1. Introduction

1.1 INTRODUCTION

South Korea (hereafter Korea) has been a symbol of fast economic growth for several decades. Such achievement has been characterized as a successful “catch-up” in the sense that Korea has avoided the middle-income trap and steadily closed the gap with Japan or the US in terms of per capita income, for instance, reaching 95% of the Japanese level in the 2010s. Given that Japan, in particular Japanese industrial policy, was the role model for Korea, the focus of the earlier literature was on the role of the government vs. markets in catching-up development (Amsden 1989; Chang 1994; World Bank 1993). Subsequently, other views were put forward, such as the technology-oriented view (OECD 1992; L. Kim 1997a), which focused on explaining the process with which a latecomer economy like Korea tried to catch up with forerunning economies by assimilating and adapting the relatively obsolete technology of advanced countries. In this view, catching-up is considered as a question of relative speed in a race along a fixed trajectory or path. However, Lee and Lim (2001) indicated that a latecomer does not simply follow the path of the forerunner, but often skips some stages or even creates a path that is different from those of the forerunners. This observation is consistent with the leapfrogging thesis, which has become a very influential concept after it was first proposed by neo-Schumpeterian economics. Perez and Soete (1988) argued that a changing techno-economic paradigm could serve as a window of opportunity for latecomers who skip investment into the existing vintage of technologies, but leapfrog into emerging technologies.

This book takes up this concept of leapfrogging as the focus, and utilizes this concept to explain the catch-up by Korean firms and economy. An important window of opportunity for leapfrogging by Korean industries was the emergence of digital technology, which Korean firms promptly adopted to produce digital products, whereas Japanese firms were stuck in the incumbent trap of staying with the products of existing analogue technologies. Thus, the two key chapters in this book are Chapter 8 and Chapter 9. Chapter 8 analyzes the evolution of selected industries in Korea in the 1980s and 1990s, and finds three different patterns of catch-up
Economic catch-up and technological leapfrogging

by Korean firms in world market shares, namely, path-creating (mobile phone), stage-skipping (D-RAM [dynamic random-access memory] and automobile), and path-following (audio equipment, PCs, and machine tools). Chapter 9 elaborates on the case of leapfrogging into digital TV by Korean firms, by comparing with the Japanese lock-in with analogue-based high definition (HD) TV.

However, not every latecomer dares to try leapfrogging because of the accompanying diverse risks. Latecomer firms and industries should build a certain level of capabilities before they launch leapfrogging. This was the case for Korea. The country went through the process of capability building along a safe mode of “path-following” catch-up from the 1960s to the 1980s before it switched to rapid catch-up with path-creation or leapfrogging. Similar to other developing countries, Korea used to specialize in labor-intensive goods for export. Wages were low and trade deficits were persistent during the 1960s and 1970s. These two decades were periods of “a rapid growth but a slow catch-up” in income levels compared with Japan. In other word, Japan was growing fast, and thus the gap between the two economies was not closed. Real catch-up occurred only after the 1980s when Korea shifted to higher-end goods backed by the in-house research and development (R&D) of private firms. We consider the mid-1980s as a turning point because this was the time when the R&D/gross domestic product (GDP) ratio of Korea surpassed 1% and the share of the private sector in total R&D expenditure surpassed 50%. Moreover, the intensification of R&D expenditure and higher education laid the basis for sustaining the catch-up growth through upgrading industrial structures. This upgrade in technological capability resulted in a trade surplus for the first time since Korea’s independence from Japanese colonial rule. Hence, building and upgrading capabilities is another key concept in this book that can be used to sell Korea as a role model for economic catch-up and to show the difference between Korean policies and the typical Washington consensus type policies.

In sum, this book presents a new view on Korean firms and the economy by characterizing the country’s long and turbulent journey as “a successful economic catch-up (in income levels) by leapfrogging based on building and upgrading capabilities, especially technological capabilities.” Thus, although this book draws upon existing works of the author, a consistent theme of capability and leapfrogging is used.

This book consists of three parts. Part I deals with catch-up and leapfrogging at the macro or economy level, and starts with an overview on the historical and initial conditions required for economic take-off (in Chapter 2). Part II comprises stories of catch-up and leapfrogging at the industry level. Part III deals with cases of successful catch-up and
leapfrogging by big businesses and small and medium-sized enterprises (SMEs) in Korea, as well as their internationalization.

Chapter 3 is a core chapter given that it presents the essence of the Korean catch-up model as the process of capability building and upgrading. In particular, this chapter discusses intra- and inter-sector upgrading and diversification, such as upgrading into higher-end segments in the same sector and upgrading by entry into the emerging higher-end sectors. The details of this upgrading process are elaborated in Chapter 4 in terms of the changing role of the intellectual property rights (IPR) regimes. The upgrading process is divided into four stages. Another issue discussed in Part I is the management of macro-financial stability to avoid a crisis, which Korea went through in 1997 and 2008. Thus, Chapter 5 discusses the origins of the 1997 crisis and post-crisis reform, and Chapter 6 discusses the similar crisis in 2008 and the reform of the macro-financial system. Chapter 7, the last chapter of Part I, deals with the question as to whether North Korea can also achieve economic leapfrogging to close the gap with the South within a short period.

Although Part III deals mainly with big business (chaebols) in Korea as the pioneer of catch-up, the idea of leapfrogging is extended to deal with the rise of SMEs in Chapters 13 and 14. In particular, Chapter 13 deals with successful catch-ups by latecomer SMEs in an emerging economy (Korea). For instance, dependent or subcontracting firms upgraded into independent or original brand manufacturing firms, and achieved significant catch-up in their global market share. These SMEs created their own paths instead of following forerunners. The paths are neither entirely new, nor have they taken the form of (big-business-style) leapfrogging, but they are characterized by new combinations of the existing paths.

The other chapters (11 and 12) of Part III deal with the case of Samsung as the symbol of the rise of the Korean economy. Chapter 11 elaborates on the development of Samsung Electronics in Korea and the process of internationalization characterized by the establishment of factories abroad. Chapter 12 uses Samsung’s cell phone business in analyzing the impact of business internationalization on domestic jobs through a comparison with the case of Apple.

In sum, unique features of this book include the following.

First, this book looks at the dynamic change of Korean firms and economy from the point of view of catch-up theory, the central premise of which is that a latecomer’s sustained catch-up is possible not by simply following the path of the forerunners but by creating a new path or leapfrogging. In this sense, the idea of catch-up distinguishes itself from traditional views that focus on the roles of either the markets (e.g., Washington...
Economic catch-up and technological leapfrogging

consensus) or the states (e.g., statists or developmentalists). The same framework is applied to the North Korean economy.

Second, this book provides a comprehensive account of the micro- and macro-level changes, or firm- and economy-level changes in the Korean economy, and similarly deals with both firm- and country-level capabilities, as well as the issue of macroeconomic stability to overcome financial crisis.

Third, this book deals with both big businesses and SMEs. The discussions elaborate the details of the rise and upgrading of big businesses, such as Samsung, which has become the symbol of economic growth in Korea. The focus is on innovation capabilities, diversification, internationalization, and job-creation effects. The global rise of SMEs is discussed as well.

What follows is a summary of each chapter divided into the three parts.

1.2 CATCH-UP AND LEAPFROGGING AT THE ECONOMY LEVEL

Chapter 2 discusses the historical origins of the catch-up regime in East Asia, in particular Korea. In economic development, the relative importance of the initial conditions vs. policy choice has always been the issue. Regarding the rapid growth achieved by East Asian tigers, the debate was on whether their success was due to a better strategy of outward-looking export promotion as opposed to an inward-looking import-substitution strategy initially adopted by Latin American economies, or, alternatively, due to better initial conditions such as better state capacity and autonomy, higher human capital formation, and more equal class structure, and so on in East Asia. We are on the side with the view that gives more weight to the initial conditions. This is because the policy-choice-oriented view cannot explain why export-oriented strategy, for example, was selected and worked fine in East Asia (Lee and Lee 1992). Among the initial conditions, state capacity and autonomy was one of the most important conditions, and this is the topic of this chapter.

Thus, this chapter first identifies the common initial condition to be the tradition of the hard Confucian state in East Asia. The East Asian states were Confucian hard medium states filled by respected elite who were autonomous from partisan interests both from the inside and outside of the country. The political leadership viewed economic development as a national imperative and persuaded the society that a strong modern economy was a public good that would benefit every member of society (although in reality the sacrifice of the many might have created disproportionate opportunities for the few). In terms of capacity and autonomy,
the authoritarian regimes in Korea were hard enough to resist partisan pressures from social forces and to convince the population of the public-good nature of economic growth. The state agencies filled by the best elite in the society were capable of mobilizing private resources, motivating people, and implementing well-designed industrial policies. The political stability also contributed to lengthening the time horizons of the private entrepreneurs, enabling long-term planning and investment.

Aside from the existence of a growth-committed hard political leadership and national consensus on the goals, our investigation has identified three important constituents of the catch-up regime. First, state activism in the Korean authoritarian regimes was not only based on purely the political authority of the state, but more importantly on their real economic power, which was derived from the state ownership of banks or loanable funds, where the state’s financial control over big business worked as a highly discretionary and qualitatively different control instrument that was not available in minimal states. Second, their businesses were subjected to a double discipline mechanism—namely, market discipline, especially to exogenous world markets, and market-conforming network discipline based on the intimate long-term relationship between the well-informed state agencies and business. Third, state activism played a part, not in the small-business-oriented private sector, but only in targeted strategic sectors and big businesses where the private–public boundary was ambiguous or did not exist. The above three elements can be the main building blocks of the regimes for economic catch-up. The regime would be based on market operation and private ownership of businesses (except state ownership of banks, a few natural monopolies, or strategic industries) and run by a network of efficient bureaucrats and ambitious entrepreneurs with a strong outward orientation. Clearly, this system is neither a minimal state’s free-market economy nor a maximal socialist state’s planned economy; it is also different from the conventional picture of market socialism by Lange (1937).

Chapter 3 proposes a “capability-based view” on the Korean experience in catching-up development. This approach may be considered as an extension of the technology-based view but wants to keep a distance from the government–market dichotomy as it has a more sound microeconomic foundation. The reason we are taking this view is that the real lesson from the Korean achievement is not from the role of government in economic development but from the fact that it was able to build firms’ capability and thereby sustained growth for several decades. Sustained growth for several decades is not easy, and there are numerous cases where macro-based reform brought in immediate recovery but was not sustained, and eventually the economy fell into another round of crisis. The most fundamental
factor for sustained development is whether to build local capabilities or not. We contend that without some critical degree of capabilities, growth which is based on lower wage rates or simple price competitiveness tends to be short-lived or not sustained.

The discussion in this chapter suggests that the Korean economy had laid the basis for a transition from a middle- to high-income country by building up technological capabilities since the mid-1980s. The mid-1980s is when the R&D/GDP ratio surpassed 1%, the share of private R&D exceeded half to reach around 70%, and the share of corporate patents became larger than that by individual inventors. Based on these capabilities, Korea was able to make the transition from an upper-middle income to a high-income country; its per capita GDP in 1980 was around USD1,673 in nominal terms and USD3,223 in 2000 dollar terms, and it became USD10,890 in 2000 (Lee and Kim 2009: table 1). The tertiary school enrollment rate jumped from around 10% in 1980 to higher than 30% in 1985 and finally higher than 70% in 2000 (Lee 2006: table 5). The R&D/GDP ratio was around 0.7% in 1980, increased to 1.5% in 1985, and was almost 2% in 2000. In contrast, the trade/GDP ratio was already as high as 70% in 1980 and was still around that level in 2000. These figures clearly indicate that it is not more openings but capability building associated with tertiary education and private R&D that has made the transition possible.

The final section of the chapter discusses the issue of the transferability of the Korean model, focusing on the role of the government, the possibility of state activism in the World Trade Organization (WTO) environment, and the role of locally owned firms.

Chapter 4 investigates the role of the IPR system in Korea’s technological catch-up. The detailed overview of the evolution of the Korean system of IPR shows Korea’s dynamic perspective on IPR policy. During the early stages, IPR were granted even to minor inventions or adaptations by local residents while there was less need for domestic recognition of foreign IPR. However, during the later stages, with the growth of technological capacity, the need for international technology transfer and the local market for technology increased. Thus, protection of both domestic and foreign IPR needed to be provided. From the late 1980s, Korea increased substantially the level of IPR protection and expanded the scope of patentable subjects. Korea has now attained the most developed level in terms of the scope of subject matters, including the most recent IPR, like those for biotechnological inventions and business method inventions. Since then, as big business reached the technological frontier, the focus of government policies has turned to the following issues: encouragement of more IPR attainment by SMEs, commercialization/utilization rather than production of IPR, and utilization of R&D capabilities and the role of universities.
We have also found some interesting facts in the trend of several IPR variables over the course of catch-up in Korea. First, in the early days of catch-up, Koreans filed mostly petit patents (utility models) and few regular (invention) patents. Only at the later stages did the share of invention patents grow to exceed that of petit patents. Second, in the early days of catch-up, individual inventors filed patents. Corporations accounted for a small share. Later, the share of corporate assignees grew to exceed that of individual inventors. Third, the relative share between domestic and foreign patents in Korea show more dynamic patterns. In the early days, foreigners had no interest in Korean IPR and thus filed no patents, which led to the dominance of the domestic patents. This was reversed at a certain point in time when foreigners were filing the highest number of patents. But, eventually with the growth of the capabilities of domestic inventors (usually firms), the share of domestic inventors increased and they registered a bigger number of patents than those filed by foreigners. The three facts suggest that the importance of patents and IPR had not been seriously recognized by Korean firms until the mid-1980s. Before then, Korea had been accumulating its absorptive technological capacity with focus on utility model patents. Then, only beginning in the mid-1980s, they began to aggressively invest in their own in-house R&D, which led to the rapid building up of indigenous R&D capabilities.

This chapter finds that the IPR system in Korea was similar to the Japanese system. While strict protection of IPR in the early stages of economic growth might have had an adverse effect on technological development, some features of both the Japanese and Korean systems resolved this dilemma. First, both countries had a tendency to grant IPR to inventors with a narrowly defined technological field (Rahn 1983). Second, IPR used to be granted to “small inventions” in Japan. Korea followed suit. Japan has a utility model system which awards IPR to inventors of small inventions that do not qualify for patent rights and are related to less sophisticated devices that serve a practical purpose (Institute of Intellectual Property 2000).

Chapter 5 discusses the unfolding of the financial crisis in 1997–98 and the post-crisis reforms and their impacts. The crisis prompted the Korean government to undertake a number of reforms in finance, corporate governance, and the labor market. This chapter analyzes the dynamics of the reform process and assesses the outcomes of the reforms, which aimed at introducing the Anglo-Saxon economic model. It argues that the reform outcomes were conditioned on the interplay of local-specific conditions and interest politics and that the reforms were intent more on establishing a market-oriented economy than promoting the long-term growth potential and the competitiveness of the economy.
In Chapter 6 a structuralist macroeconomics perspective is taken to interpret the two recent financial crises in Korea, and a new policy framework and reform measures are suggested to build a crisis-resilient macro-financial system in Korea. The chapter focuses on the so-called “Frenkel-Neftci” cycle (Taylor 1998) and the two kinds of expected spreads, namely, interest spread and capital gain spread, which initially motivate foreign financial investment in emerging economies. To establish a crisis-resilient macro-financial system, a new macro policy framework that can be described as “an intermediate system” is proposed, with capital mobility but with explicit options for capital controls, a flexible basket, band, and crawl (BBC) exchange rate system, and relative independence in monetary policy making with a new balance between interest rates and exchange rate targeting. A justification for the intermediate system proposed in this chapter is made because it is not easy to prevent the “two kinds of spreads” from happening simultaneously in a standard (orthodox) open macroeconomic policy setting.

Chapter 7 argues that North Korea can achieve an economic catch-up after decades of economic isolation and stagnation if it tries a specific type of economic opening (leapfrogging) focused on foreign trade and investment in a sustained manner. An analogy has been made with the case of Fujian Province in China, which has accomplished economic catch-up, mainly due to Taiwanese investments. To realize its potential, it is argued that North Korea should treat its foreign direct investment (FDI) from South Korea as intra-Korean investment. The chapter also discusses the diverse modes of engagement with foreign capital that are available for North Korea considering its own capability (absorption or management capabilities), rivalry among possible foreign investors, implications for market structure (monopoly or more competition), the nature of target technologies or facilities, opportunity for learning and transfer, and so forth. Finally, the chapter discusses the economic and political preconditions for such economic catch-up.

1.3 CATCH-UP AND LEAPFROGGING AT THE SECTOR LEVEL

Chapter 8 examines the experiences of selected industries in Korea to identify the stylized facts in the process of technological capability building and thereby to sort out the conditions for the catching-up to occur.

To explain the process, we have built a model of technological and market catch-up. Special attention has been given to the question of whether there has been a case of leapfrogging in any industry in Korea and, if so, what
are the conditions for its occurrence. In our framework, we first measure the degree of catching-up in terms of market shares in the world. Then we focus on catching-up in technological capabilities in explaining the different records and prospects of Korean industries in market share catch-up. In the model, technological capability is determined as a function of both technological effort and the existing knowledge base. As determinants of technological effort, we look at the technological regimes of the industries, such as cumulativeness of technical advances, fluidity (predictability) of technological trajectory, and the properties of knowledge base.

Using this model, we explain the different technological evolutions of selected industries in Korea in the 1980s and 1990s, including the memory chips (D-RAM), automobile, mobile phone, consumer electronics, personal computer (PC), and machine tool industries. We find three different patterns of catching-up: path-creating catching-up (CDMA [code division multiple access] mobile phone), stage-skipping catching-up (D-RAM and automobile), and path-following catching-up (consumer electronics, PCs, and machine tools). We interpret the first two cases of catching-up as “leapfrogging.” Unlike the argument by Perez and Soete (1988), we find that important R&D projects involved both private and public capacities (except automobiles, where there was only private R&D), and that entry was not driven by endogenous generation of knowledge and skills but by collaboration with foreign companies.

Chapter 9 examines the leapfrogging thesis using the case of catch-up in digital TV by Korean firms. Despite the disadvantages implied by the technological regime of digital TV and the risks facing early entrants in trajectory choice and initial market formation, Korean firms had achieved a “path-creating catch-up” in the sense they chose a different path from the Japanese forerunning firms. As they had been closely watching the technological trends and the standard-setting process, there was less risk of choosing the wrong technological trajectory. Also, despite the lack of sufficient capability and core knowledge base, Korean firms had some complementary assets, such as the experience of producing analogue TV, and were able to develop the prototype digital TV and the ASIC (application-specific integrated circuit) chips, given the access to foreign knowledge via overseas R&D posts and the acquisition of a foreign company. To secure the initial market size, Korean firms targeted the US market from the beginning, and their source for competitive advantage was the speedy setting up of the production system for mass production of products at the initial stage. The initial failure of Japanese firms and the success of Korean firms do suggest that the period of paradigm shift, like this toward digital technology, can serve as a window of opportunity for latecomers while penalizing the forerunner.
Chapter 10 deals with the question of why making a catch-up is even more difficult in capital goods industries that are usually led by SMEs. It relies upon the sectoral systems of innovation (Malerba 2004) as a theoretical framework for analysis. From the findings, the chapter has identified three sources of difficulties in the catch-up of the capital goods industry, particularly in machine tools. First, while small firms in the capital goods industry are usually specialized suppliers to big final goods assembly firms in the consumer goods industry or other industries, and thus the tacit knowledge accumulated from the interface between the producer and the customer firms is very important, a serious difficulty lies in the fact that local client firms are reluctant to use locally made capital goods due to their poor quality and low precision level. Second, a typical difficulty arises because incumbent foreign firms often react by charging predatory prices upon news of the local development of capital goods by latecomers. Third, if the catch-up firms overcome this barrier, then the next strategy used by incumbent firms is to charge latecomers with legal actions for patent violations.

Despite these intrinsic difficulties, the Korean economy has achieved a slow but gradual catch-up in the capital goods industry. The chapter attributes such achievement to several factors, including the strenuous efforts of the government, niche markets in general-purpose machine tools and emerging economies, and, finally, the increasing introduction and adoption of information technology (IT) or digital technologies in machine tools. Furthermore, the three sources of barriers to catch-up imply that any latecomer firms that wish to record a successful catch-up should have these barriers in mind from the beginning of the road toward catch-up. We observe that a successful catch-up requires the ability to produce goods of better quality and lower prices than those produced by incumbent firms from advanced countries. After the initial success, they should also be well prepared against eventual or possible attacks by the incumbent firms in the forms of predatory pricing and IPR charges.

1.4 CATCH-UP AND INTERNATIONALIZATION BY BIG BUSINESSES AND SMEs

Chapter 11 explains the success of Korean business groups in the Chinese market, despite their late entry. It uses the concept called “project execution capability” of diversified business groups, which has led to another strategic capability of “vertical integration” (VI) among affiliates. It examines Samsung’s electronics businesses in China as an excellent case of resource sharing and coordination among affiliates in the execution of a
project despite late entry into a new market. The chapter finds that the VI network was first created in the early 1970s in Korea and has since been replicated in many parts of the world such as Mexico, Malaysia, and, most recently, China. The VI network has three tiers consisting of Samsung Electronics at the top as the final assembler, Samsung Electro-Mechanics and Samsung SDI in the middle, and, finally, Samsung Corning at the bottom. In the rapidly changing display market, Samsung’s stable component sourcing among affiliates has played a critical role in developing new products at lower costs to meet changing market needs. This case shows that business groups can upgrade their capabilities rather than simply lose their advantages with the maturing of market mechanisms.

Chapter 12 examines the effects of establishing factories abroad on domestic jobs and the issue of technological hollowing out, using the case of Samsung Electronics’ mobile phone business. It finds that the offshoring of mobile phone assembly to China, India, Brazil, and Vietnam did not result in a reduction of domestic jobs. On the contrary, Samsung’s domestic employment increased from 5,960 persons in 2002 to 20,500 in 2012. This increase mainly reflects a net increase in high-paying jobs (R&D, engineering, design, marketing) while the number of low-paying jobs (assembly) remained stagnant. To cope with possible technological hollowing out, Samsung kept its core engineers/technicians in a special unit, instead of firing them, whenever domestic assembly lines were reduced or foreign lines were established. They were kept inside the so-called “global manufacturing technology center,” with the number of its employees increasing from 80 in 2006 to more than 1,103 in 2011. These employees visit overseas factories to conduct activities such as maintenance, monitoring, re-modeling of assembly lines, and automation. In terms of strategy, Samsung engages in offshoring, but not outsourcing. This is in contrast to Apple, which does both offshoring and outsourcing by contracting with Foxconn.

Chapter 13 investigates how, through the transformation of latecomer SMEs in emerging economies from dependent or subcontracting original equipment manufacturing (OEM) firms into independent or original brand manufacturing (OBM) firms, it is possible to achieve a significant catch-up in terms of share of regional or global markets. Given that SMEs are rarely able to make such a transition, we elaborate this dynamic process by performing case studies on eight Korean SMEs. These SMEs created their own paths instead of following their forerunners. These paths are neither entirely new nor take the form of leapfrogging, but are characterized by new combinations of existing paths. We identify several risk factors, such as counterattacks and intellectual property (IP) lawsuits, that latecomer SMEs face from incumbent SMEs. In addition, we emphasize
the importance of cultivating firm-specific knowledge by engaging in a continuing process of trial-and-error-type in-house experiments.

Chapter 14 develops a new sequential internationalization theoretical framework to explain the processes of internationalization by SMEs from a dynamic emerging economy. It is applied to 18 FDI cases of Korean SMEs in China to analyze the changing map of the division of labor between parent firms in Korea and subsidiaries in China. We have found that the internationalization process has been sequential, reflecting the cautious behavior of SMEs with more resource constraints compared to large firms. They proceeded from a product-based division of labor to a value-chain-based one, and finally to a market-based division of labor between the parent firm and its local subsidiaries. In the first stage, Korean SMEs establish production subsidiaries in China to manufacture low-end goods for re-exportation. In the second stage, the subsidiaries expand production scope to high-end goods, while the parent firm administers R&D, marketing, and production of some high-end goods. In the third stage, as the Chinese market grows in importance with local consumers’ increasing purchasing power, the subsidiaries integrate marketing and local-market-specific R&D with the existing value chains.