

AN ECONOMIC ANALYSIS OF TAIWAN'S AUTOMOBILE INDUSTRY

by

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ABSTRACT

The Taiwanese automobile industry was established in 1953 under the protection of the government. After forty years of development, however, Taiwan's manufacturers have not kept up with the local demand, and as a result about 30 percent of the automobile market is now made up of imported cars. In stark contrast, Korea, with a similar economic background and structure in the 1970s, has become a new force in shaping the dynamics of the global automobile industry.

An economic analysis carried out in this thesis shows that an inefficient market structure has impeded the growth of Taiwan's automobile industry. Taiwan has one of the largest car markets in Asia, but the industry there cannot take full advantage of it because eleven small-scale firms share this domestic market without significant exports. Therefore, production costs remain too high resulting from a lack of economies of scale.

The present tendency toward Taiwan's market structure is a consolidation of current manufacturers, a plausible solution for the problems of inefficiency. However, this trend is not strong even though these individual producers barely make a profit. Moreover, the free-trade stance that the Taiwanese government has adopted will add to the increasingly competitive environment. Recognizing their own problems, these auto makers are shifting their focus to the emerging Chinese market, the market with the most potential for the next century.

In this thesis, the necessity for consolidation in the Taiwanese automobile industry and the factors impeding this consolidation process are examined. Other alternatives to improve economic efficiency will also be offered as a reference for policy-makers either in the government or in the private sector.

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I would like to dedicate this thesis to my parents, who have long paid close attention to my education. They always try their best to provide me with both financial and spiritual support. I have always regarded them as my ultimate driving force in overcoming all the obstacles I have encountered in my academic career. This thesis is far from the achievement a son would wish in order to demonstrate his feelings to his parents and make them proud. It however stands for infinite love and respect for the whole family.

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TABLE OF CONTENTS

| | |
|---|-----------|
| I. INTRODUCTION | 10 |
| 1.1 Overview | 10 |
| 1.2 Research Goal, Scope, and Methodology | 12 |
| 1.3 Organization of Thesis | 12 |
| II. INTRODUCTION TO TAIWAN'S AUTOMOBILE INDUSTRY | 14 |
| 2.1 Current Market Situation..... | 14 |
| 2.2 Competitive Advantages And disadvantages..... | 19 |
| 2.3 Industrial Policies..... | 22 |
| 2.3.1 Why The Automobile Industry Is Important To Taiwan | 22 |
| 2.3.2 The Evolution of Automobile Industry Policies in Taiwan | 23 |
| 2.3.3 Current Government Policies..... | 30 |
| III. ECONOMIC ANALYSIS OF TAIWAN'S AUTOMOBILE MARKET ... | 32 |
| 3.1 Economic Characteristics of The Automobile Industry..... | 32 |
| 3.1.1 Economies of Scale vs. Economies of Scope | 32 |
| 3.1.2 Internal and External Economies of Scale..... | 34 |
| 3.2 The Supply Side..... | 35 |
| 3.2.1 Current Manufacturers | 35 |
| 3.2.2 The Market Structure of Suppliers | 37 |
| 3.3 The Demand Side..... | 39 |
| 3.3.1 Demand of the Domestic Market | 40 |

| | |
|---|-----------|
| 3.3.2 Demand from Exports | 43 |
| 3.4 Analysis of The Market | 43 |
| 3.4.1 Lack of Economies of Scale | 43 |
| 3.4.2 International Comparisons..... | 46 |
| | |
| IV. FACTORS LEADING TO THE INEFFICIENT MARKET | |
| | |
| STRUCTURE..... | 49 |
| | |
| 4.1 Historical Factors | 49 |
| 4.1.1 The Failure of The “Big Auto Plant” in The Early 1980s..... | 49 |
| 4.1.2 The Sudden Rise in Demand in The Late 1980s..... | 49 |
| 4.1.3 Future Hope in Chinese Market in The 1990s..... | 50 |
| | |
| 4.2 Government Policy Failures | 56 |
| 4.2.1 Weak Government Intervention | 56 |
| 4.2.2 Flaws of Taiwan’s Licensing Policy..... | 58 |
| 4.2.3 Lack of a Consistent Long-term Policy | 59 |
| | |
| 4.3 The China Factor | 62 |
| 4.3.1 Obstacles for Foreign Firms | 63 |
| 4.4.2 Advantages of Taiwanese Firms in The Chinese Market | 65 |
| | |
| 4.4 Difficulty to Merge..... | 66 |
| | |
| V. RECOMMENDATIONS..... | 67 |
| | |
| 5.1 Acceleration of the Consolidation Process | 67 |
| | |
| 5.2 Reduction in the Level of High-Tariff Protection..... | 70 |
| | |
| 5.3 Improvement in Productivity..... | 71 |
| 5.3.1 Lean Production..... | 71 |

| | |
|--|-----------|
| 5.3.2 Flexible Manufacturing | 77 |
| 5.4 Changes in the Market Structure | 79 |
| 5.4.1 Rationalization of Production for The Domestic Market..... | 79 |
| 5.4.2 Regionalism and Barter Trade | 83 |
| 5.4.3 International Specialization, Cooperation and Strategic Alliances | 85 |
| 5.5 Promotion of Parts Industry..... | 89 |
| 5.5.1 Characteristics of Taiwan's Automobile Parts Industry | 89 |
| 5.5.2 Future Opportunities | 89 |
| 5.6 Development of Export Markets..... | 92 |
| 5.6.1. Improvement in Quality and Technology..... | 93 |
| 5.6.2 Expansion of Export Markets | 95 |

TABLE OF EXHIBITS

| | |
|--|----|
| EXHIBIT 1: 1992 WORLD AUTOMOBILE PRODUCTION | 14 |
| EXHIBIT 2: CURRENT SITUATION IN THE TAIWANESE AUTOMOBILE INDUSTRY | 15 |
| EXHIBIT 3: AUTOMOBILE MANUFACTURERS IN TAIWAN | 16 |
| EXHIBIT 4: EVALUATION OF AUTOMOBILE INDUSTRIES IN SELECTED COUNTRIES | 18 |
| EXHIBIT 5: DETERMINANTS OF NATIONAL ADVANTAGES | 20 |
| EXHIBIT 6: AUTOMOBILE-RELATED INDUSTRIES IN TAIWAN | 23 |
| EXHIBIT 7: THE EVOLUTION OF THE TAIWAN AUTOMOBILE INDUSTRY | 25 |
| EXHIBIT 8: TARIFF RATES OF AUTOMOTIVE IMPORTS IN 1994 | 30 |
| EXHIBIT 9: FUTURE GOAL OF TAIWAN'S AUTOMOBILE INDUSTRY IN 2000 | 31 |
| EXHIBIT 10: MAJOR ECONOMIC CHARACTERISTICS OF THE AUTOMOBILE INDUSTRY | 33 |
| EXHIBIT 11: CAR SALES BY TAIWANESE COMPANIES | 36 |
| EXHIBIT 12: STRUCTURE OF ASSEMBLY INDUSTRIES IN DEVELOPING COUNTRIES | 37 |
| EXHIBIT 13: FINANCIAL STATUS OF TAIWAN'S AUTOMOBILE MANUFACTURERS | 38 |
| EXHIBIT 14: CONCENTRATION OF MARKET SHARE IN TAIWAN'S AUTOMOBILE INDUSTRY | 39 |
| EXHIBIT 15: AUTOMOBILE REGISTRATION BY COUNTRIES | 39 |
| EXHIBIT 16: COMPARISONS OF VEHICLE PRODUCTION AND NEW REGISTRATIONS | 40 |
| EXHIBIT 17: WORLD MOTOR VEHICLE CENSUS 1992 | 41 |

| | |
|--|----|
| EXHIBIT 18: TAIWAN'S AUTOMOBILE SALES | 42 |
| EXHIBIT 19: EXPORT AND IMPORT RATIOS IN DEVELOPING COUNTRIES, 1987 | 43 |
| EXHIBIT 20: EXPORTS OF TAIWAN-ASSEMBLED AUTOMOBILES | 44 |
| EXHIBIT 21: ESTIMATES OF MINIMUM EFFICIENCY SCALE | 45 |
| EXHIBIT 22: COMPARISONS OF INTERNATIONAL AUTOMOBILE INDUSTRIES, 1993 | 47 |
| EXHIBIT 23: CAR ASSEMBLY ECONOMICS: DEVELOPING VERSUS DEVELOPED COUNTRIES | 48 |
| EXHIBIT 24: GROWTH OF DEMAND IN TAIWAN'S AUTOMOBILE MARKET | 51 |
| EXHIBIT 25: TYPES OF MANUFACTURING COOPERATION | 52 |
| EXHIBIT 26: TYPES OF CAPITAL-INTENSIVE MANUFACTURES | 53 |
| EXHIBIT 27: HORIZONTAL COOPERATION BETWEEN TAIWAN AND CHINA | 54 |
| EXHIBIT 28: VERTICAL COOPERATION BETWEEN TAIWAN AND CHINA | 55 |
| EXHIBIT 29: RESTRICTIONS ON SETTING UP AUTOMOBILE FACTORIES IN TAIWAN | 60 |
| EXHIBIT 30: FOREIGN OWNERSHIP OF AUTOMOTIVE COMPANIES IN DEVELOPING ECONOMIES | 65 |
| EXHIBIT 31: RECENT INVESTMENTS OF MAJOR TAIWAN MANUFACTURERS | 68 |
| EXHIBIT 32: SAMPLE SOLUTION TO ENCOURAGE MASS PRODUCTION | 69 |
| EXHIBIT 33: LUXURY CAR ASSEMBLY PLANT PRODUCTIVITY, 1989 | 74 |
| EXHIBIT 34: LUXURY CAR ASSEMBLY PLANT QUALITY, 1989 | 75 |
| EXHIBIT 35: ASSEMBLY PLANT PRODUCTIVITY, 1989 | 76 |
| EXHIBIT 36: FRAGMENTATION OF AMERICAN VEHICLE MARKET, 1955-1989 | 77 |

| | |
|--|-----------|
| EXHIBIT 37: ANNUAL PRODUCTION VOLUME OF THE AVERAGE MODEL | 78 |
| EXHIBIT 38: GROWTH IN STRATEGIC ALLIANCES, AUTOMOBILE INDUSTRY | 87 |
| EXHIBIT 39: REASONS FOR STRATEGIC ALLIANCES IN AUTOMOBILE INDUSTRY, 1980-89 | 88 |
| EXHIBIT 40: AUTOMOTIVE COMPONENT EXPORTS FROM DEVELOPING ECONOMIES | 90 |
| EXHIBIT 41: EXPORTS OF PARTS FROM TAIWAN TO AFFILIATE OEMS IN 1993 | 91 |
| EXHIBIT 42: FOREIGN TRADE ORIENTATION IN VEHICLE SECTOR, EARLY 1990S | 92 |
| EXHIBIT 43: ESTIMATED DEVELOPMENT OF MATERIAL CONTENT. 1989-2000 | 95 |

I. Introduction

1.1 Overview

The Taiwanese automobile industry was started forty years ago with the establishment of Yue Loong Motor Corporation Ltd. in 1953. After decades of development, however, this industry still remains entangled in an inefficient infrastructure.

Although the quality of Taiwan-made cars is sufficient for international competition, the high cost of production limits their competitiveness. According to past experience, an automobile manufacturer should have a production volume of at least 100,000 units in order to enjoy the cost advantages that come with mass production. However, eleven manufacturers make up the Taiwanese market which is large enough for only two or three firms. They share the domestic market evenly and have negligible exports and, therefore, none of them has a large-scale production. This division of the market results in the high costs of Taiwanese cars, which are 1.3 to 1.4 times those of Japanese cars. With too many manufacturers and a limited and nearly saturated domestic market, the Taiwanese automobile industry is unable to achieve economies of scale that can bring costs down enough for it to be competitive in the world market. This, as Justin Su has said, creates a vicious cycle (high costs =>no exports =>no economies of scale) that the industry cannot seem to break out of.¹

The Taiwanese automobile industry is particularly interesting for several reasons. First, Taiwan's automobile industrial policy has been far less successful than similar policies that were devised and implemented for such strategic industries as steel, electronics, and petrochemicals.² If

¹ Su, Justin C. 1992. *Factors Impeding the Growth of the Taiwan Automobile Industry*. Master Thesis, Sloan School of Management at MIT. p2.

² Arnold, Walter. 1989. "Bureaucratic Politics, State Capacity, and Taiwan's Automobile Industrial Policy," in *Modern China*. Vol. 15 No. 2, April 1989. p180.

we are correct in saying that the Taiwanese government did not have enough experience and knowledge to develop its own automobile industry, how could it have succeeded in penetrating into the world markets in other industries? There must be some hidden difficulties behind the facts from which we can learn some lessons.

Second, this slow growth of the Taiwanese automobile industry can also be contrasted with the successful development of the Korean automobile industry, which began with the establishment of the Sanara Motor Co. in 1962, nine years after Taiwan had started its automobile industry. Korea, now being called “the second Japan,” became the fifth largest country in world automobile production by 1994. Korea is the first of the developing countries that have actually succeeded in producing vehicles of world standards. The country’s top three car manufacturers, the Hyundai Group, the Daewoo Group and Kia Motors, not only design and manufacture their own models, but also export over 400,000 vehicles a year. They are relying less on the US market and export increasing numbers of automobiles to countries in Europe, the Middle East and Latin America.³ Korean automobiles have retained their competitive prices, despite the problems besetting the country’s automobile industry. Even Taiwanese car-makers have been threatened by low-priced Korean imports. Why are the automobile industries in these two countries, which had an almost identical structure and had achieved comparative levels of local content by the early 1970s, so different after decades of developing? What accounts for the striking divergence?

Third, a similarly inefficient market structure as that in Taiwan can also be found in many developing countries, such as Malaysia, Indonesia, and Thailand. An understanding of the Taiwanese automobile industry is crucial for these countries, as a negative example, when they

³ Paisley, Ed. “An Industry In Suspension,” in *Far Eastern Economic Review*. August 13, 1992. p39.

develop their automobile industries, and this present study may be helpful to them.

Throughout this thesis, the author will try to discover reasonable answers to these interesting questions and, furthermore, make recommendations to the Taiwanese automobile industry.

1.2 Research Goal, Scope, and Methodology

The goal of this research is to identify the problems in the current Taiwanese automobile industry and endeavor to form a policy proposal as a useful reference for both managers and government officials in the automobile industry.

The present research of Taiwan's automobile industry attempts to elucidate the implications between governmental policy and the development of this industry. Because the topic is too broad and complicated, the scope of this research will narrow down and focus on possible ways to reduce the economic loss due to the inefficient infrastructure. The key concern here will be the consolidation of the eleven existing manufacturers currently operating in Taiwan.

The research methodology in this thesis is quite straightforward. The procedure will be based on three steps. First, the existence of problems will be proved and their significance will be identified. Second, the issue will be further analyzed and the factors resulting in these problems will be explained. Finally, possible solutions to the problems will be provided as a conclusion.

1.3 Organization of Thesis

There are a total of 5 chapters in this thesis. Chapter 1 gives an overview of the research. Chapter 2 introduces the automobile market, manufacturers, and government industry policies in the Taiwanese automobile industry. Chapter 3 identifies the major problem in this

industry, that is, the high costs of production due to a lack of economies of scale. Chapter 4 determines the reasons causing the economic inefficiency and why consolidation did not happen in the Taiwanese automobile industry. Chapter 5 makes recommendations to its future perspectives.

II. Introduction to Taiwan's Automobile Industry

2.1 Current Market Situation

In 1993, the total annual production of automobiles in Taiwan was 404,500 units, which accounted for 74.8% of the domestic market. Taiwan was ranked as the fourteenth largest country in the world automobile production, as shown in Exhibit 1.

Exhibit 1: 1992 World Automobile Production

| Rank | Country Name | Annual Production (units) | Percentage in the world automobile production |
|-------|---------------------------------------|------------------------------|---|
| 1 | Japan | 12,490,000 | 25.3% |
| 2 | United States | 9,770,000 | 20.0% |
| 3 | Germany | 8,190,000 | 16.60% |
| 4 | France | 3,780,000 | 7.60% |
| 5 | Spain | 2,300,000 | 4.60% |
| 6 | Canada | 1,980,000 | 4.00% |
| 7 | Korea | 1,720,000 | 3.50% |
| 8 | Italy | 1,680,000 | 3.40% |
| 9 | United Kingdom | 1,540,000 | 3.10% |
| 10 | Commonwealth of Independent States | 1,440,000 | 2.90% |
| 11 | Brazil | 1,090,000 | 2.20% |
| 12 | Mexico | 1,080,000 | 2.20% |
| 13 | China | 920,000 | 1.90% |
| 14 | Taiwan | 430,000 | 0.89% |
| 15 | India | 36,000 | 0.73% |
| | Others | 55,000 | 1.10% |
| Total | | 49,430,000 | 100.00% |

Source: Industrial Bureau of the Ministry of Economic Affairs, Republic of China

General information on Taiwan's automobile industry is provided in Exhibit 2. In 1993, the number of domestic companies related to the automobile industry was 4,420, accounting for 5.5% of the manufacturing industry in Taiwan, and the number of workers directly involved in this industry was 120,000, accounting for 5.5% of those in manufacturing industries.

Exhibit 2: Current Situation in the Taiwanese Automobile Industry

| Item | Units | 1993 |
|--|-------------------------------------|------|
| Output Value of Taiwan Automobile Industry | Billion U.S.D. | 14.2 |
| Number of Workers | Thousands of People | 120 |
| Annual Output Value Per Person | Thousand U.S.D. Per Person Per Year | 120 |
| Percentage of R&D to Sales | Percent | 2.2 |
| Percentage of Technical Engineers to Total Workers | Percent | 10 |

Source: Industrial Bureau of the Ministry of Economic Affairs, Republic of China

There are currently eleven automobile assembly plants, as listed in Exhibit 3 and their sales almost entirely depend on the domestic market. Except for those manufacturers located in countries with large domestic demand, like the US, most of the automobile manufacturers are eager to apply an export strategy to lower their costs by increasing their production, as do Japanese and Korean firms. However, the number of exported assembled automobiles from Taiwan is very small. After

reaching a peak of 6,859 units in 1988, exports declined to 649 units in 1993 (China market was not included), which accounts for only 0.2% of the total production. Consequently, almost none of the firms owns a large enough plant to achieve economies of scale. In 1993, the number of manufacturers with annual production above 100,000 units was only one and above 50,000 units was three.

Exhibit 3: Automobile Manufacturers in Taiwan

| Manufacturers | Date Est. | 1993 Production | Capacity | Capacity Utilization | Market Share | Sales Rank |
|---------------|-----------|-----------------|----------|----------------------|--------------|------------|
| Ford Lio Ho | 1973.1 | 111,834 | 110,000 | 101.7% | 28.2% | 1 |
| Chung Hwa | 1974.10 | 85,045 | 93,000 | 91.4% | 20.0% | 2 |
| Yue Loong | 1953.9 | 55,853 | 120,000 | 46.5% | 14.6% | 3 |
| Kuozoi | 1984.4 | 57,504 | 70,000 | 82.1% | 13.3% | 4 |
| San Yang | 1967.5 | 40,098 | 100,000 | 40.1% | 9.8% | 5 |
| Yeu Tyen | 1977.5 | 23,920 | 40,000 | 59.8% | 6.0% | 6 |
| Prince | 1965.5 | 9,665 | 24,000 | 40.2% | 2.4% | 7 |
| Ta Ching | 1987.10 | 8,475 | 30,000 | 28.3% | 2.3% | 8 |
| San Fu | 1966.3 | 5,471 | 36,000 | 15.2% | 1.8% | 9 |
| CAC | 1988.3 | 6,669 | 24,000 | 27.8% | 1.6% | 10 |
| Chin Chun | 1994.6 | ----- | 10,000 | | | |

Source: Industrial Bureau of the Ministry of Economic Affairs, Republic of China

Furthermore, these Taiwan automobile manufacturers depend too much on Japanese firms, which are the main cooperation partners for providing technical support. Of all the current eleven manufacturers, except for the cooperation between San Fu and Renault, France, CAC

and Citroen, France, and Chin Chun with Volkswagen, Germany, the rest of these firms are in some degree of cooperation or joint venture with Japanese firms. As for the foreign technical cooperation partners for parts and component suppliers, 95 percent of these firms are also Japanese firms. This dependence has weakened the Taiwanese manufacturers' incentives to spend more on Research and Development (R&D) with a hope to build their own technology. It also has significant effects on the costs of Taiwan-made cars whose major parts and components are imported from Japan. The recent appreciation of the Yen has caused continuously rising costs of domestic cars.⁴ The exchange rate of the Yen to the American dollar had appreciated from 143.45 in 1989 to 108.75 in 1993, and the rate of appreciation in the Yen reached as high as 24.2%. According to the current tariff, as the Yen appreciates 1%, the costs for domestic firms to get the parts from Japan would rise 0.58%. As for assembled cars, the total costs would rise 0.406%. The increase ratio in costs was very close to the return ratio. Using the average return ratio of 7% in 1989 as a example, it would be offset by 5.7% in 1994 due to the effects of the strong Yen. This huge increase in costs has forced the domestic producers to rationalize their production, raise the local content of their automobiles, and educate parts suppliers in order to reduce their costs.

The quality of domestically assembled automobiles and parts has gradually caught up to the world standard. Facing the challenges from growing automobile industries in other developing countries, the Taiwanese firms are more willing to invest more on R&D and automation because the advantage in costs no longer exists. They have to build their competence in advanced technology in order to differentiate the markets. In fact, We can see that this improvement already works. The quality of

⁴ Industrial Bureau of the Ministry of Economic Affairs, Republic of China. 1994. "Transportation Industry," in *1993 Yearbook of the Industrial Development in Republic of China*. In Chinese.

automobiles assembled by the major Taiwanese auto makers has become the best among their affiliate manufacturers.⁵ In addition, the quality of parts and components they produce has been verified by many large foreign firms. However, as presented in Exhibit 4, the high price of Taiwanese cars has limited their competitiveness.

Exhibit 4: Evaluation of Automobile Industries in Selected Countries

| | Assembly Quality ¹ | Price ² | Parts Quality |
|--------------|-------------------------------|--------------------|---------------|
| USA | | | |
| Japan | **** | 1.0 | **** |
| Europe | | | |
| Taiwan | ** | 1.3-1.4 | *** |
| Korea | ** | 0.9 | *** |
| Malaysia | ** | 1.5 | * |
| Thailand | ** | 1.5 | * |
| Australia | ** | 0.9-1.0 | **** |
| South Africa | * | 1.04 | ** |
| Mexico | ** | 0.9 | *** |
| Brazil | ** | 0.9 | *** |

- 1: * poor
- ** fair
- *** good
- **** excellent

2: Use the average price in USA, Japan, Europe as 1.

Source: Industrial Bureau of the Ministry of Economic Affairs, Republic of China

The trend for future development of this industry is difficult to predict for the following reasons. First, the results from the fierce

⁵ World Journal. Dec. 2, 1994. p. A18. In Chinese.

competition among domestic producers and between domestic and imported cars still remain unclear. Second, the interaction between the Taiwanese government's policy and auto makers is still uncertain. However, these implications are critical to the future changes in the market structure. Finally, the opening of the large Chinese market is a good opportunity for the Taiwanese manufacturers to explore in the future. However, due to high country risks in China and the delicate political and economic relationship across the Taiwan Strait, these Taiwanese firms are still hesitating.

2.2 Competitive Advantages And disadvantages

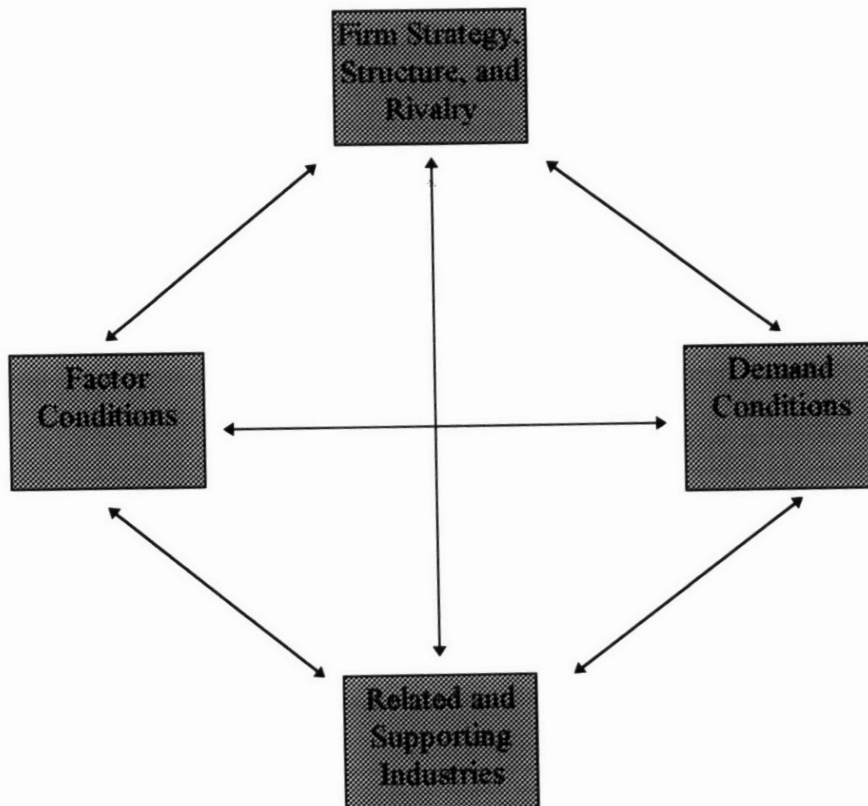
According to "the diamond of national advantage" (see Exhibit 5) suggested by Porter⁶, we can analyze Taiwan's automobile industry in four aspects to illustrate its pros and cons.

1. Factor Conditions. In the capital-intensive automobile industry, government policy is a dominant factor for its success. The Taiwanese government has tried hard to balance conflicting interests from producers and consumers; producers ask government for higher protecting tariffs while consumers ask for lower-priced automobiles. Therefore, government policies are always fickle and unreliable to producers. The Taiwanese government has been criticized for lacking a long-term, consistent policy, fluctuating import policies, and unrealistic local content ratios. In addition, Taiwan is facing labor problems including rising labor costs, increasing labor activism, and shortage of labor. Taiwan used to be considered a low-cost labor country, but not any more. The increase in labor costs has taken away this advantage. Taiwan's wage level is now 3 to 7 times higher than that of southeast Asian countries and 10 to 15 times higher than in mainland China.

⁶ Porter, E. Michael. "The Competitive advantage of nations," in *Harvard Business Review* 90(2) (March-April 1990), pp. 73-93.

However, abundant human resources in Taiwan, such as skilled labor and educated engineers, are very beneficial to this industry.

Exhibit 5: Determinants of National Advantages



Source: Porter, Michael E. 1990. "The Competitive Advantage of Nations," in *Harvard Business Review*.

2. Demand Conditions. It might seem that the globalization of competition would diminish the importance of home demand. In practice, however, this is simply not the case, especially for the Taiwanese automobile industry which has few exports. In fact, the composition and characteristics of the home market usually have a disproportionate effect

on how companies perceive, interpret, and respond to buyer needs. In the Taiwanese automobile market, we can see cars manufactured from almost all over the world, and the competition among them is ferocious. Taiwan's automobile industry gains competitive advantage because demanding domestic buyers in Taiwan can pressure companies to improve faster. However, corresponding to the buyers' needs for variety, the manufacturers in Taiwan adopt a strategy of economies of scope, that is, they produce up to 50 models with small production volume for each one. This is a disadvantage in the current stage because the domestic market is limited, and hence it is very difficult for these producers to reduce their costs through economies of scale.

3. Related and Supporting Industries. The current automobile parts industry in Taiwan is still immature. In 1990, only 300 of the total of 2,000 parts suppliers had the quality standards and the facilities to supply the domestic assemblers or OEM manufacturers. Most of the parts and components exported were after-market products. However, the closer cooperation between parts suppliers and assemblers introduced by Japanese firms has helped this industry tremendously both in improving quality and increasing productivity.

4. Firm Strategy, Structure, and Rivalry. Excess small-scale firms in this industry result in an inefficient structure in Taiwan. None of them is capable of achieving economies of scale. Facing changeable government policy, pressure from imports, and competition among themselves, these producers were not well prepared to meet the international competition. Their goals were to pursue foreseeable profits in domestic markets by taking advantage of tariff protection. In addition, these auto makers were dependent on foreign auto manufacturers, lacking their own design and R&D skills. However, because of increasing pressure from imports, these firms are driven to invest more in long-term plans in recent years.

2.3 Industrial Policies

2.3.1 Why The Automobile Industry Is Important To Taiwan

The automobile industry often plays a dominant role in a country's economic development. In the US, the automotive industry accounts for 5 percent of GNP and 17 percent of industrial employment. It is a vital element in the country's development because of the substantial linkages to other economic activities. For example, it absorbs 76 percent of aluminum alloys produced in the country, 43 percent of zinc alloys, 36 percent of cast iron, and 18 percent of uncoated flat-rolled iron and steel products. Forward linkages to marketing, repair and maintenance, fuel and lubricants, insurance, shipping, and accessories are equally extensive.⁷

In Taiwan, the automobile industry is especially important to its government and other industries. Industries related to the automobile industry account for as high as 70% of the total manufacturing industries, as shown in Exhibit 6, and their total outputs related to this industry are as high as 260 billion New Taiwan Dollars. Because the automobile industry is the last link in the economic system, the influence of its decline would track back to upstream industries until it reaches steel and petroleum industries. Furthermore, five auto manufacturers are within the top ten largest private enterprises. Any managerial crisis involving these firms would soon become a public concern and would furthermore influence public confidence in Taiwan's economy. In addition, the technology level in the whole nation will be promoted by developing the automobile industry. Consequently, the Taiwanese government never gives up its ambitions to develop this industry.

⁷ Yannis, Karmokolias. 1990. *Automotive Industry Trends and Prospects for Investment in Developing Countries*. Washington, DC: The World Bank and International Finance Corporation.

Exhibit 6: Automobile-Related Industries in Taiwan

| Industries | 1986 | 1990 | 1993 |
|-----------------------------------|--------|--------|--------|
| Transportation Industry | 6.00% | 7.10% | 7.47% |
| Chemical Material Industry | 6.92% | 6.98% | 8.18% |
| Chemical Product Industry | 2.08% | 2.45% | 2.69% |
| Petroleum Industry | 4.56% | 4.80% | 5.08% |
| Rubber Product Industry | 1.48% | 1.58% | 1.35% |
| Plastic Product Industry | 8.67% | 7.78% | 6.21% |
| Metal Industry | 6.73% | 7.64% | 9.00% |
| Metal Product Industry | 5.15% | 5.52% | 5.46% |
| Mechanical Industry | 3.86% | 4.75% | 4.99% |
| Electrical & Electronics Industry | 14.08% | 17.29% | 19.19% |
| Total | 59.53% | 65.89% | 69.62% |

Source: Industrial Bureau of the Ministry of Economic Affairs, Republic of China

2.3.2 The Evolution of Automobile Industry Policies in Taiwan

Taiwan's economic bureaucracy has long distinguished itself by its political conformity and loyalty, and this in turn has allowed the Ministry of Economic Affairs (MOEA), and the Council for Economic Planning and Development (CEPD) and its antecedent organizations to play a leading role in the shaping of Taiwan's industrial policies since the early 1950s.⁸ The CEPD, acting in the same role as MITI in Japan and the Economic Planning Board in South Korea, has been primarily concerned with the strategic macro and sectoral planning for Taiwan's automobile industry. On the other hand, MOEA's Industrial Development Bureau has been responsible for the details and technical aspects of Taiwan's auto

⁸ Arnold, Walter. 1989. "Bureaucratic Politics, State Capacity, and Taiwan's Automobile Industrial Policy," in *Modern China*. Vol. 15 No. 2, April 1989 p 178-214.

industry policy formulation and implementation. According to the characteristics of those policies in the past, the history of Taiwan's automobile development can be classified into five periods, a framework developed by the Industrial Bureau of the MOEA.⁹

1. Passive Protection Period (1953-1960): This period began with the incorporation of the Yue Loong Motor company in 1953. At that time, the Taiwanese government adopted an import substitution policy, and implemented the first four-year economic development plan. In that plan, the government used a protection tariff (60% for sedans, 40% for buses, trucks, and body panels, and 15% for parts and components), foreign exchange regulation, and import permits to protect its domestic market in order to develop low-skill, low-capital and labor-intensive industries. Although originally linked to the national defense effort, Taiwan's automotive industry was slow in developing because of the lack of technological capacities, scarcity and high cost of capital, and insufficient economies of scale in production. There was no active program to promote the automobile industry in this period.

Throughout the 1950s, major American and European automakers pushed their exports of fully assembled automobiles to Taiwan and had no intention of shifting either to the production or assembly of knockdown components in Taiwan, nor did the world's automakers show any inclination to transfer automotive technology to Taiwan's fledgling auto industry. Against this background, Yue Loong Motor Company, aided by American foreign aid funds, first assumed production of auto engines in September 1956, marking the beginning of Taiwan's highly diversified auto industrial sector.

⁹ Wang, Kung. 1989. "Development Strategies for the Automobile and Parts Industry of the Republic of China," A study in IMVP International Policy Forum. P 1-10.

Exhibit 7: The Evolution of the Taiwan Automobile Industry

| Periods | Passive Protection | Active Protection | Inconsistent | Strategic Promotion | Institutional Promotion |
|------------------------|--------------------------------|---|---|---|--|
| Year | 1953-1960 | 1961-1968 | 1969-1976 | 1977-1984 | 1985-1990 |
| Industrial Skill Level | KD Assembly | KD Assembly | CKD Assembly | Localize Parts Manufacture | |
| Major Producers | Yue Loong | Yue Loong | Yue Loong Ford Lio Ho San Fu San Yang Chung Hwa Yue Tyen | Yue Loong Ford Lio Ho San Fu San Yang Chung Hwa Yue Tyen Kuozei | Yue Loong Ford Lio Ho San Fu San Yang Chung Hwa Yue Tyen Kuozei |
| Domestic Content | | 20% | 60% Manufacture 2 out of 6 Major Parts | 70% Manufacture 4 out of 15 Major Parts | 70% First 3 Years 50% Afterwards |
| Foreign Relationship | Willys Nissan | Nissan | Nissan Toyota Fuji GM Mitsubishi Ford Honda Peugeot | Nissan Fuji GM, Ford Mitsubishi Honda Peugeot Renault Suzuki Daihatsu Hino | Nissan Fuji Ford Mitsubishi Honda Peugeot Renault Suzuki Daihatsu Hino Toyota Citroen Opel |
| Import Restrictions | All Imported Automobile Banned | Small Passenger Cars Banned Small, Large Trucks and Buses Allowed to be Imported | Small Passenger Cars Allowed to be Imported then Restricted Trucks and Buses Allowed to be Imported | Only Japanese Small Passenger Cars Banned Japanese Trucks & Buses Closed at First then Open again | Only Japanese Small Passenger Cars Banned |

Source: Current Status and Future Prospective of the Taiwan Automobile Industry, Vol.19. Chang Hwa Commercial Bank. 5/91. In Chinese.

However, Yue Loong's activities were severely constrained by a lack of automotive and production technology. From the very beginning of its operation, Yue Loong had actively sought the transfer of technology from abroad, proposing technological cooperation with many of the major automakers in Western Europe, the United States, and Japan. For some time, none of the foreign automakers showed any interest in entering into any form of technological cooperation with Yue Loong. None perceived Taiwan as possessing adequate technological base or potential market for an automobile industry. Eventually, Yue Loong's persistence led to technology cooperation agreements with America's Willys Corporation, covering Jeeps in 1956, and Japan's Nissan, covering trucks and passenger cars in 1957. Furthermore, the "Bluebird," the first Taiwan-assembled passenger car, was introduced to the market in March 1960 with a local content ratio of 20%.

2. Active Protection Period (1961-1968): In May 1961, the Executive Yuan (Cabinet) approved the "Developing Domestic Automobile Industry Program" (DDAIP). According to DDAIP, domestic automobiles should be fuel efficient, durable, comfortable, and inexpensive. Assemblers and parts producers were to be encouraged to specialize in their production. Before DDAIP expired, no assembly plant could be approved. In order to cope with a four-year economic plan, DDAIP was implemented for three years (1962-1964) and then extended for another four years (1965-1968).

In 1961, the cabinet also issued the "Industry Assistance Criteria" (IAC), which stated that the domestic content ratio for any specified product of the machinery industry should be attained gradually, and application for a new plant should match the local content ratio achieved by the existing plants. Based on IAC, the MOEA announced the "Machinery and Electric Industry Achieving Local Content Program" (MELCP). According to the MELCP, the MOEA was responsible for issuing

the item and local content ratio every year. The local content ratio was calculated by the ratio of the difference between price of the final product and total price of the imported parts to the final product price, where prices were adopted from the international market.

In 1962, Yue Loong revised the local content agreement with Nissan to 10% annual growth and up to 60%. Lured by the protective environment of the auto industry, many applications for setting up new assembly plants were filed. However, because none of the new plants could match Yue Loong's 60% local content ratio, all applications were rejected by the MOEA.

Although Yue Loong worked very hard to guard its monopoly position, criticism arose because production fell short of increased demand. In 1966, chassis below 3.5 tons could be imported, and foreigners were also allowed to import passenger cars with them. The MOEA, under heavy pressure and constant criticism from the public, finally lifted the ban on setting up new plants. In 1967, the MOEA approved technical cooperation programs of Liu Ho with Toyota), San Fu with Fuji Heavy Industries, and San Yang with Honda. Annual demand for automobiles at the end of this period exceeded 15,000 units, compared to only 2,000 units in 1962.

3. Inconsistent Period (1969-1976): In this period, the government's policy shifted back and forth between considering consumers' welfare, improving the balance of trade, and promoting the automobile industry.

In September 1968, the government issued "The Guidelines for Protecting the Domestic Automobile Industry and Importing Foreign Automobile" to replace DDAIP. The guidelines stated that the domestic automobile industry would be "properly protected." The importation of automobiles would be handled by the Central Trust Bureau and quotas would be flexibly applied to satisfy the excess demand. In April 1969, the

ban on automobile imports was lifted, and Yue Loong's sales dropped to 2,000 units that year.

In 1969, the government announced that application for new assembly plants had to satisfy a capital requirement of NT \$100 million (US \$2.5 million) in order to improve the stability of operation. In the same year, Chung Hwa's technical cooperation program with Mitsubishi to produce trucks was approved by the MOEA.

Toyota ended its cooperative effort with Liu Ho in order to get a foothold on Mainland China. Ford USA purchased 70% equity in Liu Ho and renamed the company Ford-Liu Ho in 1972. In 1974, San Yang accepted 13% equity investment from Honda USA and in 1976, Yeu Tyen filed for a technical cooperation program with Peugeot France.

4. Strategic Promotion Period (1977-1984): In the automotive sector the strategic policy shift from import substitution to export promotion began when the CEPD first announced a new strategy of export promotion in the Seventh Economic Development Plan, 1976-1981. The plan called for the upgrading of Taiwan's industrial structure and a rapid move into the production of high-value-added manufacturers destined for export.

In January 1978, the MOEA submitted to the Executive Yuan a general proposal to establish a large-scale automobile plant with an annual capacity of over 200,000 units of low-priced, fuel-efficient, high-quality compact cars slated primarily for export. The MOEA chartered a special Automobile Task force in January 1979 with preparing a comprehensive report on the state of affairs in the auto sector and proposing a plan to remedy the prevailing problems afflicting the industry. This report was submitted to MOEA by mid-summer 1979 and after revisions and amendments was forwarded to the Executive Yuan, which approved it on August 30, 1979, as the "Guidelines for Accelerating the Development of the Automobile Industry." At the same

meeting the Executive Yuan approved the “Big Auto Plant” project as a part of the new auto industrial policy.

Taiwan’s state authorities immediately began the process of searching for a suitable joint partner for the Big Auto Plant project and let their intentions be known at the international level. Taiwan emphasized its stable sociopolitical environment, its comparative advantage in labor, and the ample supply of highly qualified engineers and technicians. From seven candidates, Toyota was selected as the joint venture partner for the Big Auto Plant project. However, this plan finally collapsed in 1984 after a long negotiation.

5. Institutionalized Promotion Period (1985-1990): The Executive Yuan issued “liberalization, internationalization, and institutionalization” guidelines for economic development in 1984. Based on these guidelines, the “Automobile Industry Development Act” (AIDA) was passed in 1985. There are two goals for the AIDA: (1) to enhance the competitiveness of the parts and the automobile industry, and (2) to respond to consumers’ desire for a quality automobile at a reasonable price. The development policies for ASDA include: (1) reduce protection and reinforce free competition; (2) induce foreign capital and technology and encourage exportation; (3) promote research and development, and enhance technology level; and (4) establish an inspection system and raise inspection standards.

Although this policy is a compromise between liberalism and protectionism, it does generate tremendous pressure on the automobile and the automobile parts industry. The government might have already achieved some policy objectives to a certain degree. For quite some time, local producers have been resisting equity investment proposals from their technical partners. After AIDA was issued, Yue Loong finally accepted Nissan’s investment up to 25% in 1985. Chung Hwa motor company followed suit and accepted Mitsubishi’s investment in 1986. A

new relationship finally evolved, 30 years after the first technical cooperation program was approved.

Research and development have been enhanced. Yue Loong, Yue Tien, and Chung Hwa have been awarded commodity tax reduction from 3% to 6% for their efforts to design or modify their own bodies or chassis. Some design ability has been attained by these producers. In terms of export, Ford-Liu Ho has exported 6,000 subcompact cars to Canada each year from 1986 to 1988.

2.3.3 Current Government Policies

Taiwan applied for GATT membership in 1992 and started to negotiate with other member countries in 1993.¹⁰ In order to be consistent with the free trade stance, the Ministry of Economics Affairs announced in 1991 that no official Acts will be applied in automobile sector because of its protective undertone. Instead, “guidelines” will be announced and implemented, and the government will still do “whatever it has to do” to push the automobile industry towards the right direction. International comparisons of current automobile policies are shown in Exhibit 8.

Exhibit 8: Tariff Rates of Automotive Imports in 1994

| Countries | Tariff Rate |
|-----------|-------------------------------|
| Taiwan | CBD 30%; CKD 18.8% on Average |
| Japan | 0% |
| Korea | CBU 10%; CKD 8% |
| Brazil | CBU 35%; CKD 30% |
| Mexico | CBU 20%; CKD 0-20% |

Source: Industrial Bureau of the Ministry of Economic Affairs, Republic of China

¹⁰ Baum, Julian. “Waiting for the Call,” in *Far Eastern Economic Review*. March 23, 1993. p47.

In Aug. 1992, the government announced “The Development Strategy for Automobile Industry” and set the goal in year 2000 as shown in Exhibit 9.

Exhibit 9: Future Goal of Taiwan’s Automobile Industry in 2000

| | |
|-------------------------------------|---|
| Output Value of Automobile Industry | N.T.\$ 360 Billion (7% of Total Manufacturing; 1,670,000 Units) |
| Number of Labor Force | 150 Thousands of People |
| Export Value | N.T.\$ 160 Billion (200,000 Units of Assembled Automobiles & Parts Equivalent to 800,000 Units) |
| Percentage of R&D to Sales | 5% |

Source: Industrial Bureau of the Ministry of Economic Affairs, Republic of China

In this strategy, government exercised controlling and promotional policies to shape the future of automobile industry. However, in order to join GATT, government will help, but not control or intervene in the development of automobile industry. Current government’s emphasis, as current Minister in Economic Affairs said, is to encourage consolidation of the manufacturers, reduction of models, and standardization of parts.¹¹

¹¹ Industrial Bureau of the Ministry of Economic Affairs, Republic of China. 1994. *Research of the Impact of GATT to Taiwan’s Automobile Industry and Future Strategy*. In Chinese.

III. Economic Analysis of Taiwan's Automobile Market

3.1 Economic Characteristics of The Automobile Industry

In the Taiwanese automobile industry, high cost of production is a major problem. In order to realize how the cost factor affects manufacturers' competitiveness, we must be clear about some basic, but very important, economic characteristics and their effects on the automobile industry. We can then conclude that internal economies of scale should be considered the most important factor for automobile industries in developing countries to reduce their costs.

3.1.1 Economies of Scale vs. Economies of Scope

In order to lower unit costs, auto makers have two choices: economies of scale and economies of scope. The term "economies of scale" decides the way in which the average unit cost of production can be lowered by mass production; lower unit costs can be achieved by fully utilizing facilities along the production line and sharing the huge fixed cost among an increased number of production units. "Economies of scope," on the other hand, can be sought when firms produce more than one product and these products are closely linked to one another, for example, when an automobile company produces automobiles and trucks. In such a case, the unit cost of production could be lowered by taking advantage of economies of scope, which result from the joint use of inputs or production facilities, joint marketing programs, or possibly of the cost savings of a common administration.¹²

In the capital-intensive automobile industry, each of the choices has some advantages. Economies of scale, however, can result in greater reduction of costs for developing automobile industries because their

¹²Pindyck, S. Robert and Rubinfeld L. Daniel. *Microeconomics*. 3rd edition. p213-p218. 1995. New Jersey: Prentice-Hall, Inc.

low utilization ratios of manufacturing facilities have caused severe problems in higher production and capital costs. Since the production volume of an automobile plant is fixed, only when firms can maintain certain amount of production will they start to expect the extra reduction of costs that accompany economies of scope. The basic characteristics of economic scale in the automobile manufacturing process are estimated as shown in Exhibit 10.

Exhibit 10: Major Economic Characteristics of the Automobile Industry

| Stage | Investment Level | Scale | Labor Content | Logistics/Transport Costs |
|----------------------------------|-------------------|----------------------|---|---|
| Assembly | \$400-500 million | 100,000 to 200,000 | > 50 percent | 10 percent |
| Major Components | \$400-500 million | 500,000 | 10-20 percent | 5-15 percent |
| Moderate Processed Parts/Systems | \$50-200 million | 500,000 to 1,000,000 | 10-20 percent | 5-15 percent |
| Rough Process Parts/System | \$20-100 million | 200,000 to 1,000,000 | 10-20 percent Except wiring harness, trim. Radio assembly 30 percent or more | 5-15 percent Higher for some plastic. Lower for electronics |

Source: IFC (International Finance Cooperation) Data.

3.1.2 Internal and External Economies of Scale

It is obvious that economies of scale can bring cost advantages for automobile manufacturers. To analyze the effects of economies of scale on market structure, however, one must be clear about what kind of production increases are necessary to reduce the average cost.

Economies of scale have two different categories.¹³ Internal economies of scale occur when the cost per unit depends on the size of an individual firm but not necessarily on that of the industry as a whole. On the other hand, external economies of scale occur at the level of the industry instead of the firm. External economies of scale are found in the case where there are a large number of firms producing similar goods and volume reduces costs. This gives rise to an obvious circularity, since a country that can manufacture a product cheaply will also therefore tend to produce more of it. External and internal economies of scale have different implications for the structure of industries. An industry where economies of scale are purely external (that is, where there is no advantage in having a large firm) will typically consist of many small firms and be perfectly competitive. The success of the computer industry in Taiwan provides a good illustration of these economies of scale. Internal economies of scale, by contrast, give large firms a cost advantage over smaller ones and lead to an imperfectly competitive market structure. The failure of the Taiwanese automobile industry discussed here is a typical case to show problems resulting from a lack of internal economies of scale. Because internal economies of scale are easier to identify in practice and of immediate value to the automobile assembly industry, the author will focus on these internal issues.

¹³ Krugman, R. Paul and Obstfeld, Maurice. 1994. *International Economics: Theory and Policy 3rd edition*. New York: HarperCollins College Published. p115-116.

3.2 The Supply Side

3.2.1 Current Manufacturers

In 1992, ten assemblers in Taiwan built about 300,000 vehicles under contract for American, Japanese, and European nameplates; and another 130,000 units entered its market in under a recently liberalized import policy. Almost every foreign producer had exported cars to Taiwan. In 1994, one new company, Ching Chun, was permitted to produce commercial vehicles only for exports and its entry had added the number of total manufacturers to eleven.

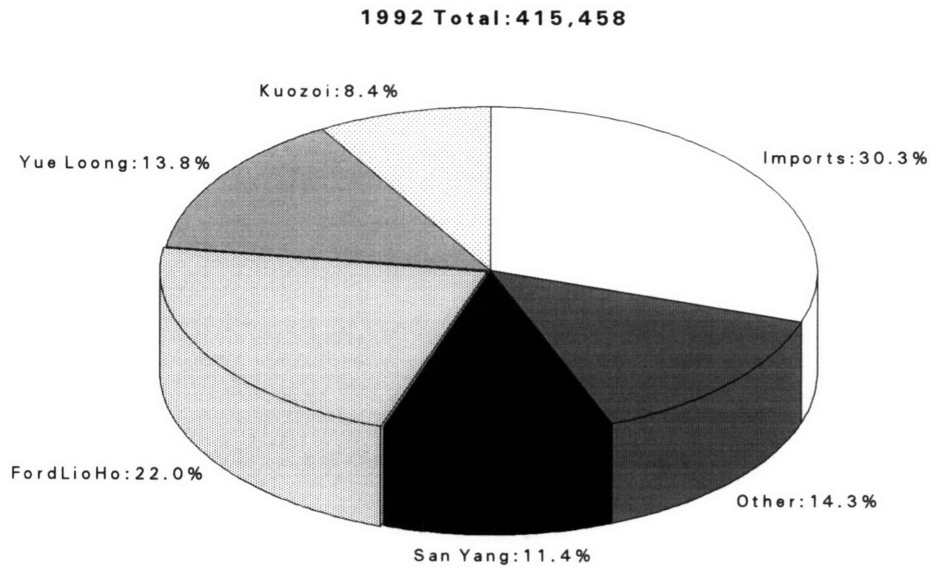
“Taiwan is the only market that has virtually every big player,” said Lawrence Wong, Vice President of Ford Lio Ho Motor Co. Ltd.. “You don’t see this anywhere else in the world. It’s very unique. Very crazy.” U.S. automakers’ ambitions of becoming major players in the Far East are being tested in Taiwan, a small but free-for-all market where virtually all the world’s makers jostle for space on the country’s crowded roads and streets.¹⁴ This is why Saturn, a secret weapon aimed ultimately at Japanese compact cars by one of GM’s divisions, began its overseas sale first in Taiwan; in June, 1992, this model was introduced there to test its competitiveness prior to its sale in the rest of the world.¹⁵

Indeed, international auto makers have been investing in assembly plants throughout Asia, one of the world’s fastest growing consumer markets, after virtually ignoring the region. Among these Asian countries, Taiwan, with only 20 million residents, is the largest single export market for US cars, with 39,000 units shipped through first half-year of 1992, as compared to 43,000 units in all of 1991. In 1989-1990, Taiwan was the biggest export market in the world for each of the Big Three; all have sizable operations on the island.

¹⁴ Johnson, Richard. “Peddler Paradise,” in *Automotive News*. December 7, 1992. p3.

¹⁵ Frame, Phil. “Saturns on sale in Taiwan,” in *Automotive News*. June 15, 1992. p2.

Exhibit 11: Car Sales by Taiwanese Companies



Source: National Statistics

One might ask, since the portion of market shared by each firm is limited, why so many firms still insist to stay in the Taiwanese automobile market? Are their revenues from small number of sales large enough to cover their costs? In fact, we might also see this phenomenon existing in many other developing countries such as Indonesia and Thailand.

A general solution to the questions is provided here. Economic inefficiency occurring in these developing countries, however, does not necessarily imply lack of profitability for individual firms. Companies have been able to stay in business, or even prosper, for a variety of reasons external to the economies of the automobile industry in the country where they operate. Those reasons include the high prices which the markets have borne; transfer pricing operations available to firms where multinational corporations have a significant stake and the

volume of intra-trade is large; in some cases, the availability of credit at low or negative real rates of interest; and dealing by the firms in activities bearing little or no relation to the automotive industry.

3.2.2 The Market Structure of Suppliers

In the late 1980s, The level of market concentration was very low among these automobile manufacturers and this resulted in mushroom-growing market structure. From Exhibit 12, we can see that in the early 1990s, the output share of top 3 firms in Taiwan was 48%, compared to 95% in Korea, 66% in Mexico, 95% in Brazil, 88% in India. The Taiwanese market is shared evenly by the domestic producers and at the

Exhibit 12: Structure of Assembly Industries in Developing Countries

| Region/Country | Mid 1980s | | Early 1990s | |
|-------------------|--------------|---------------------------------|--------------|---------------------------------|
| | No. of Firms | Output Share of Top 3 (percent) | No. of Firms | Output Share of Top 3 (percent) |
| Mexico | 5 | 68 | 5 | 66 |
| Brazil | 7 | 82 | 5 | 95 |
| Republic of Korea | 3 | 100 | 6 | 95 |
| Taiwan | 10 | 40 | 10 | 48 |
| Indonesia | 12 | 64 | 12 | 54 |
| Malaysia | 7 | 75 | 7 | 62 |
| China | 13 | 46 | 18 | 48 |
| Thailand | 8 | 70 | 8 | 66 |

Source: Peter O'Brien and Yannis Karmokolias. *Radical Reform in the Automotive Industry*.

same time the scale of each firm is still small. Therefore, this market structure cannot be a threat to new market entrants and, on the contrary, attracts more to join the market. The trend of concentration from mid 1980s to 1990s is very low, only 8 percent of increase.

During the 1980s, firms in the market still enjoyed some profits because of government protection. However, in the early 1990s, since the government has announced its policy to eliminate trade barriers, these manufacturers had lower earnings. Simultaneously worsened off by the appreciation of the Yen, only three manufacturers retained earnings in 1993.

Exhibit 13: Financial Status of Taiwan’s Automobile Manufacturers

| Year | 1991 | 1992 | 1993 |
|---------------------|------|------|------|
| Firms with earnings | 10 | 8 | 3 |
| Firms with loss | 0 | 2 | 7 |

Source: Industrial Bureau of the Ministry of Economic Affairs, Republic of China

After 1991, the market shares of the Taiwan domestic manufacturers began to concentrate faster. The concentration of automobile market shares has become more obvious, and this causes the weak companies to get weaker. The ratio of the market share for the first five largest firms was rising. The sales for smaller firms are declining and these firms began to lose money. In 1993, there were four firms whose production was less than 10,000 units. However, this consolidation occurred too late and should have taken place ten years ago. Since the Taiwanese market is increasingly threatened by imports, whose price is significantly lowered because of the reduced tariffs, the speed of concentration is comparatively too slow for these firms to be well prepared for future challenges.

Exhibit 14: Concentration of Market Share in Taiwan's Automobile Industry

| Year | 1990 | 1991 | 1992 | 1993 |
|----------------------------|-------|-------|-------|-------|
| Total Market Shares | 80.0% | 79.9% | 84.1% | 86.2% |
| By 5 Biggest Manufacturers | | | | |

Source: Industrial Bureau of the Ministry of Economic Affairs, Republic of China

3.3 The Demand Side

In the 1980s, due to the rapid economic growth, the demand in Asian countries including Korea, China, Taiwan had changed dramatically. The number of automobiles on the road in these countries had been at least doubled from 1981 to 1988. These emerging markets nourished the growth of automobile industries in these countries.

Exhibit 15: Automobile Registration by Countries

| Country | 1981 (thousands) | 1988 (thousands) | Percentage Change |
|---------------|---------------------|---------------------|----------------------|
| United States | 155,890 | 179,045 | 14.9 |
| Japan | 37,856 | 49,902 | 31.8 |
| Mexico | 5,655 | 7,886 | 37.7 |
| Brazil | 10,291 | 11,937 | 16.0 |
| China | 930 | 4,123 | 343.3 |
| Korea | 519 | 1,611 | 210.8 |
| Taiwan | 482 | 1,728 | 204.6 |
| Thailand | 881 | 1,326 | 50.5 |
| World Total | 416,817 | 518,964 | 24.5 |

Source: Automobile International. *World Automotive Market*. 1983,1989.

From mid 1980s to early 1990s, the growth of new registrations in developing countries often accomplished by a growth of domestic production as shown in Exhibit 16. However, although the new registrations in Taiwan increased tremendously at a ratio of 3.2, the production grew up at a much lower speed, only at a ratio of 1.5. Partial (around 20 to 30 percent) of the new car demand was supplied by imported automobiles.

Exhibit 16: Comparisons of Vehicle Production and New Registrations

| Country | Production (MN. units) | | New Registrations (MN units) | |
|-----------|------------------------|-----------------|------------------------------|-----------------|
| | 1991 | 1991/1985 ratio | 1991 | 1991/1985 ratio |
| Mexico | 0.99 | 2.5 | 0.64 | 2.0 |
| Brazil | 0.96 | 1.0 | 0.77 | 1.0 |
| Korea | 1.50 | 3.9 | 1.05 | 4.3 |
| Taiwan | 0.21 | 1.5 | 0.55 | 3.2 |
| China | 0.51 | 1.2 | 0.62 | 1.4 |
| Thailand | 0.21 | 2.6 | 0.30 | 3.5 |
| Indonesia | 0.25 | 1.8 | 0.24 | 1.7 |

Source: Excerpt From Automotive News, *1992 Market Data Book*. New York.

3.3.1 Demand of the Domestic Market

The annual demand for new car has increased from less than one thousand to 557,000 units. The annual exceeded 10,000 in 1969, exceeded 50,000 in 1974, exceeded 100,000 in 1979, exceeded 200,000 in 1986, and exceeded 500,000 in 1992. The growth rate of annual demand for new car is 21% and the rate for the domestic products is 14% in the 1980s.

However, in this rapidly growing period, imports, especially for passenger cars from the U.S. and Europe with engine capacity of more than 2,000 c.c., enjoyed even faster expansion. The market share for imports increased from 7.5% in 1980 to 9.4% in 1984, 36.3% in 1988. It reduced to 27% in 1993.

Automobile ownership per thousand people had increased from 1 in 1953, 88 in 1987, to 99 in 1992. Although the cars owned by each residence is higher in Taiwan than those in the other countries listed in Exhibit 17, the small population limits the market size. If we take the area of a country's size into account, the density of automobiles on the Taiwan road is even higher and this has constrained its growth.

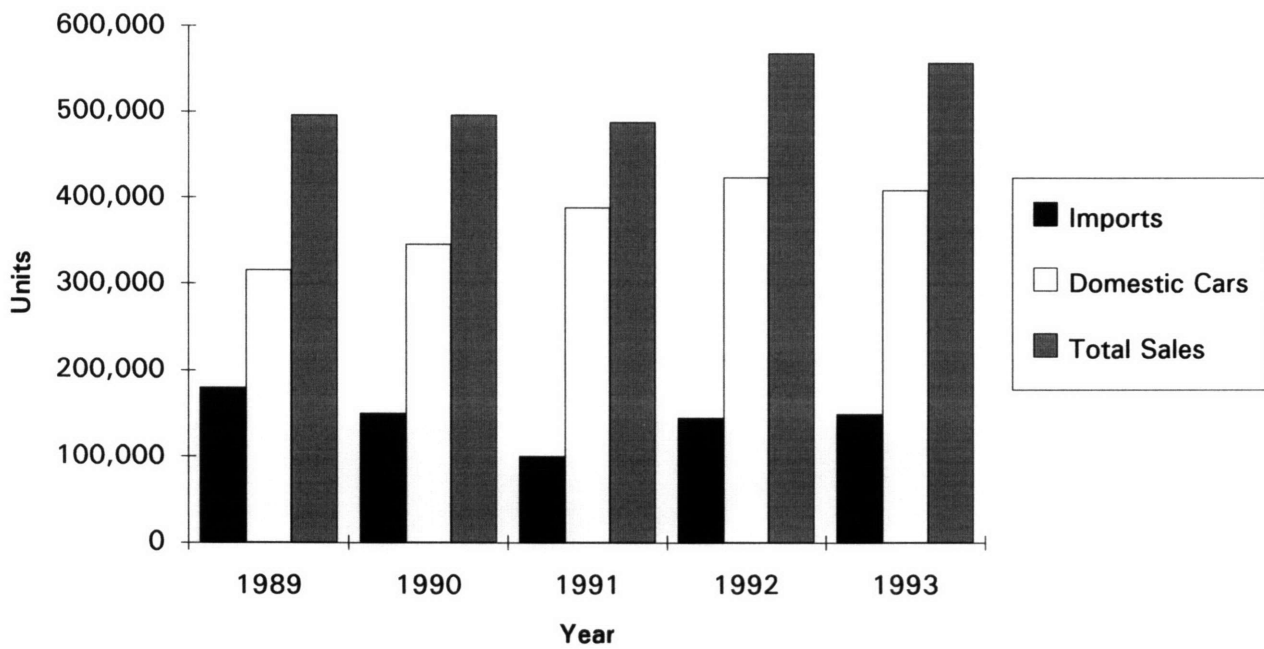
Exhibit 17: World Motor Vehicle Census 1992

| Country | Car | Population (million) | Persons Per Car |
|-----------|------------|-------------------------|-----------------|
| Taiwan | 2,077,000 | 20.9 | 10.1 |
| Brazil | 12,128,000 | 158.2 | 13.0 |
| Mexico | 6,819,000 | 92.4 | 13.5 |
| Korea | 2,727,862 | 44.1 | 16.2 |
| Hong Kong | 242,000 | 5.9 | 24.3 |
| Thailand | 825,072 | 57.6 | 69.8 |
| Indonesia | 1,294,000 | 195.7 | 151.2 |
| China | 1,764,871 | 1,169.6 | 662.7 |

Source: 1993-1994 World Automotive Market Report

During the early 1990s, the automobile market in Taiwan has gradually saturated as shown in Exhibit 18. Lower economic growth, limitations of road construction, and more difficult parking are slowing down the expansion of the car market.

Exhibit 18: Taiwan's Automobile Sales



Source: Industrial Bureau of the Ministry of Economic Affairs, Republic of China

3.3.2 Demand from Exports

The high cost of production of Taiwanese manufactures limits their exports. From Exhibit 19, we can see that the export ratio of total output in Taiwan was less than 1%, compared to the much larger number in Korea, Brazil, Mexico. We can also see from Exhibit 20 that besides an sudden increase of exports in the late 1980s, when Ford Lio Ho exported about 40,000 cars to Canada (Ford Lio Ho sold the cars there as Mercury Tracers), the export volume has remained very minimal.

Exhibit 19: Export And Import Ratios in Developing Countries, 1987

| Country | Exports as percentage of total production | Imports as percentage of total sales |
|----------|---|--------------------------------------|
| Brazil | 30 | 1 |
| Korea | 53 | 1 |
| Mexico | 41 | 1 |
| Taiwan | 1 | 16 |
| Thailand | 1 | 1 |
| Malaysia | 1 | 11 |

Source: O'Brien, Peter, *The Automotive Industry in the Developing Countries: Risks and Opportunities in the 1990s*. The Economist Intelligence Unit, London, 1989.

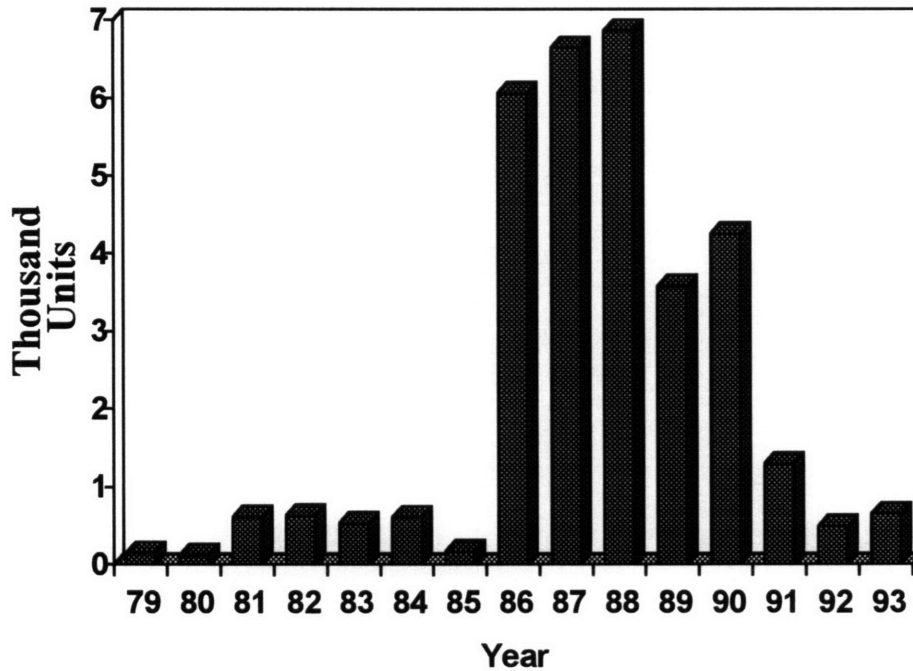
3.4 Analysis of The Market

3.4.1 Lack of Economies of Scale

To be competitive in the auto industry, it is essential to cut costs by increasing production volume and achieving economies of scale. Exhibit 21, which lists the estimates given by a number of researchers of the minimum efficiency scale, shows that individual models should be produced at a minimum level of 200,000 units according to the

traditional mass production principles. This is why in France and Germany, in the post-World War Two period, Citroen and Volkswagen mass-produced small cars with no model changes in order to take advantage of economies of scale.¹⁶ However, in 1993, the ten Taiwan

Exhibit 20: Exports of Taiwan-assembled Automobiles



Source: Industrial Bureau of the Ministry of Economic Affairs, Republic of China

automobile manufacturers produced a combined total of only about 408,000 vehicles and over 50 models. That is an average of only 40,800 vehicles per manufacturer per year and less than 8,000 units per model per year. If we look at the production scale of one single model, those ones produced below 10,000 units stood for two-thirds of the total production and there was no model with a production over 50,000 units.

¹⁶ Baranson, Jack. 1969. *Automotive Industries in Developing Countries*. Baltimore: The Johns Hopkins Press. p71.

In 1988, the largest production volume for a single model car was the San Yang (Honda) Civic with 36,632 units, which is still quite far from achieving economics of scale. As for the parts suppliers, each manufacturer has a business relationship with 105 part suppliers, on average. The size of these suppliers was much smaller. Under these circumstances, none of these producers can achieve economics of scale with the limited segmented market.

Exhibit 21: Estimates of Minimum Efficiency Scale

| | Casting | Machining | Stamping | Assembly |
|---------------------|-----------|-----------|----------|----------|
| Pratten(1) | 1000 | 250 | 500 | 300 |
| Rhys(2) | 200 | 1000 | 2000 | 400 |
| White(3) | Small | 260 | 400 | 200 |
| University Group(4) | 1000-2000 | 400-1000 | 500+ | 200-400 |

Units: Thousand Units Per Year

(1) Pratten, C.F.(1971) Economics of Scale in Manufacturing Industries

(2) Rhys, D.G.(1971) The Motor Industry: An Economic Survey

(3) White, L.J.(1971) The Automobile Industry Since 1945

(4) University of Bristol Research Group

Source: Krish Bhaskar. The Future of the World Motor Industry. 1980. NY, NY: Nicholas Publishing Co.

Many people argue today that economies of scale in a modern assembly line cannot be measured at the individual model level, but, rather, have to be Japanese-style techniques, and using well-trained workers and flexible equipment, a modern assembly line can manufacture many model variations without sacrificing productivity. However, annual volume per assembly line still needs to be between

100,000 to 200,000 units.¹⁷ Even with this argument, the Taiwan automobile industry is still far away from achieving economies of scale. In 1991, there were 10 firms in Taiwan and the total production including commercial cars is 381,890 units. Three among the firms have production ranging from 50,000 to 100,000 units. The production of another 5 firms fall in the range of 10,000 to 50,000 units and the production of rest firms is below 10,000 units.

As one can see, even with modern manufacturing techniques, the majority of Taiwanese assembly plants are just not big enough to achieve economies of scale, which makes its costs uncompetitive in the world marketplace. Therefore, with no exports and with the small demand, the Taiwan automobile industry is only big enough for at most three large auto manufacturers, not eleven (one firm joined the market in 1994) we see today.

3.4.2 International Comparisons

The inefficient structure in Taiwan can be also verified by international comparisons.

First, we can compare the Taiwanese market structure to other developing countries. In Korea, the total production was more than two million units in 1993 because of larger demand from exports. However, there were only five major auto makers and three of them had production far over 100,000 units. The Hyundai Motor Co. even had a production volume of 767,090 units, which was far over the total production of Taiwanese automobile industry. In Mexico, the total production was around one million units. Almost half of its production was going to export. The market shares were concentrated on five firms which had almost equal production volume of 200,000 units. This market situation

¹⁷ Su, Justin C. 1992. *Factors Impeding the Growth of the Taiwan Automobile Industry*. Master Thesis, Sloan School of Management at MIT. p48.

was beneficial to both the economics of scale and market competition. In Brazil, its annual production was 960,115 units which was almost three times that of Taiwan. There were ten firms in the markets, which is almost the same as Taiwan. However, the production was highly concentrated among four of them and their scales were above 100,000 units. The rest of the firms had very small amount of production for commercial purposes.

Exhibit 22: Comparisons of International Automobile Industries, 1993

| Country | Taiwan | USA | Japan | Korea | Mexico |
|-----------------|---------|---------------------------|------------|-----------|-----------|
| Date Est. | 1953 | 1908 | 1933 | 1962 | 1925 |
| Manufacturers | 11 | Domestic: 3 Foreign: 7 | 11 | 6 | 5 |
| 1993 Production | 404,524 | 10,853,721 | 11,227,546 | 2,050,058 | 1,080,144 |
| 1993 Exports | 649 | | 5,017,761 | 638,554 | 493,612 |
| Export Ratio | 0.2% | | 44.7% | 31.1% | 45.7% |

Source: Industrial Bureau of the Ministry of Economic Affairs, Republic of China

Next, let's compare automobile industries between developing and developed countries. The competitive advantage of an industry depends on two factors: relative wage rate and productivity in home country. Generally speaking, lower labor costs in developing countries gain more comparative advantages over the higher production volume and productivity in developed countries. As we can see in Exhibit 23, total assembly costs in developed countries are higher than that of developing

with a ratio of 1.4 to 2. However, with the loss of wage advantage, Taiwan’s auto makers have higher costs in their products which are 1.3 to 1.4 times that of developed countries. Consequently, the only way for them to reduce costs is to raise production volume and productivity.

Exhibit 23: Car Assembly Economics: Developing Versus Developed Countries

| | Developing (e.g. Brazil) | Developed |
|--|--------------------------|-----------|
| Volume per year | 100,000 | 200,000 |
| Total labor hours per units | 48 | 22-30 |
| Wage rate with fringe | 3-5 | 20-30 |
| Labor cost per unit | 144-240 | 440-900 |
| Other costs per units (depreciation, taxes, utilities, overhead) | 450 | 500-600 |
| Total Assembly Cost | 594-690 | 940-1500 |

Source: IFC (International Finance Corporation) Data.

IV. Factors Leading to The Inefficient Market Structure

4.1 Historical Factors

4.1.1 The Failure of The “Big Auto Plant” in The Early 1980s

Recognizing the inefficient structure existing in its automobile industry, the Taiwanese government had tried hard to negotiate with Toyota about the establishment of a large-scale automobile plant with an annual capacity of over 200,000 units for export in the early 1980s. Cancellation of the plan for the joint-venture plant, announced on 6 September, 1984, after almost two years of talks, was particularly embarrassing for the government as it was the centerpiece of efforts to upgrade local car makers and parts suppliers.

The main sticking points in Toyota deal were export levels and local content. Taiwan had demanded half of the plant’s eventual output of 300,000 cars a year should be exported and 90% of the parts be made locally. Toyota feared the target would be impossible to attain at competitive price, as parts from Taiwan’s small scale and relatively inefficient manufacturers cost 20-60% more than those from Japan or the United States.

If this project should succeed, the existence of the big auto plant would have threatened other small firms and new entrants, and, therefore, accelerated the consolidation process among these firms. Taiwan would have a strong automobile industry as Korea right now.

4.1.2 The Sudden Rise in Demand in The Late 1980s

After the failure of “Big Auto Plant”, the Taiwanese government tried to promote its automobile industry by the consolidation of existing small auto makers. Therefore, the “Automobile Industry Development Act” was carried out in 1984 and ended in 1991. The original goal of this

Act was to use free trade and increasing competition to eliminate the small and non-competitive auto makers while nurturing two or three large scale auto makers to dominate the industry and to lead in exportation. However, due to the sudden rise in auto demand in Taiwan during the latter part of the 1980's, the government's goal was not achieved at all.

In 1984, the market demand for autos in Taiwan was only 130,000 units; however, in 1990, the demand has risen to about 500,000 units, and is expected to rise to 700,000 units by the year of 2000. Between 1985-1990, some research estimated that the consolidation would be soon happened. However, the increase in market demand coming along with high economic growth and excess demand stimulated by lowered tariff gave these manufactures the chances to survive and made money. This induced two more firms to enter this market during this period and another one in 1994.

4.1.3 Future Hope in Chinese Market in The 1990s

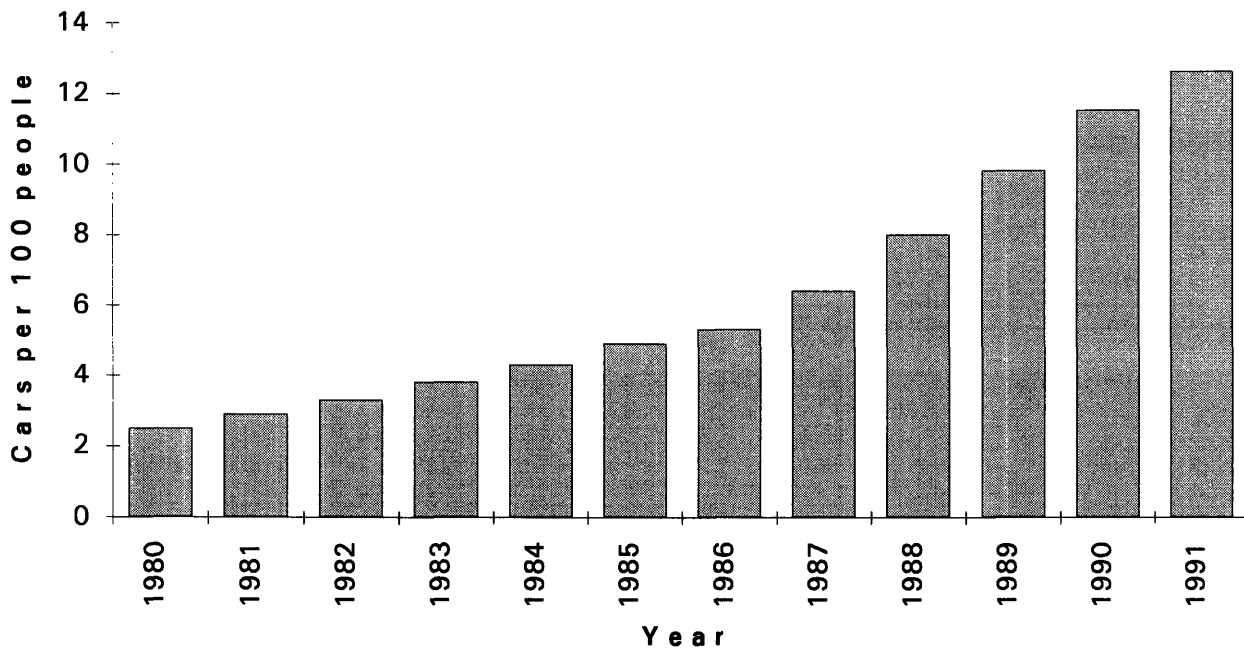
Because of the pressure from rising labor cost and limited domestic market in the early 1990s, the Taiwanese manufacturers faced a dilemma whether to get out of the business or to merge with other firms. As the consolidation process progressing, the opening of the large Chinese market gave them another opportunity to stay in the market. In fact, Taiwan has improved its economy through investment in China and was the second highest foreign capital investor in China today.¹⁸

Two possible forms of manufacturing cooperation which the Taiwanese firms pursue are illustrated in Exhibit 25. Horizontal cooperation indicates that firms produce their own final goods and cooperation through international trade; while vertical cooperation

¹⁸ Baltierra, Miguel. "Looking to the Mainland For Future Growth," in *Architectural Record*. July 1994.

means that firms are responsible for their own products during the manufacturing process.

Exhibit 24: Growth of Demand in Taiwan's Automobile Market



Source: National Statistics

Exhibit 25: Types of Manufacturing Cooperation

| | Cooperation Forms | Cooperation Activities |
|------------------------|--|---|
| Horizontal Cooperation | Cooperation in Same Products (F,I) | Cooperation in Quality, Product, Brand |
| | Cooperation in Similar Products (F,I) | Manufacture Cooperation in Different Products Within Same Manufacture |
| | Cooperation in Different Products (I) | Produce Different Products Individually |
| Vertical Cooperation | Cooperation in Manufacturing Process (F,I) | Manufacture Cooperation in Upstream, Downstream Activities |
| | Cooperation in Management (F) | Functional Cooperation of Manufactures, Marketing, Finance, R&D |

F represents cooperation between firm level;

I represents cooperation between industry level.

Source: Industrial Bureau of the Ministry of Economic Affairs, Republic of China

Considering the relative advantages possessed by these two regions, we can categorize their cooperation in capital and technology intensive manufactures into four types. Type I represents those Taiwanese manufactures which have advantage in manufacturing, but

their development is limited by the market size such as the automobile industry discussed here. Type II is the manufactures lack of market and technology such as aeronautics industry. Type III is the manufactures which have already achieved economies of scale and the technology in this field is more advanced than Chinese firms such as electronics. Type IV is the manufactures with enough market scale, but the technology level of the Taiwanese firms is still lower than Chinese firms such as some special mechanical equipment.

Exhibit 26: Types of Capital-Intensive Manufactures

| | | Technical Advantage of Taiwan over China | |
|--------|----------------|--|----|
| | | Yes | No |
| Market | Sufficient | I | II |
| | Not Sufficient | III | IV |

Source: Industrial Bureau of the Ministry of Economic Affairs, Republic of China

Horizontal cooperation has advantages in enlarging the market, reducing transportation cost, and specializing products. However, it also has several disadvantages. First, the outflow of capital will decrease the investment in Taiwan and reduce work opportunities. Second, diseconomies of scale will decrease economic inefficiency leading to higher production cost. Third, for Taiwan, the biggest problem is the technology transfer. If Chinese firms have learned the technology, Taiwanese firms will face their competition in the future market. In automobile industry, we can see the favorable solution for the Taiwanese automobile industry (Type I in Exhibit 26) is to produce high value-added products such as engines and transmission systems.

Exhibit 27: Horizontal Cooperation Between Taiwan and China

| | Value Added | | |
|-----|-------------|--------|-----|
| | High | Medium | Low |
| 0 | T | T M | M |
| I | T | M | M |
| II | M | T | M |
| III | T | T | M |
| IV | M | T | M |

(1) 0 represents the labor-intensive manufactures and I, II, III, IV represents four types of capital-intensive manufactures.

(2) T means Taiwanese firms control, M means Chinese firms control, and T M means those two share control.

Source: Industrial Bureau of the Ministry of Economic Affairs, Republic of China

Compared to horizontal cooperation, vertical cooperation during the manufacturing process can take advantage of relative advantages on both sides, and therefore is the key to success in the cooperation between Taiwan and China. For example, Taiwan can concentrate on

capital-intensive products while China can major in labor-intensive goods. Because of specialization in certain manufactures, economies of scale can be easily achieved and the manufacturing process can be more efficient. Furthermore, Taiwanese firms can take this opportunity to promote their technology level while specializing certain products. However, under cooperation in manufacturing, the dependence on each other will increase. From Type I in Exhibit 24, we can also conclude that the best solution for Taiwanese auto makers is to assemble cars both in Taiwan and China by using some minor parts and components made in China such as lighting system, and market products in both markets. Through vertical cooperation, these Taiwanese firms can be more competitive in export markets because of the economies of scale achieved by supplying both the Taiwanese and Chinese markets.¹⁹

Exhibit 28: Vertical Cooperation Between Taiwan and China

| Management Procedure | | 0 | I | II | III | IV |
|--------------------------------|----------------|---|-----|-----|-----|-----|
| Information Collecting | | T | T | T>M | T | T>M |
| Initial Research & Development | | M | M>T | M | T>M | M |
| Technology Developing | | T | T | M>T | T | T>M |
| Producing | | M | T>M | M>T | T>M | M>T |
| Quality Controlling | | T | T | T>M | T | T>M |
| Marketing & Service | Chinese Market | M | M | M | T | M |
| | Export Market | T | T | T>M | M | T>M |

Source: Industrial Bureau of the Ministry of Economic Affairs, Republic of China

¹⁹ Industrial Bureau of the Ministry of Economic Affairs, Republic of China. 1994. *Research of the Impact of GATT to Taiwan's Automobile Industry and Future Strategy*. In Chinese.

4.2 Government Policy Failures

The automobile assembly industry has long been regarded as a strategic industry in developing countries because it has a deep and far-reaching influence on other manufactures in these countries. However, this industry is very difficult to develop successfully because of entry barriers to the acquisition of technology and strong financial support. Therefore, the government always plays an important role in developing its own automobile industry either as a source of financing, protection, or trade information.

As in other developing countries, the Taiwanese government has used a high tariff and quota system to protect its own automobile industry and has hoped to develop the industry from a learning-by-doing process.²⁰ However, under this protectionism, these manufacturers have sought short-term profits rather than the long-term advantages to be gained by developing enough to compete internationally. Thus, the government protectionism, unaccompanied by other effective government policies such as restrictions on setting up new plants, has generated an inefficient market structure. Worst of all, feeling the pressure from other trade partners, the Taiwanese government has announced its goal to take a free-trade stance. As a result, these small manufacturers will face a crisis of surviving in the near future.

4.2.1 Weak Government Intervention

Some Taiwanese government officials, of course, have realized the economic problems facing in the automobile industry. However, government just does not have enough power to guide this industry properly.

In order to maintain political conformity, the Council for Economic Planning and Development (CEPD) has played a leading role, as has the

²⁰ Head, "Learning by Doing and Infant Industries," p10-14, 16-39, 47-64.

Ministry of Economic Affairs (MOEA), in the shaping of Taiwan's industrial policies since the early 1950s. However, the industrial policy in Taiwan is far less depoliticized and insulated than it was intended to be. CEPD is composed of Taiwan's "techno-bureaucrats," a group whose power is based on broad managerial and technological expertise rather than on political affiliation. In the mid-1970s they perceived a comparative advantage for Taiwan's auto industry and targeted that industry for development. Ostensibly impressed by the Korean example, the techno-bureaucrats seemed to favor strong state action in the automobile sector. Insofar as policy was concerned, they wanted Taiwan's auto producers and assemblers to streamline operations and achieve economies of scale in production; they were also ardent champions of liberalization and called for an end to protectionism in the automotive sector. Because politics determines economies in Taiwan, the endeavors of the techno-bureaucrats were repeatedly frustrated by the activities of societal actors, including domestic and foreign economic interests, that managed to influence auto industrial auto industrial policy through connections in top political decision-making circles.²¹ Consequently, the weak state action the Taiwanese government adopted limited the effects of Taiwan's industrial policies on guiding the industry.

This weak relationship between the government and the industry also stems from the basic philosophy the Taiwanese government pursues. Putting heavy emphasis on the even distribution of income, the Taiwanese government has invested its resources in creating a better manufacturing environment in which firms can compete equally, rather than in concentrating on those firms which had the best opportunities to be competitive in the international market, as the Korean government did. Therefore, without direct participation in the management of the

²¹ Arnold, Walter. 1989. "Bureaucratic Politics, State Capacity, and Taiwan's Automobile Industrial Policy," in *Modern China*. Vol. 15 No. 2, April 1989. p181-182.

companies, the Taiwanese government has not been able to guide its automobile manufacturers.

Furthermore, the basic differences between Korean and Taiwanese government policies has resulted in different organizational. Taiwan has more medium and small private companies and Korea has more big companies with government subsidies. It might be beneficial for Taiwan to build some industries which have more cost advantages in external economies of scale such as computer industry. However, in the automobile industry, which is capital-intensive and has more cost advantages in internal economies of scale, Korea, which has fewer but larger firms, has the advantage over Taiwan.

4.2.2 Flaws of Taiwan's Licensing Policy

Taiwan's policy in licensing new auto plants is too flexible and unplanned. An irreversible mistake was made at the beginning by the Taiwanese government. In 1953, only one auto plant, owned by Yue Loong, was allowed to operate. For more than ten years, Yue Loong had no competitors in the market. Its goal was to maximize profits by taking full advantage of the protection of high tariffs without preparing efficiently to enter the competitive world market. This was the complete opposite to what the government had hoped. The Taiwanese government finally adopted another extreme policy as a result of public pressure. This new licensing policy of 1969, though, was too permissive. It required only a minimum amount of capital and put no restrictions on the number of auto plants. Its purpose was to be fair to all the qualified applicants. However, within the ten-year period after the licensing policy was modified in 1969, six more companies joined the market, so that the total number of auto makers was increased to seven before the 1980s. Since then, these two inappropriate policies have shaped the inefficient

market structure we have today from which both government and industry have suffered for decades.

If we look at the Korean automobile industry, the licensing policy which strictly limits the number of firms has contributed significantly to its advantageous market structure. One of its government's goals has been to build up enough volume to achieve economies of scale and take full advantage of the low labor costs in Korea. In the early stage of the Korean automobile industry, the number of licenses issued to new companies was only three; this was large enough for competition and small enough for their scales of production. In 1990, after decades of development, Korea had only five big manufacturers, Sangyong Motors, Asia Motors, Daewoo Group, Kia Motors and Hyundai Motors. In 1992, the Korean automobile manufacturers were concerned over the license to manufacture commercial vehicles granted to the Samsung Group because they felt the entry of another manufacturer into the crowded car market would undercut the dwindling shares of their five companies. In 1994, therefore, the Korean government denied Samsung entry into the automobile market, claiming that another manufacturer would hurt its competitiveness.²² In contrast, in the same year, the Taiwanese government permitted yet another new company, Chin Chung, to enter the car market and the number of domestic producers was increased to eleven.

4.2.3 Lack of a Consistent Long-term Policy

The Taiwanese government has been criticized as inconsistent. In compared with the emphasis on producers' interests by the Japanese and Korean governments, and the emphasis on consumers' interests by

²² Paisley, Ed. "Samsung's Challenge: South Korean Auto Makers Fear New Rival," in *Far Eastern Economic Review*. July 23, 1992. p40.

the U.S. government, a trade-off strategy is pursued by the Taiwanese government.

Exhibit 29: Restrictions on Setting Up Automobile Factories in Taiwan

| Year | Restrictions |
|------|---|
| 1961 | The Plan for Developing the Local Automobile Industry was promulgated, prohibiting the establishment of an automobile assembling factory. |
| 1969 | The minimum capital investment for automobile manufacturing was specified at N.T. \$100 billion. |
| 1977 | The establishment of automobile factories with exports representing 5 percent of production was permitted, and all others were temporarily suspended. |
| 1979 | Establishment of plants for manufacturing heavy-duty trucks and passenger cars was proposed based on the Plan for Promoting the Development of the Automobile Industry. |
| 1985 | The Plan for the Development of the Automobile Industry was announced, which included three regulations concerning foreigner setting up an automobile factory in Taiwan: (1) foreigners could invest in factories manufacturing parts and components that were not intended for export; (2) foreigners could invest in and even own a factory entirely, when all of the factory's output would be exported; (3) automobile manufacturers who intended to sell to the domestic market could cooperate financially with foreigners to build up a factory and then export the products according to regulations. |

Lai, Shyh-Bao. 1992. *Taiwan's Enterprises in Global Perspective*. ed. NT Wang. Armonk, New York: M.E. Sharpe.

The Taiwanese government, of course, has hoped to protect and develop its automobile industry. However, no minister-level official is willing to stick his neck out and play the part of a strong advocate for the industry, especially when liberal economic thinking has suddenly come into vogue.²³

Industrial policy making in Taiwan has been susceptible to societal pressures and mass media. During the slow development of the automobile industry, domestic public opinion has become increasingly impatient with the high price of automobiles. As small passenger cars came increasingly within the reach of more and more of the urban middle class, the tariff policy on imported cars became more politicized. Under public pressure, the government reduced the tariffs from 65% to 42.5% between 1985 and 1988, which boosted the sale of imported cars.

This policy of reducing tariffs has continued until today because the pressure still exists, but its sources has shifted to some trade partners demanding free trade. The Taiwanese government has not protected its automobile industry as it promised. This has made the manufactures lose confidence toward government and become more short-sighted, pursuing immediate profits rather than looking at long-run development. In contrast, the Korean government adopted a consistent long-term policy by first banning imports, second, limiting foreign ownership of domestic firms, and third helping to obtain the necessary technology through licensing. Its industry received a lot of support in the form of easy lines of credit, favorable tax treatments, and assistance in exporting. Therefore, the Korean firms were more ambitious about future development because of their confidence in their government. One evidence of strong protection from the Korean

²³ Chu, Yun-han. 1994. "The State and the Development of the Automobile Industry in south Korea and Taiwan," in *The Role of the State in Taiwan's Development*, eds., Joel D. Aberbach, Davis Dollar, and Kenneth L. Sokoloff. p125-166. Armonk, New York: M.E. Sharpe.

government is that even facing strong demands from US for lower tariff rates on foreign car imports, the Korean government still insists on its position to guard its market for its producers.²⁴ However, on the other side, the Taiwanese government has announced to open the domestic market in the future.²⁵

To develop the automobile industry needs a decade. However, Taiwan's industrial policies were often complained by auto makers about its continuity. A different car policy often comes with each new minister. For example, in mid-1982, General Motors pulled out of a heavy truck deal after production had already started when the government changed its previous commitment to long-term protection from Japanese truck imports to only a one-to-two-year grace period. Toyota's project of setting up Big Auto Plant in Taiwan collapsed right after the strongest local supporter, Economics Minister Chao Yao-tung, was replaced by Hsu Li-teh in June 1984. This is the second time policy zigzags have aborted a major vehicle manufacturing venture.

4.3 The China Factor

Major car manufacturers in the world are positioning themselves for a potential boom in China's car market composed of 1.2 billion people. However, there are still some barriers to foreign firms who wish to do business directly with the Chinese. With the political tensions and economic restrictions between China and Taiwan slowly withering away, foreign auto makers are looking at Taiwan as their springboard into the potentially huge Chinese market. As a result, the world's major auto manufacturers are all gathered on the small island of Taiwan, a situation not seen anywhere else in the world.²⁶

²⁴ "Korea Rejects U.S. Demands For Lower Tariff Rates," in *Automotive News*. August 22, 1994. p45.

²⁵ Vines, Stephen. "Taiwan Reduces Import Tariffs," in *Automotive News*. Jan 13, 1992. p22.

²⁶ Su, Justin C. 1992. *Factors Impeding the Growth of the Taiwan Automobile Industry*. Master Thesis, Sloan School of Management at MIT. p90.

4.3.1 Obstacles for Foreign Firms

The Chinese government's plan to develop the automobile industry and the expanding auto-parts market has attracted heavy foreign investment.²⁷ However, it will be difficult for foreigners to do business directly with China because of language and cultural differences, and above all, China's xenophobic attitudes.²⁸ China's xenophobic attitudes rose from historical factors and long disputes with foreign governments. For example, the Big Three automakers were ahead of the competition in China's potentially lucrative automotive market; however, accusations by the US complaining of Chinese government's tolerance of intellectual property theft in January 1995 could have an adverse impact on this advantage because China claimed to put all negotiations with US firms on hold in retaliation. This dispute increased the risks of US manufactures and worsened China's attitudes toward foreign firms.²⁹

It will be even more difficult for the Japanese because of China's deep hatred of them developed during World War Two. On the other side, Japan's big car makers remain wary of China. They are less eager than their international competitors to obtain a share of the potentially huge Chinese market. Although they are mainland China's largest importers, Japanese companies remain cautious about the joint ventures and technology transfers that Beijing is demanding for the future. They also worry about the likelihood of strikes and official entanglements in local factories. Barriers from both sides make cooperation unlikely in the near future.

In addition to these psychological factors against foreign firms, there are some more practical problems suggested by Lee. First, the bureaucracy of the Chinese government is huge and complex; it is

²⁷ "Auto Market Crazes Foreign Investors," in *Beijing Review*. Aug. 22, 1994. p4.

²⁸ Su, Justin C. 1992. *Factors Impeding the Growth of the Taiwan Automobile Industry*. Master Thesis, Sloan School of Management at MIT. p90.

²⁹ Johnson, Richard. "Trade Dispute Sours China on U.S. Cars," in *Automotive News*. Jan 16, 1995. p3.

difficult for foreigners to find out who has authority to negotiate and who has authority over final decisions. Second, for firms involved in joint ventures, they should have at least 25 percent of equity; this is required by law (as shown in Exhibit 30). However, because of the economic, social, and political environment in China, foreign firms have problems in exerting control over projects to ensure their success. Third, all of the laws pertaining to foreign investment in China are relatively new and even these regulations are frequently changed. This is an area of concern to firms because they need a stable legal environment in order to operate smoothly. Fourth, protection of proprietary information remains suspect in the Chinese environment. Foreign firms are suspicious that transfer of technology may also cause it to lose all rights once the information is out of their hands. Fifth, political instability increases country risks in China. Because of these problems, once foreign firms are operating in China, they must be prepared to tolerate the inadequacies of the infrastructure, the difficulty in obtaining inputs, foreign exchange regulations, and problems in developing access to local markets. They should also be wary of patent protection, and constantly do environmental scanning to assess the political tides and their effect on the firms' operations.³⁰

Therefore, for China, the value of a Taiwanese company over a foreign firm cannot be too strongly stressed. The "Chinese" identity of a Taiwanese company will be more welcomed by the Chinese government.

³⁰ Lee, David. 1987. *The Automobile Industry in China*. Master Thesis, Sloan School of Management at MIT. p136-159.

Exhibit 30: Foreign Ownership of Automotive Companies in Developing Economies

| Year: 1987 | Percentage of Equity Participation | | | |
|------------|------------------------------------|-------|-------|--------|
| | 0-25 | 26-50 | 51-75 | 76-100 |
| China | - | 3 | - | - |
| Taiwan | 3 | 1 | 1 | - |
| Brazil | 2 | 1 | 1 | 5 |
| Thailand | 1 | 1 | 4 | - |
| Mexico | 1 | 2 | - | 5 |

Units: Number of Companies

Source: O'Brien, Peter, *The Automotive Industry in the Developing Countries: Risk and Opportunities in the 1990s*. The Economist Intelligence Unit, London, 1989.

4.4.2 Advantages of Taiwanese Firms in The Chinese Market

Chinese-speaking technicians and managers from Taiwan will be great assets for foreign auto makers when they set up operations in China. Some day, when China's economy develops enough to support an automobile industry, Taiwan-made cars, which will probably be recognized as domestic cars, can be exported from Taiwan to China. Experienced Chinese-speaking managers from Taiwan can also be sent to China to set up distribution and sales systems, and even manufacturing facilities.³¹

We can see the trend happening already. Toyota is a latecomer to Taiwan, having set up its Corona assembly line there in 1989. The plant's total capacity is only 40,000 units a year, but other managers count the affiliate, which is 22 percent owned by Toyota, as a strong competitor in the future, because of the Japanese parent's formidable strength

³¹ Su, Justin C. 1992. *Factors Impeding the Growth of the Taiwan Automobile Industry*. Master Thesis, Sloan School of Management at MIT. p91.

worldwide. Toyota invested in Taiwan in 1970, building the factory now occupied by Ford. Then it pulled out in 1972 apparently under pressure from China. In 1990, Toyota was hoping to use Taiwan as a base for exports to the mainland, where it had no plant, but this would have to wait until direct trade is finally liberalized, which may take place within the next few years.³²

All the foreign car makers in Taiwan hope that having a foothold there will enable them to export to China eventually. Although labor costs in Taiwan are more than 10 times those in China, there are still factors in favor of Taiwan as a destination for investment. These include higher productivity, sophisticated labor, and low country risk.

4.4 Difficulty to Merge

Since fewer firms are making money, why don't they merge? There are some difficulties which make merge strategy untenable. First, the auto makers have foreign partners, so any decision to merge would have to be approved by them. Second, the auto makers differ in their ways of making cars. One company's facilities and equipment may not be suitable for another. Third, the ego of the Taiwanese auto makers' owners will not allow mergers to come about. One company loses too much face if forced to merge with another. Fourth, the major auto makers all have enough plant space to raise production capacity to 200,000 units if needed, so mergers should not be necessary.³³

³² *Far Eastern Economic Review*. June 21, 1990. p76.

³³ Su, Justin C. 1992. *Factors Impeding the Growth of the Taiwan Automobile Industry*. Master Thesis, Sloan School of Management at MIT. p49.

V. Recommendations

5.1 Acceleration of the Consolidation Process

Su has suggested that the best thing the government can do is nothing. The government should allow “survival of the fittest” and not try to save all auto makers.³⁴ Under free competition, with so many auto makers and so many models, many weaker auto makers will naturally be left behind and eventually be forced to leave the business. As more and more auto makers drop out, the few auto makers that survive will be able to gain an increasing share of the market, and, therefore, be capable of achieving greater economies of scale in their production.

However, this opinion was too optimistic. Although the number of firms making money is less, the consolidation is unlikely to take place merely based on free competition. Ever since the late 1980s, the competition in domestic market was stiff and the new cuts were expected to hasten the inevitable consolidation within the industry. Based on this observation, an industry analyst at the Chun Hwa Institute for Economic Research, a government-funded think tank, predicted in 1988 that only three or four of Taiwan’s seven car makers would survive in the next six years.³⁵ However, the number of firms did not reduce as expected, but on contrast, it increased eleven in 1994.

Recently, each of the manufactures is continuing to invest in facilities in order to raise its production volume or productivity as shown in Exhibit 31. The trend to consolidation is not progressing, but moving backward at full speed. Therefore, instead of doing nothing, the Taiwan government should provide more incentives for auto makers to speed up consolidation internally.

³⁴ Su, Justin C. 1992. *Factors Impeding the Growth of the Taiwan Automobile Industry*. Master Thesis, Sloan School of Management at MIT. p82.

³⁵ Moore, Jonathan. “Full Speed Backwards,” in *Fareastern Economic Review*. Mar. 24, 1988.

Exhibit 31: Recent Investments of Major Taiwan Manufacturers

| | Planned Annual Production | Investment Value (Billion N.T.) | Time to Finish |
|------------------------|---------------------------|---------------------------------|--|
| Kuozoi (Toyota) | 125,000 | 25 | 1993: Expanding Chung-Lih Plant 1994: Kwa-In New Plant |
| Chin Chun (VW) | 120,000 | 15 | End of 1997; Partial Production Line Started In June, 1994 |
| CAC (Opel) | 20,000 | 1 | July, 1993 |
| Chung Hwa (Mitsubishi) | 120,000 | 10.3 | End of 1997 |
| Yue Loong (Nissan) | 100,000 | 0.94 | Dec., 1993 |
| San Fu (Renault) | 80,000 | 0.29 | Dec., 1993 |
| Prince (Suzuki) | 48,000 | 2 | Dec., 1993 |
| Total | 593,000 | 54.5 | |

Source: Industrial Bureau of the Ministry of Economic Affairs, Republic of China

However, in order to cope with the free-trade policy, the Taiwanese government will have difficulty in controlling or driving the market in a certain desired direction. However, the government can still guide this process by giving tax incentives for achieving production. For example, if an auto maker achieves production of 50,000 units for a single model, its

tax rate can be reduced by five percent. If production reaches 100,000 units then the tax rate can be reduced more. Similar to this method, the government can follow Australia's lead and increase taxes if a certain production level is not reached.³⁶

Exhibit 32: Sample Solution to Encourage Mass Production

| Annual Production of Single Model | Exemption of Tariff For Parts (NT/Unit) | Exemption of Commodity Tax (Percentage) |
|-----------------------------------|---|---|
| 30,000 - 40,000 | 6,000 | 1% |
| 40,000 - 50,000 | 8,000 | 2% |
| 50,000 - 60,000 | 10,000 | 3% |
| Above 60,000 | 12,000 | 4% |

* Assume the tariff for imported parts in each car to be NT\$ 20,000.

³⁶ Industrial Bureau of the Ministry of Economic Affairs, Republic of China. 1994. *Research of the Impact of GATT to Taiwan's Automobile Industry and Future Strategy*. In Chinese.

5.2 Reduction in the Level of High-Tariff Protection

According to the infant industry argument, developing countries have a potential comparative advantage in manufacturing, but new manufacturing industries in developing countries cannot initially compete with well-established manufacturing in developed countries. To allow manufacturing to get a toehold, in many developing countries, their governments may use tariffs or import quotas as temporary measures for getting industrialization started. As in other developing countries, the Taiwanese government is a follower of this theory and has long protected its automobile industry

However, economists have pointed out many pitfalls in this argument. If not properly used, protectionism might make the situation worse-as seen in the Yue Loong example. The disadvantages of protection are stated in the following section. First, relative costs of production have been high by international standards. Second, under a system of protection, in an industry producing at above international costs, the net gains from an upgrading of industrial skills may be more than offset by the net losses due to inefficient plant operations. Third, because of the high cost of tooling up for low-volume production, developing countries usually end up with vehicle models and production techniques that lag behind the latest developments. But since the costs of research and development are high, little or no effort is made to adapt product design and production techniques to low-volume production. Fourth, once production is built into a national economy, it is difficult to remove because of vested interests. The windfall profits possible under systems of protection and import substitution encourage the mushroom growth of small-scale, inefficient plants until markets become saturated. The higher the tariff wall, the more extensive the inefficient growth-as can be seen in the case of Chile. There were only 7,800 vehicles

manufactured in Chile in 1964 by 22 firms. Tariffs and domestic content requirements (25-50 percent) were relatively high for this small number of vehicles. Installed capacity (29,600 units) was estimated at more than three times the average annual output in 1964. In addition, the new protectionism stated that protectionism might deteriorate the whole nation's welfare. It continued arguing that the Japan-bashing syndrome fails to consider the significant difference between American and Japanese standards of living. Despite trade imbalances, Americans have 33% more consumer power than the Japanese. Protectionism tends to stagnate free trades, deter economic benefits, and discourage new jobs.³⁷

In addition, most economists strongly support free trade because it encourages countries to specialize in the goods that they make most efficiently, exporting these goods in exchange for imports of other goods that are more efficiently made elsewhere. While US automobile manufacturers went backward and started to request its government to impose a large tariff on imported vehicles in an effort to spur further interest in their products³⁸, the Taiwanese government has already announced its intention to take a free-trade stance and lower the tariffs annually until they are ultimately eliminated. Moreover, the government also consider to lift the import ban for Japanese cars.³⁹ This author believes that this policy is on the right track and should continue at an appropriate speed.

5.3 Improvement in Productivity

5.3.1 Lean Production

While the Taiwanese auto makers are trying hard to raise their production volume in order to lower their costs, it is also necessary for

³⁷ Stelzer, M. Irwin. "The new protectionism: protectionism doesn't save jobs or raise anyone's living standard," in *National Review*. Mar. 16, 1992. p30.

³⁸ Dalglish, Brenda. "The Road Back," in *Maclean's*. Jan 25, 1993. p26.

³⁹ Vines, Stephen. "Taiwan woos Japan; import ban may end," in *Automotive News*. Mar 9, 1992. p36.

them to improve their productivity through lean production which might result in more savings in costs.

Even if developing countries like Taiwan with cost advantages in low wages have achieved economies of scale, it is still very difficult for them to compete with Japanese cars both in price and quality. The Japanese have pioneered a production system that permits a continuous process of building motor vehicles from raw materials to the finished product. This just-in-time system has proved to be extremely efficient because the need for inventories is reduced by removing bottlenecks in the manufacturing process. This system provides Japanese firms with more efficient and productive manufacturing, allowing them to reduce the time needed for making a car from 250 to 130 hours. This was achieved in the time period between 1970 and 1981.

Japanese efficiency has offset the low-wage advantage of other countries. For example, in 1980 the Korean Ministry of Commerce estimated that the production cost of a Pony built in Korea was \$3972 while the estimated cost of a Toyota built in Japan was only \$2300. A cost savings of almost \$1700 was achieved despite the vast difference in wage rates, \$1 per hour in Korea versus \$7 per hour in Japan. Korea has a better developed industrial infrastructure than many of the other developing countries and its productivity is also correspondingly higher. The cost advantages that the Japanese enjoy imply that either wages in the developing countries have to go down much further or that productivity has to go up much higher.⁴⁰ Since rising labor costs in Taiwan is a serious problem, the only way to reduce costs is to promote productivity.

This system is continuously improved by the Japanese and its effect on production is eye-opening as shown in Exhibit 33 and Exhibit

⁴⁰ Lee, David. 1987. "The Automobile Industry in China," Master Thesis, Sloan School of Management at MIT. p100.

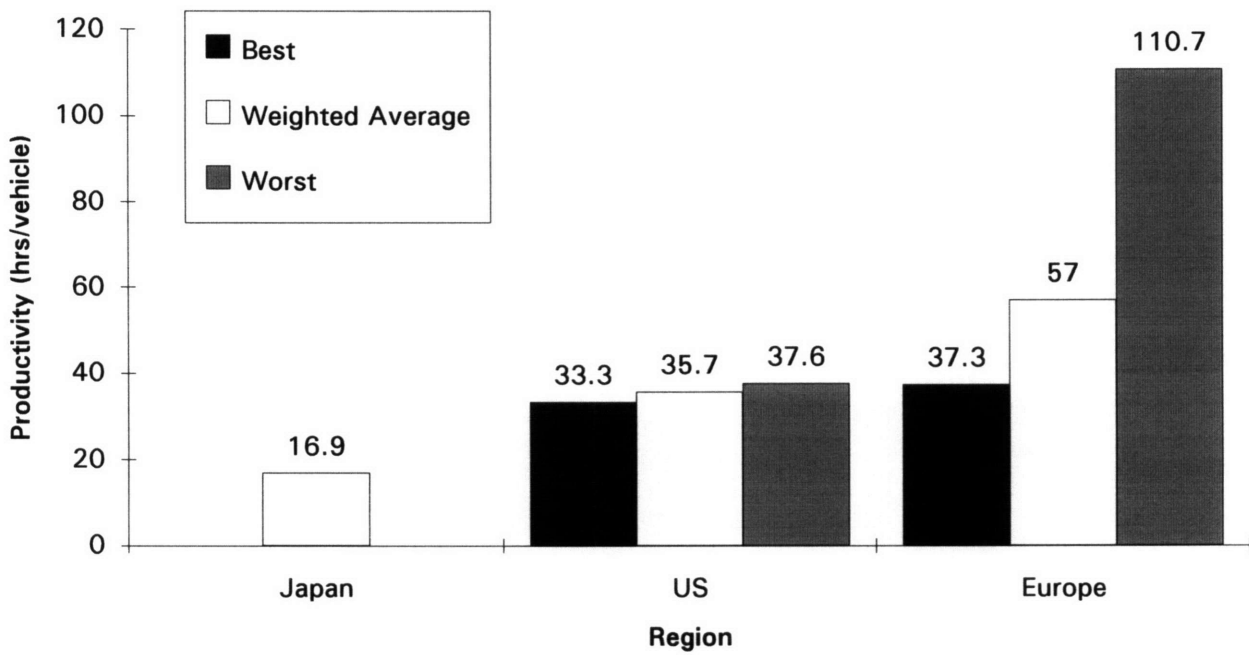
34. A world assembly survey researched by IMVP showed that Japanese plants require one-half the effort of the American luxury-car plants, half the effort of the best European plants, a quarter of the effort of the average European plants, and one-sixth the effort of the worst European luxury-car producers. At the same time, Japanese plants greatly exceed the quality level of all plants except one in Europe-and this European plant requires four times the effort of Japanese plants in assembling a comparable product.⁴¹

One additional and very important finding of the survey by IMVP is worth noting. They found that there was almost no relationship between productivity and quality, contrary to their expectations. What accounts for the manufacturing advantages for both higher productivity and quality standards of Japanese firms? The answer is lean production. The truly lean plant has two key organizational features: It transfers the maximum number of tasks and responsibilities to those workers actually adding value to the car on the line, and it has in place a system for detecting defects that quickly traces every problem, once discovered, to its ultimate cause.⁴² Exhibit 35 also shows that some of the best plants in developing countries (including Taiwan, Korea, Mexico, and Brazil) were very productive. This indicates that some opportunities for the Taiwanese firms to compete in the international market still exist if they too can get lean.

⁴¹ Womack, P. James, Jones, T. Daniel, and Roos, Daniel. 1990. *The Machine that Changed the World*. New York: Rawson Associate. p92.

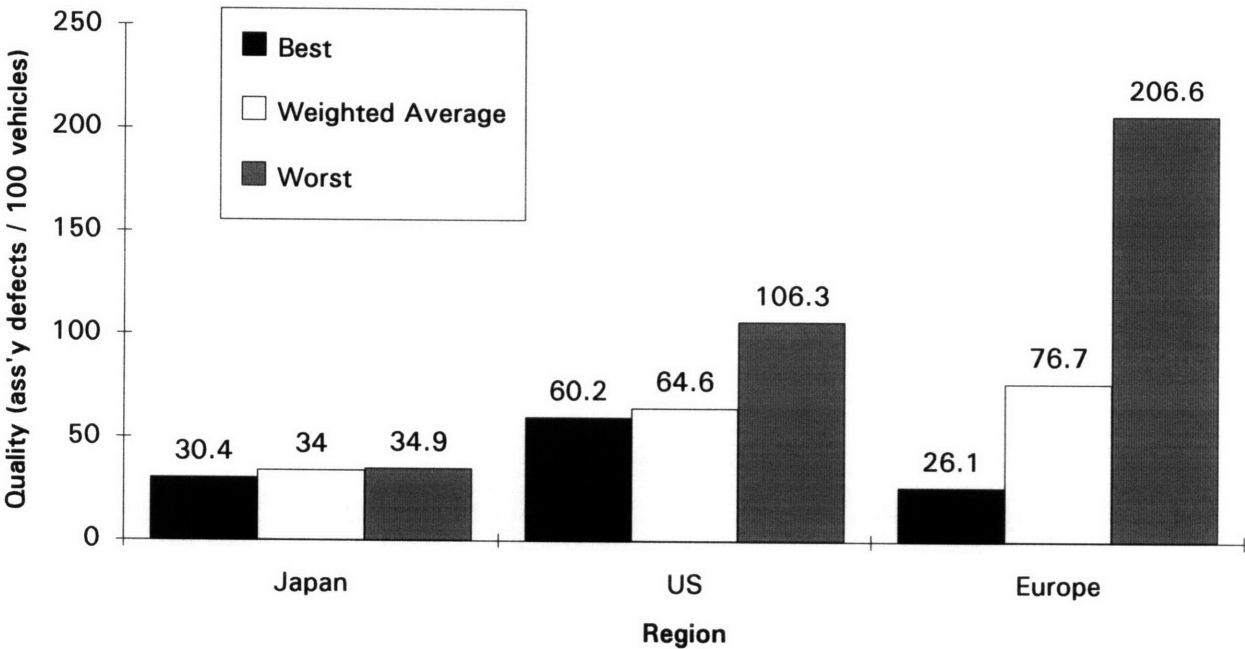
⁴² Womack, P. James, Jones, T. Daniel, and Roos, Daniel. 1990. *The Machine that Changed the World*. New York: Rawson Associate. p99.

Exhibit 33: Luxury Car Assembly Plant Productivity, 1989



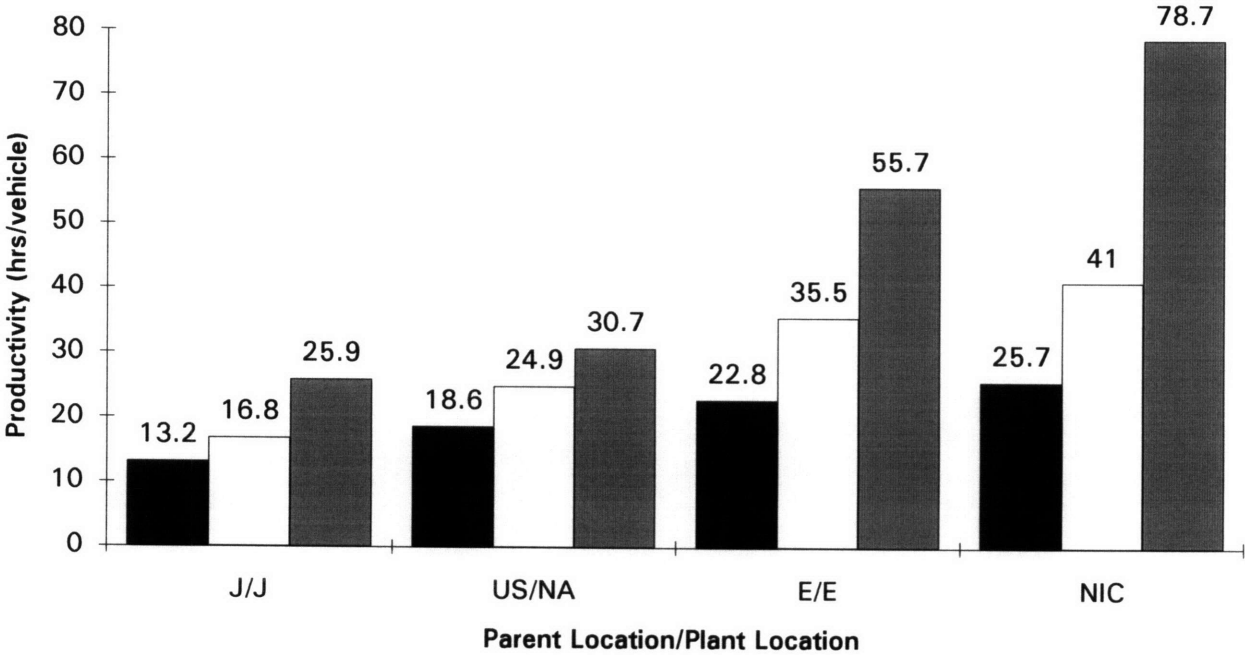
Source: IMVP World Assembly Plant Survey

Exhibit 34: Luxury Car Assembly Plant Quality, 1989



Source: IMVP World Assembly Plant Survey

Exhibit 35: Assembly Plant Productivity, 1989



Note: J/J = Japanese-owned plants in Japan
 US/NA = American-owned plants in North America
 E/E = European-owned plants in Europe
 NIC = Plants in newly industrializing countries: Mexico, Brazil, Taiwan, and Korea

Source: IMVP World Assembly Plant Survey

5.3.2 Flexible Manufacturing

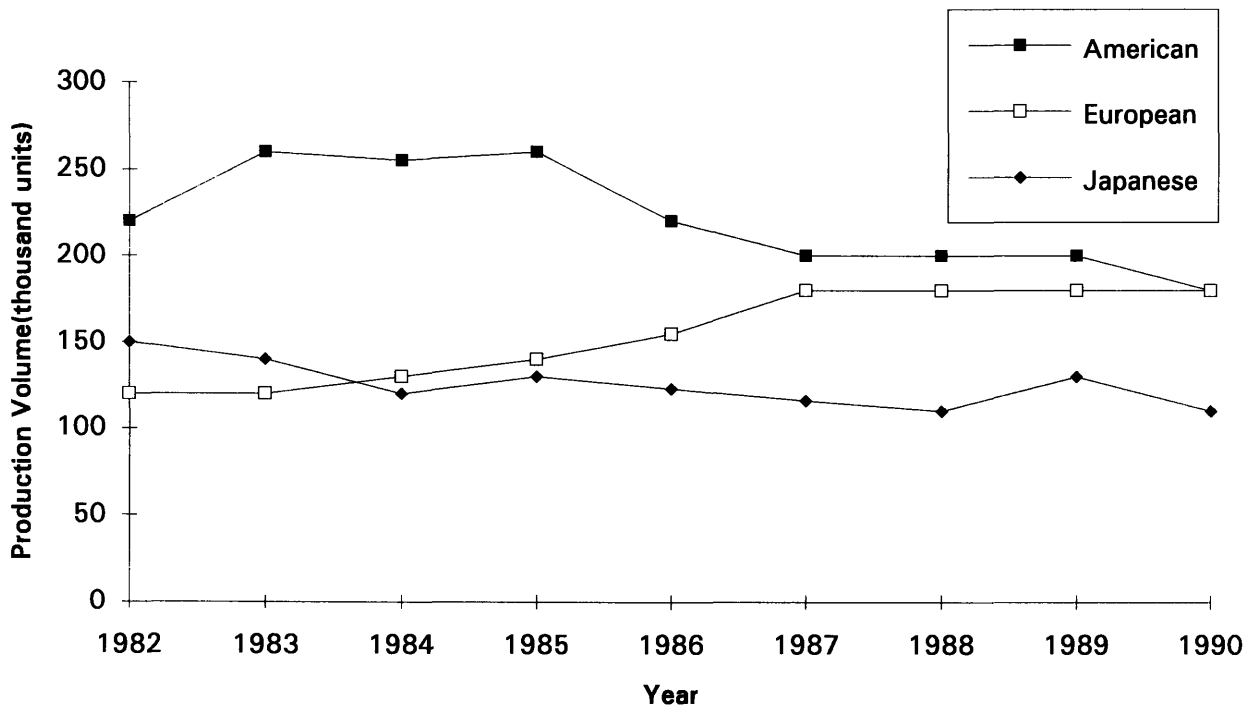
Mature markets in North America, Europe, and Japan are rapidly fragmenting. In the U.S., for example, the number of physically distinct cars on sale has increased from around 25 in the mid-1950s to more than 90 in the mid 1980s. The sales volume for these products has fallen from an average of more than 300,000 units per year to around 100,000. The fact that the number of products offered is continuing to rise and the number of sales per product is continuing to fall suggests that consumers are now more concerned with obtaining a vehicle which meets their precise needs rather than simply obtaining a vehicle with a lower cost. This change is beneficial to the Taiwanese automobile industry because it is exactly the kind of production that it is accustomed to.

Exhibit 36: Fragmentation of American Vehicle Market, 1955-1989

| Number of Products on Sale | 1955 | 1973 | 1986 | 1989 |
|----------------------------|------|------|------|------|
| American Products | 25 | 38 | 47 | 50 |
| European Products | 5 | 27 | 27 | 30 |
| Japanese Products | 0 | 19 | 41 | 58 |
| Total | 30 | 84 | 117 | 142 |

Source: Womack, P. James, Jones, T. Daniel, and Roos, Daniel. 1990. *The Machine that Changed the World*. New York: Rawson Associate.

Exhibit 37: Annual Production Volume of the Average Model



Source: Calculated by Antony Sheriff from production data from PRS.

However, increasing the models in the production lines requires that the efficiency brought by mass production must deteriorate simultaneously because the production volume of each model is reduced. In order to produce more models while enjoying cost advantages in economies of scale, it is also essential for the Taiwanese firms to learn flexible manufacturing systems (FMS). Traditionally, costs have been reduced either through dedicated automation for the production of one product to achieve scale economies or through low wage rates. However, the flexible manufacturing system offers a method of achieving economies of scale over a range of products. Whereas in older assembly plants, a minimum of 250,000 units of the same model is required to achieve acceptable scale economies, with a flexible manufacturing system one can assemble a total of 250,000 units of several different models.

5.4 Changes in the Market Structure

The fundamental obstacle to production efficiency is the diseconomies of scale associated with production oriented toward internal markets of limited size. Adjustment models must seek to overcome the scale disadvantage either through extending the size of the market or rationalizing production so as to achieve larger production runs. The former may be achieved through regionalism or specialized production for world markets. The latter may be realized by reducing the number of models and plants serving domestic markets.

5.4.1 Rationalization of Production for The Domestic Market

National programs aimed at the standardization and interchangeability of components and parts can advance production efficiency through longer production runs. In some cases, more economic scales have been achieved through the use of consolidated assembly

facilities for various models and makes or through the joint utilization of a parts manufacture plant to serve a broader range of equipment manufacturers.⁴³ It will be even more helpful if the automakers can adopt Japan's flexible manufacturing technology.

One possible method for rationalizing production is through the national car strategy, which was adopted by Volkswagen in its beginning to lower the cost of its cars. In a national car strategy, only one car model is offered, and consumers do not have any other choices. Today, however, consumers are exposed to and demand more and more variety in products. They are sophisticated and will not let products be forced on them, as is the case with a national car strategy. Consequently, the national car strategy is not appropriate today and instead, small scale production for different models has become inevitable.

Tightening the relationship between suppliers and manufacturers in Taiwan will provide opportunities for rationalizing production. The firms involved in the automobile industry will be able to meet together and negotiate the possible production lines in which each firm can specialize. Each firm produces only certain parts or models in order to achieve mass production. This strategy might work because it allows firms to benefit each other.

However, for some major components such as engines, it is very difficult for individual firms to develop because of either the capital or the technology. In addition, firms might worry about the risks of incurring the huge "start-up" costs of adapting technology to local circumstances or opening new markets. In this case, governments might play an important role in helping firms work together to share risks. For example, in 1990, the Taiwanese government started with a plan for a common engine and currently is pushing very hard for the development

⁴³ Baranson, Jack. 1969. *Automotive Industries in Developing Countries*. Baltimore: The Johns Hopkins Press. p74-76.

of this project. The government has asked Taiwanese auto makers for support. It plans to spend NT \$3 billion (about \$100 million) to develop this engine and manufacture about 300,000 units by 1995. The goal is to promote technology through participation from manufacturers and reduce costs by mass production. This plan will also help local producers to get out of the control of foreign partners.

The common engine plan began in 1990 by figuring out the design concept and doing the feasibility analysis. The firms with direct participation include Yue Loong, Chung Hwa, and Yeu Tyen and the rest of the firms were in indirect participation. In 1993, the plan went into the stage of detailed design and the Lotus Company in England was in charge of the detailed design of the engine and the development of the prototype. The objective products are 1.2L engines with 8 and 16 valves. The development of a prototype was estimated to be finished in August, 1994 and would be pushed to the stage of investment in production. MOEA hoped to build a new company which would do the production and the development of the common engine. The main financial resources were from private investments. The investment of a new company was estimated to be NT \$ 2.4 billion and the annual production was 95,000 units.

Many auto makers feel very skeptical about this proposal.⁴⁴ The biggest difference among cars is the engine, and each auto maker takes pride at the engine they produce. To use a common engine will be difficult for them to accept, and even if they do decide to accept a common engine, the engine may not necessarily fit the cars they put in. Today, the trend is towards specialization in manufacturing in different countries. Taiwan, compared to Japan, just does not have the industrial base, technologies, and other advantages needed to manufacture engines

⁴⁴ Kuozui Motor Co. Ltd. 1989. *Suggestions for the Development of the Taiwanese Automobile Industry*. In Chinese. p48.

well. Furthermore, this strategy would not be acceptable to consumers. Consumers today demand a wide range of choices when buying cars, and a common engine would decrease the number of models offered. The failure example was given by Australian experience. In 1977, the Australian government expressed its desire for a common engine. As a result, Toyota began using the GM- Holden engine in its Corona model. However, the engine just did not fit well with the car, resulting in many quirks and severely damaged Toyota's quality image in Australia.⁴⁵

However, the situation in Taiwan is very different from Australia. This small 1.2L engine is aimed at low-end customers who are more price sensitive rather than performance oriented. As long as the engines can possess good quality and fit into cars well, the cost lowered by localization might stimulate excess demand from the large population of motorcycle riders in Taiwan. On the other side, since the engines are the same for auto makers in this market level, manufacturers have to make their products more attractive by offering better price, quality, design, and service, which will provide incentives for these firms to progress or consolidate. In the international automobile market, we can find many similar examples. Strategic alliances between Ford and Mazda, Honda and Austin Rover, allowed them to lower developing cost by using some basic designs such as chassis and engines in some models. These cars they produced distinguished each other from properties brought by different brand names and competed in the same market.

Moreover, with the reduction of production costs, the probability to export either parts or the whole automobiles would increase. If we aimed at the motivation for exports, even if fewer models reduced the sales in domestic market, the larger exporting market might compensate for this

⁴⁵ Su, Justin C. 1992. *Factors Impeding the Growth of the Taiwan Automobile Industry*. Master Thesis, Sloan School of Management at MIT. p89.

and give rise of more opportunities for mass production. At that time, the small domestic market is no longer crucial for manufacturers.

In fact, the main point of this project is the promotion of technology, which gives future advantage. The success of this project can, in addition to producing physical output, create intangible benefits such as knowledge or new markets. Facing competition from other developing countries with lower cost, Taiwan has to upgrade its industry level from labor intensive to technology or capital intensive and its human resources and industry bases are ready for this change. From this point of view, no matter how worse the evaluation of future markets for this engine shows, this common engine project is worth developing in the long run.

5.4.2 Regionalism and Barter Trade

A very different path to the future involves “regionalization”, which is to say development focused within regions, such as East Asia, rather than on product flows from less to more developed countries. This possibility is based on the following factors and trends.

The Asian rim, including Korea, Taiwan, Malaysia, Thailand, and China, is likely to be the area of greasiest demand growth for motor vehicles during the remainder of this century and well into the 21st century. By contrast the mature motor vehicle markets -- the U.S., Western Europe, and Japan -- are likely to be totally stagnant in annual demand for units. Penetration of these mature markets by new entrants from low-wage areas will become progressively more difficult because of the competence of large firms in Japan, the U.S., and Europe. Therefore, manufacturers within these developing countries tend to focus growth plans on this region rather than on external markets. This makes regionalism more possible. In fact, the Asian & Pacific Economic Cooperation (APEC), a meeting participated by those countries within

the area, has allowed some degrees of regionalism to happen. Taiwan is currently planning the Asian & Pacific Transportation and Manufacturing Center in order to take advantage of this potential market.

We can see that the trend of regionalism in the Asian region is also consistent with trends in the rest of the world. The most ambitious of these moves was the attempt to create a unified market in Europe, generally referred to as "1992." It is unusual in that the countries involved already constituted a customs union, with no tariffs or quotas on internal trade. What Europe was aiming for was something deeper-in effect, to eliminate completely the distinction among its different national economics.

In North America, attentions now are focusing on the creation of a North America Free Trade Agreement (NAFTA) by the governments of Canada, the United States, and Mexico. In November 1993, after one of the most fiercely contested battles in the history of U.S. trade politics, NAFTA was finally ratified by the U.S. Congress. From Tuktoyaktuk to Tapachula, over three-hundred and sixty million people would be linked together in the world's largest free trade market. According to the NAFTA provisions, the tariff for automobiles and parts will be gradually eliminated by the year 2004. The implementation of the NAFTA has led to the proliferation of US-made automobiles in Mexican markets. At the same time, the NAFTA allows Mexico to increase its exports to the US and Canada and enables US automobile manufacturers to integrate their Mexican operations more closely to their North American plants. The law also generated plenty of foreign investments for Mexico despite the country's turbulent political climate.⁴⁶

Finally, in 1991 the South American nations of Brazil, Uruguay, and Argentina formed a customs union, generally known as Mercosur.

⁴⁶ Versical, David. "Small Cars Are Mexico's Future; NAFTA Could Fuel Growing Demand," in *Automotive News*. Nov. 15, 1993. p4.

Few observers gave the union much chance of success given past failures in the region and the political and economic turmoil in Brazil. In its first year of operation, however, Mercosur astonished the skeptics as trade among its members surged by 50 percent.

Are the agreements a good thing? Most analysts believe the direct effects of NAFTA and “1992” will be clearly positive (there has been little careful study of Mercosur). That is, the gains from trade creation will outweigh any losses from trade diversion. The concern is, instead, that the large economic blocs being formed may turn protectionism against the outside world—for example, that 1992 will pave the way for “Fortress Europe.” All of the policymakers involved deny that this will happen; it remains to be seen if they are right.⁴⁷

5.4.3 International Specialization, Cooperation and Strategic Alliances

International specialization has become popular in the automobile industries. Because of economies of scale, no country is able to produce a full range of manufactured products. In order to reduce their cost of production, manufacturers in the world market purchase parts and components from other countries with relatively low costs. A reduction in the cost of transportation in the future will enlarge this intra-industry trade, which means the exchange of manufactured goods for manufactured goods. (Intra-industry trade is distinguished from inter-industry trade, which means an exchange of manufactured goods for food).

One possible form of international cooperation is by forming strategic alliances, which is project-oriented cooperation rather than a long-term relationship. In Exhibit 38, we can see that the number of

⁴⁷ Krugman, R. Paul and Obstfeld, Maurice. 1994. *International Economics: Theory and Policy 3rd edition*. New York: HarperCollins College Published. p178-179.

strategic alliances in the automobile industry has increased tremendously, because such alliances have advantages in technology complementarity, reduction of innovation time span, and new market access as seen in Exhibit 39. There are three types of alliances: joint ventures, nonequity alliances, and minority equity alliances. Traditional joint ventures are formed when two or more partners create a newly incorporated company in which each has an equity position. The Austin Rover-Honda alliance, for example, is a nonequity alliance in which the two firms work together to develop and produce, but not market, a number of different automobiles. The activities undertaken by the Ford-Mazda alliance are similar, but because Ford owns 25 percent of Mazda, this is categorized as a minority equity alliance.⁴⁸

Korea, because of its similarity to Taiwanese economic development, and China, because of its complementarity in technology and labor resources, are both especially important partners of the Taiwanese automobile industry. Although Korean manufacturers enjoy a large export market, its rising labor costs have increased their costs. Without a price advantage, Korean automobile industries find it very difficult to compete with Japanese firms, which achieve high quality with lower cost through mass production and efficiencies. A study by Suh suggested that the Korean government should consider a regional development plan between itself and Taiwan, whereby each country would produce 50% of the necessary components for a passenger car and barter the products for assembly in each country.⁴⁹ Marketing and service would be the responsibility of each country. The existing vendors producing the items to be mass-produced by the other country should be encouraged to maintain and update their facilities so as to be

⁴⁸ Killing, J. Peter. "Understanding Alliances," in Contractor, J. Farok and Lorange, Peter, eds., *Cooperative Strategies in International Business*. Lexington, Mass.: Lexington Books, 1988. p56.

⁴⁹ Nam Pyo Suh. *An Assessment of Critical Issues Confronting the Korean Machinery Industries*. July 1980. p13.

competitive. In some cases, government subsidies for these vendors may be necessary.

China is building its own automobile industry. Although it has the advantage of low labor costs, China needs more experience and technology in order to develop its industry. There is a delicate relationship between Taiwan and China: these two entities used to be enemies in politics, however, they are close together in economic development today. Taiwan needs advantages in low labor cost and large market, on the other side, China is eager to acquire technology and experience. Although Japanese and American firms might be better partners for China, there are physical reasons why Taiwan is in a better position to help China develop its automobile industry as stated in China factor.

Exhibit 38: Growth in Strategic Alliances, Automobile Industry

| Region | 1980-1984 | | 1985-1989 | | Percentage Change |
|----------------------|-----------|---------|-----------|---------|-------------------|
| | Number | Percent | Number | Percent | |
| United States-Europe | 10 | 39 | 24 | 30 | 140 |
| United States-Japan | 10 | 39 | 39 | 49 | 290 |
| Europe-Japan | 6 | 23 | 16 | 20 | 167 |
| Total | 26 | 100 | 79 | 100 | 203 |

Source: United States Congress, Office of Technology Assessment, 1993, figure 5.3.

Exhibit 39: Reasons for Strategic Alliances in Automobile Industry, 1980-89

| | | |
|--------------------------|------------------------------------|-----|
| Automobile Industry | Number of Alliance | 205 |
| Main Reason For Alliance | High Cost Risks | 4% |
| | Lack of Financial Resources | 2% |
| | Technology Complementarity | 27% |
| | Reduction Innovation Time Span | 22% |
| | To Share Basic R&D | 2% |
| | Market Access/Structure | 52% |
| | Monitoring Technology/Market Entry | 4% |

Source: Hagedoorn and Schakenraad (1990a).

5.5 Promotion of Parts Industry

5.5.1 Characteristics of Taiwan's Automobile Parts Industry

The characteristics of Taiwan's automobile parts industry can be examined in three groups, namely the OEM supplier for the domestic market, the suppliers for the international new car market, and suppliers for international aftermarket. First, the Taiwanese OEM suppliers for the domestic market are flexible. Because the demand is low, they have to produce different parts and even supply competing assemblers. The labor force is relatively well educated, their responses to modifications on design or manufacturing process is quick, extensive, and friendly. In recent years, they have been cooperating with assemblers to improve product manufacturing and management. Although they are good at modification, they are relatively weak in design and development. Excess capacity is a problem they should solve in order to meet challenges in the future. Second, the suppliers for the international new car market are very internationalized. Some of them, such as wire harness suppliers, are very competitive in terms of quality, cost, and delivery. Since the technology requirements for these parts are relatively low, their position might be replaced by other new entrants. Third, the suppliers for international aftermarket are flexible and competitive in cost; however, they have to deal with problems like the appreciation of the NTD (New Taiwan Dollar), and increasing wages.

5.5.2 Future Opportunities

The Taiwanese government has announced its intentions to follow the example of Belgium, "Europe's parts center," to nurture Taiwan into becoming "Asia's parts center." Belgium does not make its own brand of cars; however, its parts industry is very strong, and many famous European car makers manufacture components and assemble cars in

Belgium. The Belgian parts industry contributes 15 percent of Belgium's total GNP.⁵⁰

Exhibit 40: Automotive Component Exports from Developing Economies

| Country | 1980 | 1985 | 1987 | Percentage Change 1980-1987 |
|-----------|------|-------|-------|-----------------------------|
| Taiwan | 94.7 | 345.6 | 618.3 | 552.9 |
| Argentina | 63.3 | 62.9 | 67.2 | 6.2 |
| Singapore | 82.6 | 78.5 | 98.4 | 19.1 |
| Thailand | 9.3 | 11.4 | 21.3 | 129.0 |
| Korea | 20.5 | 93.0 | 181.0 | 782.9 |
| Malaysia | 2.7 | 3.7 | 5.7 | 111.1 |

Units: Million US Dollars

Source: United Nations Trade Data, 1989.

Taiwan's situation is very similar to that of Belgium. Most of the major world auto makers already assemble cars in Taiwan; Taiwan just lacks a strong parts industry. In 1991, there were 2,657 companies related to automobile manufacturing. Companies with less than 100 workers accounted for 95%. Taiwan can start exchanging parts with other manufacturing affiliates in order to lower costs for both. Therefore, current government policy imposes upon firms which import parts and components from Japanese partners the responsibility to sell back domestic parts. The minimum ratio of exports for parts and components to total imports is 2.5% in 1991 and has increased annually to 10% in 1995. Moreover, firms can consider international manufacturing and interchange systems based upon national specialization in components

⁵⁰ Su, Justin C. 1992. *Factors Impeding the Growth of the Taiwan Automobile Industry*. Master Thesis, Sloan School of Management at MIT. p88-89.

or products. The possibilities include the manufacture of specialized components and parts, responsibility for a particular vehicle line, specialization in low-volume replacement parts for obsolete models, or the reconditioning of engines and parts.

Exhibit 41: Exports of Parts From Taiwan to Affiliate OEMs in 1993

| System | Million N.T. Dollars | Percentage of Exports |
|-------------|----------------------|-----------------------|
| Yue Loong | 1,274 | 24.75% |
| Kuozoi | 1,040 | 15.00% |
| Chung Hwa | 1,024 | 20.71% |
| San Yang | 858 | 16.72% |
| Ford Lio Ho | 494 | 9.00% |
| Yue Tyen | 148 | 9.40% |
| Da Ching | 65 | 5.48% |

Source: Industrial Bureau of the Ministry of Economic Affairs, Republic of China

The Taiwan auto and part makers are preparing themselves to become major parts and components suppliers for the Japanese auto makers. The Japanese auto makers are setting up a network of manufacturing facilities throughout Asia in its push towards specialization in manufacturing. For example, Shoichi Toyoda, President of Toyota Motors of Japan, said that Toyota’s globalization plan is to “optimize its operations by planning and managing all of them from a global perspective.”⁵¹ This means buying parts, building cars, and selling them around the world regardless of national boundaries. The world would become a giant Toyota City and Toyota will establish operations wherever they make economic sense.

Toyoda said that Asia is an example of how Toyota would like to operate in the future. Toyota has built a network of production facilities

⁵¹ Alex Taylor III. 1990. “Why Toyota Keeps Getting Better and Better and Better,” *Fortune*.

in Thailand, Indonesia, Malaysia, and the Philippines, and Taiwan, specializing in certain parts and components it has a competitive advantage in , while still continuing to manufacture complete vehicles in each nation. It has established a long term and stable part supplying network, which will help it capture a bigger share of the growing Asia auto market. By supplying each other with components, Toyota's plants in these countries can achieve greater economies of scale with each item than if they try to manufacture everything alone.⁵²

5.6 Development of Export Markets

The ability to export automobiles is crucial for the Taiwanese auto industry. Because of Taiwan's small and saturated domestic market, the only viable way for the Taiwanese auto industry to develop and grow is to export. Exports would solve its upstream and downstream capacity problems and help it break out of the vicious cycle it is currently entangled in.

Exhibit 42: Foreign Trade Orientation in Vehicle Sector, Early 1990s

| Region/Country | Share of Output Going to Exports (percent) | Share of Supply Coming from Imports (percent) |
|-------------------|--|---|
| Mexico | 35 | 5 |
| Brazil | 20 | negligible |
| Republic of Korea | 25 | <1 |
| Taiwan, China | <1 | 30 |
| Indonesia | negligible | negligible |
| Malaysia | 10 | 13 |
| Thailand | 7 | 3 |

⁵² Toyota Motor Corp. Annual Report. 1990.

Source: United Nations, International Commodity Trade Data Base; and Automotive Manufacturers' Associations of Argentina, Brazil, Indonesia, India, Malaysia, Thailand.

5.6.1. Improvement in Quality and Technology

Quality is of the utmost importance before firms start exporting. Suppliers must strive to apply a "zero defect" philosophy to their operations as well as to ensure that their product performs harmoniously with the other parts of the car. At the same time, car manufacturers should help their suppliers to develop a strong capability in product design and technological innovation. That means that they must invest a lot on R&D.

The quality and reputation of a car directly influence its sales. In the early stage of Hundai's exports to the North American market, the bad reputation of the Excel it produced had pushed Hundai to spend more on research to rebuild its image. Feeling 101, the first Chinese-designed car, was introduced to both domestic and foreign markets by Yue Loong in 1986. In spite of the high expectations of the Taiwanese people, this car failed in its sales due to the quality problems. In order to ensure the project's success, Yue Loong set up an engineering division of 300 technicians and spent more than NT \$2 billion on the car's design and development. After an initially favorable reception, customers began to complain because the locally produced components broke down. Sales slumped after a weak promotion campaign. Only 9,450 units were sold in the first year and 3,846 in the second.

In fact, feeling the pressure of lower labor advantages from other developing countries such as China, Malaysia, and Thailand, the Taiwanese government has tried hard to raised its technology level and product image. MOEA is pressing the country's car makers to triple their R&D budgets by 2000. Although the quality of Taiwanese cars is

improving, however, Taiwanese car-parts makers have found their exports hindered by a poor image overseas. Therefore, the Taiwanese government aims to educate consumers worldwide that Taiwanese products are equal in quality, design, and price of those made anywhere.⁵³

Recently, Taiwan automobile firms have succeeded in changing their position from technology input to technology output. For example, Chun-Hwa Motor CO and TEMSA group in Turkey signed up a contract to produce a new model, which is designed by Chun-Hwa Co. This 1.1L commercial car will be on sale soon in Turkey. The annual production is 3,000 units in the first year and gradually increases to 24,000 units in the fourth year. Except providing the technology, parts, Chung Hwa Motor Co. will also help Turkish manufacturers to promote their part industries and raise their local content ratio. Right after that, Chun-Hwa got the approval from Mitsubishi Co. in Japan to output its technology and cooperate with Sun-She Motor. Group in China to produce Mitsubishi commercial cars named Delica with a annual production of 7,200 units. This is a good direction for other manufacturers to follow.

In addition, automobile manufacturers should also notice the worldwide trend toward automobile demand and prepare themselves for the technology changes. For example, Environmental Priority Strategy (EPS) has been integrated into the decision-making process together with the traditional cost analysis. Environmental cars which have less weight, less emissions, and are more recyclable have become more popular in Germany and this concept will spread around the world soon. Another example is the change in materials. The replacement of steel sheet with plastics or aluminum is gradually increasing because of their light-weight property, which implies more fuel-economy and better performance.

⁵³ "It's very well made in Taiwan," in *Nation's Business* Jan 1993. p29.

Exhibit 43: Estimated Development of Material Content. 1989-2000

| | Iron/Steel | Aluminum | Plastics |
|-----------------|------------|----------|----------|
| Model Year 1989 | 71 | 3 | 7 |
| Model Year 1990 | 65 | 5 | 13 |
| Model Year 2000 | 60 | 8 | 17 |

Source: Consultants for Trade and Industry. *European Industry's Investment Outlook in LDCs*. June 1989.

5.6.2 Expansion of Export Markets

The number of countries for Taiwan to export assembled cars in the near future is limited. First, firms from similar developing countries such as South Korea and Mexico have occupied the huge European and North American markets by their cars they produced with good quality, reasonable price, and any other advantage Taiwan might have. The regionalism in these regions makes it more difficult for outside firms to compete with local advanced ones. Second, selling cars back to Japan is also very difficult. Japan's strict quality standard, competitive marketplace, efficient manufacturing process, and its low car prices all make this option unrealistic for Taiwan auto makers. Finally, markets in the newly developing countries in East Asia region are even well protected by their governments and difficult to enter.

Recognizing that the models produced in Taiwan are not economically efficient and knowing that Taiwan is going to join GATT, some Taiwanese manufacturers are trying hard to find overseas production base and through the enlargement of production, they can lower their costs of production. Among those possible countries, China, with the same race, language, and culture, is the best choice for Taiwan to export. However, although Taiwan firms have a special advantage in economic cooperation with China, they are also taking a decreasing political risks. Therefore, it is crucial for the producers to diversify their

export market, not only concentrate on one market. Actually, we can see this strategy already adopted by the Korean firms. They penetrated the American market first and then followed by relying less on the US market and increasing exports to Europe.

However, it is impossible for Taiwan to export its own brand of car in current stage. First, the government is not supportive enough, especially since it is moving towards a less protective economic policy. Second, the auto makers have no experience selling abroad. Third, the cost for advertising and setting up a sales network abroad is too high, and Taiwan auto makers don't have that kind of financing. And finally competition abroad from the established foreign brand names is too tough. Facing the difficult to export its own brand, the best strategy for the Taiwan auto makers is to export using its foreign partner' brand name and sell through their export and market channels abroad. This kind of third country trade has been gaining acceptance by Japanese auto makers. For example, Toyota has been producing the "Kijiang" (Asia Car) in Indonesia for export to other Asian countries.⁵⁴

⁵⁴ Su, Justin C. 1992. *Factors Impeding the Growth of the Taiwan Automobile Industry*. Master Thesis, Sloan School of Management at MIT. p80-81.

BIBLIOGRAPHY

Arnold, Walter. 1989. "Bureaucratic Politics, State Capacity, and Taiwan's Automobile Industrial Policy," in *Modern China*.

Alex Taylor III. 1990. "Why Toyota Keeps Getting Better and Better and Better," in *Fortune*.

Asare, Henry R., and Kim, Yoonsuh. 1990. *The South Korean Automobile Industry: A Study of Korea's Export Strategy*. Master Thesis, MIT.

Asian Survey. Nov. 1992. v32. "Export Processing Zones in Asia: A Comparative Study."

Auto & Truck International. 1993. *1992-93 World Automotive Market Report*. Des Plaines, Illinois: Johnston International.

Automotive News. 1992-1993.

Baranson, Jack. 1969. *Automotive Industries in Developing Countries*. Baltimore: The Johns Hopkins Press.

Bhaskar, Krish. 1980. *The Future of the World Motor Industry*. New York: Nicholas Publishing Co..

Business Week. 1992-1994.

China Information Bureau. 1990. *Annual Report of Taiwan's Manufacturing Industries: Automobile and Motorcycles*. Taipei, Taiwan. In Chinese.

China Post. Sept. 9, 1991. "There Is No Hurry to Have Our Own Automobile Brand." Taipei, Taiwan. In Chinese.

Chu, Yun-han. 1994. "The State and the Development of the Automobile Industry in south Korea and Taiwan," in *The Role of the State in Taiwan's Development*, eds. Joel D. Aberbach, Davis Dollar, and Kenneth L. Sokoloff. Armonk, New York: M.E. Sharpe.

Cinneide, Barra O. 1993. "Going Global-The Ford "Mondeo"," Wellesley, Massachusetts: European Case Cleaning House(ECCH).

Dornbusch, Rudiger and Fischer, Stanley. 1994. *Macroeconomics*, 6th ed. McGraw-Hill, Inc.

Executive Yuan, Republic of China. 1991. *Statistical Yearbook of the Republic of China*.

Facts on File. 1993.

Far Eastern Economic Review 1984-1992.

Forbes. Oct. 9, 1992. V150. "Meeting the Challenge of A New World Order: the Republic of China at eighty-one."

Frost, Anthony and Frost Ann. 1994. "Magna International and the North American Free Trade Agreement," Sloan School of Management, MIT.

Green, Andrew E. 1992. "South Korea's Automobile Industry: Development and Prospects," in *Asian Survey*. The Regents of the University of California.

Hong, Roy W. 1984. *The World Automobile Industry: Penetration Strategy of Hyundai Motor Co.*. Master Thesis, MIT.

Industrial Bureau of the Ministry of Economic Affairs, Republic of China. 1994. "Transportation Industry," in *1993 Yearbook of the Industrial Development in Republic of China*. In Chinese.

Industrial Bureau of the Ministry of Economic Affairs, Republic of China. 1994. *Research of the Impact of GATT to Taiwan's Automobile Industry and Future Strategy*. In Chinese.

Krugman, R. Paul and Obstfeld, Maurice. 1994. *International Economics: Theory and Policy 3rd edition*. New York: HarperCollins College Published.

Kuozui Motor Co. Ltd. 1989. *Suggestions for the Development of the Taiwan Automobile Industry*. In Chinese.

Lai, Shyh-Bao. 1992. "Strategy for Technology Development of Taiwan's Automobile Industry: A Case Study of Yeu-Tyan Machinery," in *Taiwan's Enterprises in Global Perspective*. ed. NT Wang. Armonk, New York: M.E. Sharpe.

Lee, David. 1987. *The Automobile Industry in China*. Master Thesis, Sloan School of Management at MIT.

Motor Magazine. 1994-1995. Taipei. In Chinese.

Nation's Business. Jan 1993. "It's very well made in Taiwan."

Porter, Michael E. 1990. "The Competitive Advantage of Nations," Harvard Business Review.

Santoso, Murniaty. 1989. *A Strategic Analysis of the Indonesian Automotive Industry*. Master Thesis, Sloan School of Management at MIT.

Su, Justin C. 1992. *Factors Impeding the Growth of the Taiwan Automobile Industry*. Master Thesis, Sloan School of Management at MIT.

Suh, Nam-Pyo. 1980. "An assessment of Critical Issues Confronting the Korean Machinery Industries," A preliminary report to the Economic Planning Board, Republic of Korea.

The Economist. 1992-1995.

Toyota Motor Corp. Annual Report. 1990.

Wang, Kung. 1989. "Development Strategies for the Automobile and Parts Industry of the Republic of China," A study in IMVP International Policy Forum.

Wilks, Steven. 1984. *Industrial Policy and the Motor Industry*. Manchester University Press.

Womack, P. James, Jones, T. Daniel, and Roos, Daniel. 1990. *The Machine that Changed the World*. New York: Rawson Associate.

Womack P. James. 1987. "The Development of The Chinese Motor Vehicle Industry: Strategic Alternatives and The Role of Foreign Firms," A study in International Motor Vehicle Program, Massachusetts Institute of Technology.

World Journal. 1995. New York.

World Motor Vehicle Data. 1990.

Yannis, Karmokolias. 1990. *Automotive Industry Trends and Prospects for Investment in Developing Countries*. Washington, DC: The World Bank and International Finance Corporation."

Yannis, Karmokolias and O'Brien, Peter. 1994. *Radical Reform in the Automotive Industry: Policies in Emerging Markets*. Washington, DC: The World Bank and International Finance Corporation."

Zhou, Chi-Hung. Aug., 1991. "Automobile Parts Empire Is not A Dream," in *Excellence Magazine*. Taipei. In Chinese.