CHAPTER 4

Conclusions and Lessons to be Drawn

4.1. CONCLUSIONS

In the present research, we have analyzed the relationship between the gross domestic product (GDP) of South Korea and its knowledge capital, physical capital and labor\(^1\), for a period covering more than three decades: from 1970 to 2004. The main question of this research is whether and to what extent R&D has played a significant role in the growth process of South Korea.

In the light of our empirical investigation (1970-2004), there are four major findings. First, based on our model specification, significance has been detected for R&D, represented in the cumulative number of scientists and engineers, over the sub-period from 1980-2004, but we could not detect a significant role of R&D towards economic growth in Korea, over the sample period as a whole. Second, derived from our empirical results, human capital seems to be the true vehicle of the Korean growth. Third, based on our model specification, Korea’s stock of capital does not seem to be significant in its growth process. Fourth, based on our theoretical analysis, the government's growth policies, and its dedication for the attainment of its targets seem to contribute to Korea's distinguished record of growth along the developmental path.

The first finding, namely the insignificant role of R&D in growth, is not entirely new. It has been reported in a number of earlier papers. Griliches (1980), found that the R&D coefficient in US manufacturing industries failed to achieve statistical significance during the period

\(^1\) Knowledge capital of a country is usually defined in literature (and in this research) by the cumulative R&D investments or the total number of scientists and engineers; Labor input is defined as either the number of laborers employed in all industries or the average working hours per week.
from 1959 to 1977. Others have found the same results, as quoted in Lichtenberg and Siegel (1989), notable among them are E.C. Agnew and D.E. Wise in 1978, Albert Link in 1981, and F.M. Sherer in 1981. Scherer (1983), in his study on the US industry, concluded that R&D has had insignificant impact on productivity during the 1960s and 1970s. Jones (1995), in his time series tests of endogenous growth models applied on a sample of OECD countries (not including Korea), provided empirical evidence against the R&D-based models, and stated that these growth models are inconsistent with time series evidence over the period from 1950 to 1988. However, what is new in this research is a confirmation of this finding on the scale of an Asian tiger, South Korea, using more recent data sets. The figures used and the data sets manipulated in this research cover three decades and more into the 2000s, specifically 2004. So it gives a more recent evidence of the role of R&D in the economic growth of that country. In addition, we would like to draw attention to the point that by taking certain sub-periods in the case of South Korea, high significance could be detected for R&D.

Although the 'knowledge capital' alone does not appear to have much influence on Korea's growth over the period as a whole, human capital seems to be the true vehicle of the Korean growth, not its stock of capital, which is our second finding. The distinguished role of human capital can be obviously detected from the significant coefficient of the labor variable, which is represented in the form of the total number of laborers employed in all industries. All regressions that were run using Korea’s laborers employed in all industries showed high significance of their coefficients. So, taking into regard here, in our case study of South Korea, that the Korean laborers are well-educated, highly-trained and competently-qualified, we can safely say that they are the human capital of South Korea. Moreover, they are the pillars of the Korean industries, their innovative activities and R&D as well. It is worth noting here as well that the cumulative number of scientists and engineers, which was used as an indicator of R&D in Korea, showed significance in the sub-period from 1980-2004, the case which support this finding.

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Our third finding indicates that, based on our model specification, Korea’s stock of capital does not seem to be significant in its growth process. This finding is against what Young (1994, 1995) and Krugman (1994) have said. In his study the Newly Industrialized Countries (NICs) which covered a period from 1960 till 1990, Young (1994) asserted that "rapid factor accumulation, of both capital and labor, explains the lion's share of the East Asian growth miracle, both in the aggregate economy and in the manufacturing sector." Then again in his 1995 article, Young demonstrated the fundamental role played by factor accumulation in explaining the extraordinary growth of the four Asian tigers.

Along the same lines, Krugman (1994) emphasized that there is nothing miraculous about the successes of Asia's tigers. In his opinion, the NICs have achieved rapid growth in large part through an astounding mobilization of resources; i.e. their rise was fueled by increasing inputs of machinery, infrastructure, and education. "Asian growth [...] seems to be driven by extraordinary growth in inputs like labor and capital rather than by gains in efficiency." Given that the application of these factors is subject to diminishing returns, Krugman wrapped up with the necessary slow down of East Asia's growth rates. However, on closer inspection, we find that Krugman's conclusion is not necessarily true. Until now Asia's tigers still exhibit high growth rates opposite to what Krugman expected eleven years ago, the case which shed a lot of doubt on Krugman's conclusions.

The fourth finding is that the government’s attitude toward growth and its dedication to achieve the objectives of its plans certainly influence its position among countries in the development path. Through examining Korea’s history since the 1960s, in our theoretical analysis, we find that Korea’s government consistently put growth and catching up with the developed countries as its ultimate objectives which Korea used to work on achieving. Therefore, its five year plans and policy objectives always reflected its ambition of growth.

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Korea's plans and policies always targeted the best performance and a more advanced ranking among the developed countries. The first five-year plan (1962-66) targeted a growth rate of 7.1, with the objectives of poverty alleviation and establishing the foundations of self-sustaining economic development; and fortunately it ended up with a growth rate of 7.9 per cent. The second five-year plan (1967-71) planned a growth rate of 7 per cent, with the objectives of modernization of industrial structure and promotion of self-sustaining economic development; and again it accomplished a much more higher growth rate of 9.7 per cent. The third five-year plan (1972-76) targeted 8.6 per cent growth rate, with objectives of harmonizing growth, stability and equity, realizing self reliant economy and balancing national and regional development. Yet again, a 10.2 growth rate was achieved, to continue in the growth process. However, the fourth five-year plan (1977-81) did not accomplish much of the desired growth. The government targeted 9.2 per cent, yet only 5.7 per cent was achieved. The reasons behind that drop of the expected growth rate were many as mentioned earlier in chapter two: the sociopolitical unrest caused by the assassination of President Park Chung Hee in 1979, the most disastrous domestic rice harvest since 1962 due to a severe cold weather, and the effect of world economic developments, such as the drastic increase in world oil prices in 1979. On the other hand, Korea was able to recover from this crisis by initiating its fifth, sixth and Seventh five-year plans (1982-1996) with major objectives of manpower development, reorganization of education and training and the promotion of science and technology. As a result, growth rates jumped to 9.9 per cent in 1991 and slowed down a little in 1996 to be 7.1 per cent.

In its New Economy five-year plan (1993-97), Korea's objective was bringing the economy up to the level of advanced countries. Therefore, it worked on certain policy directions: strengthening growth potential of the economy, expanding international marketing, improving living conditions and reforming institutions, administration and work ethics. However, due to the 1997 crisis, the economy started to deteriorate. The 1997 real GDP growth rate went down to 6 per cent, then got worse to be a negative 5 per cent in 1998, which never happened since the 1980's severe recession. Nonetheless, The government of Korea has launched many economic reforms to avoid the occurrence of such a crisis again. Its efforts included: financial

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sector reform, corporate sector reform, labor reform. As a result of its successful efforts, Korea was able to reach a growth rate of 9.3 per cent in 2000.

As a demonstration of its continued efforts, the government of Korea encouraged moving away from labor-intensive to capital- and technology-intensive exports, and launched its *Heavy and Chemical Industries* (HCI) promotion program in the 1970s. After 1980, the proportion of heavy and chemical industries exceeded that of light industries. So, "Korea jumped straight from the early industrial stage to the late industrial stage as a result of the government's policies in the 1970s. By the late 1980s, it was starting to resemble a mature advanced economy."6 Throughout fostering the heavy and chemical industries, the government's policy was to encourage existing firms to increase their production capacity. However, after 1981, the government supported the establishment of new firms, and accordingly the number of firms started to increase rapidly.7

So, based on our empirical results, Korea’s investment in human capital appeared to be a highly significant determinant of its distinguished growth, rather than its R&D efforts, in addition to its flows of physical capital. Physical capital and labor appeared to be highly-significant in South Korea's growth, rather than its R&D efforts, over the sample period as a whole. However, based on our model specification, significance has been detected for R&D over the sub-period from 1980-2004. Furthermore, R&D's inclusion as an additional variable explaining the growth performance slightly improved Korea's growth model specification over the same period. It is worth noting as well that the government's growth policies, and its dedication to the attainment of its targets contributed to Korea's distinguished record of growth on its path to development.

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7 ibid, p.28
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4.2. LESSONS TO BE DRAWN

Over the past four decades, South Korea has transformed itself from technologically backward and poor, to relatively modern and prosperous economically. It has experienced more than a four fold increase of per capita income over the period.\(^8\) “It took the United Kingdom, the United States, France and Germany eighty years or more, beginning in the 19\(^{th}\) century to achieve such growth.”\(^9\) Therefore, the exemplary performance of the Asian tigers including South Korea and the question of how they did that were of huge importance to researchers. In this section we are trying to investigate some major causes of Korea's growth to come up with lessons to be drawn for the developing countries in general, and Egypt in specific.

Based on our research, it can be concluded that many factors affected the incredible growth witnessed by Korea. It is not just the R&D efforts, or factor accumulation; It is a combination of factors, which should be considered as lessons to be drawn from the Korean growth experience. Among these factors are: efficient government intervention, government policies, trade, investment in human capital, education, the knowledge-based economy and institutional reform.

There is no doubt that Korea’s rapid economic development was led by the government, and the success of the Korean economy involved heavier government intervention than in any other country. However, experiences from various regions of the world do not necessarily say that a strong government tends to lead to economic success. In the Korean case. “it was not more government that had a positive effect, it was better government”.\(^10\) The success of the intervention depends not only on whether the government intervenes more or less, but on whether it intervenes efficiently and in a way that minimizes macroeconomic distortions. The export promotion strategy during the 1960s was essential in the rapid growth of South Korea,

\(^9\) ibid
in spite of the government intervention, which was not much less than elsewhere over the same period. However, Korea’s interventions were neutral regarding the composition of the exports, so that they were market-conforming. On the other hand, its interventions during the Heavy and Chemical Industrialization (HCI) program were different. The heavy-handed controls by the government to promote the HCI resulted in inflationary pressure, emergence of the big conglomerates and widening inequality in income and wealth distribution.\textsuperscript{11}

The above experience of the Korean interventions entails that the nature of the intervention determines the results for the economy. The most effective interventions are those which are market-friendly, while the least market-conforming policies are to fail. Therefore, an important lesson to the developing countries is that in order for the intervention to be constructive, it depends not on its strength but on its market conformity.

**Government policies** are fundamental in helping a country to embark on high growth path. A government has to have a supporting role in the transition to a market economy. It has to see growth and catching up with the developed countries as its ultimate objectives, and work on accomplishing these targets. Government's policies have to reflect these objectives. Among the policies that could be followed by a developing country could be the redistribution policies to combat high income inequality, as persisting income inequality could have negative impacts on poverty and growth. Sound fiscal and monetary policy is required for stable export-oriented exchange rates and narrowing budget deficits. Reforms targeting macroeconomic stability, trade and exchange rate, and freeing domestic markets, are considered the foundations of rapid growth. Furthermore, effective mobilization of idle resources, reallocation of resources to the manufacturing sector, expanding basic industries and infrastructure, developing manpower and promoting science and technology, are other policies that could be followed by the developing countries. Sincere dedication to the achievement of policy objectives is a critical requirement for attaining growth.

One of the major sources of growth in Korea is considered to be a cluster of export-oriented reforms launched in the early 1960s. Its emphasis on trade gave it a way to exploit its

\begin{footnotesize}\textsuperscript{11} ibid\end{footnotesize}
comparative advantage in low-wage labor, support more investment, and start its fast productivity improvement and rapid real income growth. In addition, efforts have been made to attract foreign firms that are export-oriented. Supporting trade and export-oriented firms will help firms be exposed to international competition and encourage them to hunt for new technologies abroad. International knowledge spillovers transmitted by trade could play a dominant role in a country's growth.

**Investment in human capital** and strong commitment to **education** are other pillars backing South Korea's continuing high growth rates. The Koreans realized the significance of education since their early stages of development. They were aware of how crucial the education is to the economic and technological development of their country. The educational strategy of Korea provides important lessons for developing countries. It focused its spending first on the lower grades in order to achieve universal literacy, before expanding spending on secondary and tertiary education. Post-secondary education laid a strong emphasis on vocational training and engineering\(^\text{12}\), thus guaranteeing a supply of qualified labor that fit with Korea's technology policy. A study on Taiwan carried out by Chuang (1999) found that investments in human capital account for almost half (46\%) of its outstanding growth in the aggregate manufacturing industry in recent decades.

In addition, there are wider benefits for the developing countries from education. It is not just the increasing labor productivity that would result from investment in education; it is personal development of people, as well. It is worth quoting Weiss (1995) in this respect:

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\text{Education does not have to be justified solely on the basis of its effect on labor productivity. This was certainly not the argument given by Plato or de Tocqueville and need not be ours. Students are not taught civics, or art, or music solely in order to improve their labor productivity, but rather to enrich their lives and make them better citizens.}^{\text{13}}
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Accordingly, education and investing in human capital should be major priorities of a developing country's agenda to enhance its labor productivity, as well as, enrich its people's lives.

Education and investment in human capital are thus needed for building a **knowledge-based economy**, which is a key to economic development. Knowledge is one of the principal resources for growth in a global economy. Therefore, South Korea has devoted its efforts to transform to a knowledge-based economy. In 2004, Korea was ranked globally the first in high-speed internet, the second in the proportion of internet users, and the third in internet accessibility. As for the knowledge-intensive manufacturing, it was ranked the second among OECD countries.14

With the increasing demand for IT workforce, Korea has placed more focus on IT in education, and designed more training programs on science and technology to increase the educational level of its labor force. So, to develop an information society that provides the opportunity for promoting sustainable development, attention must be given to knowledge and information technology.

**Institutional reform** is a crucial accompaniment to any reform carried out by developing countries. In 1960, the Korean civil service was widely viewed as a corrupt and incompetent institution. In less than two decades, this view has dramatically changed. By the late 1970s, Korea’s bureaucracy had become one of the most reputable in the developing world. Realizing the need for a competent and honest bureaucracy to help him achieve his goal of bringing Korea into the ranks of the industrialized world, President Park Chung Hee, upon his takeover in 1961, reorganized the civil service and replaced the corrupt system with a merit-based one.15 This is an important lesson to be drawn from the Korean experience. Wishing to embark on a high growth path and catch up with the industrial world, a developing country

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has to accompany its various reforms with the institutional reform. The government itself, the civil service, the courts: all need to be well-run and to function effectively. They need to be transparent and uncorrupted. There need be an independent judiciary that can enforce property rights and other contracts; regulators to police commercial codes. These are all important if a country is to be able to continue successfully on the path to development.

Egypt has been transforming its economy into a market-oriented one for the past several years and has been achieving remarkable results. The Korean experience in the socio-economic development could be a good reference for economic planners and policy makers of Egypt to improve and step up their reform policy. However, it must be noted that the policies of South Korea are not easy to replicate. Application of the same policies might not produce as large payoffs as they did in the Korean circumstances. Egypt, or any other developing country, differs to a large extent in terms of its initial conditions, economic and political institutions, and the availability of resources.

Therefore, notwithstanding the aforementioned lessons that might be applied by a developing country in trying to attain high growth rates, some researchers think that the Korean experience is unique and is not replicable. Among the reasons are the Japanese compensation due to their occupation and exploitation of Korea, the unusual amounts of aid extended by the US during the period 1953 to 1963, and the Confucian culture that stresses education and social solidarity and order\textsuperscript{16}. However, thinking that way will lead us to dead ends. Attention must be given to broader lessons from South Korea's experience to be drawn and applied by the developing countries in general, and Egypt in specific.

In a summary of this thesis, empirical investigation has been carried out to evaluate the contribution of R&D, and look for the best model specification explaining South Korea's growth over the same period. Based on our empirical results, evidence showed that human capital was the true vehicle of the Korean growth, rather than its R&D efforts or stock of capital. However, significance has been detected for R&D, represented in the cumulative

number of scientists and engineers, over the sub-period from 1980 to 2004, but we could not detect a significant role of R&D towards economic growth in Korea, over the sample period as a whole. In addition, it seems from our theoretical analysis that the government's growth policies in reforming industry, education and institutions, and its dedication to the attainment of its targets substantially contributed to Korea's distinguished record of growth on its path to development, the case from which we drew many lessons from the Korean experience for the developing countries.