined or remained stagnant.

Sixth, the consistent decline across the various HS shares for Japan (and for that matter for Taiwan, Korea, and Malaysia as well), should, however, be seen as a mirror image of the respective gains for China, noting that the Chinese electronics and IT industry has become very substantially dominated by FDI originating directly or redirected from these economies, and noting also that the exports from China are virtually all a matter of processing trade. The accelerated increases in the Chinese shares in Japan’s imports of electronics and IT products may also be seen from the same perspective.

Seventh, China, nevertheless, still stands at the very end of the East Asian “flying geese formation,” noting that (1) the country’s share in U.S. imports of integrated circuits (HS 8542), which is embedded with high technology is still negligibly small, at just 3 percent in 2004, compared to 6 percent for Singapore (the smallest share among the other East Asian exporting countries) in 2004; (2) the country actually depends greatly on outside supply of ICs to sustain and expand output of the electronics industry (to the extent of 80% of the domestic requirements); and especially (3) the bulk of ICs imported are not only from such advanced countries as Japan (24%) and the United States (9%), but also Taiwan (18%), Malaysia (10%), Korea (8%), and Singapore (4%) as well (all 2001 figures).

The question to be raised, finally, should be: What would the future hold for the Chinese electronics and IT industry within the broader East Asian production networks? Or perhaps more specifically, in light of the enormous advances made by China in both output and exports

of the industry in the recent past, would the other East Asian economies be eventually "crowded out" of the regional industrial scene?

The answer seems to be mixed. The accelerated Chinese foray into the U.S. or global market for consumer electronics as taking place in the past two years, captures essentially the initial big-push effect of the country's accession to the WTO in 2001. The momentum is poised to continue unabated probably for some more years. Moreover, China is also rapidly catching up with the neighboring economies in developing or adopting new technology for IC manufacturing (See Box 1 for the interview with Dr. Lee). Thus, the competition in exports against the other East Asian economies will likely further intensify in the years to come. However, this will inevitably lead to a higher degree of diversification and sophistication in the output structure of the industry. And there simply appears to be no reason why Korea, Taiwan, Malaysia, or Singapore, let alone Japan will not be able to further engage in technological upgrading to enhance their competitive edge and carve out their own market niches for the industry, by emulating, say, such tiny but highly successful countries as Finland (home of Nokia) and Sweden (Ericsson).

Furthermore, as it presently stands on the matter of semiconductor design (i.e., the very core technology of the industry), China still lags far behind Taiwan, not to mention Japan and the United States. As Dr. Stephen Lee sees it, the gap with Taiwan alone is still around eight years in this respect. Can the other East Asian neighbors not come in to join the technological race? Notice also that the entire Chinese electronics and IT industry, especially its export base, is by and large no more than a matter of two relatively small municipalities, Dongguan in Guangdong province and Suzhou in Jiangsu.

IV. THE AUTOMOBILE INDUSTRY

A. FDI and Import-Substitution

In a way, the Chinese electronics and IT industry represents faits accomplis, which the automobile industry seems poised to emulate. But when will the latter be able to complete its highly import-substituting mission to turn around to be export-oriented as well? To answer the question, we have to first look at the role played by FDI in the Chinese automobile industry, noting that foreign investment is instrumental, as in the case of the electronics and IT and many other industrial branches in China, for promoting exports.

The figures in Table 15 show that the Chinese automobile industry is in fact also heavily dominated by FDI. Around a quarter of the GVIO (26%), total sales (26%), and fixed assets (23%) of the industry are all accountable by foreign investors in 2002, although the shares are still far less than that for the electronics and IT industry, respectively 54 percent, 52 percent, and 43 percent for 2001 (See Table 15). FDI's share in the automobile industry's total "export delivery" (at ex-factory prices), standing at 44 percent for 2002, also appears to be substantial, but it is again still far below that of 79 percent for the electronics and IT industry. In absolute terms, the discrepancy in "export delivery" by FDI between the two industries is indeed most substantial, 14,849 million Yuan for the automobile industry in 2001 (or 23,671 million Yuan in 2002) versus 273,320 million Yuan for the electronics and IT industry.

However, similar to the electronics and IT industry, foreign-invested manufacturing plants in the automobile industry also appear to be much larger in scale and hence more efficient. This is clearly reflected in their much larger shares in the industry's GVIO, total sales, and fixed assets, relative to the comparable shares in employment and the number of firms in

the industry (Table 15). Notice also that their share in gross profits (50%) is also larger than theirs in total sales revenue and GVIO. This implies higher efficiency as well for FDI.

Notice nevertheless that the figures in Table 15 cover all types of motor vehicles (trucks, buses, and passenger cars) and motor cycles, as well as output of engine and vehicle parts and accessories. When the figures for sedan production are isolated, it is clear that the manufacturing and sales of passenger cars in China are virtually controlled by global conglomerates such as Volkswager, Audi, General Motors, Renault, Ford, Honda, and now increasingly Toyota and Nissan as well, after the latter two Japanese automobile giants have synchronized with China's accession to the WTO to make a most aggressive foray into the huge domestic car market (Kueh 2003, p. 522). All such other familiar brand names as Daimler-Chrysler, BMW, Volvo, Fiat, Mazda, and especially Hyundai, are now also represented in China.

Table 15: Share of FDI in China's Automobile Industry by Major Economic Indicators, 1992, 1995, 1999, 2000, and 2002

(in million Yuan and in percent)

Items	1992		1995		1999		2000		2002	
	Value	%	Value	%	Value	%	Value	%	Value	%
No. firms (unit)	2,555	1.7	2,479	6.8	2,362	11.4	2,326	11.5	2,436	14.7
Employees (100 persons)	18,095	2.5	19,525	6.6	18,068	9.8	17,813	9.7	15,705	12.2
Engineer technician	-	-	1,660	9.0	1,606	10.8	1,643	10.4	1,680	12.6
GVIO	119,105	16.0	221,651	24.8	312,272	31.9	361,256	30.6	622,464	25.6
Investment completed	10,275	17.1	23,134	32.3	19,399	50.2	17,875	33.9	28,316	20.1
Fixed assets	16,033	21.3	115,002	15.1	222,361	25.1	254,576	23.9	364,233	23.4
Sales revenue	118,741	16.2	217,514	25.3	2742,50	34.3	356,044	30.2	594,769	26.3
Exports	2,806	0.4	3,967	0.2	6,185	29.4	12,714	26.3	23,267	43.7
Gross profits	8,781	21.4	8,555	49.4	5,786	134.5	13,807	72.2	37,384	50.3
R&D outlay	699	0.8	-	-	3,818	54.7	6,774	36.3	8,619	19.2

Notes: The FDI shares cover both wholly-foreign owned enterprises and Sino-foreign joint ventures, and include a relatively small proportion of investment from Hong Kong, Macao, and Taiwan combined. GVIO stands for Gross Value of Industrial Output at current prices. The value of fixed assets is based on original acquisition prices. The statistics cover all motor vehicles (including motor cycles), and output of engine and vehicle parts and accessories.

As a matter of fact, all foreign car-makers in China operate as joint ventures with Chinese partners, and many have now increasingly come under the umbrella of the three largest Chinese automobile conglomerates-namely China First Auto Works (FAW) (based in Changchun, Jilin province), Dongfeng Motors (Dongfeng) (based in Shiyan Manicipality, Hubei), and Shanghai Automotive Industry Corporation (Shangqi) (based in Shanghai). As a result, the three Chinese automobile giants, FAW, Dongfeng, and Shangqi now increasingly function as a holdings company.

Joint Ventures/Location	Share Distribution	Main Products
FAW (Changchun, Jilin)		
Volkswagen (Changchun)	VW40%	Audi(A6,A4),VW(Bora,Jetta,Golf)
FAW Xiali (Tianjin)	FAW51%	Xiali, Xiali 2000, Echo, Vizi
Toyota (Tianjin)	FAW Xiali 50%	Toyota (Vios)
FAW Sedan (Changchun)	Wholly-owned	Red Flag series, Mazda 6
FAW Hainan (Haikou)	Wholly-owned	Mazda (Mazda 323, Primacy)
Dongfeng (DF)(Shiyan)		
Citroen (Wuhan)	PSA (France) 32%	Fukang, Citroen & Peugeot series

Fengshen (Guangzhou)	Yulong (Taiwan) 40%	Nissan Bluebird & Sunny
DF-Yueda-Kia (Yancheng)	Kia (Korea) 50%	Kia (Pride, Accent)
Dongfeng (Wuhan)	Nissan 50%	Nissan series
Shangqi (SQ)(Shanghai)		
SQ-VW(Shanghai)	SQ 25%, VW 50%	Passat, Santana, Polo, Golf
SQ-GM(Shanghai)	SQ 50%, GM 50%	Buick Sail
GM-Dongyue (Yantai)	GM(Shanghai) 50%, SQ 25%, GM 25%	Buick Sail (compact)
SQ-Qirui(Wuhu)	SQ 20%	Chery

Sources: Huang and Wu, p.4, and SCMP, 19 May 2004

Shangqi (SQ) controls two major joint ventures, SQ-Volkswagen (VW) and SQ-General Motors (GM), but leaves both of them to operate as independent management entities. For VW, which was the first major global automobile giant to establish a joint venture in China as early as in 1985/6, the "intrusion" of GM into its domain in the mid 1990s was of course an unwelcome event, as the author was told by Mr. Wang Rongjun during the personal interview in Shanghai (op. cit.). Mr. Wang sees it as an important factor why VW subsequently also wanted to team up with FAW. However, now that FAW's door is also open to other foreign carmakers as well, notably Nissan, VW has again found it profitable to "renew its interests in Shangqi." VW has indeed lately decided to extend its investment in Shanghai, by setting up its fourth manufacturing plant in the New Pudong district, where GM is also based.

The circumstances seem to suggest a two-pronged Chinese government policy on the automobile industry: one is to court as many global auto giants as possible to invest in China to enhance competition in the huge new born domestic market for passenger cars; the other is to push for further conglomeration and consolidation of the Chinese automobile industry by grouping the various joint ventures under the three state-run super conglomerates, FAW, Dongfeng Motors, and Shangqi. Changchun, a well established Chinese heavy industrial base in Northeast China, where the FAW is based is now on the Chinese government's agenda to be promoted as the third largest vehicles manufacturing centre of the world (Ta Kung Pao, 12 March 2004; and China Daily, 8-9 May 2004).

Notice also that taken together, the three Chinese automobile groups presently already account for more than 50 percent of the country's total vehicles output and sales. If the other relatively major five carmakers are included, including Honda in Guangzhou and Hyundai in Beijing, the share would easily increase to around 80 percent (Huang & Wu, 2003, p. 4). As expected, with China now in the WTO, the 100-odd small, unlikely Chinese vehicles manufacturing plants are bound to be rendered out of business before too long.

As to when the tide may begin to turn to enable the country to target its vehicles output to the global market, obviously we have yet to first look at the relative degree of satiation of the Chinese domestic market and more importantly, the degree of technological sophistication attained in the vehicle production, relative to the prevailing standards of overseas demand.

B. Scale of output and technological sophistication

We shall confine our consideration to the passenger car industry. Table 16 provides figures for China's output of vehicles, with a particular reference to sedan production. Notice that while the production of goods trucks and buses to a lesser extent, experienced a considerable setback in the mid 1990s (following massive economic retrenchment for curbing inflation) (Kueh, Chai, and Fan, pp. 270-273), sedan production continued to increase at high speed throughout most of the years since the early 1990s. The growth rate of sedan output

averaged to a remarkable 26 percent per year from 1995 to 2003, compared to 7 percent for trucks and 14 percent for buses. As a result, the distribution ratio for trucks, buses, sedans narrowed in favor of sedan output from 63 : 25 : 11 in 1991 or 50 : 28 : 22 in 1995, to the equal distribution of 34 : 33 : 34 in 2002, then swiftly to the "lopsided" development of 27 : 27 : 45 in 2003 (as may be calculated from the figures in Table 16).

Table 16: Growth of Vehicles Production in China, 1991-2003

Year	Total	Chassis	Trucks		Buses		Sedans	
	Units	Units	Units	Percent	Units	Percent	Units	Percent
1991	708,820	122,873	452,023	-	175,742	-	81,055	-
1992	1,061,721	199,162	626,414	38.6	272,582	55.1	162,725	100.8
1993	1,296,778	171,769	774,868	23.8	292,213	7.2	229,697	41.2
1994	1,353,368	169,106	785,876	1.4	317,159	8.5	250,333	9
1995	1,452,737	162,713	721,822	(8.1)	405,454	27.8	325,461	30
1996	1,474,905	167,651	688,614	(4.6)	395,192	(2.5)	391,099	20.2
1997	1,532,628	178,644	659,318	(4.3)	439,615	10.2	487,695	24.7
1998	1,627,829	206,325	661,701	0.4	659,025	5.4	507,103	4
1999	1,831,596	229,113	756,312	14.3	509,179	10.9	566,105	11.6
2000	2,068,186	252,063	751,699	(0.7)	709,042	39.3	607,455	7.3
2001	2,341,528	317,946	803,076	6.8	834,927	17.8	703,525	15.8
2002	3,253,655	425,601	1,092,546	36.1	1,068,347	28	1,092,762	55.3
2003	4,443,700	-	1,229,600	12.5	1,195,200	11.9	2,018,900	84.8
Annual Growth Rate 1995-2003	15.0			6.9		14.5		25.6

Sources: CAIYB 2003, p.413 for 1991-2002
www.xinhuanet.com 20 January and 12 February 2004 for 2003

Undoubtedly, joint ventures with foreign car-makers overwhelmingly dominate sedan production and sales in China, as shown below by the shares of the top ten manufacturers for 2003.

Table 17: Market Shares of the Top 10 Car Manufacturers, 2003

Car Manufacturers	Output		Sales	
	Unit	Share (percent)	Unit	Share (percent)
SQ-VW	405,252	20.00	396,023	20.00
FAW-VW	302,346	14.97	298,006	15.11
SQ-GM	168,991	8.37	201,282	10.21
FAW-Xiali	93,200	4.61	96,180	4.88
Guangzhou Honda	117,178	5.79	117,030	5.93 (5.8)
DF-Citroen	n.a	n.a.	n.a.	(7.7)
Changan (Suzuki)	n.a	n.a.	n.a.	(7.9)
SQ-Qirui	91,223	4.51	85,349	4.33
DF-Fengshen (Taiwan)	n.a	n.a	n.a	n.a
Beijing Hyundai	55,113	2.72	52,128	2.64
Total	**1,594,300**	**78.80**	**1,587,700**	**80.50**

Notes: The figures for FAW-Xiali cover the most popular brand, Xiali, only. Figures for the other five or six different types of cars produced by the company, notably Xiali 2000, Echo and Vizi are not included; hence the total is smaller than that of Guangzhou Honda.
Sources: www.xinhuanet.com, 20 January, and 3 and 10 February 2004.
Figures in parenthesis are from HSBC, Monthly Report, January 2004, p. 23, referring to 2002.

Notice that except for Qirui (Chery) and Xiali which may be considered as home¬grown models, the others produced and sold in China all carry familiar foreign brand names (see Table 16). Note also that Xiali is essentially based on imported technology as well.

Most importantly, by international standards, the scale of passenger car or total vehicles output in China, taken either as a whole or separately by major producers, compares unfavorably with any global automobile giants. Hyundai, which is Korea's top automaker, controlling 42 percent of the country's auto market, for example, sold 1.899 million units of vehicles in 2003 and expects to increase the sales to 2.145 million in 2004 (including domestic sales of 639,000 units) (Reuters, 2 January 2004, via Google, accessed 31 January 2004). This represents nearly half of China's total vehicles output in 2003. Given that Hyundai's total output comprises essentially passenger cars, Hyundai should therefore compare favorably with any of the major carmakers in China, in terms of scale of output, as shown in the tabulation above.

However, the relatively small scale of production of the carmakers in China does not necessarily imply that the car manufacturing technology will continue to drag behind that of the overseas counterparts. For one thing, most of the new technologies applied are already based on proven blueprint developed by the relevant foreign carmakers. With enhanced protection of property rights under the WTO, it seems that foreign partners may now feel more at ease to affect technology transfer to China. In fact, the author was told during an interview with Mr. Wang Rongjun in Shanghai (op. cit.) that Chinese car manufacturers consider it as an "unexpected upshot" of the country's accession to the WTO that all foreign carmakers investing in China have now become much more prepared to bring in new models and share their design and manufacturing technology in light of the enhanced competition in the domestic market that has resulted from the increased influx of foreign carmakers in the past couple of years. Mr. Wang also shared with the author the information that Shangqi's specialists have been invited by VW to their headquarters in Germany to engage in joint research and development for new VW models. This was all "inconceivable" prior to WTO accession, when foreign carmakers basically remained lethargic to the rigorous government promulgation to "open up the domestic market in exchange for technology" (a policy slogan personally coined in 1992 by the late Deng Xiaoping, China's paramount leader).

There are other important practical measures adopted by the Chinese government in compliance with the WTO requirements that will encourage or even compel foreign carmakers investing in China to apply state-of-the-art technology used in their home countries (Huang & Wu, 2003, p.2). These measures include, (1) the gradual reductions in import tariff (from 70-80% to 38-43% in 2003 and 25% by 2006) and the dismantling of import quotas (fully by 2005) for foreign cars, which will clearly help enhance competition in the domestic market; (2) elimination of the "local contents (localization rate)" requirements for foreign carmakers (effective 2002), which will facilitate global sourcing of parts and accessories of international quality standards; and (3) lifting the restrictions on the class and model to be produced (in 2003), which will leave foreign carmakers free to make such decisions on a purely commercial basis and for the benefits of product diversification; (4) removing the limitation to Sino-foreign joint ventures for producing car engines and auto parts so as to allow for wholly owned foreign undertakings, which will further strengthen confidence in technology transfer to China; and perhaps most importantly, (5) the abolishment of the "foreign exchange balance requirement." As mentioned in the Introduction to this study (p. 4), this will greatly enable foreign carmakers to concentrate on manufacturing for the Chinese domestic market.

A word or two should be said about the last point made. For such global automobile giants as Toyota and Nissan, requiring them to export the cars manufactured in China (in order to be able to balance their own foreign exchange expenditure, as was the case in the pre-WTO accession era) would clearly be tantamount to creating a Frankenstein of Chinese competition that will undermine them in third country markets. According to Mr. Wang Rongjun (personal

interview, op. cit.), this was the main factor that prevented the Japanese auto giants from investing in China in the past, although they were all highly interested in the huge China market. As for Volkswagen (VW), which started to gain a foothold in China as early as 1985, Mr. Wang mentioned that the same "foreign exchange balance" rule applied as well, but VW was, nonetheless, willing and able to commit itself by manufacturing vehicles parts and accessories and car engines in China for export to Germany.

It seems that this German connection has now developed to be an important and integral part of the Chinese automobile industry and has indeed been rapidly maturing as a significant export undertaking, with total export value greatly surpassing that of finished vehicles in 2003, for example (China Daily, 8-9 May 2004; and Ta Kung Pao, 4 April 2004). As Mr. Wang puts it, it is also partly for the reason that quality parts and accessories have become increasingly available domestically that the Japanese automobile conglomerates have turned to be much more interested in China. Notice that the purchases of vehicle parts and accessories from Chinese domestic sources may not necessarily involve foreign exchange outlay, as foreign carmakers may pay with the Chinese currency (renminbi) that have been obtained from the sales of cars manufactured in China.

At any rate, China's accession to the WTO has significantly altered the institutional parameters for foreign investment in the Chinese automobile industry and has indeed resulted in the accelerated influx of foreign carmakers. This has lately prompted Standard and Poors to alert all involved to a potential overcapacity in the industry in the medium to long term (China Automobile Times)[8]. In fact, since the WTO-accession, the industry has already seen price wars erupting repeatedly among the passenger cars manufacturers in China both large and small. Whatever the implications, this seems poised to eventually trigger a quality competition as well.

An array of technical measures has also been promulgated by the Chinese government since the WTO-accession to help bring the Chinese automobile industry in line with global standards. These include preferential treatment for carmakers which adopt environment-friendly exhaust fumes purifiers and catalysts, electronic fuel injection, anti-brake system, airbags, etc.; and the unified National Treatment standards of quality control for both imported and domestically manufactured vehicles (CAIYB 2003, p.2).

Thus, as a Chinese commentator puts it, "the new models produced in the past couple of years share one common characteristic: virtually all have reached the same advanced international standards for comparable classes (of passenger cars) produced elsewhere, yet their prices are by a clear margin lower than that of imported cars" (CAIYB 2003, p. 4).

There seems to be some element of truth to the point made, judging at least by the fact that after the WTO-accession, the expected import influx of foreign-made passenger cars has been largely confined to high-class luxury saloons (CAIYB 2003, p. 227), while those produced in China are mostly small (compact and subcompact) and middle-size sedans (CAIYB 2003, p. 413), which for the reasons cited can well forestall competition from sedans of similar classes imported from abroad.

Thus, the days seem to have effectively gone, when the popular "Santana" model produced by Volkswagen in Shanghai could by no means be compared with its genuine German counterpart in terms of design sophistication and quality. In fact, before Buick

[8] See Ryan (2002) for an earlier estimation of the possible size of overcapacity in the Chinese automobile industry, in relation to the estimated income and purchasing power in China.

manufactured by General Motors in Shanghai came into the scene, there were widespread complaints made in the country that the same "Santana"–the taxi image of China and Shanghai in particular, was reproduced over and over again, without a single trace of improvement since its inception in the late 1980s.

In the same vein, up to the eve of China's accession to the WTO, the then highly publicized Buick New Century, also produced in Shanghai, and the new Honda VTI built in Guangzhou, or for that matter, the Audi A6 of Changchun, all represented models that were more or less at the maturity stage of their life cycles in the West when they staged their debut in China (Kueh 2002, p. 51). But obviously this can no longer be the situation in the future.
The question is now, finally, whether the Chinese sedan industry is presently ripe for testing the Asia-Pacific waters, or even beyond.

C. Export Potentials and Implications for the Region

Against the backdrop of the foregoing discussion, a number of points may be made about the export potentials of the Chinese automobile industry.

First is, given the pace with which sedan production has been expanded in China in the recent past, and given as well, the accelerated adoption of advanced Western designs and manufacturing technology, the Chinese automobile industry seems poised to be fully integrated into the global networks of production and marketing under the control of the global automobile giants such as General Motors, Toyota, Nissan, and Volkswagen.

Second, on the eve of China's accession to the WTO, it was still unknown whether the American approach to the China sedan market (i.e., exporting directly from home plants in order to take advantage of the reduced import tariff and import quota barriers) would eventually prevail (Kueh, 2002, pp. 50-1). But now the established EU approach as represented by Volkswagen, of directly investing in China (import-substituting and tariff-jumping) has clearly gained the upper hand. Following the WTO accession, the country has indeed seen most existing foreign carmakers expanding their scale of investment in China, and many newcomers, notably the Japanese auto giants joining in the spree as well[9]. This will all greatly help raise the scale of output, which is bound to spill over to the export markets sooner or later, with or without the pressures of any excess production capacity.

Third, the belated initiatives taken by Toyota and Nissan towards China warrant some words. Various explanations were given as to why the two auto giants, among others, were not inclined to enter into any major deals with the Chinese counterparts until after the WTO accord was sealed in 2000. A frequently cited explanation was that the Japanese were particularly concerned about "forced technology transfer" or were wary of the inadequate Chinese record of property rights protection (Were the Germans or Americans not concerned?). It is argued, however, that the Japanese conglomerates were actually already assured of sizeable market shares in China; in addition to the Chinese predilection for the relatively less expensive Japanese cars, most of the vehicles used by the great number of investors from Hong Kong and Taiwan were also made in Japan (and indeed shipped through Hong Kong to China); hence there appeared to be no urgency for the Japanese car-makers to invest in China (Kueh 1997, p. 44-5). Whatever the reasons, the fact is that Toyota and Nissan now simply cannot afford to ignore the enormous China automobile market, especially that the "foreign exchange balance"

[9] For a more detailed listing of the automobile joint ventures in China see HSBC China Monthly Report, January 2004, pp.21-22 and 26-27.

rule is no longer in place. This also implies that such global auto conglomerates may eventually be prepared as well to risk creating a Frankenstein from China, which will compromise their own overseas markets.

Fourth is, the same WTO whirlwind has also vigorously sucked in FDI, increasingly from wholly foreign-owned car manufacturers for production of car engines, parts and accessories. This has also triggered competitive efforts from domestic Chinese manufacturers to import advanced foreign technology to enhance output, in order to meet the increasingly sophisticated domestic demand. As a result, import demand for vehicle parts and components tended to decline–relative to the accelerated increases in exports in recent years (See Table 18). The upshot is, exports of parts and accessories have continued to exceed that of finished vehicles by an increasingly larger margin, accounting namely for two-third of total exports of all vehicles products combined in 2002. Many new products have indeed already become the targets of global sourcing by international vehicles dealers (Wang, 2003, p.227) This suggests that the Chinese sedan industry which presently consists essentially of assembling plants, are now poised to become a vertically integrated industrial system. A recent report from the Chinese government reveals that the country has already formulated a grand plan for developing ten major regional bases for exports of vehicles and parts and accessories, targeting a combined export value of USD110 billions for year 2010 (Ta Kung Pao, 2004). This represents an annual growth rate of between 36 to 38 percent from the planned total export value of USD15 billion to USD20 billion for 2005.

Table 18: China's Imports and Exports of Finished Vehicles and Vehicles Parts and Accessories, 1995-2002

Year	Total finished vehicles (units)		Trucks (units)		Sedans (units)		Parts and accessories (in USD millions)		Vehicle Products Total (in USD millions)	
	M	X	M	X	M	X	M	X	M	X
1995	158,115	17,747	12,037	9,070	129,176	1,413	8,547	3,761	25,755	7,214
1996	75,863	15,112	6,256	6,256	57,942	635	10,776	3,821	25,002	8,165
1997	49,039	14,868	7,424	8,297	32,019	1,073	9,280	4,472	20,782	9,878
1998	40,216	13,627	4,373	6,306	18,016	653	8,049	4,896	20,579	8,834
1999	35,192	10,095	2,685	3,868	19,953	326	10,043	7,069	25,812	11,873
2000	42,703	27,136	3,085	7,093	21,620	523	21,128	11,254	40,475	24,785
2001	71,398	26,073	3,138	8,527	46,632	763	26,177	16,322	47,033	27,123
2002	128,195	28,645	6,692	10,520	70,329	969	29,587	22,101	65,999	33,589
2003				25,348		2,849				

Notes: The figures for trucks include chasis. Sedans do not include light SUVs and 9-seater (and smaller) buses. Import figures for parts and accessories do not include motor cycles and car engine. Export total of vehicles products cover car engine, as well as trailer and semi trailer.

Sources: Wang, p.231 for 1995-2002
www.xinhuanet.com 23 January 2004 accessed 25 January 2004 for 2003.

Fifth, the present-day export capability of the Chinese automobile industry is by any measure miniscule. In 2002, the country exported only 28,645 vehicles (See Table 17). Of the total, trucks were already for 37 percent; trailers and semi-trailers, 23 percent; and chassis, 20 percent. The number of sedans exported stood at a negligible low of 969 units (excluding 269 units of minibuses and 440 light SUVs) (Wang, 2003, p. 229). Major export destinations were, in terms of value and in descending order: Hong Kong, Iraq, Liberia, Vietnam, the Sudan, and the Philippines (Wang, 2003, p. 228). These figures are self-explanatory when compared to those of Thailand, the single largest auto manufacturer among ASEAN countries, concentrating especially on passenger cars. Thailand, where most of the global auto giants, such as GM,

Toyota, Nissan, Ford, Honda, Mitsubishi, Mazda, BMW, and Renault have a stake of varying sizes, but which still cannot be ranked as a major global auto manufacturing base, exported a total of 173,382 cars out of the total number of 536,000 cars produced over the first nine months of 2003 (with the annual targets estimated by the Federation of Thai Industries to be 227,699 and 729,465 units respectively) (www. tradeportalofindia.com, 30 January 2004, accessed via www.google.com).

Sixth, there are, nonetheless, clear early signs of an offensive taken by some major foreign carmakers in China to rigorously move into the global export markets. Honda tied up with Dongfeng Motors and the Guangzhou Automobile Group to secure a deal (in Beijing, July 2002) to establish an export base in Guangzhou's Export-Processing Zone for manufacturing compact Honda sedans exclusively for exporting, with an initial capacity of 50,000 units a year. More recently, Daimler-Chrysler "is seeking approval to set up a 250 million euro joint venture with Dongnan (Fujian) Auto Industry to manufacture commercial vehicles for export to Southeast Asia, with an initial output of 20,000 units a year" (HSBC, January 2004, p.22). In an interview with the Chinese press, in June 2002, Mr. Bernd Leissner, President of Volkswagen's Asia-Pacific Headquarters (which was then just moved to Beijing from Wolfsburg), was quoted as saying that Volkswagen "has vowed to export its made-in-China automobiles to 84 countries in the next three to five years (by slashing high costs)" (www.china.org.cn via www.google.com, accessed 31 January 2004). In fact, the first batch of VW's "Passat" was already shipped to Southeast Asia in May 2003 (www. xinhuanet.com, 20 May 2003, courtesy Economic Reference Times, accessed 2 February 2004). This was followed by another shipment of 600 VW Polo to Australia late last year (information courtesy of Mr. Wang Rongjun). Notice also that the total number of sedans exported by China increased from 969 units in 2002 to 2,849 units in 2003 (www.xinhuanet. com 23 Jan 04, accessed 25 January 2004).

Finally, the question is in what way may the Chinese advances bear on the East Asian production networks of automobile manufacturing in the future. In a report published by the Japanese Research Institute in October 2001, which did not take into account in earnest the possible "China factor," the likely contour of the ASEAN automobile industry in the future was briefly highlighted on the premises that the ASEAN free trade area (AFTA) would soon become a reality.

First, Thailand, which is already home to by far the largest concentration of Japanese automobile and parts manufacturers in the ASEAN-4 (Thailand, Malaysia, Indonesia, and the Philippines), would become a base for exporting automobiles to the world. European (e.g., BMW) and American (specifically GM) automakers had also begun to see Thailand as a production and supply base for ASEAN and Asia.

Second, the regional production structure which is being reinforced by AFTA, would cause the Japanese firms, which have production bases in all of the ASEAN-4 countries, to "come up with a mutual complementary strategy that will allow them to utilize the particular characteristics of each base." Thus, the Report saw a strong possibility that production of passenger cars would be concentrated in Thailand (e.g., by Toyota, Nissan, and Honda) while van-type commercial vehicles for developing nations as well as recreational vehicles would be centered in Indonesia (by Honda and Nissan) (Minako Mori, p. 2).

The same Report refers to the "China factor" in passing, arguing that "if ASEAN's automobile industry is to maintain its presence in Asia, the realistic option would appear to be to increase the depth of the industry throughout the region, through complementary activities" (ibid. p.3).

Would some sort of a tacit agreement on regional specialization among the major Japanese carmakers really help, without factoring into the ASEAN context the rapidly emerging Chinese automobile industry? Nobody knows for sure at this stage. However, the single most important question that should be raised, in the first place, is whether the Frankenstein created in China by the Japanese or other global automobile giants would leave room for their own counterparts in ASEAN countries to maneuver in the future. These are all realistic questions, especially when taking into consideration that the ASEAN 10+1 (China) FTA will soon become a reality. According to Mr. Wang Rongjun, whom the author interviewed in Shanghai, the likely scenario initially would be that the various global giants would each come up with an arrangement for the different regional manufacturing plants to specialize in different classes and models of vehicles and different categories of auto parts and accessories. That is, to mutually engage in what the report of the Japan Research Institute suggests as "complementary activities." This would be similar to the emerging pattern of specialization between China and the other East Asian economies (as discussed in the previous section) with respect to their exports of electronics and IT products to the United States. However, given the enormous size of the China market, which seems capable of absorbing any classes and models of vehicles produced in the world in the long run, how long could the perceived regional specialization really sustain the continuous economic pressures for further regional conglomeration for the benefi t of scale economies? We really do not know for sure. Perhaps this is too distant a question to warrant any further discussion.

V. CONCLUSION AND IMPLICATIONS FOR REGIONAL COOPERATION

The main points made in the paper may be summarized as follows:

First, the electronics and IT industry represents the single largest branch of the new and high-technology industry in China. It is classified as a pillar industry, but is strongly dominated by foreign investment. The core technology is controlled essentially by foreign investors, notably from Japan, Taiwan, and the United States. The industry is highly export-oriented with exports essentially representing processing trade. In the past decade or so, and especially after China's accession to the WTO, the volume of exports has increased drastically, threatening to cut deeply into the market shares of neighboring East Asian economies such as Korea, Taiwan, Malaysia, and Singapore, and most remarkably, even that of Japan as well. As a matter of survival, however, most of these affected exporting economies have managed to enhance their competitiveness by diverting resources to production and exports of particular lines of products for which they enjoy a competitive edge. As a result, the "China factor" tends to significantly help alter the shape of the East Asian production network for the electronics and IT industry, with the upshot that the structure of the industry has become more and more diversified and competitive.

Second, the Chinese automobile industry, which is classified as a pillar industry as well, is likewise greatly endowed with foreign investment, and hence strongly depends on global automobile giants for the adoption of new core technology. Similar to the electronics and IT industry, the Chinese automobile industry is essentially made up of assembly plants, focusing on passenger cars, in particular. It stands nonetheless in sharp contrast to the electronics and IT industry, in that foreign carmakers have hitherto been catering exclusively to the Chinese domestic market. The industry has therefore followed the Asian experience of hosting FDI for the purpose of "import-substitution," whereas the electronics and IT represents a "leapfrog" from "import-substitution" to "export-orientation." However, there are now clear signs that the Chinese automobile industry is on the threshold of targeting the export market as well. Thus, given that most of the global auto giants investing in China also have considerable similar stakes in

ASEAN countries, the new reorientation towards the overseas market appears to be tantamount to creating a Frankenstein of Chinese competition to undermine their third country markets. The existing regional network for automobile manufacturing seems therefore poised for a signifi cant reshuffling as well. To ameliorate the situation the various automobile giants will likely have to readjust their modus operandi, by assigning, for example, their manufacturing plants in different parts of the region to specialize in different models and classes of vehicles to be produced.

The ongoing or anticipated changes in the East Asian production network are bound to bear on the pattern of investment and trade flows in the region, given the enormous size of the "China factor" and its potential export capability. Put simply, the country's accession to the WTO will likely continue for some years to serve as a great magnet for foreign investment in both the electronics and automobile industries. Japan, the United States, European Union, Korea, and Taiwan as well, all seem poised to expand investment in China as a manufacturing base, either for exporting to third country markets or for the purpose of avoiding high labor costs in meeting their own domestic demand. As a matter of fact, the observed increases in electronics exports from China to Japan, the United States, or for that matter, Germany and the Netherlands, seem to exactly represent the latter type of trade flows. It remains of course a matter of conjecture as to whether the Chinese automobile industry will also be able to follow the same pattern of development in the future.

However, as a result of continuous income growth and increased purchasing power amidst the industrialization drive in China, one may expect the country to increasingly become a major export market for the other neighboring developing East Asian economies as well; as it indeed already is for the United States, Japan, and the European Union for high-technology products and advanced industrial consumer durables. If one considers, for example, that the entire Chinese computer export-manufacturing industry is essentially a matter of two relatively small municipalities (i.e., Dongguang and Suzhou) then there is obviously no reason why similar industrial slots cannot be developed in Southeast Asia. Malaysia is currently one of the few major exporters of integrated circuits to China. Whether in light of China's rapid advances with the same technology Malaysia will be able to hold on to that position is a question which should not detain us here. However, as industrialization advances in East Asia, the cross-Atlantic experience (i.e., the Leontief paradox) clearly suggests that there will be increased room for inter- and intra-industrial specialization and exchange between Northeast and Southeast Asia. It will of course all depend on the entrepreneurs and high-tech professionals to help carve out the market niche for the different countries involved. Under these circumstances, governments certainly play the very important role of a facilitator. And the ASEAN 10+1 FTA agreement as hammered out in November 2002 has clearly helped to establish the necessary overall framework.

Acknowledgements

This manuscript has grown out of a larger project entitled "Production Networks, Industrial Adjustment, Institutions and Policies, and Regional Cooperation" funded by the International Development Research Center (Canada) via its Regional Headquarters in Singapore. I am grateful to Professor Ponciano S. Intal, Jr., the Project Leader, for inviting me to participate in the project. It will be presented as a paper at the 6th Asian Development Research Forum meeting to be held in Bangkok under the auspices of the Thailand Research Fund and IDRC, 7-8 June 2004.

In preparing the manuscript I have benefited greatly from interviews granted separately by three key personalities and conducted in Shanghai as follows:

i) Mr. Wang Rongjun was Managing Director of Shanghai Volkswagen Automotive Company, Ltd. from the inception of this much cerebrated Sino-German joint venture in 1985 or 1986 until his retirement a few years ago. He is now a member of the China National Automotive Industry Consultative Committee.

ii) Dr. Steven S. L. Lee, Special Assistant to CEO of the Taiwan-based VIA Technologies, Inc. VIA is one of the leading ICs design houses in the world. The establishment features a total employment of more than 4000 persons (80% are R&D experts and ICs designers) distributed among the Taiwan home base (2500) and its branches in the United States (700 – 800) and in the Chinese Mainland (in Shanghai, Beijing, Shenzhen, and Hangzhou, totaling about 1000). Dr. Lee, who holds two PhD degrees (in Engineering and Material Science) from the University of California at Los Angeles, was previously Deputy Executive Managing Director of U.S.-based Lam Research, Inc. specializing in semiconductor manufacturing equipment (research and manufacturing as well). The firm is a major equipment supplier of the two largest electronic conglomerates in Taiwan, United Microelectronic, Inc. and World Semiconductor Manufacturing, Inc.

iii) Mr. Yenho Tree, Managing Director-Asia of U.S.-based Centurion Wireless Technologies, Inc., based at Centurion Electronic (Shanghai) Ltd., with branches in Beijing (employment 500 persons) and Penang (Malaysia) (about 1000), in addition to Shanghai (400). Centurion specializes in R&D and manufacturing of mobile phones terminal antennae. It controls a global market share of 25 percent to 30 percent. Around 90 percent of its total global output is now manufactured in Shanghai, Beijing, and Malaysia.

I owe a great debt of gratitude to all three of them, Mr. Wang, Dr. Lee, and Mr. Tree for graciously sharing their great professional views and insights during the interviews. I am of course solely responsible for any errors and misinterpretations that I may have made in the manuscript.

My thanks also go to Mr. Edward H. K. Leung, Chief Economist of the Hong Kong Trade Development Council for helpful guidance to research materials held by the TDC's Business Infocentre at the Hong Kong Exhibition and Convention Centre, and as well to Mr. Benson Wong of the Infocentre for practical assistance in identifying and locating the useful materials.

References

Alpha Research Co. Limited, Thailand in Figures 2002/2003, Bangkok, January 2003.

China Automobile Industry Yearbook (CAIYB) (in Chinese), various years.

China Automobile Market Prospects (CAMP). (2003). Edited by China Information Centre and State planning Commission (Office for Industrial Development) and published by China Machine Press, Beijing 2003.

China Automobile Times (Zhongguo Qiche Bao)

China Custom Statistical Yearbook (CCSYB), various years.

China Daily China Securities Times (Zhongguo Zhengjuan Bao)

China Electronics and Information Industry Annual Report 2001 (CEIIAR 2001) (in Chinese), published by the Ministry of Information Industry (Section on Economic System Reform and Operation), May 2002

China Electronics and Information Technology Products Exports – Research Report 2001 (CEITPERR 2001) (in Chinese), edited by Qu Weizhi and Li Zhiming, Beijing: Zhongguo Jingji Chubanshe, August 2001

China Electronics Industry Yearbook (CEIYB), various years

China Foreign Economic and Trade Yearbook (CFETYB), Chinese edition, various years

China High and New Technology Industry Development Yearbook (CHNTIDYB 2002)

China Industrial Development Report (CIDR) (in Chinese), edited by Institute of Industrial Economics of the Chinese Academy of Social Science, and published by Beijing: Jingji Guanli Chubanshe, various years

China Statistical Yearbook (CSYB) (in Chinese), various years.

China Statistical Yearbook on High Technology Industry (CSYBHTI) (2002), edited by National Bureau of Statistics, State Development Planning Commission, Ministry of Science and Technology, and State Economic and Trade Commission, and published by China Statistics Press, 2003.

Economic Reference Times (Jingji Cankaobao) Global Trade Information Services,Inc.

Howe, Christopher, Y Y Kueh and Robert Ash, China's Economic Reform: A Study with Documents, London and New York: RoutledgeCurzon Press, 2003

HSBC (Hong Kong and Shanghai Banking Corporation), China Monthly Report, Hong Kong, various issues.

Huang Yonghe and Wu Songquan. "The Automobile Industry One Year After China's Accession to the WTO", in CAIYB 2003, pp. 1-5

Huang Fanzhang. "The New Era of Shenzhen: New Opportunities, New Positioning, and New Development" in Special Zone Economy, No.180 (January 2004), pp.7-9

Jin Pei. The International Competitiveness of the Chinese Industries: Theory, Methodology, and Empirical Research, Beijing: Jingji Guanli Chubanshe, 1997

Kueh Y. Y. (1997). "China and the prospects for economic integration within APEC" in Joseph C.H.Chai, Y.Y. Kueh and Clement A. Tisdell, eds. *China and the Asia Pacific Economy*, New York: Nova Science Publishers, Inc. 1997, pp.29-47

Kueh, Y.Y. (2002). "Coping with Globalization in China: Strategic Implications of WTO Accession" in *Journal of World Investment (Geneva)*, Vol.3 No.1 (February 2002), pp.37-63

Kueh Y. Y. (2003). "Sino-Japanese economic relations and the prospects of trade liberalization in East Asia" in Lim Huasheng and NyawMeekau, eds. *ASEAN and Japan in Economic Cooperation within the Chinese Economic Areas* (in Chinese), Singapore: World Scientific Publishing Co., December 2003. pp. 505-525

Kueh Y.Y., Joseph C. H. Chai, and Gang Fan. ndustrial Reform and Macroeconomic Instability in China, Oxford: Oxford University (Clarendon) Press, 1999.

Leissner, Bernd. “Volkswagen to power China’s auto exports”,(interview in People’s Daily, 5 June 2002), www.china.org.cn accessed via www.google.com on 31 January 2004
Minako Mori. “Automobile manufacturers unveil new ASEAN strategies”, in *Asia Monthly* (Japan Research Institute), October 2001
Ryan, P. “China Car Market Goes Into Overdrive: Over-capacity Scenario in the Mid-term”, Economic Reports, Marubeni Research Institute, Japan, October 2002, in www.marubeni.co.jp/research/eindex/0210/body. html via www.google accessed 31 January 2004
South China Morning Post (SCMP), Hong Kong
Shanghai Daily.
Ta Kung Pao (2004). (Impartial Daily), Hong Kong
Wang Zude, “Imports and Exports of Our Country’s Automobile Industry in 2002: A General Survey”, in CAIYB 2003, pp. 227-229
World Trade Atlas (website)
Wu Peng, “Sedans Production Breaks Record of Two Million Units with Reordering of the Top Ten (Manufacturers) in China” in Beijing Entertainment Times via xinhuanet.com 3 February 2004