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Perfecting the Catching-up: The Case of Taiwan's Motorcycle Industry

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Abstract

The final stage of the catching-up process has formidable hurdles. This paper examines the case of Taiwan's motorcycle industry and shows how latecomers overcame the hurdles. In the early 1990s, the two largest motorcycle makers in Taiwan, Sanyang and Kwang Yang, had completed the catching-up process and became independent from Honda, on which they had technologically depended since the early 1960s. The requisite for independence was acquiring the capacity for product innovation. The two assemblers could cultivate technological capacity by investing abundant resources, which they accumulated in the protected market. It should be noted that although the market was protected and highly concentrated, it was also very competitive. Another condition was the solid local suppliers of parts and components. The local suppliers had also grown under the government's industrial policies. However, their development beyond imitators can be attributed to their own initiatives.

Keywords: Taiwan, Motorcycle Industry, Catching-up

JEL classification: L13, L52, L62, N85, O14

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Introduction

Since Gerschenkron (1962)'s argument about late industrialization, adequate knowledge has been accumulated on the same. Two significant propositions have emerged. One is that latecomers can catch up with the advanced countries by accelerating the process of their industrialization. The other is that government plays a crucial role in late industrialization. This paper attempts to further discuss these propositions and deepen the understanding about late industrialization.

Latecomers try to develop their manufacturing sectors following the path of advanced countries. Gerschenkron indicated that latecomers can achieve their targets if they pursue them at higher speed than they get forward at the frontier. In this process, their most critical challenges pertain to the narrowing technological gaps between them. Amsden (1990; 2001) maintained that latecomers in the postwar period were able to acquire technologies by means of learning and, in this respect, they are significantly different from the first mover, England, which accomplished inventions and from other advanced countries that developed by means of innovation. Latecomers strive to learn about new technologies from the advanced countries in various ways such as imitation, purchase of modern machines and equipments, technology transfer contracts, foreign direct investment (FDI), and subcontracting, as argued by previous studies.

However the existing studies have not paid sufficient attention to one crucial problem: the catching-up process is not monotonous. For instance, Suehiro (2008) comprehends a wide range of arguments on late industrialization, but does not make any explicit reference to this issue. In particular, the final stage of the process has two formidable hurdles. First, the technology that the latecomers need to learn at this stage is more sophisticated and complicated. It should be particularly noticed that more fundamental knowledge for innovation is essentially difficult to transfer because most of it is tacit and deeply rooted in the organizations. Second and more important, in the final stage, latecomers cannot use many channels of technology transfer that they were previously dependent upon. The completion of catching-up implies that firms in latecomer countries acquire the capacity to compete with those in the advanced countries on

equal terms. Therefore, the latter prevent the state-of-art technology from spilling over to the former in order to maintain their leading positions. How do latecomers get through the final stage of being independent and equivalent to the advanced firms? What factors provoke, back up, or obstruct latecomers' challenges? A closer analysis of these questions is indispensable in order to gain a comprehensive understanding on the catching-up process.

Another proposition asserted by previous studies is that government's role is vital in late industrialization. Gerschenkron demonstrated that in a less developed country like Russia, the government needed to exercise a stronger and more direct leadership. Amsden maintains that the government should intervene in market mechanism so as to promote industrialization, since only government's intervention can create opportunities to learn.

On the one hand, this study offers some evidence that supports the views of Gerschenkron and Amsden. On the other hand, however, I try to modify their argument. The previous studies overestimate government's role to the extent that they tend to undervalue the impacts of firms' activities. There is no doubt in the fact that government is capable of improving conditions and encouraging firms' learning; however, in many cases, government is unable to provide them with entirely sufficient incentives or to force them to learn new technology. Further, as long as firms design the details of the learning process, their strong and spontaneous motivations are indispensable. In particular, the final stage of the catching-up process is replete with risks, owing to which the incentives provided by government are not sufficient to encourage firms to step forward. Only if firms themselves realize that the challenges are necessary, they decide to undertake them. Therefore, we have to closely consider the views and behavior of firms as well as the policies of government.

This study attempts to modify the arguments on late industrialization by examining the case of Taiwan's motorcycle industry.[1] Taiwan is, in general, supposed to be one of the most successful cases of late industrialization in the postwar period. In addition, Taiwan's motorcycle industry is a typical case of accomplishing catching-up and overcoming the dependence on

[1] I have written two Japanese papers on Taiwan's motorcycle industry (Sato, 1999; 2006). I integrated these papers into this paper with some significant improvements.

advanced firms. Since many years, Japanese firms have been globally predominant in the motorcycle industry. In particular, Honda has been extremely strong and has retained dominant shares in many markets. Taiwan's motorcycle industry had been dependent on Honda and other Japanese firms since the early 1960s. In the 1990s, however, Taiwan's motorcycle firms eventually succeeded in overcoming Japanese hegemony and becoming independent. Today, no other matches up to Taiwan. How did Taiwanese motorcycle firms accomplish the catching-up process? In particular, how did they overcome the hurdles in the final stage of the catching-up? The answers to these questions might lead to the ones to the general questions mentioned above.

The following argument has two steps. First, I will show the direct reasons for overcoming the hurdles in the final stage of catching-up. Two factors are necessary and sufficient for accomplishing catching-up. One is acquiring the capacity for product innovation. Another is the development of independent parts and components suppliers. As the second step, I examine the reasons for the two factors. I focus on the role of the state, the influence of the structure of the global industry, and the local firms' initiatives by referring to the case of Taiwan's auto industry.

This study has three sections, in addition to a conclusion as well as an introduction. The first section illustrates the catching-up attainment of Taiwan's motorcycle industry by observing its firms, production, export, and outward investment. The second section demonstrates two direct factors for the industry's success in catching up, and the third section argues the mechanisms behind the two factors. The conclusion summarizes the argument, derives some implications, and shows the problems prevalent at the post-catching-up stage.

I Catching-up Process of Taiwan's Motorcycle Industry

In this section, I will show the catching-up process of Taiwan's motorcycle industry by focusing on the period from the mid-1970s to the mid-1990s. This industry finished the catching-up process by the mid-1990s and stepped into a new stage in the late 1990s. I argue this situation at the post-catching-up stage in the conclusion.

Firms and Production

Taiwan's motorcycle industry emerged in the 1950s. In those days, motorcycles were protected from imports, and the quality of the products, which were made of imported parts, was very low. When the government lifted the protection in 1959, local assemblers were immediately weeded out by the imports. Therefore, the actual starting point of Taiwan's motorcycle industry was the establishment of Sanyang Industry, Co. Ltd. in 1961, which followed the reintroduction of the ban on imports in the same year. Sanyang contracted technical assistance with Honda.[2] The subsequent two years saw 11 newcomers including Kwang Yang Motor Co., Ltd., which was technically supported by Honda. A dozen other assemblers entered the market when the restriction on building a new factory was lifted in 1965. In 1968, however, most of them exited owing to introduction of some regulations such as ban on riding a motorcycle below 50 cc. Only twelve assemblers remained by the end of the year. Further, the industry comprised around 10 assemblers, with the exception of several makers' entry in 1980.

Figure 1 shows the production from 1976 to 1995. The production in Taiwan's motorcycle industry was more than 300 thousand in 1976 and had rapidly increased to 746 thousand in the consecutive three years; the scale was only next to Japan in Asia.

The industry stagnated in the early 1980s mainly because of slack economy growth. The slump brought in some structural changes. First, Honda invested in Kwang Yang in order to rescue the company as it lost a large portion of its market shares in the early 1980s.[3] Second, Yamaha and Suzuki groups restructured themselves. They had two related companies each in Taiwan like Honda. Yamaha Motor Co., Ltd. provided technical

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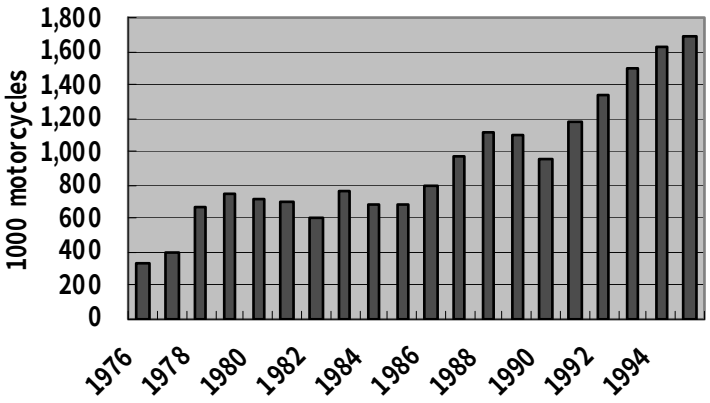
[2] In the late 1960s, Honda began providing Sanyang technical assistance on manufacturing automobiles, and in 1974, it invested in 13% of its equity through its U.S. subsidiary in order to prevent Sanyang from cooperating with the other auto makers (Chang, 1987: 142).

[3] The actual situation is more complicated. Kwang Yang's slump was brought in not only by the shrunk market but also by the battle between Honda and Yamaha (so-called HY War). In 1981, Yamaha also attacked Honda's partners in Taiwan by introducing a new model of scooter into the island market through Wanshan Industry, which Yamaha provided technical assistance. According to my interview with one person related to Honda on September 19, 2005, although Honda provided Sanyang with a matching model, it could only supply the one-generation older model with Kwang Yang. As a result, Kwang Yang's share decreased drastically.

Figure 1 Production of Motorcycle (1976-1995)



source: ITRI (1997).

assistance to Kung Hsue She Co., Ltd. and Wanshan Industry. Considering their deteriorating performances, Yamaha Motor decided to carry out a radical reform. In 1986, it established Yamaha Motor Taiwan Co., Ltd with Kung Hsue She holding 51% of the equity. Kung Hsue She retreated itself from the motorcycle business. Wanshan also disbanded and Yamaha Motor Taiwan bought out its factory. Suzuki Motor Corp. also reorganized one of its two related companies, Tai Lung Machinery Co., Ltd., into a joint venture, Tai Ling Engineering and Development Co. Ltd., in 1984, and Tai Ling took over the equipment and employees of another related company, Suzuki Industrial, in 1990. Further, Japan's Suzuki held 20% of Tai Ling's equity.

Owing to the prosperity in the late 1980s, the island's market quickly extended again and the production exceeded one million in 1988. At the same time, the newly established Yamaha Motor Taiwan adopted innovative policies on products line-up and sales, which made a significant contribution to the expansion of demand by attracting new users such as females and youth. Sanyang and Kwang Yang also followed it immediately. Consequently, the market share highly concentrated on these three firms.

Following a temporary decline in 1989 and 1990, the production continued to increase and reached a peak of 1,695 thousand in 1995. The growth in the early 1990s was largely attributable to export.

In the late 1980s, Sanyang and Kwang Yang started efforts to break the constraints imposed by Honda. They had accepted restrictions on some

operations, including export, for the sake of benefits from Honda's technical assistance. However, Sanyang clearly indicated its willingness to be independent of Honda, and the government supported it. Initially, Kwang Yang hesitated to follow Sanyang, but eventually, adopted a more active stance. A change of contract between Taiwanese firms and Honda demonstrates the process of their independence. According to the original contracts, the roles of Sanyang and Kwang Yang were principally restricted to the production and sales of models designed by Honda in Taiwan. At the 1991 revision, the restriction on export was removed. However, the revised contract still assumed that Taiwan's two assemblers heavily depended on Honda and obliged them to pay 2% for domestic sales and 4% for export, under which the R&D efforts of the two assemblers could not sufficiently pay off. The 1994 revision overcame this problem. Under the new contract, they only needed to pay for Honda's patents, which they actually used (ITRI, 1996: Chapter 2, 25). This contract between Kwang Yang and Honda expired in 1997, and a new contract was not concluded (Taiwan Jicheshi Bianji Weiyuanhui, 1998: 67).[4] The capital relations between Sanyang and Honda were dissolved in 2002 and those between Kwang Yang and Honda were dissolved in 2003.

Export and Outward Investment

Sanyang and Kwang Yang's efforts to be independent from Honda were motivated by their desire to enter the overseas market. In the 1980s, although the Taiwan market had considerably grown, the saturation was supposed to be inevitable in the near future, considering the island's population. In order to sustain growth, the two Taiwanese assemblers needed to advance to the foreign market. For this purpose, it was indispensable for them to get rid of the constraints on export and outward investment.[5]

Figure 2 shows that Taiwan's export was rather insignificant, and its export

[4] Although I have not confirmed the technical relation between Sanyang and Honda, it is supposed to be almost similar to the relation between Kwang Yang and Honda.

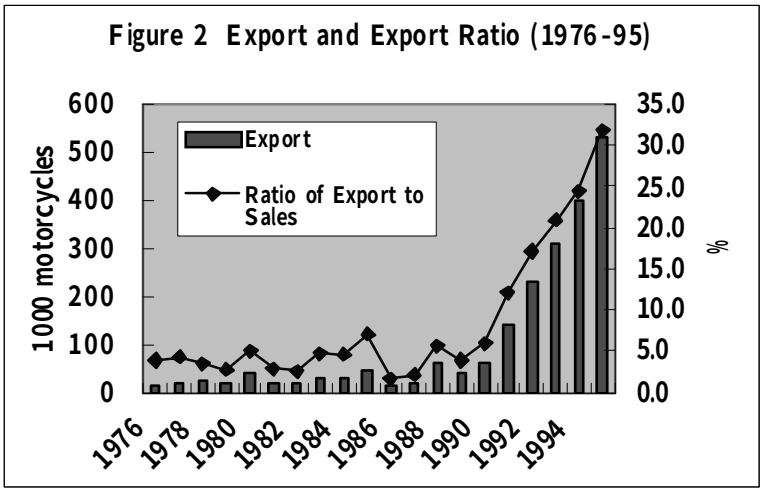
[5] Contracts of technical assistance between Taiwanese and foreign motorcycle makers usually included restriction on the formers' export. Yen (1983: 32) shows that of the 10 Taiwanese motorcycle makers, which contracted technical assistance with foreign makers, seven makers answered that their export was restricted and eight makers answered that their export needed permission from the foreign partners.

ratio stayed very low during the old regime before 1989. However, the export has abruptly and quickly increased, and the ratio has soared since the restraint on export was lifted in 1990. In 1995, Taiwan exported more than 500 thousand motorcycles, which was more than 30% of the total sales. It should also be noted that Taiwan's success in exporting in the early 1990s was attributed to the fortunate corresponding with the emergence of the Chinese market. In 1995, 75% of the export was for Hong Kong. Indeed, Hong Kong was not the final destination, but an intermediary to China. In addition, Vietnam was also a constant absorber of Taiwan's export.

Another approach to foreign market is foreign direct investment. It is the only effective way to penetrate into a protected market in particular. In effect, China banned the import of SKD parts in 1995 (The Chinese Bank, 1996: 15). Sanyang received the approval for investment in Vietnam from the Taiwan government in 1993 and for investment in Xiamen of China in 1994. The initially planned scales of the annual production were 100 thousand in Vietnam and 240 thousand in Xiamen. Kwang Yang planned to set up factories in Changsha and Changzhou of China and was approved by the government in 1993. Two factories were prepared for the production of 150 thousand respectively. Kwang Yang also set up a factory in Indonesia in 1996. The factory was planned to produce 200 thousands annually.

Sanyang and Kwang Yang's aggressive activities toward overseas market evidently demonstrated their independence from Honda. They could export and made FDI without any limitations by achieving technological autonomy and removing the conditions imposed by Honda. The significance of their independence might be more obvious as compared to that of Yamaha Motor Taiwan. Since Yamaha held the control of Yamaha Motor Taiwan with more than half of its equity, the latter's activities followed the world strategy of the former. In the early 1990s, Yamaha Motor Taiwan was not positioned as an exporting base under Yamaha's strategy. Therefore, its export ratio in 1995 was only 6.8%, which was conspicuously lower than Sanyang's 29.4% and Kwang Yang's 47.3%.[6]

[6] Today, Yamaha Motor Taiwan is exporting more number of products because the parent company positions it as the base of development and production of small scooters in the group.



source ITRI (1997).

II Perfecting the Catching-up

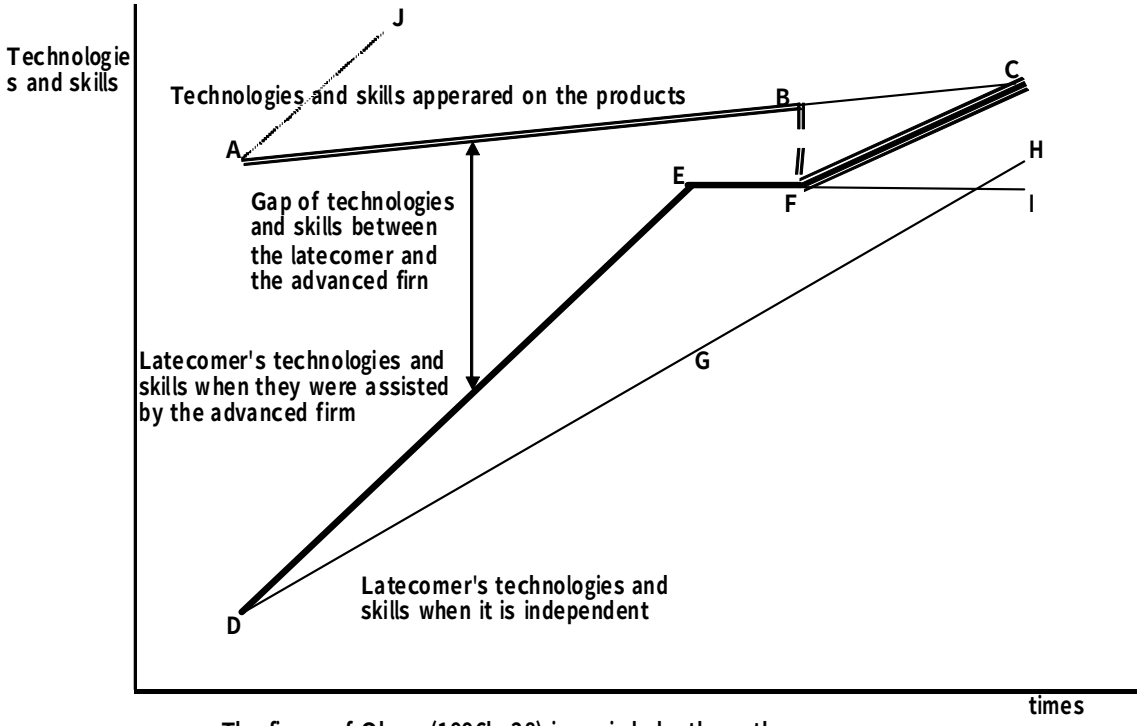
Acquiring Capacity for Product Innovation

A latecomer firm can accumulate technologies and skills through the technical support from advanced firms. However, this process has a limit because advanced firms never share all the technologies and skills with latecomer firms (Ohara 2006b). Advanced firms tend to maintain their leadership by not disclosing state-of-art technologies. In addition, in many cases, it is rather difficult to ascertain how to carry out innovation because the related knowledge is tacit and deeply rooted in the organization. This is a significant hurdle in the final stage of the catching-up process mentioned in the introduction. Consequently, latecomer firms are motivated to overcome dependence on advanced firms and to acquire new technologies and skills.

Figure 3 1illustrates the concept of two types of catching-up paths and switching between them. Latecomer firms can produce advanced products on being assisted by advanced firms (A–B) and to accelerate its catching-up (D–E) compared to the path without assistance (D–G). However, the path has a ceiling (E–F). Therefore, latecomer firms need to switch the path and increase the technologies and skills alone (F–C) in order to sustain its technological development.

In the case of Taiwan's motorcycle industry, Sanyang and Kwang Yang could

Figure 3 Concept of Two Paths of Catching-up



source: The figure of Ohara (1996b: 28) is revisde by the author.

learn manufacturing skills from Honda and maintain the leading positions in the island's industry.[7] Although they became less dependent on Honda in the manufacturing process, their alliances with Honda never enabled the two assemblers with respect to product innovation because Honda by no means taught them the technology. Honda wished to keep its influence on them holding it closely. A staff of one of the two companies said, "We learned from Honda the process after a plan was completed, but did not learn how the plan was drawn up."[8] It was acquiring capacity for product innovation that Taiwan's motorcycle industry must overcome at the final stage of catching-up.

It should be noted that switching the paths entails the risk of inviting a severe difficulty. Considering latecomer firms' independent R&D activities, advanced firms might withdraw their assistance as a sanction. At the moment, however, latecomer firms have not yet acquired sufficient

[7] One instance is the case shown in footnote 3. In the early 1980s, Wanshan, backed up by Yamaha Motor, challenged Sanyang and Kwang Yang by releasing a new model of scooter, which caused several small firms to enter the scooter market. The two companies eventually fought off them in a resort to obtain Honda's assistance.

[8] My interview on September 13, 2005

technologies and skills. In other words, latecomer firms are compelled to determine to embark on a venture for independence before the requirement for it was not fulfilled. Figure 3 depicts this problem. When latecomer firms decide to switch the path, they lose the assistance from advanced firms (point B to F). Latecomer firms would be seriously disadvantaged if their rivals continue to be supported by advanced firms.

In reality, the case of Kung Hsue She's aborted challenge obviously illustrated this risk (Yen, 1983:44; Taiwan Jicheshi Bianji Weiyuanhui, 1998: 52; 72–73). In 1976, with the support of the government, Kung Hsue She tried to become independent from Yamaha, which had provided it technical assistance for many years. Kung Hsue She stopped taking technical assistance from Yamaha and started to use its original brand KHS in place of Yamaha. Yamaha found a new partner, Wanshan Industry. Yamaha contracted technical assistance with it and allowed it to use the Yamaha brand. As a result, Kung Hsue She was deprived of a large share of the market by Wanshan. Its share dropped from 8.0% in 1978 to 4.9% in 1980. Kung Hsue She's failure was attributed to an immature R&D capacity as well as to a weak brand. For instance, Kung Hsue She only had the capacity to develop a frame of plate and was not capable of developing a frame of pipe, which was in fashion those days. Kung Hsue She resumed the relation with Yamaha in 1980 and its market share recovered to 7.0% in 1982.

In the process of challenge started in the late 1980s, Sanyang and Kwang Yang had to consider the risk because they were competing with Yamaha Motor Taiwan, which enjoyed the support of Yamaha Motor. The two companies were required to accomplish the challenge as soon as possible in order to introduce the new models into the market and to not lose large portions of the market.

Two factors promoted Sanyang and Kwang Yang to switch the path of the catching-up. One was the matured technologies of motorcycle. If rapid innovation continued in the industry (A-J in Figure 3), their ventures on catching-up would have been extremely difficult. The other was the predictable saturation of the island's market mentioned in the previous section. They had to acquire the capacities for product innovation and become independent from Honda in order to advance to the foreign markets. If the island's market continued to expand, it would be less necessary for

them to switch the path at the risk of losing the market shares.

Fortunately, for Sanyang and Kwang Yang, Honda's hegemony over them solely rested on its technological capacity. Since Honda had minorities of the two companies' equities, it was not able to control them depending on ownership. Therefore, Honda did not have the authority to stop their R&D activities. Further, Sanyang and Kwang Yang could be independent from Honda only if they matched Honda in technological capacity.

In the late 1980s, Sanyang began R&D activities for the purpose of independence from Honda. The company spent 150 million NTD on R&D every year in the late 1980s (*Lianhebao*, Oct. 15, 1989) and furnished the equipments, which surpassed Industrial Technology Research Institute (ITRI), semi-governmental institution for industrial technologies, in 1990 (*Gongshang Shibao*, June 30, 1990). As early as June 1988, it released a 125 cc scooter—*Fengsu*—the aspect of which it designed by itself (*Gongshang Shibao*, Nov. 19, 1988). In 1990, it accomplished the full development of a new model *Difei* (*Gongshang Shibao*, June 30, 1990).

Kwang Yang undertook the R&D activity for product innovation in 1987. Although its action was slightly delayed, it was not less aggressive than Sanyang. In 1990, the company employed more than 120 of the R&D staff and invested 70 million NTD in workstations, CAD/CAM, and test equipments for strength and electrical system (*Gongshang Shibao*, June 30, 1990).

The data of one of the two companies collected in 1993 and 1997[9] shows that the company employed more than 200 of the R&D staff in 1993 and around 300 in 1997 (including other target than motorcycle). No Japanese staff was dispatched from Honda. It held one set of test equipments and a test course. It also had the ability to develop large-size dies by itself. Its R&D expenditure was 500 to 600 million NTD in 1997, accounting for about 5% of the total sales (also including other target than motorcycle).

Two conditions enabled Sanyang and Kwang Yang to swiftly acquire the technology of product innovation. One was their own resources and

[9] The institute of Developing Economies conducted a research project on Japanese firms in Taiwan in 1993, and I participated in it as a project leader. The project team visited the company. Although I visited other company on that day and could not join the interview with the company, we shared the research result. We also visited two other motorcycle makers, which were capitalized by Japanese companies. In 1997, I myself visited the company and interviewed a manager.

capabilities. In the next section, I will argue how they obtained them. Another was the substitutive sources for technology. The equipments and staff were easily purchasable, but buying them was not sufficient and learning invisible know-how was necessary for product innovation. In our interview with another company of the two in 2005, they explained that they could develop new models by way of joint projects with some institutions in Europe that specialized in engines designs. More importantly, the company utilized the projects as opportunities to learn how to develop a new model.[10]

The company was already capable of developing new models without support from other institutions, when we visited it in 2005. It possessed nine engine models for motorcycle and two models for ATV, which were classified by piston displacement. They were all developed after the alliance with Honda was dissolved.

As a result of acquiring capacity for product innovation and completing catching-up, Sanyang and Kwang Yang had converted their relations with Honda and finally achieved independence, as shown in the previous section. It is also observed already that the removal of constraints brought about the rapid increase of export and aggressive outward investments.

Building Independent Suppliers

Another indispensable factor for the assemblers' autonomy is independent suppliers of parts and components. A motorcycle is a machine assembled from many parts and components. While some of them are produced in-house by assemblers, others are procured from domestic and overseas suppliers. For instance, Kwang Yang procured approximately 60% of the parts and components from outside (Chang, 2005: 89).

In the 1990s, almost all parts and components were procurable in Taiwan. The Taiwan government imposed the requirements for local content on the assemblers and had raised the ratio step by step: 30% in 1962, 40% in 1964, 60% in 1966, 70% in 1969, 80% in 1973, and 90% in 1974 (Chang, 1987; Taiwan Jicheshi Bianji Weiyuanhui, 1998). All these requirements had been

[10] In 1996, ITRI organized a project for developing a large-scale motorcycle. Sanyang and Kwang Yang participated in it, through which they also learned how to develop a new product (my interview with the company on September 13, 2005).

satisfied quickly. A research conducted on 15 assemblers in 1970 shows that the average ratio of actual local content was 75% (Wang, 1971:140), while the government's requirement was 70%. The three assemblers that we visited in 1993 procured more than 90% from domestic suppliers. The ratio of one of them was as high as 95%. In addition, it is also noteworthy that there were a small number of foreign firms in the suppliers. The ratios of Japanese firms in the numbers of the suppliers for the three assemblers were 13%, 15%, and 20% respectively.[11]

Independent suppliers contribute to the two activities of assemblers. One is their product development, which is essential for their autonomy, as mentioned above. The assemblers depend on the suppliers not only in their production capacities but also in their R&D abilities. The development of a new product is a joint project by the assembler and the suppliers. The suppliers develop the individual parts and components, and the assembler carries out general design by integrating the parts and components as well as the development of engines. The suppliers' proximity to the assemblers allows close communication and interdependence between them and enhances their mutual trust.[12] Without domestic suppliers, assemblers would need to collaborate with foreign suppliers. The cost and time of communication would rise considerably. Foreign suppliers might not be willing to support Taiwanese assemblers because they have more important customers.

Another activity to which independent suppliers made significant contribution is outward investment. Since the assemblers outsource many parts and components, they need to bring over the suppliers when they set up factories abroad. In fact, 23 suppliers complied with Kwang Yang's request and built factories adjacent to its Changzhou factory (The Chinese Bank, 1996: 25). Nineteen suppliers also accompanied Sanyang's investment to Xiamen (ITRI, 1996: chapter 2, 78). The suppliers were all

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[11] Of course, there have been fluctuations since then. In the research in 2005, I found that the control of one joint venture transferred from local capital to Japanese company because the local founder retired. At the same time, I also discovered the case that one assembler subcontracted a process for attaching a tire to a wheel which had been done in-house to one local firm. The former case increased the ratio of Japanese firms, while the latter decreased the ratio. Overal,l there is considered to be no dramatic change.

[12] In the third section, I will show two cases showing the advantages of the local suppliers over Japanese subsidiaries.

Taiwanese firms. The reason behind their support for the assemblers was that they have been closely interdependent on one another in Taiwan. The assemblers could not expect foreign suppliers to readily follow their outward investment.

III Mechanism for Catching-up

The previous section shows that Taiwan's motorcycle industry acquired capacities for product innovation and established independent suppliers, which resulted in the completion of catching-up and independence from Japanese hegemony. As the next step, I argue how the industry could cultivate the capacity for product innovation and how it could build up the independent suppliers focusing on interaction among Taiwanese government, local firms, and leading foreign firms.

Competitive Oligopoly and Accumulation of Resources

The most significant reasons that Sanyang and Kwang Yang acquired the capacity for product innovation were that they held abundant resources to invest and competent management teams, which could skillfully use the resources. Of the various resources, money was the most important. They could purchase other resources including equipments, staff, and access to the sources of technology in exchange for money.

With respect to their management team, since the two companies were large-scale and profitable companies, they could attract distinguished talent. For instance, S. C. Wang, the president of Kwang Yang, was a graduate from the department of mechanical engineering of National Cheng Kung University, which was considered the most excellent in this field in Taiwan. The able management team successfully converted the resources into capacity for product innovation.

The mechanism for Sanyang and Kwang Yang's growth and profitability was the establishment of competitive oligopoly.[13] Protection from imports was a necessary condition, but it did not necessarily bring in growth and

[13] The Japanese automobile industry is a precedent case of industrial development based on competitive oligopoly within protected market. My argument was suggested by studies on this case, such as Muto (1984) and Ito (1988).

profit. First, the limited size of domestic market often prevents the firms from achieving economy of scale. Second, the stable profit generated by protection tends to make firms shirk. In particular, this negative effect would be intensified if the government introduces a restraint on entry lest the sizes of the firms contract to below efficient scale. In other words, it is extremely difficult for government to attain economy of scale and competitiveness simultaneously. Even worse, it is commonplace that government fails to achieve both of them.

Taiwan's motorcycle industry seemed not to fall into these traps. Although the industry had ordinarily consisted of around 10 assemblers, a few large firms had maintained the high rates of market share and enjoyed economy of scale. In particular, the market share has highly concentrated on the top three since the mid-1980s. S. C. Wang pointed out that "Since Taiwan's market had concentrated on Sanyang, Yamaha Motor Taiwan and Kwang Yang since 1987 and the production of each firm had been more than 200 thousands, these firms had afforded to do research and development" (Weng, 1997: 99). At the same time the industry was quite competitive despite the high concentration ratio, owing to which the firms were never allowed to be slack.

How was the competitive oligopoly built up? I argue below the fundamental factor, the roles of the government, local firms, and foreign leading firms, and the interaction among them.

The fundamental factor was the rather large size of the island's market. In the 1990s, 10 million motorcycles were held and more than one million were sold annually. The reason for the enlarged market in comparison with the population of about 20 million was considered to be the inadequate development of public transportation. In fact, 50 cc scooters are used for daily commuting. The large scale of the market alleviated the trade-off between economy of scale and competitiveness.

The most important role of the government was the design and operation of the protection policies, including requirement for local content. Without these policies, Taiwan's motorcycle industry would have never been established. In addition, it is also vital that the government did not implement any other restriction on competition. The ban on entry in the motorcycle industry was lifted in 1965 and was never reintroduced. As a result, the industry had experienced vigorous entries by the newcomers,

which had multiplied the severity of the competition.

Local firms have contributed to sustaining and increasing the competitiveness of the market. The ambitions of two local leaders, Sanyang and Kwang Yang, have shaped Taiwan's competitive market. In addition, there have been frequent entries and exits by small assemblers in the industry. Although they did not put immediate pressures on large assemblers, they continued to be a potential threat to them.

Leading foreign firms had manifested conspicuous effects on building up oligopoly. With support from foreign firms, local firms were able to decisively prevail over those without the support of foreign firms. Moreover, the global motorcycle industry has been oligopolistic. Therefore, the number of latecomer firms that could conclude the contracts with these dominant firms was limited in one market. Of course, each dominant firm was capable of imparting their assistance to more than two firms in one market, but it would be more profitable for the dominant firm to restrain the number of partners.

In the late 1980s, market concentration was rapidly augmented by the interaction among Yamaha Motor Taiwan, Sanyang, and Kwang Yang. The newly established Yamaha Motor Taiwan, directed and full backed up by Yamaha, initiated an aggressive strategy and only Sanyang and Kwang Yang could follow it immediately. The other assemblers including Tai Ling, Suzuki's joint venture, failed to keep up with them. As a result, more than 90% of the market share concentrated on Yamaha Motor Taiwan, Sanyang, and Kwang Yang.

The strategy adopted by Yamaha Motor Taiwan was a combination of a new line-up of products and innovation of the sales system. The new sales system consisted of the reorganization of the sales channel led by the assembler and its instructions and guidance to the retail dealers. Under the traditional system, independent distributors (*jingxiaoshang*) mediated between the assemblers and the retail dealers, owing to which the assemblers were unable to directly offer instructions to the dealers. Therefore, the assemblers paid bare attention to promoting activities such as advertisement and after-sales service and entrusted the distributors to organize sales networks. Yamaha Motor Taiwan and other large assemblers reformed the system by establishing sales companies together with the distributors and replacing distributors with sales companies. The new

system enabled the assemblers to directly communicate their ideas to retailers through the sales companies, of which they had ownership and control. Yamaha Motor Taiwan promoted its brand image by instructing the retail outlets to remodel their layouts combining massive advertisement. The new line-up of products was further effective with the innovation of the sales system.

Since the innovation had economy of scale and first-mover advantage, it contributed to concentration. Moreover, the large assemblers' innovation accidentally coincided with the change of the consumers and consequently augmented the effect. The innovated line-up with cleanly and brightly renewed outlets and the freshly advertised impression admirably suited the newly emerged consumers such as the youth and females.

Evidently, Yamaha Motor Taiwan's new strategy not only increased concentration but also intensified competition, in particular non-price competition. Although the market was highly concentrated, it continued to be severely competitive in the 1990s due to the existence of Yamaha Motor Taiwan as a threat to Sanyang and Kwang Yang. They have always desired to seize the top share and have not allowed the others to shirk.

Comparison between Motorcycle Industry and Auto Industry

Comparing the motorcycle industry to the auto industry can enhance the conviction of some of the factors argued above. Taiwan's auto industry has been dependent on the foreign firms, which indicates that it has not yet accomplished catch-up. The scale of production is small and export is even scarce. The case of Sanyang exhibits the contrast between the two industries. Although Sanyang's motorcycle business succeeded in becoming independent from Honda, it continued to rely on Honda in auto production until the rupture in 2002.

The poor performance can be attributed partly to much more complex technology of automobiles. At the same time, however, the absence of the competitive oligopoly, which was the clue to the leading companies' accumulation of resources in the motorcycle industry, also hindered the auto industry from catching up. The industry has been less competitive than the motorcycle industry, which is shown by the fact that the exits from the industry have been quite rare. Except for the case of Toyota's affiliate, which retreated on political account in the 1970s, there had been only two

cases of exit until the early 1990s. One was GM's withdrawal from Huatung Motors, Ltd, which was shortly reorganized as Kuozui Motor, with investment by Hino Motors and Toyota; another was the bankruptcy of Yeu Tyan Machinery Manufacturing Co., Ltd. The market was less concentrated and no auto assembler produced more than 100 thousand cars annually in the mid-1990s. Evidently, they were not able to fully enjoy economy of scale. The disadvantageous structure was caused by lack of some conditions which the motorcycle industry satisfies. First, Taiwan's auto market is much smaller than the motorcycle market, although its minimum efficient scale is considered to be larger than that of the motorcycle market. The annual sales of automobiles produced in Taiwan were 400 thousands at most. Consequently, the industry easily fell into a trade-off between scale of economy and competitiveness of the market.

Second, the policies have not been consistent (Kawakami, 1995); they swung owing to the trade-off. The government strictly restrained the entry until 1967, but failed to discipline the firms to raise the efficiency. The abolition of the restriction on entry invited newcomers to enter the industry, which made it difficult for a firm to reach the efficient scale. The entry was restricted again in 1974, and the market structure was frozen. In the early 1980s, the government drew up a plan to set up one large-scale auto maker in cooperation with a foreign firm, which ended in a failure due to the poor capability of the bureaucracy (Arnold, 1989). The government had neither accomplished a competitive market nor firms that could enjoy economy of scale. In 1985, the government not only lifted the restriction on entry but relaxed its control on import. The new policy implied that the government abandoned the strategy to develop the auto industry in a similar manner as the motorcycle industry.[14]

Third, the global industrial structure of the auto industry was different from that of the motorcycle industry. A larger number of advanced firms were capable of providing technical support to the auto industry than to the motorcycle industry. As a result, more number of firms could enter the auto industry than the motorcycle industry. It was also more difficult for a

[14] The policy implemented in 1985 was supposed to deprive the auto makers of chances to become independent. However, the result was more complicated. Some makers succeeded in achieving partial autonomy taking advantage of the slump of Japanese partners which provided capital and technical assistance with them (Cheng, 2007).

limited number of firms to concentrate the market shares.

Flourishing Independent Suppliers

Interactions among the government, foreign firms, and local firms also brought about the development of parts and components suppliers. First, the industrial policy was indispensable for it. As mentioned above, the government introduced the requirement for local content in the early 1960s and quickly raised the ratio. This policy not only endowed the local parts and components suppliers with the domestic market but also urged foreign firms to invest in or provide technical assistance to local firms.

Second, foreign firms made considerable contribution to improvement in the suppliers' technology and skills. One electric parts maker that I visited in 2004 was a typical case of success in improving its technology and skill with the support of a Japanese partner. The company was requested to introduce technology and capital from a Japanese firm that produced the same type of products by its major customer. Its founder visited the future partner and discovered what the company had been lacking in before. The company had developed the products according to the samples and the assembly drawings provided by the assembler. However, since the assembler had not supplied the illustrations of the parts, the company had not understood the properties of the material. He also found that it had not undertaken an endurance test. The company remedied these deficiencies with assistance from its Japanese partner.

It should be noted that the foreign parts and components makers' control over Taiwanese partners, which they invested in or provided assistance to, was much weaker than the assemblers'. Taiwanese parts and components suppliers have been doing outward investments without constraints. The reason is that the foreign firms and Taiwanese partners can differentiate the market and avoid direct competition. Taiwanese suppliers chiefly transact with Taiwanese assemblers' subsidiaries abroad and do not forcibly compete for the affiliates of the foreign firms' customers.

Third, the assemblers' played a significant role. As exemplified by the abovementioned case, one of their roles was of an intermediate who introduced the foreign firms as an instructor to the local suppliers. Second, the assemblers themselves were instructors who coached the suppliers in technology and skill. Based on abundant and superior resources such as

manpower and equipment, they had more sophisticated technology and skill than the suppliers. Their third role was to screen out inadequate suppliers. K. A. Chang, the former president of Sanyang, maintained that

> "A part of suppliers say they can pass the quality inspection by frequently associating with Sanyang's staff responsible for procurement and by repeatedly entertaining them. However we never purchase parts and components from such irresponsible and unenterprising firms." (Chang, 1987: 190)

Finally, the most significant factor for the development of the independent suppliers was the local firms' own initiative. If they had been satisfied with the protected market and slackened the efforts to improve their own abilities, Taiwan's motorcycle industry could not possess the independent and efficient parts and components suppliers. In fact, many firms did not realize that enhancing their abilities was necessary. However, a few of them recognized it as important ahead of others. For instance, in the early 1980s, lamp makers enjoyed considerable profits by copying the advanced firms' products and most of them never invested a part of profit in their product development. However, a lamp maker that I visited in Sept. 26, 2005, determined to initiate product development despite losing money in hand. Today, the firm survived the change of the industry and others were weeded out.

Interestingly, some local suppliers already outweigh the joint ventures supported by the advanced firms. One case is that of the lamp maker mentioned above. The maker leads a joint venture between Japanese and Taiwanese firms in the market of lamps for motorcycles. Another example is that of a meter maker. It competed with a joint venture supported by Japanese company and held more than 60% of the share in the island's market in 2005, although the joint venture maintained about 80% of the share in the past. The reason for the local makers' ascendancy is the assemblers' independent product development. The local suppliers can respond to the assemblers more quickly than the joint ventures, which need coordination with Japanese partners. In other words, the emergence of local suppliers with R&D capabilities backed up the assemblers' independence.

Conclusion and Supplementary Argument

The experience of Taiwan's motorcycle industry can be summarized as follows. The two largest motorcycle makers in Taiwan, Sanyang and Kwang Yang, had been growing technologically depending on Honda at the cost of their autonomy, particularly in the sphere of overseas activities, since the early 1960s. The two assemblers began their efforts to break through Honda's hegemony in the late 1980s. The main challenge was acquiring the capacity for product innovation. This capacity was the key to Honda's control, owing to which Honda never shared it with them. The challenge entailed a considerable risk that they might not release new models for some time because Honda would stop providing them with new designs before they finished learning the capacity. However, the two firms swiftly mastered the capacity and became independent from Honda. Another significant factor for the two assemblers' autonomy is independent suppliers of parts and components. The assemblers not only procure many parts and components from them but also need their cooperation in product development. Furthermore, the assemblers required the suppliers to accompany their overseas production. Since independent suppliers are established in Taiwan, the assemblers can carry out these activities free from restraint.

How were Sanyang and Kwang Yang able to cultivate the capacity for product innovation? Their success in learning can be attributed to the abundant resources that they invested in it and a competent management team, which can use the resources effectively. An established competitive oligopoly caused the two assemblers to grow in scale and become highly profitable, which, in turn, enabled them to earn considerable profits and accumulate distinguished managerial talent.

Although the government's protection is a fundamental condition, this policy has two traps in general. One is that firms cannot enjoy scale merits in the limited scale of the domestic market. The other trap is scarce competitiveness. Sanyang and Kwang Yang could avoid falling into these traps owing to large scale of Taiwan's market and competitive oligopoly. In the 1980s, on the one hand, the two local assemblers and Yamaha Motor Taiwan surpassed other firms and succeeded in obtaining the major portion

of the market. On the other hand, the small firms' vigorous entries and Yamaha Motor Taiwan's aggressive strategy enhanced the competitiveness of the market and did not allow the two assemblers to be slack. I also contrast this mechanism of the motorcycle industry to Taiwan's auto industry.

The independent local suppliers of parts and components have also been established through interactions among the government, foreign firms, and local assemblers and entrepreneurs. The government's requirement for local content was a foundation for the development of local suppliers. Foreign firms and leading assemblers have contributed to the suppliers' skill formation and technological progress by way of instruction and selection. The most significant reason for the suppliers' development was their own initiative. A few visionary firms realized that it was necessary to cultivate their technological capabilities beyond imitation. Their efforts have formed today's solid supplier system in Taiwan.

The experience of Taiwan's motorcycle industry indicates some implications for late industrialization. First, the development of Taiwan's motorcycle industry is convincing evidence that the state can play a significant role. Without the protected domestic market, the local assemblers could not have emerged and grown. Requirement for local content was a necessary condition for establishing local parts and components suppliers.

Second, however, Taiwan's experience also indicates the limitations of government's intervention. Some policies are generally ineffective or harmful. The combination of policies is also important. The protection of the domestic market was applied to both the motorcycle and the auto industries. In the motorcycle industry, however, the restriction on new entry was lifted in the mid-1960s, while the policy was sustained for many years in the auto industry. The contrasting performance between the two industries was caused partly by the different policies.

More importantly, state's intervention is not sufficient for industrial development. In other words, government's industrial policies cannot succeed without complementary factors. Protection is effective given the large size of the market. The strategies of the foreign firms and the domestic firms also have significant influence on the result of the policies determining the nature of the market, competitiveness, competition in price, quality, or innovation. The case argued here indicates that it is necessary to

modify Gerschenkron's and Amsden's arguments, while it supports them.[15]
Third, Taiwan's experience also contributes to deepening the understanding on late industrialization. It illustrates that the catching-up process is not monotonous and the final stage of the process has a formidable hurdle, as I mentioned in the beginning of this paper. While Sanyang and Kwang Yang had obediently learned the manufacturing technology from Honda, the relations between the two assemblers and Honda were harmonious and intimate. However, this process by no means led the assemblers to complete the catching-up, since Honda did not share with them the capacity for product innovation. They needed to switch their development paths defecting from dependence on Honda in order to finish the catching-up process. This is the hurdle that latecomers had to overcome in the final stage of the process.
I also show the conditions for success in the challenge. They are a firm's motivation, substitutive source of the factor necessary for completing the catching-up, and resource for using the alternative source. In the case of Taiwan's motorcycle industry, Sanyang and Kwang Yang were motivated to challenge the hurdle by the limit of the domestic market. They could substitute the supply of new models from Honda with joint development with the European institutions. Their ample funds enabled them to access the alternative sources. Further, the competent management teams were extremely keen that they effectively utilize the joint project as opportunities for learning the capacity for product innovation.
I ended the argument by briefly mentioning Sanyang and Kwang Yang's situation after perfecting the catching-up. The two assemblers' purpose of independence from Honda was to do overseas activities without restriction. However, their performance abroad has not been satisfactory according to them. With respect to the Chinese market, they succeeded in exporting a substantial amount of products in the early 1990s. Although they embarked on production afterwards, their production in China has been unsuccessful up until now. Sanyang set up a subsidiary in Xiamen in 1992, and Kwang Yang established subsidiaries in Changsha in 1993 and in Changzhou in 1995. All their achievements have been below the plan. Kwang Yang's

[15] My argument is also different from Wade (1990) who illustrates the role of government in Taiwan's industrialization. The core of his argument is the leader-follower dichotomy between government and the private sector. I argue that the complementarity among actors is more important.

subsidiary in Indonesia has not even reached the planned scale. The only exception is Sanyang's Vietnam affiliate. Its production in 2004 was more than 250 thousand.

The difficulty in the Chinese market can be attributed to the peculiarity of the market (Ohara, 2006a). Since riding a motorcycle is virtually banned in the cities, most of the Chinese consumers reside in the non-city areas, and their incomes are extremely low. Therefore, it is difficult for assemblers to find consumers who are willing to pay more for better quality. Even Japanese makers including Honda have not succeeded in steadily expanding their shares in China like other countries. Taiwanese assemblers' advantages are higher quality than local makers as well as lower prices than Japanese makers. However, there is no space for the assemblers to reap their advantages in the Chinese market.

The difficulties faced by Taiwanese assemblers in the Southeast Asian market are a more serious problem for them. In addition to Kwang Yang's failure in Indonesia, we should also pay attention to the absence of Taiwanese assemblers in Thailand whose market is considerably large. In these countries, Japanese rivals are so competitive that it is difficult for Taiwanese assemblers to acquire a part of the market. Japanese makers' brands are considered an important source of their competitiveness. Sanyang's exceptional success in Vietnam is due to the fact that the company entered this emerging market earlier than Japanese makers established their brand. Taiwanese assemblers' post-catching-up experiences indicate that perfecting technological catching-up might be insufficient for latecomer firms to measure up to advanced firms. In particular, in overseas markets, latecomer firms also need marketing capabilities, which might be more difficult to learn and acquire than technological capabilities.[16]

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[16] Marketing capacity might be able to complement insufficient technological capacity. Huang (2009) shows that some Korean firms have been successful in the Chinese market by chiefly using marketing capacity, despite being inferior to advanced firms in technological capacity.

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