FOREIGN DIRECT INVESTMENTS, COMPETITIVENESS, AND INDUSTRIAL UPGRADING: THE CASE OF THE REPUBLIC OF KOREA

By

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INTRODUCTION

Since the late 1980s, the Republic of Korea has experienced a dramatic surge in the outflow of foreign direct investment (FDI). This rising trend has been attributed to many different factors, including domestic wage hikes, increasing amount of labor union activities, search for new markets, trade jumping, and technology acquisition (Kim, 1998). Asia, in particular, has received Korean FDI characterized by low-technology and labor-intensive manufacturing activities. Consequently, the movement of production activities overseas has prompted many concerns about a possible Korean "industrial hollowing," which posed as a threat to the country's competitiveness in the global economy.

This research will investigate the issues related to Korea's FDI and its impacts on industrial structure, including industrial hollowing. Does the outflow of FDI necessary lead to industrial hollowing? Or is it simply a form of *industrial restructuring*, where FDI is a necessary step towards upgrading the competitiveness of Korean manufacturing firms? In order to answer these questions, I will start with certain definitions of key terms. The development trend of mature economies, particularly those of the G7 countries, reveal that the weight of service industry in GNP tends to increase in the later stages of development. When coupled by a decreasing importance of the manufacturing sector in GNP, this process is known as *deindustrialization*.

Deindustrialization, however, is not necessarily equivalent to *industrial hollowing*. Chen and Yang (1997) define industrial hollowing as "a phenomenon where industries in the manufacturing sector fail to upgrade while the economy is moving into the stage of deindustrialization, resulting in a loss of competitive edge internationally and an imbalance of the industrial structure." In other words, industrial hollowing occurs only if sectors that are losing competitive advantage *fail to upgrade* in the process of industrial restructuring. The key to avoiding industrial hollowing therefore lies on the economy's ability to upgrade its science and technology base, which can be achieved by sustained domestic investments in the manufacturing sector and R&D.

To recapitulate, industrial hollowing occurs only under the following conditions: declining share of manufacturing in the GDP, declining value of manufacturing sector's absolute output, and heavier reliance on imports. The resulting increase in trade deficit and domestic unemployment are linked to the process of industrial hollowing. But these few economic indicators are merely a part of the bigger picture, as we will try to demonstrate later on in this paper.

The paper is divided into six sections. A brief review of theories on outward FDI will be covered in Chapter 1. Chapters 2 and 3 will discuss general trends in Korean foreign direct investments in the last ten years and its broad impact on the domestic economy. Chapter 4 will analyze the declining competitiveness of the Korean manufacturing sector and argue that Korea is gradually moving towards de-industrialization. Based on these economic trends, the issue of a possible industrial hollowing is presented. Chapter 5 will present some evidence that Korea is avoiding the pitfalls of industrial hollowing by mobilizing massive investments in science and technology, which upgrades Korea's manufacturing base into more sophisticated levels. Specific government policies will be discussed in Chapter 6 to demonstrate the important role of the state in the process of industrial upgrading. The conclusion of this paper will prove that Korea is following a natural path towards industrial transformation as FDI moves low-end manufacturing activities to developing countries, thus stimulating the emergence of high-end sectors in the domestic economy.

Chapter 1

OUTWARD FDI: A THEORETICAL REVIEW

Motivations to foreign direct investment can vary significantly by product, market goals, country, and investment climate. This section will explore the three most popular theories in FDI, under which most motivations can be categorized.

Theory of oligopolistic competition (Hymer, 1976)

Perhaps the most conventional theory on foreign direct investment, the theory of oligopolistic competition argues that companies primarily move their activities abroad in order to exploit less competitive markets. Hymer refers to multinational companies characterized by economies of scale, advanced technologies, and large capital, which give oligopolies great advantages in foreign direct investments. Oligopolies engage in FDI in order to avoid domestic and international competition, and more importantly, to increase profits. Many other scholars and studies have subsequently presented empirical evidence in support of Hymer's theory.

Product life cycle theory (Vernon, 1976)

This theory predicates on the "life cycle" of products, which can be broken down to three distinct stages: innovation, growth, and maturity. The innovation stage occurs mostly in advanced nations, where products are first invented and marketed under the protection of patents. In the later part of this stage, innovating firms may decide to move its production activities abroad in order to gain direct entry into overseas markets. Multinationals may also want to transfer new technology though FDI and licensing, which secure profits for the company, rather than allow foreign companies to copy the technology. The innovating firm therefore controls all production processes in the primary stage of product development. The secondary stage occurs when the product "grows," i.e., other countries are able to catch up

with the new technology and begin producing similar goods. An increase in the number of producers will inevitably create greater price competition. The innovating firm, in turn, may expand its production and marketing operations to emerging industrial markets. The final part of the cycle occurs when the product "matures" and becomes a standard merchandise. In this stage, the theory predicts that firms will move investments to less developed countries in search of lower production costs.

Factor endowment theory (Kojima, 1973; Ozawa, 1979)

Based on Japan's experience on foreign direct investments, this theory argues that companies move its production abroad because of unfavorable changes in domestic factors, such as higher wages and land costs. From the company's perspective, foreign direct investment is a strategic move to maintain its competitive edge by finding lower costs of production abroad. Investments are mostly concentrated on labor-intensive and low-technology sectors, which in turn fuels the growth of light industries in developing countries. This process thus creates an international division of labor between developed countries and less developed countries, with the former shifting towards capital-intensive sectors and the latter towards labor-intensive sectors.

While each of these theories has its own merits in explaining motivations for FDI, foreign investments can be further categorized as either "market-oriented" (i.e. offensive) or "production factors-oriented" (i.e. defensive). The former type of investments is geared towards increasing operational scale by finding new or larger markets abroad. This also applies in situations when host countries impose trade barriers, such as quotas and tarriffs, which prompts businesses to "jump" barriers by moving production activities within host countries. Since most companies that engage in "offensive" investments are medium-sized, high technology-based, or financial services-oriented, these types of investments are in accord with Hymer's theory of oligopolistic competition.

The second class of investments is driven by the host country's changing factors of production. Companies engage in "defensive" type of investments in order to secure new or

better sources of inputs, such as raw materials and primary goods, that are scarce in host countries. Moreover, higher wages or labor shortages in home countries often motivates companies to move production activities abroad where cheaper and more abundant labor can be exploited. Land scarcity and strict environmental laws could also influence the firm's decision to invest in foreign countries where more favorable markets exist. "Defensive" investments are mostly concentrated in labor-intensive and low-tech industries, and thus primarily belong to Kojima and Ozawa's factor endowment theory.

It should be emphasized, however, that these two types of investments are not mutually exclusive. Both investment strategies can be observed at different stages of a product's life cycle. At the early stages of product development, innovating companies have oligopolistic advantages and therefore engage in "offensive" investments in order to expand its operations. In the later stages of the product life cycle, the competitiveness of the innovating company begins to deteriorate as other firms enter the market. The company consequently resorts to "defensive" investment strategies in order to maintain its competitiveness. Depending on the characteristic of the product and the market environment, the motivations to invest abroad can therefore vary over time.

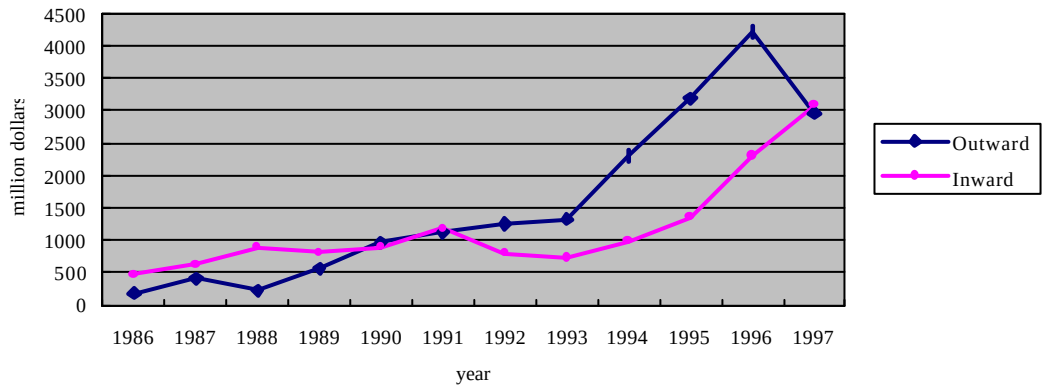
Chapter 2

TRENDS IN KOREAN OUTWARD FDI

Rapid surge in FDI since late 1980s

Despite Korea's rapid economic growth in the last few decades, the country's outward foreign direct investments remained somewhat insignificant until the late 1980s (see Figure 1). Prior to this period, the government's strict controls on capital exports greatly curbed the outflow of investments (Kim and Wang, 1996). In addition, domestic conditions favored production activities at home. Since the late 1980s, however, the Korean government gradually introduced financial liberalization and deregulations that boosted the Korean economy. This consequently led to a rise in domestic real wages and an increase in the number of labor disputes (Lindauer et al, 1997; Tcha, 1998). The effect was particularly pronounced in the manufacturing sector where wage rates went up by 35.5% from 1987 to 1989, and profitability of manufacturing businesses (in gross profit per capital unit) deteriorated by 16.4% in the same period. The competitiveness of Korean exports subsequently experienced a dramatic decline, especially in labor-intensive sectors such as textiles, apparel, leather and fur, paper, and printing. As a result, many companies were compelled to move its activities overseas in order to maintain its competitiveness and

Figure 1. Inflows/Outflows of Korean FDI (1986-1997)



profitability. Figure 1 shows the rapid surge of total outward FDI stock, which rose from $0.11 billion in 1986 to $4.2 billion in 1996. By 1992, outward FDI surpassed the level of inward FDI, making Korea a net exporter of capital. Moreover, outward FDI grew at an annual rate of 27.4% between 1991 and 1996.

As a caveat, it should be noted that the share of outward FDI in the country's GDP remains small (2.3% of GDP in 1995), and is relatively low compared to other developing countries (Kim, 1998). Moreover, outward FDI experienced a dramatic shock with the onset of the Asian financial crisis in 1997. Although outward FDI is currently in the process of slow recovery, further discussion of these issues is beyond the scope of this paper.

Sectoral distribution

At the surface level, outward FDI seems to be concentrated in a limited number of sectors. In particular, trading and manufacturing industries experienced the most rapid growth in outward investments, accounting for 64.8% of the nation's outward FDI in 1995. Regional and sub-industry data, however, reveals a somewhat different picture. One third of Korean FDI to Asia are on labor-intensive and low-technology sectors such as textile, apparel, footwear, and parts assembly (see Table 1), while more than half are

Table 1. Area and Sectoral Composition of Outward FDI from Korea to Asia (outstanding as of the end of 1997)

(Unit: project; US$1,000)

	Project	Amount
Manufacturing subtotal	4,434	5,230,931
Food and Beverages	296	301,727
Textiles and Clothes	887	704,287
Leather and Footware	396	304,517
Wood and Furniture	193	99,761
Paper and Printing	83	119,426
Petrochemical	410	588,726
Nonmetals	186	313,878
Basic metals	167	257,349
Fabricated metals	796	1,793,977
Machinery and Equipment	214	240,866
Other manufacturing	806	506,853

Source: *Overseas Direct Investment Statistics Yearbook* (KFB1998)

invested in heavy manufacturing industries such as petrochemicals, metals, and machinery.

Outward investments from the former group are primarily geared towards exploiting lower labor and production costs overseas, whereas the latter group are more market seeking by nature.

Cost-Reduction is Priority in Southeast Asia

According to a survey conducted by the Korean Business Federation in 1991, Korean investments in Southeast Asia are mostly defensive by nature (see Table 2). Topping the list of FDI motivations in this region is low production costs, followed by firm/market expansion, and to a much lesser extent, securing sources of raw materials. These reasons coincidentally match the labor-intensive, low-tech nature of most Korean investments in Southeast Asia. In contrast, the respondents of the survey indicated that investments in OECD countries were primarily motivated by market/firm expansion, followed by trade barrier jumping.

However, across the sectors in which foreign direct investment to Southeast Asia was targeted, different motivations can be identified. Firstly, in sectors including apparel, leather and fur, rubber products, pottery and china, and miscellaneous products that are strongly labor intensive and Korea was losing competitiveness, the investments were cheap labor-seeking. Most products were re-exported to Korea or third-country markets rather than being consumed in local markets. Secondly, in chemicals, electrical and electronic products industries that are more capital-intensive, investments were

Table 2. Survey Results on Motivations for FDI

	Southeast Asia	OECD Region
Market expansion	21.1	29.3
Low Production Cost	33.2	7.6
Avoid Trade Barriers	7.8	18.2
Raw materials	8.6	4.5
Advanced technology		6
Relocation of excess capacity	4.7	
Firm expansion strategy	21.6	22.7
Others	3	3
Total	100%	100%

Source: KBF (1991) in Lee (1994)

primarily market-seeking and secondarily cheap labor seeking. In these sectors, local market absorbed a relatively high percentage of sales. Third, for the wood product sector, the raw material seeking has been the primary motivational factor, although other factors such as cheap labor in Asia added to its attraction.

Increasing Share of Developing Countries in outward FDI

Most of Korea's investments abroad are channeled to Asian countries and the United States (see Table 3). Asia, in particular, received over half of FDI from Korea

Table 3. Approved Foreign Investment by Area

(unit: US$million; %)

Year	ASEAN	China	Indonesia	Japan	NAFTA	USA	EU	World
1995	416	825	200	219	586	535	376	3187
	13.05%	*25.89%*	*6.28%*	*6.87%*	*18.39%*	*16.79%*	*11.80%*	*100%*
1994	165	642	68	60	575	524	278	2309
	7.15%	*27.80%*	*2.94%*	*2.60%*	*24.90%*	*22.69%*	*12.04%*	*100%*
1993	138	273	59	58	395	384	157	1323
	10.43%	*20.63%*	*4.46%*	*4.38%*	*29.86%*	*29.02%*	*11.87%*	*100%*
1992	248	141	164	64	392	347	127	1255
	19.76%	*11.24%*	*13.07%*	*5.10%*	*31.24%*	*27.65%*	*10.12%*	*100%*
1991	326	42	170	15	474	395	67	1125
	28.98%	*3.73%*	*15.11%*	*1.33%*	*42.13%*	*35.11%*	*5.96%*	*100%*
1990	229	16	164	11	438	346	47	963
	23.78%	*1.66%*	*17.03%*	*1.14%*	*45.48%*	*35.93%*	*4.88%*	*100%*
1989	90	6	75	10	283	169	15	570
	15.79%	*1.05%*	*13.16%*	*1.75%*	*49.65%*	*29.65%*	*2.63%*	*100%*
1988	32	..	20	7	99	96	19	223
	14.35%	..	*8.97%*	*3.14%*	*44.39%*	*43.05%*	*8.52%*	*100%*
1987	128	..	126	1	189	165	6	411
	31.14%	..	*30.66%*	*0.24%*	*45.99%*	*40.15%*	*1.46%*	*100%*
1986	2	..	1	2	81	60	3	186
	1.08%	..	*0.54%*	*1.08%*	*43.55%*	*32.26%*	*1.61%*	*100%*
1985	16	..	6		30	15	39	116
	13.79%	..	*5.17%*	*0.00%*	*25.86%*	*12.93%*	*33.62%*	*100%*

Source: The author's calculation based on *International Direct Investment Statistics Yearbook* (OECD 1997)

since 1995, with 26.5% of total investments going to China alone. China has surpassed the United States as the top destination of Korean outward FDI in 1994, with $825 million FDI stock flowing into the country. China's large share was regarded to many factors, including its geographical proximity to Korea, the restoration of official diplomatic relationship between the two countries, abundance in cheap labor, favorable investment environment, and huge domestic market potential. Prior to 1991, ASEAN countries were the preferred destination of Korean FDI in labor-intensive manufacturing activities.

The inflow of Korean investments to European countries also grew significantly, doubling from 9.9% in 1990 to 20% in 1995. Unlike China, the surge in FDI to Europe was driven mostly by companies trying to circumvent the EU's anti-dumping laws. North America also remains as an important destination of Korean FDI, albeit at a declining rate. The region's share fell from 41.2% of Korean foreign investments in 1990 to 17.9% in 1995. Furthermore, Korean investments in North America are mostly geared towards technology acquisition and market access.

China

FDI in China deserves a closer look due to the country's growing popularity for Korean investments. Although FDI in China is a relatively recent phenomenon, Korean investments started to gain momentum in the late 1980s. The surge in FDI was further boosted in 1992 with the resumption of diplomatic relations between China and Korea (C.H. Lee, 1994). Two years later, China became the largest recipient country of Korean FDI in 1994, with a majority of the investments concentrated in the manufacturing sector.

China became the prime destination of Korean FDI due to the country's good quality, low-cost labor force, as well as relatively stable employer-employee relationship, which offer as a solution to Korea's deteriorating comparative advantage in labor-intensive light industries. Most investments were made by small and medium sized exporters in the apparel, assembly, footware, and leather manufacturing sectors. In addition to cost-oriented motives, Korean companies also invested in China to penetrate its enormous domestic market. For many investors, China's relatively closed economy means that a huge market potential still exists in

the country, which can be tapped through direct investments (C.H. Lee, 1994).

Comparing the flow of Korean investments in the Republic of China and Southeast Asian countries, it appears that the two regions have a substitution relationship. The recent rise of China as the top destination of Korean FDI was accompanied by a general decline in Korean investments to ASEAN countries. Most Korean FDI in these two regions are in labor-intensive and low-end manufacturing activities, which provides further support for regional substitution. Studies have shown that the rapid rise of relative labor costs and the growing instability of investment environment in Southeast Asia might have prompted the re-routing of investments to China in the early 1990s (Tcha, 1998; C.H. Lee, 1994).

United States and EU

Until 1993, the United States was the primary destination of Korean FDI. This is understandable given the country's strong economic ties with Korea (Lee and Lee, 1992; C.H. Lee, 1994). Since the beginning of Korea's economic development, the United States has provided key products, markets, and technologies that helped fuel Korea's growth. Recently, however, the inflow of Korean investments to the US significantly declined after peaking at 43.05% of total FDI stock in 1988 to 16.79% in 1995 (see Table 3). Coincidentally, this trend is paralleled by an increase in Korean investments to the European Union, which suggests that the advanced countries of Europe have substituted for investments in the United States. Most Korean investments in advanced countries are centered in trade, services, and high-end manufacturing activities, which reflects the comparative advantage of the US and the EU in these sectors.

Increasing Labor Disputes

Another important catalyst for Korean outward FDI is the increasing number of labor disputes in the domestic economy (Tcha, 1998). Decades of government suppression on labor's demands and rights led to a surge of labor unrest in 1987, when the country underwent a democratic transition of government. The situation was further

Table 4. Outward FDI and Labor Disputes for Korea (1975-1994)

	Working Days Lost	No of Disputes	Working Days Lost per Dispute	Outward FDI (in US$ million)
1975-79	56561	546	103.6	n.a.
1980-85	196142	1158	169.4	n.a.
1986	72025	276	261.0	186
1987	6946835	3749	1853.0	411
1988	5400837	1873	2883.5	223
1989	6351443	1616	3930.3	570
1990	4487151	322	13935.3	963
1991	3257621	234	13921.5	1125
1992	1527612	235	6500.5	1255
1993	1308326	144	9085.6	1323
1994	1484368	121	12267.5	2309

Source: Tcha (1998)

exacerbated by rising domestic wages and a general decline in the competitiveness of Korea's domestic industries, which pressured Korean manufacturing firms to find cheaper labor abroad in order to maintain its export competitiveness. As Table 4 shows, the number of working days lost per dispute in Korea rose significantly post-1986. This is correlated by the increase in outward FDI to countries that have relatively more stable labor conditions, such as ASEAN and China, especially in labor-intensive sectors.

In summary, Korean outward FDI has dramatically increased in the last decade. In 1992 Korea became a net exporter of FDI, most of which are channeled to developing countries in Asia. In general, Korean FDI in the developing countries of Asia are concentrated in labor-intensive sectors, while FDI in the industrialized countries of North America and Europe are geared towards capital-intensive industries. China, in particular, has become the largest recipient of Korean FDI due to its relatively stable investment environment, large market potential, and cheap labor supply. The following chapter will focus on the impact of FDI on the Korean economy in the context of Korea's gradual de-industrialization, with the declining output and employment of the domestic manufacturing sector corresponding with the surge in outward FDI.

Chapter 3

IMPACT ON DOMESTIC INDUSTRIES

Impact on investment and output

At its peak, the manufacturing sector accounted for 36.67% of Korea's GNP in 1987 (see Table 5). This share gradually declined in the following years and stabilized around 30% in by the mid-1990s, suggesting that the country is moving toward de-industrialization as the weight of Korea's manufacturing sector shrinks. Although somewhat erratic, the growth rate of manufacturing sector has also dropped significantly from peaking at 19.50% in 1986 to 7.42% in 1996. This trend is similar to the experiences of mature economies that became service-oriented in the later stages of economic development. Japan's manufacturing sector, for example, reached an equilibrium weight of around 29% since 1977 when the country began to de-industrialize (Chen and Yang, 1997).

Investment trends also show that domestic investments in Korean manufacturing sectors since the early 1990s are modest compared to developed

Table 5. Key Economic Indicators of South Korea (1985-1996)

(unit: % at 1990 constant prices)

	Weight of mfc sector on GNP	GDP real growth rate	Mfc sector real growth rate	Mfc tangible assets growth rate	Outward FDI growth rate
1986	36.22%	11.60%	19.50%	n.a.	60.34%
1987	36.67%	11.50%	19.50%	24.18%	120.97%
1988	34.84%	11.30%	13.80%	22.43%	-45.74%
1989	32.25%	6.40%	4.20%	25.37%	155.61%
1990	29.37%	9.50%	9.70%	28.64%	68.95%
1991	29.37%	9.13%	9.09%	15.93%	16.82%
1992	29.38%	5.07%	5.07%	-19.10%	11.56%
1993	29.15%	5.75%	5.02%	9.70%	5.42%
1994	29.70%	8.58%	10.45%	10.80%	74.53%
1995	30.28%	8.94%	10.81%	36.00%	38.03%
1996	30.42%	7.13%	7.42%	13.00%	32.38%

Source: The author's calculation based on the *Economics Statistics Yearbook (BOK, annually),* and the *Report on Mining and Manufacturing Survey* (Korea Statistical Association, annually)

countries. Although the tangible assets investments in manufacturing sectors anomalously jumped to 36% in 1995, it generally remained at an annual average of 12.5% after 1990, which is significantly lower to Japan's 30% average investment rate during the same period (Chen and Yang, 1997). Thin investments are often indicators of possible risks to industrial hollowing, given that industries need to be injected with massive investments in order to upgrade.

The surge of Korean investments abroad since the late 1980s coincides with the gradual decline in weight of the manufacturing sector and investments in the domestic economy. Although causal relations cannot be deduced by looking at these trends, it nonetheless suggests a negative relationship between Korean FDI and the manufacturing sector's growth and investment.

Impact on employment

Labor trends are difficult to assess due to a lack of firm-level studies on Korean outward FDI and domestic employment. Overall trends in Korean unemployment rate, however, suggest that the surge in outward FDI since the late 1980s was not accompanied by an increase unemployment, which dropped from 4% in 1985 to 2% in 1996. It has been suggested that these conflicting trends are primarily due to the fact that outward FDI constitutes a very small part of the Korean economy in terms of flow and stock (Kim, 1998). As shown in Table 5, fixed capital formation in domestic manufacturing sector has grown over years except 1992, and Korea has maintained very high growth rate.

Industry-level analysis reveals that the weight of the manufacturing sector employment has slightly decreased since the mid-1980s (see Table 6). This trend is coincidentally paralleled by the rising share of service sector employment, which provides another evidence that the country could be experiencing de-industrialization as labor factors increasingly move towards service-oriented industries. Similarly, the annual growth rate of employment in the manufacturing sector has dropped significantly since peaking at 15.42% in 1987, contrasted by the stable growth of service sector employment in the same time period. It should be emphasized that this trend does not necessarily mean that the absolute number of

employment decreased in the

Table 6. Employment In South Korea (1985-1996)

	Unemployment rate	Mfc employment/ Total employment	Mfc employment growth rate	Svc employment/ Total employment	Svc employment growth rate
1985	4.00%	23.41%	..	50.62%	..
1986	3.80%	24.68%	9.19%	50.50%	3.33%
1987	3.10%	27.00%	15.42%	49.97%	4.37%
1988	2.50%	27.67%	5.68%	50.86%	4.98%
1989	2.60%	27.80%	4.61%	52.11%	6.66%
1990	2.40%	27.60%	2.23%	54.51%	7.74%
1991	2.30%	26.83%	0.06%	56.35%	6.38%
1992	2.40%	25.46%	-3.32%	58.43%	5.65%
1993	2.80%	24.16%	-3.65%	60.88%	5.79%
1994	2.40%	23.67%	0.92%	62.52%	5.82%
1995	2.00%	23.42%	1.66%	63.98%	5.11%
1996	2.00%	22.52%	-2.01%	65.77%	4.76%

Source: The author's own calculation based on the *Major Statistics of Korean Economy* (BOK, 1997)

manufacturing industry. As Table 6 shows, employment in the manufacturing sector shrunk only for three years out of twelve years (1985-1996). However, it is supportive to argue that the general trend of employment in this sector is either stabilizing or decreasing.

Beyond this surface-level analysis, it is difficult to establish any relationship between outward FDI and domestic employment in Korea with the data available. It may be surmised that even if unemployment increases due to outward FDI, the service sector or other industries in manufacturing sector were able to absorb the surplus labor created by the movement of manufacturing activities overseas, thus neutralizing FDI' s downward pressure on employment. In addition, it is also possible that outward FDI contributed to the improvement of domestic employment by increasing foreign demand and Korean exports. Outward FDI may have upgraded the skill intensity of Korea' s labor force as low-end manufacturing activities are moved abroad. In turn, this creates an increased demand for workers in the service sector as the Korean economy undergoes de-industrialization. Any of these scenarios is completely possible under the observed trend of declining unemployment and FDI growth, although more in-depth analysis is required to reach definitive conclusion.

Table 7. Share of Southeast Asian countries and China in Korea's trade with the world (1985-1994)

	Thailand		Malaysia		Indonesia		Philippines		PRC and H.K.	
	Export	*Import*	*Export*	*Import*	*Export*	*Import*	*Export*	*Import*	*Export*	*Import*
1985	0.47%	0.49%	1.48%	3.96%	0.65%	2.15%	0.79%	0.48%	5.30%	3.12%
1986	0.55%	0.88%	0.63%	2.85%	0.52%	1.36%	0.54%	0.39%	5.23%	3.23%
1987	0.58%	0.47%	0.63%	2.65%	0.51%	2.01%	0.47%	0.30%	5.11%	3.08%
1988	0.89%	0.51%	0.68%	2.57%	0.66%	1.75%	0.56%	0.35%	6.48%	3.75%
1989	1.21%	0.68%	0.87%	2.45%	1.07%	1.85%	0.76%	0.33%	6.11%	3.72%
1990	1.49%	0.66%	1.09%	2.27%	1.66%	2.29%	0.77%	0.39%	6.71%	4.13%
1991	1.58%	0.69%	1.44%	2.29%	1.88%	2.52%	0.94%	0.40%	8.03%	5.17%
1992	2.00%	0.78%	1.48%	2.15%	2.52%	2.80%	0.97%	0.32%	11.17%	5.53%
1993	2.14%	0.64%	1.74%	2.32%	2.55%	3.09%	1.14%	0.38%	14.08%	5.80%
1994	1.91%	0.61%	1.72%	1.83%	2.65%	2.78%	1.26%	0.40%	14.81%	5.98%

Source: The author's calculation based on *The Trend of Foreign Trade* (KFTA, annually)

Impact on trade

Historically, the United States and Japan have been Korea's largest trading partners (Amsden, 1989). In 1996, trade with these two countries comprised almost one third of Korea's total trade. Korea's growing trade with China, however, has continuously decreased the share of Japan and the US as trading partners. China accounts for 10% of Korea's trading activities by 1997, which is a significant jump from less than one percent in 1986. Furthermore, trade with ASEAN countries has grown significantly in the last decade, which coincided with the influx of Korean FDI in the region. In particular, the share of trade with Thailand, Malaysia, Philippines, Indonesia, and China as a percentage of Korea's total trade continued to increase from the mid-1980s (see Table 7). Korea's combined trade with China and Hong Kong grew fastest among the given countries, comprising almost 20% of Korea's total trade in 1994. As Southeast Asian countries and China also receive substantial amount of Korean FDI, it can be surmised that FDI links might have promoted trade activities between Korea, Southeast Asia, and China. Such conclusion is difficult to reach, however, by merely using descriptive analysis.

Impact on exports

Since the early 1960s, Korea has taken an export-driven strategy to develop its economy (Amsden, 1989). This strategy rapidly built Korea's manufacturing base to become

a major exporter in the international market. Manufacturing activities, however, are increasingly being moved abroad as discussed previously. To date, no systematic study has been conducted on the relationship between export performance and Korean outward FDI. Analyzing the general trends in exports, however, reveals that light-manufacturing industries experienced negative growth rates since the early 1990s (see Table 8). Export contraction is particularly pronounced in the non-durable consumer goods, including travel goods, clothing, and footwear sectors, which started to decline in the early 1990s. Durable consumer goods also experienced negative export growth from 1988 to 1992 primarily due to the decline in exports of electronic products. These manufacturing sectors, characterized by labor-intensive and low-technology activities, coincidentally make up the majority of FDI outflow to developing countries. Although causal relationships are difficult to establish, these trends suggest that FDI may have contributed to the decline in the overall exports of light-manufactures

In summary, the growth of Korean outward FDI since the late 1980s was coincided by various macroeconomic trends in the domestic economy. Unemployment rate continued to drop until 1997, which suggests that Korea's outward FDI was not large enough to offset the positive effect of overall economic growth. The absolute output, investment, and growth of Korea's manufacturing sector contracted, suggesting a negative effect of outward FDI on the performance of the domestic manufacturing sector. In terms of employment, the share of manufacturing sector on the country's total labor force also declined. This coincided with the growth of the service sector, which indicates that Korea is heading towards a gradual de-industrialization. More important, these trends suggest that FDI paves the path towards industrial hollowing as Korea's manufacturing base begin to lose its international competitiveness. The following chapter will provide further evidence on this point by analyzing the decline in the comparative advantage of Korea's manufacturing sectors since the late 1980s..

Table 8. Growth of Korean Exports by Commodity Groups (1986-1994)

	1986	1987	1988	1989	1990	1991	1992	1993	1994	Avg
Food	38.4%	32.3%	19.4%	-5.6%	-7.9%	5.6%	-0.7%	-1.9%	12.4%	10.2%
Industrial supplies	8.9%	22.7%	25.3%	11.4%	7.5%	19.0%	19.5%	11.6%	14.0%	15.5%
Crude materials	4.5%	27.4%	24.6%	26.1%	11.2%	-0.6%	2.8%	8.0%	24.7%	14.3%
Mineral fuels	-33.5%	16.2%	-22.2%	16.6%	0.6%	124.4%	14.6%	7.5%	-5.6%	13.2%
Industrial chemicals	14.3%	23.3%	39.6%	8.3%	22.3%	26.8%	39.3%	9.6%	28.4%	23.6%
Metals	-1.6%	15.1%	37.9%	11.0%	-3.7%	4.5%	19.8%	15.2%	-4.6%	10.4%
Capital Goods	-15.3%	29.8%	53.3%	4.7%	15.0%	30.8%	11.1%	15.2%	29.2%	19.3%
Non-electric machinery	44.8%	71.4%	52.5%	4.7%	6.6%	15.6%	8.1%	15.0%	19.0%	26.4%
Electric machinery	42.2%	51.4%	42.1%	16.1%	13.0%	19.0%	13.6%	16.9%	45.0%	28.8%
Transport equipments	-54.5%	-23.6%	95.4%	-13.5%	32.4%	79.3%	9.7%	13.5%	17.3%	17.3%
Non-durable Consumer Goods	25.8%	37.5%	21.7%	2.1%	-3.6%	-6.6%	-10.8%	-13.3%	-10.5%	4.7%
Textile products	4.8%	35.7%	20.6%	-4.2%	1.8%	10.1%	7.6%	3.5%	6.6%	9.6%
Travel goods, handbags	34.5%	47.5%	18.7%	3.3%	-2.5%	-5.6%	-13.7%	-11.0%	-11.3%	6.7%
Clothing	23.1%	37.5%	17.1%	4.1%	-13.3%	-6.0%	-8.7%	-9.3%	-8.6%	4.0%
Footwares	34.2%	25.1%	43.8%	-3.5%	19.8%	-11.3%	-17.6%	-28.7%	-24.7%	4.1%
Durable Consumer Goods	67.3%	58.7%	16.8%	-5.7%	-2.6%	-11.9%	-4.1%	1.6%	12.0%	14.7%

Source: The author's calculation based on *The Trend of Foreign Trade* (KFTA, annually)

Chapter 4

INTERNATIONAL COMPETITIVENESS

Early studies on the international competitiveness of mature economies have placed great emphasis on trade and balance of payments. It is widely believed that if a manufacturing sector becomes "inefficient" by failing to achieve a balance in trade, then the sector may lose its international competitiveness. Singh (1989) defines an "efficient manufacturing sector" as one that could (1) meet domestic demand at lowest possible costs, and (2) export and earn enough foreign exchange to purchase imported products. In short, international competitiveness depends ultimately on the *efficiency* of the manufacturing sector.

Using different parameters, our chosen definition of "industrial hollowing" similarly connotes that international competitiveness depends on the *upgrading* of the manufacturing sector. Although the movement of manufacturing activities abroad affect the domestic economy in various forms, direct investments do not necessarily lead to industrial hollowing as long as the country maintains its international competitiveness. In the natural path towards economic maturity, countries will inevitably lose competitive advantages in certain areas while gaining advantages in new fields. To illustrate this process, the following discussion will examine the trend in comparative advantage of Korean manufactured products in the last ten years.

Revealed Comparative Advantage Index (RCA)

The Revealed Comparative Advantage (RCA) index uses actual trade data in measuring the comparative advantage of specific industries. Although there are many ways to measure the RCA, this paper will use a framework developed by Lafay (1992) in analyzing the competitiveness of Korean industries from 1988-1997. The Lafay index was selected because it allows the ranking of products according to their respective contribution to the country's total trade. Lafay's comparative advantage indicator, f_{ik}, is defined as follows:

$$f_{ik} = y_{ik} - z_{ik}$$

Where f_{ik} is the advantage or the disadvantage of the product k exported by country i, calculated by the difference between y_{ik} (the balance in relation to GDP) and z_{ik} (the attributed balance). The corresponding value for y_{ik} is calculated by:

$$y_{ik} = a(X_{ik}-M_{ik})/Y_i$$

Where a is the chosen index constant (a=1000), and $(X_{ik}-M_{ik})/Y_i$ is the product's trade balance $(X_{ik}-M_{ik})$ in relation to GDP (Yi). In turn, y_{ik} can be used to calculate the value of the attributed balance, z_{ik}, through the equation

$$z_{ik} = g_{ik} * y_{ik}$$

Where g_{ik} is the relative importance of the chain, or the share of the good k's total trade $(X_{ik}+M_{ik})$ in country i's total trade (X_i+M_i).

Defined in terms of contribution to the trade balance, the Lafay indicator therefore measures a product's comparative advantage/disadvantage by comparing the product's actual balance with its attributed trade balance (i.e. the product's share of the overall surplus or deficit in the economy's total trade) in relation to GDP. In short, the Lafay equation reveals that a product gains comparative advantage when domestic production increases faster than domestic demand, *ceteris paribus*.

The data used in this section is derived from *The Trend of Foreign Trade* published annually by the Korea International Trade Association. The analysis is limited to Korea's largest trading partners: the United States, Japan, Republic of China, and the European Union. Due to product classification mismatch between Korea's exports and imports, however, analysis of the data will be confined to first and second digits using the Harmonized Commodity Description and Coding System. Classification mismatch is particularly problematic in analyzing the sub-products listed under durable consumer goods, which are

inadvertently omitted. Nonetheless, the proceeding analysis captures the general trend of deteriorating comparative advantage of Korea's manufacturing sectors relative to its major trading partners.

Korea and the United States

Table 9 reveals that the comparative advantage of Korea's industries generally declined relative to the United States since 1988. Specifically, Korea continuously experienced a comparative disadvantage in food, capital goods, and industrial goods sectors in the last ten years, although the latter category have progressively improved from –31.34 in 1988 to –10.68 in 1997. All four sub-sectors under industrial supplies experienced similar improvement in the same time period. In contrast, Korea had a comparative advantage in non-durable and durable consumer goods in the last decade. However, Korea's comparative advantage in these two sectors have significantly declined from 32.92 in 1988 to 3.25 in 1997 for non-durables, and from 32.06 to 1.65 for durable goods in the same time period.

Table 9. Comparative Advantage ROK-USA (1988-1997)

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Food	-7.61	-8.26	-6.40	-4.38	-4.37	-3.32	-3.47	-5.90	-6.23	-4.27
Industrial supplies	-31.34	-28.21	-24.21	-20.89	-15.66	-14.88	-12.63	-15.38	-13.37	-10.68
Crude materials	-20.42	-18.97	-15.36	-11.58	-9.15	-8.28	-7.06	-7.63	-5.92	-4.99
Mineral fuels	-1.97	-1.78	-3.66	-2.90	-2.20	-2.11	-1.44	-1.24	-1.30	-0.86
Industrial chemicals	-9.53	-9.48	-7.40	-7.10	-5.36	-5.89	-5.34	-5.84	-5.27	-4.95
Metals	4.18	2.00	2.29	0.88	1.58	1.15	1.33	0.02	-0.48	-0.03
Capital Goods	0.27	-5.28	-3.27	-1.52	-3.06	0.32	1.65	1.17	-3.77	-3.30
Non-electric machinery	-2.08	-4.76	-4.94	-3.89	-4.37	-2.75	-3.88	-6.74	-6.54	-3.54
Electric machinery	0.41	2.15	2.26	0.47	1.32	2.93	4.49	8.27	3.20	-1.30
Transport equipments	1.45	-3.09	-1.04	1.76	-0.08	0.15	1.08	-0.15	-0.06	1.74
Non-durable Consumer Goods	32.92	33.80	28.64	20.58	14.73	10.37	7.65	4.71	3.31	3.25
Clothing	18.05	19.73	15.34	11.95	9.59	7.62	6.07	4.01	3.21	3.26
Durable Consumer Goods	32.06	26.56	18.68	11.95	9.43	7.00	5.94	3.92	2.50	1.65

Source: The author's calculation based on the *Trend of Foreign Trade* (KFTA, annually)

Korea and Japan

Except in the capital goods sector, Korea's comparative advantage with Japan is also experiencing a general decline (see Table 10). Compared to Japan, Korea has had a comparative disadvantage in the industrial supplies and capital goods sectors since 1988. It should be noted, however, that Korea's advantage in capital goods has consistently improved in the same time period, from –51.10 in 1986 to –22.95 in 1997. All sub-sectors under capital goods have shown similar improvements. In contrast, Korea has maintained its comparative advantage in non-durable and durable goods in the last ten years, albeit at a rapidly declining pace.

Table 10. Comparative Advantage ROK-Japan (1988-1997)

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Food	9.54	8.45	6.47	5.90	5.11	4.32	4.25	3.83	3.61	2.92
Industrial supplies	-17.65	-12.73	-11.01	-9.55	-9.34	-9.44	-9.88	-11.06	-7.81	-6.33
Crude materials	-1.51	-0.97	-0.67	-0.74	-0.85	-0.86	-0.70	-0.77	-0.72	-0.86
Mineral fuels	1.49	1.36	0.05	1.05	1.02	0.16	0.10	0.56	2.62	2.74
Industrial chemicals	-11.70	-11.03	-8.61	-8.08	-6.97	-6.56	-6.05	-6.95	-5.91	-5.39
Metals	-3.41	-1.07	-0.13	-0.03	-0.59	-0.16	-1.20	-1.60	-1.79	-1.12
Capital Goods	-51.10	-45.67	-35.90	-38.12	-31.43	-30.00	-32.38	-32.14	-28.79	-22.95
Non-electric machinery	-24.56	-24.58	-20.92	-22.30	-17.65	-15.36	-17.18	-17.66	-15.81	-10.98
Electric machinery	-21.17	-16.86	-11.28	-11.82	-10.50	-10.46	-10.11	-9.28	-8.74	-9.32
Transport equipments	-2.20	-1.07	-1.27	-1.43	-1.15	-1.65	-2.10	-1.84	-1.53	-0.75
Non-durable Consumer Goods	17.76	19.96	14.09	12.52	9.71	7.81	6.85	5.16	3.90	2.09
Clothing	14.04	16.37	10.95	9.42	7.25	5.84	5.30	4.01	2.93	1.70
Durable Consumer Goods	-0.30	1.88	1.83	0.99	0.70	0.82	1.67	2.17	2.39	1.48

Source: The author's calculation based on *The Trend of Foreign Trade* (KFTA, annually)

Table 11. Comparative Advantage ROK-EU (1988-1997)

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Food	-1.36	-0.32	-0.61	-0.52	-0.38	-0.44	-0.77	-1.02	-1.34	-1.07
Industrial supplies	-16.45	-14.05	-12.21	-9.88	-7.76	-8.84	-9.02	-9.36	-9.71	-8.53
Crude materials	-3.23	-2.45	-2.06	-1.52	-1.19	-1.58	-1.51	-1.45	-1.18	-1.14
Mineral fuels	-0.41	-0.30	-0.75	-0.23	-0.23	-0.22	-0.16	-0.26	-0.21	-0.20
Industrial chemicals	-9.19	-7.82	-6.13	-4.78	-3.84	-3.83	-3.58	-3.85	-3.29	-2.74
Metals	-2.55	-2.02	-2.55	-2.19	-1.27	-1.59	-2.11	-1.96	-3.09	-3.63
Capital Goods	-7.09	-6.13	-3.28	-3.46	-2.93	-0.62	0.17	5.39	1.82	6.31
Non-electric machinery	-6.77	-8.93	-9.69	-7.62	-6.37	-5.20	-6.99	11.97	-8.17	-3.72
Electric machinery	-0.94	1.19	1.27	1.63	0.82	1.70	4.90	7.24	3.92	2.20
Transport equipments	0.25	1.38	4.70	2.22	2.31	2.60	1.81	5.27	6.14	7.97
Non-durable Consumer Goods	15.78	12.20	11.23	9.41	5.85	2.98	1.13	0.43	-0.23	-0.12
Clothing	10.63	7.89	6.55	5.89	3.78	2.19	1.09	0.46	0.26	0.41
Durable Consumer Goods	14.91	11.96	13.30	7.55	4.92	3.96	2.65	1.85	1.62	1.43

Source: The author's calculation based on the *Trend of Foreign Trade* (KFTA, annually)

Korea and the European Union

The trend in the comparative advantage of Korea relative to European Union countries reveals a somewhat different picture. In particular, Korea has significantly improved its advantage in capital goods, which stood at –7.09 in 1988 to 6.31 in 1997 (see Table 11). This is mostly attributed by an improvement in Korea's advantage in transport equipments in the same time period. Similarly, Korea's industrial supplies sector is experiencing an upward trend, although the country persistently experienced a disadvantage in this sector since 1988. Among durable consumer goods sectors, the advantage of Korean products have dramatically declined in the last ten years. Korea's position on the non-durable goods has also deteriorated significantly, from 15.78 in 1988 to –0.12 in 1997.

Korea and the Republic of China

As a non-industrialized country, China's position relative to Korea as a trading partner is a special case. China is clearly in the earlier stages of economic development, which normally results to an advantage in labor-intensive and low-end manufacturing activities and a disadvantage in capital-intensive activities. Indeed, the advantage of

Table 12. Comparative Advantage ROK-PRC (1990-1997)

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Food	n.a.	n.a.	-1.53	-2.66	-3.10	-2.71	-2.48	-0.86	-1.20	-1.88
Industrial supplies	n.a.	n.a.	-6.01	-6.19	-0.52	2.85	2.90	3.08	6.45	7.95
Crude materials	n.a.	n.a.	-10.63	-1.18	-0.77	-0.50	-0.42	-0.23	-0.17	-0.34
Mineral fuels	n.a.	n.a.	-1.68	-1.33	-1.47	-0.72	-1.14	-0.78	-0.47	0.82
Industrial chemicals	n.a.	n.a.	-0.50	0.00	1.03	1.32	2.07	3.55	3.62	4.11
Metals	n.a.	n.a.	-0.14	-0.58	2.17	2.73	1.50	-0.94	-0.15	-0.44
Capital Goods	n.a.	n.a.	0.37	0.38	0.75	3.63	2.61	2.88	3.72	2.91
Non-electric machinery	n.a.	n.a.	0.00	0.09	0.34	1.01	1.53	1.84	2.69	2.00
Electric machinery	n.a.	n.a.	0.37	0.32	0.32	0.64	0.50	0.44	0.62	0.61
Transport equipments	n.a.	n.a.	0.01	-0.01	0.10	1.97	0.52	0.54	0.40	0.24
Non-durable Consumer Goods	n.a.	n.a.	-0.07	-0.16	-0.29	-0.32	-0.67	-0.81	-0.96	-1.05
Clothing	n.a.	n.a.	-0.02	0.07	-0.16	-0.33	-0.63	-0.78	-0.98	-1.03
Durable Consumer Goods	n.a.	n.a.	-0.12	-0.15	-0.18	-0.09	0.10	0.21	0.15	0.09

Note: Data for PRC unavailable for 1988-1989

Source: The author's calculation based on the *Trend of Foreign Trade* (KFTA, annually)

Korea's industrial supplies and capital goods sectors over China is progressively increasing (Table 12). Korea's industrial supplies sector, in particular, experienced a significant improvement since 1992, when the index jumped from negative (i.e. disadvantage) to positive (i.e. advantage). The surge in advantage of this sector can be attributed to the rising importance of industrial chemicals, which grew from –0.50 in 1990 to 4.11 in 1997. In contrast, Korea has a slight disadvantage in non-durable and durable goods sectors, which remained somewhat unchanged in the last ten years.

Comparative Advantage and FDI

To take the analysis a step further, it is useful to compare the comparative advantage trends found in Tables 9 to 12 to Korea's FDI in the US, Japan, Europe, and China (see Table 13). The industrialized countries of US, Japan, and Europe all enjoyed a relative comparative advantage in capital-intensive sectors, particularly in industrial supplies and capital goods. This is reflected by the large concentration of Korea's FDI in capital-intensive sectors

in these countries. Fabricated metals, in particular, dominate Korea's outward FDI in all three groups of countries, which corresponds with Korea's comparative disadvantage in this sector relative to industrialized countries. This is most evident in the case of Japan, where 96.21% of Korea's FDI stock (in terms of value) are channeled to the fabricated metal sector alone. This, in turn, gives strong support to the negative relationship between comparative advantage and outward FDI. In other words, since industrialized countries are better at producing high-end and capital-intensive goods, Korean manufacturing firms should naturally move its high-end activities to these countries through direct investments.

As a developing country with a comparative advantage in labor-intensive sectors, China should attract Korean firms in the low-end manufacturing activities. Indeed, a strong correlation between outward FDI and comparative advantage can be observed if we consider the sectoral distribution of Korean investments in China. Light industries account for almost one half of the outstanding Korean FDI in China as of 1997, which corresponds with the declining comparative advantage of Korea in these sectors. In particular, almost 30% of Korea's FDI projects in China are concentrated in

Table 13. Share of Korean FDI in Labor Intensive and Capital Intensive Sectors, (outstanding as of the end of 1997)

Sector	USA		Japan		Europe		China	
	Project	*Amount*	*Project*	*Amount*	*Project*	*Amount*	*Project*	*Amount*
Food and Beverages	6.78%	1.87%	16.67%	1.18%	4.81%	2.05%	7.98%	5.64%
Textiles and Clothes	17.11%	3.82%	2.78%	0.08%	8.56%	8.23%	19.87%	14.52%
Leather and Footware	3.83%	0.50%	0.00%	0.00%	2.67%	0.65%	9.11%	7.04%
Wood and Furniture	1.77%	2.39%	0.00%	0.00%	1.07%	1.34%	5.03%	1.71%
Paper and Printing	3.54%	1.89%	2.78%	0.08%	0.53%	0.13%	1.92%	1.83%
Subtotal: labor intensive	33.04%	10.47%	22.22%	1.35%	17.65%	12.39%	43.91%	30.74%
Petrochemical	6.78%	0.83%	11.11%	0.33%	7.49%	5.79%	8.31%	10.95%
Nonmetals	0.59%	3.61%	5.56%	0.62%	1.07%	0.80%	4.07%	7.08%
Basic metals	4.13%	28.59%	8.33%	0.91%	4.81%	2.71%	3.84%	6.68%
Fabricated metals	31.86%	46.97%	41.67%	96.21%	48.66%	71.40%	16.26%	26.67%
Machinery and Equipment	6.19%	3.16%	5.56%	0.54%	4.81%	3.45%	5.43%	7.52%
Subtotal: capital intensive	49.56%	83.15%	72.22%	98.60%	66.84%	84.15%	37.91%	58.90%
Other manufacturing	17.40%	6.53%	5.56%	0.05%	15.51%	3.46%	18.18%	10.38%
Manufacturing total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Source: The author's calculation based on the *Overseas Direct Investment Yearbook* (KFB, 1998)

two labor intensive sectors: textiles and clothing, and leather and footwear. However, it should be noted that capital-intensive manufacturing sectors also constitute a significant part of outward Korean investments. Fabricated metals, in particular, account for a large share of Korea's total FDI projects (16.26%) and total investment stock (26.67%) in China. While Korea's comparative advantage in metals relative to the PRC has slightly deteriorated since 1995, the overall magnitude of Korean FDI in capital-intensive sectors to China simply does not correspond with Korea's strong comparative advantage (relative to the PRC) in industrial products. This suggests a dual strategy in the case of China, where Korean FDI in capital-intensive sectors are market-seeking, while FDI in labor-intensive sectors are cost-oriented.

In summary, the preceding analysis revealed that Korea is experiencing a general decline in the competitiveness of non-durable and durable goods manufacturing sectors, which are often related to labor-intensive and low-tech production activities. Moreover, the downward trend persisted throughout the same period when the outflow of Korean FDI rapidly increased to developing countries that have comparative advantages in these industries. In contrast, the competitiveness of Korea's capital-intensive manufacturing sectors has

generally improved.

This brings us to the question whether the surge of Korean FDI led to industrial hollowing. Recall that industrial hollowing is determined by three major factors: (1) de-industrialization, (2) the deterioration of international competitiveness, and (3) the failure to upgrade the industrial base. The evidence presented in the last chapter certainly suggested that Korea is gradually moving towards de-industrialization. Comparative advantage analysis, however, revealed that capital-intensive manufacturing industries became more competitive in the last decade. Although the RCA index of these industries remain negative, the upward trends nonetheless provided implicit evidence that Korea has avoided industrial hollowing. The following chapter will present more direct evidence on this point by discussing Korea's efforts to upgrade its science and technology base in order to maintain competitiveness in the international market. In other words, Korea is on the threshold of an industrial transformation as its manufacturing base shifts into more sophisticated and technologically advanced levels of production.

Chapter 5

INDUSTRIAL UPGRADING

Like the other newly industrializing Asian economies, Korea's phenomenal growth in the last several decades was propelled by technology borrowed from foreign countries (Kim, 1997). The growing demand for more sophisticated and high-tech products in the international market, however, has made it more difficult for Korea to continue its "imitation" paradigm. Foreign companies are increasingly becoming more skeptical in sharing its new technologies with Korea. Furthermore, the country's heavy dependence on imported technology contributes significantly to Korea's trade deficit with technologically advanced countries like Japan. For example, the remarkable growth of Korean automobile exports is also accompanied by a surge of imports on components and equipment (OECD, 1996). Given that Korea's manufacturing industries has experienced a general decline in comparative advantage, and that manufacturing activities are increasingly being moved abroad, it is

therefore crucial to upgrade the country's industrial base in order to prevent industrial hollowing.

Recent efforts of the Korean government to upgrade the country's technology will be discussed in the next chapter in greater detail. In cooperation with the government, the private sector has also mobilized vast resources to improve its science and technology base. The accelerated drive in both public and private R&D investments started in the late 1980s to stimulate technological innovation and upgrade Korea's science and technology (S&T) to G-7 status (MOST, 1999). Although a comprehensive evaluation of these projects is difficult to perform due to its nascence, some key data suggest positive outcomes. For example, the number of US patents awarded to Korean products has increased dramatically since the 1980s (see Table 14). Korea's US patents skyrocketed in less than a decade, from 40 in 1985 to 765 in 1993. Although more than one-third of these US patents are awarded to a single Korean conglomerate, Samsung, it nonetheless reveals that Korean S&T has caught-up with and surpassed many OECD countries in technological innovation. By 1993, Korea ranked the 10th among OECD countries that received the most number of US patents. Among the dynamic Asian economies, Korea ranks second only after Taiwan in terms of innovation. This is not surprising given Taiwan's long history as a recipient of foreign direct investments that helped establish its strong technological base, as well as the Taiwanese government's early efforts to channel massive investments in R&D (Chen and Yang, 1997).

Korea's recent push for R&D investments has also brought the country up to par with many industrialized countries in terms of government expenditures in research and development (GERD) as a percentage of GDP (see Table 15). By 1993, it ranked

Table 14. US patent data: all product fields combined (1975-1993)

	1975	1980	1985	1990	1991	1992	1993
Korea	12	10	40	224	403	537	765
Australia	254	270	341	436	458	412	372
Austria	313	265	322	394	361	371	301
Belgium	285	250	237	315	328	327	346
Canada	1325	1103	1333	1855	2029	1974	1907
Denmark	148	160	191	159	208	194	196
Finland	98	122	203	304	330	358	286
France	2366	2096	2501	2859	3040	3024	2809
Germany	6044	5767	6651	7587	7648	7304	6588
Greece	9	4	11	8	14	8	7
Iceland			4	4	1	7	5
Ireland	16	19	2	54	53	52	52
Italy	736	806	915	1260	1206	1268	1244
Japan	6358	7136	12756	19519	21027	21918	20947
Mexico		43	33	31	33	38	45
Netherlands	628	659	768	974	1001	861	781
New Zealand	28	50	33	51	40	45	38
Norway	105	80	92	110	113	108	115
Portugal	7	2	4	6	7	2	4
Span	98	65	78	129	153	133	161
Sweden	105	80	92	772	719	635	623
Switzerland	1469	1279	1235	1295	1348	1213	1120
Turkey	1	2	1	2	1	4	1
United Kingdom	3043	2416	2504	2796	2800	2425	2264
United States	46551	37214	39549	47332	51135	52161	55174
Other Dynamic Asian Economics							
Hong Kong	11	28	26	54	51	63	61
Malaysia	4	0	3	4	13	5	14
Singapore	1	4	9	12	15	32	39
Taiwan	23	69	172	732	908	999	1186
Thailand		2	1	2	3	2	7

Source: OECD (1996)

Table 15. Main S&T indicators for Korea and OECD countries (1993)

	GERD million current PPP$	GERD as % of GDP	Per capita GERD current PPP$	GERD per labor force
Korea	7,615	2.33	153	46
Australia	3,712	1.36	218	50
Austria	2,415	1.58	302	25
Belgium	2,853	1.66	285	43
Canada	8,319	1.50	289	47
Denmark	1,786	7.30	344	47
Finland	1,755	2.23	346	61
France	25,984	2.41	451	55
Germany	37,265	2.48	459	61
Greece	560	0.62	54	20
Iceland	65	1.33	249	48
Ireland	504	1.06	142	43
Italy	13,220	1.30	236	30
Japan	74,849	2.93	600	97
Mexico	1,963	0.32	22	3
Netherlands	4,965	1.87	327	40
New Zealand	410	0.88	120	29
Norway	1,631	1.94	378	69
Portugal	709	0.71	72	12
Span	4,567	0.88	117	2
Sweden	4,578	3.12	525	59
Switzerland	4,242	2.68	617	51
Turkey	1,436	0.49	25	6
United Kingdom	21,584	2.19	373	48
United States	169,964	2.72	659	76

Source: OECD (1996)

8th among OECD countries in this criteria. Korea's GERD reached $7.6 billion the same year, with per capita GERD amounting to $153. Given the government's increased efforts to boost both public and private investments in R&D, the country is expected to continue its upward climb among the ranks of technologically-advanced countries.

Several domestic level data also indicate the initial success of Korea's R&D investment drive (see Table 16). From 1988 to 1992, for example, Korea experienced a boon in industrial property rights with an increased number of patents, utility models, industrial designs, and trademarks granted to domestic applicants. The trend is particularly pronounced in patents, which jumped from 2,174 in 1988 to 10,502 in 1992. The total number of industrial property rights granted almost doubled within the same time period. It should be noted, however, that the number of applications grew much

Table 16. Industrial property rights applied for and granted in Korea (1988-1992)

Year	Patents		Utility Models		Indust. Designs		Trademarks		Total	
	Applied	*Granted*	*Applied*	*Granted*	*Applied*	*Granted*	*Applied*	*Granted*	*Applied*	*Granted*
1988	20,051	2,174	22,677	3,108	18,162	10,502	34,681	17,272	95,571	33,056
1989	23,315	3,972	21,530	5,311	18,196	12,561	39,832	22,263	102,873	44,107
1990	25,820	7,762	22,654	8,846	18,769	13,927	46,826	23,790	114,069	54,325
1991	28,132	8,690	25,895	8,370	20,097	13,723	46,612	23,876	120,736	54,659
1992	31,073	10,502	28,665	7,870	22,948	13,635	45,124	30,298	127,810	62,305

Source: OECD (1996)

slower than the rights granted, which implies that the government is perhaps approving applications more generously than before. Nonetheless, one should not overlook the remarkable increase in the absolute number of applications and awards, albeit at a different pace, that is expected to continue if the level of R&D investments is sustained.

Manpower

In addition to sustained investments, the development of high-skilled and innovative manpower is a prerequisite to productive R&D activities. Since "skill" is related to the level of education of personnel, government programs heavily promote the strengthening graduate education in science and technology. As a result, graduate enrollment has continuously increased since the 1980s, with approximately one-fourth of graduate students enrolled in doctoral programs in engineering and natural sciences by 1994 (see Figure 2). The Korean government has also created two research-oriented

Figure 2. Enrollment in graduate schools

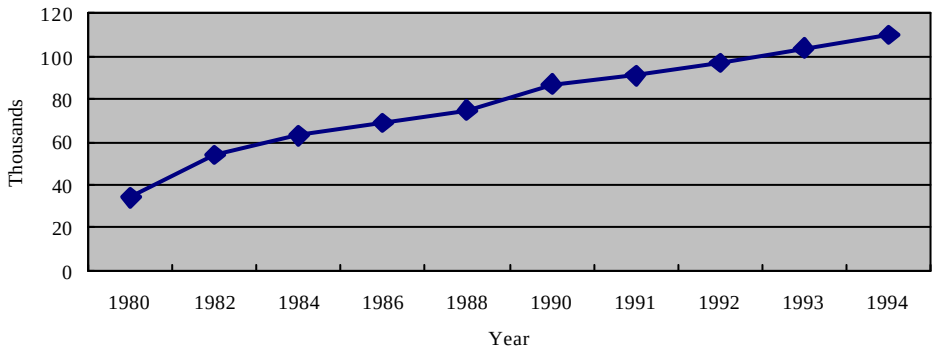


Table 17. Researchers and R&D Expenditures, by sectors of performance, 1993

	Universities	GRIs	Industries	Total
Researchers	26,618	16,068	54,078	98,764
	29%	16%	55%	
Researchers holdring PhD degree	19,750	4,737	2,326	26,813
	74%	18%	9%	
R&D expenditure (in million won)	44,701	1,310,576	4,397,706	6,152,923
Government financed R&D expenditure	824	8,495	947	10,266
(in 100 million won)	8%	83%	9%	
R&D expenditure per researcher (1,000 won)	15,539	81,564	81,322	62,300

Source: MOST in OECD (1997)

universities in order to build future generations of high-quality engineers and scientists. The Korean Advanced Institute of Science and Technology (KAIST), and more recently, the Kwang-Ju Institute of Science and Technology (KJIST) have become centers of scientific research and education. The government provides generous financial support for both specialized institutes since its inception (MOST, 1999).

In general, however, R&D expenditure in Korean universities is very low. In terms of total amount of R&D expenditures per researcher, Korean universities are in a deficit as compared to government research institutes (GRIs) and private industries (see Table 17). This is primarily due to the larger concentration of PhD-level researchers in universities, combined with insufficient government funding for university R&D. This implies that the research potential of universities is extremely underutilized. Moreover, universities focus on basic science research, in contrast to GRI and private R&D that emphasizes applied research and experimental development. These are important issues that the Korean government should address in order to stimulate scientific innovation among it human resources in the future.

Technology Transfer

Despite the recent drive to improve domestic science and technology, foreign countries continue to be an important source of new technologies for Korea (MOST, 1999). Direct technology transfers can be achieved through inward FDI or importing

Table 18. Technology transfer to Korea (1962-1993)

	Technology imports (TI)		Foreign direct investment (FDI)		Ratios (TI:FDI)		Capital goods imports (KI)	
	Payments (m$) [A]	Cases [B]	Amount (m$) [C]	Cases [D]	[A]/[C] (%)	[B]/[D] (%)	Amount ($m) [E]	[E]/total imports
1962-1966	0.8	33	47.4	39	1.7	0.85	468	18.9
1967-71	20.4	285	218.6	350	9.3	0.81	2,268	30.8
1972-76	96.5	434	879.4	851	11	0.51	8,106	27.3
1977-81	451.4	1225	720.5	244	62.7	5.02	25,685	27.7
1982-86	1184.9	2078	1767.5	565	67	3.68	46,572	32.0
1987-91	4359.4	3471	5634.7	1622	77.4	2.14	111,499	36.4
1992-93	1797	1240	1938.8	506	92.7	2.46	61,184	37.0
Total	7906.1	8766	11207.6	4177	70.5	2.1	256,200	33.5

Source: KITA in *Reviews of National Science and Technology Policy* (OECD, 1996)

machinery and equipment that embodies new technologies. Technology imports (TI) has historically outdone FDI in transfers, mostly due to Korea's protectionist policies that curbed the inflow of FDI in the last several decades (OECD, 1996). The ratio of cases in the 1980s and the early 1990s show that technology imports still outperform FDI by almost threefold in technology transfers (see Table 18). However, when the total value of investments are considered, the ratio of payments has increased dramatically from 1.7% in the 1960s to 92.7% in 1993. This indicates that the level of technology transfers has almost balanced between TI and FDI in the recent years. The amount of capital goods imports (KI), which often embody new technologies from trading partners, also increased significantly from 18.9% in the 1960s to 37% in 1993.

It is also helpful to look into the types of industries that engage in technology imports. Table 19 shows that petrochemical, electrical, and machinery industries utilized over two thirds of technology imports from 1962 to 1993. The three industries also dominated the use of TI since the late 1980s, implying that these sectors are heavily dependent on foreign sources for new technologies. If Korea aims to be more self-sufficient in producing its own technology, then government policies should be oriented towards channeling more R&D investments in these sectors.

Table 19. Technology Imports by Industry (1962-1993)

Year	Foods	Textiles	Metals	Petrochm	Electrical	Machinery	Shipbldg	Other	Total
1962-1966	2	7	1	5	5	6	0	7	33
1967-71	6	7	28	59	65	58	1	61	285
1972-76	7	24	45	85	84	116	10	63	434
1977-81	30	41	105	194	205	403	45	202	1225
1982-86	101	127	112	317	473	546	94	308	2078
1987-91	94	226	114	619	981	812	63	562	3471
1992-93	29	62	27	126	403	365	18	210	1240
Total	269	494	432	1405	2216	2306	231	1413	8766
(%)	3.1	5.6	4.9	16	25.3	26.3	2.6	16.1	100

Source: KITA in *Reviews of National Science and Technology Policy* (OECD, 1996)

As a caveat, it should be emphasized that the preceding discussion does not establish a causal relationship between R&D investments and industrial upgrading. Descriptive analysis showed that Korea's science and technology base significantly improved at the same time when the government pushed for increased investments in R&D. Although the experience of industrialized countries reveals that R&D plays an important role in industrial development, Korea's new technologies will not necessarily improve the efficiency of domestic industries. Among other things, the long-term impact of R&D investments on industrial upgrading depends on the successful diffusion of new technologies to individual businesses. Such definite discussion requires more rigorous quantitative analysis using time-series data, which is beyond the scope of this paper.

Chapter 6
GOVERNMENT POLICIES IN R&D

The preceding section illustrated that the Korean society, as a whole, is attempting to improve its science and technology base through increased investments in R&D, manpower, education system, and technology procurement. Several key measures that indicate successful industrial upgrading were also presented. Although the private sector accounts for a large share of Korea's R&D activities, the government's role in promoting the country's technological advancement is clearly undeniable. This is particularly true in the 1990s when the government launched a series of policies in order to promote scientific innovation. The country found it more difficult to rely on foreign technology transfers to maintain the competitiveness of its industries, especially since many foreign sources of technology are increasingly becoming skeptical to share its advanced technology in order to protect its production activities (OECD, 1996). In the process of industrialization and achieving economic maturity, Korea had to create its own science and technology base that will propel its industries to the ranks of advanced nations.

The Ministry of Science and Technology (MOST) initiated the National R&D Program in 1982 based on the Technology Development Promotion Law. At the outset, the program was geared towards two major types of research: (1) "government-initiated projects" (i.e., high-risk research) and, (2) " industry-initiated projects" (i.e. core industry research). By 1992, the National R&D Program was expanded to five major categories: (1) the Highly Advanced National Project (HAN Project), (2) the Creative Research Initiative (CRI), (3) the Strategic National R&D Project, (4) the International Joint Research Project, and (5) the Research Planning and Evaluation Project. The first two projects are directly related to industrial upgrading and will be subsequently discussed in the following sections.

HAN Project

Implemented in 1992, the HAN Project is a large-scale R&D venture jointly funded

by private and government sources. It aims to develop strategic industrial technologies in order to make Korea more self-reliant on science and technology. The first goal is "product technology" development to tap into Korea's growth potential in certain emerging industries. These products include agrochemicals, ISDN, HDTV, ASIC, next generation vehicles, biomedicals, and express railways. A partial list of these projects under this category is listed in Table 20. The second goal of the HAN Project is the development of fundamental technology to sustain the country's economic growth. These core technology targets include next-generation semiconductors, advanced manufacturing systems, environment technology, new energy, nuclear energy, and ergonomics. A partial list of the projects that fall under the category of "core technology" is found in Table 21.

An evaluation of the first two years of HAN Project revealed positive results: 550 patents were granted out of 2,500 applications; 1,900 papers were published in scholarly journals; and 2,100 papers were presented in conferences.

Table 20. HAN Project: product technology development

Project	Objective
Development of new drugs and agrochemicals	Development of new drugs from traditional Oriental medicines by 1996 Discovery and development of two or three new drugs and agrochemicals by 1997
Development of broadband integrated services and data network (B-ISDN)	Development of ATM (asynchronous transfer mode) by 1996 Development of B-ISDN by 2001
Development of high-definition television (HDTV)	Establishment of HDTV monitor technology by 1993 Development of transmission and broadcasting technology by 1994
Development of next generation vehicle technology	Development of technologies related to next-generation automobiles and parts, including electrical vehicles to cope with environmental and energy problems as well as rapid socio-economic changes

Source: MOST (in OECD, 1997).

Table 21. HAN Project: fundamental technology development

Projects	Objectives
Development of ultra-large-scale integrated circuits (ULSI)	Development and production of 256 mega DRAM by 1996 Development of 1 giga DRAM by 2000
Development of new advanced materials for the information, electronics, and energy industries	Development of high value added new materials and synthesis of ultra-pure raw materials that are important for the information industry and a highly developmed industrial society.
Development of advanced manufacturing systems	Development of computer-integrated manufacturing (CIM) by 1996 Research and development of intelligent manufacturing system (IMS) by 2000
Development of new functional biomaterials	Development of high quality and high productivity biological resources expected to be important in the 21st century industries but now in the early stage
Development of environmental technology	Upgrading technology to solve national and global environmental problems and to provide a better human and social environment, as part of co-operation for global environmental protection and conservation.
Development of new energy technology	Development of highly efficient and clean energy; contribution to highly developed industry and society
Research and development on next-generation nuclear reactor	Design and verification study for a new reactor concept; securing stable energy sources in preparation for the exhaustion of fossil energy.

Source: MOST (in OECD, 1997).

Creative Research Initiative (CRI)

Initiated in 1997, the Creative Research Initiative aims to develop of a knowledge-

based economy. In a broader sense, the CRI attempts to address the lack of innovation among Korean personnel, which is a major barrier to technology development. The CRI attempts to shift the Korean technological paradigm from imitation to creativity, originality and innovation through two major programs: (1) individual research grant, and (2) theme based grant. The government awards grants, with a maximum amount of $200 thousand per researcher, to deserving projects that promote CRI' s goals.

International S&T Cooperation

The Korean government realizes the importance of international cooperation in S&T and seeks to become an active player in this field. Korea plans tremendously from the technological know-how of other countries, and vice versa. To achieve this goal, government policies are geared towards establishing bilateral cooperation with foreign countries, especially the United States, the United Kingdom, Japan, China, Germany, and Russia. The government is also promoting multilateral cooperation with international organizations, such as the OECD, APEC, and the International Science Technology Center (ISTC).

The International Joint Research Program

Started in 1985, the International Joint Research Program supports bilateral agreements in S&T projects. More than 906 joint projects were initiated under this program, primarily with technologically advanced countries like the United States, Germany, France, the United Kingdom, and Russia. The growing importance of China as Korea' s trading partner has also increased the number of joint projects between the two countries in the 1990s. In general, however, Korea aggressively seeks partnerships with countries that have comparative advantage in advanced technologies.

Five Year Plan for S&T Innovation (1997-2002)

In 1997, the Korean government established the first Five-Year Plan for S&T Innovation based on the Special Law on Innovation of Science and Technology. The plan was created in response to the growing need to upgrade Korea' s R&D base to the level of

industrialized countries by focusing on 10 major fields, as follows:

1. Public R&D Investment: The government of Korea plans to increase R&D expenditure to at least 5% of the government budget by the year 2002. In particular, the government plans to increase the budget in education, national defense, and the environment. The government plans to improve the efficiency and productivity of R&D activities through better coordination between ministries, prioritization of projects, and improved research management.

2. National R&D Program for Critical Technologies: The government plans to invest $703 million in six major technology fields: information, strategic industries, social welfare, energy, systems, and newly emerging industries.

3. Promotion of Basic Research: Basic research is the primary source of technological innovations, and the government plans to increase the level of investments on basic research to 20% of total R&D funding. The goal is to raise Korea's international rank in basic R&D from 19th in 1996 to 10th by the year 2002. Three key projects will receive greater government funding: the Basic Scientific Research Fund, Excellent Research Center, and Regional Research Center.

4. Manpower Development and its Utilization in Science and Technology: The government plans create a more flexible manpower system as well as increase the number of highly qualified researcher to 192,000. Government support for educational institutions that focus on science and technologies will be strengthened, such as increasing the number of post-doctoral fellowships to over 2,000 students.

5. Promotion of Engineering Technology: Eight major technological fields in engineering will be developed in order to increase Korea's market share from 3% in 1995 to 5% by the

year 2002. The government will also improve project coordination and technology distribution among engineering networks.

6. Development of Dual Use Technology: Technologies utilized by both military and commercial sectors (i.e., dual use) will be encouraged in order to make Korea more self-reliant on national defense. The government will also improve technology transfers between both sectors.

7. Supports for Industrial R&D including Medium and Small Business: Upgrading industrial R&D is crucial to maintaining the competitiveness of Korean businesses. The government plans to create a stronger industrial base by building techno-parks, incubation centers, and university consortiums, which can foster venture firms in high-tech research.

8. Improvement of S&T Education and Associated Infrastructure: The government plans to improve Korea's S&T educational system by establishing science education centers, modernizing laboratories, creating research centers for gifted students, and holding International Science Olympiads.

9. Infrastructure of Science and Technology: The government plans to cover 100% of required equipment expenditure for research facilities; create a technical information center that will increase public awareness of R&D activities; and diffuse Korea's R&D to the international level.

10. Technology Development Plan related to Social Overhead Capital: Research on four major areas will be expanded under Social Overhead Capital: transportation, water resources, housing, and construction. The government plans to bring SOC technology up to par with industrialized countries.

The Five Year Plan differs from previous long-term legislation in science and technology

in that it aims to produce realistic and concrete results. Despite the current financial crisis, the Korean government has indicated its commitment to maintain the plan's allocated budget. The government recognizes that, more than ever, building a stronger technology base is needed to restore the international competitiveness of its industries.

Table 22. Share of R&D expenditure by source and type in Korea (1986-1996)

	Government and Public	Private	Basic Research	Applied Research	Experimental Development
1986	23.22%	76.70%	16.67%	26.51%	56.82%
1987	24.65%	75.31%	16.63%	19.57%	63.80%
1988	21.29%	78.69%	15.59%	20.37%	64.04%
1989	20.37%	79.59%	14.95%	19.18%	65.87%
1990	19.41%	80.57%	16.08%	24.46%	59.47%
1991	19.44%	80.38%	14.84%	30.73%	54.43%
1992	20.58%	82.39%	12.60%	26.32%	61.08%
1993	20.40%	83.11%	13.15%	24.33%	62.51%
1994	15.92%	84.08%	14.34%	23.82%	61.84%
1995	18.86%	81.14%	12.47%	25.02%	62.51%
1996	22.17%	77.83%	13.23%	26.91%	59.86%

Source: The author's calculation based on data from MOST website (1999)

Private Sector R&D

Private research institutes are at the heart of Korea's R&D activities, accounting for approximately 80% of the country's R&D expenditure every year (see Table 22). Sponsored by conglomerates, private research institutes usually focus on applied and experimental development research in order to develop and advance new products. In turn, the government of Korea has historically supported R&D activities of conglomerates through three major venues: tax incentives, financial incentives, and government procurement. First, the government instituted a "technology development reserve fund system" that requires private companies to re-invest a certain share of its

profits to R&D, which in turn can be used for corporate tax deductions. Similarly, tax credits can be obtained from private expenditures for technology and development of human resources. Second, the government uses financial incentive systems to channel funds, mostly as low-interest loans, into private R&D projects. Three major funds has been established by

the government to achieve this end: The S&T Promotion Fund (1991), Information and Telocommunication Promotion Fund (1993), and Technology Commercialization Fund (1978). Third, government supports private R&D by awarding direct procurements contracts with private companies involved in high-level research. It should be noted, however, that government incentives have played a relatively minor role in the success of private research primarily driven by market forces. Trends in R&D funding reveal that applied research in Korea is sufficiently funded by the private sector, which implies that the government should aim its policies toward developing public R&D and basic research in order to improve the country's S&T base.

In summary, the government of Korea is leading a national drive towards advancing the country's science and technology to the level of industrialized countries. Government policies are geared towards stimulating domestic innovation, strengthening international R&D cooperation, and supporting private sector research, which are all critical to upgrading Korea's industries. Through five-year plans, the government is taking a comprehensive approach in addressing the country's structural weaknesses and market potentials in science and technology, such as the development highly-educated human resources and increased public R&D investments, in order to ensure the country's international competitiveness in the future.

CONCLUSION

The experience of the Republic of Korea on foreign direct investments indicates that the Korean economy is approaching maturity. Over the last ten years, Korean direct investments were channeled abroad in search of new markets and lower production inputs. The influx of FDI is particularly evident among less developed countries, such as China and ASEAN members, that provided more favorable environments for Korean manufacturing activities.

This study tried to demonstrate that outward FDI has broad implications on the Korean domestic economy, ranging from the deterioration of the country' s competitiveness to stimulating the growth of the service sector. Several key evidences point to the conclusion that Korea is approaching de-industrialization, with the weight of manufacturing firms in terms of GDP gradually shrinking over the years. Moreover, employment, growth, output, and the comparative advantage of labor-intensive manufacturing sectors have generally contracted. This downward trend is coincided by the increasing flow of manufacturing activities abroad in search of better and more cost-efficient inputs.

De-industrialization, however, is not necessarily equivalent to industrial hollowing. The latter occurs only if a country *fails* to upgrade its technology base in the process of industrial restructuring (i.e. manufacturing activities are moving abroad through FDI). This paper has argued that Korea is avoiding the hazards of industrial hollowing by mobilizing massive investments, from both public and private sectors, into research and development. The government, in particular, has taken strong initiatives to bring the country' s science and technology up to par with industrialized countries. There is plenty of good evidence that supports the rapid advancement of Korea towards this goal in the last decade.

In the broader context, we can conclude that Korea is on the verge of transforming itself from a production to service-based economy. The overall trends in FDI and R&D investments fit perfectly under the framework of industrial transformation. In other words, FDI is a necessary step in order to develop the competitiveness of new industries, especially in

service and high-tech sectors. Much as it did several decades ago with the manufacturing industry, the Korean government is once again flexing its muscles to spearhead a technological "catching-up" with advanced countries. Although the recent policies seem to be succeeding, it should be emphasized that the long-term success of Korea's S&T drive is still too far from being conclusive.

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