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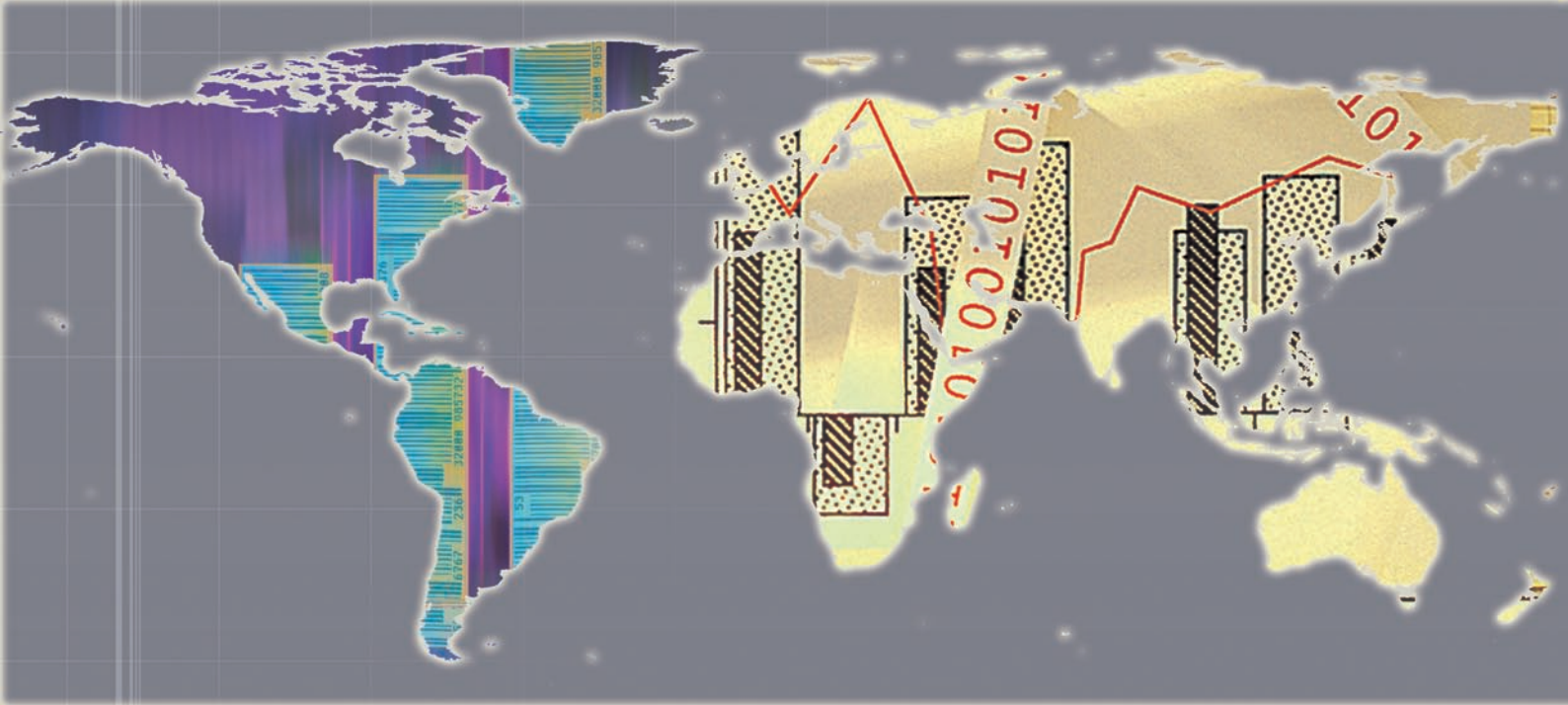
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Impact of the Global Economic Crisis on the Thai Automotive Industry: From the Perspective of the Interplay between Shocks and the Industrial Structure



RESEARCH AND STATISTICS BRANCH
WORKING PAPER 07/2009

Impact of the Global Economic Crisis on the Thai Automotive Industry: From the Perspective of the Interplay between Shocks and the Industrial Structure

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Vienna, 2010

Acknowledgements

Maria Fermie was responsible for stylistic revision. UNIDO Regional Office in Thailand assisted the field study for this research, and Gorazd Rezonja, UNIDO consultant, provided useful comments on the paper.

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1. Introduction

The current global economic crisis, which originated in the financial sector of the developed countries, spread at a rapid pace to the real sectors in developing countries. Considering the scale and the speed of its transmission, this could be viewed as the worst crisis for the developed and more so for developing countries since the Great Depression in the 1930s. Freer movements of goods, people and money through globalization have synchronized the development as well as the destruction of the world economy more than ever before. Akin with climate change and environmental destruction, an economic crisis of such a magnitude becomes a global issue, and as such it requires a multilateral framework where the causes, effects and solutions can be considered.

Differences in the speed of the crisis' transmission to developing countries and its effects on their manufacturing industries are evident. Conventional industrial characteristics, such as degrees of foreign market exposure and factor intensities, explain them only partially. Globalization of manufacturing industries, evidenced by the international division of production processes, foreign direct investment in production, and interaction of foreign subsidiaries and local suppliers, has made the causes of such differences more complex. To better understand how this crisis was transmitted to and has affected an industry, its workers and other industries, and to draw policy implications for the future, it is necessary to look into the details of the production structure and its evolution.

There are three reasons why the automotive industry in general, and the Thai automotive industry in particular, make an interesting case for studying the effect of the global economic crisis. First, as more than 30,000 parts go into a final product, the automotive industry has significant linkages with other industries, including steel, electricity, rubber and plastics, as well as the service sector. Thus, studying the automotive industry permits an investigation of the transmission mechanism within a country.

Secondly, the Thai automotive industry had grown quantitatively until 1996 with a relatively mild interventionist approach of the Thai Government, and a more active participation of a large number of multinational corporations. However, it seems that alongside this quantitative expansion, qualitative, technological improvement did not take place at the same pace. This limited technological deepening of the industry could well have been one of the underlying causes of the Asian financial crisis of the 1990s. The effects of the current crisis on the industry

are again a function of the production structure that has evolved since the last crisis. A comparison of the two crises enables one to have a better understanding of the interplay between a shock and production structure in the process of generating the effects on industries.

Finally, in the history of a generally market-based development, the Thai automotive industry continues to exhibit dynamism. The bargaining power and position of each actor have shifted according to the strategies of multinational corporations, Government policies and the collective actions of automotive firms. This diversity of actors and their changing relations provide a fertile terrain for studying the complexity of the process of structural changes that works as a catalyst in the transmission and generation of crisis' effects.

In the twenty-first century, as a country develops a scale-intensive industry, such as automotive manufacturing, the chances of it pursuing a relatively liberal development approach, like Thailand, seems much greater than the other end of continuum, namely, state-led development. In this sense, after due consideration of specific differences in domestic and international conditions of the time, the case of the Thai automotive industry could provide important lessons for countries during this period of globalization.

Section 2 briefly introduces the background of the Thai automotive industry, with facts and figures provided to illustrate the transmission and unfolding of the current crisis in the industry. Section 3 discusses the evolution of the industrial structure and their interplay with past crises, while section 4 focuses on the transmission mechanism and effects of the current global crisis and elucidates their similarities and differences in comparison with the past crises. Section 5 concludes.

2. Background of the industry's development and situation in the current crisis

The Thai automotive industry started in the early 1960s, led by Japanese corporations. Geographical and cultural proximity and a relatively stable political climate of Thailand attracted the attention of Japanese corporations. In addition, the development stage of the Thai automotive industry was especially favourable to Japanese corporations, who wanted to profit from international operations, but at the same time lacked the experience in international manufacturing and the technological capabilities to penetrate more developed automotive industries (Doner, 1991:77).

Promotional incentives induced the successful entry of some Thai firms into the automotive industry, proving that technological capability was not the most important determinant. Favouring large-scale firms, Government incentives mainly prompted well-established businessmen to start automotive production, thus barring the entry of small, experienced manufacturers (Suehiro, 1989). Also, while patron-client relationships were still important, political connections and business networks of large established firms made a difference, especially since foreign firms investing in such a political and economic environment sought local and politically well-connected partners (Siroros, 1992). The small Thai automotive market was quickly overcrowded by the entry of a large number of foreign and Thai firms through Government promotion. Furthermore, the different models and types that each automaker produced aggravated the market condition.

The conspicuous businesses of multinational corporations and large Thai firms, unfettered by Government regulations, gradually came into conflict with the public that was suppressed by Thailand's military in the early 1970s. A democratic movement and the withdrawal of United States troops from Viet Nam eventually led to the collapse of the military regime in Thailand. This was followed by a period of political democratization, anti-foreign sentiment among the public—especially against the Japanese—the oil crisis, and an unstable political climate had a negative effect on foreign direct investment and the well-established businesses in Thailand (Yoshihara, 1994:57; Takeuchi, 1991:207). The deterioration of the economy and frequent changes in Government made it difficult for the State to implement basic reforms in the automotive industry.

However, coming out of the turmoil of the democratic regime, there were two important developments that had effects on subsequent periods. First, the Government recognized the importance of intervention in favour of local firms. This resulted in the birth of the local content regulation and partial ban of completely built up (CBU) imports (Doner, 1991; 201). Second, there was a transition of the Government-business relationship, previously governed by patron-client ties, to a more formal relationship through business associations (Anek, 1992). The two points were interdependent as the increase of local content rate induced the entry of Thai firms into the automotive industry and thus strengthened their business associations. In turn, the bargaining power of the associations was strengthened enabling them to press for a further increase in the local content. Owing to the emergence of local parts manufacturers, the three actors—Government, multinational corporations and the Thai firms—who cooperated on, and

were opposed to, different issues, significantly influenced the subsequent course of the industry's development.

In the 1980s, the steady increase in the local content brought about greater participation of Thai firms in the industry. However, the industry as a whole remained uncompetitive, as it was mainly oriented toward the domestic market under the protection of the Government. Frustrated with the poor performance of the automotive industry and chronic trade deficits, the voice of free trade economists grew louder in Government bureaucracies (Kesavatana, 1989). In a broad sense, the increasing advocacy of export-oriented industrialization was born out of a context in which development thinking among intellectuals was generally changing towards export-oriented growth away from import-substitution industrialization, which had largely failed to bring about structural changes in developing countries. Besides, in the early 1980s, the Thai Government received loans from the World Bank under the condition, among others, that structural changes would be made to ensure that exports would play a greater role in economic growth.

The transition from a protected, domestic orientation to liberal, export orientation was, however, far from smooth, as each orientation was supported by different Government bureaucracies. Thus, the Government's policy for the automotive industry kept oscillating between the two orientations until the fall of an influential nationalist politician in the mid-1980s. Ever since, the balance appears to have tipped in favour of a more liberal policy.

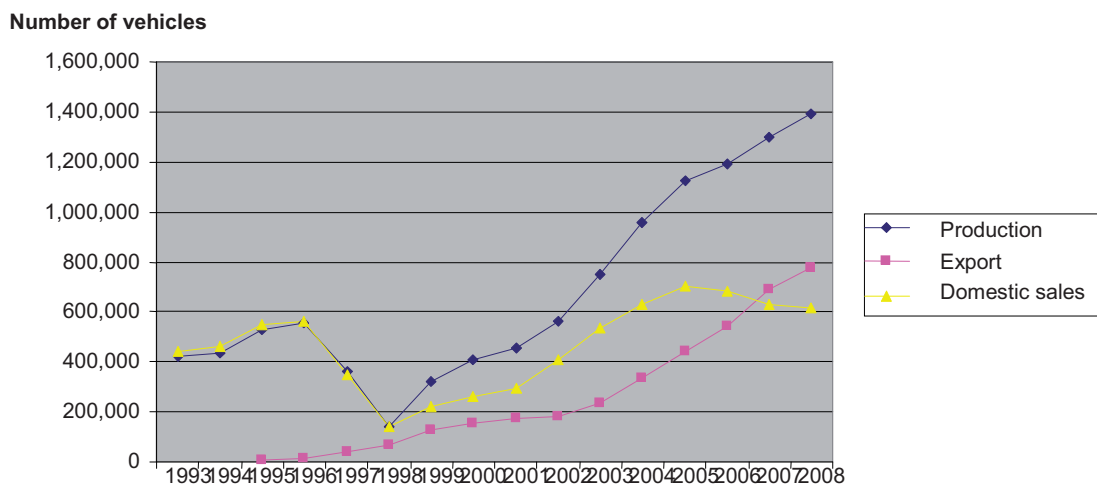
As liberalization gradually proceeded, competition in the industry intensified. In addition, the appreciation of the Japanese yen and maturing of the automotive industry in Japan made foreign direct investment an attractive choice even for smaller Japanese firms (Mori, 1999: 131-132). A rush of Japanese investment into Thailand exerted further competitive pressure on existing firms in the industry. At the same time, since the end of the 1980s, rapid growth of the Thai economy as a whole, contributed to the expansion of the Thai auto market. This helped to postpone a real shake-out of the industry to a later stage—the breakout of the Asian financial crisis in 1997.

The crisis hit the Thai automotive industry hard, with sales in 1998 declining to a third of the 1996 level. It was a rude awakening to the still largely protected industry, which considered exports as a supplementary measure to domestic sales. The crisis forced automakers to look for export markets to compensate for declining domestic sales, and the Government was forced to extend full support to export promotion and liberalize the auto market, thus restructuring the

industry. Foreign-affiliated firms were able to stave off bankruptcy with financial and technological support from their headquarters, but wholly Thai-owned firms, with no affiliation, were in dire straits, as their management structures and technological capabilities were not ready for international competition (Bangkok Post, 25 October 1999). This situation led the Government to change investment regulations and allow foreign majority ownership in joint ventures. The devaluation of the Thai baht and liberalization of investment helped to increase FDI inflows in general, and continued to attract Japanese investment in the Thai automotive industry (Bello et al., 1998).

It took some five years for automotive production to recover to pre-crisis levels. The Asian crisis abruptly changed the focus of the industry—from domestic to export orientation. The economic crisis sifted firms with international competitiveness from those that could survive only under heavy Government protection. Most wholly Thai-owned firms belonged to the latter group and faced financial difficulties (*Far Eastern Economic Review*, 17 August 2000). Firms in the former category moved on to strengthen relations with multinational corporations. Initially, export promotion was regarded as a temporary measure to compensate for the rapidly shrinking domestic demands. However, the consolidation and technological upgrading of the Thai parts industry through foreign direct investment, which was encouraged by the post-crisis liberalization of the industry, brought about structural change and firmly established export promotion as a characteristic feature of the Thai automotive industry.

Figure 1 Volumes of vehicle production, domestic sales and exports, 1993-2008

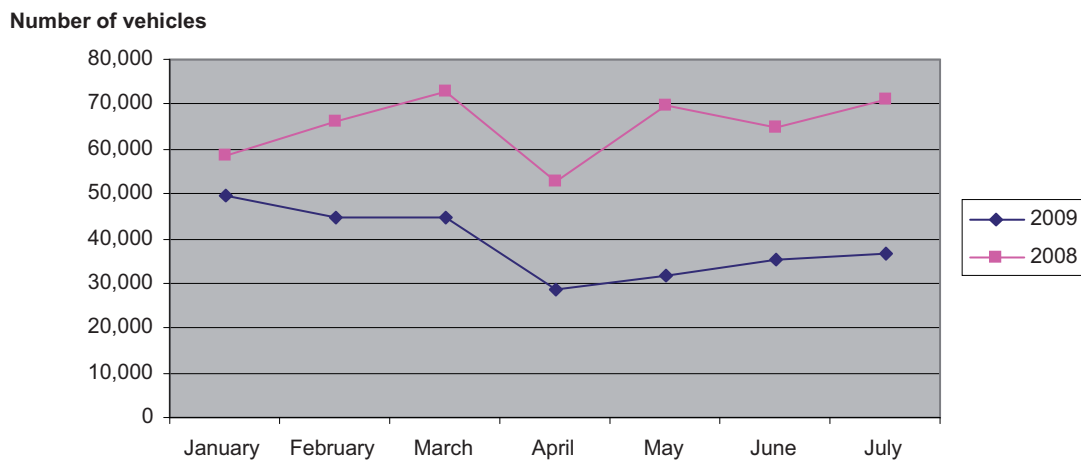


Source: The Thai Automotive Institute.

As seen in figure 1, before the Asian financial crisis of 1997, exports were negligible, and volumes of production and domestic sales were almost identical. After reaching a low point in 1998, volumes of production and domestic sales started diverging as exports started growing. In 2007, the volume of exports exceeded that of domestic sales for the first time, and the difference between the two increased in 2008 as exports continued to grow, while domestic sales declined.

Immediately following the crash of Wall Street in October 2008, the shock was felt by the Thai automotive industry—in November 2008—in the form of shrinking export demand. This was the first time in 2008 that vehicle exports declined on year-on-year basis compared to the previous year. Since then, the projection for 2009 production has been repeatedly revised downward. As of July 2009, the industry’s production target for 2009 was 68 per cent of the 2008 level, which could be achieved only if substantial recovery in demand in the second half of the year takes place, especially considering that the production volume up to July 2009 was only 55 per cent of the 2008 level.

Figure 2 Comparison of export volumes between 2008 and 2009 on a monthly basis

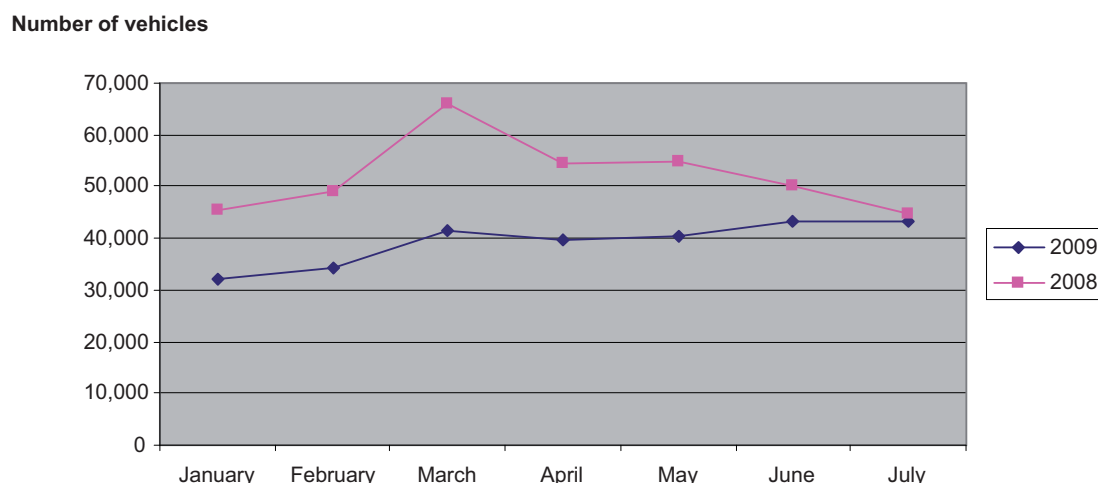


Source: The Thai Automotive Institute.

Figures 2 and 3 show where the demand declines originated. By the first quarter of 2009, both domestic and foreign demand were affected by the crisis. However, the effect on the former seems to be milder as domestic sales stabilized and are on a gradual recovery path as of the second quarter of 2009. Exports for their part, are yet to show signs of improvement. This is in contrast to the Asian financial crisis, which caused the endogenous meltdown of the economy and

prolonged the effects on domestic demand for well over five years, while exports played a role in alleviating low domestic sales. Detailed analyses on the transmission mechanism and the effects of the crisis on the Thai automotive industry are presented in section 4.

Figure 3 Comparison of domestic sales volumes between 2008 and 2009 on a monthly basis



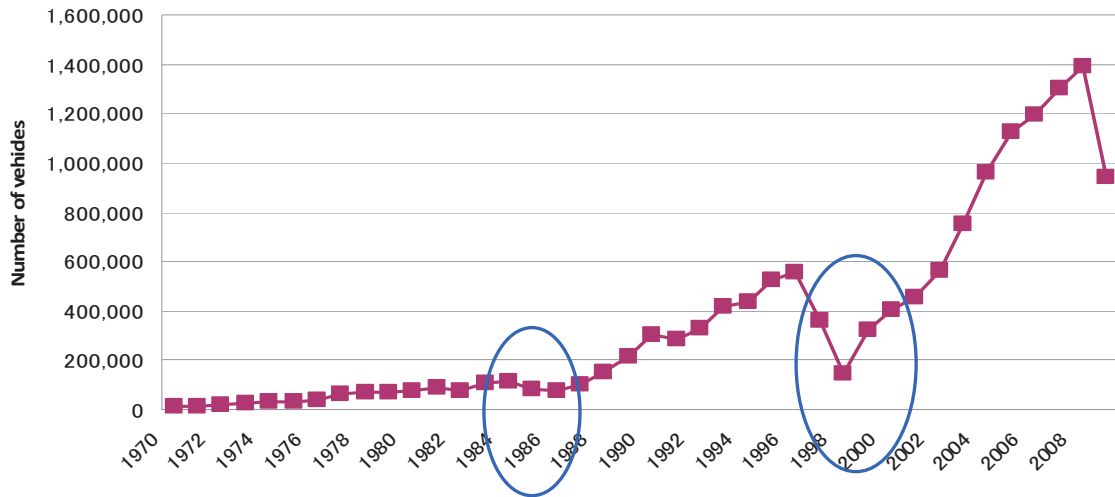
Source: The Thai Automotive Institute.

Next, an examination is made of the evolution of industrial structure in Thailand together with the interplay between the structure and past downturns. Such an analysis provides strong indications, from which some parallels can be drawn, in order to further estimate the effects of the current crisis on the Thai automotive industry.

3. The evolution of the industrial structure and interplay between the structure and past downturns

Between 1970 and the current crisis, the Thai automotive industry faced two major downturns which resulted in negative growth for more than two consecutive years (figure 4). The first one was attributed to the economic recession in the mid-1980s, resulting from high oil prices, global recession, low commodity prices for Thai exports and interest rate hikes (Kochhar et al., 1996). Automotive production declined by some 25 per cent in 1985 and decreased further by 10 per cent in 1986 before recovering. The second major downturn was the Asian financial crisis of 1997, as discussed in the previous section, which led to declines of 36 per cent and 56 per cent of automotive production in 1997 and 1998, respectively.

Figure 4 Vehicle production, 1970-2009

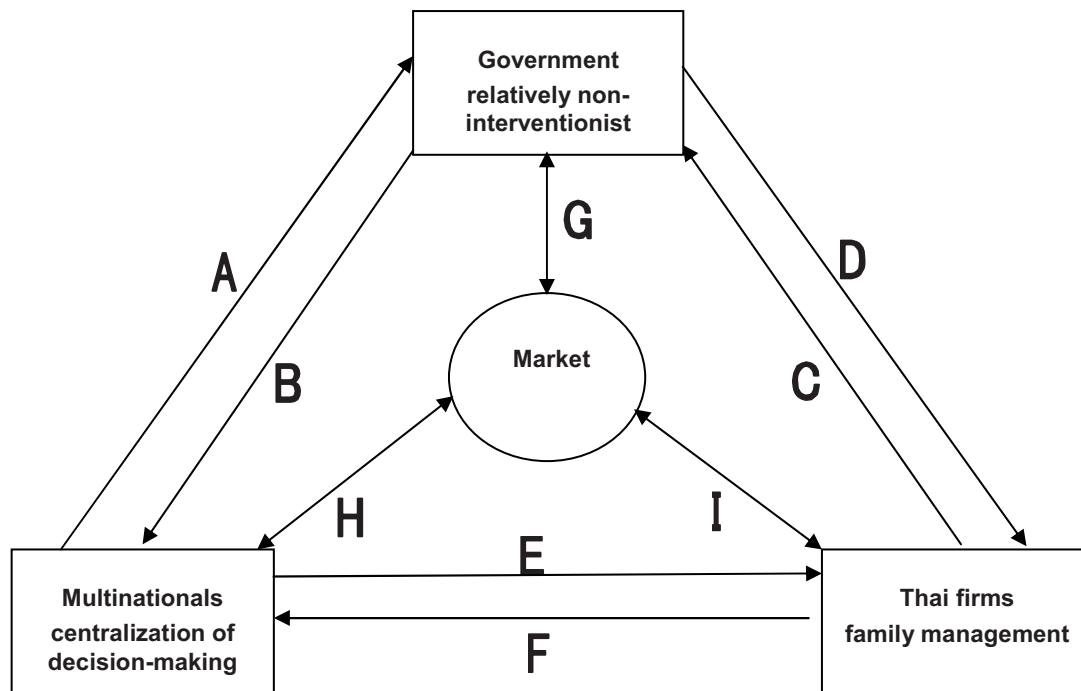


Source: Thailand Automotive Directory 1997 for data between 1970 and 1992, and Thai Automotive Institute for data between 1993 and July 2009.

Note: The 2009 figure is a forecast made by the Japan External Trade Organization, Bangkok.

This section analyzes both qualitatively and quantitatively how the industrial structure interacted with the each decline to generate particular impacts on the industry and the economy, which led to the evolution of the industrial structure and accelerated growth in the subsequent period (figure 4). These two previous cases will be compared with the situation of the current crisis in the section 4. The first part in this section depicts the principal processes of interaction among the main actors—the Thai firm, Government and multinational corporations—in the Thai automotive industry that have been instrumental in shaping the development of the industry. Within the general pattern of such interactions, the structure of the Thai automotive industry has continued to evolve, despite recessions and crises. This dynamic feature of the industry is discussed in the latter part of this section, which focuses on the two periods of the downturns.

Figure 5 Principal pattern of interactions among main actors of the Thai automotive industry



From the start, multinational automotive firms dominated the Thai automotive industry, and were generally able to operate on their own terms in the open Thai market. This behaviour of multinationals was based on, or made possible by, several relations, as shown in the above conceptual framework (figure 5). First, represented by arrow A, multinational corporations possessed the requisite technology, which was very attractive to the Thai Government. Their skills and technological know-how gave multinational corporations a strong bargaining power over the Government. Even though the Government did not necessarily give in to their demands each time, especially when multinational corporations were closely united, they were able to push their demands through.

Second, the limited interference of the Thai Government in activities of the multinational corporations, represented by arrow B, also helped multinational corporations to operate in a relatively unrestrained environment.¹ Essentially, the Government wanted to develop the automotive industry and, since local firms lacked the necessary technology, the Government was

¹ In a World Bank report published in 1983, Thailand ranked second among 31 developing nations with the least price distortion (Anek, 1992:166). Also, UNCTAD reported the existence of fewer non-tariff barriers in Thailand and Malaysia than other developing ASEAN countries (Suzuki, 1996:58).

generally supportive of, rather than hostile to, foreign automotive firms entering the Thai market. When local development needs conflicted with activities of multinational corporations, the Government intervened. However, the effectiveness of the intervention was conditioned by State capability and the relationship between the Government and Thai firms. Often bureaucratic infighting prevented effective intervention, while weak government-business relationships could not constitute a strong counterforce against multinational corporations (Higashi, 1995). The growth of local parts firms during the import substitution period strengthened ties between Thai firms and the Government through a formal association (Doner 1991). Yet, as indicated by arrow C, the association was not organizationally cohesive, providing membership to all kinds of firms, ranging from a majority of foreign-owned firms to small Thai firms manufacturing only spare parts. Even the Government did not show any inclination to foster the relationship, as was the case with the Korean and Japanese Governments when they tried to develop their domestic automotive industries (Mardon and Paik, 1992).

Finally, the existence of very few technologically capable Thai firms made multinational corporations conduct business with firms in their own group, or with advanced foreign firms. Keeping the production chain in the hands of multinational corporations was also convenient for, and strategically compatible with, assemblers in Thailand. Their headquarters in home countries centralized decision-making for its role in research and development and co-ordination with their group firms (Abo, 1992). Thus, it became much easier for an assembler to purchase parts from a foreign-affiliated firm with whom a business relation had already been established at the level of their headquarters, probably through joint participation in product development or at least regular meetings of the suppliers' association. In addition, when Japanese multinational corporations sought a supplier, their interest extended beyond the quality and price. They were more interested in a reliable production system which would provide assurance of high quality and low cost of the product. Since the system was developed in Japan and involves such aspects as employment practice, training and management-labour relations, it took time to transfer the system to a Thai firm, which engages in the industry via different institutions from those of the Japanese automotive industry. Consequently, Japanese automotive firms conducted business largely with foreign-affiliated firms and had very weak relations with Thai firms, as shown by arrows E and F in the framework. Although Thai firms were able to expand their business opportunities as the Government increased the local content requirement, wholly Thai-owned firms usually figured last on the list of potential parts suppliers because of their low level of technological development and the behaviour of multinational corporations.

These three factors enabled multinational corporations to enter the Thai market in droves and to operate, based on their own strategies, as arrow H indicates. More than a dozen multinational corporations produced vehicles for the Thai market. Moreover, the small market size was further fragmented with numerous vehicle models and types. This customization strategy of multinational corporations was designed to maintain higher profit margins in the Thai market, where customer tastes were highly differentiated and price elasticity of demand was low.

This same situation was simultaneously engendered by the Thai Government. Opening up the Thai market through investment incentives helped to attract multinational corporations to Thailand. As soon as they were firmly established in the market and had started production, it became difficult for the Government to reduce the number of manufacturers (Kesavatana, 1989). All it could do was forbid new entrants. In addition, failure of the Government to regulate the masses, sustained market conditions which limited the benefits of economies of scale. The Government's minimal intervention in the market due to the lack of administrative capability and industrial know-how, as indicated by arrow G, coupled with the oligopolistic behaviour of multinational corporations and their long experience in the automotive industry, therefore, resulted in the fragmentation of the Thai automotive market.

Turning to Government efforts to upgrade the skills of Thai firms and the general public at large, policy implementation was both qualitatively and quantitatively limited (arrow D). Other than the local content requirement, the Government did not have too many tools to improve the technological state of Thai firms. When they finally extended assistance to Thai firms, as seen in the example of the 'Vender Meet Customers' Program, it was barely sufficient to change the technological conditions in any significant way.²

Similarly, Governmental promotion was inadequate in advancing the country's education and science and technology capacities (Yoshihara, 1998). Low enrolment in secondary schools was alarming since secondary education was often considered the minimum qualification necessary for skill development at work (Sirilaksana, 1995:311). As for higher education, the expertise of graduates supplied by universities did not meet the demand of the industry (Mikami, 1998).

² Compared with similar linkage-creation programmes in other Southeast Asian countries which offered privileges to participating foreign firms, the Thai programme played the role of disseminating business information to improve market efficiency, but did not go beyond that to facilitate foreign-local firm linkages further through Government interventions (Sakura Sougou Kenkyujo, 1999: 16).

Strong Government policy initiatives were needed to ameliorate the situation. The shortage of engineers hobbled every stage of technological adoption, adaptation and innovation. Ultimately, even Government support in research and development was insufficient to meet the country's technological needs. Added to this, funding as well as cooperation with academia and the private sector were lacking.

Of course, the Government was not omnipotent. There are practical limitations to what a government can do. This is especially so for the government of a developing country, often constrained in terms of financial, technical and managerial resources. What should be emphasized here, however, is that in the case of the Thai Government, there seems to have been a predisposition to a lower level of intervention, which characterized the overall action of the Government. Whether it was caused deliberately or not, low-level intervention of the Thai Government was most likely rooted in given institutions.

So far, discussion has centred mainly on multinational corporations, the Thai Government, the market and their interactions, explaining how their actions, reactions, and inactions affected the development of the Thai automotive industry. Based on the discussion, this section concludes with an analysis of the causes for the underdevelopment of Thai firms.

As shown in the framework, Thai firms had three possible external supports for their technological development: technology transfer from multinational corporations (arrow E), Government promotion (arrow D) and market forces (arrow I). As already explained, these are not independent of each other. A degree of influence from one source is often determined by its relation with others, including Thai firms. Also the effectiveness of these external factors on the technological development of Thai firms depended on internal factors of the Thai firms themselves, such as the level of technological accumulation and management characteristics.

First, looking at the influence of multinational corporations, the discussion explained the marginal business relations between multinational corporations and Thai firms in comparison with the relations among multinational corporations themselves and their relations with their headquarters. The strategies of multinational corporations, the weak intervention of the Thai Government and the lack of technological know-how and skills of Thai firms all contributed to this weak linkage between multinational corporations and Thai firms. Since the existence of business relations is a

minimum condition necessary for technology transfer to take place, Thai firms were unable to benefit significantly from this source for technological development.

Second, support derived from Government policy was equally unsubstantial. The technological superiority of multinational corporations and their long experience in the automotive industry often made the strategies and demands of multinational corporations prevail in the Thai automotive industry, limiting the scope of Government policy for the development of Thai firms. This influence of multinational corporations was certainly in addition to the Government's own characteristic of low-level intervention. State fragmentation and lack of know-how resulted in insufficient and ineffective policy intervention at both industry-specific and functional levels, and the relatively weak government-business relation did little to help the situation.

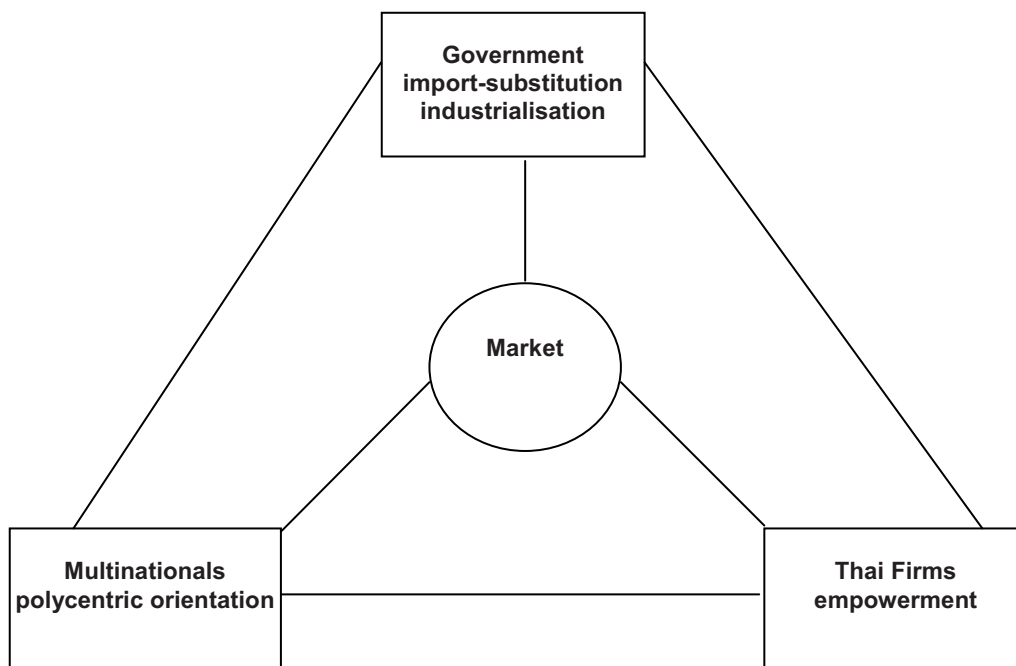
Finally, market conditions were not conducive to the sound development of the Thai firms. The open-market policy of the Government encouraged the entry of a large number of multinational corporations to the small Thai automotive market and, following their entrance, failed to reduce the number of vehicle models and types produced. Market fragmentation and model proliferation limited benefits of the economies of scale, which largely determines the kinds of products that can be produced in the market. From their incipient stage of development, therefore, Thai firms had to face market conditions which, apart from the terms of volume, resembled those of a developed country: a segmented market with frequent model changes. Without being given an opportunity to accumulate the learning experience through the manufacture of one product, Thai firms were unable to run down the learning curve fast enough, which is necessary for gaining competitiveness and further acquiring technological capability.

Accordingly, all three external factors—behaviour of multinational corporations, government policy and market conditions—did not help Thai firms. They found themselves in an unfavourable environment for technological development. However, it should be kept in mind that the effects of these factors were determined through their interaction with internal factors of Thai firms. Their family management system appeared to have slowed the progress of skill formation which probably further dimmed the prospects of business opportunities with multinational corporations. Moreover, they failed to make full use of the period of Government protection through modernization of management. Little improvement in the competitiveness of Thai firms led the Government to lose confidence in the continuation of the import substitution policy, resulting in a gradual shift in policy towards liberalization.

Based on the principal characteristic of each actor, this section examined the causes of the most prominent structural characteristics of the Thai automotive industry: the underdevelopment of Thai firms and their limited participation in key production processes, such as assembling and supplying functional parts as first-tier suppliers. Since principal characteristics and their basic relations among actors were slow to evolve, the underlying forces have had lasting effects on the development of the Thai automotive industry. While the above analysis epitomizes the condition of the Thai automotive industry in general, there was also dynamism in their interactions as strategies, policies and positions of the actors changed. This concurrence can be explained by the fact that each actor is able to influence other actors, and this again points to the importance of considering actors together when analyzing their interactions.

This part focuses on the periods which correspond to the development stages of the industry just before the past two downturns and shows how the industrial structure evolved through the shocks. The impact of the recession on the industry is illustrated through input-output analyses.

Figure 6 Patterns of interaction from the beginning of the 1970s to the mid-1980s



Although tariffs were levied on imported automotive parts when the Thai automotive industry first started, their effects on the behaviour of multinational corporations were minimal. As long as

they were allowed to, they imported automotive parts because of their unavailability in Thailand. In this sense, a non-tariff measure introduced during this period changed the relations between actors in a significant way because it forced assemblers to purchase parts locally.

The local content requirement, following a domestic cry for industrial deepening, was thus considered the beginning of import-substitution industrialization, in terms of effects on the structure of the Thai automotive industry. The Government's localization policy increased the number of Thai auto firms, leading them to jointly assert their interests through a formal association. Empowered quantitatively and institutionally, Thai firms were no longer a passive group. Their demands were reflected in the measures of the localization policy which, in turn, further strengthened the position of Thai firms.

The forced purchase of local parts and the steady increase in the amount purchased gave multinational corporations no choice but to reorganize the way they produced automobiles in Thailand. It was no longer an option for them to assemble vehicles through the wholesale import of parts from foreign countries. Parts production had to be increasingly based in Thailand, and locally-produced parts had to be included in assembled vehicles. Faced with this new reality, multinational corporations discovered two ways to cope with the situation.

First was to find or help establish, where unavailable, wholly Thai-owned firms and improve their skills and production processes so that they could become parts suppliers. Some foreign assemblers encouraged their former local parts importers and retailers to get into production, and provided the necessary know-how to new producers. Furthermore, engineers from assembly plants visited their local suppliers and assisted in solving production problems. In addition to such individual support, Japanese multinational corporations made efforts to transfer their production system *en masse* by establishing a suppliers' association, which functioned well in Japan as a catalyst for interactive learning among suppliers (Internal documents of W corporation in Thailand, 1999). In the process of upgrading the skills of wholly Thai-owned firms, foreign parts suppliers, who had been associated with their multinational assemblers for a long time, were involved as advisers, technology licensors and leaders in suppliers' associations, to facilitate technology transfer.

The second measure taken by foreign assemblers for local procurement was to encourage foreign suppliers to start parts production in Thailand. The close relations of the assemblers'

headquarters with their group suppliers enabled headquarters to play a role in facilitating the direct investment of parts suppliers into Thailand. These multinational parts suppliers were highly regarded by foreign assemblers as the production system was considered favourable by the assemblers. Also, expatriates were ready to act on the technical requests of assemblers, and they often shared a long experience with headquarters in their home countries. These advantages of the multinational parts suppliers, in addition to their technological capability, made them very attractive and convenient to the assemblers. As a result, a limited number of foreign parts suppliers and the small auto market in Thailand led to a loosening of the group business practice prevalent in Japan. Parts makers supplied products to most assemblers beyond the bounds of a *keiretsu* group, in order to satisfy the needs of those assemblers who wanted to purchase from foreign suppliers as much as possible, and the needs of those suppliers who wanted to have more customers in the small market.

Of the two measures employed by assemblers to cope with parts localization, assemblers relied much more on foreign-affiliated firms because of closer ties with their headquarters and their superior technological capability. The localization policy of the Thai Government increased the number of wholly Thai-owned firms and helped technology transfer from foreign firms to Thai firms. However, strong efforts were made by foreign firms to expand business with foreign-affiliated suppliers as the local content requirement increased. Thus, it appears the main effect of the localization policy was to localize the operations of foreign suppliers from whom parts were imported in the past (Mori, 1999).

The Government policy forced multinational corporations to localize their production, which was also supported by a shift in their strategies. After accumulating experience in international operations, it became easier for multinational corporations to delegate some degree of decision-making authority to their Thai subsidiaries. Especially, during this period, the Thai automotive industry was protected from foreign competition and entirely oriented to the domestic market. In this situation, the localization of production, accompanied by the delegation of appropriate authority, was likely to enhance the efficiency of the Thai subsidiary as well as the group performance of the parent multinational as a whole. Localization was, therefore, not entirely against the interest of multinational assemblers, as seen in their efforts to increase of the local content rate to a specified level.

Summing up the local technological development during this period, the import-substitution policy failed to establish the wholly Thai-owned firm as a major business partner of the foreign assembler. Nonetheless, Thai firms that entered into business with foreign assemblers were usually successful and their sales increased rapidly along with market growth, since there were neither many competitors in Thailand nor threats from imports due to Government protection. Sheltered from foreign competition and making handsome profits, wholly Thai-owned firms felt little competitive pressure during this import-substitution period and hence had no incentive to modernize family management for technological advancement. Added to limited technology transfer from foreign firms, little technological development from their own efforts slowed progress in competitiveness. With hindsight, these conditions failed to prepare Thai firms for prospective market liberalization.

Table 1 Degree of dependence of motor vehicle production on sources of demand in 1985

Private consumption	Government consumption	Gross fixed capital formation	Increase in stocks	Total domestic final demand	Exports
0.3643	0.0167	0.5462	0.0435	0.9709	0.0375

Source: UNIDO's calculations based on 1985 Thai input-output data (180 sectors).

Note: For the details of the calculation method, refer to appendix 1.

Table 1 shows how much each source of demand induced automotive vehicle production in Thailand in 1985. The results confirm domestic orientation of this import-substitution period. Most of the production was due to domestic demand, largely from private consumption and gross fixed capital formation. Exports played a negligible role in inducing Thai automotive production.

Table 2 Total multiplier effect of a unit increase in the demand for motor vehicles, 1975, 1980, 1985

1975	1980	1985
1.651	1.7654	1.735

Source: UNIDO's calculations based on 1975, 1980 and 1985 Thai input-output data (180 sectors).

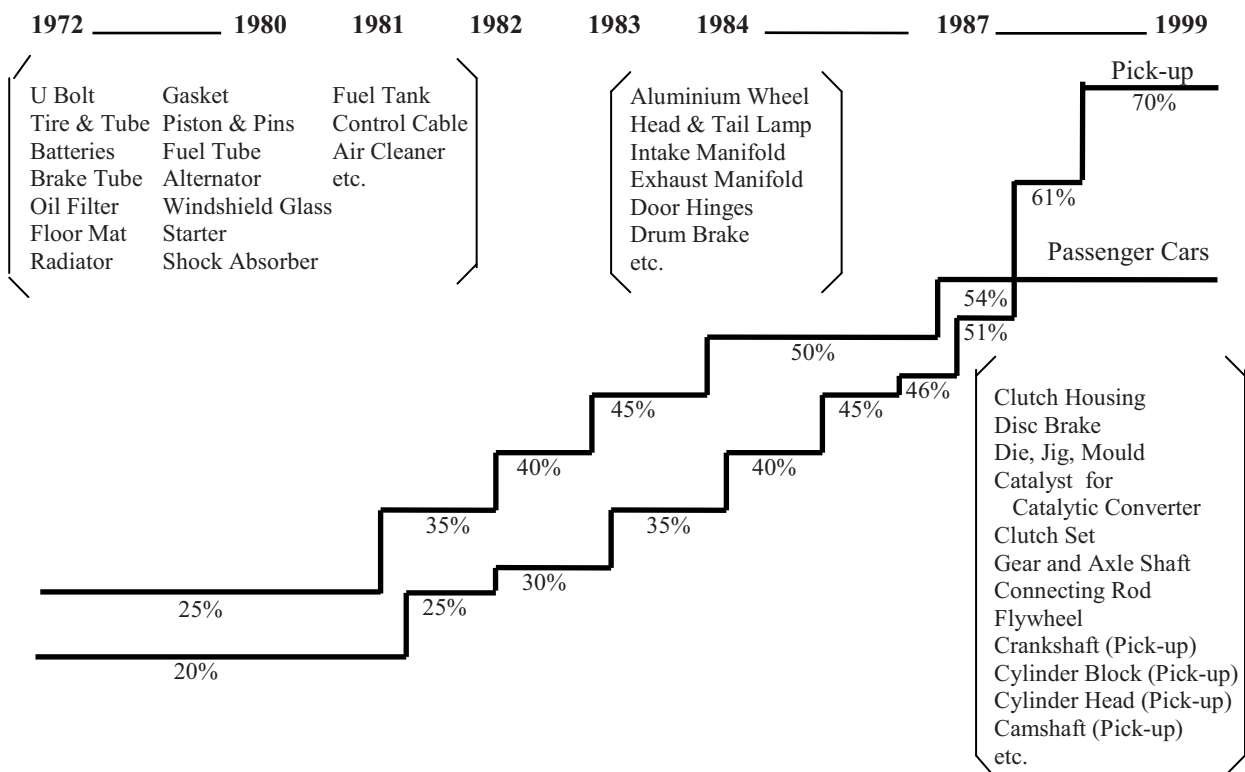
Note: Multipliers indicate how much one unit (for example, one dollar) increase in demand would increase the output of the economy, including the initial demand of one unit.

For details on the calculation method, refer to appendix 1.

Table 2 indicates how much one unit of a final demand for motor vehicle production in Thailand would have induced output from the economy through production linkages. During this period, as described above, indeed it seems that the import substitution strategy created more production

linkages among auto manufacturers in Thailand, although here the effect of linkage creation on production efficiency is not taken into consideration. As shown in figure 7, as mandatory local content requirement increased, production for more technologically demanding auto parts was undertaken in Thailand.

Figure 7 The rise in local content rate and localization of auto-parts production



Source: Author's compilation based on the data from Yahata and Mizuno (1988); Higashi (1995); Thailand Automotive Industry Directory (1997).

Even the engine sector, which usually figures late in the localization process, increased supply to the automotive sector, meeting approximately one third of the industry's total procurement needs for engine parts in 1985 (table 3).

Table 3 Production linkage between a motor vehicle sector and engine/turbine sector

	Total demand Induced		Domestic demand induced		Rate of domestic procurement	
	1975	1985	1975	1985	1975	1985
Engine and Turbine	0.10239	0.07511	0.01497	0.02527	0.14621	0.33645

Source: UNIDO's calculations, based on 1975 and 1985 Thai input-output data (180 sectors).

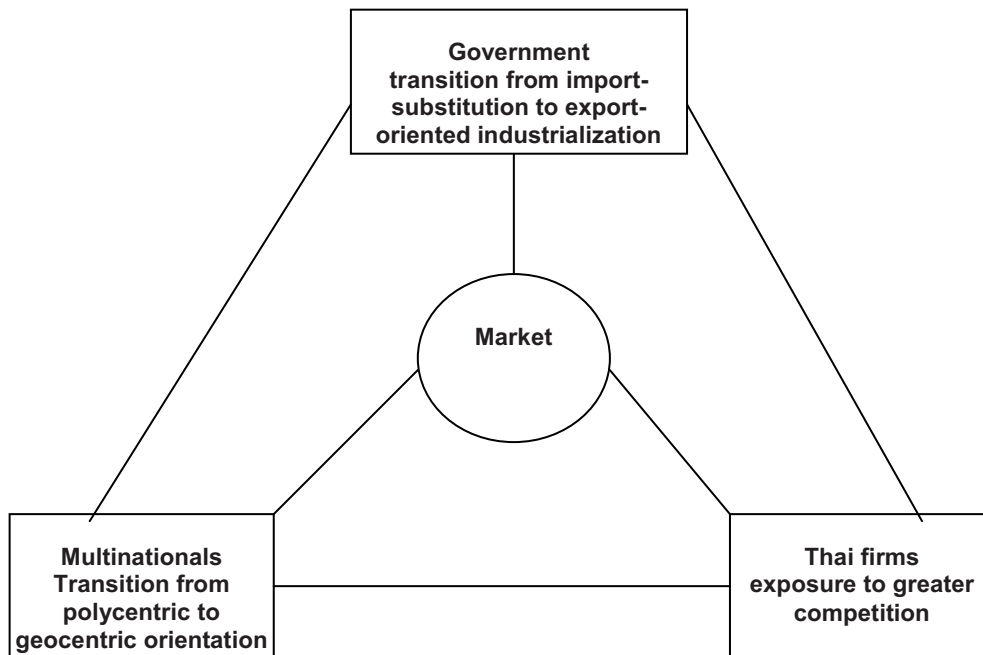
Note: For details on the calculation method, refer to appendix 1.

At the end of this period, the recession in the mid-1980s, which was apparently a mild one for the economy as a whole since it still managed to post real growth rates of 4.6 per cent and 5.5 per cent in 1985 and 1986, respectively, had severe negative effects on the Thai automotive industry in terms of production growth. The fact that a vehicle was considered a luxury item for the general public at that time, the demand for vehicles might have been sensitive to the economic climate.³ In addition, the prevailing industrial structure in the mid-1980s seems to have amplified the negative effects of the recession on the automotive industry. Reliance on the small domestic market without support institutions for export promotion under the import-substitution regime made it difficult for the industry to resort to exports at a time when domestic sales declined. Furthermore, the fact that the industry made the progress in localization during this period made the impact of the recession much more severe than it would have been without such a high level of domestic linkages.

Nevertheless, due to the small scale of the automotive industry, relative to the size of the economy at that time (2.2 per cent of the manufacturing value added in 1986 against 12 per cent in 2006), and the higher growth of the rest of the economy, the impact of recession on the industry was largely contained. The downturn of the automotive industry in the mid-1980s was a industry specific phenomenon and hence it did not permeate the rest of the economy.

³ Even in 1990, on average only 4.6 per cent of the population owned a vehicle (World Development Indicator, World Bank).

Figure 8 Patterns of interaction from the mid-1980s to the Asian financial crisis (1997-1998)

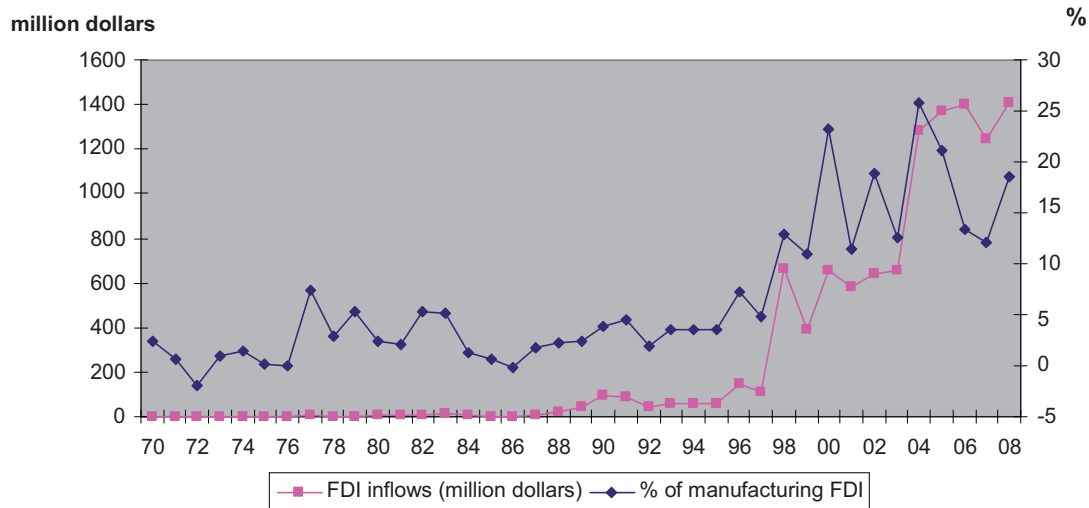


The tide of the industry gradually turned in favour of export orientation, or at least regional coordination, from the mid-1980s, becoming more apparent in the 1990s. During this period, as shown in figure 9, the inflow of foreign direct investment accelerated; however, investments were not exclusively for local purposes to meet Government regulation. The purpose and the kind of firms coming to Thailand varied; they included smaller and lower tier parts producers (Mori, 1999:132).

These changes in foreign direct investment and the growth of the Thai automotive industry reveal the potential of the industry becoming a regional production hub, thus providing an incentive to multinational assemblers to concentrate more pro-actively in production in Thailand with a view to exporting pick-up trucks to the world market (Kohpaiboon, 2008). As the Thai automotive industry became increasingly integrated into the international division of labour, at least in the strategies of multinational corporations, they increasingly relocated production of pick-up trucks to Thailand and suggested to the Thai Government the need for an institutional infrastructure for regional cooperation. The strategic shift of multinational corporations strengthened the role of headquarters once again, but in comparison with ethnocentric orientation, the roles of headquarters and subsidiaries became more differentiated, as the headquarters exerted influence

eclectically with an eye to improve coordination among subsidiaries and the efficiency of the group's global performance.

Figure 9 FDI inflows in Thai transport equipment and machinery industry, 1970-2008



Source: Bank of Thailand.

Changes in the strategies and behaviour of multinational corporations enhanced interaction further with Government policy shifting from mere localization to industrial deepening and promoting international competitiveness through liberalization. More than a decade of forced localization had engendered an uncompetitive industrial structure, which allowed firms to be complacent inside the wall of government protection, and to enjoy high profit margins at the expense of consumers. Technologically, the industry stagnated showing no signs of catching up with advanced countries. These conditions, together with international pressure to liberalize the market gradually, formed a broad consensus for market liberalization. Initially, opening the Thai automotive market proceeded while maintaining the basic measures of localization, permitting the co-existence of both import-substitution and export-oriented industrialization policies. Later, the Asian economic crisis tipped the scales toward full deregulation.

The strategic change of multinational corporations and policy shift of the Government had considerable effects on Thai firms. Due to continued market growth and the existence of localization measures, however, Thai firms were slow to realize the effects and failed to adapt to the changing industrial environment. Thus, when the crisis hit, Thai firms were suddenly exposed to the effects of deregulation (Far Eastern Economic Review, 17 August 2000). Facing

the decline in auto sales by 75 per cent, the Government was no longer in a position to localize the industry, but instead needed to promote exports. Besides, abiding by an international treaty, it was deprived of measures of localization. Multinational corporations also had to make strong efforts to export products and find parts of exportable quality in Thailand or, if not otherwise available, through imports. Table 4 illustrates how drastically and abruptly the change from the domestic market orientation to export orientation was brought about by the Asian financial crisis. Thai firms, caught short in these sudden retreats from domestic orientation on the sides of both Government and multinational corporations, were vulnerable without technological competitiveness and political clout (Kohpaiboon, 2008). Firms belonging to the Association of Thai Parts were already organizationally weakened, and were thus unable to ameliorate the situation through political channels.

Table 4 Degree of dependence of motor vehicle production on sources of demand, 1990 -2000

Year	Private consumption	Government consumption	Gross fixed capital formation	Increase in stocks	Total domestic final demand	Exports
1990	0.2415	0.0037	0.5404	0.1932	0.9788	0.0059
1995	0.2970	0.0053	0.5779	0.0750	0.9552	0.0448
1998	0.3192	0.0217	0.2574	-0.1059	0.4923	0.5077
2000	0.2303	0.0040	0.2515	-0.0068	0.4790	0.5210

Source: UNIDO's calculations are based on 1990, 1995, 1998, 2000 Thai input-output data (180 sectors).

Note: For details on the calculation method, refer to appendix 1.

Table 5 shows how total factor productivity changed over the two different periods of import-substitution and export promotion. In the table, $G(Y)$, $G(K)$, and $G(L)$ represent the annual growth rates of value added, book value of fixed assets and number of employees, respectively.⁴ The results largely support the above mentioned qualitative assessments of the technological capabilities of the Thai automotive industry. During the import-substitution period—from 1976 to 1984—which necessitated the use of local contents, there appears to have been a technological upgrading of the auto parts sector, by all Thai automotive firms. The negative productivity growth during the second period hints that the parts sector was not able to sustain its effort to enhance productivity. Liberalization of the automotive industry since the mid-1980s has attracted advanced foreign firms to Thailand that introduced new technology and improved productivity of the parts sector (Mori, 1999). However, negative total factor productivity in the period implies that, on the one hand, technology brought in by foreign firms was largely embodied in machines that were accounted as capital inputs; and on the other hand, a stable

⁴ Appendix 2 shows the details of the calculation method.

learning environment to sustain disembodied technological growth was disrupted by increasing competition.

Table 5 Total factor productivity of the Thai automotive industry

Periods	Industry as a Whole				Parts sector Only			
	G(Y)	G(K)	G(L)	TFP	G(Y)	G(K)	G(L)	TFP
(I) 1976-1984	.080	.180	.112	-.088	.437	.271	.217	.181
(II) 1985-1993	.096	.102	.091	-.004	.025	.081	.101	-.061

Source: Author's calculations, with data drawn from the Report of the Industrial Survey and Industrial Census of Thailand, various issues; Industrial Statistics Yearbook volume 1, various issues; and Statistical Yearbook for Asia and the Pacific, various issues.

Note: 1) Valued added amounts (Y) were adjusted to constant prices by using wholesale price indices for transportation equipment, drawn from Statistical Yearbook for Asia and the Pacific, various issues. Also, the book values of fixed assets (K) were adjusted to constant prices by using whole sale price indices for machinery and equipment, drawn from the same source as the above.

2) α is $1-\beta$, and β was estimated through dividing wages and salaries of employees by value added amounts. An average of β s of the beginning and end of a period was used for each period.

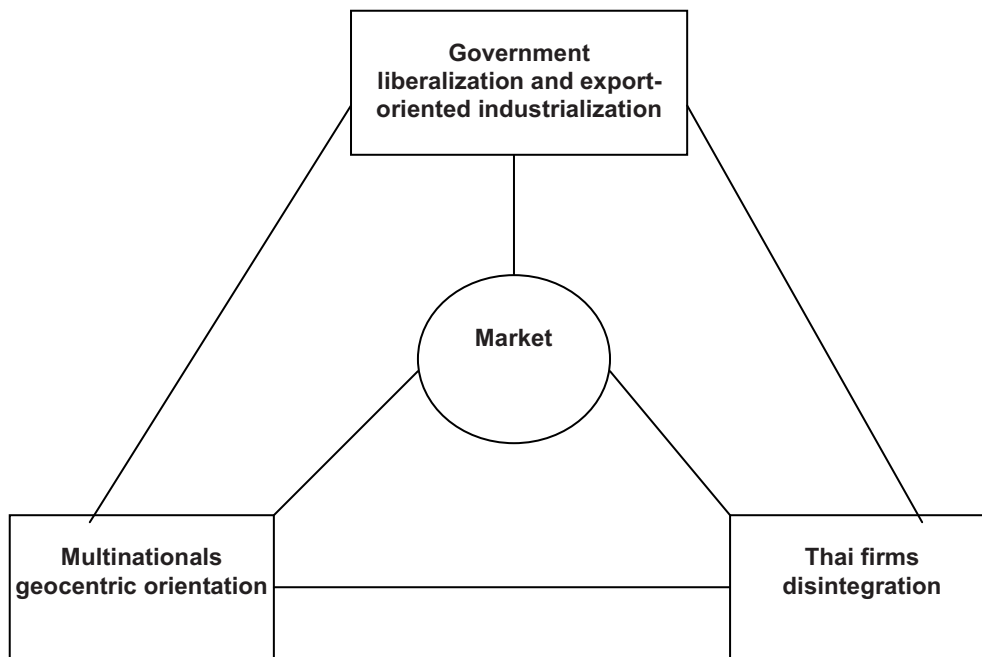
In short, the Government's gradual and cautious liberalization of the Thai automotive industry for the first 10 years of this period was suddenly neglected, amid the severe impact of the Asian financial crisis, and shifted to an unambiguous open-door policy for the promotion of the industry with the support of foreign capital and markets. In comparison with the slump of the Thai automotive industry in the mid-1980s, the industry not only experienced an even bigger production decline during the Asian financial crisis, but was also forced to undergo radical demand and supply structural changes, shifting from domestic to export orientation by the increased presence of foreign capital. Thus, the state of the Thai automotive industry as it came out of the recession at the beginning of 2000s was not the upward extension of, but a departure from, the past.

4. Structural change since the Asian financial crisis and the impact of the global economic crisis

Lifting a restriction on foreign-majority ownership and encouraging foreign direct investments by the Government allowed the industry to steer the course to export-driven growth. Exporting cars to international markets requires the industry to also adopt international standards in procurements and assembler-supplier relations in order to keep quality and price internationally competitive. During the import-substitution period, multinational assemblers had to pro-actively seek local suppliers to meet the local content requirements and provide support, if necessary, to local firms beyond the level normally required. Often cars assembled in Thailand were copies of

already existing models, and assemblers supplied samples, part drawings, and dye designs to parts makers, who could participate in the production if they possessed the necessary investment and operational capabilities (Techakanout and Terdudomtham, 2004).

Figure 10 Patterns of interaction from the Asian financial crisis (1997-1998) to the global economic crisis



However, export orientation triggered by the Asian financial crisis altered the business model, making it more akin to contractual relationships based on price and technological capabilities through competitive bidding. In order to export new models manufactured in Thailand, multinational assemblers expected first-tier suppliers to possess not only investment and operational capabilities, but also process and product engineering capabilities. As most Thai suppliers lacked of such capabilities, foreign firms increased their presence by acquiring majority ownership in existing joint ventures and making new direct investments, as evidenced in figure 9. Added to this, in an environment of increased uncertainty and undertaking a new venture of exporting, vertical integration or *keiretsu* (group company) relationships became the preferred modes of controlling key production processes and technologies by multinational assemblers and parts makers—another reason behind the increased presence and control of production by foreign firms (Wong and Boon-itt, 2008). Indeed, before the Asian financial crisis, automakers in Thailand were not overly bound by *keiretsu* relationships, due to the limited number of *keiretsu*

suppliers in Thailand. In order to meet the local content requirements, automakers procured parts regardless of *keiretsu* relationships. However, after the crisis, there was a rapid increase in foreign direct investments from home countries of automakers allowing them to gradually recreate business relationships, which they were accustomed in their home countries, in Thailand.

Table 6 Business transactions of a major car maker in Thailand with first-tier suppliers

	Number of firms in business transaction	Shares in the total business volume with the suppliers
Foreign firms	362	90.6
Thai firms having a license agreement with a foreign firm	9	6.9
Thai firms without a license agreement	170	2.5

Source: Questionnaire survey by the author (October 2009).

In the face of drastic changes in business practices and required capabilities, in addition to facing financial difficulties due to the crisis, many wholly-owned Thai firms were pushed out of the market, or were forced into the second and third-tier supplier segments or to the spare parts sector. In 2009, the number of (first-tier) wholly-owned Thai firms is estimated at around 200, led by a few major automotive groups, such as Thai Summit, Somboon and Thai Rung, as against some 400 foreign firms (based on interviews and a questionnaire survey with automotive assemblers in Thailand from 12 to 16 October 2009). Even though in terms of the number of enterprises, Thai firms still seem to have a substantial presence in the first-tier supplier group, only a handful dominate transactions with assemblers. Table 6 shows the number of firms and volume of businesses that a major auto makers in Thailand have with foreign firms, those that Thai firms have a license agreement with a foreign firm, and those that do not. As can be seen, most businesses with suppliers concentrated on foreign-owned firms and a small number of Thai firms that have technological ties with a foreign firm. In the second- and third-tier supplier groups, there are many more Thai firms, but they are either small in size and volume of transactions, or supply spare parts only.

Due to the rapid increase in foreign direct investments by technologically-advanced foreign firms and the enhanced linkages of a few dominant Thai firms with foreign technology suppliers, the local content of a car produced in Thailand increased since the Asian financial crisis, even though the local content rate requirement was eliminated in 2000. Automotive manufacturers and related associations claim that the local content rate for pick-up trucks and passenger cars stands at some

90 per cent and 70 per cent, respectively in 2009. However, some of the products considered as locally produced often comprise imported parts, materials and machines. Thus, the real local content of a vehicle produced in Thailand could be much smaller than the rate indicated above. (The author calculated the share of total domestic value added in one unit of output by using Thai input-output tables.) As shown below, the domestic value added increased after the Asian financial crisis, but not to the levels claimed by the industry.

Table 7 Domestic value added per unit of output

	<i>1975</i>	<i>1980</i>	<i>1985</i>	<i>1990</i>	<i>1995</i>	<i>1998</i>	<i>2000</i>	<i>2005</i>
Share of domestic value added in one unit of output	0.674	0.617	0.492	0.538	0.535	0.526	0.596	0.615

Source: Author's own calculations on the basis of Thai input-output tables (180 sectors)

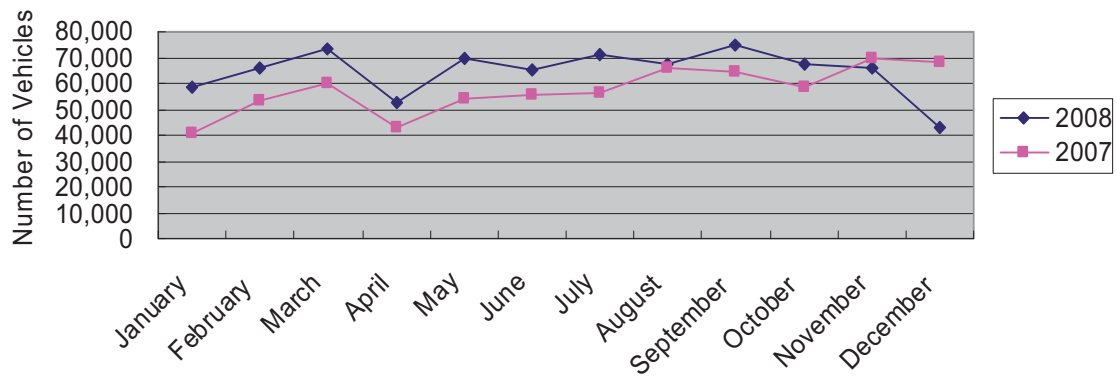
Furthermore, following the Asian financial crisis, the Thai automotive industry has been consolidated by the increased presence of foreign suppliers. Their continued active participation resulted in the rapid export-driven growth of the Thai automotive industry, as shown in figure 4.

Structural change in the industry was accompanied by the shift in the context of policy-making. The industrial policy was drawn up on the basis of the framework suggested in this paper (figure 5) before the crisis, with the bargaining power shared by the three actors, depending on issues, based on their solidarity, connections and technological levels. After the crisis, due to the Government's commitment to liberalize and the exit of the technologically weak, Thai firms that needed and lobbied for protection, the voice of domestic investors largely disappeared (Niyomsilpa, 2008). Hence, the principal actors in policy-making are foreign firms and the Government. The latter fosters a much closer relationship with foreign firms than before (Interview with Thai Automotive Industry Club).

The above clearly indicates the structure and profiles of main players of the Thai automotive industry as the country entered the global economic crisis in 2008. Figures 11 and 12 show the comparisons between 2007 and 2008 performance on export and domestic sales, on a monthly basis, in order to roughly identify when the industry started feeling the impact of the crisis and how it has transmitted to the industry. The export data illustrate that the consistently higher export performance of 2008 reversed as of November 2008, and export sales have continued to deteriorate in 2009, as seen in figure 2. In contrast, domestic sales in 2008 were lower than those in 2007, even before October 2008 when the crisis became a global phenomenon, and there was

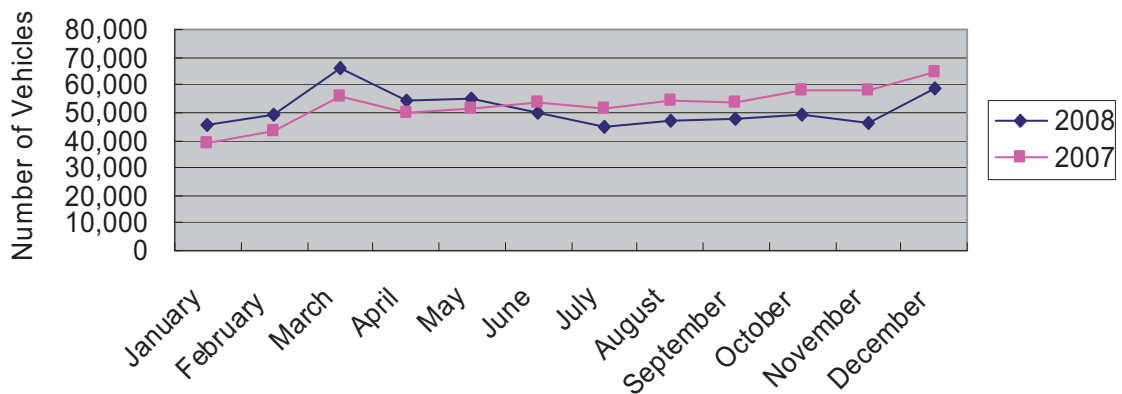
no clear sign of deterioration towards the end of the year—after October 2008. Therefore, the poor domestic sales performance in 2008 relative to 2007 was likely to be caused by a factor other than the global crisis, such as political instability, as often argued in reports on the Thai economy (Ernst and Young, 2009; Thanachart Bank Public Company, 2008). The impact of the crisis on domestic sales seems to have lagged and became more noticeable in the first quarter of 2009 (figure 3).

Figure 11 Comparison of export volumes between 2007 and 2008 on a monthly basis



Source: Thai Automotive Institute.

Figure 12 Comparison of domestic sales between 2007 and 2008 on a monthly basis



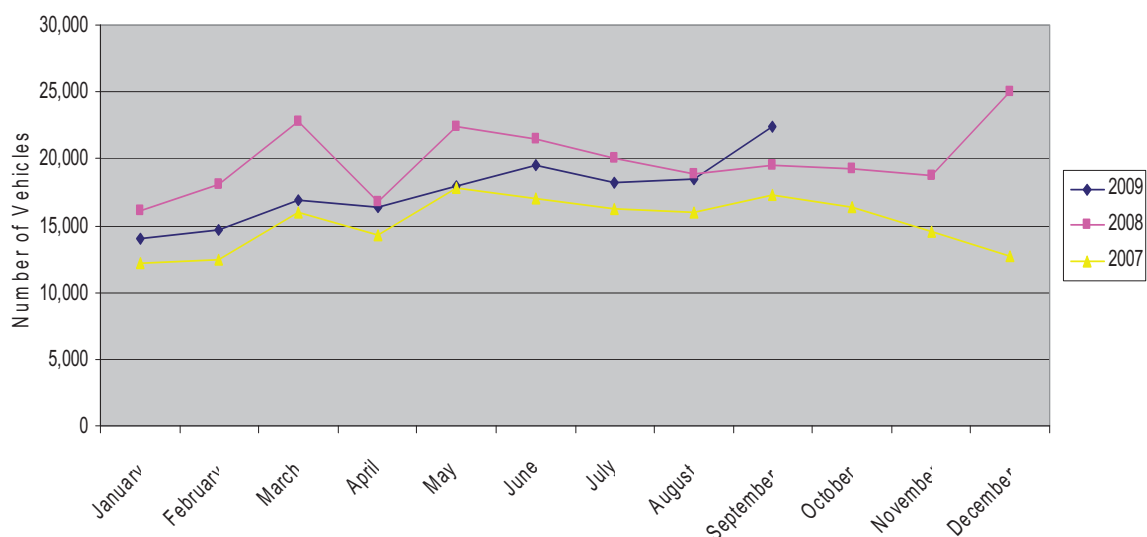
Source: Thai Automotive Institute.

Therefore, it would be safe to state that the effects of the global crisis were first transmitted to the Thai automotive industry through the decline in foreign demand for the Thai exports, immediately following the crisis, which broke out in October 2008. In addition to this direct

impact on the industry, as the global crisis deepened, the slowdown of the Thai economy and weakening consumer confidence affected the domestic consumption for vehicles. This indirect effect on the industry through the crisis' impact on the general economic conditions became visible a few months after the direct effect, starting in January 2009.

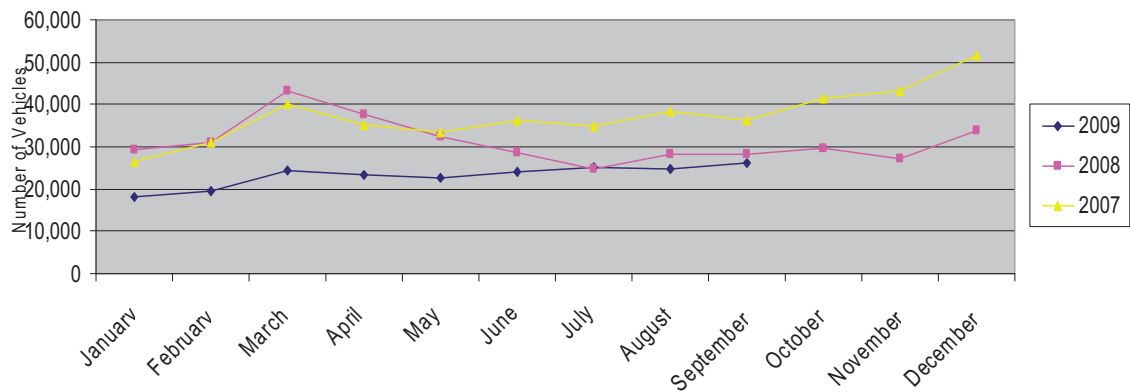
Within the domestic market, the impact was greater on commercial vehicle sales than passenger cars sales (see figures 13 and 14). Thailand is the world's second largest market for pick-up trucks, which have been used often as multi-purpose vehicles in Thailand for carrying both people and goods, especially in rural areas. The Thai Government has provided a tax incentive for the purchase of pick-up trucks, and this measure, coupled with the higher local content of pick-up trucks, has made this vehicle much cheaper than passenger cars in Thailand. However, the sales of this popular vehicle have been affected by the crisis because consumers, who purchase pick-up trucks, are usually more sensitive to the economic climate than those who purchase passenger cars. The reduced incomes among workers, due to shorter working hours or an increase in unemployment and also the tightening of credit conditions by banks, have hit the sales of pick-up trucks (Interview, Thai automotive institute: October 2009). The crisis' impact on the domestic sales of passenger cars was negligible as the main customers for these were relatively wealthy people dwelling in cities, who apparently were not been affected by the current crisis much compared with that of the Asian financial crisis.

Figure 13 Comparison of passenger car sales, 2007-2009 on a monthly basis



Source: Thai Automotive Institute.

Figure 14 Comparison of commercial vehicle sales, 2007-2009 on a monthly basis



Source: Thai Automotive Institute.

While the Asian financial crisis devastated the Thai automotive firms and subsequently led to the rapid increase in foreign direct investment through the liberalization by the Government to keep the industry alive, the current global crisis has hit the foreign firms more than Thai firms, due to the dominance of the former in terms of investments and revenues. Since the Asian crisis, multinational companies in Thailand expanded production by promoting exports and making Thailand the global hub for pick-up truck production. This is evident in figure 1, which shows that essentially the growth of the industry from the pre-Asian crisis level in 1996 was due to an increase in exports because the level of the domestic sales in 2008 was about the same as that in 1996.

This change from domestic to export orientation over the past 10 years has made the Thai automotive industry vulnerable, particularly as it faces the external shocks of the current crisis. The automotive industry is one of the worst hit industries in Thailand. Moreover, the Thai automotive industry has suffered more from the impact than other automotive industries in Southeast Asian countries due to the former's export orientation. During the first six months of 2009, exports and domestic sales decreased by 40 per cent and 25 per cent, respectively, compared to the same period in 2008. According to the Thai Automotive Institute, it has been estimated that some 100,000 people, or one-third, employed by the industry's employment lost their jobs at the worst point of the current crisis (Interview, October 2009). Contract workers were the first ones to lose their jobs, while the employment of regular workers has not been too affected by the crisis.

The impact of this scale on the Thai automotive industry should have far-reaching effects on other industries, such as material suppliers and service providers, though they are only indirectly related to automotive production, due to the industry's domestic linkages that have expanded since the Asian financial crisis (footnote 5). In 2005, the automotive industry was ranked forty-fourth of the 180 sectors listed in the backward linkage index, which is much higher than the average of all the sectors (table 8).⁵

Table 8 Backward linkages of selected sectors in Thailand

Sector	Iron and steel	Tyres and tubes	Motor vehicles	Agricultural machinery	Ship building	Fabricated metal products	Petroleum refinery
Backward linkage index	1.309	1.196	1.111	0.990	0.958	0.943	0.798
Ranking (out of 180)	4	18	44	105	113	118	154

Source: Author's calculations based on 2005 Thai input-output table.

Based on the 2005 Thai input-output table, which reasonably represents the pre-crisis structure of Thai industries as technical coefficients change only slowly, table 9 shows some of the sectors that have strong linkages with the Thai automotive industry⁶ For example, \$1 million worth of final output by the Thai automotive sector would generate \$0.066 million worth of demand for secondary steel and products sector. As seen in the table, the automotive sector has substantial linkages not only with the material sectors, but also with some service sectors, such as banking and business services.

⁵ Backward linkage index indicates the extensiveness of sector's business transactions with domestic suppliers, relative to other sectors. The higher the number is, the stronger the sector's linkage is with domestic suppliers. One is average. The index higher than one indicates relatively stronger linkage of the sector in reference to the country's standard.

⁶ As of October 2009, the Office of the National Economic and Social Development Board of Thailand, which compiles Thai input-output tables, had not released the 2005 table based on producer's prices that is consistent with the tables of other years used in this paper. Thus, the author used the 2005 purchaser's price table.

Table 9 Linkage levels of suppliers of the Thai automotive industries

Suppliers of the automotive industry	
Secondary steel and products	0.0664
Engine and turbines	0.0319
Petrochemical products	0.0211
Banking services	0.0175
Tyres and tubes	0.0162
Paint	0.0147
Plastic	0.0138
Non-ferrous metal	0.0125
Business service	0.0106

Source: Author's calculations based on 2005 Thai input-output data (180 sectors).

Note: For details of the calculation method, refer to appendix 1.

Due to these linkages, output decline in the automotive industry must have generated ripple effects on the sectors directly or indirectly linked to the industry, resulting in employment reduction in these sectors and the economy as a whole. Based on the input-output analysis, the estimations on the crisis' impact on employment were made after the first quarter of 2009 when the full scale of the impact was not yet certain. Table 10 indicates that the estimated decrease in employment for the automotive sector was close to the figure reported by the Thai Automotive Institute, which was some 100,000, during the author's visit to the Institute in October 2009. If these estimates were fairly accurate, the effects of the output decline in the automotive sector on other sectors and the economy as a whole must be around the scale shown in the table below. The sector's extensive production linkages could reduce employment in other sectors, including those which are only indirectly connected to the automotive sector, such as financial services.

Table 10 Potential effects of output decreases in the automotive sector on employment, wages and output

Sector	Potential decrease in output (million baht)	Potential decrease in total wages and salaries (million baht)	Potential decrease in employment (numbers)
Automotive industry	215,749	26,817	111,737 (37 per cent of employment)
Iron and steel	4,163	611	6,981
Financial services (Banking and Insurance)	3,222	1,147	4,551 (1.3 per cent of employment)
Total economy			431,272 (1.2 per cent of total labour force)

Source: Author's calculations based on 2005 Thai input-output data (180 sectors).

As far as the automotive sector is concerned, the total number of employees decreased due to the current crisis, and compares with the figure reported during the Asian financial crisis. The differences between the two crises, however, seem to lie in their effects on the industry's structure and speed of recovery. The Asian financial crisis not only witnessed the reduction in outputs and employment of the industry, but also instituted fundamental changes in the structure and subsequent course of development. The crisis sifted the financially sound and technologically competitive firms from the rest and led the government to liberalize the industry, all of which served as a basis for export-driven growth in the following 10 years. Partly due to this effect on the structural change, the recovery process from the crisis was prolonged. It took five years for the industry to reach the pre-crisis level of outputs, but, as it came out of the crisis, the industry was reinvigorated and ready to take a different and higher growth trajectory departing from the past growth trend as seen in figure 4.

At its peak, during the first quarter of 2009, the impact of the current crisis on the Thai automotive industry could compare with that of the Asian financial crisis. However, this time the industry was able to withstand the impact better because of the factors attributed to both the Thai automotive industry and the nature of the current crisis. Relative to the time of the Asian financial crisis, as it faced the current crisis, the industry comprised more competitive Thai firms that survived the Asian financial crisis and financially-secure multinational corporations. Not many firms, including small and medium Thai firms, went bankrupt due to the current crisis (Interview at Thai Automotive Institute, October 2009). Besides the resilience of the Thai automotive industry, the fact that the crisis has bottomed out faster than during the Asian crisis has so far helped to limit the impact of the global crisis on the Thai automotive industry.

Since the third quarter of 2009, many firms have started recruiting contract workers. As of October 2009, it is estimated that the industry's employment, which was reduced by 30 to 35 per cent, has increased to 85 per cent of the pre-crisis level (Interview with Thai Automotive Industry Club, October 2009). The industry association projects that the production volume in 2010 will return to 85 to 90 per cent of the 2008 level if the current pace of recovery continues and fully recovers from the crisis by the end of 2011.

Even though the industry may recover to pre-crisis levels in a relatively short period of time, with its competitive structure intact, in medium to long term, it is not certain whether the Thai

automotive industry could revert to the fast growth rate during the 10 years following the Asian crisis. The industry has succeeded in gearing production for the niche market of pick-up trucks. Demand for pick-up trucks may not continue to be as robust as before as there seems to be a sign of slowing down of foreign demands for these vehicles. Currently, the Thai government hopes to make Thailand a production base for fuel-efficient small passenger cars as the second area of specialization, in addition to pick-up trucks, by providing a tax incentive (Niyomsilpa, 2008). Most major automakers have eventually declared their support for the Government plan, either willingly or reluctantly. However, as in the cases of the past Government policies, such as local content or export promotions, commitment of automakers to such a policy is likely to come only when they feel inclined to do so, in line with their global production strategies.

5. Conclusions

This paper underscored the importance of examining both the nature of a crisis (external or internal origin, magnitude, general pace of recovery, etc.), industrial structure and, above all, their interplay, in order to determine the transmission process and the effects of the crises on the Thai automotive industry. It also illustrated that history matters, since the industrial structure has evolved through the past crises and based on interactions of government policies, strategies of multinational corporations and development of the Thai firms. Based on this analytical framework, the effect of current global crisis on the Thai automotive industry has been studied, especially in contrast with the case of the Asian financial crisis. In terms of demand contraction and employment reduction, the initial shocks brought by the two crises to the industry might not be so different. However, the Asian financial crisis had more destructive effects on the industry in general, and Thai firms in particular, than the global crisis because of market orientation, policy regime and technological levels of the industry at that time. The Asian crisis had a scrap-and-build sort of effect on the industry's structure. In Schumpeter's terms, it brought about a "creative destruction" to the industry and laid the foundation for subsequent growth. In contrast, the current global crisis would probably not have any effect on the industry, beyond the temporary production and employment declines, due to the industry's structure, which has advanced as a result of the Asian financial crisis, and bottoming out of the current crisis in a relatively short period of time. Thai automotive industry could probably cope with the crisis better this time even if the world economy prolongs the recovery process, and demand for the Thai automotive vehicles remains low for the coming years.

This study analyzed the effect of the global economic crisis on the Thai automotive industry in comparison to the cases of the past crises. Even though the results are specific to the case considered in this study, it is hoped that the approach taken here, which takes the perspective of interplay between shocks and industrial structure, has wider applications for other crisis studies on industries.

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Appendix 1

To show direct transaction relations between industries, input coefficients were computed from transaction tables as follows. The coefficients used here do not separate domestic and foreign sources.

$$a_{ij} = \frac{x_{ij}}{x_j} \quad i = 1, 2, \dots, n; \quad j = 1, 2, \dots, n$$

where a_{ij} is the input coefficient of sector j from sector i .

x_j is the output of sector j

x_{ij} is the output of sector i used as input in sector j

While input coefficients illustrate the direct relations of the industry transactions, the real picture of inter-industry linkages is revealed by looking at the ultimate effects of a sector on other industries. For example, an increase in a footwear sector requires more raw materials and industrial machinery and, in turn, the supply sector would have to increase its purchase of materials and machines necessary for production. Finally, this ripple effect spreads to the bottom of the production chains which are only indirectly linked to the footwear sector. This whole web of linkages, including indirect effects, is shown by the inverse matrices of input coefficients as follows. Two types of inverse matrices are calculated: non-competitive and competitive import types.

$$AX + F = X \tag{1}$$

where A is the input coefficients matrix =

The diagram shows a square matrix with dashed lines forming a grid. The elements are labeled as follows: a_{11} at the top-left, a_{1n} at the top-right, a_{ij} in the center, a_{n1} at the bottom-left, and a_{nn} at the bottom-right. Dashed lines connect these elements to form a grid structure.

X is the output vector =

$$\begin{bmatrix} X_1 \\ \vdots \\ X_n \end{bmatrix}$$

F is the final-demand vector =
$$\begin{bmatrix} F_1 \\ \vdots \\ F_n \end{bmatrix}$$

From equation (1), X can be derived as follows:

$$X = (I-A)^{-1}F \quad (2)$$

I is the identity matrix. The term $(I-A)^{-1}$ is the inverse matrix of $(I-A)$. Since A is the matrix of input coefficients computed without separating domestic and imported inputs, the inverse matrix is of the non-competitive import type.

If only domestically produced inputs in the technical coefficient are included, in order to properly take account of the effects of imported inputs, it follows that:

$$AX+F^d+E-M=X \quad (3)$$

where F^d is domestic final demands

E is export

M is import

$$M=m(AX+F^d) \quad (4)$$

m is an import coefficient, which is

$$m = \frac{M_j}{DD_j} \quad j = 1,2,\dots,n$$

M_j is import of sector j

DD_j is domestic demand (including both final and intermediary) for sector j

Replacing the M in (3) with (4)

$$X=[I-(I-m)A]^{-1}[(I-m) F^d+E]$$

Shares of value added attributed to different origins can be calculated as follows:

For import: $MV=A^m[I-(I-m)A]^{-1}$

MV= share of value added attributed to import

$$A^m = A - (I - m)A$$

$$\text{For domestic value added: } DV = V[I - (I - m)A]^{-1}$$

DV = share of domestic value added

$$V = \frac{v_j}{X_j} \quad j = 1, 2, \dots, n$$

where V is the row vector of value added coefficient

v_j is the value added of sector j

x_j is the output of sector j

$$\text{For Tax: } TV = T[I - (I - m)A]^{-1}$$

TV = share of value added attributed to tax

$$T = \frac{t_j}{X_j} \quad j = 1, 2, \dots, n$$

where T is the row vector of tax coefficient

t_j is the tax paid by sector j

x_j is the output of sector j

Appendix 2

Assume a production function of

$$Y=F(K,L,T) \quad (3.3)$$

where Y, L and T are output, capital input and a level of technology. Differentiating (3.3) with respect to time and dividing both sides by Y, reveals

$$\frac{dY}{Y} = \frac{\delta Y}{\delta K} \cdot \frac{K}{Y} \cdot \frac{dK}{K} + \frac{\delta Y}{\delta L} \cdot \frac{L}{Y} \cdot \frac{dL}{L} + \frac{\delta Y}{\delta T} \cdot \frac{T}{Y} \cdot \frac{dT}{T} \quad (3.4)$$

Then, express this in growth rates of $dx/x=G(x)$

$$G(Y) = \frac{\delta Y}{\delta K} \cdot \frac{K}{Y} \cdot G(K) + \frac{\delta Y}{\delta L} \cdot \frac{L}{Y} \cdot G(L) + \gamma \quad (3.5)$$

$\gamma = \delta Y / \delta T \cdot T / Y \cdot dT / T$ is the proportional rate of shift of the production function; that is technological change or total factor productivity. Under the assumptions of perfect competition and homogeneity of degree one, $\alpha = \delta Y / \delta K \cdot K / Y$, $\beta = \delta Y / \delta L \cdot L / Y$ and $\alpha + \beta = 1$. (3.5) can be rewritten as

$$G(Y) = \alpha G(K) + \beta G(L) + \gamma \quad (3.6)$$

Equation (3.6) indicates that output growth is the result of the growth of inputs and technological progress.⁷ Therefore, technological progress is expressed as

$$\gamma (\text{TFP}) = G(Y) - \alpha G(K) - \beta G(L) \quad (3.7)$$

Based on equation (3.7), the total factor productivity of the Thai automotive industry as a whole, including the parts sector, and the parts sector alone is calculated for the following two periods. Period I, from 1976 to 1984, is the era of import substituting industrialization under the Government's localization programme. Period II, from 1985

⁷ In this model, inputs are not adjusted for quality improvements, thus total factor productivity growth may include some of the embodied technological change.

to 1993, is when the industry was increasingly liberalized and received massive inflows of foreign direct investment. In the table, $G(Y)$, $G(K)$, and $G(L)$ represent the annual growth rates of value added amounts, book value of fixed assets and number of employees, respectively, and TFP is total factor productivity.

This relatively simple method to account for technological progress attracted economists and was widely applied to empirical studies. But, at the same time it also attracted the attention of critics who scrutinized the different aspects of the method and found that quantifying technological progress was not as simple as the method implies (Fine, 1992; Chen, 1997; Felipe, 1999). First, neo-classical assumptions of total factor productivity often contradict reality, especially for developing countries, where the assumptions of perfect competition, profit maximization, and constant returns to scale cannot be taken for granted. Secondly, the result of total factor productivity measurement crucially depends on the specification of what factor inputs are included and how they are measured. Therefore, differences in these specifications and in the availability and reliability of data among countries make international comparison difficult. Finally, the very concept of technological progress was contested, as the process was dynamic and more complex than was expressed in the methodology. Felipe (1999) argued the dynamic combinations of different factors advanced technology. If complementarities and interdependence exist among inputs, it is not relevant to attribute the sources of growth to individual inputs.

Given the above criticism, the results of calculations on total factor productivity in this paper should be viewed with reservation. There is certainly room for doubt about the accuracy of the outcome, and the absolute values derived from the calculations may be of little significance. However, for comparisons across periods rather than across countries, this exercise may illustrate a basic pattern of technological development within the scope of a model's specification. Above all, it is important that the results of this study are understood within the context of other qualitative and quantitative analyses of this research.



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