경제학석사 학위논문

Can industrial policy work?

Evaluating LCRs in terms of GVC framework for the cases of Malaysia, Thailand and China in comparison with Korea

산업 정책은 효과적인가?

GVC 프레임워크에서의 말레이시아, 태국, 중국과 한국의 사례를 바탕으로 한 LCRs 의 비교 및 평가

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屈荻

Abstract

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This study analyzes the effective factors of LCRs for the cases of Malaysia, Thailand and China in automotive industry through GVC framework, and the implementation of LCRs in China's wind turbine industry as a supplementary case.

The study first examined what effects LCRs in Malaysia, Thailand and China in their automotive industry. For Malaysia, although local ownership and supportive policies are guaranteed by government, the lack of competition makes Malaysia's auto industry competitiveness poor, so they are neither exporting strongly nor globalize their production, and the less export also makes vehicle

manufacturers hard to achieve scale economics with a smaller domestic market to a great extent. For Thailand, they perform better than Malaysia in the export market, while due to the absence of local ownership and protective policies, foreign firms had taken over the whole domestic market and they do not own a self-owned brand, and they do not globalize their production either. For China, China is the most successful case among three countries, while protecting local manufacturers through restricting foreign ownership and policies, the government did not prevent competition in the domestic market, which made China succeed in the implementation of LCRs, for the market size, China owns a market with a big size itself, which makes it easier for producers to achieve scale economics. The effective element found in three countries are market structure, complementary policies and local ownership.

The paper also examined the factors that affect LCRs in China's wind turbine industry as a supplementary case, among effective factors of LCRs for automotive industry in China, supportive policies implemented by government is considered to be the most important one.

Key words: automotive industry, industrial policy, local content requirements, global value chain, LCRs, GVC

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1. Introduction

According to the definition given by OECD, Local content requirements (LCRs) are industrial protection policy that require manufacturers to use domestically manufactured goods or services provided by local suppliers in their producing process. These local suppliers can be either indigenous firms or localized foreign-owned firms(Kuntze and Moerenhout, 2013, p.4).LCRs had been used with the aim to promote the development of infant industries or tried to create a "level playing field" for domestic firms(Belderbos and Sleuwaegen, 1997,p.102).However its effectiveness has been questioned for years as different results appeared in different countries and sectors.

LCRs in China were implemented to promote the development of wind turbine industry in 2000. Before LCRs were implemented foreign wind turbine manufacturers dominated in Chinese domestic market, 5 foreign firms captured almost the whole market before 2000(Jieying , He, 2015a, p.26). This situation was changed after serious policies supporting wind power manufacturing were launched including LCRs, and almost 90% of market was occupied by Chinese

domestic firms by 2009. China not only increased local production of wind turbine successfully, but also supported their own brand during the development of wind turbine industry.

In other sectors, Thailand and Malaysia also tried to promote their auto industry through LCRs. As ASEAN countries, LCRs in Thailand and Malaysia were implemented almost at the same time. However, their development strategies in parallel with LCRs were significantly different and naturally led to different results. Malaysia chose the independent development strategy to promote their automotive industry (Tai and Ku, 2013, p.60) through relying on the development of a monopolistic market (Abdullah, 2002, p.1133). National owned car brands were created through this strategy. On the other hand, Thailand chose a dependent development mode, which tried to attract lots of FDI to produce component and assemble vehicles in Thailand (Tai and Ku, 2013, p.60). After several years of development, Thailand became the biggest exporter of automotive among ASEAN countries (Tai and Ku, 2013, p.66), while Thailand did not own a national car brand like Malaysia, foreign ownership was dominated in both their vehicle market and component market. In

opposite, Malaysian local ownership was dominant in production and sales after LCRs were implemented(Wad, 2009, p.185). However, Proton—the first Malaysian national car did not keep its high market share even at the height of its development, and it started getting lower and lower after 2000.

Observing the implementation of LCRs in Malaysia, Thailand and China, our analysis deals with the following questions: why does Thailand much better than Malaysia in production export market in the same auto industry? Why did Malaysian domestic auto manufacturers capture market in their initial stage while failed to keep that advantage? Why did Chinese domestic manufacturers succeed in increasing production? To answer these questions, the study analyzes the effective factors in three countries' auto industry. The cases of the wind turbine industry in China and automotive industry in Malaysia, Thailand and China are investigated.

In section 2, our study begins with reviewing literatures to draw forth our hypotheses. Section 3 presents the application of LCRs in Malaysia, Thailand and China's automotive industry and evaluates the effectiveness of LCRs in three cases through GVC indicators. And

then analysis the reasons for different outcomes in three countries' automotive industry. Additionally, section 4 analyzed the implementation of LCRs in China's wind turbine industry. Finally, in section 5, we summarize our findings and present the contributions of our study.

2.Literature review and hypotheses

For the literature on Global Value Chain(GVC), Gereffi(1994)proposes a framework of Global commodity chains(GCCs) in 1994, in which, a commodity chain is defined by Gereffi (1999) as the whole range of activities involved in the design, production, and marketing of a product rooted in production systems. According to Gereffi's comment(1994), a production system links the economic activities of firms to technological and organizational networks, and in the GCC perspective, economic activity is not only international in scope, it is also global in its organization, it highlights the need to look both in terms of geographical spread of transnational production arrangement and their organizational scope. Gereffi(2014)also states that GVC framework should focuse on globally expanding supply chains and how value is created and

captured therein.

In Gereffi's study, the driver force of a GVC could be divided into Buyer-driven and Producer-driven, the Producer-driven GVC refers to those industries in which large integrated industrial enterprises play the central role in controlling the production system, including its backward and forward linkages, in contrast, buyer-driven chains refer to industries where the control resides at the distribution and marketing end of the chains, capital-and technology-intensive industries are mainly contained in term.

Later, Gereffi(1999) states the viewpoint that with the case of Japan in the 1950s and 1960s and East Asian NIEs during the 1970s and1980s, that to succeed in the GVC perspective, industries should not only improve the value-added of their exports, but also need to upgrade their OEM exporter role to OBM exporter role. Gereffi and Tam(1998) propose that more participation in GVC can help the development of an economy as it can save learning time and improve its extent of diversification, which can help spread risk and increase stable growth. While over relying on the role of GVC may also result in an inability to handle the negative economic shocks to the industry.

A similar viewpoint is also expressed by Lee, Szapiro and Mao(2017) in their study, to participate in GVC, it is considered can provide a mechanism for industrial upgrading to be at the value chain. For developing countries, Lee(2012) mentions the significance of improving developing countries' ability to produce and sell products in the international market. As mentioned in Gereffi's study, risks are also believed to integrate into the GVC. Lee and Mathews(2012) point out this risk in their study, the initial success of OEM that are in the bottom of the value chain would lead the increase of wage, then its position will be replaced by cheaper factories, also they would be trapped in the low value added activities if they don't try to transfer to higher value added activities. Then, the question is, it's beneficial to join in GVC for development of industry, while it's also risky at the same time. Therefore, it's important to find a proper mode to integrate into GVC. Concerning this point, Lee, Szapiro and Mao(2017) propose an "in-out-in again" way for operating in GVC, which is in the initial stage, it's good to participate in GVC to learn foreign advanced knowledge, while during the process of industry development, a period of independence development should be

pursued for building and upgrading own local chains for value and knowledge creation, then try to reintegrate into GVC after building their own local value chain. Then there is another problem, how to measure the extent of participation in GVC specified industry? Concerning about this, Banga(2013)suggests that value-added created by forward and backward linkages in GVCs can provide a measure of extent of a country' s participation in GVCs. More detailed, forward linkages: where the country provides inputs into exports of other countries, backward linkages: where the country imports intermediate products to be used in its exports.

For the literature on industrial policy, Lee(2009) in his study on the case of Korea, proposes that given that the development of industry itself is a dynamic long-term process, the industrial policies are also supposed to be in a dynamic process, and due to this reason, Lee(2012) also suggests there are various evaluation criteria for the effectiveness of industrial policy, and different tools are needed depending on different targets.

Considering the middle-income countries like China, Lee(2012) emphasizes that industrial policy should focus on their technological

capabilities, which is, the goal of industrial policy for them is to promote technology-based specialization, not trade-based specialization, because capabilities failure is more unique and serious in developing countries. Especially under the context of GVC, Gereffi(2014) also emphasizes that GVC-oriented industrial policy should focus to a greater extent than in the past on the intersection of global and local actors to affect a country's positioning in global or regional value chains under the context of GVC.

For literature on Local content requirements(LCRs), according to the definition given by OECD(2016), LCRs are policies imposed by governments that require firms to use domestically manufactured goods or domestically supplied services in order to operate in an economy. While LCRs have been around for decades, recent years have witnessed a substantial increase in the use of these measures to try and achieve a variety of policy objectives, such as to meet employment, industrial or technological development goals.

In terms of improving the abilities and increasing production in a relatively less developed country, FDI was believed to be effective by Pavlínek, Domański and Guzik (2009) in their study on automotive

industry in central European. For literature on the response of foreign firms to LCRs, there is also evidence that LCRs could boost FDI in host countries according to Belderbos, Jie-A-Joen and Sleuwaegen (2002)'s study. While in perspective of long-terms, Lee and Lim(2001) suggest that it will be hard to guarantee a sustainable development without improving technological abilities. With the development of indigenous firms, Lee, Gao and Li(2016) suggest that foreign firms tend to become reluctant to provide technology transfer. Similar viewpoint is also mentioned in other study, Marin and Bell(2006) propose that the spillover effects of FDI would not happen if host countries do not focus on the linkages between FDI and domestic economy to make knowledge assets flow more effective. In other words, local ownership appears important in terms of technical activities, furthermore, in terms of capabilities improving in developing countries. As Lee, Gao and Li(2016) mention in their study, the development should depend on government and indigenous firms, not FDI. Also, under the context of GVC, Lee,Szapiro and Mao(2017) argue that national ownership is necessary to build local value chain during realize upgrading. In perspective of GVC, a

successful implementation of industrial policy should localize production while increasing local added value, and according to the "in-out-in again" view given by Lee, Szapiro and Mao(2017), the indicators measuring the extent of participation in GVC in an industry should show some signals that an independence development is pursued during the development of industry.

For the effectiveness of industrial policy, Aghion(2015) regard competition as a precondition of an effective industrial policy, specifically, for the factors that make LCRs succeed, Greenway(1992) proposed some factors that affect this policy in his study, among them market structure was considered as a key factor that would have impact on the implementation of LCRs. Hao(2010) emphasized the significance of domestic market while implementing LCRs , a stable and sizeable domestic market are considered to be important factors that can determine the success of LCRs in his study about the implementation of LCRs in British wind power sector. He also suggests that LCRs are not a policy implemented alone, some supportive policies stimulate the use of wind power should be joint implemented with LCRs together.

The effectiveness of LCRs is also believed to be affected by other policies. Lahiri and Ono (1998) mention in their study that government can control foreign, investment through the combination of tax and LCRs and impact the host country, Davies and Ellis(2007)also express similar point of view, which is there are complementary relationship between performance requirements such as LCRs and tax policies. Similarly, Belderbos, Jie-A-Joen and Sleuwaegen(2002) propose that MNE prefer to import intermediates from its own plant abroad if there is no restriction like LCRs, while LCRs could also make MNEs shift their producing phase to host county as a kind of discriminatory policy, in case that there is cost disadvantage in host countries then LCRs could not promote local participation, in other words, the effectiveness of LCRs needs complementary policies to be guaranteed.

For literature on mode and situations of development in auto industry, Korea as a successful case could be a notable example here. Over the past fifty years, Korean auto industry has grown from a small auto parts supplier to a global center of automotive(2011). Also the independence mode is considered as a factor that helps Korean

auto firms to achieve industrial upgrading from OEM to OBM(2017). Hyundai, one of the typical Korean car brand, as stated by Lee, Szapiro and Mao(2017), Hyundai chose an independent strategy to develop its own engines after Mitsubishi refusing to provide the technology of engine. According to Ravenhill(2003)'s study, the reason that Hyundai increased their localization rate faster than other Korean automotive producers is believed to be that they avoid dependence on their partners and at the same time integrate licensed technology from different countries to develop technology, including their own engine, actually although Korean automotive producers began in form of JVs, foreign ownership was limited from the beginning. For Hyundai, their partner Mitsubishi only hold 5% shareholding, the total shareholding by Kia's foreign partner is 17%, for Daewoo, they started JVs with GM in the form of 50/50, but the cooperation was dissolved in 1993 due to GM's unwillingness to Daewoo's foreign expansion plans(Auty, 1994; Ravenhill, Études and Ifri, 2005). In terms of ownership, the auto industry of Malaysia is very similar with Korea, Proton—Malaysia's first national car brand, began with Mitsubishi in form of JVs with 70 shareholdings by

Malaysian, which became lead firm in Malaysia later(Tai and Ku, 2013). Except preserving a high local ownership, the government also forbid other manufacturers to produce the models which could result in direct competition with Proton.(Tai and Ku, 2013; Athukorala, 2014) . Similarly, Malaysia's second national car brand was also built in a same form(Athukorala, 2014), which is different from Korea, although foreign ownership is limited, there is huge competition Korea's auto industry since 1987(Lee, 2011), also the support from state is considered to be a factor that affect the development of Korea's auto industry in his study. In terms of market structure, Thailand is more similar with Korea, restriction on auto industry was loosened after 90s (Tai and Ku, 2013), the government did not prevent competition in the market like Malaysia, furthermore, the restriction on foreign shareholding was also removed in 1997(Intarakumnerd and Gerdsri, 2014), Thailand almost became a totally open market and foreign ownership has taken over its domestic market since then, also the level of liberalization of the domestic market is very high(Natsuda and Thoburn, 2013). For China, there are two kinds of manufacturers

in domestic market— state owned JVs and self-owned brands coexist in the market(Zhilong, 2010), although self-owned brands entered the market after 2000, they have been rising quickly. Same with Korea and Malaysia, shareholding in JVs is also restricted, the Chinese part shall hold more than 50% of shares(Yu, 2008). The market share is split by JVs and self-owned brand averagely at present. (Xiaopeng, 2009). While comparing with self-owned brand, JVs in China are considered to perform not as good as self-owned brand, due to less technological activities and reliance on foreign partners than self-owned brand(Zhilong, 2010).

In generally, comparing the situation with that of Korea's auto industry, Malaysia and China are similar with Korea in terms of keeping a high level of local ownership and remaining independent from their foreign partners in JVs. While in terms of market structure, Thailand and China share more common points with Korea, which is that the competition is not prevented by government.

For literature on the comparison between Thailand and Malaysia, different development approaches are also considered as the reason leading to different results, which are dependent development and

independent development(Tai and Ku, 2013). In this perspective, China's auto industry, especially self-owned brand, can also be seen as independent development. For literature on the auto industry policies, Tai and Ku(2013)summarize in their study that policies implemented in Malaysia is that to build their own industry through protection of state, while Thailand chose the so-called open-door policy, aiming to attract FDI. For China's case, the direction of policies in China seems to be between Thailand and Malaysia, which is known as "Market for Technology", which is interpreted by Nanxiao(2005) in his study that the government try to acquire technology by attracting FDI through China's domestic market size while imposing controls on FDI.

For the cases of China, Malaysia and Thailand, Thailand did increase their production and export volume during the implementation of LCRs in auto industry, while failed in increasing their local value-added, as well they don't even own a national car brand. On the contrary , Malaysia not only built their own national car brand, but also reduced the dependence on imported parts in auto industry. However, a higher local ownership did not help Malaysia to

improve their competitiveness of product in the global market. While in China's case, different with Thailand and Malaysia, they perform well in terms of both production and local value−added increasing in auto industry. Similarly, in wind turbine industry in China, dependence on imported parts was significantly reduced while the flourishing development during the implementation of LCRs.

We build three hypotheses as follows. Given that this study will examine the effective factors of LCRs in three countries, according to the literature mentioned above, we first hypothesize that the limited success of Malaysia in auto industry is because they lack of competition in the domestic market, and the size of market is not big enough also do not export a lot for the implementation of LCRs. We second hypothesize that Thailand failed in promoting their local auto industry while only perform well in the export market is because there are neither complementary policies nor local ownership in their auto industry. Our last hypothesis is that China succeeded in the LCRs is because they restricted foreign ownership, implemented protective policies except for LCRs, there also exists competition in the domestic auto industry and their market size is big enough.

3.LCRs and automotive industry in China, Malaysia and Thailand

3.1.Development of automotive industry in Thailand，Malaysia and China

Both Thailand and Malaysia's automotive industries started from 1960s. Preliminarily, Malaysia government restricted import of the completely built up(CBU) through complicating the procedure of import and charging high import tax, which made the local automotive assembly industry got rapid development in a short time. The assembly factories at that time were mainly established by European car manufacturers and local partners jointly. Similarly, Thailand also restricted import of the completely built vehicles and decreased the tariff of imported completely knock down(CKD) for attracting foreign large car manufacturers to cooperate with local enterprises, which also made a huge increase of the local assembly car quantity(Tai and Ku, 2013 pp.60-61).

While after 80s, they turned to different directions on their car polices. In 1982, Malaysia government declared the "National Car

Project" , a project trying to establish a national champion brand——Proton, through the cooperation among national enterprises, HICOM (Heavy Industries Corporation of Malaysia Berhad) and Mitsubishi Corporation. Reliably, with the government's support, Proton became the leading brand of Malaysian car market at that time(Natsuda and Thouburn, 2013 p.12).

Different with Malaysia developing its national brand, in 1985, due to the Plaza Accord, Yen appreciated, Japanese manufacture enterprises had to seek for lower cost abroad manufacturers, with which Thailand government made series favorable tax policies mainly for Japanese enterprises to attract foreign investment(Tai and Ku, 2013,p.64)and furtherly canceled the restriction of car industry after 90s, as well as balanced import competition through boosting the export.

China's auto industry started a little earlier than Malaysia and Thailand, five car factories with annual production capacity of 60 , 000 vehicles had been established in China when auto industry just started in Malaysia and Thailand(Li, 2003,p.13). While the strategy taken by Chinese government at that time is totally

independent development, so there is a big gap between Chinese car manufacturers and foreign manufacturers in terms of technology level(Yu, Zhou Ming, 2008,p.3). This situation was changed in 1980s, JVs were established in China to promote industrial upgrading under the strategy "Market for Technology", production of automotive increased significantly in this period, while self-owned brand did not have a place in China's domestic market due to ignoring of independent development capacity(Ying, 2007,p.10).Nevertheless, after joining WTO, private capital was allowed to enter market, and self-owned brand began to appear at the market massively(Xiaoqing, 2013 p.169).

3.2. LCRs and LCRs' outcome in Malaysia, Thailand and China

3.2.1. LCRs in Malaysia, Thailand and China

1) Malaysia：

In 1979, Malaysia government made Mandatory Deletion Policy (MDP), which forbids foreign manufacturers to add some contents in their imported CKD kits and stipulated 30 kinds of parts must be produced locally(Natsuda and Thouburn, 2013 p.9). In 1992, the

government furtherly made specific LCRs through vehicle types and displacement volume and were abolished in 2004 at last because Malaysia jointed the WTO and had to do so under their request(Wad, 2009 p.181) .For the localization rate, 70% content of cars produced by Proton achieved localization(Simpson, Sykes and Abdullah, 1997 p.132), some major models made by Proton have even 90% of local content(Natsuda and Thouburn, 2013,p.18).

Table 3.1 Local content requirements in Malaysia

	Passenger Vehicles		Commercial vehicles
	1,850cc or less	1,850 to 2,850cc	2.5tons or less
1992	30%	20%	20%
1993	40%	30%	30%
1994	50%	35%	35%
1995	55%	40%	40%
1996	60%	45%	45%

Source: (Fujita, 2015)

2) Thailand：

Table 3.2 Local content requirements in Thailand

	Passenger Vehicles	Commercial vehicles
1975	25%	20% 15%(cars without windshield)
1980	35%	20%
1981	40%	25%
1982	45%	30%
1983	45%	35%
1984	50%	40%
1987	54%	51%
1994	54%	72%(diesel engine) 60%(gasoline engine)

Source: (Natsuda and Thoburn, 2013; Fujita, 2015)

In the first two years of the implementation of LCRs, the effect of the policy was undermined by large number of imported CBU automobiles, so import ban of CBU passenger cars was announced in

1978 to further protect local production. (Fujita, 2015 p.152)

Similar with Malaysia, MDP(Mandatory Deletion Policy) was also made in parallel with LCRs, which stipulated the local production of brake drums, exhaust systems and other parts(Natsuda and Thouburn, 2013 p.10).Meanwhile, assemblers were mandated to use locally-made engine on their pick-up truck(Natsuda and Thouburn, 2013,p.10)

Thailand had to abolish LCRs after joining the WTO in 2000 , the same reason with Malaysia(Tai and Ku, 2013 p.66).With regard to the localization rate, the requirements were met by some vehicles, the Soluna model, and pick-up truck, the Hilux model produced by Toyota, had achieved over 70 percent local content in 1999, before the abolition (Natsuda and Thoburn, 2013,p.20).

3) China:

In 1990, the implementation of <Temporary Provisions Regarding Localization Acceleration of Cars by Applying Tax Preference> marked the introduction of LCRs within the Chinese auto industry.

According to this regulation, concerning auto parts and components needed to be imported at different stages of localization for the

production of cars franchised by the nation, the principle is applied that the higher level of localization comes with a lower import tariff while the lower level of localization accompanies a higher import tariff. Industrial and commercial consolidated tax shall be levied in compliance with statutory tariff of 5%. Tariff and added-value tax shall be reduced differently according to principles below.

1. Once the localization rate is between 40% and 60%, parts and components which are imported in a year shall be levied at the reduced tax rate of 75% subject to Tax Regulations; Added-value tax of above-mentioned parts and components for importation shall be levied at the reduced tax amount payable of 50%.

2. In the case of the localization rate from 60% up to 80%, parts and components which are imported in a year shall be levied at the reduced tax rate of 60% subject to Tax Regulations; Added-value tax of above-mentioned parts and components for importation shall be levied at the reduced tax amount payable of 50%.

3. Provided the localization rate exceeds 80%, parts and components which are imported in a year shall be levied at the reduced tax rate of 40% subject to <Tax Regulations>; Added-value tax of above-

mentioned parts and components for importation shall be levied at the reduced tax amount payable of 50%.

4. The implementation period of tax preference during the localization shall be based on the calculation of annual growth in the localization rate which is 20%. By the third year after the start-up stage, tax preference shall be waived if the localization rate fails to meet 80%.

5. For enterprises that achieved an annual growth in the localization rate of 20%, tax of the imported parts and components shall be reduced for three to five years once the localization rate is higher than 80%; But the overall period of tax preference including start-up stage and localization stage shall be no more than ten years.

Note : "Start-up Stage" stands for a specific phase that a certain number of loose pieces are imported by franchised manufacturers to assemble, which is approved by the authority, after the initial introduction of OEM technologies, aiming to understand, research and introduce technologies.

From 2002 to 2004, the policy was abolished to comply with international trade principles required by WTO. (Shiyu, Tan Wanzong, 2017,p.85)

From 2005 to 2009, localization polices were executed differently. Since China's entry into WTO, foreign-owned auto part manufacturers gained access to the industry while localization policies were abolished, which had a dual impact on domestic auto part manufacturing sector. To provide domestic auto part manufacturers with a period of time for adjustment, a temporary policy <Measure for Import Administration of Auto Parts with Entire Car Features> was introduced. According to the Measure, that "CBU Feature" when the sum of imported parts accounts for more than 60% of the total price of the entire car, and tariffs shall be levied at the tax rate of CBU. Hence, such a measure is regarded as an indirect localization policy. (Shiyu, Tan Wanzong, 2017,p.85)

Table 3.3: Localization rate of leading manufacturers in China in 2011

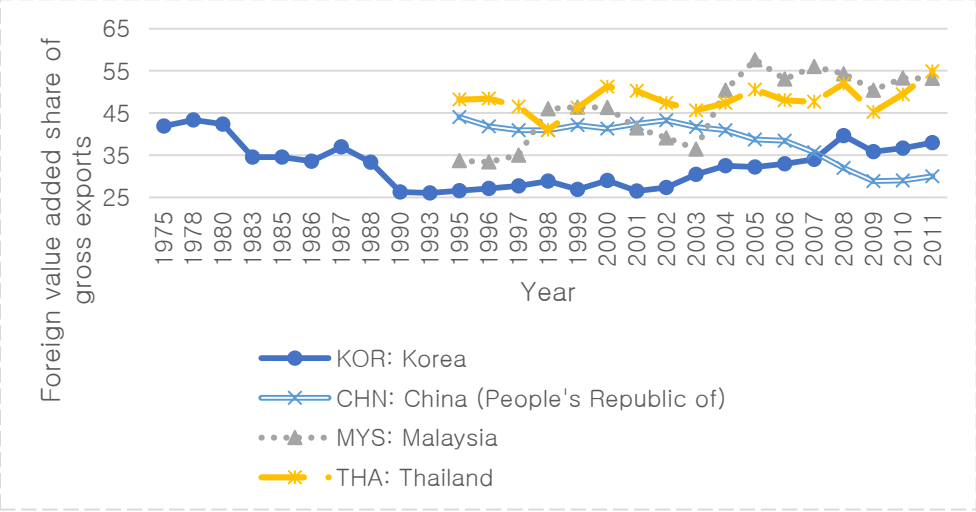
	Guangqi Honda	Toyota	Shanghai Volkswagen	FAW Volkswagen	Nissan	Dongfeng Honda	Beijing Hyundai
Model	Accord	Corolla	Lavida	Audi	TIIDA	CIVIC	ELANTRA
Localization Rate	90%	80%	95%	90%	60%	72%	91%

Source:(Hailong, Song Haisu, 2013)

3.2.2. Outcome of LCRs in China, Malaysia and Thailand

According to Lee(Lee, Szapiro and Mao, 2017 p.3) , for latecomer it is necessary to increase participation in GVC in the initial stage of industry development, because this provides them a chance to learn foreign knowledge and production skills. While, when economy enters the middle-income stage, to achieve upgrading, it is important to seek for separation and independence from GVCs, by doing so, domestic industry can prevent itself lose in a competition against other sites with lower wage rate. Then, after building their own local value chain, they should seek reintegration back into the GVC.

Figure 3.1 EXGR_FVASH: Foreign value added share of gross exports in Korea, Malaysia, Thailand and China's transport sector



According to the definition given by OECD, foreign value added of gross exports captures the value of imported intermediate goods and services that are embodied in a domestic industry's exports (OECD, 2017.p,8).It is a backward linkage in terms of gross exports. The value added can come from any foreign industry upstream in the production chain:

$$EXGR\_FVAc = Vc \square BcEXGRc,i,$$

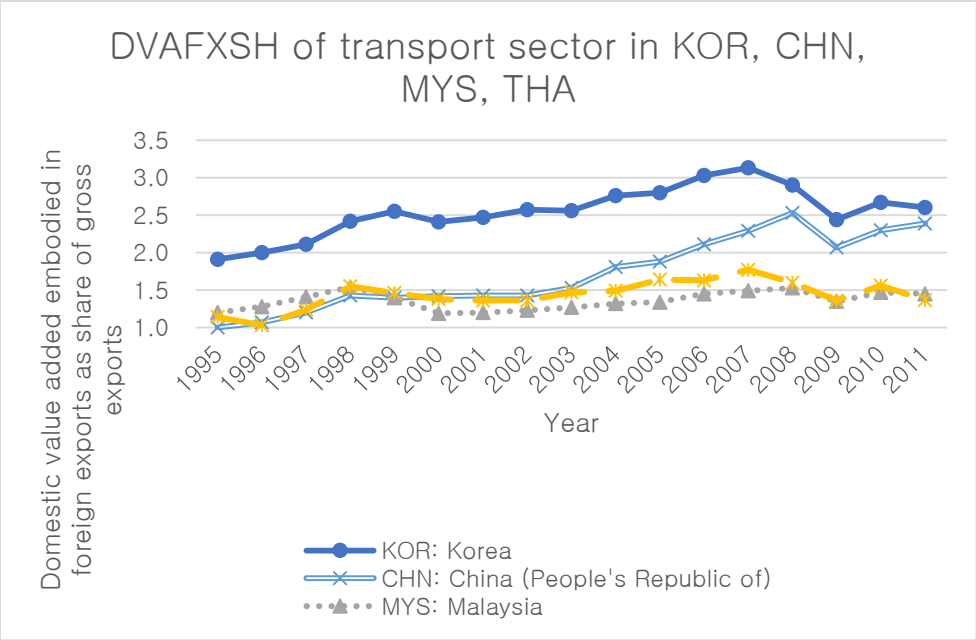
where Bc is a matrix represents the total gross output from all countries required for a one unit increase in country c's demand, with Bc being the column block of B corresponding to country c, with the row block corresponding to c being zero, Vc represents domestic value added shares of output for each industry i , and EXGRc,p represents a K x 1 vector of gross exports from country c to country p for all K industries.

It reflects the total value-added created in other countries which enters the exports of a country, in other words, a higher value of this indicator shows a higher participation in GVC, and a lower level of local value-added was created. As a reference, the "in-out-in again "view has been proved here through the trend of Korea. At the initial

stage, the proportion of FVA in gross exports takes a big share, while after a period of development, a lower share of FVA shows that the industry is under the independence development and tried to build their own local value chain

In this view, only China shows a decreasing trend for a long period. Although Malaysia also shows a decreasing trend during 1998－2003, it does not last long like Korea and China and sharply increased, in which year that LCRs were abolished. While Thailand fluctuates more in this indicator, also keeps a high level, which indicates that their extent of participating in GVC still keeps a high level. Neither Thailand nor Malaysia succeeded in terms of independence development and building their own local value chain. Their exports still rely on foreign value added.

Figure 3.2 EXGR_DVAFXSH: Domestic value added embodied in foreign exports as share of gross exports in Korea, Malaysia, Thailand and China's transport sector



According to the definition given by OECD, domestic value added embodied in foreign exports as share of gross exports presents the ratio between the domestic value added content of gross exports of foreign countries industry i to gross exports of source country c (OECD, 2017.p,9). It is a forward linkage.

$$EXGR\_DVAFXSH_{c,i} = \sum_p EXGR\_BSCI_{c,p,i} / \sum_p EXGR_{c,p} \times 100 ,$$

where EXGR_BSCIc,p,i represents origin of value added in gross exports by source country and industry ,

country of value added origin c

industry of value added origin it

exporting country p

exporting industry i , and EXGRc,p represents a K x 1 vector of gross exports from country c to country p for all K industries.

It links a country to GVC through forward linkage where the country provides inputs into exports of other countries, it measures domestic value-added which goes into other countries' gross exports(Banga, 2013,p.14).

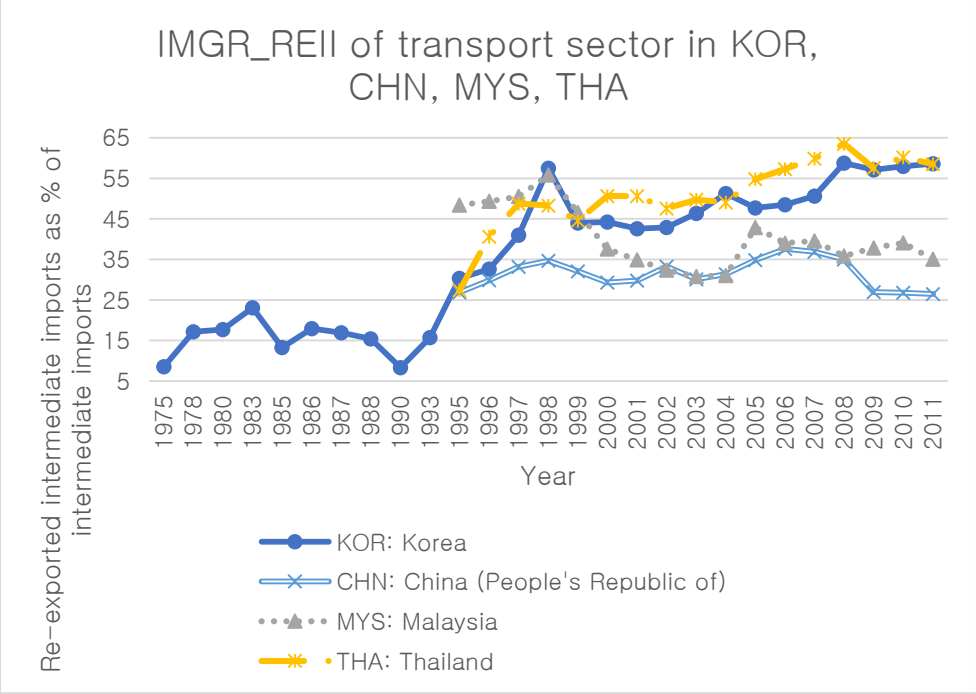
For Korea, after great development , Korean car makers began to invest in other countries, for instance, Hyundai Motors had made a lot of investment in China, India and other countries to utilize their cost advantages(Bose, 2012 p.164), this is why Korea is high in this indicator, they have globalized their production.

For China's case, it is the only one among three countries who shows an increasing trend, which means that China is also starting building factories globally, Chinese car manufacturers, including CBU

and parts manufacturers began to build factories overseas since 2001, especially self-owned brand like Chery own 16 overseas factories in Malaysia, Brazil, Ukraine and other countries(Qu, 2015 p.6)

While Thailand and Malaysia almost remain unchanged in this indicator meaning that they have not globalize their production yet.

Figure 3.3: IMGRINT_REII: Re-exported intermediate imports as a % of total intermediate imports in Korea, Malaysia, Thailand and China's transport sector



According to the definition given by OECD, re-exported intermediate imports by exporting industry as a share of intermediate imports shows how much of the imports are exported (OECD, 2017.p,17). Different from the first indicator, it is a backward linkage in terms of intermediate exports.

$$IMGRINT\_REIIc,i = (\sum pAp,cBc,cEXGRc)i / \sum pIMGR\_INTc,p,i$$

where $(\sum p\ Ap,cBc,cEXGRc)i$ refers to imported products which are used as inputs into production processes and then exported again are referred to as re-exported intermediate products,

and $\sum p\ IMGR\_INTc,p,i$ is total intermediate imports of country c from each industry i.

It links the country to GVC through backward linkage where the country imports intermediate products to be used in its exports, it measures foreign value added in its gross exports(Banga, 2013,p.14).

Also as a reference here, Korea used to be low in this indicator, while it soon increased fast because the development of auto industry in Korea made it shift to export orientation, Korea became the sixth largest auto-making country in 1994 and made a huge exports in auto industry since then(Hyun, 1995,p.4). That is why this indicator

in Korea increased after 1990.

In this term, though Thailand also keeps a high level in this indicator, due to the absence of local car makers, the high exports here are all made by foreign firms who built factories in Thailand, not their own local makers.

For China and Malaysia, they still keep a lower level than that of Korea and Thailand, while for China, we know that they are following Korea's path from the previous two indicators. We may predict that this indicator of China will increase in the future if their auto industry starts to export.

3.3. Key factors leading to different results among Malaysia, Thailand and China

3.3.1. Malaysia

1) Policies:

For the smooth implementation of the plan, while implementing LCR, many other supportive policies were also carried out. Firstly, the import tariffs were increased. Among of them, the tariff of CKD kits is 40%−60%, and CBU was 140−200%. However, the tariff of CKD

kits for national vehicles was exempted. In order to lower the price of national vehicles(Tai and Ku, 2013 p.62; Athukorala, 2014 p.116). Together with the "National Car Project", the "Vendor Development Program" (VDP) was also carried out to boost the development of local SME parts suppliers. Through this program, the part manufacturers of national car were provided production subsidies, which made their parts price decrease by 10%−12%, and the number of parts suppliers of Proton increased rapidly from 17 in 1985 to 186 in 1999(Natsuda and Thouburn, 2013 p.12−13; Tai and Ku, 2013 p.62).

2) Ownership:

The LCRs of Malaysia and the "National Car Project" nearly ran in parallel. Mitsubishi and HICOM were chosen to build national vehicle company−− Proton. As joint venture, Mitsubishi took 30% of shares(Athukorala, 2014 p.115).

In 1991, another national car plan—Perodua was announced, similar with Proton, this firm was also established as a JV between Japanese car manufacturer and domestic firm, Daihatsu was chosen as a

partner, Malaysia holds 68% of shareholding(Wad and Govindaraju, 2011 p.158). Perodua enjoys the same tariff concessions, tax relief and other government supports with Proton(Athukorala, 2014 p.118).

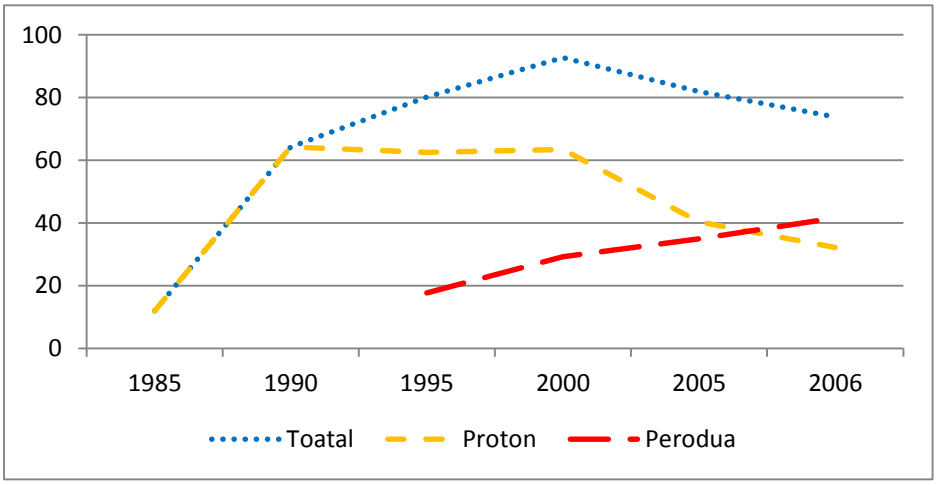
3) Market structure:

While providing high allowance to Proton, the government also forbid other manufacturers to produce the models which could result in direct competition with Proton.(Tai and Ku, 2013 p.62; Athukorala, 2014 p.116), to avoid direct competition with Proton Perodua only produce cars with an engine capacity of less than 1,000cc(Athukorala, 2014 p.118).Under a series of government policies' support, the car model--Saga produced by Proton took 45% of same level on the market in late 80s(Tai and Ku, 2013 p.62).

Before national car appeared in Malaysian market, Toyota and Nissan were dominant in the market, while Proton seized market in a very short time with the help of a series discriminatory policies including LCRs. It occupied 80% share of vehicles under the 1500cc range by 1987(Nizamuddin, 2008,p.355) ,this situation was improved in 1991, Malaysia government made a reform to reduce restriction of automotive industry, which made new entrants in the market,

Hyundai, Citroen, Rover and some other international car manufacturers began to come into Malaysian market. By the end of 2000, there were 15 car manufacturers in Malaysia, most of them are non-national car assemblers (Wad and Govindaraju, 2011 p.159) , the major market share was still occupied by national cars, which is quite different from the situation in Thailand.

Figure 3.4: Domestic car sales and the market share of national carmakers

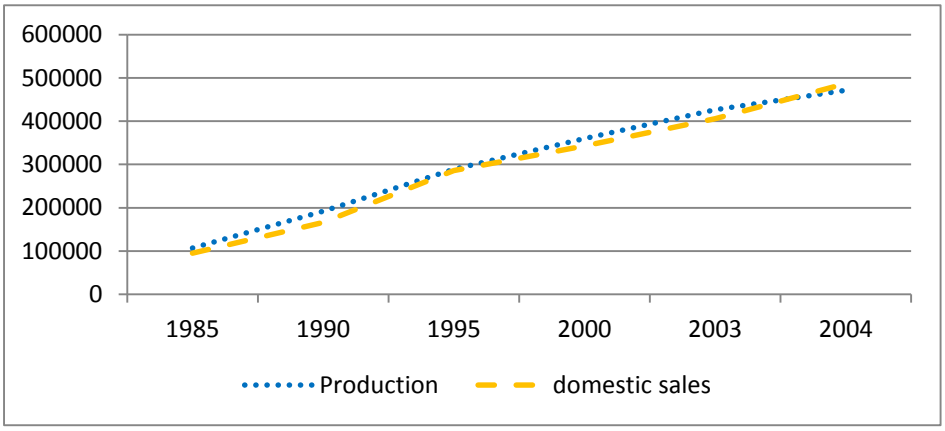


Source:(Athukorala, 2014)

In terms of part suppliers, some part suppliers of Proton have existed before Proton was established but more than half of them were established after Vendor Development Program was launched,

about 250 local part suppliers were fostered by Proton through Vendor Development Program, in terms of ownership, the majority of them were owned by Malaysian(Abdullah, 2008 pp.95-96). Not only Malaysian domestic auto part industry was promoted through this program, but also this the way how Proton meet the LCRs, 70% content of cars produced by Proton achieved localization(Simpson, Sykes and Abdullah, 1997 p.132). The automotive group formed by Proton and Perodua once produced 6,000 auto parts in their heyday(Tai and Ku, 2013 p.62). While after high-quality models produced by Japanese manufacturers with lower price were launched on the market, the market share taken by Proton was squeezed(Wad, 2009, p.185).

Figure 3.5. Auto production and domestic sales in Malaysia



Source: (Tai and Ku, 2013 p.69)

We can see that the auto production in Malaysia keeps growing after the implementation of LCRs, while most of the production are sold to meet the local demand. However, the size of Malaysia's domestic market is not that big for producers to achieve economies of scale to big extent.

3.3.2. Thailand

1) Policies:

Before 1990s, the Thailand government still tried to strengthen local participation in auto industry through series policies, for example, a high import tariff is levied—300% for PVs with

displacement higher than 2,300cc, meanwhile import ban on PVs with displacement lower than 2,300cc was imposed(Natsuda and Thouburn, 2013,p.10). While the restriction was loosened after 90s because the government believe that they have to stay current on new technologies with mainstream car manufacturers to promote domestic auto industry to international market(Tai and Ku, 2013 p.65).

The Thai government first assigned 1-ton pick-up truck as a product champion to develop auto industry, which also made Thailand become a hub of pick-up truck(Intarakumnerd and Gerdsri, 2014, p.8). And the tariff on import of CKD and CBU also declined year by year, the tariff of 1-ton pick-up truck used to be as low as 20%, other import tariffs of vehicles with different displacement was also significantly reduced. In addition, series of measures including eight years of corporate income tax exemption, offsetting import taxes on machinery and equipment, material import duty rebates were also developed by Thai government to attract FDI(Tai and Ku, 2013, p.65).

Table 3.4: Import tariffs in Thailand's auto industry

	Passenger cars under 2300cc		Passenger cars over 2300cc		One-ton Pick-up truck		Big truck	
	CBU	CKD	CBU	CKD	CBU	CKD	CBU	CKD
1991	60%	20%	100%	20%	60%	20%	40%	10%
1992	42%	20%	68.5%	20%	60%	20%	40%	10%
1994	42%	20%	68.5%	20%	60%	20%	40%	10%
1997	80%	20%	80%	20%	60%	20%	40%	10%
2000	80%	33%	80%	33%	60%	33%	40%	10%

Source:(Tai and Ku, 2013)

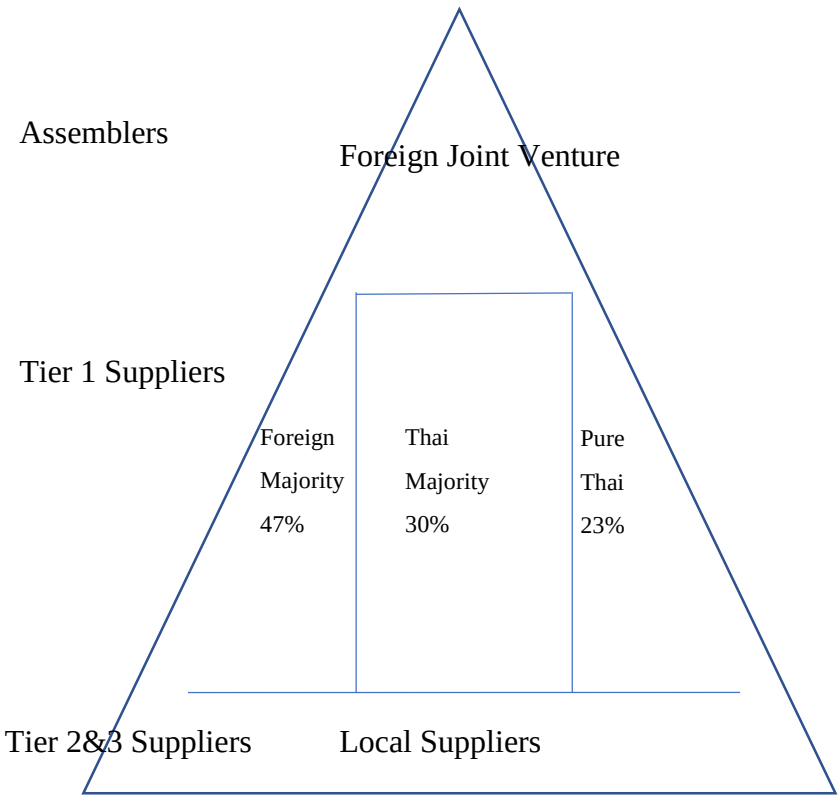
While the CKD import tariffs of PVs in Malaysia for non-national car is 40%-60%, and for CBU is 140-200% at the same time(Fujita and Hill, 2015 p.313), which is much higher than that of Thailand.

2) Ownership:

In 1997, the government further removed the restriction on foreign shareholding, which used to require the majority ownership to be held by a Thai national(Intarakumnerd and Gerdsri, 2014, p.8)As a

response, Fort, Kreisler, GM from US established their assembly factories in Thailand. In the meanwhile, their suppliers also followed close behind them into Thailand. Apart from that, Japanese manufacturers also built new factories in Thailand in 90s. After several years' promotion through policies, the MNEs auto suppliers in Thailand increased 300 manufacturers during 1987-2005(Wad, 2009, p.187).The foreign ownership has taken over the Thailand domestic market.

Figure 3.6: Manufacturers in Thailand's auto industry



Source:(Natsuda and Thoburn, 2013)

Among the leading firms in Thailand's auto industry, especially the JVs with Japanese car makers, majority shares are held by Japanese firms, Toyota Motor Corporation holds 86.4% of Toyota Motor Thailand[1], Mazda Sales(Thailand) is 96.1% and Mazda Powertrain Manufacturing(Thailand) is 100% held by Mazda Motor Corporation[2],

[1] https://newsroom.toyota.co.jp/en/detail/159480
[2] http://www.mazda.com/en/about/profile/related/

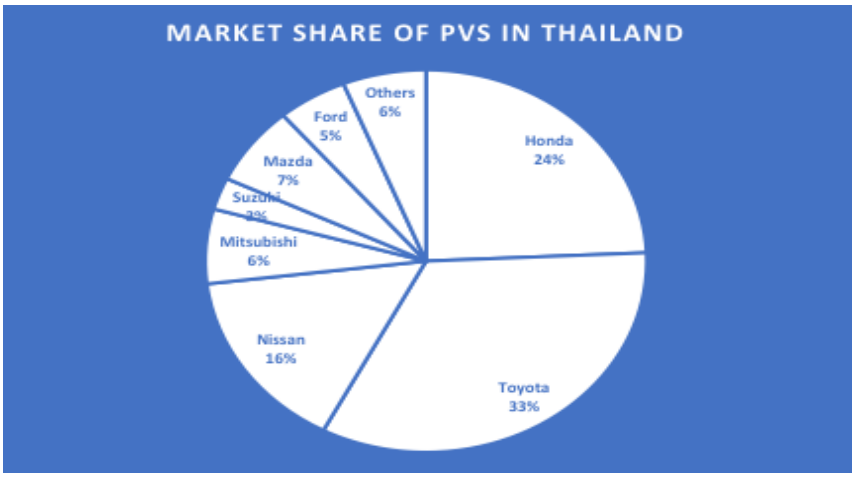
Nissan Thailand(Intarakumnerd and Charoenporn, 2015) and MITSUBISHI[3] Thailand are both totally held by foreign ownership.

3) Market structure:

Although the production and export volume of Thailand is the largest among ASEAN countries(Tai and Ku, 2013 p.66), they do not own a automotive brand like Malaysia. By the end of 2005, there are 16 car assemblers and 1,800 component suppliers in Thailand. Among assemblers Japanese firms were dominated with 91% market share(Busser, 2008,p.35).

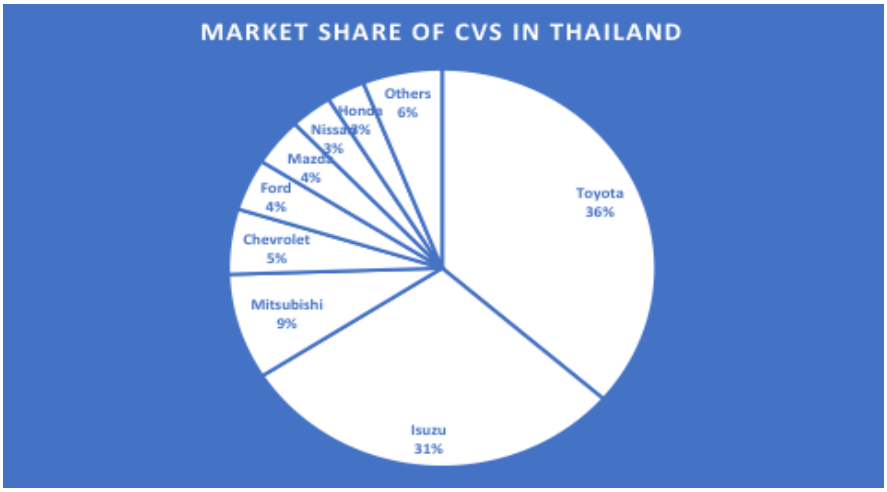
[3] https://www.mitsubishi-motors.com/content/dam/com/ir_en/pdf/irtop/2015/presentation_20150306.pdf

Figure 3.7: Market share of passenger vehicle in Thailand in 2013



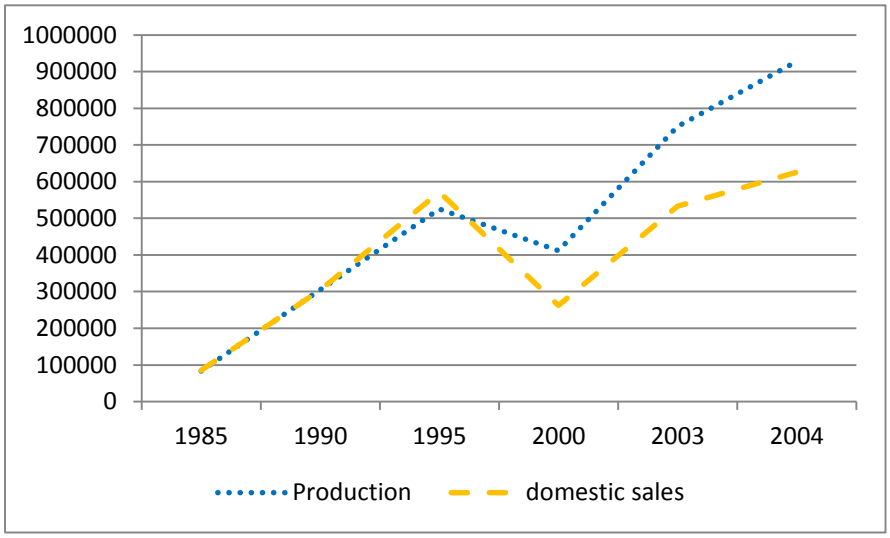
Source: https://www.marklines.com/en/statistics/flash_sales/salesfig_thailand_2013

Figure 3.8: Market share of commercial vehicle in Thailand in 2013



Source: https://www.marklines.com/en/statistics/flash_sales/salesfig_thailand_2013

Figure 3.9 Auto production and domestic sales in Thailand



Source: (Tai and Ku, 2013 p.69)

Different from the situation of production and sales in Malaysia, although the production and sales of Thailand's auto industry decrease during 1995−2000, the production that is exported is getting more and more, the vehicle manufacturers could benefit through the growing demand from exports to achieve scale economy, which is similar with Korea's auto industry.

3.3.3. China

1) Policies:

Except LCRs, supportive policies issued by the Chinese government for auto industry include three categories: import restriction, investment management and consumption delay.

Import Restriction: According to <Auto Industry Policy> issued in 1994, import quota license is used to rigorously regulate import of cars and key auto parts. the types of imported cars shall be consistent with auto production plan nationwide. Either used cars or parts for car assembly are forbidden, which means auto manufacturers are not allowed to import kits to produce cars in a way of SKD or CKD(Xiushan, Chen Bo, 2007,p.71).

Investment Management: Foreign enterprises are not allowed to establish more than two joint adventures in China for one specific type of cars. For investment projects with regard to CBU and engines, foreign auto manufacturers shall work with local manufacturers(Nanxiao, 2005,p.81). Chinese private enterprises were kept from the market as well. It was not until China's access to WTO, they were approved to enter the market when foreign

enterprises were allowed(Xiaoqing, 2013,p.169).

Consumption Delay: During the after-sales registration, vehicle purchase surcharge levied for imported cars is higher than that of domestic cars(Xiushan, Chen Bo, 2007,p.72).

2) Ownership:

According to requirement of share proportion, the Chinese part of JVs shall hold more than 50% of shares, so most of JVs in China's auto industry took the form that shareholding is half held by foreign and Chinese partners(Liu, 2014, p.44). It is worth mentioning that this requirement will be gradually abated from next year. Also Joint ventures are requested to establish R&D centers inside the enterprise instead. In doing so, R&D centers must have an ability of developing the products of the next generation(Yu, 2008 p.3).

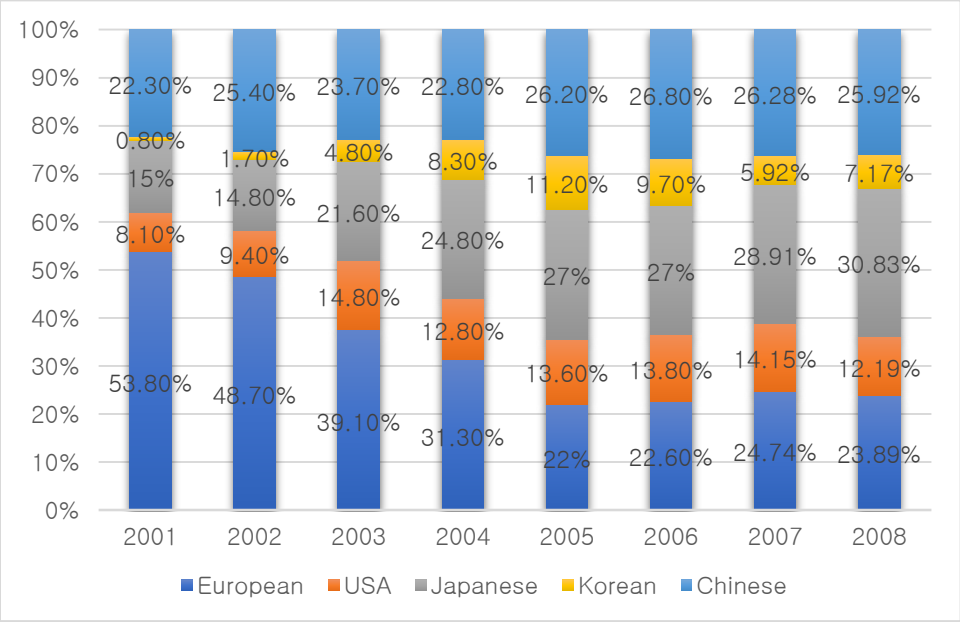
3) Competition:

In 1985, German Volkswagen accessed to Chinese market, which led the trend of foreign investment. By 2003 when BMW entered the market by establishing a joint venture, the global top ten auto manufacturers have all left their footprints in China. Although JVs and

self-owned brands coexist in the market at present, before 2000 JVs almost monopolized Chinese domestic market(Zhilong, 2010,p.141).

The rise of local brands such as Great Wall Automobile, Cherry Automobile and Geely Automobile truly marked the development of self-owned brands.

Figure 3.10: Market share of vehicles in Chinese market

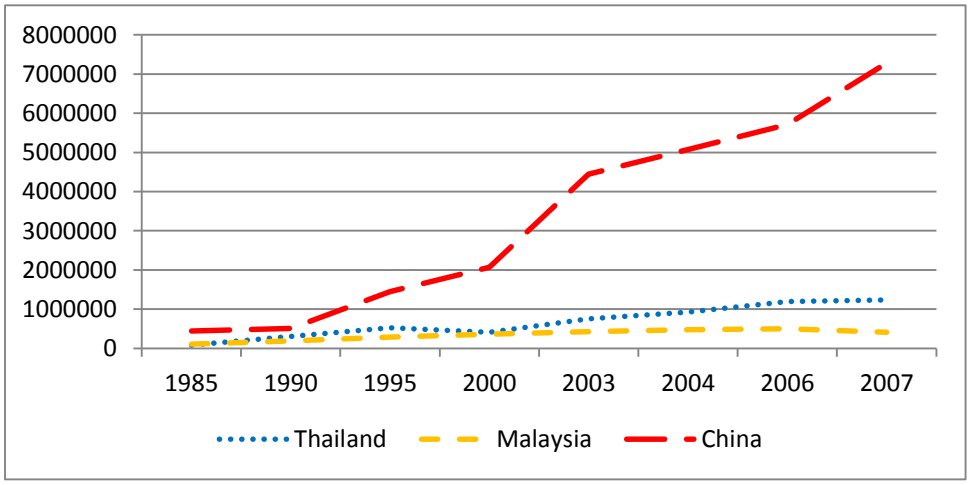


Source : (Xiaopeng, 2009)

Market share taken by Chinese self-owned brand reached 29.7%, exceeded Japanese brand to become the highest occupant of market share in domestic market in 2009(Zhilong, 2010 p.141), the year that

LCRs were abolished. The advantages that help Chinese brand to seize market are believed to be the market position chosen by Chinese car manufacturers and price advantage. Among the five top Chinese self-owned brands, except for Brilliance-Auto , all of them entered market through producing low-end cars, which was ignored by the manufacturers already on the market, and also control cost in their ways to keep products cheaper(Zhilong, 2010 p.145).

Figure 3.11: Auto production in three countries



Source： (Li, 2003; Wad, 2009; Tai and Ku, 2013)

Through comparing auto production, we know that China has the biggest domestic market among three cases, therefore, it's easier for vehicle manufacturers to achieve scale economy than Thailand and

Malaysia even though they do not export that much.

Baldwin(2016) in his book holds that the development of auto industry in Thailand is successful while Malaysia failed because Thai performed much better in terms of increasing production and exports due to the different strategies taken by two countries. We argue against this suggestion, because it only focuses on the increasing of production and export volume while ignores the importance of the extent of localization and whether Thailand achieved industrial upgrading in auto industry, in other words, in perspective of GVC, the sustainable development of Thailand should be questioned.

4. LCRs and wind turbine industry in China

4.1. Development of wind turbine industry in China

Chinese wind turbine manufacture industry can be divided into three stages, namely, independent R&D with government support, imitative innovation with technology licensing, as well as the associated R&D and cooperative innovation(Xiang et al., 2011,pp.11-12)

The first stage began around 1986, when Shandong Rongcheng installed 55KW turbines purchased from Denmark's Vestas, marking the beginning of grid connected wind energy in China. Although Wind turbines of 18KW, 55KW and 200KW were developmented by the end of 1995, the industrial production was not realized due to the technical defects.

In the second stage, the government implemented the “Ride the wind program” in 1996, which helped to build two joint venture enterprises of wind turbines. According to the agreement, the selected foreign manufacturers transfer technology to Chinese manufacturers(Klagge, Liu and Campos Silva, 2012,p.376). In the meanwhile, government promised to provide certain fund and a certain amount of orders for supporting technology transfer. Besides,20 percent of local content was required to achieve technology transfer in this program. However, the two joint ventures did not grow up because they did not do much R&D activities and the foreign manufacturers were reluctant to provide the core technology, so they could only produce the wind turbines with technology introduced at that time. (Lema and Ruby, 2006,p.7; Zhi Qiang, Su Jun,

2013,p.52)

The third stage began around 2003, when the Chinese government launched the wind power concession bidding projects and put forward local requirements for the wind farm developer participating in the bid invitation, that is, the wind farms whose local content was less than 50% were prohibited to build(Zhi Qiang, Su Jun, 2013,p.52). In order to produce equipment to seize the market within a short time, most Chinese local manufacturers chose to import or purchase foreign technology licenses.

4.2. LCRs in China in wind turbine industry

LCRs in China was first joint implemented with the “Treasury Bond Wind Power Project”. According to the project issued by National Energy Administration in 2000 , 80MW domestic wind turbines will be installed as demonstration wind farm project (Implementing Plan of Treasury Bond Wind Power Project”,2000, No.46 document) of which the assessment method for the localization rate of wind turbine is as following:

Except tower, the localization rate is calculated based on the five major parts:

1) generator; 2) speed increasing gearbox; 3) electronic control system; 4) direction adjustable device; 5) wind turbine blade.

1. *For each project, 30% of the total installed capacity should adopt any two parts domestically produced among the above. The localization rate should be more than 50% as price calculation. 40% of the total installed capacity should realize four parts are produced domestically, according to price calculation, the localization rate can be above 75%. Another 30% of the totally installed capacity should realize all of the five parts are produced domestically, and achieve 85% or the localization rate as price calculation.*

2. *In principle, there is no upper limitation for the capacity of the turbine used in demonstration wind farm. For the set lower than 600 KW, all of the five parts should be produced domestically.*

Chinese government also launched "Wind Power Concession Bidding Project" in 2003, which carried out for five terms. Except the first term which required the localization rate could not be less than 50%, according to the No.1204 document issued by The National Development and Reform Commission (NDRC) in 2005, the

localization of wind power equipment should be more than 70%, and the wind farm which is not qualified on localization rate is not allowed to construct (Notification about the construction and management of wind power,2005, document 1204).

In 2006, the conditions of tender for wind power concession project got new change(Liping and Pengfei, 2006,p.3)

1. *Each bidder has to get one wind power equipment manufacturer to attend. Apart from that, wind power equipment manufacturers had to submit a commitment letter for promising they would supply the wind turbine with 70% localization rate.*

2. *After winning the bidding, bidder have to, and only could adopt the wind turbine produced by the equipment manufacturer stipulated in the bidding documents. It was not allowed to select another manufacturer through equipment bidding.*

Table 4.1: Localization rate of wind turbines installed in the "Wind Power Concession Bidding Project"

Term	Bindding Winner	Localization rate of wind turbines (%)
1	Huarui Group	68.4
	Guangdong Yuedian Group	>60
2	Longyuan Power Group	77.1
	Bgdl joint bidding	97.8
	Longyuan Power Group joint bidding/ Huaneng Renewables joint bidding	72.12
3	Guohua Energy Resources Investment Corporation/ State Power Investment	Huarui 84.4 Goldwind 6.24/ 95.96
	Huanghe Hydropower Development co.,Ltd	95.582
	Huadian Power International Corporation Limited	-
4	CGN Group Co., Ltd joint bidding/ Beifang United Power co.,Ltd	70/79
	Longyuan Power Group co.,Ltd and Hero Asia Investment Limited joint bidding	94.46
	China Energy Conservation Investment Corp joint bidding	78.5
5	Huadian Power International co.,Ltd and Huadian HONGKONG co.,Ltd joint bidding	77.6

	Power Beijing International Energy co.,Ltd	71.3
	Jointo Energy Investment co.,Ltd	66.5
	China Energy Conservation Investment Corp joint bidding	70.9

Source: Shuang(2011,p.71)

4.3. Key factors making China succeed in wind turbine industry

4.3.1. Policies

Since the 1970s, the Chinese government has gradually realized the importance of renewable energy and started to implement various policies to encourage the development of renewable energy. The initial wind power industrial policy was implemented during the seventh and eighth Five-Year Plan (1986-1995), during which time the government supported the development of 55kW and 200kW wind turbines(Xiang,2011,p.11). Since1995, the "New Energy and Renewable Energy Development Plan" was passed, which facilitate the development of wind power generation through subsidies, taxes, demonstration projects and other policies. By 2000 the value-added tax of wind power plant decreased to 8.5% from 17%(Xiang,

2011,p.13) ,providing a basis for market development.

In 1996," Ride the Wind Program" was implemented and tried to encourage the transfer of advanced foreign technologies through the introduction of joint ventures between foreign enterprises and local enterprises(Xiang, 2011, p.11) , there were also many incentive policies implemented in this period. Subsidies to new energy were also greatly enhanced at the same time.

Figure 4.1: Supportive policies and installed capacity during the implementation of LCRs

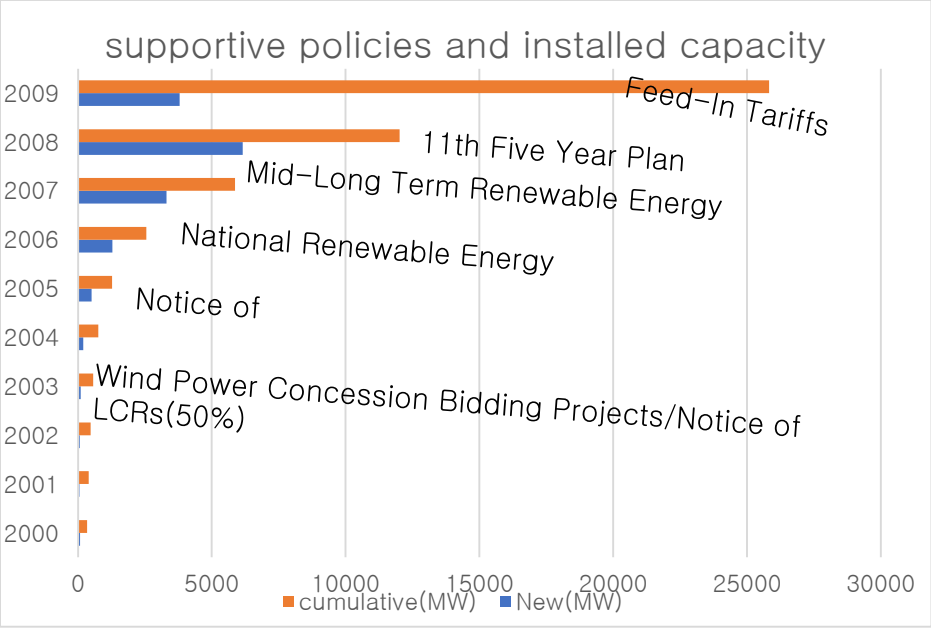
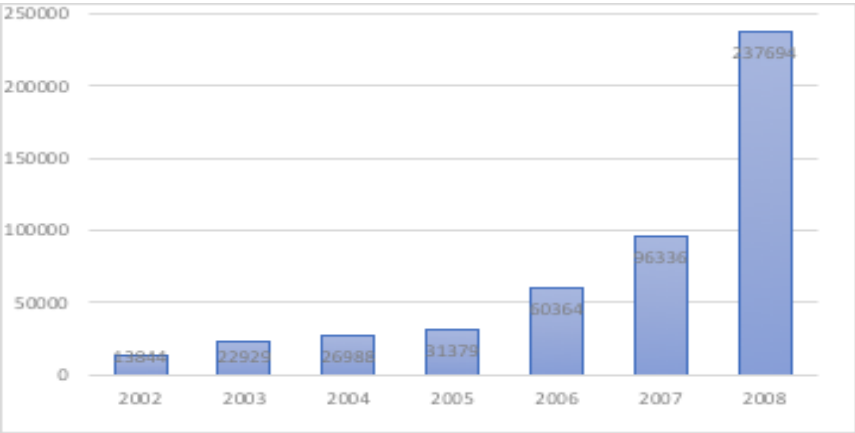
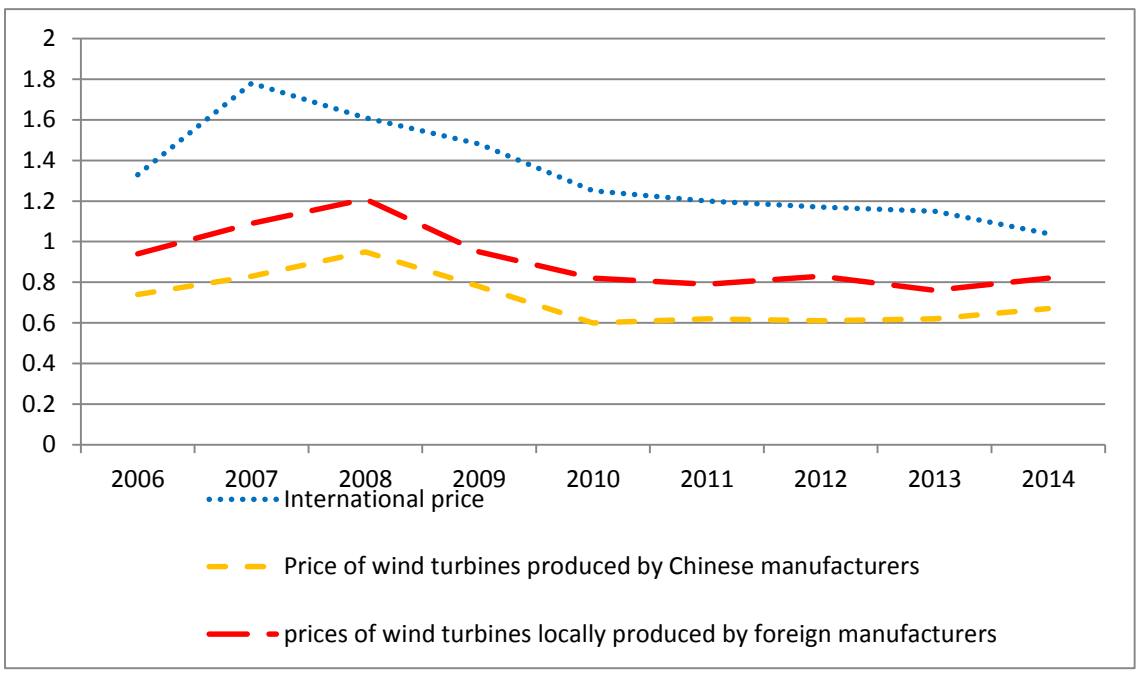


Figure 4.2 : Government subsidies to wind power industry (￥/million)



Source: Research Report on the development of wind power and electricity price in China (2009,p.11)

Figure 4.3: Wind turbine prices[4] in international and China markets ($m/MW)



Source: Hanergy Holding Group Limited(2015,p.56)

It can be seen that the price trend of China's local turbines is basically the same as the national price, but the price of domestic

[4] The prices of wind turbines with capacity higher than 2WM are exclusive

turbines is always lower than the price of foreign brands produced in China and international price.

The reason that the price of wind turbines made in China is the lowest is believed that state-owned enterprises are willing to weaken competitors with lower price because they may want to gain market share or meet government target(Lam, Branstetter and Azevedo, 2017,p.597). With regard to the drop of price, the author of "China Wind Energy Outlook" suggests that due to the increase of localization, the decrease of raw material price, and the increase of scale benefit, the price of domestic wind turbine decreases greatly(Junfeng, Pengfei and Hu, 2010,p.18). With the decreasing of price, the position of foreign firms was gradually replaced by indigenous manufacturers in Chinese domestic market.

4.3.2. Ownership

Before 2004, there were only 6 domestic wind turbines manufacturers in China, but at present the number of large scale wind turbines have already reached 26, the number of wind turbine

manufacturers had reached hundreds including SME wind power equipment manufacturers and component manufacturers(He , Jieying, 2015 p.26). Most of them are local enterprises have been encouraged by government policies since 2005.For foreign firms, only a few large firms, which have a large share in the international market, establishing subsidiaries or joint ventures with local firms in China.

1) Chinese manufacturers:

Since the large foreign firms have the most advanced technology in the industry, so most of them are reluctant to cooperate with local manufacturers in China(Zhi Qiang, Su Jun, 2013 p.52). In order to obtain core technologies in a short time, most of the Chinese manufacturers chose to purchase technology of abroad manufacturers who didn't enter the Chinese market or joint development, and some companies even took over foreign companies directly. Goldwind took over Vensys from Germany in 2008, and then obtained world's advanced technology and professional staff after the acquisition(Lewis, 2011 p.286).

Table 4.2: Leading Chinese manufacturers and their technology sources

SINOVEL	SOE	1.5MW turbine technology licensing from Flender(Germany), 3MW turbine jointly developed with American Superconductor
Goldwind	SOE	600KW production license from JACOBS(Germany), 750KW production license from Repower(Germany) Took over of Vensys(Germany)in2008
Dongfangturbine	SOE	1.5 MW turbine production license Repower(Germany) 3 MW turbine joint developed with Windtec(Austria)
United power	SOE	1.5MW turbine jointly developed with Aerodyn (Germany)
Mingyang	Private	1.5MW wind turbines jointly developed with Aerodyn(Germany)
Shanghai electric	SOE	2.5 MW turbine technology licensing from Zephyros(Netherlands) 1.25 MW turbine technology licensing from EU Energy Wind(Britain) Took over of Darwind(Nederlanden)
Windey	SOE	1.5MW turbine technology licensing from Repower(Germany)

Source: Klagge, Liu and Campos Silva(2012,p.380)

Although the initial technology sources were license purchasing

among Chinese domestic wind turbine manufacturers ,they further established collaborative relationships just like what Goldwind did at last, and this kind of special technology transfer promoted by LCRs was also considered to be successful(Lema, 2012, p.29).

2) Foreign manufacturers:

For the wind power equipment used in wind power farm, as long as the equipment is produced domestically, it can satisfy with the requirement of LCRs. In addition, the form of JV is also approved(Xiaohui and Baiying, 2010,p.40). Therefore, foreign manufactures with advanced technologies are reluctant to cooperate with domestic manufacturers, in case Chinese manufacturers master their advanced technology trough cooperation, most foreign manufacturers in Chinese market built branches in China for satisfying with LCRs.

Table 4.3: Operating activities of MNEs in China's wind turbine industry

Company	
Vesta	Bulit a blade factory in 2006, a dynamotor factory in 2007, a mechanical processing factory and a control system factory in 2008. Built a foundry in Jiangsu in 2008
Gamesa	Set up office in Beijing and built an assembly plant in Tianjin in 2006
GE	Built a factory in Liaoning in 2005, set up office in Shanghai and built an assembly plant in Tianjian in 2006
Nordex	Built factories in Hebei and Ningxia in 2004 and 2006. Built a blade factory in Shandong in 2007.
Suzlon	Set up office in Beijing ,built blade and turbine factories in Tianjin in 2007
LM	Built blade factories in Xinjiang and Hebei in 2007.

Source: Mingwei et al.(2015,p.120)

It can be seen that after the LCRs was implemented, to satisfy with the policy, foreign firms started carrying out production in China, while most of the market share was gradually occupied by Chinese domestic firms.

3) component suppliers:

With the development of wind power industry and the implementation of LCRs, the wind power part industry also grew rapidly. Although core component like control system still rely on import(Li, Shi and Gao, 2010 p.37), most of the components of wind turbine are localized.

Table 4.4: Main component manufacturers in China by 2007

Component	Name of enterprise	Technical resource	Stage
Gearbox	Nanjing High-speed & Accurate Gear Group Co. Ltd	Own R&D	Batch production
	Chongqing Gearbox Co. Ltd	Own R&D	Batch production
	Hangzhou Advance Gearbox Group Co. Ltd	Own R&D	Batch production
Generator	Lanzhou Electric Corporation	Own R&D	Batch production
	Haerbin Hadian Wind Power Equipment Co. Ltd	Own R&D	Batch production

	Beiche Group Yongji Electric Motor Factory	Own R&D	Batch production
	Shanghai Electric Group Shanghai Electric Motor Co., Ltd	Own R&D	Trial production: batch production started in the first quarter of 2007
	Shangxi Fengxi Heavy Industry Co. Ltd	Own R&D 1.5MW（Technology introduced from Germany for 2MW by license）	Design phase, trial production in March 2007
Blades	Shanghai FRP Research Institute	Joint design (Germany Company)	Batch production
	China Composites Group Corporation Ltd	Technology transfer (purchase the technology from NOI)	Batch production
	LM Glasfiber (Tianjin) Co. Ltd **	Sole foreign proprietorship Own R&D	Batch production
	ZhongHang (Baoding) Huiteng Windpower Equipment Co. Ltd	Own R&D	Batch production

Electrical control	Hefei Sunlight Power Co. Ltd	Own R&D	Trial production
	Nanjing Automation Research Institute (Nanrui Group)	Own R&D	Trial production
	Beijing Corona Science & Technology Co. Ltd(Institute of Electrical Engineering Chinese Academy of Sciences)	Own R&D	Trial production
Tower	Shanghai Taisheng Power Engineering Machinery Co. Ltd	Technology introduction (learn and simulate processing according to the design)	Batch production
	Qingdao Wuxiao Pipe Co. Ltd	Technology introduction (design provided by client)	Batch production
	South China Pipe Industry Company (Guangzhou)	Joint design with Gold Wind	Batch production

Note: * is the only foreign firm among main component manufacturers

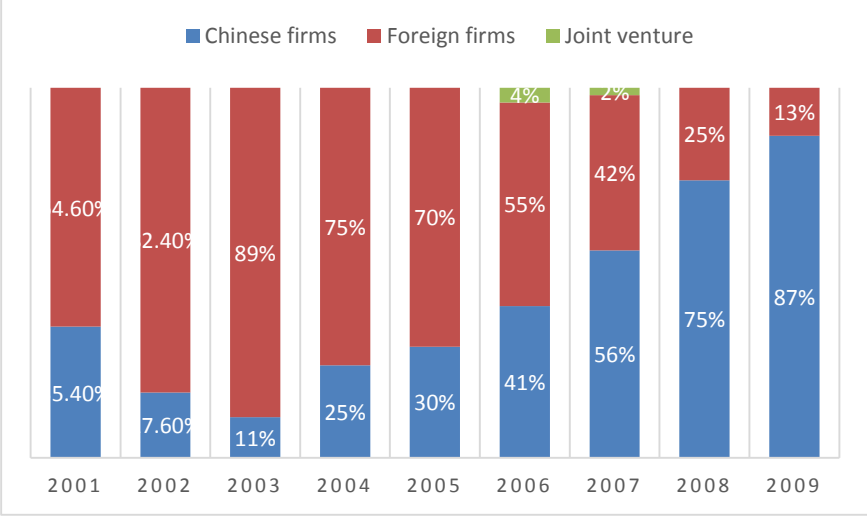
Source: China wind report 2007

The main reason for the rapid industrialization of components is considered to be good industrial foundation(Junfeng, 2008, p.45), there existed large amount of component manufacturers in the market, and with the development of wind power industry A large number of enterprises are actively engaged in the development and production of wind power parts.

It can be seen that even among the part suppliers, the market is dominated by China's local ownership. And for the wind turbine manufacturers, the state owned firms have been seizing the market, local ownership has become the mainstream of market.

4.3.3. Market structure

Figure 4.4: Share change of wind turbine manufacturers in China



Source: Junfeng, Pengfei and Hu(2010,p.37),CWEC

We can see that when LCRs were first applied, the lager market share was occupied by foreign firms, while with the development of local wind turbine manufacturers, they had seized market share in a short time, competition exists in China's wind turbine market. LCRs were implemented for both domestic and foreign manufacturers, and the Chinese government did not prevent competition in the domestic wind turbine market, the reason that the impact on domestic and foreign firms are different and market was captured by Chinese domestic firms is that they can provide wind power equipment with a lower price than foreign firms(He , Jieying, 2015 p.27). A detailed description will be made at next part.

In terms of market size, China has the second largest installed capacity all around the world by 2009, in which year LCRs were abolished(Li, Shi and Gao, 2010,p.3).

5.Summary and concluding remarks

We analyzed the effective factor of LCRs, for the cases of auto industry in Malaysia, Thailand and China, through judging the participation extent in GVC, we know that China is the most successful case among three countries, especially comparing with the

case of Korea. In Malaysia's case, although local ownership and supportive policies are guaranteed by government, the lack of competition makes Malaysia's auto industry competitiveness poor, so they are neither exporting strongly nor globalize their production, and the less export also makes vehicle manufacturers hard to achieve scale economics with a smaller domestic market to a great extent. In Thailand's case, they perform better than Malaysia in the export market, while due to the absence of local ownership and protective policies, foreign firms had taken over the whole domestic market and they do not own a self-owned brand, and they do not globalize their production either. China is the most successful case among three countries, while protecting local manufacturers through restricting foreign ownership and policies, the government did not prevent competition in the domestic market, which made China succeed in the implementation of LCRs, for the market size, China owns a market with a big size itself, which makes it easier for producers to achieve scale economics, and will perform better in the future if they keep following Korea's path. Then we can summarize that for the cases of auto industry in Malaysia, Thailand and China, the effective factors

of LCRs are the policies implemented in parallel with LCRs, ownership of car makers and market structure including market size and competition.

For China's wind turbine industry, we analysis the implementation of LCRs in this industry as a complementary case to support our theory. The policy did promote the development of indigenous manufacturers in wind turbine industry, and the part industry was also promoted at the same time with the development wind turbine industry. Although LCRs were oriented towards both domestic and foreign firms, the reason that Chinese indigenous firms catch-up with even exceed the market share of foreign firms is that domestic firms who were supported by government could provide products with a lower price than foreign firms under the premise that they did a rapid technology introduction.

This study has two contributions. First, this study tries to analyze the effective factors that would have impact on the implementation of LCRs in auto industry in three countries, and found that competition in the domestic market, local ownership and policies as complementarity of LCRs are the effective factors. Second, this study

examined the effective factors of LCRs in China's wind turbine industry and found that the rapid technology introduction of local manufacturers, competition in the domestic market and the supportive policies from government are the effective factors. And the limitations of this study is that

This study only compares the different situations among Malaysia, Thailand and China, the found of research cannot be generalized in other countries who also utilize LCRs to promote their industry, and there is no enough data for regression analysis.

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초 록

본 연구에서는 GVC 프레임워크를 사용하여 말레이시아와 태국, 중국 자동차 업계에서의 LCRs 실시 현황에 대한 비교를 진행했으며, 이 정책의 유효성에 대해 분석해 보았다. 이뿐만 아니라 중국의 풍력 발전 업계에서의 LCRs 현황에 대한 추가적인 사례 분석도 진행했다.

이 연구에서 필자는 우선 말레이시아와 태국, 중국 자동차 업계에서의 LCRs 정책에 영향을 미치는 요소에 대한 토론을 진행했다. 말레이시아의 경우 비록 정부에서 현지 소유권과 각종 지원 정책을 실시하고 있는 것은 사실이나 경쟁이 결여된 시장 상황은 도리어 말레이시아의 자동차 산업의 업계 경쟁력을 저하시키고 있는 상황이다. 또한 비교적 작은 시장의 규모와 수출량 또한 생산 업체로 하여금 규모의 경제를 쉽게 형성하지 못하게 만들고 있다. 태국의 경우 수출 시장 방면에서는 말레이시아보다 전반적으로 상황이 좋은 편이긴 하나 현지 소유권 및 보호 정책이 제대로 시행되지 못하고 있으며, 외국 업체들이 태국 국내 시장의 거의 전부를 차지하고 있다. 중국의 경우 이 세 국가 중에서 가장 성공적인 편에 속하는 사례라 할 수 있다. 중국에서는 외국 업체의 소유권 제한과 보호 정책 시행을 통한 국내 생산자 보호에 앞장서고 있다. 이와 동시에 정부에서는 시장 경쟁을 직접 통제하지 않는 방식으로 중국 자체의 시장 규모를 확대시키고 있으며, 이러한 방식을 통해 꼭 수출량이 많지 않더라도 규모의 경제를 보다 효과적으로 실현하고 있다. 전체적으로 봤을 때, 이 세 국가의 LCRs에 영향을 미치는 요소는 시장 구조, 보조 정책 및 현지 소유권이라고 할 수 있다.

이 외에도 필자는 본 연구에서 중국의 풍력 발전 업계에서의 LCRs 시행 현황에 대한 토론을 진행했으며, 그 결과 모든 영향 요소 중에서도 정부의 지원 정책이 중국의 풍력 발전 업계의 성공을 촉진할 수 있었던 가장 주된 요소라는 것을 발견할 수 있었다.

주요어: 자동차 산업, 산업 정책,국산부품 사용요건, 글로벌가치사슬

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