

DIVERGING DEVELOPMENT PATHS OF THE ELECTRONICS INDUSTRY IN KOREA AND TAIWAN

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INTRODUCTION

THE electronics industry is the largest manufacturing sector and also forms the largest export industry in both the Republic of Korea (hereafter Korea) and Taiwan. However, the industry's development process and present makeup differ greatly in the two economies. Today Korea has developed to a level comparable with the advanced countries in the production of ICs, in particular DRAMs, while Taiwan has developed into one of the world's largest personal computer production bases (Table I).

This kind of difference reflects each economy's strengths attained through their past development process. However, at the initial stage the electronics industry in both Korea and Taiwan followed a very similar development path. When and how did the difference arise? This paper will attempt to clarify the different development processes of the two economies and the differences in underlying mechanisms through a comparative analysis of the electronics industry.

This study will be divided into three sections. Section I will show that in its initial stage the electronics industry in both Korea and Taiwan followed a similar development process until the mid-1970s. They had a dual structure where a domestic demand sector coexisted with an export sector. Furthermore Section I will explain the limits of the dual structure using the example of Taiwan's consumers electronics sector.

Section II will show the differences that arose between Korea and Taiwan in the mid-1970s and examine the mechanism for the formation of such differences. Thereafter new players with totally different characters came into existence in the two economies, which helped overcome the trap of the dual structure. In Korea, *chaebol* (giant business conglomerates) affiliates which traded in both the domestic and overseas markets began to develop, while in Taiwan indigenous export-oriented small and medium-size enterprises began to mushroom. Section II will also argue that such developments reflected differing government policies and corporate strategies in the two economies.

TABLE I
PRODUCTION OF THE ELECTRONICS INDUSTRY IN KOREA AND TAIWAN

A. Korea

	(U.S.\$ million)						
	Total	Color TVs		Computers		ICs	
1981	3,815	552	(14.5)	—	(—)	342	(9.0)
1982	4,071	584	(14.3)	—	(—)	490	(12.0)
1983	5,769	890	(15.4)	39	(0.7)	661	(11.5)
1984	7,436	852	(11.5)	108	(1.5)	1,018	(13.7)
1985	7,543	661	(8.8)	183	(2.4)	941	(12.5)
1986	12,095	1,000	(8.3)	436	(3.6)	1,169	(9.7)
1987	17,438	1,349	(7.7)	520	(3.0)	1,782	(10.2)
1988	23,939	1,726	(7.2)	1,010	(4.2)	2,510	(10.5)
1989	29,036	1,744	(6.0)	1,733	(6.0)	4,044	(13.9)
1990	29,352	2,027	(6.9)	1,328	(4.5)	4,410	(15.0)
1991	33,558	2,225	(6.6)	1,485	(4.4)	5,655	(16.9)
1992	33,564	2,155	(6.4)	834	(2.5)	6,860	(20.4)
1993	37,977	2,339	(6.2)	926	(2.4)	8,730	(23.0)

B. Taiwan

	(U.S.\$ million)						
	Total	Color TVs		Computers		ICs	
1981	6,421	498	(7.8)	2	(0.0)	237	(3.7)
1982	5,996	391	(6.5)	7	(0.1)	310	(5.2)
1983	7,315	491	(6.7)	21	(0.3)	336	(4.6)
1984	9,458	555	(5.9)	195	(2.1)	470	(5.0)
1985	8,451	509	(6.0)	168	(2.0)	393	(4.7)
1986	13,610	748	(5.5)	344	(2.4)	667	(4.9)
1987	19,149	894	(4.7)	824	(4.3)	853	(4.5)
1988	23,708	847	(3.6)	1,310	(5.5)	1,068	(4.5)
1989	28,293	861	(3.0)	1,843	(6.5)	1,362	(4.8)
1990	28,995	595	(2.1)	1,908	(6.6)	1,486	(5.1)
1991	32,538	579	(1.8)	2,294	(7.1)	1,838	(5.6)
1992	34,768	516	(1.5)	2,466	(7.1)	2,243	(6.5)
1993	36,627	487	(1.3)	2,266	(6.2)	3,546	(9.7)

Sources: For Korea, EIAK, *Electronic Industry of Korea* (1990–91, 1995). For Taiwan, ROC, DS (various issues).

- Notes: 1. Total amounts in Taiwan show those of electric and electronics industries.
2. Figures in parentheses show the percentage of each product to the total.

As was explained at the outset, a distinct difference between Korea and Taiwan at present is that the former has achieved notable development in ICs and the latter in personal computers. Section III will focus on this difference and show that it has been due to the diverged development paths discussed in Section II. Finally, this paper will present a view that the development mechanisms of the two economies will not immediately converge and will stay put for the foreseeable future.

I. FORMATION AND LIMITS OF THE DUAL STRUCTURE

A. *Mechanism of Dual Structure Formation*

After World War II and particularly from the 1960s, both Korea and Taiwan adopted an import-substitution policy along with an export-promotion policy. The result was the formation of a dual structure composed of a domestic demand sector which was protected through the import-substitution policy, and an export sector driven by the export-promotion policy. This section will start with an examination of the mechanism that formed this dual structure.

The Korean and Taiwanese governments, like those of other developing countries, planned to foster their industries in the 1950s by protecting the domestic markets. In an effort to develop the intermediary goods industry at the same time, they adopted local contents regulations for parts and components. The governments demanded that companies wanting to use foreign technologies enter into technological tie-ups without involving capital participation or establish joint ventures. In the 1960s, Korea and Taiwan started their export-promotion policy while continuing their import-substitution policy. Under the export-promotion policy, they exempted export-oriented production from the local content requirements and tariffs on imported intermediary goods in fear that the requirements might weaken international competitiveness. Regulations on equity ratios for foreign companies were also eased. In exchange, foreign companies were required to export their whole production and their participation in the domestic market was prohibited.

These policies led to the formation of the two sectors with their contrasting characteristics. In the domestic demand sector, which depended heavily on a small domestic market and used relatively high ratios of local content, indigenous enterprises or joint ventures were the major players. In the export sector, which was engaged in mass production intended for overseas markets and had a low ratio of local content, the major players were wholly foreign-owned firms.

The dual structure typically emerged in the electronics industry. The main reason was the difference in the production systems between the small amount of production of various products intended for a small domestic market and mass production intended for overseas markets. There were two additional reasons. First, since electronics companies in the developing countries such as Korea and Taiwan had to introduce technologies from the developed countries, they were often subject to export restrictions imposed by the foreign companies.¹ This made it difficult for the enterprises in the domestic demand sector relying on the introduced

¹ According to Simon (1980, p. 445), about 20 per cent of technical cooperation contracts concluded between Taiwanese and foreign electronics firms in the 1970s included some provisions restricting exports.

technology to embark on exporting. Second, electronics companies had to establish sales networks if they wished to enter the domestic market.² Consequently, such export-oriented enterprises had to bear substantial fixed costs.

The international business environments also contributed to the formation of the dual structure. In the electronics industry, it was in the mid-1960s that many companies in the developed countries such as Japan and the United States began to operate in the developing countries including Korea and Taiwan in order to utilize the cheap labor there. This trend helped establish a typical offshore-type export sector of fairly large size, making the two sectors in the dual structure all the more distinct.

B. *Evidence of the Dual Structure*

According to Schive and Yeh (1980), a typical dual structure in Taiwan was formed in color TV production.³ Major players in the domestic demand sector included joint ventures and local firms such as Tatung Co., Sampo Corp., Teco Electric and Machinery Co., Ltd., and Matsushita Electric (Taiwan) Co., Ltd. The export sector was dominated by foreign-owned firms such as RCA (Taiwan) Ltd. There were noticeable gaps in the export ratio and the local content ratio between "the wholly foreign-owned firms" and "joint ventures and indigenous companies." According to the research by Schive and Yeh done in the late 1970s, the export ratio was 100 per cent for the former enterprises, and 2.2 per cent and 1.3 per cent respectively for joint ventures and indigenous firms. In 1978 the local content ratio stood at 33 per cent for the wholly foreign-owned companies, and at 60 per cent and 71 per cent for the latter two types of firms respectively (Schive and Yeh 1980, p. 269, Table 5). Joint ventures and indigenous companies began establishing R&D divisions from the late 1960s, but the wholly foreign-owned firms showed no such moves (Schive and Yeh 1980, pp. 281–82).⁴ Table II shows that such a dual structure still continued in the mid-1980s and spread to the area of VCRs.

Chen and Tang made a quantitative analysis of foreign-affiliated electronics enterprises in Taiwan and found that export-oriented and domestic-demand-oriented firms have the following differences. Compared with domestic-demand-oriented

² During the surveys I conducted in Taiwan in 1989 and 1993, two consumer electronics makers belonging to the domestic demand sector stressed the importance of sales networks. The company surveyed in 1993 owned one thousand affiliated stores whose combined sales accounted for 85 per cent of the company's total sales.

³ The dual structure in black-and-white TVs had been overcome by that time. The export ratio in black-and-white TVs for wholly foreign-owned companies was 100 per cent; the same was true for color TVs. The export ratio for black-and-white TVs was also high in the case of joint ventures and indigenous companies (Schive and Yeh 1980, p. 269, Table 5).

⁴ The only exception was AOC International. This was because it had separated from the R&D division of Rockwell, which was the original parent company, when ownership changed to an overseas Chinese (Schive and Yeh 1980, p. 281).

TABLE II
TAIWAN'S SALES OF COLOR TVS AND VCRs BY COMPANY (DOMESTIC MARKET AND EXPORTS)

A. Color TVs	1987		1991 ^a		(%)
	Domestic Market	Export	Domestic Market	Export	
1. AOC International	A 15.6	1. Orion Electric (Taiwan) Co., Ltd.	1. Shinlee Corp.	1. Funai Electric Co. of Taiwan	A 14.9
2. Sampo Corp.	B 13.6	2. RCA (Taiwan) Ltd.	2. Matsushita Electric (Taiwan) Co., Ltd.	2. RCA (Taiwan) Ltd.	A 13.8
3. Shinlee Corp.	C 12.2	3. AOC International	3. Taiwan Kolin Co., Ltd.	3. Orion Electric (Taiwan) Co., Ltd.	A 13.7
4. Tatung Co., Ltd.	B 11.5	4. Shirasuna Electric Corp., Taiwan ^b	4. Sampo Corp.	4. Action Electronics Co., Ltd.	— 10.5
5. Taiwan Kolin Co., Ltd.	B 9.7	5. Capetronic (Taiwan) Ltd.	5. Toshiba	5. Kuang Yuan Co., Ltd.	B/C 8.5
6. Matsushita Electric (Taiwan) Co., Ltd.	A 8.4	6. Philips Electronics Industries (Taiwan) Ltd.	6. Tatung Co., Ltd.	6. Shirasuna Electric Corp., Taiwan ^b	B/C 8.4
7. Sanyo Electrics (Taiwan) Co., Ltd.	B 7.0	7. Hitachi Television (Taiwan) Ltd.	7. Others	7. Taiwan Toyo Radio Co., Ltd.	A 6.2
8. Teco Electric & Machinery Co., Ltd.	C 4.5	8. Kuang Yuan Co., Ltd.		8. Emperor Corp.	B/C 4.1
9. Chung-Hsin Electric & Machinery Manufacturing Corp.	C 3.1	9. Funai Electric Co. of Taiwan		9. Tele Electronic (Taiwan) Co., Ltd.	B/C 1.6
10. Proton Electronic Industrial Co., Ltd.	C 2.4	10. Tatung Co., Ltd.		10. Hitachi Television (Taiwan) Ltd.	A 1.5
11. Others	12.0	11. Others		11. Others	16.8

TABLE II (Continued)

B. VCRs	1987			1991			(%)
	Domestic Market		Export	Domestic Market		Export	
1. Shinlee Corp.	C 23.9	1. Orion Electric (Taiwan) Co., Ltd.	A 67.8	1. Shinlee Corp.	C 16.2	1. Sony Video Taiwan Co., Ltd.	A 41.2
2. Sampo Corp.	B 23.1	2. Dashen Electronic Industry, Ltd.	A 17.9	2. Matsushita Electric (Taiwan) Co., Ltd.	A 13.2	2. Capetronic (Taiwan) Ltd.	A 15.9
3. Matsushita Electric (Taiwan) Co., Ltd.	A 14.6	3. Sony Video Taiwan Co., Ltd.	A 11.6	3. Sampo Corp.	B 12.7	3. Action Electronics Co., Ltd.	— 8.8
4. Sanyo Electronics (Taiwan) Co., Ltd.	B 12.5	4. Tatung Co., Ltd.	B 0.9	4. Toshiba	I 10.3	4. Matsushita Electric (Taiwan) Co., Ltd.	A 2.0
5. Taiwan Kolin Co., Ltd.	B 5.4	5. Sanyo Electronics (Taiwan) Co., Ltd.	B 0.8	5. Tatung Co., Ltd.	B 9.5	5. Tatung Co., Ltd.	B 0.1
6. AOC International	A 5.2	6. Funai Electric Co. of Taiwan	A 0.3	6. Taiwan Kolin Co., Ltd.	B 7.8	6. Others	32.0
7. Tatung Co., Ltd.	B 4.0	7. Funai Electric Co. of Taichung	A 0.1	7. Others	29.9		
8. Teco Electric & Machinery Co., Ltd.	C 3.3	8. Others	0.6				
9. Synco Corp.	— 2.7						
10. Shengjia	— 2.0						
11. Others	3.3						

Sources: ROC, IDB (1987, 1991). For capital structure, CCIS, *The Largest Corporations* (various years).

Notes: 1. A = wholly foreign-owned firms and joint ventures with 50 per cent or more foreign capital; B = joint ventures with less than 50 per cent foreign capital; C = indigenous enterprises; B/C = ventures with less than 50 per cent foreign capital or indigenous enterprise; I = import; and — = not clear.

2. Domestic market and exports indicate the ratios of numbers and amounts, respectively.

^a Including black-and-white TVs.

^b Shirasuna Electric Corp., Taiwan was a Japanese-affiliated enterprise, but later it was sold to an indigenous enterprise.

firms, export-oriented firms: (1) are labor-intensive, (2) are low in value added, (3) employ a larger proportion of unskilled labor, (4) show complementarity between capital and unskilled, skilled, and white-collar labor (compared with substitutability between capital and unskilled and skilled labor in the domestic-demand-oriented companies) (Chen and Tang 1986), (5) are efficient in terms of closeness to the production frontier (Chen and Tang 1987), and (6) are capable of faster reduction in their skill and capital intensity (Chen 1992).

Like Taiwan, a dual structure also came into existence in Korea. According to Taniura (1981, p. 104, Table 4-5; p. 106, Table 4-7),⁵ the export ratio of consumer appliances in 1979 was 99 per cent for wholly foreign-affiliated firms, 54 per cent for joint ventures, and 60 per cent for indigenous firms. The ratio of local content was lower for exports than for domestic markets, standing at 43 per cent versus 80 per cent in electronic calculators, and 39 per cent versus 65 per cent for recorders.⁶

C. *Limits of the Dual Structure*

The problem with the dual structure is that neither the domestic demand sector nor the export sector achieves the momentum to grade up itself. This is why over time the two sectors reached their limits (Satō 1990, pp. 142–45). The following discussion will identify the difficulties confronted by the two sectors in Taiwan's consumers electronics industry which presented the most conspicuous limits.

It should be noted first that the domestic demand sector, which has depended on a protected market, has failed to build up competitiveness and thus upgrade itself. Taiwan's small domestic market also has prevented the sector from enjoying economies of scale. With a major cut in tariff rates, therefore, the Taiwanese market has been heavily eroded by imported goods since the mid-1980s.⁷

On the other hand, foreign-affiliated companies, which were positioned by their parent companies as production bases to capitalize on local low-cost labor, were not expected to obtain their own technological foundations. Since the late 1980s, many export-oriented foreign firms pulled out due to the appreciation of the N.T. dollar and continuously rising wages. RCA (Taiwan) Ltd., which was the largest foreign company in Taiwan for many years, left in 1992.⁸ In 1991 Zenith Taiwan Corp. also announced its intention to withdraw from Taiwan (*Nikkei sangyō*

⁵ Bloom (1992, p. 28) also points out the dual structure in Korea's electronics industry.

⁶ The dual structure in the Korean black-and-white TVs sector seems to have disappeared as was the case in Taiwan. The local contents ratio for both overseas and domestic shipments stood at 95 per cent.

⁷ For example, imports of color TVs, which stood at U.S.\$6 million in 1985, reached U.S.\$115 million in 1988. Imports of VCRs increased from U.S.\$1.2 million in 1985 to U.S.\$148 million in 1988 (ROC, IDB, 1988).

⁸ RCA (Taiwan) ranked high on the list of *The Largest Corporations in Taiwan* prepared by the China Credit Information Service (CCIS, various years), but its name disappeared in the 1993 edition which carried the ranking for 1992.

shimbun, November 14, 1991). Among Japanese firms, the suspension of production by Orion Electric (Taiwan) Co., Ltd. had a great impact (ROC, IDB, 1992, p. 272). Funai Electric Co. of Taiwan also announced a shift of its production base for TVs and audio equipment to the People's Republic of China (*Nikkan kōgyō shimbun*, August 17, 1990), while Dashen Electronic Industry, Ltd., a subsidiary of Mitsubishi Electric, discontinued production and became an asset management company ("Nikkei kigyō" 1993, p. 305). And it seems that Shirasuna Electric Corp., Taiwan was sold to a Taiwanese.⁹

Table I shows a sharp drop in color TV production in Taiwan since 1990, reflecting increased imports as a result of tariff cuts and the withdrawal of foreign firms which had engaged in exporting.

II. DIVERGENCE OF DEVELOPMENT PATHS

Korea and Taiwan both overcame the limitations of the dual structure, albeit in different ways, and in so doing they have continued to develop economically. A new stage in the electronics industry was prepared by big enterprises affiliated with the *chaebols* in Korea and by export-oriented and venture-minded indigenous enterprises in Taiwan.

A. Growth of Electronics Enterprises Affiliated with Chaebols in Korea

In Korea, the dual structure was overcome through the development of electronics enterprises affiliated with the *chaebols* which were marketing their products in both domestic and overseas markets, although the majority of their exports were based on OEM (original equipment manufacturing).¹⁰ These *chaebol* affiliates differed from foreign-affiliated firms engaged in exporting in that they had achieved a degree of independence in sourcing parts and developing technologies. This has enabled them to achieve independent development while relying on technological tie-ups and OEM, and can expect to export products under their own brand names to overseas markets in the future. In this sense, the *chaebol* affiliates have surmounted the trap of the export sector. At the same time, they have avoided the trap of inefficiency in the domestic demand sector by realizing economies of scale through mass production for overseas markets and by coping with international competitive pressure.

The production of color TVs in Korea started in 1974 with a joint venture be-

⁹ The name disappeared in the 1991 edition of *Kaigai kigyō shinshutsu sōran* [Companies operating overseas] (Tōyō Keizai Shimpōsha 1991). However, the enterprise still exists under a Taiwanese chairman and president. See Satō (1989, pp. 149–52) for information about Uniden Corp. of Taiwan and others.

¹⁰ See Bloom (1992, p. 32) for the dependence of Korean firms on OEM.

¹¹ The development process of the Korean TV industry is explained by Hanabusa (1983).

tween a local company and Matsushita Electric Co., Ltd.¹¹ This was followed by Samsung Electronics Co., Ltd., Goldstar Co., Ltd., and Taihan Electric Wire Co., Ltd. There were still no domestic color broadcasting services in Korea, and all production of color TVs was initially intended for export. As exports declined in 1978 due to export restrictions, color TV broadcasting started and domestic sales of color TV sets were approved. As the result of this process, manufacturers of color TVs came to be engaged in both export and domestic sales. Meanwhile, Matsushita Electric and Sony, which had come in some time after Matsushita, withdrew from the Korean market. This helped bring about an oligopoly of Goldstar, Samsung Electronics, and Taihan Electric Wire which was acquired by Daewoo group and renamed Daewoo Electronics Co., Ltd.¹² The way these *chaebol* affiliates entered the color TV production market helped them avoid the trap of the dual structure. Production of color TVs in Korea has continued to increase since the latter half of the 1980s in contrast to its decline in Taiwan.¹³

B. Development of Small and Medium Export-Oriented Indigenous Enterprises in Taiwan

In Taiwan there were some enterprises, such as Tatung Co., Ltd. and Sampo Corp., that engaged in the production of a wide range of products, but their operational scale was much smaller than that of the Korean *chaebol* affiliates (Table III). Rather than these older enterprises, it was the development of new enterprises manufacturing electronic goods such as calculators and telephones that overcame the dual structure. These enterprises shared the following characteristics: They (1) depended on indigenous capital, (2) were generally small and medium-scale, and (3) had very high export ratios. As export channels they depended on OEM. Though quite different in nature, these manufacturers shared this dependence on OEM with the Korean *chaebol* affiliates.

These small and medium-size enterprises were able to accumulate resources under the dual structure while at the same time they were able to avoid its trap. Having to compete in overseas markets kept them away from the trap of inefficiency that prevailed in the domestic demand sector. The fact that they engaged on OEM-based production suggests that at least production technology was held by the Taiwanese side, which in turn indicates a higher level of technological independence than under that of direct investment (Satō 1989, pp. 141–42).¹⁴ Presumably those new companies derived their competitiveness from flexible production systems as well as from low-cost labor (Satō 1996, pp. 108–9). These factors provided them

¹² Three color TV manufacturers had a combined market share of 93 per cent in 1981 (Hanabusa 1983, p. 47).

¹³ This is partly due to restrictions on imports from Japan. However, Korean exports continued to increase moderately, in contrast to the sharp decline seen in Taiwan's exports.

¹⁴ Hobday (1994) also regards OEM as the next stage for direct investment.

TABLE III
MAJOR ELECTRIC AND ELECTRONICS ENTERPRISES IN KOREA AND TAIWAN

A. The First Half of the 1980s

	Korea (1981)				Taiwan (1983)			
	Company Name	Sales Amount		Employees	Company Name	Sales Amount		Employees
		U.S.\$ Million	%			U.S.\$ Million	%	
1. Goldstar Co., Ltd.		607	16.0	12,121	1. Tatung Co., Ltd.	335	4.6	22,500
2. Samsung Electronics Co., Ltd.		543	14.3	10,933	2. Matsushita Electric (Taiwan) Co., Ltd.	205	2.8	3,917
3. Taihan Electric Wire Co., Ltd.		390	10.3	8,051	3. Sampo Corp.	202	2.8	5,000
4. Goldstar Cable Co., Ltd.		228	6.0	2,563	4. Sanyo Electrics (Taiwan) Co., Ltd.	126	1.7	3,774
5. Goldstar Telecommunication Co., Ltd.		115	3.0	3,227	5. Teco Electric & Machinery Co., Ltd.	126	1.7	2,400
6. Oriental Precision Co., Ltd.		90	2.4	2,711	6. Walsin Lihwa Electric Wire & Cable Corp.	110	1.5	1,309
7. Samsung Display Devices		89	2.3	2,424	7. Pacific Electric Wire & Cable Co., Ltd.	95	1.3	1,992
8. Goldstar Electric Co., Ltd.		71	1.9	2,912	8. Shinlee Corp.	79	1.1	1,571
9. Korea Electronics Co., Ltd.		51	1.3	1,827	9. Taiwan Kolin Co., Ltd.	70	1.0	1,559
10. Orion Electric Co., Ltd.		47	1.2	1,210	10. Sinoca Enterprises Co., Ltd.	58	0.8	1,411
Total		2,231	58.8	47,979	Total	1406	19.2	45,433

B. 1993

	Korea				Taiwan ^a			
	Company Name	Sales Amount		Employees	Company Name	Sales Amount		Employees
		U.S.\$ Million	%			U.S.\$ Million	%	
1. Samsung Electronics Co., Ltd.		7,818	20.6	47,597	1. Tatung Co., Ltd.	1,198	3.3	10,331
				10.2				2.6

TABLE III (Continued)

Korea						Taiwan ^a					
Company Name	Sales Amount			Employees		Company Name	Sales Amount			Employees	
	U.S.\$ Million	%		Persons	%		U.S.\$ Million	%		Persons	%
2. Goldstar Co., Ltd.	4,852	12.8		29,197	6.3	2. Matsushita Electric (Taiwan) Co., Ltd.	938	2.6		5,108	1.3
3. Daewoo Electronics Co., Ltd.	2,214	5.8		11,969	2.6	3. Philips Electronic Building Elements Industries (Taiwan), Ltd.	817	2.2		2,806	0.7
4. Samsung Display Devices Co., Ltd.	1,295	3.4		10,301	2.2	4. Philipis Electronics Industries (Taiwan), Ltd.	798	2.2		5,267	1.3
5. Samsung Electro-Mechanics Co., Ltd.	774	2.0		7,050	1.5	5. Chungghwa Picture Tubes, Ltd.	739	2.0		5,600	1.4
6. Anam Industrial Co., Ltd.	618	1.6		5,979	1.3	6. Acer Inc.	733	2.0		2,803	0.7
7. Orion Electric Co., Ltd.	519	1.4		4,650	1.0	7. Teco Electric & Machinery Co., Ltd.	540	1.5		3,220	0.8
8. Daewoo Telecom Co., Ltd.	489	1.3		2,641	0.6	8. Pacific Electric Wire & Cable Co., Ltd.	495	1.4		2,100	0.5
9. Korea Electronics Co., Ltd.	331	0.9		2,360	0.5	9. Sampo Corp.	488	1.3		3,531	0.9
10. Trigem Computer Inc.	319	0.8		1,433	0.3	10. Motorola Electronics Taiwan, Ltd.	476	1.3		2,752	0.7
Total	19,227	50.6		123,177	26.4	Total	7,222	19.7		43,518	11.1

Sources: For Korea, KLCA (1982); CRI (1994). For production output and number of employees, ELAK, *Electronics Industry Today* (1983); *Electronic Industry of Korea* (1995). For Taiwan, CCIS, *The Largest Corporations* (1984, 1994). For production output, ROC, DS (various issues). For number of employees, ROC, CLA (1986, 1993).

Notes: 1. For Korea, only companies listed on the stock exchange are compiled.

2. Percentages show the ratios of electric and electronic industries in Taiwan and those of the electronics industries in Korea.

3. Percentages of sales amounts are calculated by dividing sales amounts by production output.

^a Not including some joint ventures.

with an adroitness to respond to the extreme fluctuations in demand on overseas markets. Indeed some of these enterprises succeeded in acquiring technologies to develop new products in the course of OEM-based production.

Human resources have been an important ingredient that these new enterprises have inherited from the past dual structure period. A monitor manufacturer which I visited in September 1993 is a case in point. The development of the company was due greatly to the previous experience that the vice president brought into the venture. Having majored in electronics engineering in university, he worked in the R&D division of a domestic-demand-oriented consumers electronics maker, and then in the same division of an export-oriented electronics maker, and finally in the marketing division of a trading company handling electronics. Then he joined the monitor manufacturer as a core member for its startup group and engaged in the designing of products based on his experience.

Some of these enterprises have developed into big companies, such as Kinpo Electronics Inc., Inventa Corp., Great Electronics Corp., and Kingtel Telecommunication Corp.; the first two companies mainly manufactured calculators and the last two mainly manufactured telephones. Let us look at Kinpo Electronics Inc. as a typical firm in this group.¹⁵

Kinpo's founder, C.Y. Hsu, established a trading firm in 1970 to import electronic parts and to export calculators assembled from the imported parts. He then set up an electronic calculator firm, Kinpo Electronics, in 1973. Starting with less than fifty employees working on a 330 square meter rented plant, the company began producing OEM-based exports and developed into the world's third largest electronic calculator maker in terms of output. However, Mr. Hsu was not satisfied with merely assembling and processing using low-cost labor. He endeavored to raise the technological level by quickly introducing automated equipment, and established an R&D division to develop new products. As a result, the company not only continued handling OEM orders, it also proceeded to the stage of ODM (original design manufacturing). In this type of transaction Kinpo developed new products jointly with customer-manufactures in the developed countries and its customers sold Kinpo-developed products but under their own brand names. Later the company expanded its operations into facsimiles and the areas of information equipment which was handled by its affiliate, Compal Electronics Inc. In terms of sales, Kinpo ranked eightieth and Compal eighty-sixth among Taiwanese private manufacturing companies in 1993 (CCIS, *The Largest Corporations*, 1994).

C. *Causes of Divergence*

Why have Korea and Taiwan followed different development paths? A closer look at the development process of the Korean color TV industry reveals two

¹⁵ The major source for this description of Kinpo Electronics Inc. is CCIS, *Zhonghua minguo* (1985).

points that distinguish the industry from its Taiwanese counterpart. First, there were not many foreign companies and no wholly foreign-owned companies which exported their entire production. Some foreign companies which started operation in Korea in the form of joint ventures were finally forced to pull out. Second, *chaebol*-affiliated enterprises were intent on exporting.

The second point was especially significant for overcoming the dual structure. But the question could be asked why the *chaebol*-affiliated enterprises did not confine their business to the domestic market where they could make large profits without difficulty. The primary reason was that the government did not permit it. An important Korean industrial policy for electronics was protecting the domestic market.¹⁶ In return for protection of the domestic market, the government required the enterprises to export a part of their production (Bloom 1992, p. 31). The Korean government pursued dual policies (import substitution and export promotion) at the corporate level.

However, this explanation is not entirely convincing. *Chaebol*-affiliated enterprises started production of color TVs even when there was no domestic market that would ensure stable profits. The efforts of Samsung Electronics in particular should be noted. With no way to introduce foreign technology, it had to develop its own technology. Such action seems to reflect the fact that the enterprises accepted the government's scheme and regarded it as their own. Specifically the objective shared by the government and the companies was to follow the Japanese model. For the Korean government, Japan was a model in industrialization, and this required a shift from the production of black-and-white TVs to color TVs. For this purpose, the government undertook the above-mentioned intervention. For their part, Korean enterprises also saw Japan's comprehensive electric and electronics companies, which were engaged in both domestic sales and exporting, as the model for their development,¹⁷ and from the experience of Japanese companies, the production of color TVs was a logical next step for them to take after black-and-white TVs.¹⁸

Another point which deserves attention here is the fact that color TV production

¹⁶ Korea's policy of fostering the electronics industry started with the establishment of the Electronics Industry Promotion Law in 1969. In the 1970s the industry was included in the six industries covered by the heavy and chemical industrialization policy. However, no funds were provided to the industry by the National Investment Fund, an important instrument of the heavy and chemical industrialization policy (Fukagawa 1994, p. 138). The industry received only a modest allotment of loans from abroad which represented another important means of promoting industrial policy. However, since the capital adequacy ratio in 1979 was 21 per cent for the electric and electronics industries according to the *Financial Analysis for 1979* put out by the Korea Development Bank (KDB 1979), government intervention through general bank loans appears to have been possible.

¹⁷ According to Fukagawa (1989, p. 206), Samsung Electronics took Sanyo Electric Co., Ltd. as a model. Bloom (1992, p. 48) also points out that Korean companies followed Japanese models.

¹⁸ This is based on interviews at a *chaebol*-affiliated company conducted on August 31, 1994.

was concentrated not in independent firms but in *chaebol*-affiliated enterprises. This point is important for the Korean IC industry which will be discussed in the following section. The primary reason has been a tendency among *chaebols* toward diversification.¹⁹ Presumably in Korea as a latecomer, there were many opportunities to do business following the developed countries as models, and the government supported private companies in utilizing those opportunities. Those who were intent on seizing these opportunities in wide areas of business grew to be *chaebols*, and those especially earnest groups could rise into a higher bracket. The expansion into the electronics industry seems to have been part of their diversification strategies. Another reason has been the financial resources of these groups. Covering many business areas, *chaebols* could afford cross subsidies within themselves. Moreover, they were in an advantageous position for borrowing from governmental financial institutions thanks to their personal relationships.²⁰ It seems that this advantage in fund raising has led to a convergence of electronics manufacturers into some *chaebol*-affiliated enterprises in their pursuit of constantly introducing of new products and integrating parts and component production, which needed a substantial amount of investment.

For Taiwanese enterprises, there was no need to develop in a way comparable to their Korean counterparts because their government did not strongly require the domestic-demand-oriented firms to export their products, and probably because they chose not to follow the example of Japanese companies as Korean enterprises did. Unlike Korea, Taiwan did not pursue an aggressive industrial policy, and the resultant constraints on fund raising brought about few enthusiastic efforts to diversify corporate operations. There was neither a swelling into big conglomerates nor an advance in concentration.

It was due to the emergence of indigenous small and medium-size enterprises as major players in the export sector that the trap of dual structure in Taiwan was overcome. The government played little positive role in fostering and developing these enterprises and simply prepared an export sector that was a comparatively free area for corporate activities. As far as funds were concerned, those enterprises established themselves with what they could afford. In sum, they were produced and bred purely by Taiwanese society with few relations to the government. In other words, their emergence exhibited an economic development mechanism held within Taiwanese society independent from the government.²¹

¹⁹ See Amsden (1989, pp. 126–29) regarding Korea's underdevelopment and the tendency of *chaebols* to diversify. Also see Hattori (1988, pp. 65–76) for the relationship between *chaebol* diversification and government industrial policy.

²⁰ On this point, see Hattori's paper (1997) in this issue.

²¹ A detailed observation of the development mechanism of small and medium-size enterprises is given by Satō (1996, pp. 103–13).

III. DRAMS VERSUS PERSONAL COMPUTERS

A. ICs for Korea and Personal Computers for Taiwan

The divergence in the development path that occurred in Korea and Taiwan in the 1970s became more conspicuous in the 1980s, as reflected in the fact that the core area of the electronics industry was represented by ICs in Korea and by personal computers in Taiwan. This difference was already noted by Mody (1990), who also revealed that the main players were *chaebols* in Korea and small and medium-size enterprises in Taiwan. This paper will show that such differences have emerged in response to the different development paths that have been analyzed so far.

Table I shows the difference between Korea and Taiwan in such advanced technological areas as ICs and personal computers. Taiwan's IC production has grown but it pales beside Korea's production. In the area of personal computers, Taiwan's lead is unmistakable, while Korea's production has been slowing especially since 1990.

B. Korean and Taiwanese Development Paths in the IC Industry

In Korea the assembling process of IC production was started in the 1960s by foreign-affiliated firms. Indigenous firms outside *chaebols* also joined in later years. Research and development of the fabricating process was started by the government in the 1970s, but commercial production began in the 1980s.

The fabricating process is characterized by three factors. First, it requires a large amount of investment. Among IC products, Korean companies focused their efforts on DRAMs which require the largest amounts of investment. They had to make constant investment in order to produce more integrated chips. The successful development of the Korean IC industry is due to the existence of the *chaebols* which could afford continuous huge investments. The Korean enterprises which presently engage in DRAM production all belong to one of the three biggest *chaebols*.

Second, DRAMs are a typically standardized commodity. This explains why Samsung has chosen DRAMs judging that only with sufficient funds would it be able to catch up with leading American and Japanese companies (Yanagimachi 1991, p. 126). The progressing standardization of DRAMs had another important meaning for Korea as a latecomer. It would be relatively easy to enter international markets with standardized products only if Korean enterprises were able to ensure certain product quality and had price competitiveness. Indeed, exports accounted for 85 per cent of Korea's total IC production in value in 1993 (EIAK, *Electronic Industry of Korea*, 1995).

Third, the IC was the star of Japan's electronics industry following consumers

electronics, and especially DRAMs played a central role in the development of the country's IC industry. It is conceivable that Japan's development model was again applied in IC production as it had been in color TV production. In other words, Korean enterprises launched into DRAM production as an extension of color TV and VCR production (Ernst 1994, pp. 94–95). The development pattern for DRAMs was identical with that for color TVs and VCRs: A pattern of establishing a mass production system for highly standardized products and then starting up its industry aiming at overseas markets.

In contrast, Taiwan lacked big conglomerates as major players which could mobilize huge amounts of funds. Naturally, Taiwan's IC industry lagged behind Korea's and took a different course of development. In the initial stage the two countries shared the same course: They already had the assembly sector established by foreign firms and their governments had initiated R&D in the 1970s. But here the similarity ends. In Taiwan no major players for commercial production emerged from the existing private sector. As a result, the government's R&D project members had to establish two IC companies to engage in the fabricating process with governmental assistance: United Macroelectronics Corp. (1980) and Taiwan Semiconductor Manufacturing Co., Ltd. (TSMC) (1986, a joint venture with Philips).

Although some private DRAM companies were set up later, Taiwan's IC industry still differs from its Korean counterpart in three ways. First, while Taiwan is still inferior to Korea in memory chip production, especially DRAMs,²² it holds a strong competitiveness in the non-memory sector where Korea is weak. Second, Taiwan's division of labor is advanced. There are no integrated DRAM manufacturers covering the fabricating and assembling processes as seen in Korea. The situation is in sharp contrast to Korea where Samsung Electronics' integration includes its supporting industries (Yanagimachi 1991, pp. 140–41). Third, the foundry business plays an important role for the manufacturers in the fabricating process. TSMC has been specializing in the foundry business since its founding.

These characteristics suggest that Taiwanese enterprises have opted for a way that requires less funds than DRAM production in the absence of big companies and corporate groups with abundant funds like Korean companies. Taiwanese IC manufacturers have not regarded Japanese companies as their models as Korean firms have. Instead they were greatly influenced by American IC firms,²³ and consequently they discovered and chose a development path different from Korean or Japanese manufacturers.

²² Many DRAM manufacturers have been established since the beginning of the 1990s.

²³ Taiwan's IC firms have many managers and engineers who have studied or worked in the United States. For example, Morris Chang, who proposed the idea of TSMC specializing in the foundry business (Wang 1993, pp. 239–41), was once in charge of IC operation at Texas Instruments and, after working for General Instruments, he went to Taiwan.

C. Small and Medium Indigenous Enterprises Sustaining the Growth of the Information Industry

The world market for personal computers and peripherals expanded rapidly in the 1980s. Taiwan has developed as production base for these products with a very high export ratio, reaching 95 per cent in 1993. That year Taiwan enjoyed world market shares of 8 per cent in desk-top personal computers, 22 per cent in notebook computers, 83 per cent in mother boards, and 51 per cent in monitors (III 1994).²⁴

Taiwan's information industry developed on the accumulated experience of its electronics industry.²⁵ Since information equipment basically forms an assembly industry, engineers and workers retain the skills they have acquired and accumulated while assembling and designing in the traditional electronics industry. Taiwan relies on imports for basic components such as CPUs, DRAMs, and LCDs, but procures many other components from its own existing supporting industries. The industry's pattern of dependence on OEM/ODM for access to markets is also the same as that for electronic calculators and telephones.

Especially notable is the fact that the characteristics of information equipment, such as short commodity cycles and a modest degree of differentiation, have been most appropriate for Taiwan's small and medium indigenous enterprises and for the specialization networks they have formed. A short commodity cycle requires quick and timely product development. Since the late 1980s, more information equipment and instruments exported from Taiwan have been designed by Taiwanese enterprises than before, even when foreign brands are used, i.e., on an ODM basis. In that case, decisions about product development are made by the Taiwanese side. Such decisions are made quickly because information and power are often centered in the top management in Taiwanese small and medium-size enterprises. Adaptation to a short commodity cycle has also been possible because part of production process can be subcontracted through specialization networks. For example, many information equipment manufacturers, especially small and medium-size enterprises, rely on subcontractors for the work of inserting devices into printed circuit boards.²⁶ This practice helps these manufacturers to concentrate on product development while keeping themselves slim.

²⁴ Overseas production by Taiwanese companies is included. The reason for the low share of desktop computers is that final assembling is often conducted at places close to consumers. It appears that the world production of mother boards does not include in-house production by big companies in the developed countries.

²⁵ The continuity between the information industry and its preceding electronics industry is detailed by Kawakami (1996).

²⁶ Makoto Abe and I visited a monitor maker in September 1994 and noted that at the startup stage it inserted parts into printed circuit boards at its own plant and that the company turned to subcontracting after production reached a stable level. A medium-scale notebook computer maker which they visited had no parts-insertion process of its own and was relying on subcontractors entirely.

Differentiation of information equipment can be achieved through designing mother-board circuits based on general-purpose components. In the case of notebook computers, the manufactures can differentiate their products through industrial design. Such differentiation is made possible because the Taiwanese information industry retains a lot of small and medium-size enterprises which have the capability of designing. Differentiation can also be achieved through combinations of components. This is also made possible by various suppliers within specialization networks.

Taiwan's information industry could develop because the characteristics of information equipment have been appropriate for the country's indigenous small and medium-size enterprises and their specialized networks. As shown in Table I, the production of information equipment in Korea has been stagnant since the beginning of the 1990s. With the exception of the leading personal computer company, Trigem Computer Inc., the main producers are all affiliated with *chaebols* in Korea. The reason for the stagnation is that big organizations with advanced levels of vertical integration like *chaebol* affiliates are inadequate for short cycles and product differentiation.²⁷

OUTLOOK

Mody (1990, pp. 307–11) and Bloom (1992, pp. 120,124) regarded the financial power of big Korean companies as the source of their competitiveness, and expected Taiwan to converge on a Korean type of industrial system composed of big companies. By contrast, Ernst and O'Connor (1992, pp. 238–39, 271–72) and Ernst (1994, pp. 100–102; Chapter 5) concluded that the Taiwanese style would prevail on the grounds that the mass-production-oriented strategy of big Korean companies and their centralized R&D systems would become outdated with the ending of the Korean electronics industry's catch-up process (i.e., with the narrowing technological gaps between Korea and the developed countries) and with the changing pattern of international competition.

However, this paper stresses the difficulty in altering industrial organizations and corporate strategies in both Korea and Taiwan for two major reasons. First, their respective industrial organizations and corporate strategies are deep rooted in

Levy and Kuo (1991, p. 365) also report that two out of three personal computer makers were subcontracting out parts insertion to subcontractors.

²⁷ Levy and Kuo (1991, pp. 369–70) report that the strategy which Korean companies had chosen for assembling key boards proved to be inadequate for products with short cycles. Ernst (1994, p. 40) also points out that Korean companies have failed to adapt themselves to changes that have taken place in the personal computer market since 1988. On the other hand, during this period, Taiwan's indigenous enterprises secured an advantage over foreign affiliates and noticeably increased ODM-based production.

the government-business relationships and their business systems.²⁸ Second, it would be wasteful to abandon the present industrial organizations and corporate strategies because they have been evolving for many years and have become "intangible assets" due to the accumulation of experience by the organizations and their members and the enhanced mutual adaptation among related sectors.

It appears most likely that the electronics industries in the two economies will continue to develop in the coming years utilizing their established characteristics. The Korean companies affiliated with *chaebols* are ahead of Taiwanese companies in the area of LCDs which have characteristics similar to ICs. In Taiwan's personal computer industry, on the other hand, new generation companies with advanced designing abilities typified by Asustek Computer Inc. have emerged. Although big companies like Acer Inc. have established a mass production system by introducing automatic equipment and are diversifying their activities, they do not appear to be aiming at growing into big enterprises as seen in Korea. Instead they are intent on retaining their own competitiveness by fully decentralizing their organizations.

²⁸ See papers by Numazaki (1997) and Hattori (1997) included in this issue.

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