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SPECIAL ISSUE ARTICLE

Global Value Chains, Industrial Policy, and Industrial Upgrading: Automotive Sectors in Malaysia, Thailand, and China in Comparison with Korea

Keun Lee[1,2] · Di Qu[1,2] · Zhuqing Mao[3]

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Abstract

This study compares the evolution of automotive sectors in Malaysia, Thailand, and China with that of Korea by focusing on industrial policy, particularly local content requirements (LCRs) and global value chains (GVCs). Although LCRs show common effects of increasing the localization ratio to a certain degree, the eventual development paths of automotive sectors diverge in the three countries. In terms of three measures of upgrading in GVC, namely, the share of domestic (or foreign) value-added in their exports, export orientation (re-exported intermediate imports), and international competitiveness of their intermediate parts (domestic value-added embodied in foreign exports), China is the most successful (highest in two measures), followed by Thailand with strong export orientation, and with Malaysia being the least successful. Such divergent outcomes in three countries are explained in terms of three key factors, namely, local ownership, disciplines from market competition, and firm-level effort and strategies. Given the monopoly by national brand makers, Malaysia lacks discipline from market competition, whereas Thailand lacks local ownership and consistency in promoting domestic value-added. China is neither a national monopoly nor dominated by foreign joint ventures, but a strong entry by locally owned firms result in fierce market competition. In addition, Chinese firms attempt to build their technological capabilities and localize the production of key parts and components.

Keywords Global value chain (GVC) · Industrial policy · China · Korea · Malaysia · Thailand · Auto industry

Résumé

Cette étude compare l'évolution du secteur automobile en Corée avec celui de la Malaisie, de la Thaïlande et de la Chine en se concentrant sur la politique industrielle, en particulier sur les exigences de contenu local (ECL) et les chaînes de valeur

✉ Zhuqing Mao
mm7ng7ng@hotmail.com

Extended author information available on the last page of the article

mondiales (CVM). Bien que, dans une certaine mesure, les ECL montrent des effets communs en terme d'augmentation du taux de localisation, en bout de compte, les trajectoires de développement des secteurs automobiles divergent dans les trois pays. Si l'on considère trois mesures permettant l'amélioration des CVM, à savoir la part de la valeur ajoutée nationale (ou étrangère) dans leurs exportations, l'orientation des exportations (importations intermédiaires réexportées) et la compétitivité internationale de leurs parties intermédiaires (valeur ajoutée intérieure intégrée dans les exportations étrangères), la Chine est la plus performante (elle l'emporte sur deux des mesures), suivie de la Thaïlande qui est fortement orientée vers l'exportation, et la Malaisie est la moins performante. Des résultats si divergents dans trois pays s'expliquent par trois facteurs clés, à savoir l'appropriation locale, la discipline face à la concurrence sur le marché et les efforts et stratégies au niveau des entreprises. Compte tenu du monopole exercé par les fabricants de marques nationales, la Malaisie manque de discipline face à la concurrence sur le marché, tandis que la Thaïlande manque d'appropriation locale et de cohérence dans la promotion de la valeur ajoutée nationale. La Chine n'est ni un monopole national ni dominé par des entreprises communes (joint venture) étrangères, mais l'importante entrée sur le marché d'entreprises locales entraîne une concurrence féroce. En outre, les entreprises chinoises tentent de renforcer leurs capacités technologiques et de localiser la production de pièces et de composants clés.

JEL classification F23 · O14 · O24 · O25 · O38 · L62

Introduction

Firms from latecomer economies are often characterized as "resource-poor and late entrants" (Mathews 2002). Given their late entry into the international division of labor, latecomer economies have limited choices and inherited certain segments, typically low ends, from firms in advanced economies, in the form of subcontracting original equipment manufacturers (OEMs) or subsidiaries of foreign multinational corporations (MNCs; Amsden 1989; Hobday 1994). Thus, the path from OEM to original brand manufacturer (OBM) via original design manufacturer (ODM) has become the standard upgrading process for latecomer firms.[1] However, the eventual transition or upgrade to the OBM stage is quite rare (Lee et al. 2018). As such, merely joining global value chains (GVCs) in the form of OEM or foreign direct investment (FDI) may not guarantee an upgrade into higher value-added segments. The optimistic view, such as that of Baldwin (2016), is that this inclusion helps in the industrialization of latecomer economies without the need to build entire value

[1] According to Hobday (1994), OEM is a specific form of subcontracting under which a complete, finished product is made to fit exact buyer specifications. Several OEMs evolve into ODM firms, which perform most of the detailed product design. The final mode is the OBM in which firms are responsible for all functions, including design of new products, R&D for materials, production, and sales and distribution for their own brand.

chains.[2] By contrast, the pessimistic view indicates the possibility of the OEM trap in only performing low value-added activities without value upgrading (Lee and Mathews 2012).

These contrasting views imply that the key issues are learning and building local capabilities after joining the GVC (Lee et al. 2018). Thus, industrial policies are pursued to upgrade local industries to achieve a higher degree of competitiveness in global markets. One of the most typical industrial policies that promote the growth of infant industries or at least create a "level playing field" for domestic firms is local content requirements (LCRs; Belderbos and Sleuwaegen 1997). With this policy, manufacturers are required to use domestically manufactured goods or services provided by local suppliers in their production process to enable more domestic jobs, value-added segments, and eventual upgrading of industries. These local suppliers may either be domestic or localized foreign-owned firms (Kuntze and Moerenhout 2012). However, the effectiveness of industrial policies has been questioned for years, as different countries and sectors show varying results, whereas a few countries, such as China and Korea, achieve success (Lee 2013).

In China's wind turbine industry, foreign firms dominated and captured nearly the entire market before the implementation of LCRs in 2000 (He 2016). This dominance changed dramatically after the launch of a series of policies supporting wind power manufacturing, including LCRs. By 2009, almost 90% of the market thus became occupied by domestic firms. China not only increased the local production of wind turbines but also supported its own brand during the development of the wind turbine industry. A similar success was achieved in the automotive sector, which features fierce competition among foreign joint ventures (JVs) and indigenous makers, with the market shares of the latter rising since the 2000s (Hu 2009; Chu 2011). China soon became the world's largest producer with an annual production of over 20 million.

Thailand and Malaysia attempted to promote their automotive industries using various tools of industrial policy but achieved mixed success or failure. Baldwin (2016, pp. 250–254) observed that different from the failed "build strategy" in Malaysia, a successful case is the "join strategy" of the automotive sector in Thailand, wherein Japanese firms established Thai factories that focused on the assembly and promotion of Thai component suppliers under LCRs. One of the key points for such success was the firms' focus on a particular market segment (e.g., light pickup trucks and vans) to achieve sufficient economy of scale at a minimum cost for international competitiveness rather than attempt to produce a whole range of models (Baldwin 2016).

Given this literature review, a comparison of Malaysia, Thailand, and China would be of interest because they all attempted to implement LCRs in their automotive sectors before they joined the World Trade Organization (WTO) and cancelled the policy, resulting in divergent outcomes. Although Thailand has become

[2] The main point is that building an entire value chain in a latecomer economy is highly difficult and risky, and such activity does not provide sufficient economy of scale required to achieve cost competitiveness due to limited market size (as in the case of Proton in Malaysia).

the largest exporter of automotive among ASEAN countries (Tai and Ku 2013), the amount of domestic value-added generated is unclear, given the dominance of MNCs. This question can be answered by examining several GVC indicators, which will be discussed in "Dynamic Patterns of Linkages and Upgrading in GVCs" section. Thailand has only gained mixed success in its share of domestic value-added in gross exports, whereas it has been more successful in exports. By contrast, the question for Malaysia is why locally owned makers, such as Proton, have captured the market in their initial stage but could not maintain that advantage, failing to increase not only the domestic value-added but also the export orientation. The final question is how China has upgraded its automotive sector with domestic value-added increasing remarkably over time.

In this paper, "Industrial Policy in Malaysia, Thailand, and China" section provides an overview of the auto industries in Malaysia, Thailand, and China, focusing on the LCR policy. "Dynamic Patterns of Linkages and Upgrading in GVCs" section investigates the performance of these automotive sectors and compares them with that of Korea in terms of the degree of upgrades in GVCs using the measures of backward and forward linkages, including the share of domestic value-added in gross exports. "Explaining the Divergence in Terms of the Three Factors" section explains various performance outcomes in terms of three key explanatory factors namely, local ownership, disciplines from market competition, and firm-level effort and strategies to build technological capabilities. "Summary and Conclusion" section presents the summary and concluding remarks.

Industrial Policy in Malaysia, Thailand, and China

Malaysia, Thailand, and China all desired to promote their automotive industries, which are usually regarded as an important industry with strong backward and forward linkages. However, these countries are considered latecomers, given that their automotive sectors started in the post-war period or even the 1960s. As such, these countries have to rely on foreign technology by either importing licensed technology or joining GVCs. Although all of them use LCRs to increase local value-added, their actual growth paths have diverged.

Malaysia has focused on establishing a local brand and is the only one that owned its national brand in the ASEAN. The first Malaysian car—Proton—has successfully occupied the domestic market. However, the brand failed to compete in the international market. Thailand has approximately 14 automakers, but all of them are majority-owned by foreign companies. Thailand has become the largest exporter among ASEAN countries and highly liberalized and competitive markets due to foreign makers' participation. By contrast, the automotive sector in China now features fierce competition among foreign JVs and indigenous makers, despite the initial dominance of the former, including the one with Volkswagen (Chu 2011). Indigenous makers, such as Chery and Geely, entered the market after China joined the WTO and rapidly captured market shares in the 2000s (Hu 2009; Lee et al. 2016).

Table 1 LCR ratios in the Malaysian automotive industry

	Passenger vehicles		Commercial vehicles
	1850 cc or less	1850–2850 cc	2.5 tons or less
1992	30%	20%	20%
1993	40%	30%	30%
1994	50%	35%	35%
1995	55%	40%	40%
1996	60%	45%	45%

Source Fujita (1998)

LCRs in the Malaysian Automotive Industry

In the 1960s, the Malaysian government targeted industrial development through import substitution; thus, its automotive industry expanded rapidly (Athukorala 2017). The government encouraged assembly factories and suppliers of components and parts for assembled cars, and approved 6 assembly plants in 1967; by 1980, this number increased to 11 (Athukorala 2017; Wad and Govindaraju 2011). Meanwhile, protective tariffs were imposed on completely built-up (CBU) and completely knocked down (CKD) units.[3] However, the local content ratio of locally assembled cars were less than 10% (Athukorala 2017). Therefore, in the early 1970s, the government recommended the local content ratio to reach 40% and implemented a policy to reach at least 35% by 1982 (Wad and Govindaraju 2011; Lim and Onn 1983). To achieve this, the government created a "mandatory deletion program" to remove certain components from import approval lists and protect local component manufacturers (Athukorala 2017). Finally, Malaysia established two national car brands, Proton and Perodua, through the "National Car Project" (Athukorala 2017; Wad and Govindaraju 2011; Fujita 1998).

Following the LCR policy, the LCR ratios had annually increased since the 1990s, as shown in Table 1. In 1992, the rate was only 30% in the case of 1850 cm^3 or smaller-sized passenger vehicles (PVs), 20% in the 1850–2850 cm^3-sized PVs, and 20% in the case of commercial vehicles (CVs) no larger than 2.5 ton. In 1996, the rates then rose to 60% in small passenger cars and 45% in large passenger cars and CVs. However, the LCRs were abolished when Malaysia joined the WTO in 2004 (Wad 2009). The actual localization has reached over 70% in the cases of Proton-branded cars before the LCRs were abolished (Simpson et al. 1998).[4]

[3] CBU and CKD tariff rate ranges were 30–80% and 20–30%, respectively, in 1966 (Bower 1991).

[4] Local content ratio or localization rate is defined as the percentage of the value of domestically produced parts or components in the value of finished products (Thuy 2008).

Table 2 LCR ratios in the Thai automotive industry

	Passenger vehicles	Commercial vehicles
1975	25%	20%
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) and Fujita (1998)

LCRs in the Thai Automotive Industry

The automotive industry in Thailand started in the 1960s, while LCRs were initiated in 1975. In the first 2 years of its implementation, the effect of the LCR policy was undermined by the large number of imported CBU automobiles. Moreover, massive imports resulted in increasing trade deficits (Natsuda and Thouburn 2013; Fujita 1998). To raise the effects of LCRs and decrease the trade deficits, the Thai government announced protective policies that banned CBU imports and increased the tariff ratio on CKD (Natsuda and Thouburn 2013; Fujita 1998; Tai and Ku 2013). Furthermore, a "mandatory deletion" scheme was imposed in conjunction with LCRs to forbid foreign manufacturers to add contents in their imported CKD kits and stimulate the local production of components, such as brake drums and exhaust systems (Natsuda and Thouburn 2013). Meanwhile, assemblers were mandated to use locally produced engines on their pick-up trucks (Natsuda and Thouburn 2013).

The LCR ratio has gradually increased since 1975, as shown in Table 2. The ratios were initially low at 25% for PVs and 20% for CVs. In 1994, the LCR ratio increased to 54% for PVs and over 60% for CVs. The actual localization ratio reached over 70% in 1999 for certain special vehicles, such as the Soluna model, pick-up trucks, and the Hilux model produced by Toyota. However, LCRs were abolished when Thailand joined the WTO in 2000.

LCRs in the Chinese Automotive Industry

The implementation of the "Interim Regulations on the use of Tax Incentives to Promote the Localization of Small Cars" ("Tax Regulations") opened the gate for LCRs in China in 1990 (Song and Wang 2013). The state council also announced the "Automotive industry Policy" in 1994 and then the "Interim Provisions on the Use of Tariffs to

Table 3 Localization rate of leading automotive manufacturers in China (2011)

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

Source Song and Wang (2013)

Promote the Localization of Light Passenger Cars" in 1997. An important part of LCRs in China is its scheme with detailed linkages to import tariffs. The basic idea is that a higher rate of localization is associated with a lower import tariff, and vice versa. The details of the tariff and added-value tax for the various levels of localization can be found in the "Tax Regulations" and other supplementary LCR documents.

Tariff rates imposed for imported parts and components of units with localization rates between 40% and 60% was 75%, but only 60% for those with 60%–80% localization. If the localization rate exceeded 80%, then tariffs were reduced to 40%. Furthermore, such tax preference was guaranteed only when the annual growth of the localization rate was higher than 20% during the initial 3 years. An important graduation clause was included, that is, a total period of the preferred tariff treatment may not be over 10 years.

The LCRs were also abolished when China joined the WTO in 2001. The WTO entry resulted in double shocks on local component manufacturers from the intrusion of foreign manufacturers and the elimination of protection policy. Hence, the general administration issued the "Measures for the Administration of Import of Automobile Components and Parts Featuring Complete Vehicles" in 2005 as a buffer for local component manufacturers, such as tariffs on imported parts and components on CBU basis. Table 3 shows the actual localization rates in leading automotive manufacturers in China 10 years after the elimination of the LCR policy. The rates were all higher than 80% in 2011, except for TIIDA of Nissan and CIVIC of Dongfeng Honda. The highest localization rate was 95%, which was achieved by Lavida of Shanghai Volkswagen.

Dynamic Patterns of Linkages and Upgrading in GVCs

The preceding section has indicated that Malaysia, Thailand, and China implemented LCRs and achieved a certain degree of localization until they all abolished LCRs after joining the WTO. The current section examines the eventual course of development centered around the time when these countries removed LCRs, focusing on upgrading to GVC.

In GVCs, the various stages of the production process, such as design, R&D, assembly, and marketing, are located across different countries. For latecomers, GVC offers opportunities to join the global production network by specializing in specific segments, hoping to gradually upgrade into high-end segments.

Humphrey and Schmitz (2002) presented four types of upgrading in GVCs: process, product, functional, and inter-sectoral upgrading. Latin America's experiences show that functional and intersectoral upgrading are rare (Giuliani et al. 2005). This phenomenon is due to the fact that although GVCs provide opportunities to learn knowledge from foreign firms, the core knowledge would be prevented from foreign firms, and local firms remain trapped in low value-added activities (Dünhaupt and Herr 2020). However, these rare upgrading types are found in Korea (Lee and Mathews 2012; Lee et al. 2018).

Therefore, analyzing and comparing the experiences of Korea with other countries is of particular interest. Motivated by the Korean experience, Lee et al. (2018) introduced the "in-out-in again" pattern in terms of the changing degree of participation in GVCs. The idea is that at the initial stage of growth by a latecomer, increased participation in GVC is necessary to learn foreign knowledge and production skills. In the functional upgrade at the middle-income stage, effort must shift to seek separation and independence from existing foreign-dominated GVCs to increase domestic value-added. Finally, after establishing their local value chains, latecomer firms and economies may have to seek reintegration into the GVC. In this dynamic pattern, the important stage is the declining period of GVC participation to increase domestic value-added, implying the occurrence of upgrading.

In this study, three measures, two of backward linkages and one of forward linkage, are used to determine GVC participation and upgrading (OECD 2017; Banga 2013; Koopman et al. 2014; Wang et al. 2013). The first measure refers to the share of foreign value-added (FVA) embodied in the gross exports of a country. The inverse of FVA serves as a measure of upgrading in terms of increasing the domestic value-added, because the higher this value is, the lower the share of domestic value-added will be. Second, the share of re-exported intermediate imports (REII) in the total intermediate imports of a country serves as a measure of export-orientation or upgrading in export competitiveness. Finally, measures of forward linkages, namely, the share of domestic value-added embodied in foreign exports as a share of the gross exports of a foreign country (herein, DVAFXSH) serves as a measure of upgrading capabilities and competitiveness of intermediate goods (parts and components); higher values of this ratio indicates higher competitiveness of a country's intermediate parts and components in international markets.

In this study, these measures are further explained using examples of the automotive sectors in Korea, which is a benchmark case of successful upgrading and globalization. Then, the same measures for the automotive sectors in Malaysia, Thailand, and China are investigated for comparison with the Korean benchmark.

Dynamic Patterns of Linkages and Upgrading in GVCs: Automotive Sector in Korea

Korea is one of the four Asian tigers, which have shown a rapid development in per capita income and manufacturing value-added. Its automotive industry is one of the

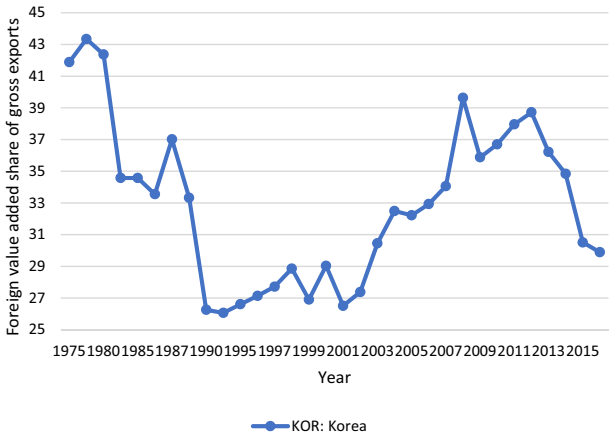

Fig. 1 FVA (share of foreign value-added in exports) of the transport sector in Korea. *Source*: Authors' estimation using the Input–Output table data of Korea 1975–1993; 1995–2011 data are from TiVA 2016 and 2012–2016 data are from TiVA 2018

leading sectors of economic development, with Hyundai Motors as a representative firm that was established in 1968 and highly globalized in production and marketing. The following is an analysis of the trend of GVC participation in the Korean automotive industry, which indicates the degree of upgrading and globalization.

First, FVA is a typical backward linkage of GVCs that indicates the extent to which domestic firms use foreign-imported intermediates for export activities (OECD 2017, p. 8). A high FVA indicates high GVC participation, and a low level of local value-added is thus created. Figure 1 shows the FVA trends on the transport sector in Korea. A long period of FVA decline was observed from the late 1970s to the early 1990s; this phenomenon indicated that Korean automotive firms increased domestic value-added by localizing formerly imported parts and supplies, including engines and transmissions (Lee and Lim 2001). From the mid-1990s, the FVA has begun to re-increase as Korean firms establish assembly factories abroad in response to the rising wage rates in the country. Overall, this long-term trend is consistent with the in–out–in again hypothesis, or at least the out-in again parts of Lee et al. (2018).

Second, REII refers to the imported intermediate goods that are used as inputs into production processes in a country and then re-exported as a part of the value of the assembled products to other countries. REII is another measure of the backward linkages in GVC; it examines the import side of international trade, whereas FVA examines the export side. If industrial policies, such as LCRs for export promotion, succeed, then REII shows an increasing trend (Banga 2013). By contrast, REII remains low if the imported intermediate goods are used for assembled cars for domestic markets. Thus, a high REII indicates that the final products embodying the imported intermediates are sold more to the international market than to the domestic market.

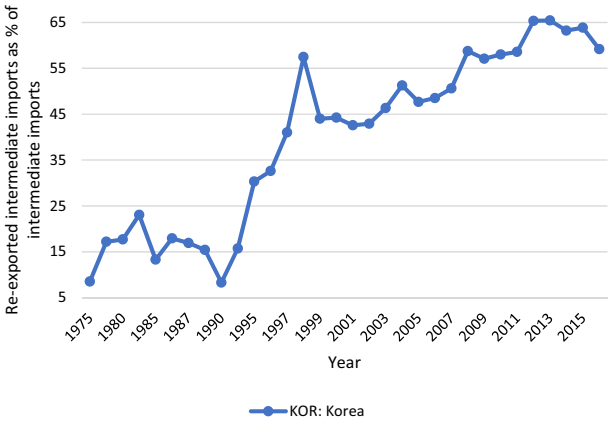

Fig. 2 REII of the transport sector in Korea. *Source*: Authors' estimation using the Input–Output table data of Korea 1975–1993; 1995–2011 data are from TiVA 2016 and 2012–2016 data are from TiVA 2018

Figure 2 shows that the REII of the Korean transport sector is initially low in the mid-1970s but started to increase because of the establishment of Hyundai, which attempted to export their products. A period of decline was observed when Hyundai experienced troubles in the American market. Eventually, the rate had displayed an increasing trend since the 1990s when Hyundai localized the formerly imported engines and gained export competitiveness in the American market. Eventually, this ratio of REII increased from 15% to over 55%, which reflected the rapid growth of car exports by Korean makers. Korea became the world's fourth largest automotive producer by the end of the 1990s (Ravenhill 2003).

Third, the DVAFXSH captures domestic value-added that goes into other countries' gross exports, measured as a share of a country's gross exports (Banga 2013). For example, Korean-made parts may be exported and used in car assembly production in China, which may target a third-world country market. Thus, the DVAFXSH is a measure of the forward linkages of GVC. A high DVAFXSH indicates a high influence to the other countries' exports. Therefore, DVAFXSH can serve as an indicator of the influence (international competitiveness) of intermediate goods produced by a domestic economy, and thus a measure of upgrading domestic industries. This ratio also increases when a country's firms have established more foreign subsidiaries and export intermediate parts to their overseas factories or when intermediate parts made by a country' firms can enter foreign market at an arm's length. In this sense, DVAFXSH is a measure of globalization of the production network in an economy.

Korean carmakers have begun to establish assembly factories overseas in the 1990s. For example, Hyundai Motors has a series of investments in the United States, Canada, China, India, and other countries to utilize their cost advantages or market access (Bose 2012). Thus, the Korean auto industry has been globalized as its overseas factories tend to import several parts and supplies from their home bases in Korea. Such an overseas investment in foreign countries

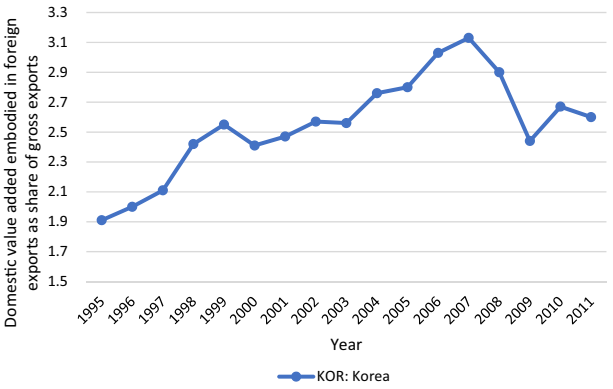

Fig. 3 DVAFXSH of of the transport sector in Korea. *Source*: Data are from the OECD TiVA database version 2016 and version 2018 (1995–2011 data are from TiVA 2016 and 2012–2016 data are from TiVA 2018)

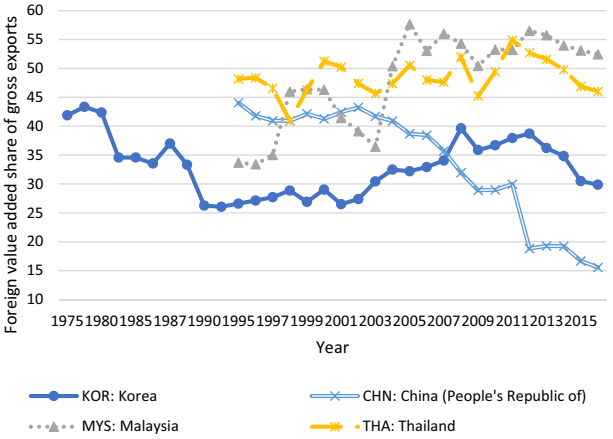

Fig. 4 FVA of the transport sector in Malaysia, Thailand, and China. *Note*: Korea 1975–1993 FVA data are the authors' estimation using Input–Output table of Korea. Other values are from the OECD TiVA database version 2016 and version 2018 (1995–2011 data are from TiVA 2016 and 2012–2016 data are from TiVA 2018)

result in increasing DVAFXSH since the 1990s, as shown in Fig. 3. This ratio may decline if foreign subsidiaries use locally made parts and supplies, rather than import from their home country.

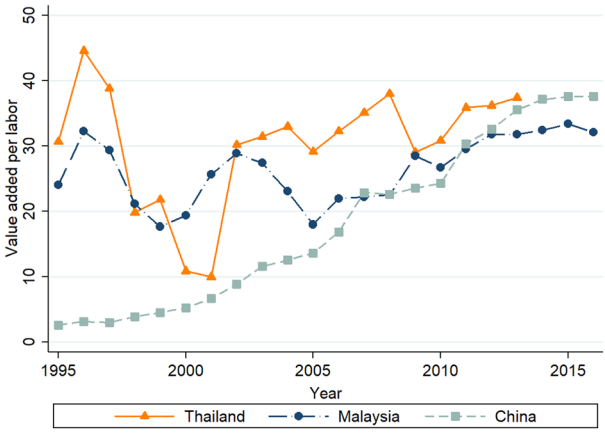

Fig. 5 Productivity trend of auto sector in China, Malaysia, and Thailand. *Note*: Authors' calculation using the data of UNIDO; value-added per labor unit is 1000 US dollars

Linkages and Upgrading in Malaysia, Thailand, and China

Figure 4 shows the FVA trend in the four countries. Only China shows a decreasing period from the mid-1990s to the late 2000s, which is similar to that in the mid-1970s to 1990s in Korea. The rapid decline, as low as 15%, implies that China is engaged in the "made in China" policy. Such a period of decreasing FVA or increasing domestic value-added is not clearly observed until the 2010s in Thailand or Malaysia, except for a short period of decline from 2000 to 2003 in Malaysia. In addition, FVA in Malaysia shows a sharp increase when LCRs were abolished in 2004, which increased again since then. FVA in Thailand is always high without a decreasing trend until 2011, which indicates no period of increasing domestic value-added before 2011.

However, Malaysia and Thailand have started to show some declining trend since 2011, although the levels are still high above 40% compared with less than 30% in China or Korea. Whether this recent trend will continue and what is the driving this warrant further investigation. In Thailand, such trend may be indicative of some upgrading due not to traditional type of industrial policy but to diverse forms of domestic–foreign partnership, which enables some "qualitative" change from simple production to technologically sophisticated activities (Intarakumnerd and Techakanont 2016). One of them is the Automotive Human Resource Development Program, which started in the late 2000s and aims to upgrade the capability of local auto part manufacturers (Lee et al. 2019). This program is a collaboration between Thailand and Japan, with the Japanese side led by four leading Japanese companies who participated in the program by providing training experts and course materials in their specialized area: Toyota (Toyota production system), Honda (mold and die technology), Nissan (scheme of skill improvement), and Denso (manufacturing skill and mind management).

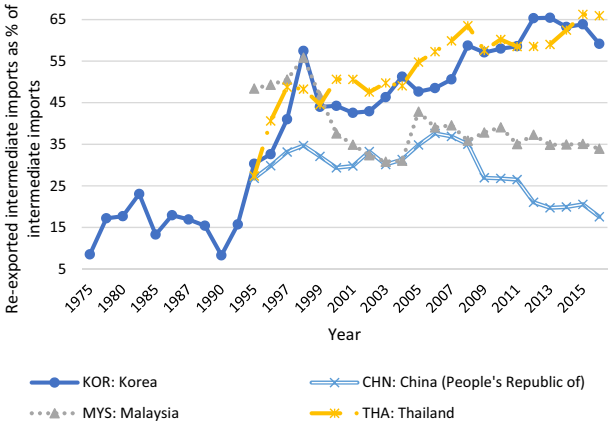

Fig. 6 REII of the transport sector in Malaysia, Thailand, and China. *Note*: Korea 1975–1993 REII values are the authors' estimation using Input–Output table of Korea. Other values are from the OECD TiVA database version 2016 and version 2018 (1995–2011 data are from TiVA 2016 and 2012–2016 data are from TiVA 2018)

Figure 5 shows the productivity trends of the automotive industry in China, Malaysia, and Thailand. Certain correspondence of these trends with that of FVA is noted. The most clear-cut pattern is in China, which shows a steady increase from the mid-1990s to the mid-2010s, at the same period of decreasing FVA or increasing domestic value-added in Fig. 4. Although China used to be lowest in labor productivity among the three, the country soon caught up. In Malaysia, the automotive industry productivity increased only from 2001 to 2004, which corresponds to its FVA declining period. Productivity in Malaysia declined in the late 1990s and increased again as GVC participation decreased. The productivity of Thailand's automotive sector fluctuates in a certain range, and the trend is not that clear. In Thailand and Malaysia, a closer correspondence is found for the most recent period of the 2010s when they recorded the pattern of increasing productivity and decreasing FVA. However, such correspondence needs a more rigorous analysis, because such labor productivity is driven by several factors. Factors include fixed capital investment, which will lead to a higher capital–labor ratio.

Figure 6 shows that among the three countries, Thailand exhibits the highest level of REII. This trend is consistent with the high export performance of the sector in Thailand. However, these exports are all conducted by foreign MNCs from Japan, and no Thai-branded cars are produced. REII in Malaysia remains low, which is consistent with the fact that its automotive industry does not produce considerable exports or that its level of technological capabilities is too weak to exploit foreign market. The low level of REII in China indicates that the country has low exports. This value may change in the future as China has begun exports. Such trends of REII in the three countries are consistent with the trend of export-orientation measured by the amount of exports as percentage of production in Fig. 7a. Thailand has kept the steadily increasing trend of export orientation, reaching 15% by the mid-2010s, in comparison with 20% of Korean case. China is the third at approximately

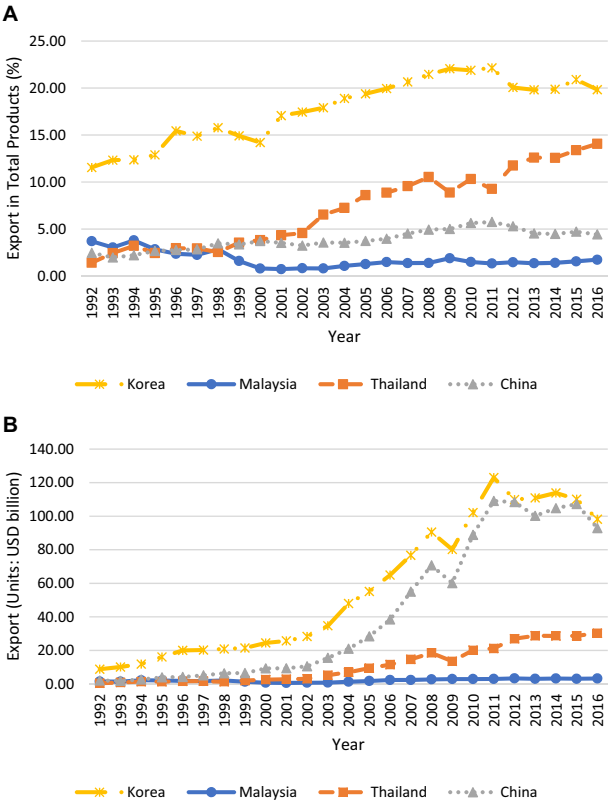

Fig. 7 **a** Export orientation of transport sector in Korea, Malaysia, Thailand and China. **b** Amount of Exports of transport sector in Korea, Malaysia, Thailand, and China. *Note*: Database is World Integrated Trade Sulston (WITS), which is available on https://wits.worldbank.org/. Notably, in the figures and table, transportation includes both cars and components

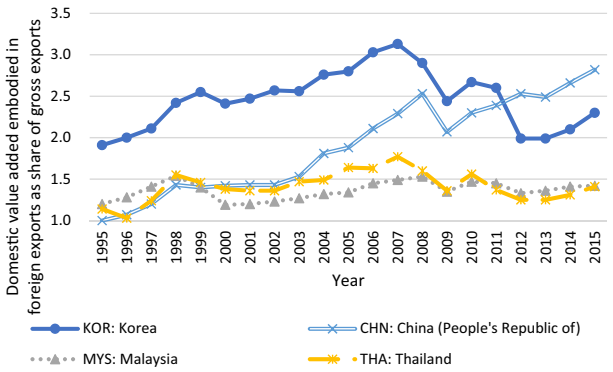

Fig. 8 DVAFXSH of the transport sector in Malaysia, Thailand, and China. *Note*: Data are from the OECD TiVA database version 2016 and version 2018 (1995–2011 data are from TiVA 2016 and 2012–2016 data are from TiVA 2018)

5%, whereas Malaysia is at the bottom, as expected. Figure 7b shows the absolute amount of the values of exports, confirming the rapid increase of Chinese exports, catching up with the level of Korean exports and more than three times larger than that of Thailand in recent years.

Finally, Fig. 8 shows that DVAFXSH remains low in Malaysia and Thailand but increases steadily and substantially in China, close to the level of the Korean automotive sector. The contrast seems to reflect the rising export competitiveness of intermediate input or globalization of production in China, which is similar to Korea. China has started establishing assembly factories abroad. For example, a locally owned and branded carmaker, Chery, owns 16 overseas factories in Malaysia, Brazil, Ukraine, and other countries (Qu 2015); other carmakers have also begun building factories overseas since 2001 in the form of CBU or production of parts. In Malaysia, the low DVAFXSH is not surprising because its automotive sector does not globalize, selling only to domestic markets. In Thailand, despite its export success (Fig. 8), the DVAFXSH remains low and reflects the fact that the country is mostly exporting CBU for domestically sold cars in host countries (Intarakumnerd and Techakanont 2016; Fig. 3). Such pattern implies that intermediate parts produced in Thailand are not considerably used in exports by foreign countries.

Explaining the Divergence in Terms of the Three Factors

Three Factors for Successful Upgrading

Although LCRs have been implemented in many countries, their outcomes are mixed, with several cases of successes and possibly more of failures. Thus, determining the success (failure) conditions of these tools of industrial policy is of particular interest. This section discusses these conditions, focusing on the following: (local vs. foreign) ownership of target firms, market structure (discipline from market vs. entrenchment from monopoly), and firm-level effort and strategies.

First, given that LCRs are oriented toward independent industrial development imposing restrictions on foreign-made goods in a national economy, they are often compared with a liberal policy stance emphasizing the positive roles of FDI. On the basis of the related literature, we hypothesize that LCRs are effective when applied to locally owned firms or to FDI firms that are later turned into locally owned firms by share purchases or merger and acquisition (M&A).

Amsden's research (1989) research is one of the early studies that emphasize the importance of promoting local ownership rather than passive reliance on FDI. Lee et al. (2016) and Lee and Lim (2001) observe that FDI can be an important channel for gaining foreign knowledge but tends to interfere with the eventual growth of indigenous technological capabilities. These observations are based on comparable examples in the automotive sectors of China and Korea (e.g., Geely and Chery vs. Shanghai Volkswagen and First Auto Works in China; and Hyundai Motors vs. Daewoo, a JV with GM in Korea). The success of Taiwanese catch-up is also supported by the eventual rise of indigenous firms (Amsden and Chu 2003). Indigenous ownership becomes more important at a later stage because foreign firms tend to become

increasingly reluctant to transfer or sell technology.[5] A similar view is shared by Marin and Bell (2006), who observe that the spillover effect of FDI does not occur if host countries do not focus on the linkages between FDI and the domestic economy. Specifically, in terms of upgrading in GVCs, Lee et al. (2018) argue that national ownership is eventually necessary to build local value chains for upgrading.

Second, we determine that LCRs are effective when combined with discipline from either domestic or global markets. Aghion et al. (2015) regards competition as a precondition of an effective industrial policy, that is, LCRs. Greenaway (1992) also considers market structure as a key factor that affects the successful implementation of LCRs. Hao et al. (2010), in a study on the British wind power sector, state that a stable and sizeable domestic market is an important factor that can determine the success of LCRs.

Third, the effectiveness of LCRs is also affected by how firms respond to such policies, along with supplementary ones. Lahiri and Ono (1998), Davies and Ellis (2007), and Hao et al. (2010) also observe that LCRs cannot be effective when implemented alone without supportive policies, such as other taxations and preferential loans. However, the most critical factor should be firms with the right response to such policies in the form of increasing effort toward building their technological capabilities. One might reason that combination of local ownership and pressure from market competition can result in firms exerting more effort for technological innovation and their own capabilities, which, however, is not always the case for firms, because firms tend to take different decisions and reactions to the same conditions. Hence, we still consider additional firm-level responses and strategies as one of the three factors to be considered.

The three requirements mentioned above for a successful upgrade to GVC by industrial policy, such as LCRs, can be discussed with the Korean automotive sector as an example. Over the past 50 years, the Korean automotive industry has grown from a small auto parts supplier to a global center of automotive companies (Ravenhill 2003; Lee 2011). Independence in terms of ownership is considered as a factor that helps Korean automotive firms achieve industrial upgrades from OEM to OBM (Lee and Lim 2001). Hyundai, one of the leading Korean brand cars, chose an independent R&D strategy to develop its own engines after Mitsubishi refused to provide the engine technology. According to Ravenhill (2003), the reason why Hyundai can increase their localization rate faster than other Korean automotive producers is their explicit strategy to avoid dependence on partners and integrate licensed technology from diverse countries to develop its own technology, including their engine. Although Hyundai Motors is initially a JV, foreign ownership (by Mitsubishi) is limited or less than 20%, and eventually bought out by the Hyundai side.

[5] An example from Lee et al. (2016) is the mobile handset sector in China. To take advantage of the large market, MNCs formed various JVs with indigenous firms to produce mobile phones in China. Nevertheless, in 2001, most MNCs stopped their JV collaborations after China joined the WTO. The same occurrence was observed in Korea when Korean IC chip firms caught up with foreign firms, and the latter became increasingly reluctant to provide designs for chip production (Kim 1997; Lee and Lim 2001).

An interesting contrast can be made with the case of Daewoo, a former JV with GM with a share of 50%. In this JV, the perception of Daewoo is that GM is reluctant to transfer core technologies to Daewoo and is not willing to allow Daewoo's foreign expansion plans (Auty 1994; Ravenhill 2005). After experiencing management conflicts among its major shareholders, this JV was dissolved in 1993, and Daewoo became independent. Only after this independence and since the-mid 1990s has Daewoo begun to realize achievements from its R&D effort (Lee and Lim 2001). This experience underscores the limitation of the JV strategy without local ownership and control. A similar story of a failure involving JV is experienced in the case of Guangzhou-Peugeot in China, which will be discussed later.

Next, we discuss the discipline from market competition in domestic or global markets and supportive policies. A fierce competition is observed among four or five carmakers in Korea, mainly among Hyundai, Daewoo, Kia, and Ssangyoung, although foreign ownership remains limited (Lee 2011). Furthermore, these brands are oriented toward the global market from the beginning. Given the oligopolistic market structure protected by high tariffs during the 1970s and 1980s, certain rents are associated with such protection but are used to pay for capital investments that are required to survive in the global market (Jung and Lee 2010); one of the key nature of industrial policy in Korea is the close linkage between export performance and privileged access to cheap loans and other supportive measures. The effects of such combination of oligopolistic rents and discipline from the global market on productivity growth are confirmed by econometric studies by Jung and Lee (2010).

Given the aforementioned framework that comprises the three factors and Korean experience, the following explanation is proposed for the performance and upgrading of automotive sectors in Malaysia, Thailand, and China. First, the failure of the automotive sector in Malaysia, despite its national brand ownership, is related to the lack of competition in markets and of specific strategies to localize imported parts and components, such as engines. In Thailand, the limited success (or upgrading) can be associated with the lack of local ownership under the less consistent industrial policy, which is given up after liberalization and WTO entry. By contrast, the relative success in China is related to the combination of restricted foreign ownership, the competitive nature of markets among foreign and national brands, and an explicit firm-level effort to build its technological capabilities through in-house R&D and M&A of foreign firms and their technologies. Further elaboration follows.

Common Starts with Divergent Ends in Malaysia and Thailand

Common Starts

The automotive industries in Thailand and Malaysia began in the 1960s. Initially, both countries aimed to build their own automotive industry, thus restricting importation of CBU by complicating its process, charging high import taxes, and charging

lower tariffs to CKD cars.[6] Given such policies, the local automotive assembly industry achieved rapid development in both countries in a short time, although the main makers are foreign JVs (Tai and Ku 2013). Both countries desired to restrict foreign ownership in such JV cases to allow domestic partners to have majority ownership. In the 1980s, the two countries diverged directions, with Malaysia heading toward a nationalist road of promoting locally owned brand cars and Thailand toward reliance on foreign (mainly Japanese) makers.

In 1982, the Malaysian government declared the "National Car Project" to establish a national champion brand—Proton, through cooperation among national enterprises, the Heavy Industries Corporation of Malaysia Berhad (HICOM) and Mitsubishi Corporation. With the government's support, Proton became the leading brand in the Malaysian car market at that time (Athukorala 2017; Wad and Govindaraju 2011; Fujita 1998). By contrast, Thailand took advantage of the eagerness of Japanese makers to establish assembly lines overseas, seeking low labor costs to offset the cost increases associated with Yen appreciation after the 1985 Plaza Accord. The Thai government initiated a series of favorable tax incentives to attract Japanese investment (Tai and Ku 2013). They also loosened the former policy of restricting foreign ownership in assembly makers in the early 1990s. In 1997, the government officially cancelled the restriction of majority ownership to be held by a Thai national (Intarakumnerd and Gerdsri 2014). Consequently, Ford, Chrysler, and GM from the US established their assembly factories in Thailand. Their suppliers of parts and components then followed. Japanese manufacturers also constructed new factories in Thailand in the 1990s. After several years of promotion through policies, the MNC automotive suppliers in Thailand have increased to 300 manufacturers from 1987 to 2005 (Wad 2009). Foreign ownership has taken over the Thailand domestic market not only in assembly but also parts and supplies in a lesser degree.

National Ownership without Competition in Malaysia

With regard to ownership, the National Car Project in Malaysia resulted in two national car brands, Proton and Perodua, with majority equities of 70% and 68%, respectively, although their Japanese partners Mitsubishi and Daihatsu owned 30% and 32% of the equity shares, respectively (Athukorala 2017; Wad and Govindaraju 2011). In 2004, Proton became a fully Malaysian owned company when Mitsubishi sold the stake to Khazanah National BHD (the government's investment arm).

To support the growth of the two national makers, various policies have been implemented. First, tariffs of CKD kits for national vehicles were exempted to lower the price of national vehicles (Tai and Ku 2013; Athukorala 2017). Second, the "Vendor Development Program" was also implemented to boost the development of local SME parts suppliers. Through this program, the parts manufacturers of national cars were provided with production subsidies, which allowed their parts

[6] Before the 1990s, the Thailand government used to charge high import tariffs, as high as 300%, for PVs larger than 2300 cm^3. Imports of PVs lower than 2300 cm^3 were not allowed (Natsuda and Thouburn 2013).

prices to decrease by 10–12%. The number of parts suppliers of Proton increased rapidly from 17 in 1985 to 186 in 1999 (Tai and Ku 2013).

However, the Malaysian automotive industry lacked competition in the domestic market, and no push was exerted to export to the global market. The government has forbidden other manufacturers to produce models that could result in direct competition with Proton (Tai and Ku 2013; Athukorala 2017). Even the other national maker, Perodua, was allowed to produce cars only with an engine capacity of less than 1000 cm^3 (Athukorala 2017), despite enjoying the same tariff concessions, tax relief, and other government supports as Proton (Athukorala 2017).

Before national cars appeared, Toyota and Nissan dominated the Malaysian market. Proton seized the market in an extremely short time with the help of a series of discriminatory policies, occupying 80% share of vehicles under the 1500 cm^3 range by 1987 (Nizamuddin 2008). In 1991, the Malaysian government made a partial reform to reduce the restriction of the automotive industry, which allowed new entrants, such as Hyundai, Citroen, Rover, and other international car manufacturers into the Malaysian market. By the mid-2000s, despite 15 car manufacturers in Malaysia, the major market share remained occupied by the two national cars (Wad and Govindaraju 2011). The two national makers thus faced no discipline in the market to upgrade their innovation capabilities, such as the localization of engines and other key parts, as shown by the high FVA and low REII ratio. Furthermore, they did not compete for the larger markets of other countries, which prevented them from achieving economy of scale and from enjoying the discipline from global markets. These firms should have devoted the financial resources from near monopoly profits to upgrading of their technological capabilities to produce their own engines, which did not actually occur.

Eventually, since Malaysia has joined the WTO and abolished LCRs in 2004, the dominance of national carmakers weakened steadily over time and they failed to enter the global market. The automotive group formed by Proton and Perodua once produced 6000 auto parts in their heyday (Tai and Ku 2013). Proton's market share declined after high-quality models produced by Japanese manufacturers with lower prices were launched in Malaysia (Wad 2009). National carmakers were not ready to compete against foreign carmakers once the market is open, because they lacked technological capabilities. Given its ever-weakening performance, Proton has become a problem for Malaysia. As a solution, it was sold to the Diversified Resource Bernhard (DRB-HICOM) in Malaysia in 2012. In 2017, the DRB-HICOM transferred its 49.9% stake to Geely, a rising Chinese carmaker that also acquired Volvo.[7]

Strong Exports with Less Domestic Value-Added in Thailand

Ownership in the Thai automotive sector is basically characterized by foreign dominance in parts suppliers and final assemblers. Most of the leading firms in Thailand's

[7] *Source* https://www.thestar.com.my/business/business-news/2017/05/24/drb-hicom-to-sell-49pt9pct-in-proton-to-geely-holding/.

automotive industry are JVs with majority shares owned by Japanese car-making firms. For example, Toyota Motor Corporation holds 86.4% of Toyota Motors Thailand; Mazda Motor Corporation holds 96.1% of Mazda Sales (Thailand) and 100% of Mazda Powertrain Manufacturing (Thailand); foreign ownership also holds Nissan Thailand and Mitsubishi Thailand (Intarakumnerd and Charoenporn 2015). By the end of 2005, 16 car assemblers and 1800 component suppliers could be found in Thailand. Among the assemblers, Japanese firms dominated the market with 91% market share (Busser 2008).

Without national carmakers to monopolize government support nor issue of entrenchment by any carmakers, foreign JVs faced the same market competition. They were also eager to enter the global market or the Southeast Asian market, using Thailand as hub. Thus, the production and export volume of Thailand became the largest among ASEAN countries (Tai and Ku 2013). However, industry policies for domestic suppliers were not sustained in Thailand; for example, tariffs on the importation of CKD and CBU and on vehicles with diverse sizes increasingly declined year by year, whereas more incentives were given to foreign JVs (Tai and Ku 2013).

Given their own need to enhance productive efficiency, Japanese makers attempted to train and upgrade the skills of Thai workers and to conduct more technologically sophisticated activities (Intarakumnerd and Techakanont 2016; Lee et al. 2019), and such effort may have translated to a certain extent into increasing the domestic value-added in the industry. However, given that nearly half of their suppliers were also foreign-owned, the eventual influence on locally-owned suppliers in terms of local value-added may have been limited. For instance, all the assemblers are foreign controlled JVs, and among the 635 1st tier part suppliers, almost halfs are foreign JVs, while local ownership is dominant only at the 2nd or 3rd tier suppliers, as of the mid 2010s (Intarakumnerd and Techakanont 2016). Thus, even though some trucks use engines locally-produced by foreign JVs, their local value-added must be limited. Further, these foreign partners do not seem to have pursued globalization in terms of setting up factories abroad. Such tendency is not surprising as it also happened to GM-Daewoo in Korea; GM did not want this JV to go for globalization (Lee and Lim 2001). This is why Thailand has ended up showing low values of DVAFXSH.

Ownership, Competition, and Policies in China

Mixed Outcome or Even Failure with JVs in the Early Period

China's automotive industry started earlier than Malaysia and Thailand. Before the 1960s, the country had 5 assemblers with an annual production capacity of 60,000 vehicles (Ma 2003). China also intended to build its own automotive industry despite its low level of technology (Yu et al. 2008). This situation led to a change in policy in the 1980s toward inviting foreign JVs with the expectation of technology transfer from the so-called "market for technology," which was also applied to other industries, such as telecommunication equipment (Mu and Lee 2005). One of the

Table 4 Chinese patents granted to automobile makers

Invention patents (application year)	1998–2001	2002	2003	2004	2005	2006	2007	Sum
Local companies (time founded)								
SAIC (Shanghai Qiche Gongye Jituan) (1955)	4	1	10	21	23	10	3	72
Chery (Qirui 1997)	0	1	1	12	19	86	103	222
Geely (Jili 1997)	5	0	0	0	5	14	2	26
Joint ventures (time founded)								
Shanghai Volkswagen (1985)	1	3	0	3	3	2	1	13
Shanghai GM (1997)	0	0	0	0	1	0	0	1
Utility model (application year)	1998–2001	2002	2003	2004	2005	2006	2007	Sum
Local companies (time founded)								
SAIC (Shanghai Qiche Gongye Jituan) (1955)	10	7	15	20	27	23	2	104
Chery (Qirui 1997)	0	28	35	6	9	143	33	254
Geely (Jili 1997)	7	0	0	0	28	79	14	128
Joint ventures (time founded)								
Shanghai Volkswagen (1985)	1	3	4	8	11	4	2	24
Shanghai GM (1997)	0	0	0	0	3	25	3	31

Note: For SAIC, included are patents owned by its local affiliates, excluded are patents owned by its foreigner JVs. Patent searched using key words, like "Shanghai Dazhong Qiche", "Shanghai Tongyong Qiche", "Qirui Qiche", "Jili Jituan + Jili Qiche + Jili Konggu"(symbol "+" means "or"), for each company in assignee/applicant field

Source: Adaptation of Table 5 in Lee et al (2009); original source of data: SIPO, http://www.sipo.gov.cn/sipo2008/

first JV was the Beijing Jeep Company signed in 1983, followed by Shanghai Auto Industry Corporation (SAIC)-VW (SVW) in 1984 and Guangzhou-Peugeot in 1985, while more came in the 1990s.[8]

In 1988, the government proposed a strategy of supporting three majors and three minors among JVs. With this series of JV agreement, the production of automobiles increased rapidly as new brands were launched, given no competing locally owned brands (Wang 2007). In these JVs, the cap of foreign ownership was regulated to be 50% or less (Liu et al. 2014) and were also requested to establish R&D centers (Yu et al. 2008).

However, this strategy of relying on FDI or JV had not led to the expected outcome in terms of technology transfer and eventual enhancement of technological capabilities of automakers in China (Chu 2011). In the early effort, the size of the country was not considerably an advantage; rather, it was a source of information

[8] In the 1990s, a joint venture agreement between SAIC and GM in 1997, followed by Guangzhou-Honda (1998), Tianjin-Faw-Toyota (2000), Changan-Ford (2001), Beijing-Hyundai (2002), Brilliance-BMW (2002), and Dongfeng-Nissan (2002); and the Chinese auto market became a global battlefield (Chu 2011).

and coordination failure associated with complex politics involving the central and local government that resulted in difficulty in conducting Japan–Korea-style centralized industrial policy (Huang 2002; Thun 2004, 2006; Brandt and Thun 2010).

Although the central government attempted to achieve economy of scale by limiting the number of automakers (e.g., three majors and three minors) in the nation, provincial government often circumvented such regulation and actually allowed entries by local or foreign JVs firms. Thus, China had ended up more 110 car assemblers with about half of them as foreign JVs (Chu 2011). The problem in the auto sector in China had been summed as "outdated products, high prices, and no R&D capabilities," or "too many production sites, indiscreet project approval, redundant investment, and slow localization" (Chu 2011). Particularly, the policy by the central government that allowed only state firms to form JVs with foreign firms is responsible for the situation that each JV adapted an old mid-market design from the foreign partner and concentrated on fulfilling government-mandated localization requirements, rather than tried to develop their own engines (Thun 2018).

Table 4 shows that these foreign JVs were not performing considerable R&D activities locally in terms of their filings of invention patents and utility models in China. The number of patents filed by Shanghai-GM or Volkswagen was only one digit in comparison with 107 patents by Chery in 2007. The number of utility model (petite patents) filed by these JV during the 1998–2007 period was only 24 and 31 for Shanghai-Volkswagen and Shanghai-GM, respectively, compared with 254 and 128 for Chery and Geely, respectively.

Guangzhou-Peugeot Automobile Company (GPAC) is a representative case that failed in China as one of the first foreign–Chinese JVs. It was established in 1985 as a JV between Peugeot and Guangzhou Automobile Group. After some success until 1992, the sales plummeted due to low competitiveness, and the total loss reached 10.5 billion RMB by 1997 until it was closed in March 1997 (Lassere and Zeng 2002). Peugeot was unwilling to promote local value chains but kept relying on foreign imported parts, which ultimately raised the final cost of the products (Harwit 1995). The reliance on CKD kits caused troubles. For example, production stopped more than two months in late 1986 when Peugeot and the Chinese could not agree on the price the JV should pay for the CKD kits (Harwit 1995; Peng 2000). Although the Guangzhou area lacked high-quality parts suppliers, Guangzhou officials prohibited the purchase of high-quality parts at a low price from other areas of China suppliers. GPAC had an extremely high dividend payout ratio instead of using profits to make changes to their products (Sun et al. 2010). Thus, the Chinese side believed that Peugeot focuses on obtaining the short-term profits from selling CKD kits quickly without facilitating localization (Fernandez and Shengjun 2007).

Notably, in Thun's (2006) three types of auto industry development model in China, Guangzho and Beijing belong to local laissez-faire system, whereas Shanghai belong to the model of local developmental state, in addition to the leading local state model of enterprises (Changchun and Wuhan). Such typologies imply diverse types of industrial policy that leads to different outcomes in terms of localization. Thun (2006, pp. 71–72) reports that in 1997, local parts accounted for 90% of the parts used by SVW compared with only 20% in Guangzhou-Peugeot, 15% in FAW-VW, and 20–30% in Beijing Jeep. Hence, although the preceding section

has reported the rapid increase of localization, the reality is quite a degree of cross-regional divergence that depends on the capability of the local government in implementing industrial policy. Thus, the Shanghai municipal government is the only local developmental state that used an industrial policy model similar to the East Asian one (Thun 2006).

The size of domestic market can be a strong source of bargaining power in dealing with foreign companies about technology transfer negotiation; however, this notion does not imply that it is actually utilized as such unless the local government has an effective plan and will to promote the local industry. Thus, the so-called "trading market for technology" idea is effectively utilized in the case of the telecommunication switch development, which is not the case in the auto sector because the local government does not give auto development projects high priority and fails to provide an effective coordination to promote a parts–supplier network until the 2000s (Chu 2011).

Success with Indigenous Ownership Since the Mid-2000s

Only after China joined the WTO in 2001 were locally owned carmakers allowed to enter the market (Zhao 2013; Lee et al. 2016), causing a rise in competition. Before 2000, JVs dominated the Chinese market (Tian et al. 2010). Since then, locally owned makers, such as Great Wall, Chery, and Geely, rapidly emerged and continued to increase in market shares, reaching 30% in 2009 (Tian et al. 2010). In passenger cars, shares by indigenous brands already reached approximately 40% in the 2000s; and in sport utility vehicles, seven of the top-10 bestselling models in 2015 were produced by indigenous firms (Lee et al. 2016).

These new companies pursued slightly different strategies from that of foreign JVs in building technological capabilities and acquiring foreign technology. They conducted in-house R&D activities, filing more patents than foreign JVs (see Table 4), and relied on active licensing and international M&As. For example, Chery bought the used assembly line of the SEAT company (a Volkswagen-subsidiary in Spain) and the Engine Factory of the Ford Company based in England in 1997 (Lee et al. 2009). With the imported assembly line, they recruited engineers from foreign JVs; the CEO (Tongyao Yin) of Chery used to be a manager in the FAW-VW, and more than 100 engineers left the FAW-VW to join the Chery. Moreover, 13 key engineers joined from the Dongfeng-Nissan and joined the development team for the Tonga famous QQ model, which took off Chery (Lee et al. 2007). These key engineers left the JVs with disappointment because the JVs had no ambition to be an independent innovator, and they wanted to build an independent automaker in China (Lee et al. 2009).

Given the strong motivation for success associated with private or non-state ownership and facing tough market competition, indigenous firms, including BYD, invested aggressively in new facilities and technologies to build their technological capabilities. These firms frequently tested and improved their ideas in the market to learn rapidly, launching over 170 models from 2003 to 2007 (Chu 2011; Lee et al. 2016). Indigenous firms further built their capabilities through global outsourcing and even acquired foreign companies (Lee et al. 2016). Chery established a JV with

Jaguar Land Rover to enhance its brand reputation and technological capabilities. In 2007, Geely set up an overseas factory and bought a stake in UK cab firm Manganese Bronze Holdings (Guo et al. 2017). In 2009, Geely acquired Australia's Drivetrain Systems International, the world's second-largest gearbox manufacturer, and Geely improved further its technological capabilities through the M&A of Volvo.

Currently, given the rise of indigenous firms, the size of domestic market segmented into low and high ends had a role in facilitating growth of such firms first based on the low-end segment while avoiding the direct competition with JVs targeting the high-end market (Tian et al. 2010; Thun 2004, 2018). Eventually, these indigenous firms, such as Geely, have achieved stage-based upgrading, from imitation to innovation, from low-end to middle and high-end, and from the domestic market to the global market. The rise of indigenous firms also indicates more competition between these local firms and JVs, which further contributes to the deepening and widening of local supply chains in China as an additional factor other than the LCR policy. Given the dominance of local firms in the low-end segment and of foreign JVs in the high-end segment, the competition for medium segment forced foreign JVs to attempt to reduce the cost and local firms to improve the quality by building their own local supplier network and increasing localization (Brandt and Thun 2010).[9]

Other than LCRs, three categories of policy initiatives have been implemented for the automotive sector in China, namely, import restrictions, entry control, and market discrimination. First, according to the "Automotive Industry Policy" issued in 1994, import quota licenses are used to regulate the import of auto parts and assembled cars. Even the types of car allowed for imports are determined in consideration of the nationwide policy of automotive sector promotion. Thus, either used cars or parts for car assembly are forbidden, which implies that automotive manufacturers are not allowed to import kits to produce cars via semi-knocked down or CKD (Chen and Han 2007). Second, foreign enterprises are not allowed to establish more than two JVs in China for one specific type of car. For investment projects with regard to such parts as CBU and engines, foreign automotive manufacturers are required to collaborate with indigenous manufacturers (Nan 2005). Third, foreign cars are discriminated through higher registration fees and taxes than those for domestic cars (Chen and Han 2007).

Summary and Conclusion

This study compares the evolution of the automotive sectors in Malaysia, Thailand, and China with that in Korea, focusing on industrial policy and upgrading possibilities. The three countries all desired to promote their automotive sector and implement industrial policy, that is, LCRs, until they joined the WTO and suspended the policy. Although the LCRs have a common effect of increasing the localization ratio

[9] The Shanghai Volkswagen case provided by Brandt and Thun (2010) is useful in understanding the upgrading effect of LCRs on local supply chains.

to a certain degree, the eventual development path of the automotive sectors has diverged.

China has been achieving a steady process of upgrading in terms of increasing the share of domestic value-added in their exports (FVA), labor productivity, and globalization in terms of the share of domestic value-added in foreign exports (DVAFXSH) although it is not yet considerably export-oriented (low REII). Although China had mixed outcome with its early policy with JV promotion, it has eventually learned and succeeded with the rise of indigenous firms competing successfully against foreign JVs in domestic markets, thus undergoing a similar success path as Korea. Thailand follows, with not a considerably fast increase of domestic value-added and intermediate part exports (low DVAFXSH) but with strong rise of exports (high REII). Malaysia comes last, with a low share of domestic value-added in their exports (FVA), extremely weak exports (REII), and low share of domestic value-added in foreign exports (DVAFXSH).

Such divergent outcomes in the three countries are explained in terms of the three key factors, namely, local ownership, market competition (discipline), and firm-level effort and strategies. Despite local ownership, global competitiveness (REII) is not enhanced in Malaysia due to the lack of competition during the protectionist period and the nonexistent will and strategies to localize high-technology parts. Thailand differs from Malaysia with its strong export performance (higher REII); however, its dominance by foreign MNCs is associated with the lukewarm performance in enhancing domestic value-added (high FVA) and no globalization (low forward GVC linkages or DVAFXSH). By contrast, China's automotive sectors are neither monopolized nor dominated by foreign JVs. Strong entries by locally owned firms since the WTO membership provided fierce competition to incumbent foreign JVs. Supportive policies have also become more consistent and confident in the 2000s, which are combined with the aggressive firm-level responses of in-house technological efforts (Chu 2011; Lee et al. 2016).

Overall, China shows a case most similar to Korea in terms of local ownership and supportive policies, with a slight difference that the former relies on discipline from huge domestic markets, whereas the latter relies on discipline from global markets. Malaysia has opted for a "half-Korean-style" strategy of "developing a national care without world market discipline" and thus resulted in dismal results due to weak technological capabilities. Thailand used to share the similar nationalist vision with Malaysia but turned to FDI-led development model, and the final outcome is a compromised success.

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Keun Lee is a Professor of Economics at the Seoul National University; Head of the Center for Comparative Economic Studies of SNU; a Fellow of the CIFAR (IEP program); director of the Center for Economic Catch-up. He is the winner of the Schumpeter Prize for his monograph on Schumpeterian Analysis of Economic Catch-up (2013), as well as the Kapp Prize (EAEPE). He is also an editor of Research Policy, and an associate editor of Industrial and Corporate Change. He served as the President of the International Schumpeter Society, and a member of the Committee for Development Policy of UN.

Di Qu holds a MA in economics degree from Seoul National University. She now lives in China.

Zhuqing Mao is a Postdoctoral fellow at University of Johannesburg. She received her Ph.D. Degree in Economics from Seoul National University. Her research interests include Economics of Development, International Trade, Area Studies (China, South Korea, South Africa, and Other Developing Economies), Economics of Innovation. She has published in Journal of China Studies, European Journal of Development Research, Journal of International Trade & Commerce, and Science Research Management.

Authors and Affiliations

Keun Lee[1,2] · Di Qu[1,2] · Zhuqing Mao[3]

Keun Lee
kenneth@snu.ac.kr

Di Qu
qqdd0519@sina.com

1 Department of Economics, Seoul National University, 1 Gwanak-ro, Gwanak-gu, Seoul 08826, Korea

2 Fellow, IEP Program of CIFAR, Toronto, Canada

3 DST/NRF South African Research Chair in Industrial Development, College of Business and Economics, University of Johannesburg, 31 Henley Road, Auckland Park, Johannesburg 2092, South Africa