From Brain Drain to Reverse Brain Drain: Three Decades of Korean Experience*

HAHZOONG SONG

This paper examines three decades of the Korean experience of brain drain, that can be termed ‘from brain-drain to reverse brain-drain’, and government policies to deal with this phenomenon.

The results confirm the major role of economic factors in return-or-stay decisions of Korean scientists and engineers (KSEs) who earned PhDs in the US. And yet, when the difference in economic conditions between alternatives is narrowed, psychological and emotional factors are identified to be important. In particular, this study suggests that some Confucian values work as an underlying element in KSEs' decisions. Consequently, this study indicates the importance of including a cultural analysis in the study of brain drain issues.

The Korean government tried to repatriate as many scientists and engineers as possible in the 1960s and 1970s. Yet, the effectiveness of policy measures during that period was limited. As the Korean economy continued to improve, many of the foreign educated scientists and engineers intended to return to Korea by the 1980s. From this time on, the Korean government adopted a policy to utilise the needed expertise of Koreans abroad, while helping them choose their residences by themselves.

Introduction

Over the last three decades, the Korean economy has grown at an average annual rate of 9 per cent. Per capita GNP rose from $87 in 1962 to $10,076 in 1995 (see Table 1). Exports increased from $55 million in 1962 to $125 billion in 1995. Following this remarkable economic performance, Korea became the 29th OECD member country in November 1996.

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Hahzoong Song is Professor, Department of Public Administration, College of Law, Kyung Hee University, 1 Hocki Dong, Dongdaemoon-Ku, Seoul, 130-701, Korea.

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While trying to maintain this economic momentum, Korea hopes to join one of the advanced countries within a decade or two. Human resources, a key to the past economic development, will remain a critical factor in achieving this goal. A corps of scientists and engineers are at the centre of efforts to enhance the national capacity to design, market and manufacture products as well as teach students and carry out research and development activities. Although a majority of them were brought up in Korea, foreign educated scientists and engineers constitute an invaluable source of high quality manpower to lead the country's science and engineering.

In recent years, there has been a massive influx of US trained Korean scientists and engineers into Korea. The USA is the home of more than 80 per cent of expatriate Korean scientists and engineers. Two-thirds of Korean scientists and engineers who obtained their doctorate in the US in the 1980s returned to Korea within three years after graduation. Considering the fact that the proportion of returning Koreans who earned their doctoral degrees in the 1960s was less than 10 per cent, the difference indicates a drastic change in the pattern of migration among highly educated and skilled Koreans during the past three decades. Since the US is the single most popular destination of graduate studies abroad among Korean students, Korea is now in a position to enjoy 'reverse brain-drain' or 'brain-gain'—an inflow of high quality human resources.
During the brain-drain controversy of the 1960s, some analysts believed that social and economic incentives would drive talented people away from developing countries towards advanced countries (Adams 1968). Given resource shortages of the developing countries, this problem seemed unlikely to be solved soon (Bhagwati and Hamada 1989). Today, many Third World countries still lose their best talent to advanced countries (Cannon 1988; Finn 1985; IIE 1995; NSF 1985, 1986, 1993). Korea’s case, however, demonstrates the possibility that the brain-drain curse might turn into a blessing. Taiwan has also experienced a similar exodus of expatriates. This phenomenon can be attributed primarily to the booming economy in both countries.

However, this goes beyond simple economy: talented people are returning despite the fact that the economic structures and living conditions of their home countries are weak compared to those of the advanced countries. As the economic conditions of the home country reach a certain level, however, psychological and emotional factors also play an important role (Dunn 1995; Gittelsohn 1989; Yoder 1989). Although the Korean case is an exception rather than the rule, it should shed light on the issue for other developing countries. It is in this regard that the developing countries should carefully design and implement their policies for utilising the repatriated talents.

This paper examines Korea’s experience: ‘from brain-drain to reverse brain-drain’ over a period of three decades (1960–88). The paper is divided into three parts. The first describes Korea’s past economic development, the state of science and technology, and values and norms of Korean society. Against this background, the choices facing Korean scientists and engineers can be clearly understood. The second part examines the changing trends in the residence choice of Korean scientists and engineers (hereinafter KSEs). Factors that affect an individual’s choice of residence are identified and analysed. The analysis is based on a survey of two groups of Korean scientists and engineers: those who decided to stay on in America, and those who returned to Korea. The last part describes the Korean government’s policies to cope with the brain-drain phenomenon from the 1960s through the early 1990s.
Trends in Economic Development and Science and Technology of Korea

The 1950s and 1960s: Korean War and Gearing up for Economic Development

In the 1950s, Korea was one of the poorest countries in the world and relied heavily upon foreign aid for most of its basic needs. The Korean War (1950-53) dealt a severe blow to the country’s hope for the future, which was already devastated by the partition of the country following the end of Japanese colonial rule. The war was a tragedy not only because it caused enormous casualties (about one million lost their lives), but also because it was the first all-out civil war caused by a conflict of ideologies implanted by foreign powers. Most of the production facilities were destroyed and the country’s poor economy was left in ruins.

President Park Jung Hee, upon assuming power following a coup d’état in 1961, launched a nationwide drive for economic development. In this early stage of economic development (the 1960s), Korea had virtually no infrastructure or economic foundation. Therefore, the main goal of economic development was to establish an industrial foundation. The Korean government announced the ‘First Five-year Economic Development Plan’ in 1962 to promote import substitution industries and export-oriented light industries. Various policy measures such as exchange rate adjustment, tax incentives and preferential financing were adopted to support these industries (STEPI 1995).

While pursuing import substitution and export promotion policies, the technological expertise most in demand was the capacity to implement foreign manufacturing technology. Foreign technologies were obtained through reverse engineering, imitation, imports of capital goods, and licensing. Science and technology policy of the 1960s was regarded as part of the industrial policy and focused on better management of technology import process (Kim 1993; Lee 1991). During this period, the Korean government established organisations which came to play a significant role in the country’s future science and technology development. The Ministry of Science and Technology (MOST) was established in 1967 to formulate and implement overall science and technology policies (STEPI 1997). In 1966 the Korea Institute of Science and Technology
(KIST) was established as the first government sponsored integrated research institution.

The 1970s: Transition of Industrial Policy

Until the mid-1970s Korea owed its economic development to the labour intensive manufacturing sectors. Light industries such as textiles and plywoods expanded very rapidly. Over time, however, pressure from developing countries that followed Korea’s suit weakened Korea’s position in the export market. At the same time, trade deficits caused by imported machinery and raw materials became a chronic problem. The Korean government sought to overcome these challenges by changing the industrial structure of the country. Accordingly, there was a shift in the industrial policy of the country—towards building up heavy and chemical industries. The government provided various financial incentives, including artificially lowered interest rates for bank loans and government guarantees for foreign loans (STEPI 1997).

The Korean government coerced big companies to commit to heavy and chemical industries by not only reducing the cost of capital investment, but also by exerting political pressure on the companies. At this stage, it was clear that a major bottle-neck in building up heavy and chemical industries was science and technology capacity. The strategy of the 1960s to copy or borrow foreign technologies was no longer appropriate. Licensing the leading edge technologies was both costly and complicated. Furthermore, advanced countries were increasingly reluctant to transfer technologies. There was a consensus among Korean policy makers that further economic development would not be possible without enhancing the domestic science and technology basis. Business leaders who also recognised the need had no other choice but to invest in their own R&D facilities and personnel. By this time, big corporations like Samsung, Hyundae and Daewoo had accumulated the necessary resources and capital to invest significantly in R&D. Given the financial capabilities, recognised needs and various incentives from the government, R&D capacity enhancement was pursued aggressively (CSTP 1988). As Table 2 shows, R&D manpower and R&D’s share of GNP grew faster in the 1980s than the overall national economy.
TABLE 2

<table>
<thead>
<tr>
<th>Year</th>
<th>R&amp;D Expenditures</th>
<th>R&amp;D Personnel</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>As % of GNP</td>
<td>Source of Funds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gov. &amp; Pub.:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Private</td>
</tr>
<tr>
<td>1963</td>
<td>0.25</td>
<td>97:3</td>
</tr>
<tr>
<td>1965</td>
<td>0.26</td>
<td>90:10</td>
</tr>
<tr>
<td>1970</td>
<td>0.38</td>
<td>88:13</td>
</tr>
<tr>
<td>1975</td>
<td>0.42</td>
<td>71:29</td>
</tr>
<tr>
<td>1980</td>
<td>0.57</td>
<td>61:38</td>
</tr>
<tr>
<td>1985</td>
<td>1.59</td>
<td>20:80</td>
</tr>
<tr>
<td>1990</td>
<td>1.88</td>
<td>19:81</td>
</tr>
<tr>
<td>1994</td>
<td>2.61</td>
<td>16:84</td>
</tr>
</tbody>
</table>

Sources: Ministry of Science and Technology, Korea, Yearbook, each year. Report on the Survey of Research and Development in S&T, each year.

The 1980s and After: Commitment to the Advancement of Science and Technology

The massive mobilisation of investment capital for heavy and chemical industries during the 1970s led to a distortion in resource allocation and slowed down the economic growth of the country. The second international oil crisis which came in the midst of tremendous political turmoil following the assassination of President Park in 1979 aggravated the economic downturn of the country. In 1980, the Korean economy recorded a negative growth for the first time since 1961.

Amid these cloudy political and economic developments, the Fifth Republic was born and the government’s top priority was to stabilise the domestic economy. Major stabilisation measures included financial and trade liberalisation, realignment of industrial incentive system, introduction of the Fair Trade Act, and devaluation of the Korean ‘Won’. Policy loans were abolished, and government subsidies such as ‘preferential’ loans were reduced (OECD 1996). Industrial targeting was gradually phased out and functional incentives were emphasised. All these measures proved to be successful and the country’s economy recovered accordingly.

In the mid-1980s, Korea enjoyed a favourable international environment which was characterised by the so-called three lows:
low interest rates, low oil prices, and low value of the US dollar. In 1986, Korea recorded a trade surplus for the first time since 1945.

In 1987, public demand and actions for democracy led to a significant political change—the popular presidential election was held for the first time in 20 years. What lay in store for the new government were active labour movements and demands for social welfare programmes. As a result, labour costs escalated rapidly, with its rate of increase exceeding that of labour productivity increases. Rising labour costs eventually accelerated an industrial restructuring toward automation and technology intensive industries.

In the 1990s, Korea continued to pursue liberalisation of industrial regulations in favour of market mechanism. By then, the Korean economy had achieved a remarkable growth in both volume and degree of sophistication. Although the government had played a key role in the initial stages, it is no longer possible for the government to manipulate industrial development. Instead of steering the industry in a particular direction, the Korean government provided various incentives for investments in R&D infrastructure and technology innovation, emphasising some high tech fields.

As described here, science and technology has become a major theme in Korea. It is clear from Table 2 that the nation’s science and technology activities became a serious undertaking from the 1980s. R&D expenditures as per cent of GNP rose from 0.25 in 1963 to 0.57 in 1980 and further to 2.6 in 1994. Government and public R&D sources, that comprised 97 per cent of R&D expenditures in 1963, accounted for only 16 per cent of the overall R&D fund in 1994, reflecting the rapid shift of R&D activities to the private sector. The total number of R&D personnel was 117,446 in 1994, up from 2,135 in 1965 and 18,434 in 1980.

**Human Resources for Science and Technology**

One of the most important factors in Korea’s industrialisation was its abundant and relatively well-educated human resources. In the early stages of development in the 1960s, workers who were able to acquire training in imported production technologies contributed to the massive growth of import substitution industries. Since the technologies of the time did not require sophisticated knowledge, a large number of workers became skilled workers after being
given a short vocational training (Lee 1995). Although their educational level was not high, those who had basic education were an important source of manpower mobilisation as technicians.

Owing of the Confucian tradition, Koreans regard education as the best asset for social excellence. This eagerness for education was the driving force for a massive cultivation of an educated manpower. Following the improvement in economic conditions, student enrolments at all levels in schools increased. As Table 3 shows, high school enrolment in 1990 was 87 per cent of the age cohort, compared to 28 per cent in 1970. With the increase in overall student enrolment, the number of domestically trained scientists and engineers also increased. In 1995, Korean higher education institutions produced 72,012 BA, 10,090 MS and 1,621 PhDs in science and engineering. Throughout the 1970s and 1980s, most of the manpower needs were met by this group of domestically trained scientists and engineers. They formed the basis for science and technology development, mostly engaging in production and management.

| TABLE 3 |
| Education Enrolments 1960–90 |

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Elementary School</td>
<td>6–11</td>
<td>3,623</td>
<td>5,749</td>
<td>5,658</td>
</tr>
<tr>
<td>Middle School</td>
<td>12–14</td>
<td>528</td>
<td>1,319</td>
<td>2,471</td>
</tr>
<tr>
<td>High School</td>
<td>15–17</td>
<td>273</td>
<td>590</td>
<td>1,696</td>
</tr>
<tr>
<td>College/Graduate</td>
<td>18+</td>
<td>101</td>
<td>201</td>
<td>625</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age</th>
<th>% of Enrolments by Age Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elementary School*</td>
<td>6–11</td>
</tr>
<tr>
<td>Middle School</td>
<td>12–14</td>
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<tr>
<td>High School</td>
<td>15–17</td>
</tr>
<tr>
<td>College/Graduate</td>
<td>18+</td>
</tr>
</tbody>
</table>

Notes:  
* Since some elementary school students are over or under the typical age, the percentage of enrolment exceeds 100.

** Since the statistical record of the age cohort in the year 1960 is not available, the percentage of enrolment has not been calculated.

A critical contribution to Korean science and technology development came, however, from foreign sources. While technology transfer through overseas licensing or direct investments helped Korean companies build up their technology basis, the utilisation of foreign trained manpower also played an important role. Foreign trained scientists and engineers adopted and refined imported technologies in Korea, taught students and engaged in R&D activities. Their knowledge and experience became a key element in upgrading the level of sophistication in overall science and technology in the country. In particular, Koreans working for overseas institutes were readily available, when Korea tried to introduce leading edge technologies or new industry. For instance, it is well known that the Korean semiconductor industry, through the utilisation of Korean engineers recruited from America, has saved at least 10 years in catching up with the Japanese and American companies.

Values and Norms of Korean Society

Korea has transformed from an agrarian society to an ‘industrialised’ society in less than a century. The transformation of the country’s economic structure was accompanied by a change in the value structure and norms of Koreans. Its bitter experiences in recent history—loss of independence to Japanese colonial rule (1910–45), the partition of the country and the subsequent civil war (Korean War, 1950–53)—shattered the rigid social system and norms of traditional Korea. The drive for economic development of the last three decades also significantly contributed to the transformation of Koreans’ values and norms. At present, many of traditional rituals and customs are either no longer practised, or have been replaced by newly adopted Western ones. It is observed, however, that many of the inherited norms and values are still reflected in the Koreans’ behaviour, intertwined with newly acquired Western ideas. Sometimes they are manifested in modified forms, and at times they lie dormant, but still remain powerful (Song 1991). In the following we will examine traditional Korean values and some of the newly adopted Western ideas.
The Confucian Social Structure and Norms

For more than five centuries, Confucianism has been the ruling philosophy of Korean society. The influence of Confucianism was so profound that it is difficult to explain the political, social, and economic conditions of traditional Korea without referring to it. Confucianism, as the moral standard and political framework of the country, was never challenged and when anything went wrong the blame was ascribed to men, and not to Confucian ideas. Although Korean culture was also influenced by other ideas and religions, the underlying values and behavioural patterns of modern Koreans are dominated by Confucianism.

Among the elements of present-day Korean values carried over from traditional society, filial piety remains an undeniable personal virtue. Even though the modern father–son relationship is not as absolute as that of traditional Korean society, a father as the head of family has the authority to dictate his son’s decisions and behaviour. A relaxed form of filial piety operates as the basic behavioural norm or code of conduct in social organisations. The concept of hierarchy, combined with other components of traditional familism or communitarianism, also dominates the Koreans’ way of thinking.

The concepts of stability and harmony, although tainted by overuse for political ends, are still cherished virtues in Korean society where individuals are expected to subordinate their interests to those of the community. While these values—filial piety, stability and harmony—are the sustaining norms for the hierarchical social structure, egalitarianism is an accepted goal to be achieved through political and economic democracy. Whether egalitarianism is interpreted as ‘equality of opportunity’ or as ‘equality of result’ will shape the future framework of Korean norms.

Although the class system has been officially abolished, elitism abounds in the Korean social systems—academia, business, military, and government bureaucracy alike. Many characteristic phenomena of elitism in Korean society are rooted in Confucian values and norms. Consideration of ‘face’ and formalism (or ritualism) still influence the behaviour of Korean people. The strong achievement motivation or desire for ‘success’ is combined with the Confucian ideal of excellence through education, which is exhibited in the feverish drive for education in modern Korean society.
Materialism and Individualism

The apparent components of Western culture found in modern Korea are materialism and individualism. As rapid urbanisation accompanied the transition of family structure from a large extended one to a nuclear one, these ideas deeply penetrated into the Korean values and norms. As a result of industrialisation, the pursuit of material well-being has rapidly replaced the disregard for practical matters maintained in traditional Korean society. While some aspects of individualism are still loathed, it is manifested in many ways in the personal behaviour of Koreans.

One of the drastic changes observed in the modern value system compared to the traditional one is the attitude toward materialistic well-being. After the class structure of yangban (the nobles) and the commoners was formally abolished in 1894, people with previously unaccepted backgrounds emerged at the top rung of the social ladder.³

Korea’s economic development over the past decades was led by a group of military careerists and businessmen who had a goal-oriented mentality. These power elites emphasised efficiency, under the slogan of 'modernisation of the nation'. Although it came into conflict with traditional values, the remarkably enhanced economic status of the country was enough to win public approval of efficiency goals. The strong efficiency incentive combined with the desire for success gave materialism a solid ground in the mentality of the Korean people. The relentless drive for materialistic achievement explains the hardworking attitude of Korean workers, as they are willing to sacrifice immediate benefits for long-term betterment.

Following the introduction of Western democracy and Christianity, Koreans accepted individualism as an essential step toward modernising the country. With the adoption of the nuclear family structure by many urban families, children in such families tend to exhibit more individualistic behaviour. The diversification of values in Korean society also fostered individualistic attitudes. Self-satisfaction regardless of position and title is becoming increasingly acceptable among the new generation. Some professions which were traditionally looked down upon, such as artistic performances, are highly valued by the younger generation. Individualism allows
them to claim rights in the organisational or community settings, instead of subordinating their interests for the sake of the organisation.¹

It is true that modern Koreans exhibit 'new' behavioural patterns. However, it is an undeniable fact that a deep-rooted traditional value structure still influences Koreans' behaviour and attitudes in many respects, both implicitly and explicitly. Even in the case of the younger generation, there is evidence of traditional family orientation and communitarian (and authoritarian) ideas. Within the context of family relations, young Koreans maintain an attitude of communitarianism, while exhibiting a more individualistic value orientation with regard to social relations. This value structure combining both traditional and Western norms raises the question of how much change has really occurred. If cultural integrity can be achieved by retaining some traditional values as well as by adopting some newly acquired ones, the eventually stabilised Korean value structure will only be identifiable after the country has passed through the present period of rapid social transformation and industrialisation.

Residence Choice of Korean Scientists and Engineers

The preference of KSEs' residence choice changed dramatically over the three decades under study—preferring America in the 1960s and Korea in the 1980s. The pattern of change in their residence choice and explanations for this will be discussed in the following. Explanations are based mainly on the survey conducted in America and Korea. Assuming that the KSEs take into account various factors while making their residence choice, the survey covered not only their education and career paths but also their attitude and values. In analysing and interpreting the survey results, the information provided earlier—the cultural background and socio-economic changes of Korea over the three decades—should be taken into consideration.

Korean Students, Scientists and Engineers in America

The number of Korean students who went abroad for higher education rose sharply in the 1980s. While this phenomenon was supported by the strong economic performance of the country, it
was facilitated by a change in the Korean government’s policy on foreign study. Throughout the 1960s, the Korean government took a restrictive position on sending students abroad. In 1964, for example, eligibility for foreign studies was restricted to college graduates. Students who wanted to study abroad had to pass a government-sponsored qualification exam and men had to complete three years of military service. Because of chronic foreign exchange shortage, Korean students did not have enough foreign currency to be able to finance their studies abroad. Besides, the Korean economy of the 1960s was so poor that only a few students could afford to pay the cost of foreign studies through their own savings or family support. Without a scholarship or fellowship from a foreign institution or international organisation, most Korean students could not pursue higher education abroad. Another major difficulty was the lack of reliable information on foreign institutions’ programmes and entrance requirements. Since information on America was easily accessible and because of the availability of various financial aid programmes, the majority of Korean students who studied abroad went to America.

These trends continued throughout the 1970s. Although the Korean economy was growing rapidly and domestic higher education was expanding, foreign education was still regarded as a privilege. Minor changes were made in the regulation of study abroad during the late 1970s, followed by a major liberalisation in 1981. Minimum domestic education requirement was reduced to the completion of high school; men who had not yet completed their tenure of military service were allowed to study abroad; and the foreign study qualification exam was abolished. These changes led to a large increase in the number of students going abroad for higher education.5

As Table 4 shows, liberalisation of the rules governing studies in foreign countries was followed by a large increase in the number of Korean students in America. In 1993, the number of Korean students enrolled in American institutions was 31,080, the fifth largest group of foreign students in America. The number of Koreans receiving doctoral degree in the US also increased rapidly. In 1993, 1,118 Koreans had a doctorate in science and engineering. This surge in the number of Korean doctorates has a significant influence on the composition of Korea’s professional workforce.
In this regard, an examination of their return or stay choice patterns will help to understand the Korean science and engineering manpower situation.

Changing Trend in Residence Choice of Korean Scientists and Engineers (KSEs)

Even though the migration of scientists and engineers has been analysed as a whole, the phenomenon is fundamentally composed of individuals' residence choice (Borjas and Tienda 1987; Katz and Stark 1987; Kwok and Leland 1982). Therefore, identification of the individual's choice pattern and affecting factors will assist in determining the implications of the issue and to design policies to cope with it. Song (1991) studied the choices of Korean scientists and engineers and obtained personal information through a mail questionnaire survey. The survey was conducted on a sample of 1,981 individuals from a population of 3,242 KSEs who were identified as having obtained their doctorate in America between 1960 and 1987. In this mail questionnaire survey, 838 people responded and

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**Table 4**

Korean Students and PhD Recipients in America and Korea, 1960–93

<table>
<thead>
<tr>
<th>Year</th>
<th>Korean Students in America*</th>
<th>Annual Korean Science and Engineering PhD Recipients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number in the USA (All Fields)</td>
<td>Rank as Foreign Students</td>
</tr>
<tr>
<td>1960</td>
<td>2,310</td>
<td>6</td>
</tr>
<tr>
<td>1965</td>
<td>2,666</td>
<td>7</td>
</tr>
<tr>
<td>1970</td>
<td>3,857</td>
<td>10</td>
</tr>
<tr>
<td>1975</td>
<td>3,260</td>
<td>11</td>
</tr>
<tr>
<td>1980</td>
<td>6,150</td>
<td>14</td>
</tr>
<tr>
<td>1985</td>
<td>18,660</td>
<td>3</td>
</tr>
<tr>
<td>1991</td>
<td>25,720</td>
<td>5</td>
</tr>
<tr>
<td>1992</td>
<td>28,520</td>
<td>5</td>
</tr>
<tr>
<td>1993</td>
<td>31,080</td>
<td>5</td>
</tr>
</tbody>
</table>

* For years before 1980, the figures shown are the average for the five years following the years in question (1960–64 for 1960).

**Sources:** Institute of International Education (1995).
their answers were analysed. Although the survey could have a bias (such as omissions in population), non-response from nearly half of the sample was the prime source of the bias, as is true with most mail surveys. The validity of the survey results was checked by comparing some key characteristics of the sample directly with those of the mother population, for instance, by comparing the respondents’ major fields by their PhD years with that of the population. In general, no noticeable discrepancy that could jeopardise the validity of the results was observed.

The survey results revealed a shift in the residence choice of Korean scientists and engineers from America to Korea over the last three decades. Most of the KSEs who received their doctorate in the 1960s chose to stay in America, only 16 per cent of them returned to Korea eventually. In contrast, nearly two-thirds of the KSEs who earned their doctoral degree in the 1980s returned to Korea by 1987. A substantial proportion of the 1980s group returned after a short stay in America, mainly after securing postdoctoral appointments (see Table 5).

<table>
<thead>
<tr>
<th>PhD Year</th>
<th>Number of Respondents</th>
<th>Stay in the USA (%)</th>
<th>Return to Korea just after PhD (%)</th>
<th>Return to Korea after Work in the USA (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before 1970</td>
<td>118</td>
<td>83.9</td>
<td>3.4</td>
<td>12.7</td>
</tr>
<tr>
<td>1970–79</td>
<td>276</td>
<td>67.8</td>
<td>10.1</td>
<td>22.1</td>
</tr>
<tr>
<td>1980–87</td>
<td>396</td>
<td>31.6</td>
<td>39.4</td>
<td>29.1</td>
</tr>
<tr>
<td>Total</td>
<td>790</td>
<td>411</td>
<td>188</td>
<td>191</td>
</tr>
</tbody>
</table>

When the KSEs first arrived in America, a majority of them expected to return to Korea after obtaining their doctoral degree. A higher population of the 1960s group changed their mind and stayed in America, whereas a smaller proportion of the 1980s group changed their mind.

Factors Affecting Individual KSEs’ Choice

During the period under study there were no significant differences in the personal conditions and perceptions of the KSEs when they first came to America. The background of the KSEs who received
their doctoral degree in the 1960s was similar to that of the 1980s group when they first came to America: their average age was around 27 years; 52 per cent were single; 86 per cent came to America as students; 62 per cent had worked in Korea for four years on average before coming to America; and more than 60 per cent intended to return to Korea after obtaining their degrees. However, their experience and changes in personal situations during and after graduate work seem to have played a major role in their residence decisions. Apart from changes in personal situations, the most important factor which affected their choice was the difference in economic conditions between America and Korea at the time of making their decision.

Following the improvement in Korea's economic conditions, as was the case in the 1980s, the value framework stemming from cultural differences between the two countries became more apparent as a determinant of the return rate. High prestige attached to teaching in Korea was a major factor influencing the KSEs' decisions. Under the Confucian hierarchical value structure of Korean society, teaching jobs have traditionally been regarded as very prestigious and, thus, teaching has been the most preferred occupation of the educated elite. Whether the KSEs have major family related responsibilities (either in Korea or America) is another critical factor affecting their decision.

Job and Career

After obtaining their doctorate, the KSEs' need for training/experience and desire for accomplishment were the primary reasons for staying in America. Also, if they found good jobs in America, they were more likely to stay. If, however, they were sent by Korean organisations, especially educational institutions, their obligations seemed to influence their immediate return.

While the need for experience naturally decreased as they stayed longer, many KSEs in America found that the opportunity for career growth in their present jobs was lower than what they had initially expected, and they expected better career prospects if they returned to Korea. However, a majority of them expressed difficulties in finding desirable jobs in Korea. This is clearly reflected in their identification of having a good job in America as a major reason for staying in America. More than half of the KSEs in
America were willing to accept jobs in Korea, provided they were their preferred jobs, mostly teaching jobs. A slightly lower but still a substantial proportion of the KSEs in America responded favourably to accepting temporary jobs in Korea.

Among the KSEs who worked in America after obtaining their PhD, a higher number returned to Korea when they felt that their further career development was blocked. Although their self-evaluation of accomplishment in America did not differ from that of KSEs in America, a higher number of the KSEs who returned to Korea compared to those who stayed in America reported that they felt that their career prospects in America were unfavourable. In addition, race or national origin was more commonly identified as a serious disadvantage by the KSEs who returned to Korea than those who stayed in America.

Among the KSEs who returned to Korea, a significant pattern of job change was observed in favour of teaching jobs. A high proportion of the KSEs in Korea holding teaching jobs (84 per cent) did not wish to change their jobs. On the other hand, corporate research jobs that have the opposite characteristics of teaching jobs have more defectors than other jobs. The main attraction of teaching jobs is social prestige and job security, while corporate research jobs are paid higher (about 50 per cent more than teaching jobs) but have less security and far less social prestige or honour. The same preference for teaching jobs and their merits were identified by the KSEs in America while describing their preferred jobs in Korea.

The KSEs' reported income in America in 1988 was two to three times higher than that in Korea. Since their reported income in America was ten times higher than that of Koreans in 1960, the KSEs' income in Korea has improved considerably over the three decades. Differences in prevailing salaries for an individual's present job in America and Korea do not appear to be a major factor in the KSEs' residence choice. Besides specific job characteristics in Korea and other personal considerations seem to offset the income difference between the two countries.

While the KSEs in America reported diverse jobs and work activities, more than 90 per cent of the KSEs in Korea were engaged in teaching and R&D activities. The recruitment of KSEs by private companies is increasing in recent years, with higher income being the major attraction.
Family, Personal Situation and Children’s Education

The KSEs in America cited their family situation as another major reason for staying in America. However, for those who returned to Korea, being reunited with family and friends in Korea was a major motivation for their return. Since most of the KSEs in Korea had lived in America for a relatively short period, their concern about their family in Korea (for example, parents) was a serious consideration. When the KSEs stayed longer, family’s adjustment and assimilation to the American way of life were likely to make them shift their family concerns from Korea to America (Zeckhauser and Samuelson 1988).

The family situation of the KSEs who stayed longer is reflected in the problem of their children’s proficiency in Korean language. In particular, when their children reached middle or high school (11 to 18 years), the problem of Korean language proficiency was a serious consideration in their return decision. About one-third of the KSEs in America expected their children to face serious adjustment difficulties if they returned to Korea. A high proportion of the KSEs who had returned to Korea in spite of their children’s Korean language problem wanted their children to live in America.

Few of the KSEs were women. This reflects the bias of Korean society which discourages women from pursuing professional careers in science and engineering. Surprisingly, there was no significant difference in residence choice among eldest sons. As eldest sons are primarily responsible for taking care of their parents and family, it was expected that a higher proportion of eldest sons would return to Korea.

On an average the KSEs took five years to complete their doctoral studies and received degrees at the median age of 32. Reflecting the increasing tendency for recent graduates to return, the KSEs in America were seven years older on an average than those in Korea. There was no noticeable difference in the quality of KSEs’ PhD awarding institutions between the KSEs in America and Korea.

The KSEs financed their graduate study mainly through university related support. In recent years, more KSEs have received financial support from Korea. If they are financially supported by Korean institutions, they are more likely to return to Korea.

Many KSEs who came to America as students changed their immigration status to permanent residents during the period of
their doctoral work and they are likely to stay in America. This tendency was stronger among those who got married during the period of their graduate work.

Perception and Attitude

Both groups of KSEs, in America and Korea, evaluated America more favourably than Korea in various aspects—work attitude, education system, trustworthiness of people, fair evaluation of job performance, work environment, and resources for work. However, they agreed that Korean ‘personal relationships’ were better; each group favoured the way of life in the country where they were living at present. This implies that KSEs preserved their intrinsic emotional framework regardless of their assimilation to the American way of life.

Both groups of KSEs expressed a belief in American dominance as a political power in the world and as a leader in science and engineering. They expressed doubts, however, about the future improvement of the American economy and social situation. Opinions about the prospects for improvement of the Korean social situation were mixed; the KSEs in Korea had a more positive attitude than those in America. Both groups were strongly optimistic that the economic and political development of Korea would continue for the next ten years. Although Korean science and engineering is not expected to be a major contender for world leadership, a small but significant proportion of the KSEs believed Korea has the potential to be a major player at the world level. They had a reserved view on the possibility of Japan’s emergence as a new leader in science and engineering.

The KSEs in America generally perceived their friends in Korea as being satisfied with their return, and evaluated their accomplishments in Korea more favourably than did the KSEs in Korea. In contrast, a smaller proportion of the KSEs in Korea thought that their friends in America were satisfied with their life in America.

In recent years, many KSEs in America have visited Korea to either meet their family or friends or to do business. Before they returned, they maintained contacts with their friends in Korea. As a group, the KSEs who remained in America did not maintain as much contact with their friends in Korea as the returnees did. The information the KSEs in America have about Korea is largely acquired through American sources.
Simulated Probability Assessment of Factors on the KSEs' Residence Choice

The simulated probabilities of the KSEs' return to Korea reveal the significant role of economic conditions. At the time of receiving their doctoral degree, the probability of their return to Korea was quite low: 1 per cent for 1963 (Korea's per capita GNP was 5 per cent of that of America) and 19 per cent for 1983 (Korea's per capital GNP was 12 per cent of that of America). But, three years after completing their doctorate, the probability of the return of the two groups to Korea varied greatly: only 7 per cent among the 1963 group, and 47 per cent among the 1983 group. This variation reflects the effect of changing economic conditions in Korea on the KSEs' decision.

Poor economic conditions in Korea during the 1960s may have forced majority of the KSEs to stay in America after they earned their PhD. Moreover, KSEs who decided to stay temporarily in America may have found it difficult to return to Korea after the originally intended stay: they either changed their mind or expected to remain in America for a long time. Among those who earned their doctorate in recent years and decided to stay temporarily in America, however, there is a growing tendency that they would return after a short period of time. Although most KSEs do not return home immediately after receiving their PhD, the improvement in Korea's situation seems to work against an extended stay in America.

The effects of personal conditions are different, depending on the economic situation at the time of taking the decision. At the time of receiving their PhD, job availability and concern for career development accounted for 14 per cent difference in the probability of return to Korea for the 1963 cohorts, and 58 per cent for the 1983 cohorts. The KSEs who perceived some kind of obligation to their home country and regarded lifestyle an important aspect of their lives were more likely to return to Korea: 7 per cent among the 1963 cohorts, and 37 per cent among the 1983 cohorts. Whether the KSEs strongly identified personal or family matters in Korea accounted for 2 per cent difference for the 1963 cohorts, and 22 per cent for the 1983 cohorts. Other personal attributes revealed similar patterns of differences between the two cohorts. These results and analyses at other decision points reveal two major
issues in explaining KSEs’ choice behaviour. First, when KSEs received their PhD, economic conditions and career related concerns were the main factors affecting their residence choices. In fact, Korea’s poor economy in the 1960s was a dominant factor inducing KSEs to stay in America. Second, as Korea’s economy made substantial progress, the KSEs’ choices were significantly affected by their personal characteristics or perceptions.

Government Policies: Underlying Assumptions and Policy Leverages

Maximise Benefit Generated by the KSEs in Korea: Korean Policies in the Earlier Period

Innovation and improvement of production are mostly carried out by those with formal education. Therefore, training and education are indispensable for enhancing the capacity of talented human beings. Government policies in the 1960s and 1970s were directed to ‘repatriate as many KSEs as possible in the earlier period of their careers’. Though the government devised and applied various incentives to this end, they were effective only in a limited sense.

One of the measures taken by the Korean government to counter the problem of brain drain was to provide financial support to the KSEs. From 1968, the Korean government financed moving expenses of those KSEs who were planning to return to Korea and living costs of temporary visitors. Even though these financial incentives were beneficial to the KSEs, they failed to significantly affect the KSEs’ residence choice itself: Most KSEs who temporarily visited Korea returned to America just after a short stint. Another measure adopted by the Korean government to counter the problem of brain drain was to provide strings-attached financial aid to those going abroad for studies. But that obligation was occasionally disregarded by the aid recipients. Lack of effectiveness of the earlier incentives cannot be attributed to the Korean government’s ineptness. Rather, the reason must be traced to a fundamental problem—their reluctance to return to the then economically less preferable Korea. In the light of this situation, all that the Korean government could effectively do at that time was to impose rather stringent qualification requirements for Korean students to go abroad.
If Korea’s economy maintains its current pace of expansion, the gap with the American economy will be steadily narrowed. In addition, if the present momentum of Korea’s political development sustains, the proportion of KSEs who intend to return to Korea should grow. In spite of these favourable trends, however, some KSEs may still prefer to remain in America for a variety of reasons: some may be compelled to stay in America for professional career development; others may find the American lifestyle more attractive; and still some others may find it economically more lucrative to remain in America. Thus, as long as America’s science and engineering sectors continue to recruit foreign students, some KSEs will choose to remain in America (APAPPI 1994; De Palma 1990; Mann 1990; Stark 1984). It is neither desirable nor realistic for all Korean students to return immediately upon completion of their studies. Since the pro-stay KSEs can serve as a well placed channel to funnel the advances of American science and technology to Korea, they can be considered an important component of Korea’s overall scientific and technological development.

The reversal of the trend in the 1980s highlights both the increasing leverage of government incentives and the importance of government role in ‘controlling’ the flow. The study reveals that the KSEs’ choices are no longer dominated by economic considerations alone. Their choices are also affected by numerous other concerns, including family, personal compatibility, and career prospects. Some of these concerns are susceptible to policy incentives. Thus, the Korean government at this point has important levers to control the KSEs’ decisions. From the mid-1980s onwards, the Korean government’s policies in relation to the KSEs have been changing in accordance with this line of logic: scout the most needed among the experienced KSEs and let the remainder decide for themselves.

Giving Emphasis to Temporary Visitors

In 1990, the programme to finance the moving expenses of returning KSEs came to an end. It was recognised that travel expenses did not work as a significant factor in residence decisions. On the contrary, the policy to fund the living expenses of temporary visitors was expanded. This policy applies not only to prominent
KSEs but also to foreigners who are likely to make contribution in Korea to international cooperation in R&D activities.

Introduction of ‘Brain Pool’

In 1994, the Korean government introduced the so-called ‘Brain Pool’ programme. This programme is aimed at enabling local universities and government sponsored research institutes to hire overseas trained KSEs for short periods. Invited KSEs, funded by the government, are supposed to teach or engage in R&D for one year and may renew their contract up to three years. These temporary positions are intended for mid-career scholars with research or teaching experience (presumably more than five years). During their stay in Korea, they have the opportunity to become acquainted with the Korean situation and may even seek permanent positions.

Allowing Research Institutes to Establish Independent Graduate Schools

Beginning 1997, government funded research institutes are allowed to establish their own education branches (at the graduate level). Surveys reveal that most KSEs prefer domestic university positions rather than those in private companies or research institutions. In fact, every year a substantial number of the KSEs who hold positions in research institutes, public or private, quit their jobs in favour of university positions. They prefer the high prestige and social status attached to professorship rather than the lucrative economic incentives of private sector jobs. The market mechanism and the changing public perception may eventually correct this imbalance, but only after a considerable period of time. The education branch of research institutes will grant the KSEs the title of a professor and researcher at the same time. This will enable the KSEs to enjoy both the prestige of professorship and the opportunity for career development in research.

Postdoctoral Appointment for Junior KSEs

Korean institutions are encouraged to offer postdoctoral positions to the KSEs who are seeking employment in Korea. While enhancing their competency, it is believed that the KSEs under this arrangement have better chances of finding permanent positions. The policy also includes measures to support overseas postdoctoral
appointments for the KSEs who received their doctorate in Korea. These measures are useful in laying the foundation for international exchange and cooperation among junior scientists and engineers.

Helping KSEs Organisations’ Activities and Networking

The Korean government is reinforcing the support for Korean scientists and engineers’ organisations abroad. Certain activities of associations in America, Japan, and Europe are sponsored by the Korean government. It was found that the KSEs who maintained good contacts with Korea were more likely to return to Korea. A useful information channel has been effectively constructed through these professional organisations. The database of these organisations serves to connect domestic demand and the KSEs with the needed expertise. These organisations also disseminate information on Korea’s progress in the members’ fields as well as general changes in the country’s situation. More complete information on Korea would help the KSEs in their decision by removing sources of misjudgment and bias. An established channel also enables the Korean industry or academia to keep track of experts in various fields and to recruit them when specific needs arise.

Policy Shift over Three Decades

As indicated by the fact that these policies were introduced largely in the 1990s, it was not until recently that the Korean government’s shift on the position regarding brain drain has become a reality. Even though the need for change was recognised during the 1980s, the government took time in implementing specific policy measures. New policies are basically designed to help the KSEs decide for themselves, but also allow them to have enough information and chance for choice. These policies are based on somewhat different ideas from those of the 1960s, that is, those of nationalists (Adams 1968). While the nationalists’ view is supported by countries experiencing brain drain, Korea’s new policies may have been formulated encompassing the reverse brain drain phenomenon.
Concluding Remarks

It should be reiterated that economic factors are central to the understanding of the brain drain phenomenon. Differences in the structure and level of economy between the host and home countries are the starting point of the problem. In the case of several newly industrialised countries (NICs), the return of expatriate scientists and engineers seems to be due in large part to the establishment of science and engineering infrastructure, coupled with substantial progress in their economies. But given the fact that, even though there still exist substantial discrepancies in living standards and social infrastructure between the advanced countries and the NICs, a large proportion of overseas trained professionals return to their country of origin, the effect of non-economic factors cannot be ruled out. It must be stressed that the cultural background that determines the frame of reference was found to be particularly important in the KSEs’ choices.

Both traditional brain drain and the unanticipated return of long-time expatriates (‘reverse brain drain’) raise some complex policy issues. Although developing countries are trying to retrieve the talent educated abroad, it is difficult for these countries to ensure proper jobs for returning expatriates. Instead of focusing simply on potential losses of the talent, discussions of brain drain must consider another aspect of the issue: how to optimise the expertise of available human resources to meet the goals of national advancement. To the extent that policies are designed to maximise the number of returning students, they must rely on incentives rather than command-and-control approaches. As demonstrated by the Korean experience in the 1960s, however, incentives are effective only in a limited sense. It will not be until overall economic conditions of the country reach a certain level—not necessarily equivalent to that of advanced countries—when well designed incentives may work as useful policy leverages. It is from that point on when policies reflecting country specific aspects (culture, lifestyle, family relations, etc.) may begin to work effectively. In order to be able to design such policies, a comprehensive investigation should be conducted on related issues.

The Korean case demonstrates the significant role of culture specific aspects in the KSEs’ decisions. This may be the case in countries with similar cultural backgrounds, such as the Far Eastern
countries. Many students-turned-immigrants from Asia took up professional jobs in America over the last three decades, constituting a substantial part of foreign scientists and engineers in America currently. Despite their stable social and economic status, their assimilation into American society and their attitudes toward their native countries seem to differ significantly from those of European immigrants. Because many aspects of the underlying orientation of the KSEs will not be much different from other Asian scientists and engineers (especially those from countries influenced by Confucian ideas), the findings of this study should be pertinent to them.

A particularly relevant group to which the findings of this study are applicable is Chinese students in America (Oh 1977; Mann 1990). At present, the number of Chinese students in America is far greater than those from most other countries (44,380 in 1994). Many Chinese students who obtained their doctoral degrees expressed their intention to stay in America. They face a dilemma comparable to that of the KSEs in the 1960s and 1970s. Although they want to return to China, poor living standards and inappropriate working conditions in China compel many Chinese students to stay in America. In addition, political concerns also influence their decision to stay in America. Their comparison of option would involve many aspects that are identified in the KSEs' decisions in the earlier years. If so, the Chinese government could utilise information from the present study to offer incentives to Chinese students to lure them back home.

NOTES

1. This description of Korea's past economic development and science and technology situation is based upon following reports: Linsu Kim (1993); Chong-Ouk Lee (1991); Won-Young Lee (1995); OECD (1996); Science and Technology Policy Institute (1995, 1997).

2. Ingredients of Buddhism, Taoism, and Shamanism have their roots in Korean tradition. Christianity was legalised in Korea in the latter part of the nineteenth century and was instrumental in modifying the values and behavioural patterns of modern Koreans.

3. Arts, business and manufacturing were professions of the lower class in traditional Korean society. Law, foreign languages, medicine and astrology were
inherited professions of a small group whose class was placed between yangban and the commoner. Military career was also regarded inferior to those of Confucian scholar-officers.

4. In Korea, individualism is sometimes interpreted as self-centredness, defying duty to the community.

5. This reversal of the Korean government's position on foreign study was one of the hastily planned reform policies of the Fifth Republic (1980-87). Although many of those reform measures were later criticised and repealed, the 'liberalisation of foreign study' survived with a few minor modifications. Because the policy was an effective way to meet Korea's explosive demand for higher education, the government is unlikely to revert to its former restrictive position.

6. Data presented here were obtained through a survey conducted by Song. Samples were drawn from a population of 3,242 US trained Korean scientists and engineers—those who identified themselves as a Korean or being of Korean origin, and had earned their doctoral degree in the US in the fields of natural sciences and engineering between 1960 and 1987. According to the US National Science Foundation data, there were 3,242 such Koreans. At the time of the survey in 1988, 1,545 of them were identified as living in America and 1,411 in Korea. Song mailed 998 questionnaires in America and 983 in Korea. Of these, 432 and 406 questionnaires were returned. Song personally interviewed 87 KSEs to supplement the mail survey. While the survey data provided information on individual KSEs' family situation, job and career, and perception and attitude, indicators of the external situation (economic, social, and political) in America and Korea were derived from published statistics. The data were analysed using several complementary approaches—descriptive comparison of the KSEs who returned to Korea and those who stayed in America, analysis of an observed discrepancy between intention and action, and discrete choice analysis.

7. The salary gap between the two countries narrowed continuously. In 1996, a recruiting director of a Korean chaebol (conglomerate) reported that the annual salaries offered to KSEs in Korea in high tech fields were equivalent to, or even higher than those of the KSEs in America. At present, the average income of the KSEs in Korea is about two-thirds of that of their counterparts in America.

8. To assess the effect of each factor on the residence choice of KSEs, a discrete choice analysis using maximum likelihood estimation was done. It was assumed that the KSEs' decision depended upon both personal conditions and external situations. Indicators for external conditions were selected to represent the political–economic conditions, and science and technology activities in both Korea and America. Most variables on personal characteristics were constructed using the KSEs' responses to survey questionnaires. Probit regressions for the KSEs' choices at the time of receiving PhD, and three years after receiving PhD were done.
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