U.S. GLOBAL COMPETITIVENESS: THE U.S. AUTOMOTIVE PARTS INDUSTRY

Report to the Committee on Finance, U.S. Senate, Investigation No. 332-232 Under Section 332 (g) of the Tariff Act of 1930

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PREFACE

On September 1, 1986, at the request of the Committee on Finance of the U.S. Senate, 1/ the U.S. International Trade Commission instituted investigation No. 332-232, U.S. Global Competitiveness: The U.S. Automotive Parts Industry, under section 332(g) of the Tariff Act of 1930 (19 U.S.C. 1332(g)). 2/ The Commission was asked by the Committee on Finance to provide information on, and analyze, measures of the current competitiveness of the U.S. industry in domestic and foreign markets; the competitive strengths of U.S. and major foreign competitors in these markets; the nature of the main competitive problems facing the U.S. industry; the sources of these problems and to what extent they are transitory or reversible situations as opposed to fundamental or structural problems; and the competitive strategies of U.S. and foreign industries and the importance of global markets to future competitiveness. The study also includes a detailed analysis of selected key products 3/ that are important to the U.S. automotive parts industry and are representative of different segments of the industry in terms of manufacturing process, import competition, marketing, and its financial condition.

Notice of the investigation was given by posting copies of the notice of investigation at the Office of the Secretary, U.S. International Trade Commission, Washington, DC, and by publishing the notice in the Federal Register (51 F.R. 27263, July 30, 1986). 4/

The Commission held a public hearing on this investigation as well as the four others in this series (investigation Nos. 332-229 through 332-233) 5/ at the U.S. International Trade Commission Building in Washington, DC, on February 24, 1987. At that time, 15 separate interested parties presented testimony in connection with this investigation. 6/

In the course of this investigation, the Commission compiled data and information from questionnaires received from 243 producers, 163 importers, and 112 purchasers. 7/ This listing was derived from mailing lists in previous Commission investigations, a Trinet Market Share Report, the Custom's Net Import File, and individual firms in the automotive parts industry. U.S. producers responding to the questionnaire accounted for over 90 percent of total industry shipments 8/ during 1982-86. In addition, data provided by

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1/ The request from the Committee on Finance is reproduced in app. A.
2/ Commissioner Rohr did not participate in this investigation.
3/ The products covered include batteries, bearings, engines, autosound components, shock absorbers, transmissions/transaxles, and tires.
4/ A copy of the Commission's Notice of Investigation is reproduced in app. B.
5/ The Committee on Finance also requested that the Commission conduct investigations on U.S. international trade competitiveness with respect to building block petrochemicals and major consuming industries; the U.S. textile mill industry; optical fibers, technology and equipment; and the steel sheet and strip industry.
6/ See calendar of witnesses in app. C.
7/ A discussion of the survey design and methodology appears in app. D.
8/ Total industry shipments compiled from official statistics of the U.S. Department of Commerce.

producers in the seven selected products represented an estimated 85 to 95 percent of their respective industry shipments. Finally, information was gathered from various public and private sources: U.S. Embassies and consulates, interviews with domestic parts firms; foreign automakers and parts companies in Japan, Taiwan, Korea, and Brazil; importers; and purchasers of automotive parts, as well as from public data gathered in other Commission studies. 1/

The information and analyses provided in this report are for the purpose of this report only. Nothing in this report should be construed to indicate how the Commission would find in an investigation conducted under other statutory authority covering the same or similar subject matter.

1/ In the use of this report it should be noted that during the period covered by this investigation, 1982-86, the general price level in the United States, as measured by the gross national product price deflator, increased by 14 percent. To express dollar values contained in this report in constant 1982 dollars, the values presented may be divided by the following factors: 1983--1.04, 1984--1.08, 1985--1.11, 1986--1.14.

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EXECUTIVE SUMMARY

The U.S. automotive parts industry is composed of some 15,000 firms that produce finished components used in autos, trucks, and buses. The major focus of the automotive parts industry is the production and sale of original equipment parts to motor-vehicle producers, and to a lesser degree, replacement parts to the aftermarket.

The economic health of the parts industry is directly related to the health of the motor-vehicle industry; thus, U.S. shipments of auto parts generally follow trends in U.S. auto production. U.S. sales of parts peaked in the late 1970's, decreased during the economic recession of 1980-82, then increased during 1983-86.

Owing to several empirical obstacles, the size of the domestic market for auto parts and the relative importance of imports into this market have been difficult to measure. In recent years, increased imports of motor vehicles have slowed U.S. auto production and therefore diminished the size of the domestic market for parts. At the same time, while imports of parts have increased substantially there have been difficulties in quantifying the magnitude of these imports because many auto parts are imported as components of engines and other assemblies. However, the Commission has been able to obtain sufficient data to estimate both the size of the domestic auto parts market and measure the relative importance of imports.

According to questionnaire data presented in table A, U.S. shipments of automotive parts increased irregularly during 1982-86, rising from $51.1 billion in 1982 to $83.0 billion in 1986, or by 62 percent. Net profits before taxes, however, followed a different trend, increasing from $4.0 billion in 1982 to $10.8 billion in 1984, and then declining to $8.3 billion in 1986. Employment in the U.S. automotive parts industry during 1982-86 rose by 21 percent, from 504,580 workers in 1982 to a peak of 610,570 workers in 1985, then decreased by 3 percent to 591,638 workers in 1986. The U.S. auto parts trade deficit and the imports to consumption ratio both increased substantially during 1982-86. The U.S. trade deficit rose from $1.2 billion in 1982 to $10.0 billion in 1986, and the ratio of imports to consumption increased from 13 percent to 20 percent during the corresponding period (fig. A).

Based on comparisons of data compiled from responses to the Commission's questionnaires with broader industrial measures, sales by the U.S. auto parts industry expanded more rapidly than the durable goods component of the U.S. gross national product (GNP), the overall GNP, and all manufacturing, but not quite as rapidly as the entire motor vehicle and equipment industry (table B). Shipments of auto parts increased by an average annual rate of 12.6 percent during 1982-86, compared to increases in shipments of motor vehicles and equipment (13.1 percent), durable goods (9.4 percent), overall GNP (8.2 percent), and all manufactured goods (3.8 percent). The increase in shipments of auto parts is largely attributable to the strong rebound in the automotive sector during 1983-85. Employment followed trends in shipments; the number of production and related workers employed by U.S. parts makers increased at an average annual rate of 4.1 percent during 1982-86, which overshadowed the decline in all manufacturing (-0.8 percent), but was slower than the rate for the motor vehicle and equipment industry (6.3 percent).

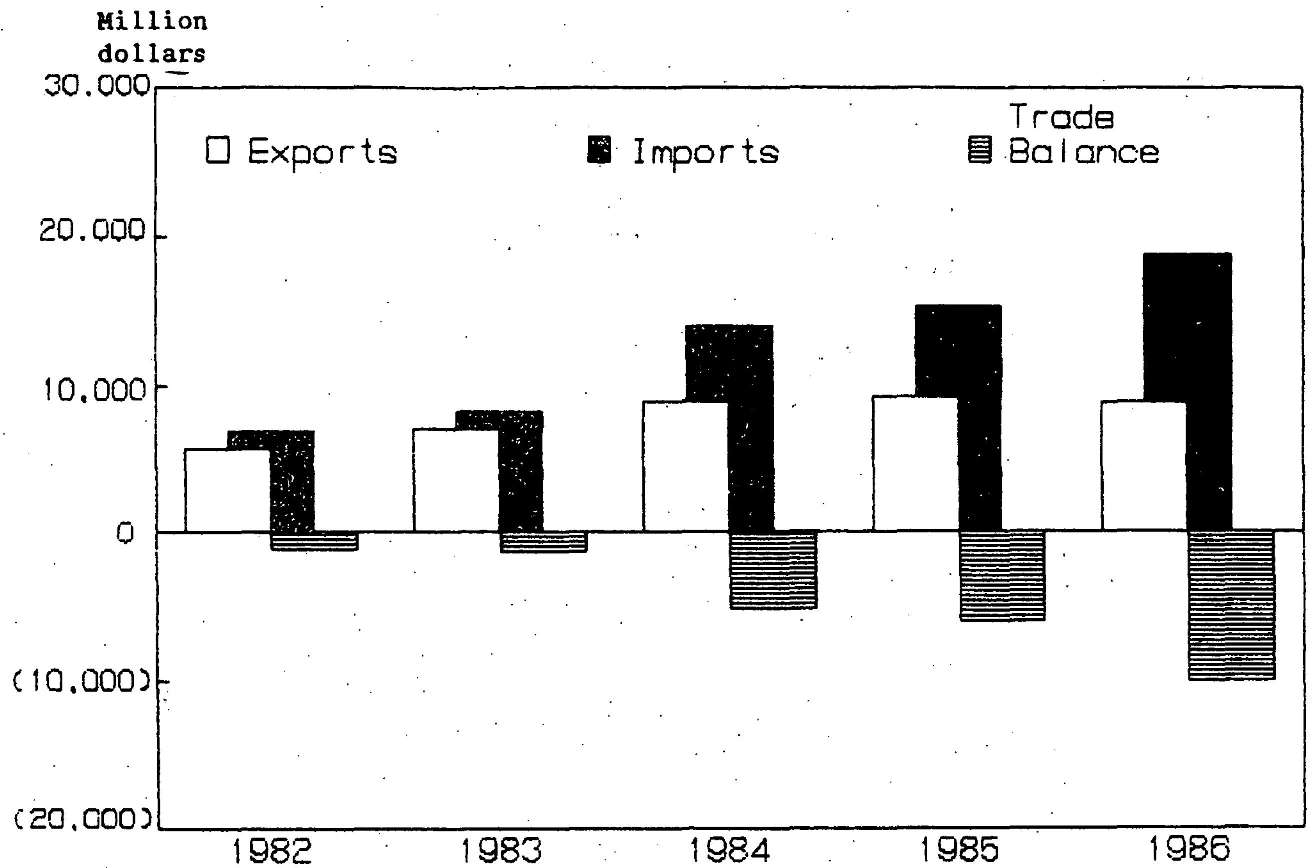
Table A
Profile of the U.S. automotive parts industry and market, 1982-86

Item	1982	1983	1984	1985	1986	Absolute change, 1986 from 1982	Average annual percentage change, 1986 over 1982
Shipments:							
Total (million dollars).....	51,146	61,605	75,187	84,459	82,992	31,846	12.9
Industry coverage (percent).................	92.3	91.1	91.6	95.9	87.8	-4.5	-1.4
Net sales 1/ (million dollars)...................	59,539	72,703	86,683	101,232	111,573	52,034	16.9
Net profit (before taxes) (million dollars).........	4,012	7,799	10,834	9,434	8,350	4,338	20.1
Ratio of net profits (before taxes) to net sales (percent)..................	6.7	10.7	12.5	9.3	7.5	.7	2.8
Capital expenditures:							
Domestic (million dollars)..	1,657	1,479	1,425	2,623	2,782	1,125	13.8
Abroad (million dollars)....	334	319	1,524	1,073	953	619	29.9
Total (million dollars).....	1,991	1,798	2,949	3,696	3,735	1,744	17.0
Ratio of domestic capital expenditures to shipments (percent)..................	3.2	2.9	3.9	4.4	4.5	1.3	8.9
R&D expenditures:							
Domestic (million dollars)..	1,269	1,355	1,597	1,642	2,074	805	13.1
Abroad (million dollars)....	142	137	172	204	282	140	18.7
Total (million dollars).....	1,411	1,492	1,769	1,846	2,356	945	13.7
Ratio of domestic R&D expenditures to shipments (percent)..................	2.5	2.2	2.1	1.9	2.5	2/	2/
Employment:							
Total (number)..............	504,580	537,045	596,283	610,570	591,638	87,058	4.1
Production and related workers (number)..........	445,344	459,352	554,965	563,334	554,117	108,773	5.6
Exports (million dollars).....	5,773	7,060	8,922	9,357	8,914	3,141	11.5
Imports (million dollars).....	6,941	8,238	14,001	15,396	18,950	12,009	28.5
Trade balance (million dollars)...........	(1,168)	(1,178)	(5,079)	(6,039)	(10,036)	(8,868)	71.2
Apparent consumption (million dollars)...........	52,314	62,783	80,266	90,498	93,028	40,714	15.5
Ratio of imports to consumption (percent).......	13.3	13.1	17.4	17.0	20.4	7.1	11.3
Ratio of exports to consumption (percent).......	11.0	11.2	11.1	10.3	9.6	-1.4	-3.3

1/ Some producers were unable to separate net sales of parts from overall operations; thus, net sales are greater than shipments.
2/ Less than 0.05 percent.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Figure A
Automotive parts: U.S. exports, imports, and trade balance, 1982-86



Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Along with the increase in shipments, the trade deficit in auto parts increased rapidly during 1982-86 at an average annual rate of 74 percent. During the same period, the trade deficits in all manufacturing and complete motor vehicles increased at slower rates of 47 percent and 35 percent per year, respectively. The rise in U.S. imports of parts largely reflects increased imports by General Motors, Ford, and Chrysler (the Big Three), an increase in the number of foreign-owned U.S. auto producers (which import much of their requirements for parts), and increased imports by other U.S. importers (truck manufacturers, mass merchandisers, trading companies, and other independent purchasers). At the same time, the import share of the U.S. market for parts increased at a faster pace than did the import penetration ratio for all manufacturing and complete motor vehicles during 1982-86.

Competition in the U.S. market for auto parts is expected to increase in the coming years as U.S. automakers continue to purchase parts from both domestic and foreign sources, Japanese auto producers located in the United States continue to purchase high-value components from Japan, and Japanese-owned parts firms open production facilities in the United States. Thus, U.S. parts makers are in a very competitive and increasingly

Table B
Comparisons of the U.S. automotive parts industry with other U.S. industries, 1982-86

Item	1982	1983	1984	1985	1986	Average annual percentage change, 1986 over 1982
U.S. gross national product (billion dollars)	3,069.3	3,304.8	3,662.8	3,998.1	4,206.1	8.2
Shipments:						
Durable goods (billion dollars)	499.9	555.3	655.7	703.5	716.8	9.4
Auto parts industry (billion dollars)	51.6	61.6	75.2	84.5	83.0	12.6
Motor vehicle and equipment industry 1/ (billion dollars)	110.1	144.4	176.4	186.1	2/ 180.4	13.1
All manufacturing (billion dollars)	1,960.2	2,054.9	2,253.4	2,279.1	2,273.3	3.8
Trade (deficit):						
Auto parts industry (billion dollars)	(1.1)	(1.1)	(5.1)	(6.0)	(10.1)	-74.1
Complete motor vehicles 3/ (billion dollars)	(14.6)	(20.8)	(27.9)	(37.7)	(48.6)	-35.1
All manufacturing (billion dollars)	(31.8)	(57.5)	(107.9)	(132.1)	(149.4)	-47.2
Employment:						
Auto parts industry (thousand persons)	505	537	596	611	592	4.1
Motor vehicle and equipment industry 1/ (thousand persons)	616	659	753	752	2/ 788	6.3
All manufacturing (thousand persons)	17,818	17,453	17,855	17,503	2/ 17,275	-.8
As a share of net sales:						
Capital expenditures:						
Auto parts industry (percent)	2.8	2.0	2.8	2.6	2.5	-
Motor vehicle and equipment industry 1/ (percent)	4.2	1.9	1.9	3.1	4/	-
All manufacturing (percent)	3.7	3.1	3.4	3.9	4/	-
Income before taxes:						
Auto parts industry (percent)	6.7	10.7	12.5	9.3	7.5	-
Motor vehicle and equipment industry 1/ (percent)	1.0	5.1	5.2	5.9	4.4	-
All manufacturing (percent)	6.3	6.2	7.0	5.8	5.8	-
Import penetration:						
Auto parts market (percent)	13.3	13.1	17.4	17.0	20.4	-
Complete vehicle market 3/ (percent)	25.0	22.6	19.1	26.4	30.0	-
All manufacturing (percent)	12.1	12.1	13.6	14.2	15.1	-

1/ Includes products in Standard Industrial Classification industry grouping 371.
2/ Estimated by the staff of the U.S. International Trade Commission.
3/ Only complete motor vehicles as defined in the Tariff Schedules of the United States.
4/ Not available.

Source: Unless otherwise noted, data for the auto parts industry are compiled from data submitted in response to questionnaires of the U.S. International Trade Commission; other data are compiled from official statistics of the U.S. Department of Commerce.

international market in which they must lower costs, improve quality, ensure timely delivery, and expand design and research and development efforts. The principal findings of the investigation are outlined below.

- Certain U.S. auto parts makers gained in competitive strength during 1982-86. However, many U.S. firms recognize the importance of continuing to improve quality, delivery, and costs in order to prosper in the 1990's.

Although the U.S. auto parts industry is gaining in competitive strength through the increased implementation of certain quality, delivery, and cost strategies, data compiled from the Commission's producer questionnaire indicate that many U.S. parts makers believe that all major countries producing auto parts (with the exception of West Germany), held an overall cost advantage compared with the United States with respect to 11 key areas that compose the cost structure of the industry. U.S. producers indicated that they held an advantage only in the cost of fuel vis-a-vis foreign competitors (pp. 8-3 and 8-4).

At the same time, three-fourths of U.S. producers believed that, overall, they were competitive in U.S. and major foreign markets during 1982-86. Certain production control techniques, such as statistical process control, just-in-time delivery, and the Taguchi method (p. 7-14) are being employed by U.S. parts makers to attain world-class quality standards. In R&D and engineering support, the U.S. industry is taking advantage of increasingly affordable computer software and hardware in systems such as computer-aided-design, computer-aided engineering, and artificial intelligence. Moreover, the U.S. industry is striving to increase communication and process standardization by means of commercial cooperative arrangements. In the marketing area, U.S. producers indicated their willingness to respond to customers, provide better service, sign long-term contracts, increase sales inventories, and offer rebates and longer warranties (pp. 7-20 and 7-21).

Based on experience to date, U.S. suppliers manufacturing commodity-type high-volume mechanical components will probably find themselves in a declining competitive position vis-a-vis other major parts-producing nations. U.S. parts makers producing components with relatively high technology requirements, or the need for flexible response to end user demand, could produce products competitive with major foreign suppliers (p. 10-5).

- U.S. auto parts producers have endeavored to maintain global market share through a variety of actions designed to enhance their competitiveness. In response to rising competitive pressures, U.S. parts firms are increasing their level of foreign investment, as well as their participation in joint ventures, mergers, and licensing arrangements.

The structure of the U.S. automotive parts industry has become increasingly complex in the last decade. The manufacture of auto parts has undergone a large degree of internationalization because of the activities as both automakers and parts producers of the Big Three, the changing demands on parts suppliers, and the domestic content requirements of foreign governments. U.S. motor vehicle manufacturers are beginning to award single-source, long-term contracts to independent suppliers, and are forging relationships with foreign motor-vehicle manufacturers to acquire both parts and complete vehicles. The internationalization of motor vehicle and auto parts manufacturing has enhanced the competitiveness of the parts manufacturers. Further complicating the structure of the industry, the large-scale introduction of electronics in automobiles has prompted new companies to enter the field, and pressed established firms to respond to changing demand. The competitive results of structural change could leave a U.S. industry composed of larger companies made up of smaller, more flexible units (pp. 3-1 to 3-7, 10-3).

- Based on estimates derived from motor vehicle production and registration data, world consumption of motor-vehicle parts is estimated to have increased from $210 billion in 1982 to $305 billion in 1986, or by 45 percent. In 1986, consumption of original equipment parts is estimated to have been $244 billion, and production of aftermarket parts, $61 billion.

World consumption of motor-vehicle parts is directly related to the number of new motor vehicles produced and the total number of automobiles, trucks, and buses currently in operation. It is estimated that 70 to 80 percent of total world parts production is used in the assembly of new automobiles, trucks, and buses, and the remaining 20 to 30 percent is destined for aftermarket use. In 1986, the United States produced almost 11 million motor vehicles, or almost 24 percent of the total world production (up from 19 percent of world production in 1982) (figs. B and C). The United States accounted for an even higher percentage of total world registrations of motor vehicles, with 172 million vehicle registrations in 1986, or 34.8 percent of the world total of 494 million registered vehicles (p. 2-2).

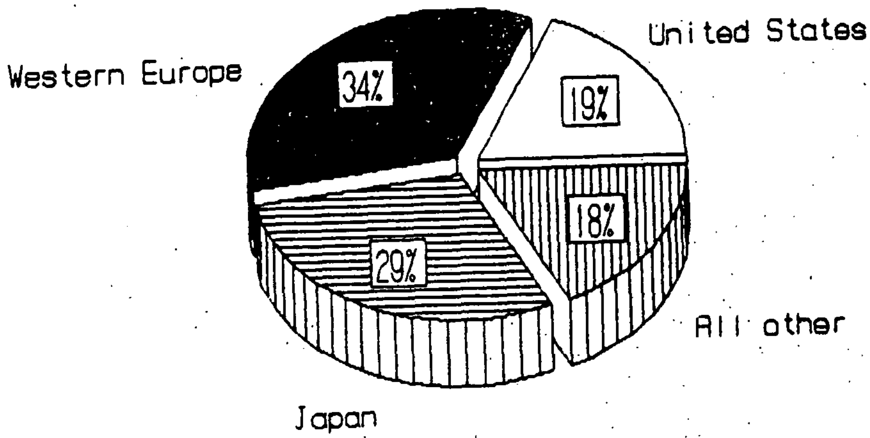
- In 1986, North America (the United States, Canada, and Mexico) accounted for over one-half of world automotive parts imports, up from a 37-percent share in 1982.

Total world parts trade (imports) increased by an estimated 53 percent during 1982-86. Europe was the second largest market after North America, accounting for an estimated 40 percent of the import total. The bulk of imports into North America, the Far East, and Western Europe were intraregional transactions. Developing country imports declined by an estimated 50 percent during the period (pp. 2-2 to 2-4).

- Domestic shipments of automotive parts by U.S. producers rose by 62 percent during 1982-86 and consumption of the parts profiled in this study increased overall by 78 percent. Both were outpaced by a tripling of imports.

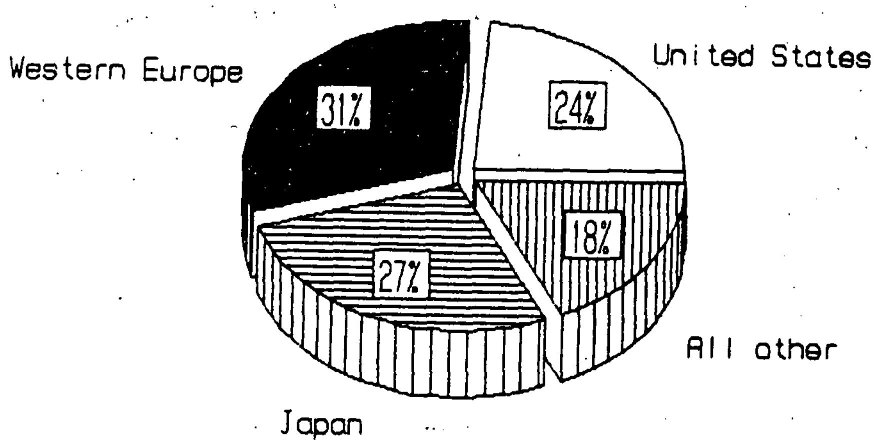
The rise in the value of domestic shipments of automotive parts during the period, from $51.1 billion in 1982 to $83.0 billion in 1986, and the

Figure B
Motor vehicles: World production by leading manufacturing countries, 1982



Source: Ward's Automotive Year Book, 1983.

Figure C
Motor vehicles: World production by leading manufacturing countries, 1986



Source: Ward's Automotive Year Book, 1987.

increase in consumption of parts to an estimated $93.0 billion in 1986 is closely linked to the strong rebound in the automotive sector following the economic decline of 1980-82. The parts producing subsidiaries of the Big Three, collectively, accounted for 53 percent of total U.S. shipments in 1982 compared with 62 percent in 1986. Factory sales of trucks rose by 81 percent to 3.4 million units, and passenger car sales increased nearly 50 percent to 7.5 million units in 1986. Apparent consumption of automotive parts rose at a higher rate than domestic shipments during 1982-86, because of accelerated growth in imports, which nearly tripled from $6.9 billion in 1982 to $18.9 billion in 1986 (pp. 3-2, 3-4 to 3-6).

- U.S. imports of automobiles during 1982-86 increased by almost 125 percent, in terms of value, and trucks increased by almost 97 percent during the same period. The principal causes for these increases include the effects of Japanese voluntary export restraints and the demand for more luxurious automobiles and lightweight trucks by U.S. consumers.

The combined total of U.S. imports of automotive parts and U.S. imports of motor vehicles increased from $30.7 billion in 1982 to $71.8 billion in 1986, or by almost 134 percent. The average annual percentage increase for autos/trucks and automotive parts during 1982-86 was 22 percent and 29 percent, respectively (p. 2-7).

- U.S. imports of automotive parts by the Big Three increased by more than 100 percent during 1982-86, to $5.6 billion, and imports by Japanese automakers located in the United States more than tripled from $486 million in 1984 to $1.6 billion in 1986.

The bulk of these imports were from either wholly owned subsidiaries of auto manufacturers or joint venture operations and were intended for original equipment use. In 1986, the Big Three imported engines, valued at $1.5 billion, and transmissions, valued at $1.0 billion, according to respondents to the Commission's questionnaire. Increased sourcing offshore underscores the growing internationalization of the motor-vehicle assembly and parts industries (pp. 2-5 to 2-6).

- The financial performance of the automotive parts industry was mixed during 1982-86, showing a strong climb in net sales and fluctuating profits.

The improvement in market conditions was reflected by an 88-percent increase in net sales, from $59.5 billion in 1982 to $111.6 billion in 1986. The ratio of net profits before taxes to sales rose from 6.7 percent to 12.5 percent during 1982-84, then fell to 7.5 percent in 1986. Capital expenditures and research and development (R&D) spending averaged to about 3 percent and 2 percent, respectively, of net sales during 1982-86 (pp. 3-8).

- There has been a tremendous increase in the level of foreign investment in the U.S. automotive industry in recent years. The impact of Japanese investment on employment in the auto parts industry has been a controversial subject; however, there are indications that such investment will represent an employment gain in the industry.

There is intense competition among U.S. State governments to attract Japanese and other foreign automakers and auto parts firms to locate in their States. Many U.S. parts makers claim that incoming Japanese firms will create overcapacity in an industry that is forecasted to have relatively slow rates of growth during 1988-97. The effect of having auto parts produced abroad and imported as opposed to producing them in the United States is to lower employment in the U.S. parts industry (pp. 5-4 to 5-10).

- The U.S. auto parts industry is affected by a number of U.S. and foreign government trade and nontrade policies. U.S. industry sources claim that unfair trade practices and nontariff barriers by foreign competitors serve as competitive impediments in both the U.S. market and foreign markets.

The U.S.-Canada Automotive Products Trade Act (APTA) of 1965 is aimed at expanding automotive trade between the two countries, and the Japanese Voluntary Restraint Agreement (VRA) provides temporary protection for the U.S. automobile industry by limiting imports from Japan. The Generalized System of Preferences (GSP) provides duty-free entry to certain products (including automotive) from designated countries, and the 806.30/807.00 tariff provisions allow U.S. automakers to take advantage of lower costs abroad by internationalizing operations. Foreign trade zones (FTZ's) are used for warehousing, transshipment, further processing, and exportation of domestic and foreign merchandise, and the market-oriented, sector-specific (MOSS) talks, which were concluded in August 1987, were principally aimed at increasing U.S. auto parts sales to Japanese automakers (p. 6-16). Nontrade related policies of the U.S. and State governments regulate and benefit the U.S. automotive parts industry in the areas of research and development, tax, safety, emissions, and fuel economy (p. 6-19).

U.S. producers allege that the domestic parts industry faces unfair trade practices affecting imports such as underpricing, dumping, subsidies, targeting, and counterfeiting. Nontariff barriers affecting U.S. exports include quantitative restrictions and similar specific limitations, strict distribution practices, nontariff charges on imports, government participation in trade, various standards, and customs procedures and administrative practices (p. 6-2).

- Auto parts production is becoming increasingly dependent on advanced manufacturing techniques; thus, the machine tool, computer, and robotics industries are developing a variety of automated production machinery.

U.S. auto parts producers have responded to competitive pressures by increasing the level of automation of their production processes. In addition, new advances in material usage and the proliferation of automotive electronics have stimulated the use of advanced manufacturing processes that utilize numerically controlled machine tools, computers, and robotics. A significant example is the plastics machinery industry. Plastics are becoming increasingly prevalent in automobile parts; as a result, the U.S. market for plastic machinery has grown from an estimated $750 million in 1982 to about $1.7 billion in 1986. U.S. producers currently dominate in the various U.S. markets for auto parts production machinery, and are continuing to innovate in product design to maintain market share. Foreign producers, principally from Japan and West Germany, have made significant inroads in the U.S. market for production machinery in recent years (pp. 7-1 to 7-12).

- Major U.S. upstream supplier industries would be affected by shifts in the level of competitiveness of the U.S. auto parts industry.

A number of U.S. industries are significantly affected by changes in the output of U.S.-made automotive parts. The supplying industries most likely affected by changes in the output of motor-vehicle parts are iron and steel forgings and foundries, the aluminum and nonferrous castings industry, and the electrometallurgical products industry. No other industry directly or indirectly supplied more than 25 percent of its output to the makers of auto parts. This implies that no other industry (besides those listed above) would experience more than a 12.5-percent drop in demand if the output of auto parts were reduced by one-half (pp. 9-1 to 9-3).

Shifts in materials content in passenger cars over the past decade (carbon steel declined by 29 percent, cast iron declined by 17 percent, high-strength steel increased by 87 percent, plastics increased by 33 percent, and aluminum increased by 63 percent) occurred in response to the auto industry's movement to produce lighter weight, more fuel efficient, better performing vehicles and to reduce production costs (pp. 9-4 to 9-5).

- The U.S. market for automotive electronics grew to $4 billion in 1986 and is expected to expand at about 10 percent annually through the turn of the century. At present, the most widespread application for automotive electronics is in engine management systems designed to increase fuel efficiency and decrease emissions.

U.S. automakers began using electronics in the mid-1970's to help achieve the federally mandated fuel efficiency and pollution control regulations. The regulations have become more stringent over the years, thereby spurring innovation in product design. As novel applications develop, new and sometimes exotic uses for electronics are being implemented for the safety, comfort, and convenience of the driver and passengers. Examples of new product innovations include electronically assisted brakes, suspensions, and transmissions as well as more esoteric systems like navigational control, heads-up display, and collision avoidance devices. The market for automotive electronics is likely to grow as more high technology electronics producers enter the market and electronic systems become increasingly commonplace. By the year 2000, industry sources indicate that the average value of electronics in an automobile may approach $2,000, (compared to about $525 in 1986), and the entire U.S. market for automotive electronics will be about $14 billion (compared to about $4.0 billion in 1986) (pp. 11-1 to 11-20).

INTRODUCTION

This report examines the factors affecting competitiveness in the global market for automotive parts. It profiles the U.S. industry and major foreign competitors and discusses the actions that U.S. firms have taken to become more competitive in both the domestic and world markets. The report also reviews the implications of structural changes for U.S. producers of automotive parts.

Competitiveness of the U.S. parts industry is a much discussed topic because of the increasing level of imports and the recent decline in exports, along with the rise in new U.S. parts production facilities established in the United States by foreign firms. It has been said that competitiveness is an idea that everyone understands, but no one can define or quantify. A discussion of the concepts and determinants of competitiveness can be found in app. D.

The U.S. automotive parts industry is currently undergoing a massive restructuring process. The major U.S.-owned motor-vehicle producers are in the process of decreasing their internal production of parts and outsourcing, turning to both independent domestic parts suppliers and foreign-owned parts firms. Concurrently, foreign-owned parts manufacturers are establishing U.S. production facilities to supply not only Japanese automobile and truck plants located in the United States and Canada, but also to compete with U.S.-owned parts producers. Thus, while nonintegrated U.S. parts producers have an opportunity to gain additional sales because of the increased outsourcing by the domestic vehicle manufacturers, they also face increased competition from offshore parts producers and from new foreign-owned firms in the United States.

As the world automotive industry expands its internationalization, so will the parts industry. Joint ventures and/or licensing agreements between companies located in different areas of the world have become a common method of entering a country. In addition, these ventures have added an additional source for components that may be utilized by both parties of the joint ventures, or exported to a third country. Finally, internationalization has helped new industrialized countries, such as Korea, Mexico, and Taiwan to become major sources of components, creating additional competition for U.S. parts producers.

Other key issues facing the industry are the changing relationships between management and labor, suppliers and purchasers, and business and Government. U.S. management and labor are learning that it is to their mutual advantage to work together, instead of maintaining an adversarial relationship. The industry is also working much more closely with its customers, especially in the design phase of components. Automakers are increasingly demanding a product with "no" defects and delivered at a specific time, so the relationship between the two has to be close. Finally, the Federal and State governments are providing various forms of aid, both financial and nonfinancial, to attract or retain the auto parts plants and are working closely with both the vehicle and parts manufacturers.

Manufacturing techniques, such as material substitution, increased use of robotics, and other new types of machinery, and new software concepts such as artificial intelligence, have dramatically changed the parts industry. Parts producers have also begun to employ many new management techniques and to make large expenditures for new machinery and research and development.

All of these issues, as well as many less important issues such as nontariff barriers and marketing policies, are thoroughly discussed and analyzed in this study. In addition, seven specific automotive parts are covered in detail in the final chapter of the report. These products are autosound components, batteries, bearings, engines, shock absorbers, tires, and transmissions.

CHAPTER 1. MAJOR FACTORS DETERMINING COMPETITIVE ADVANTAGES IN THE GLOBAL MARKET FOR AUTOMOTIVE PARTS

The three major factors that determine the competitive position of an automotive parts manufacturer are quality, cost, and the ability to deliver components in a timely manner. If a parts supplier cannot provide these three factors in the world automotive market in today's international environment, the probability that this manufacturer will continue operations profitably into the next decade is marginal. 1/ Virtually all major world-class motor-vehicle manufacturers stress that these three criteria must eventually be met by each supplier if the supplier and the vehicle producer are to remain competitive in the global market for motor vehicles.

There are many variables that lie behind the three major factors. During the last two years, the value of the dollar has declined substantially in relation to the currency of many of our trading partners, making U.S. parts suppliers much more cost competitive. Other variables are the costs of raw material; labor, capital, and utilities; government regulatory policies; government trade policies; educational levels of managers and production workers; production practices and technology (e.g., robotics, computer-aided design, and numerically controlled machinery); and supplier/customer relationships.

Price, Quality, and Delivery

During the Commission's hearing on the automotive parts industry, the president and chief executive officer of Nissan Motor Manufacturing Corp., U.S.A., testified that his company's procurement policy was very straightforward. "We source on the basis of three criteria: quality, cost, and timeliness of delivery," stated Nissan's president. 2/ He continued by saying, "This means that the quality of parts American companies offer us, must be as good as the quality we're getting from Japan or better, the cost has to be lower, and we must be assured of timely delivery." 3/ The vice president in charge of General Motors' materials management staff said that their new Supplier Assessment Program evaluates suppliers in areas of quality, cost, and delivery, as well as technology and management. 4/ He stated, "It is most important to think about suppliers in terms of the quality and the cost of their products, rather than thinking of suppliers from a geographical base perspective." 5/

The quality, cost, and delivery criteria are also well recognized by all major U.S. automotive suppliers. The president of the Budd Co., a major nonintegrated supplier of stampings, wheels, brakes, frames, and other

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1/ Arthur Andersen & Co., Cars and Competition, July 1987, p. 7.
2/ Transcript of the hearing, pp. 162-163.
3/ Ibid.
4/ Theodore G. Coutilish and Michelle Krebs, "Taking the Ax to Suppliers," Automotive News, July 27, 1987, p. E2.
5/ Ibid.

associated auto products, warns, "Automotive suppliers that don't have a cost competitive, quality image aren't going to be around over the long pull." 1/ According to Budd's president, all Budd divisions are emphasizing quality since there is a definite relationship between quality and cost reductions. Since vehicle manufacturers are seeking not only stable prices from their suppliers, but many times expect actual cost reductions over time for the components they purchase, the auto suppliers must reduce costs while maintaining quality levels.

While many world vehicle manufacturers have traditionally produced many of their own parts through wholly owned parts subdivisions, the trend in some auto companies is changing. For example, the Ford Motor Company at one time produced virtually all of its own parts. Ford now produces approximately half of its own parts, while General Motors produces approximately 65-70 percent of its requirements, and Chrysler produces less than 30 percent. 2/ However, all three companies have stated that their own subsidiaries no longer will automatically be selected as the supplier of a new part. Each subsidiary will have to bid against outside suppliers and meet all criteria in order to supply the specific part. The vice president of materials handling for General Motors summarized the automaker's position on outsourcing when he said, "We must sort out the best places to get things done, to buy materials and components at the most competitive cost, be they manufacturers outside of General Motors or manufacturers outside of the country." 3/

Supplier/Customer Relationships

Relationships between automotive parts suppliers and their principal customers, the vehicle manufacturers, vary widely throughout the world. In some countries, the major parts suppliers are wholly or principally owned by the vehicle producers. In other countries, the suppliers are mostly independently owned. Some vehicle manufacturers fully develop a new component and merely provide the specifications to the supplier. Other vehicle manufacturers and their suppliers work very closely together and jointly develop new components. In the past, many auto manufacturers signed short-term contracts with their suppliers (typically, 1 year in duration). Others negotiated 3- to 5-year contracts. These longer term contracts are becoming increasingly commonplace. The number of component suppliers that supply the identical product to the vehicle manufacturer varies from one to more than five, depending on both the individual manufacturer and/or the component involved.

Currently in Korea, there are approximately 820 auto parts producers; 55 are classified as large producers, and the remaining 765 are classified as small-to-medium-size producers. 4/ Of the large firms, all are either wholly or partially owned by the Korean vehicle producers, and almost 700 of the

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1/ "Budd Bounces Back," Automotive News, July 27, 1987, p. E28.
2/ Lynn Adkins, "Auto Suppliers Race Into The Future," Dun's Business Month, October 1986, p. 59.
3/ Ira G. Black, "Out-Sourcing Gains Momentum," Automotive Industries, June 1982, p. 9.
4/ USITC staff interview with Korean Auto Industries Corp. Association, Seoul, Korea, Apr. 29, 1987.

remaining 765 small-to-medium-size parts suppliers are affiliated with the vehicle manufacturers. 1/ In comparison, there are approximately 10,000 to 20,000 parts suppliers to the 10 principal Japanese vehicle producers in Japan, with 500 of these suppliers considered primary suppliers to the industry. 2/ However, unlike Korea, while the majority of the primary suppliers are affiliated with the auto producers, the small-to-medium-size firms are not.

In addition, whereas one major automaker in Japan has a direct relationship with only 200 to 300 parts makers, General Motors of the United States deals with approximately 3,500 different suppliers just for assembly operations. 3/ At an annual meeting of the American Die Casting Institute, the principal staff engineer of the research department of Ford Motor Co. mentioned that Ford had 2,300 large volume suppliers, but Toyota had only 250 large suppliers. 4/ According to a report conducted by a Japanese consulting group, the reason for the small number of Japanese companies with which direct business is conducted is because of the practice of "unit ordering," as the primary Japanese parts supplier is given the responsibility of subassembly as well. 5/ In addition, Japanese auto producers tend to limit the number of parts suppliers for each individual part, unlike many U.S. or European auto producers.

Japanese automakers have also tended to have longer contracts with their suppliers. With longer contracts and only one or two suppliers for each part, the customer/supplier relationship tends to be closer. The two parties are more likely to work out problems, and the suppliers know that they can plan their future financial and other requirements much easier knowing that they don't have to renegotiate a new contract each year.

European and U.S. automakers have tended to adopt Japanese practices in recent years. The resulting trend to limit the number of suppliers has accelerated dramatically during the last 5 years. European manufacturers are switching their purchases of parts from multiple to dual or single sources. A professor of operations management at Boston University said that single sourcing was being attempted in Europe by some auto companies, and that, if it is successful, more will try the method. 6/ Also, although the three major U.S. motor-vehicle producers (General Motors, Ford, and Chrysler) continue to have a large number of primary and secondary suppliers, they have drastically reduced the number of suppliers during the last 5 years. Ford has announced that although it intends to reduce the overall number of suppliers, at the

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1/ 1986 annual publication of the Korean Auto Industries Corp. Association, p. 33.
2/ The Structure of the Japanese Auto Parts Industry, Dodwell Marketing Consultants, 1983, p. 3, and "The Relationship Between Japanese Auto and Auto Parts Makers," Mitsubishi Research Institute, Inc., Feb. 6, 1987, p. 3.
3/ Ibid.
4/ Andrew Collier, "Die Casters Must Work Closely With the OEM's," American Metal Market, Nov. 11, 1980, p. 14.
5/ "The Relationship Between Japanese Auto and Auto Parts Makers," op. cit., p. 4.
6/ William Dullforce, "A Singular Way to Increase Competitiveness," Financial Times, Oct. 24, 1986, p. 14.

same time, it will try to concentrate on a few new suppliers that can provide better quality than some of the current suppliers. 1/ General Motors, which now has approximately 35,000 suppliers for all of its operations, hopes to cut this number to less than 18,000 in the future. 2/

State of Technology

Many of the basic technological developments for the auto industry originated in the electronics and aerospace industries, whereas most of the actual practical applications of the principles for the auto industry are developed by the automotive manufacturers and their primary suppliers, or in joint effort with technologically advanced industries. In some cases, the major auto producers and/or their component suppliers either own or are subsidiaries of electronics and/or aerospace companies.

Technology in the automotive industry can be separated into three basic areas. First, the level and types of technology in the motor vehicle itself, such as electronics usage or mechanical technology in the vehicle. Another area of technology is the type of machinery, both hardware and software, used in producing and designing the vehicle, as well as the type of machines used in the day-to-day operations of the particular company. Finally, the types of material used in the vehicle can also be used to help define the level of technology in the automotive industry.

Most advancements in technology in the motor vehicle itself during the last decade have been due to one of four factors: (1) fuel efficiency; (2) lower emissions, which decrease air pollution; (3) safety issues; and (4) electronics developments. After the second worldwide petroleum crisis in 1979, virtually every auto manufacturer in the world began developing new engines, transmissions, and other components which would increase the fuel mileage of their automobiles and trucks. Efforts to increase fuel mileage and lower emissions led auto manufacturers to further redesign their engines. In order to meet governmentally mandated safety regulations in most countries, auto manufacturers again faced major challenges requiring even more technological developments for their vehicles. Pressures to meet cost and quality considerations have stimulated increased adoption of electronic parts (see chapter 11).

In the area of manufacturing equipment, the automotive industry is again one of the leaders in technology developments. The U.S. automotive industry is the primary user of robotics, accounting for 50 to 60 percent of the world market for robots. 3/ Computer-aided design and computer-aided manufacturing (CAD/CAM) is used extensively by the automotive industry, and manufacturing automated protocol (MAP) is currently being pioneered by the automakers. 4/

1/ Joseph M. Callahan, "Ford's Looking for a Few (Good) Suppliers," Automotive Industries, July 1986, p. 30.
2/ Theodore G. Coutilish and Michelle Krebs, op. cit.
3/ Competitive Position of U.S. Producers of Robotics in Domestic and World Markets, USITC Publication 1475, December 1983, p. VII.
4/ Roger Rowand, "GM Moves Forward on MAP in Three Truck Plants," Automotive News, Aug. 10, 1987, p. 14.

Some of the other highly advanced manufacturing machinery and techniques used by the world automotive industry include computer-integrated manufacturing (CIM), automatic guided vehicles (AGV), machine vision, numerically controlled machine tools, and programmable stamping.

As autos and trucks have been required to become more fuel efficient and at the same time have been built to last longer, new materials have been developed to meet these demands. Processes such as hot-dip galvanizing and electrogalvanizing have been developed by the steel industry to prevent metal corrosion in body panels, making the vehicles last longer. 1/ In order to lighten the vehicle to increase fuel efficiency, many cast iron and steel components have been replaced with aluminum, plastic, and other lightweight materials. For example, in 1977, there were approximately 2,811 pounds of iron, steel, copper, and zinc in the average U.S.-built automobile. This dropped to 2,278 pounds by 1987. 2/ Plastic and aluminum usage during the corresponding period, however, increased from 265 pounds to 368 pounds per average automobile. 3/

Most of the new usage for aluminum has been in the engine and transmission where it has replaced cast-iron parts such as cylinder heads, engine blocks, and transmission cases. In some cases, aluminum has been used in body panels to replace steel, but most of the substitution for steel in the outer body panels of vehicles has been plastic. Automobiles have used plastic for the front and rear bumpers for a number of years, but in some current models, plastic is being used in hoods, suspension parts, and even fenders. One U.S.-based plastics company has recently developed a new process that it calls a low thermal mass mold. 4/ Once this process is perfected, the plastic component may be taken directly from the mold and installed on the vehicle, saving the manufacturer up to 50 percent in the cost of labor-intensive finishing of parts made by the current molding process.

Exchange Rate and Other International Economic Considerations

Exchange rate trends have tended to alter world trading patterns in the automotive parts industry, but have not been as significant as many believe. In virtually every case, there are many factors that alter patterns in auto parts trade, but seldom does an auto supplier build a new production facility in another country or outsource parts from another country based solely on currency trends. 5/ However, short-term fluctuations do have an effect on current pricing policies, and could alter trade between two countries until the currency fluctuation pattern reverses.

During the last 2 years, the U.S. dollar has declined substantially in relation to many of the world currencies, especially the Japanese yen and the West German mark, and to a lesser extent to that of some of the other major

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1/ Al Wrigley, "Material Usage," Wards Automotive Yearbook, 1987, p. 29.
2/ Ibid., p. 30.
3/ Ibid.
4/ "DuPont Develops Blow Molding Process For Out-of-the-Mold Class A Finish," Ward's Automotive Reports, Aug. 3, 1987, p. 243.
5/ Frank Gawronski, "Sayonara to Parts Suppliers," Automotive News, Dec. 15, 1986, p. E6.

U.S. automotive parts trading partners (see p. 8-10). This has caused an increase in the price of parts supplied to U.S. automobile producers from these countries, making U.S. parts suppliers more price competitive. 1/ It has also caused many of the foreign parts producers to change their procurement decisions and product mix. 2/

Some of the other major international economic considerations that affect the motor-vehicle manufacturing investment and parts trade include inflation and interest rates, capital costs and availability, investment policies, Government incentives and restrictions, debt levels, and political stability. For example, in certain Central and South American countries, inflation rates and political stability are very important factors regarding new or additional investments in parts production facilities. In the Far East, most of the countries are politically stable and have relatively little foreign debt burden (with the exception of Korea), and also provide various financial incentives for either joint ventures or wholly owned production facilities by foreign parts producers.

Labor Cost and Other Labor-Related Factors

Another factor determining the competitive position of the U.S. auto parts industry is unit labor cost. Unit labor cost depends on wage rate and labor productivity, where the latter also involves labor/management relations. Unfortunately, the Commission is not able to present data on unit labor cost primarily because of difficulties in measuring labor productivity for the large and widely diverse collection of auto parts produced. However, information was collected on wage rates (including fringe benefits) and certain aspects of labor/management relations. The substantial differences in wage rates across countries, particularly between industrialized and developing countries, are not a reliable indicator of differences in unit labor costs because wage rates are generally correlated with labor productivity, i.e., high wage countries tend to have high labor productivity.

Actual hourly compensation costs in 1985 for production workers in all manufacturing sectors for major manufacturing countries ranged from a low of $1.22 per hour in Brazil to a high of $12.72 per hour on average in the United States. 3/ Hourly compensation costs for production workers in the motor-vehicle and equipment manufacturing industry (SIC 371) for the 17 major auto producing countries in 1985 ranged from a low of $1.73 per hour in Brazil to a high of $19.73 for the United States. 4/ All of these data include benefits, which may be as little as 8 percent of actual hourly earnings in Mexico, to over 90 percent of actual hourly earnings in some European countries. 5/

1/ William J. Hampton, "U.S. Auto-parts Makers Get a Fighting Chance," Business Week, Dec. 1, 1986, p. 113.
2/ Phillip Burgert, "European Subcontractors Scrambling to Deal With Decline in Dollar's Value," American Metal Market/Metalworking News, Nov. 10, 1986, p. 7.
3/ Unpublished data prepared by the U.S. Department of Labor, Bureau of Labor Statistics, Office of Productivity and Technology, February 1987.
4/ Ibid.
5/ Ibid.

Labor/management relations in the automotive parts industry vary dramatically, depending on the country. Government policies in some European countries make it very difficult to lay off or terminate employees, but in other countries, the companies have much more control over the labor force. For example, in the United States, many parts workers belong to the United Auto Workers (UAW) Union, but the companies can temporarily lay off an employee, or even close a production facility, without getting the approval of the U.S. Government or the union. Labor/management relations in some countries are basically confrontational, yet in other countries, such as Japan or Taiwan, they seem to be somewhat more cooperative.

Capital Costs

U.S. producer responses to the Commission's questionnaire indicate a belief that foreign parts makers face lower capital costs than do U.S. parts firms. The measurement of capital costs is complex and the specific ways in which capital costs may be higher in the United States were not indicated in the questionnaires.

Market interest rates will vary across countries because of differing expected inflation rates, tax policies, perceived political risks, expectations of currency trends, and foreign exchanges and international capital movement restrictions. Costs of capital faced by individual firms will also depend on tax treatment of depreciation and new investment and property income, perceived riskiness of the firm and/or its industry, its ability to generate funds internally, and direct and indirect government subsidies, among other things.

Other Competitive Factors

Some other competitive factors that influence the international competitiveness of the automotive parts firms are cost of raw materials and other input factors (e.g., utilities and transportation), regulatory governmental policies (e.g., performance requirements and local content laws), educational levels of workforce, and types of training available for employees.

While many countries impose few trade barriers to imports of parts, some virtually exclude the importation of any automotive parts. The United States imposes virtually no trade barriers, and it does not limit U.S. investment by foreign companies. Basically, parts imported into the United States must meet the same safety and emission standards as parts produced by domestic manufacturers, and no additional requirements are placed on the importer except an average tariff rate of approximately 3.5 percent ad valorem. 1/ Other countries, such as Brazil, allow relatively few imported parts into the country, and require auto assemblers to purchase many of their components from Brazilian parts producers. 2/

Another related factor concerning a parts producer's competitive position in a specific country is related to costs of resources. If a country has to

1/ Estimated by the staff of the U.S. International Trade Commission.
2/ USITC staff interview with officials of General Motors do Brasil, Sao Paulo, Brazil, May 11, 1987.

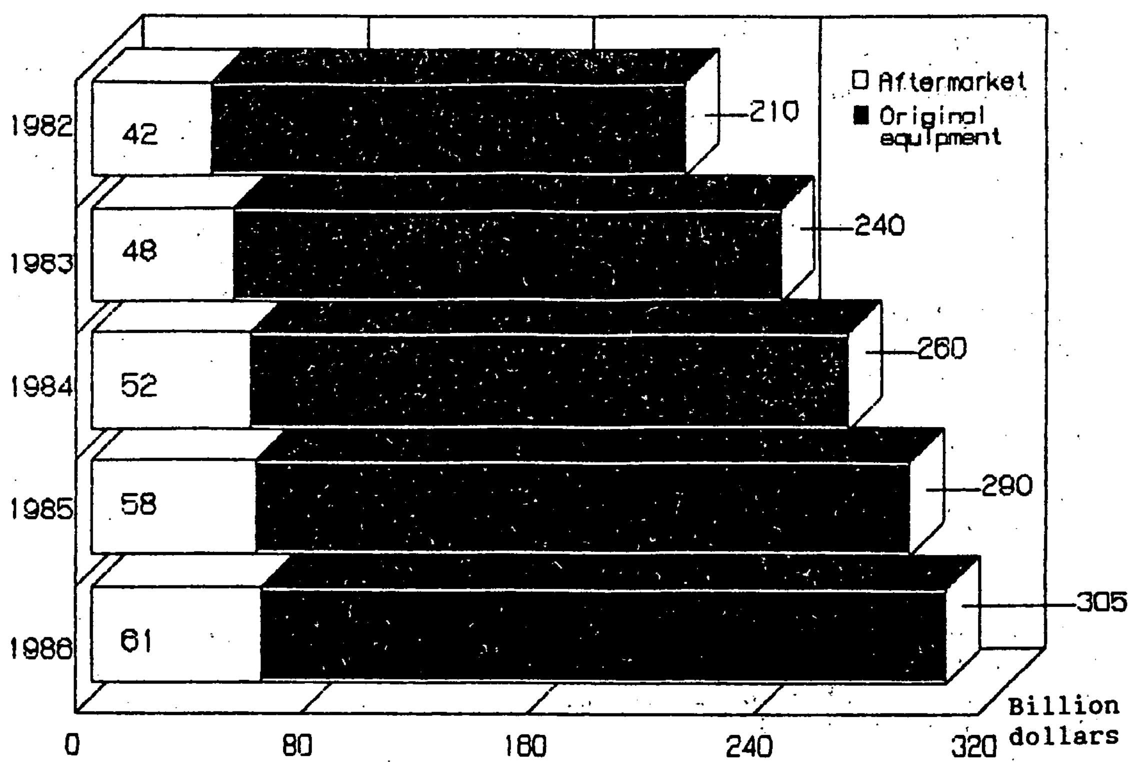
import most of its raw or semi-finished materials from distant sources, the transportation and related costs may make the parts less price competitive if the parts are then exported to a third country, or simply imported originally into that country as a finished component. Some countries have very low, sometimes subsidized, utility and fuel costs. Other countries or states/provinces within a country are sometimes willing to pay fully or partially a parts company's employee training expenses or other employment expenses. All of these factors, along with other cost-saving benefits, may entice either a motor-vehicle or parts manufacturer to produce within a particular country.

World Consumption

The Commission's estimate of world consumption of both original equipment and aftermarket motor-vehicle parts during 1982-86 are shown in figure 2-1. These estimates are based on questionnaire data collected by the Commission from the domestic automotive parts industry, official data published by the U.S. Department of Commerce, and interviews with foreign industry executives.

World consumption of motor-vehicle parts increased each year during 1982-86, although the annual rate of increase varied from a high of 14 percent in 1982-83 to 5 percent in 1985-86. World consumption of motor-vehicle parts is directly related to the production of new motor vehicles and the total number of motor vehicles in use. According to industry sources, an estimated 70 to 75 percent of world parts production is used in the assembly of new motor vehicles. The remaining 25 to 30 percent of auto parts are destined for the aftermarket where they are utilized either for repair or maintenance (e.g., replacement body panels, spark plugs, and tires) or as accessories (e.g., radios and wheels).

Figure 2-1
Automotive parts: World consumption, 1982-86



Source: Estimated by the staff of the U.S. International Trade Commission on the basis of questionnaire data; official statistics of the U.S. Department of Commerce, and foreign industry executives.

Industry sources indicate that the United States accounts for approximately 25 to 30 percent of the total world market for automotive parts. This is due, in large part, to the structure of our transportation system, which is geared to passenger automobile travel. Additionally, the United States has a large integrated highway system and reasonable gasoline prices vis-a-vis other nations. Industry sources assert that the United States is the largest unrestricted market for automotive parts in the world. 1/

Although there are no reliable statistics published regarding the value of world production of automotive parts, there are relatively accurate data available concerning total world vehicle production and total world registrations of automobiles, trucks, and buses (table 2-1).

Table 2-1
Motor vehicles: U.S. and world production and registrations, 1982-86

Item	1982	1983	1984	1985	1986
Production:					
United States (1,000 units)	6,985	9,205	10,939	11,652	10,909
Total world (1,000 units)	36,113	39,755	42,057	44,779	45,694
Share of United States to total world production (percent)	19.3	23.2	26.0	26.0	23.9
Registration					
United States (1,000 units)	159,509	163,861	166,496	1/ 169,500	1/ 171,950
Total world (1,000 units)	438,918	456,030	473,278	1/ 484,301	1/ 494,100
Share of United States to total world registrations (percent)	36.3	35.9	35.2	35.0	34.8

1/ Estimated by the staff of the U.S. International Trade Commission.

Source: Based on data published by Automotive News and by the Motor Vehicle Manufacturers' Association.

The United States produced almost 11 million motor vehicles in 1986 or almost one-quarter of the total world motor-vehicle production. In addition, the United States accounted for an estimated 35 percent of all vehicles registered in the world in 1986.

1/ Statement of the Automotive Service Industry Association before the U.S. International Trade Commission, Feb. 24, 1987, p. 7.

World Trade Patterns

World trade in automotive parts increased from $26.1 billion in 1982 to $39.9 billion in 1986, or by 53 percent. 1/ The data on world trade in automotive parts are derived from United Nations statistics, although the coverage of these data is not complete. Much of the expansion in this trade was the result of the increasing internationalization of the automobile industry, in both developed and a few developing countries. However, imports of auto parts into many developing countries that do not have an established or growing auto industry generally fell over the period.

North America

Imports of automotive parts into North America (United States, Canada, and Mexico) more than doubled during 1982-86, as this area continues to be the world's largest import market. North American parts imports increased from 37 percent of the world total in 1982 to 50 percent in 1986. The share of trade among the three North American countries as a percentage of total imports into the region fell from 81 percent in 1982 to 70 percent in 1986. Thus, the share of imports from non-North American countries rose from 19 percent in 1982 to 30 percent in 1986.

Shipments from Japan, Taiwan, and Korea more than quadrupled over the period, accounting for 18 percent of North American imports in 1986, versus a 7.5-percent share in 1982. The United Kingdom tripled its shipments to North America, and imports from France and West Germany almost tripled during 1982-86. The European share of imports into North America amounted to 10.5 percent in 1986, with West Germany and France accounting for 3.8 percent and 1.6 percent, respectively.

European Community

The European Community (EC) is the second largest motor-vehicle parts import market, accounting for an estimated 40 percent of world parts imports in 1986. Until 1983, the EC led all regions of the world in imports of automotive parts, but has since experienced a slower growth rate than the rest of the developed world.

Nearly 90 percent of all EC parts imports are from EC member countries; the Far East accounts for an additional 4 percent of imports, and North America, 3 percent. West Germany is by far the largest supplier to the EC, accounting for nearly 40 percent of total EC imports; France ranks second with 15 percent, and Italy and the United Kingdom each account for about 7 percent.

1/ These data do not include all parts, but are based on Standard International Trade Classification (SITC) item number 73289, which includes parts grouped into three basic categories: body parts, major mechanical or operational parts, and miscellaneous parts. The body parts includes such items as doors and bumpers; mechanical and operational parts include transmissions, brakes, and exhaust systems; and miscellaneous parts consists of hundreds of different items.

Belgium is the largest EC automotive parts importer, accounting for 29 percent of the EC total. The principal reason that Belgium is the leading importer is that it imports a large number of unassembled automobile kits for assembly and eventual re-export. The other top EC automotive parts importing countries are West Germany (19.3 percent), the United Kingdom (18.3 percent), and France (13.3 percent). Spain is the fastest growing European automotive market (GM and Ford are increasing investment in Spain), with total parts trade nearly doubling over the period.

Far East

The Far East (Japan and Korea) was the fastest growing import market in terms of percentage growth, increasing by 150 percent during 1982-86. Although it accounted for about 30 percent of world motor-vehicle production in 1986, the Far East accounted for only about 2 percent of world parts imports.

In dollar terms, most of the growth in trade in the region reflects increased exports from Japan. Japan increased its proportion of exports within the Far East from 30.3 percent in 1982 to 46.4 percent in 1986. West Germany, the second leading supplier to the Far East, more than doubled its shipments during 1982-86, accounting for nearly one-fifth of total exports into the Far East. Exports from Australia increased fivefold, for a 4-percent share; exports from Korea increased sixfold, accounting for 2 percent of all imports into the Far East.

Less developed countries

Data for less developed countries (LDC's) as a group are incomplete; however, imports by these countries are estimated to have fallen by 50 percent during 1982-86 (principally because of economic contractions in many countries). Brazil is the leading LDC that exported parts to other LDC's, accounting for 3 percent of the total. Japan was the leading exporting country to the LDC's, accounting for 28.9 percent of the total.

African imports of automotive parts fell by over one-half during the period, accounting for just under 2 percent of the world import totals. France accounted for nearly 33 percent of the exports to this region, followed by West Germany (15.4 percent), and Italy (13.6 percent).

The share of world imports into the Middle East fell from 3 percent in 1982, to less than 1 percent in 1986. Saudi Arabia accounted for one-third of the import total throughout the period. The United States led all exporters to the region, capturing 36.0 percent of the total. Japan and West Germany followed with 23.9 percent and 21.9 percent, respectively.

Imports into Latin American countries fell steeply over the period, and accounted for just 1.5 percent of the world total in 1986. Intra-Latin American trade accounted for an estimated 15.0 percent of the import total, with Brazil representing one-half of that amount. The United States was the leading exporter to the region over the period, accounting for 27.5 percent. France and Japan had 13.9 percent and 12.2 percent shares, respectively.

Increasing Internationalization of U.S. Automotive Parts Industry

The internationalization of the automotive industry has led to large trade flows between the United States and several other countries. Prior to the mid-1970's, most automobiles were designed and produced entirely by the final assembler in the domestic market from locally produced components. Today an automobile assembled in the United States may have a Japanese-built engine, French-built transmission, a wiring harness from Mexico, electrical parts from Brazil, and a radio from Taiwan. 1/

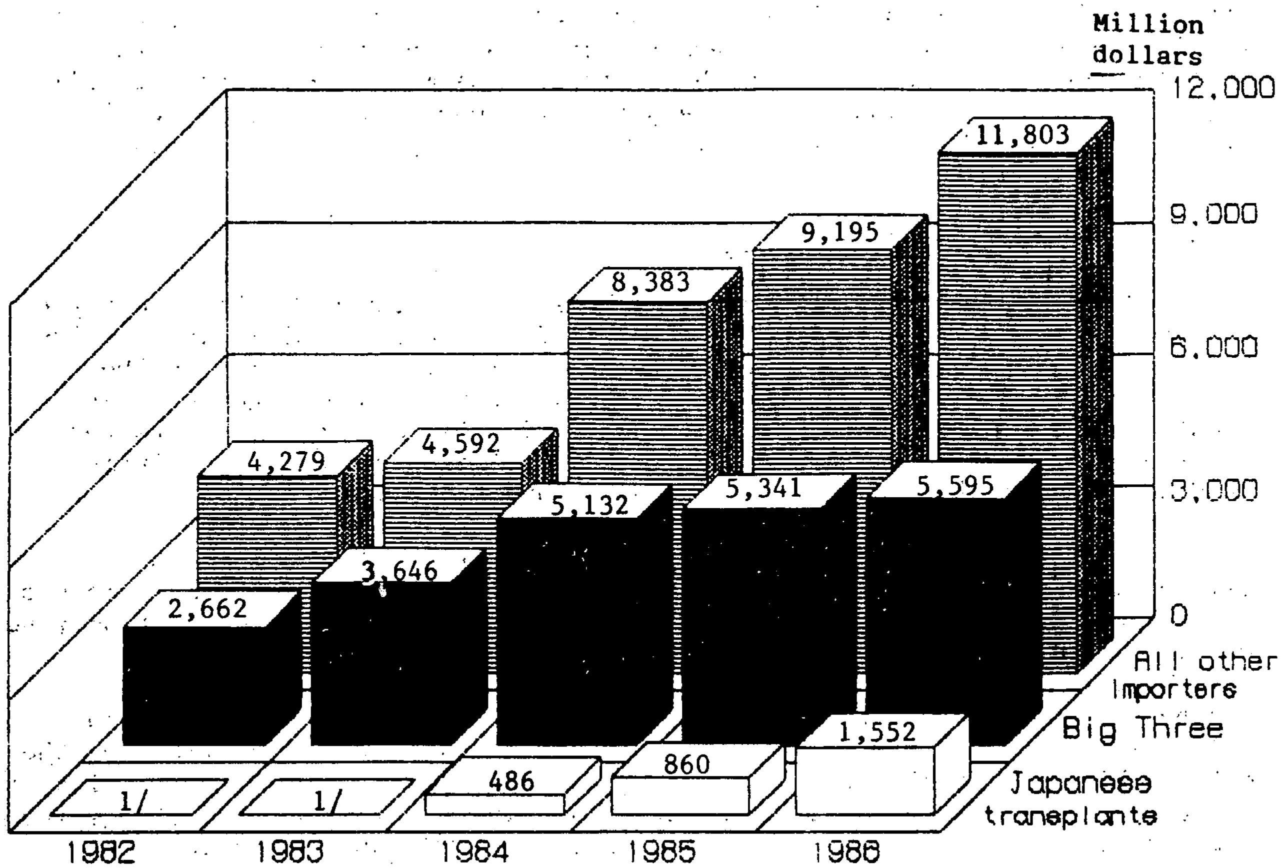
Offshore production and purchasing

U.S.-based motor-vehicle producers have been involved in the importation and offshore production of automotive parts for decades. Initially, foreign sourcing fulfilled a need for parts that were either not produced in the United States or were less expensive when purchased from foreign suppliers. Eventually, however, U.S. producers expanded foreign sourcing of parts for different reasons, including local content and local production requirements mandated by foreign Governments as a condition for foreign sales.

U.S. imports of automotive parts by the Big Three increased from $2.7 billion in 1982 to $5.6 billion in 1986, or by over 100 percent; imports by Japanese-owned auto plants located in the United States increased from $486 million in 1984 to $1.6 billion in 1986; and imports by other U.S. importers (truck manufacturers, mass merchandisers, trading companies, and other independent purchasers) rose by 176 percent, from $4.3 billion in 1982 to $11.8 billion in 1986 (fig. 2-2). Most of these imports were utilized by the motor-vehicle manufacturers for original equipment use, and a small portion of these imports were for the aftermarket. In addition, most of these parts were imported from either wholly-owned subsidiaries of the auto manufacturers or joint-venture operations. For example, in 1986, the Big Three imported engines valued at almost $1.5 billion from Canada, Japan, Brazil, and West Germany, and transmissions valued at over $1.0 billion from Canada, Mexico, West Germany, Japan, and France. 2/ These imports reflect the fact that both the motor-vehicle assemblers and the automotive parts producers operate on an international basis and compete in global industries.

1/ U.S. International Trade Commission, The Internationalization of the Automobile Industry and Its Effects on the U.S. Automobile Industry, USITC Publication 1712, June 1985, p. 2.
2/ Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Figure 2-2
Automotive parts: U.S. imports by Japanese automakers located in the United States (transplants), the Big Three, and all other importers, 1982-86



1/ Withheld to avoid disclosure of business confidential information.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Extent of increased imports of complete vehicles by U.S.-based manufacturers

U.S. imports of new automobiles and trucks increased from less than 1,500 units in 1947, 1/ to over 6 million new automobiles and trucks in 1986. 2/ Most of the automobiles imported in 1986 were from Japan, Canada, and West Germany, and virtually all of the trucks were sourced from Canada and Japan. The following tabulation, based on data derived from official Commerce

1/ When returning military personnel brought back mostly British sports cars, according to USITC staff interview with Richard Wright, automotive writer/editor, The Detroit News, Detroit, MI, Aug. 21, 1987.
2/ The U.S. Automobile Industry: Monthly Report on Selected Economic Indicators, USITC Publication 1954, February 1987, pp. 2 and 4.

statistics, shows the U.S. imports of automobiles and trucks for 1982-86 (in thousands of units):

Item	1982	1983	1984	1985	1986	Average annual percentage change, 1986 over 1982
Automobiles......	2,926	3,134	3,559	4,395	4,691	12.5
Trucks...........	682	766	1,003	1,227	1,330	18.2
Total........	3,608	3,900	4,562	5,622	6,021	13.7

U.S. imports of automobiles increased by over 60 percent and trucks by 95 percent during 1982-86, and the increase in both autos and trucks combined amounted to almost 67 percent. However, in terms of value, these imports increased at a much more substantial rate, as shown in the following tabulation (in millions of dollars): 1/

Item	1982	1983	1984	1985	1986	Average annual percentage change, 1986 over 1982
Automobiles......	20,195	23,394	29,264	36,412	45,301	22.4
Trucks...........	4,130	4,531	6,169	7,314	8,125	18.4
Total........	24,325	27,925	35,433	43,726	53,426	21.7

U.S. imports of autos during 1982-86 increased by almost 125 percent in terms of value, and trucks increased by almost 97 percent during the same period. The principal causes for the much higher increase in value when compared with the increase in units can be attributed to the effects of Japanese voluntary export restraints (p. 6-9), which led to the upgrading of Japanese auto exports, and the demand for more luxurious autos and lightweight trucks by U.S. consumers.

If the imports of automotive parts is added to the value of motor-vehicle imports, the value of all automotive imports increased from $30.7 billion in 1982 to $71.8 billion in 1986, or by almost 134 percent (fig. 2-3). The average annual percentage increase for these products for 1982-86 was 23.7 percent, with automotive parts showing the largest average annual percentage increase of 28.8 percent.

Imports of motor vehicles by the Big Three.--During the last 25 years, each of the three major U.S.-based auto manufacturers has imported complete vehicles from Canada and Japan. 2/ In addition to these two countries, one or

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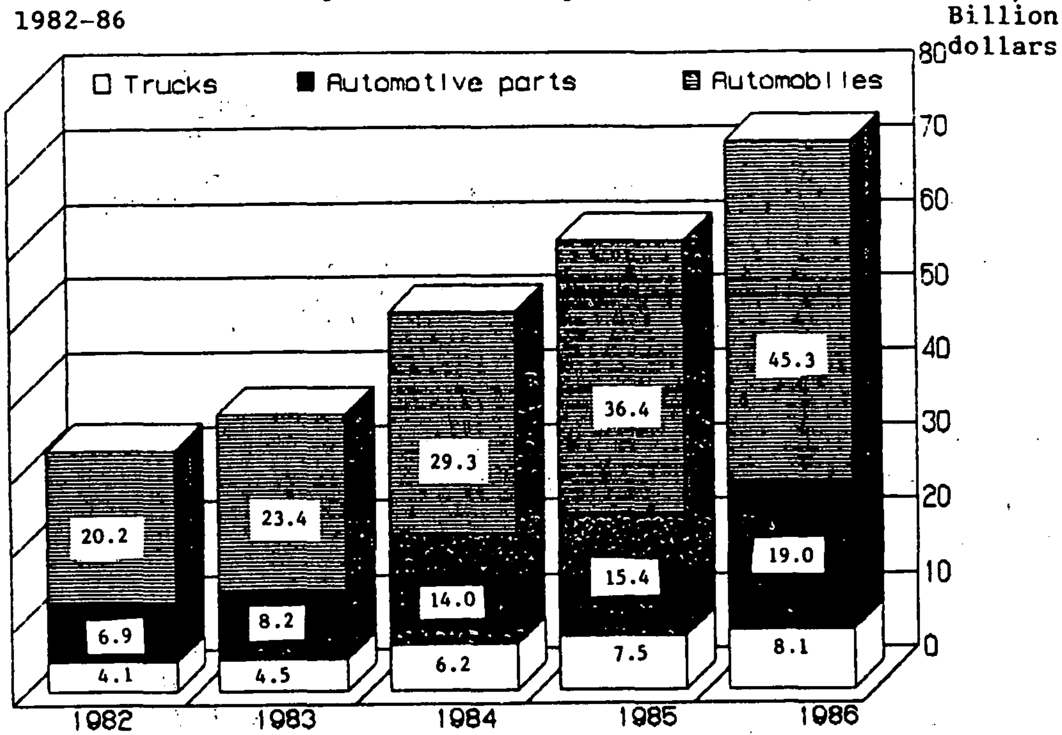
1/ Compiled from official statistics of the U.S. Department of Commerce.
2/ These vehicles were imported by domestic auto producers from either wholly owned or partially owned subsidiaries of foreign motor-vehicle manufacturers and are commonly referred to as "captive imports."

Figure 2-3
Motor vehicles and parts: U.S. imports of trucks, automobiles, and parts, 1982-86



Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission and official statistics of the U.S. Department of Commerce.

more of these producers has imported at least one automobile model from the United Kingdom, France, West Germany, Italy, Mexico, or Korea during the last 20 years (table 2-2). In addition, a recent United Auto Workers study indicated that by 1990, GM could import as much a 11 percent of its U.S. models from either wholly-owned overseas subsidiaries or joint ventures, and both Ford and Chrysler could import up to 27 percent of each of their autos sold in the United States. 1/ It should be noted that these estimates do not include imports from Canada, which would increase these estimates by 5 to 10 percent for each company.

All three major U.S. automobile manufacturers imported automobiles from Europe during the 1960's and early 1970's, although the total number was relatively small in relation to each company's domestic production. Virtually all of the imports were subcompact models that each manufacturer used to complete their model lines. Two major factors contributed to the decline in the importation of automobiles from Europe by U.S. manufacturers. First, U.S. manufacturers began producing competing fuel-efficient subcompact models in domestic facilities, and secondly, some of the imported autos reportedly had quality problems. 2/

1/ "1990's Will Present Hard Choices for U.S. Industries," American Metal Market, July 23, 1987, p. 14.
2/ USITC staff interviews with U.S. and European automakers.

Table 2-2
Automobiles and trucks: U.S. retail sales of vehicles imported by General Motors, Ford, and Chrysler, 1982-87

Company	1982	1983	1984	1985	1986	1987 1/	Average annual change, 1987 over 1982 1/
	Units						Percent
General Motors							
Canada 2/.....	456,118	639,991	650,708	647,318	547,570	535,000	3.2
Japan.........	22,304	15,530	14,600	84,860	160,363	140,000	44.4
Mexico 1/.....	-	-	5,500	27,000	20,000	15,000	-
Korea.........	-	-	-	-	-	35,000	-
Subtotal.....	478,422	655,521	670,808	759,178	727,933	725,000	8.7
Ford							
Canada 1/.....	318,510	317,943	486,318	544,551	581,379	560,000	12.0
Japan.........	32,967	5,657	-	-	-	-	-
West Germany..	-	-	-	8,974	14,315	15,000	-
Korea.........	-	-	-	-	-	25,000	-
Mexico........	-	-	-	-	-	12,000	-
Subtotal.....	351,477	323,600	486,318	553,525	595,694	612,000	11.7
Chrysler							
Canada 1/.....	222,780	224,090	329,158	342,462	357,523	350,000	9.4
Japan.........	142,287	137,525	143,016	175,530	214,234	235,000	10.5
Mexico 1/.....	-	-	6,100	14,000	40,000	60,000	-
Subtotal.....	365,067	361,615	478,274	531,992	611,757	645,000	12.1
Total.......	1,194,966	1,340,736	1,635,400	1,844,695	1,935,384	1,982,000	10.7

1/ Estimated by the staff of the U.S. International Trade Commission.
2/ Shipments of automobiles and trucks to the United States from Canadian assembly plants.

Source: Compiled from data published by Ward's Automotive, Automotive News, and the Motor Vehicle Manufacturers Association of the United States, except as noted.

In addition to imports of autos from Europe, both GM and Chrysler have imported autos from Japan during the last 10 years. All three U.S. producers imported lightweight pickup trucks from Japan beginning in the early 1970's; however, GM and Ford ceased importation of pickup trucks from Japan in the early 1980's because each established production facilities for compact trucks in the United States. Although Chrysler is currently producing a smaller pickup truck in the United States, it has continued to import a compact truck from Japan.

During the last 2 years, all three U.S.-based auto companies have begun sourcing autos from other countries as well. All three U.S. companies currently import either autos or lightweight trucks from wholly-owned subsidiaries in Mexico. 1/ Both GM and Ford currently import autos from Korea

1/ GM will discontinue imports of a lightweight truck, its only vehicle imported from Mexico, sometime in 1987.

into the United States, and Ford imports into Canada subcompact model from a joint venture in Taiwan--a model which may eventually be exported to the United States. 1/

Influence of imported vehicles on U.S. parts manufacturers.--While it is probably true, other things being the same, that an increase in the import supply of complete motor vehicles will cause a loss in production and employment in the domestic parts industry, there are several reasons why it is difficult to assess the magnitude of the effects with any degree of precision. First, it is necessary to know how many domestic vehicles would have been purchased by U.S. consumers had the supply of imports not increased. For example, if foreign and domestically produced autos and trucks are not substitutable at all, then there would be a minimal effect on production of U.S.-built vehicles. Second, since U.S. motor-vehicle producers are increasing their offshore purchases of parts, a certain percentage of the content of U.S.-made vehicles that would have replaced these imported vehicles would have been foreign. Third, many of the imported vehicles, especially those from Canada and to a much lesser extent Japan and West Germany, contain parts produced by domestic parts manufacturers. Thus, an increase in import supply of autos and trucks could cause an increase in U.S. parts production and employment if there were no change in U.S. vehicle production.

Joint ventures and investments overseas

Just as the Big Three have all entered into joint ventures overseas and have established foreign facilities, so have independent automobile parts manufacturers. For example, Sheller-Ryobi is a joint venture between Sheller Globe U.S.A. and Ryobi of Japan. Sheller Globe, a large independent U.S. parts maker, indicates that its primary interest in forming the joint venture was to tie up with a Japanese company, and to get into a new product line by using Ryobi's technology. In exchange, Ryobi (which exports to several U.S. customers) sought to ease rising trade tensions and use a U.S. management team in a domestic plant. 2/ In addition, the four largest independent producers (Borg Wagner, Budd, Rockwell, and TRW) all have relationships with companies in Canada and Europe, and all but Budd have ties to Japan and Brazil. 3/ Respondents report that U.S. producers were attracted to invest in Latin America in order to reduce labor costs; investments in Europe were made in order to gain access to high quality components; and investments in Japan were undertaken for both of the reasons above. Another motive for foreign investment by U.S. auto parts makers is the ability to enter markets and gain market share in those countries, especially where local content requirements in motor-vehicle production apply. 4/

Industry sources indicate that U.S. automakers favor three countries as production sites for parts--Canada, Mexico, and Brazil. Canada, with

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1/ Interview with officials of Ford Lio Ho, Taiwan, Apr. 27, 1987, by USITC staff.
2/ Louise Kertesz, "Sheller Globe Strategizes," Automotive News, July 27, 1987, p. E33.
3/ Ward's Automotive Yearbook, 1987, Detroit, MI.
4/ USITC staff interviews with both domestic and foreign company executives and independent automotive analysts.

substantial capacity and advanced production technology, also benefits from a free-trade agreement that provides incentive for duty-free trade of original-equipment parts (APTA, p. 6-7). Mexico and Brazil have proved to be relatively stable low-wage countries whose workforces are capable of producing quality components. U.S. automakers have sought joint ventures in other areas as well, especially in Asia (table 2-3). In these joint ventures, U.S. companies are able not only to lower production costs, but also exchange knowledge of manufacturing technology to gain market access.

Industry sources claim that the increase in joint ventures is principally due to increased international competition and changing political environments. A spokesman for MEMA indicates that they are especially supportive of this activity where the joint venture is an OE producer supplying both U.S. and Japanese automakers; however, he expressed caution regarding certain joint ventures when the U.S. firm was in a minority ownership position. 1/

Table 2-3
Automotive parts: Joint ventures by U.S. and foreign automakers, 1985

U.S. company	Foreign company	Country
General Motors	Isuzu	Japan
	Suzuki	Japan
	Toyota	Japan
	Daewoo	South Korea
	Hindustan	India
	Hua Tung	Taiwan
Ford Motor Co.	BMW	West Germany
	Hyundai	South Korea
	Otosan	Turkey
	Fiat	Italy
	Renault	France
	Mazda	Japan
	Lio Ho	Taiwan
Chrysler	Mitsubishi	Japan
	Peugeot	France
	Maserati	Italy
American Motors 1/	VAM	Mexico
	Renault	France
	Mahindra	India
	Beijing Jeep	People's Republic of China

1/ Chrysler purchased American Motors in August 1987.

Source: U.S. International Trade Commission, Internationalization of the Automobile Industry and Its Effects of the U.S. Automobile Industry, (investigation No. 332-188) USITC Publication 1712, June 1985.

1/ Interviews with MEMA officials, Washington, DC, Aug. 14, 1987.

U.S. parts producers responding to the Commission's questionnaire reported that their total cumulative direct investment abroad for all foreign affiliates in all countries engaged in the production of auto parts rose by 55 percent from $3.1 billion in 1983 to $4.9 billion in 1986 (table 2-4). To date, U.S. investment in Canada topped the list at $1.3 billion by 1986, and U.S. investment in Brazil followed at $673.9 million the same year. The largest increases were recorded in Japan and Italy; U.S. direct investment abroad rose by nearly fourfold in both countries during 1983-86.

Table 2-4
Automotive parts: U.S. direct investment abroad, as of Dec. 31 of 1983 and 1986 1/

Country of foreign affiliate	1983	1986	Average annual change, 1986 over 1983
	---1,000 dollars---		Percent
Canada	769,767	1,346,643	20.5
Brazil	538,953	673,909	7.7
United Kingdom	578,105	544,065	-2.0
Mexico	197,693	469,800	33.5
Japan	84,203	322,785	55.8
France	333,977	319,438	-1.5
West Germany	156,956	231,412	13.7
Italy	51,631	175,846	49.8
Spain	44,643	117,204	38.0
Australia	21,907	85,747	56.9
All other countries	352,937	575,989	17.7
Total	3,130,772	4,862,838	15.2

1/ Reported in U.S. dollars by questionnaire respondents.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Respondents rated manufacturing costs, labor costs, net price, and quality as the most important factors in their decisions to invest abroad (both to serve the local market and to export) (table 2-5). Development costs were rated as the least important reasons for such investment.

U.S. producers' total investment income from direct investment abroad (i.e., return on debt and equity investment in foreign affiliates producing auto parts) rose from $899.6 million in 1983 to $1.0 billion in 1986 (table 2-6). Total investment income from Canada and Brazil amounted to $321.4 million and $191.4 million, respectively, in 1986. Income from Brazil dropped by 18 percent during 1983-86, whereas income from Canada and Mexico rose by 38 percent and 91 percent (to $90.5 million), respectively, during the period.

Table 2-5
Automotive parts: Number of responses from 110 U.S. producers regarding the importance of factors in their decisions to invest abroad, 1983-86 1/

Item	1	2	3	4	5
Manufacturing costs...........	2	-	17	26	36
Labor costs..................	3	2	14	28	33
Net product price.............	3	0	20	20	30
Quality......................	4	5	20	22	25
Performance requirements......	8	5	31	23	14
Reliability of supplier.......	8	9	18	29	14
Technical ability of supplier..................	11	7	31	14	13
Availability of raw materials..................	15	12	29	16	11
Transportation costs..........	5	9	38	23	11
Availability of parts from a foreign plant...............	8	9	11	9	9
Utility costs................	11	17	35	9	8
Development costs............	32	7	18	17	2

1/ Response "1" indicates no importance; "5" indicates most important.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table 2-6
Automotive parts: U.S. producers' total investment income from direct investment abroad (return on debt and equity in foreign affiliates producing auto parts), as of Dec. 31 of 1983 and 1986

Country of foreign affiliate	1983	1986	Average annual change, 1986 over 1983
	--1,000 dollars--		Percent
Canada........................	232,988	321,405	11.3
Brazil........................	232,468	191,437	-6.0
Mexico........................	47,363	90,473	16.0
West Germany..................	47,295	73,760	24.1
France........................	20,543	48,612	33.3
Italy.........................	20,853	44,455	28.7
United Kingdom................	22,126	41,498	23.4
Venezuela.....................	26,726	47,154	20.7
Japan.........................	2,752	20,925	24.5
Spain.........................	9,481	24,220	95.3
Australia.....................	3,580	5,195	13.1
South Africa..................	4,586	1,938	-24.7
All other countries...........	228,812	93,432	-25.6
Total......................	899,573	1,004,504	4.9

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Mergers, licensing, and other cooperative agreements

In recent years, cooperative agreements in the automotive parts industry have centered on such high-technology sectors such as robotics, machine vision, and artificial intelligence. 1/ The major impetus behind these high-tech ventures has been the rapid growth of automotive electronics and a greater emphasis on electronics in the production of auto parts. As the number of electrical circuits in a car increases (due to the substitution of electrical and electronic systems for mechanical operations) automakers and auto parts producers are in greater need of access to high-tech manufacturing capabilities. One way they have achieved this is through mergers, such as GM's purchase of Hughes Aircraft and Chrysler's purchase of Gulfstream Aerospace. Similar acquisitions have been made by major auto parts producers such as Eaton and Allied Signal, which have been active in pursuing companies with electronics expertise. These auto parts firms have developed foreign relationships as well, through licensing of production overseas and investment in foreign auto parts companies. Industry sources believe that these arrangements will become more widespread between Japanese and U.S. firms. In fact, U.S. producers responding to the Commission's questionnaire stated that technical cooperation agreements are necessary for certain U.S. firms to avoid technical obsolescence. Another industry source estimated that, because of these agreements, about 20 percent of the value of items sold to OE automotive manufacturers by independent U.S parts producers are of foreign origin.

1/ The U.S. Automobile Industry, p. 40.

CHAPTER 3. U.S. INDUSTRY PROFILE

Structure of the Industry

The U.S. auto parts industry is extremely large and diverse with some 15,000 firms producing thousands of different products. The products range from simple parts such as windshield wiper blades to complex units such as engines. Most auto parts fall in the Standard Industrial Classification (SIC) 3714 (motor-vehicle parts and accessories), but other relevant industries are SIC 3465 (automotive stampings), SIC 3592 (carburetors, pistons, and rings), SIC 3647 (vehicle lighting equipment), SIC 3691 (storage batteries), and SIC 3694 (engine electrical equipment). Motor-vehicle parts and accessories accounted for 68 percent of the total value of shipments of motor-vehicle parts and stampings in 1984, followed by automotive stampings (18 percent); engine electrical equipment (6 percent); storage batteries, and carburetors, pistons, and rings (3 percent each); and vehicle lighting equipment (1 percent), according to U.S. Department of Commerce data. 1/

The largest U.S. auto parts producers are parts subsidiaries of the three largest U.S. automakers. According to data compiled from the Commission's questionnaire, the parts-producing subsidiaries of General Motors (GM), Ford, and Chrysler (the Big Three) accounted for an increasing share of U.S. shipments of auto parts during 1982-86 (table 3-1). In 1985, for SIC 3714, GM had about 21 percent of the market, Ford had approximately 15 percent, and Chrysler had about 5 percent. In total, approximately 41 percent of sales by U.S. companies were accounted for by the parts operations of GM, Ford, and Chrysler. 2/

In addition to the parts-producing subsidiaries of the automakers, there are several large independent diversified auto parts producers that account for significant shares of industry sales. Borg Warner, reported by Trinet to be the largest publicly held independent parts supplier, produces engine, transmission, and suspension components; complete transmissions; turbo chargers; plastic parts; and other miscellaneous auto parts. Borg Warner's share of the market in 1985 was about 3 percent. 3/

The Budd Co., which had 2 percent of the market in 1985, produces body stampings and frames, wheels, brakes, and plastic and plastic-related parts. Rockwell International, which accounted for approximately 2 percent of the market in 1985, produces axles, brakes, universal joints, electronic vehicle management systems, plastic body panels, door and hood locking parts, seat recliners, motors and actuators, suspension components, and other miscellaneous parts. TRW, which also had a market share of about 2 percent in 1985, produces electric and electronic parts, electromechanical devices,

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1/ 1986 U.S. Industrial Outlook, U.S. Department of Commerce, January 1987, p. 36-11.
2/ Market Share Report, SIC 3714, Trinet, Inc., 1986.
3/ Ibid.

Table 3-1
Automotive parts: Shipments of U.S. auto parts by subsidiaries of General Motors, Ford, and Chrysler, 1982-86

Item	1982	1983	1984	1985	1986	Average annual percentage change, 1986 over 1982
The Big Three's shipments (billion dollars).......	26.9	34.5	41.9	52.4	51.4	17.6
Total shipments (billion dollars).......	51.1	61.6	75.2	84.5	83.0	12.9
Ratio of the Big Three's shipments to total shipments (percent)..............	52.6	56.0	55.7	62.0	61.9	-

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

piston rings, ball joints, power steering systems, steering gears and linkages, hydraulic motors, suspension assemblies, seat belts, valves, and other miscellaneous parts. 1/

Taken together, these top four independent suppliers accounted for almost 10 percent of the market for SIC 3714 in 1985. Combined with the subsidiaries of the Big Three automakers, the top seven suppliers accounted for over 50 percent of the market in 1985. According to Trinet, other diversified suppliers with at least 1 percent of the 1985 market included Eaton (1.9 percent), Fruehauf Corp. (1.6 percent), Allied Signal (1.5 percent), Arvin Industries (1.3 percent), and A O Smith (1.0 percent).

The Bureau of the Census also publishes concentration ratios for the auto parts industry. The 1982 Census of Manufactures indicates that 61 percent of U.S. producers' shipments for SIC 3714 in 1982 was accounted for by the top 4 firms, 69 percent by the top 8 firms, 77 percent by the top 20 firms, and 85 percent by the top 50 firms. The differences between the Trinet market share estimates and the Census Bureau concentration ratios are due, at least in part, to a difference in coverage. However, both sources describe an industry with a small number of large- and medium-sized diversified auto parts producers, each accounting for a significant portion of the total market, and a large number of smaller producers, each accounting for less than 1 percent of the market.

1/ Market Share Report, SIC 3714, Trinet, Inc., 1986.

Auto parts producers tend to be concentrated in the Midwestern and North Central States. Parts producers supplying auto assemblers must increasingly locate near assembly facilities in order to minimize transportation costs and facilitate coordination with automakers' just-in-time (JIT) production and inventory schedules (see p. 7-15). However, parts makers supplying the aftermarket have little incentive to locate near the assembly sites and are scattered across the country.

During 1982-86, an increasing number of Japanese-owned parts firms manufacturing a wide variety of products set up production plants in the United States (see chapter 5 and app. G).

Degree and Type of Integration

GM, Ford, and Chrysler are all diversified companies producing automotive and nonautomotive products. Industry sources estimate that currently GM produces 70 percent of its auto parts requirements in-house, Ford is estimated to produce about 50 percent of its needs and Chrysler about 30 percent. The Big Three are both diversified across industries and vertically integrated in the motor-vehicle business (producing components as well as end products). Their investment strategies include both diversification and less vertical integration; for example, when GM purchased Hughes Aerospace and Electronic Data Systems and entered into a joint venture with Fanuc, it began consolidating parts production. (GM's decision to invest in these high-technology enterprises was based both on the profitable financial performance of these companies and the possibility of future exchanges in manufacturing expertise and technology.) 1/ Chrysler has also been scaling back parts production while concurrently purchasing nonautomotive companies such as Gulfstream Aerospace.

Industry sources indicate that U.S. automakers' goal of a decrease in vertical integration is designed to take advantage of new manufacturing techniques such as flexible manufacturing and JIT production. In addition, U.S. auto producers believe that independent U.S. and foreign suppliers have comparative advantages including lower wages, better technology, lower energy costs, and lower raw materials costs. The most significant tradeoff is a decrease in control. There is some indication, however, that U.S. producers are beginning to follow the Japanese auto producers' lead by obtaining equity interest in parts suppliers to increase their control and still be able to avail themselves of the suppliers' comparative advantages.

GM plans to increase outsourcing by about 10 percent. In order to achieve this goal, GM is sending out purchasing people and engineers to both independent and captive suppliers to determine whether or not they have a long-term future with the company. GM's objective is to assess systematically the strengths and weaknesses of suppliers and offer advice for improving cost and quality. It also plans to reduce its base of suppliers to only the most capable. This reassessment could mean a reduction of up to 40 percent of its

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1/ USITC staff interview with Delco Electronics officials, Kokomo, IN, July 17, 1987.

existing suppliers, said the manager of supplier relations for GM's Buick-Oldsmobile-Cadillac powertrain operation in Lansing, MI. 1/

According to an analyst for Solomon Brothers Inc., for every single percentage point of change in GM's mix of captive-to-outside purchasing, independent suppliers will have an opportunity to acquire up to $450 million in new business. At present, GM's outside suppliers account for about 30 percent of the company's parts, subassemblies, and materials business. An increase to 50 percent would mean about $8 billion in new business. Moreover, U.S. automakers are moving toward purchasing contracts up to 5 years or more in duration; thus, the actual value of new business would be several times the estimated $8 billion figure. 2/ The increase in new business reflects a reshuffling of business from the Big Three to independent suppliers, rather than a net increase for the parts industry as a whole.

Independent parts suppliers are significantly less vertically integrated than the automakers. The degree of diversification of many of these companies is fairly significant. Many are subsidiaries of firms that participate in a wide variety of industries. Borg Warner, the leading independent auto parts supplier, had net sales of $3.4 billion in 1986. Of that, 34 percent was automotive related, 31 percent was chemical and plastics related, 32 percent was accounted for by protective services, and the remainder was information services. 3/ Rockwell International had net sales of $12.3 billion in 1986, of which 13 percent was automotive related, 45 percent was accounted for by electronics and aerospace, 34 percent for electronics, and the remainder was miscellaneous industries. TRW had net sales of $6.0 billion in 1986 with automotive parts accounting for 39 percent, electronics and space systems accounting for 56 percent, and other industries accounting for 5 percent. Budd Co., the second largest independent auto parts supplier, had net sales of $1.2 billion in 1986. Budd is the only supplier of the top four independents that is concentrated in the automotive market. 4/

Domestic Market

Original-equipment and replacement markets

The U.S. market for automotive parts increased from $52.3 billion in 1982 to $93.0 billion in 1986, representing a 77-percent increase overall, as shown in the following tabulation: 5/

1/ David Barkholz, "Suppliers Hold Their Breath As GM Teams Rate Operations," Automotive News, July 6, 1987, p. 46.
2/ Al Wrigley, "Massive Auto Supply Outsourcing by 1995: Delphi," Metalworking News, Mar. 23, 1987, p. 29.
3/ Million Dollar Directory, Dunn and Broadstreet, Parsippany, NJ, 1987.
4/ Standard and Poors Corporation Records, New York, NY, 1987.
5/ Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Year	Value 1/ (billion dollars)
1982	52.3
1983	63.8
1984	80.3
1985	90.5
1986	93.0

There are two basic market segments for motor-vehicle parts--the original equipment (OE) segment and the aftermarket. Producers in the OE market sell their products directly to vehicle manufacturers, either for assembly into new cars, trucks, and buses, or for dealers' service operations. Aftermarket manufacturers generally supply replacement parts for sale to independent repair facilities or the general public. 2/

In part because of warranties on new cars, replacement parts are generally purchased from the OE vehicle dealer until motor vehicles are about 3 years old. After the vehicles are older than 3 years, owners generally purchase replacement/repair parts from aftermarket facilities. These time periods vary, however, tending to be longer for imported motor vehicles. 3/ Additionally, extended warranties have also changed these time periods by shifting demand for certain parts to OE vehicle dealers.

Motor-vehicle parts distributed in the aftermarket traditionally were sold from the manufacturer to warehouse distributors and jobbers 4/ that would then sell them to retail sales and service outlets. Since the 1960's, however, mass merchandisers have been directly purchasing certain "fast moving" parts from producers and selling them under private labels. These parts include high-turnover products, such as spark plugs, mufflers, filters, and shock absorbers. Recently, there has been a great deal of overlap in distribution channels as nonautomotive retailers, such as department, grocery, and drug stores, have begun to carry a wide variety of automotive items. This trend, along with the growth in jobbers and national auto parts service specialists, has contributed to a significant consolidation of the aftermarket distribution process for motor-vehicle parts. 5/

In addition to these changes in the distribution channels, technical advancements in vehicles have led distributors to stock a broader inventory. The increased market share of imported autos has also added to the need for a wider array of parts. The average number of replacement parts now maintained by a distributor serving the aftermarket is well over 80,000 items. 6/

1/ It should be noted that many time series in this study are in nominal value terms; thus, they do not necessarily indicate real (quantity) trends since the trend could be caused by a price increase.
2/ U.S. Department of Commerce, A Competitive Assessment of the U.S. Automotive Parts Industry, March 1985, p. 3.
3/ Ibid.
4/ A jobber typically operates a chain of automotive parts stores under a well publicized private name.
5/ U.S. Department of Commerce, The U.S. Automobile Industry, 1984, December 1985, pp. 53-54.
6/ Ibid.

U.S. Industry

U.S. producers' shipments

The value of U.S. producers' shipments of automotive parts rose by 62 percent from $51.1 billion in 1982 to $83.0 billion in 1986, as shown in the following tabulation: 1/

Year	Shipments (billion dollars)
1982	51.1
1983	61.6
1984	75.2
1985	84.5
1986	83.0

The steadily rising shipments of automotive parts during the early 1980's is largely attributed to the improved health of the domestic automotive industry following the 1981-82 economic downturn. As the production of automobiles and light trucks increased from approximately 10 million units in 1984 to about 11.6 million units in 1985, the value of shipments of automotive parts shipments increased proportionately. As the 1986 production level of autos and light trucks dropped to 11 million units from 11.5 million units in 1985, so the value of shipments of domestic auto parts declined slightly.

When compared with the gross national product (GNP), both U.S. shipments and U.S. imports of automotive parts show a higher rate of growth during 1982-86. The average annual percentage increase for GNP during this period was 7.6 percent, while the increase for U.S. shipments and U.S. imports was 11.6 percent and 26.6 percent, respectively.

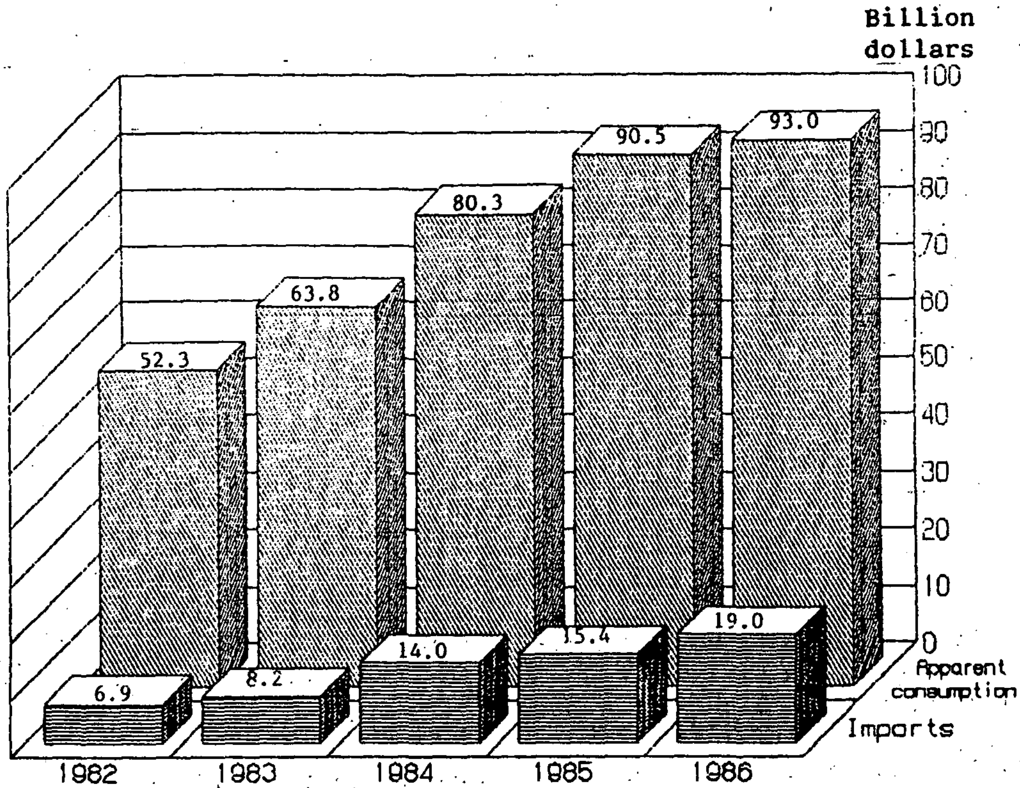
Imports

Total imports of automotive parts almost tripled from $6.9 billion in 1982 to $18.9 billion in 1986 (fig. 3-1). The ratio of imports to consumption rose during the period, increasing irregularly from 13.3 percent in 1982 to 20.4 percent in 1986 as shown in the following tabulation: 2/

Year	Ratio of imports to consumption (percent)
1982	13.3
1983	13.1
1984	17.4
1985	17.0
1986	20.4

1/ Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.
2/ Ibid.

Figure 3-1
Automotive parts: U.S. imports and apparent consumption, 1982-86



Source: Compiled from data submitted in response to questionnaires o. the U.S. International Trade Commission.

U.S. auto producers responding to the Commission's questionnaire reported lower purchase prices, better ability to meet specifications, intracompany and affiliated company transfers, and greater willingness to supply required volumes as the principal reasons for their imports during 1982-86 (table 3-2).

Exports

According to data compiled from the Commission's questionnaire, the value of U.S. exports of auto parts increased by 62 percent, from $5.8 billion in 1982 to $9.4 billion in 1985, then dropped off to $8.9 billion in 1986, as shown in the following tabulation: 1/

Year	Exports (billion dollars)
1982	5.8
1983	7.1
1984	8.9
1985	9.4
1986	8.9

1/ Compiled from data submitted in response to questionnaires or the U.S. International Trade Commission.

Table 3-2
Automotive parts: U.S. producers' ranking 1/ of factors that were the principal reasons for their imports, 1982-86

Item	Ranking
Lower purchase price (delivered)	1
Shorter delivery time	11
Engineering/technical assistance	7
Favorable terms of sale	9
Favorable exchange rates	8
Reliability of supplier	5
Intracompany and affiliated company transfers on a basis:	
Competitive with unaffiliated firms	3
Ability to meet specifications	2
Willingness to supply required volumes	4
Ability to supply metric sizing	11
Quality	7

1/ Ranking numbers range from 1 to 11, number 1 indicating the most important reason for importing and number 11 indicating the least important reason for importing. Some factors were ranked equally in importance.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

The world motor vehicle industry's procurement of parts on a worldwide basis and its participation in joint ventures have significantly altered U.S. trade flows in automotive parts. According to the U.S. Department of Commerce, Canada (where the U.S. auto producers have assembly operations) was the most important foreign market for U.S.-made automotive parts, receiving 66 percent of total U.S. exports in 1986, compared with 60 percent in 1982 (table 3-3). The U.S. trade balance with Canada, however, shifted from a surplus of $1.9 billion to a deficit of $840 million during the period (fig. 3-2). U.S. shipments to Mexico accounted for 13 percent of total automotive parts exports in 1986 and 10 percent in 1982, with a similar trend in the automotive parts trade balance. Other significant export markets during the 5-year period included West Germany and the United Kingdom.

Financial experience of U.S. producers

Reflecting an upswing in production and improved pricing levels for automotive components, net sales climbed steadily from $59.5 billion in 1982 to $111.6 billion in 1986, an increase of 88 percent (fig. 3-3). 1/ Although the industry as a whole remained profitable throughout the period

1/ Some producers were unable to separate net sales of parts from overall operations, thus net sales are greater than the shipments.

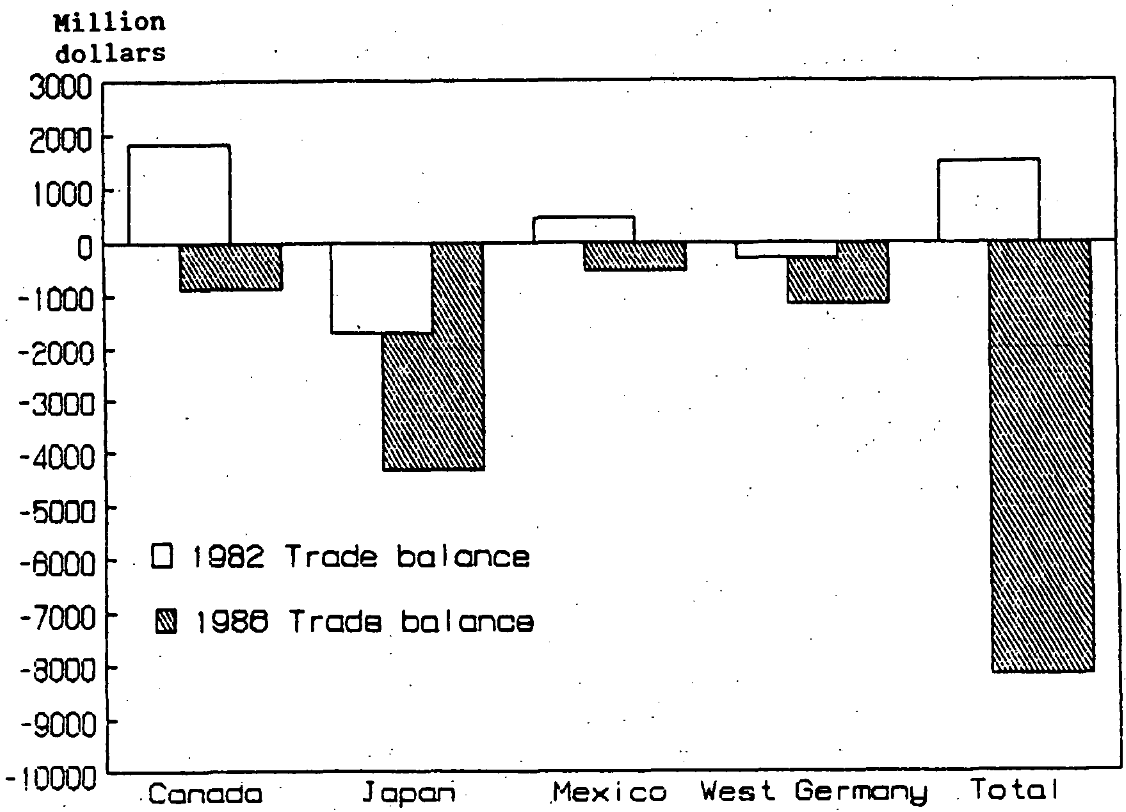
Table 3-3
Automotive parts and accessories: U.S. exports of domestic merchandise, imports for consumption, and trade surplus or deficit, by specified trade partners, 1982 and 1986

(Million dollars)

Trade partner	1982 U.S. exports	1982 U.S. imports	1982 Surplus or (deficit)	1986 U.S. exports	1986 U.S. imports	1986 Surplus or (deficit)
Canada	6,383	4,525	1,858	8,571	9,411	(840)
Mexico	1,115	648	467	1,735	2,253	(518)
West Germany	227	507	(280)	266	1,427	(1,161)
United Kingdom	196	189	7	226	476	(250)
Japan	128	1,822	(1,694)	225	4,505	(4,280)
Brazil	51	310	(259)	99	716	(617)
All other	2,542	1,109	1,433	1,917	2,412	(495)
Total	10,642	9,110	1,532	13,039	21,200	(8,161)

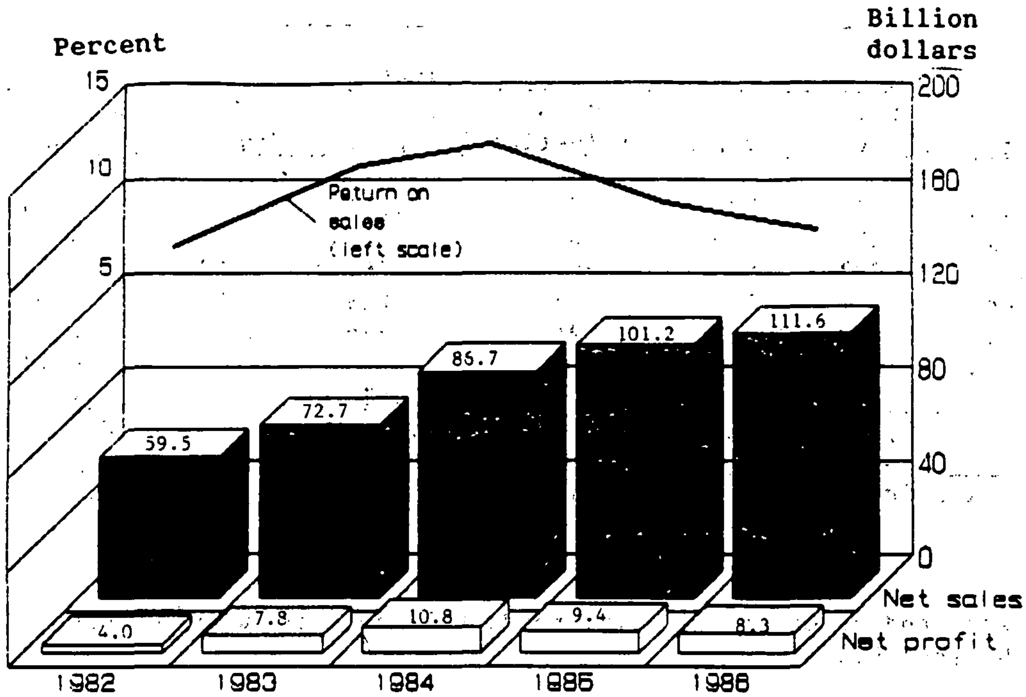
Source: Compiled from official statistics of the U.S. Department of Commerce.

Figure 3-2
Automotive parts and accessories: U.S. trade balance with major trading partners, 1982 and 1986



Source: Compiled from official statistics of the U.S. Department of Commerce.

Figure 3-3
Automotive parts: U.S. producers' total net sales, total net profit, and return on sales, 1982-86



Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

1982-86, net operating profits fluctuated widely. From a low of $4.0 billion in 1982, net operating profits more than doubled to $10.8 billion in 1984, then declined gradually to $8.3 billion in 1986. (Net operating profit was calculated by subtracting general, selling, and administrative expenses from net sales; thus, the net profit data do not include taxes paid on that income, nor has depreciation or amortization been subtracted from the total.) U.S. automotive parts producers' return on sales ratios paralleled the trend in net profit throughout the period as shown in the following tabulation: 1/

Year	Return (percent)
1982	6.7
1983	10.7
1984	12.5
1985	9.3
1986	7.5

1/ Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

(The fluctuating level of profits can be partly attributed to the accounting procedures of producers, many of whom provide data only as intracompany transfers to their parent corporations.)

Financial data for U.S. parts makers not affiliated with GM, Ford, or Chrysler (i.e., independent), differ from that reported in the totals above. Independent producers' net sales increased annually during 1982-86 to $52.6 billion, and their net profits fluctuated upward to a peak of $2.5 billion in 1986, reflecting the shakeout that saw many small parts firms cease operations in 1986 (fig. 3-4). Independent parts companies' return on sales rose from a low of 3.8 percent in 1982 to a high of 6.1 percent in 1984, as shown in the following tabulation: 1/

Year	Percent
1982	3.8
1983	4.8
1984	6.1
1985	3.9
1986	4.8

According to respondents to the Commission's questionnaire, net sales of U.S. producers' automotive parts operations located outside of the United States rose steadily by 44 percent overall to $19.0 billion in 1986 from $13.2 billion in 1982 (table 3-4). Net operating profits for these operations, however, more than doubled to $1.4 billion.

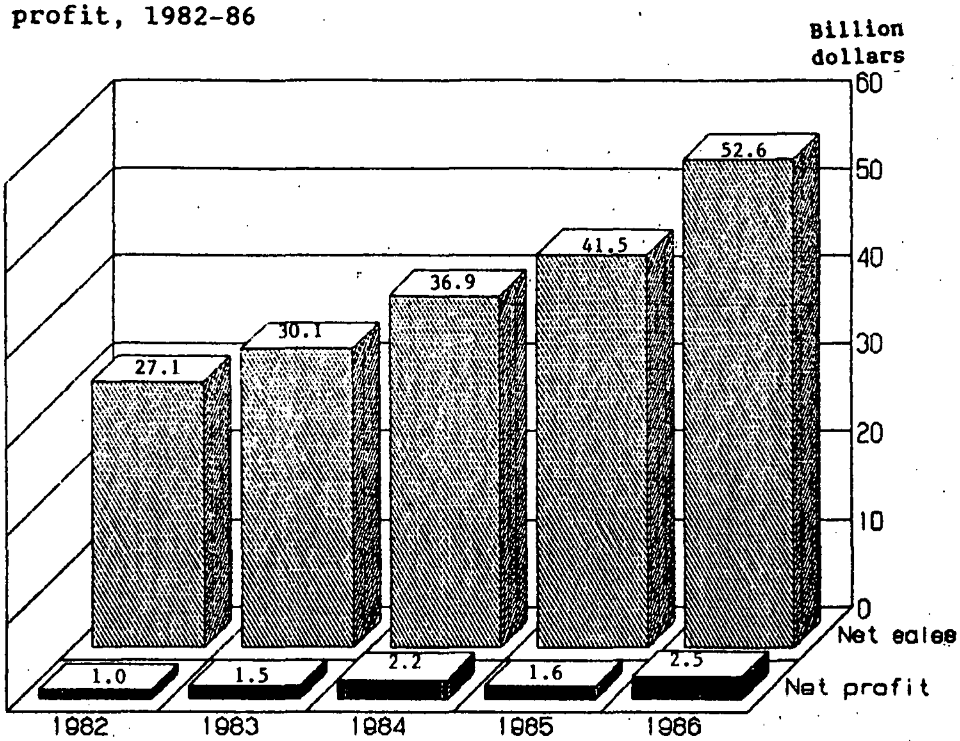
Changes in capacity

Respondents to the Commission's questionnaire were asked to indicate the amount of automotive parts capacity that would be added to or subtracted from present levels because of changes planned during the next 3 years in domestic production facilities. Responses indicate a greater overall degree of expansion of manufacturing capacity compared with planned reduction. Expansions are planned to occur principally through adding to existing facilities, followed closely by renovating or restructuring existing facilities. Constructing new facilities, reactivating closed facilities, and purchasing new facilities were not deemed viable options by most of the respondents.

Reductions in capacity were, for the most part, planned as permanent actions, through dismantling operations, selling plants, or other permanent contractions. Anticipated capacity changes in each of the seven automotive parts areas profiled, as a percent of current capacity levels, is shown in figure 3-5.

1/ Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Figure 3-4
Automotive parts: U.S. independent producers' total net sales and total net profit, 1982-86



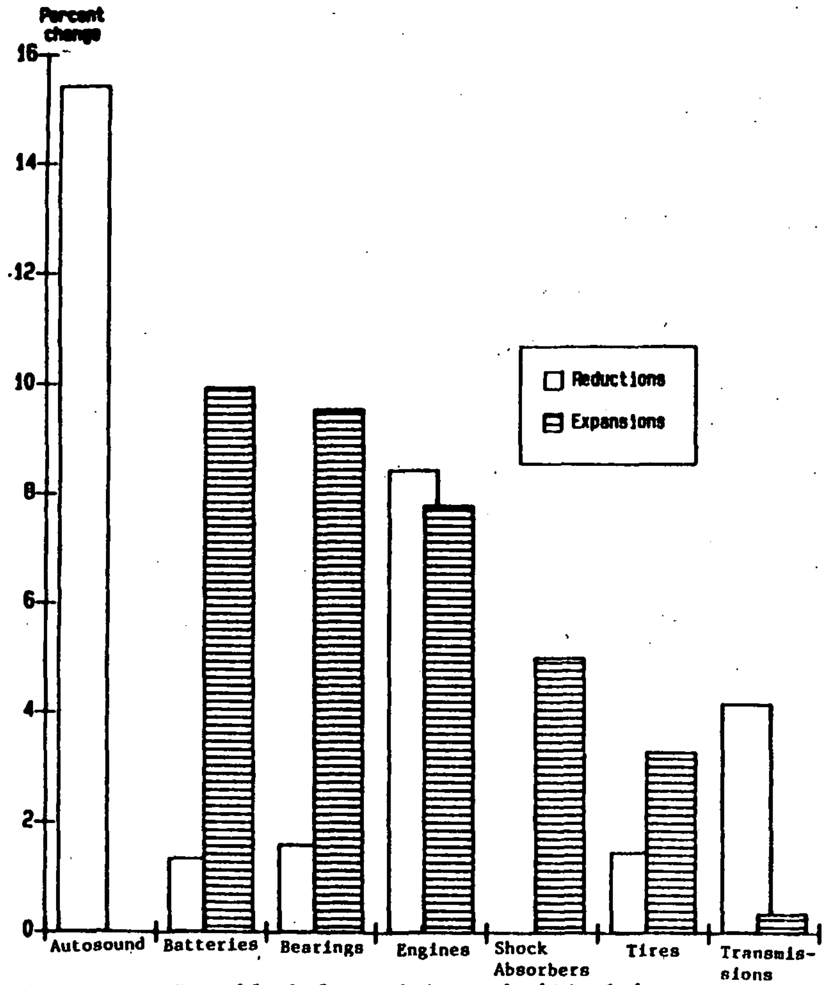
Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table 3-4
Automotive parts: Financial data for U.S. producers' automotive parts operations located outside of the United States, 1982-86

Item	1982	1983	1984	1985	1986	Average annual change, 1986 over 1982
						Percent
Net sales (less discounts, returns, and prepaid freight) (million dollars).....	13,244	13,406	16,218	17,680	19,037	10.3
Net operating profit (million dollars)......	662	971	1,496	1,411	1,420	21.1
Return on sales (percent).......	5.0	7.2	9.2	8.0	7.5	-

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Figure 3-5
Automotive parts: U.S. producers' planned capacity level changes, 1986-89



Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Capital expenditures

Capital expenditures for facilities and equipment for the production of automotive parts in the United States declined from $1.7 billion in 1982 to $1.5 billion in 1983 before climbing 87 percent to $2.8 billion in 1986 (table 3-5). In 1983, the lowest level of capital expenditures, was closely tied to the decline of passenger car production in 1982 (to less than 5 million units). Producers responding to the Commission's questionnaire indicated that the subsequent increase in capital expenditures in U.S. facilities reflects the rebound in the auto industry, the ongoing effort to economize on expensive labor, and overall awareness by U.S. producers that manufacturers with less modern plants will suffer the effects of increased foreign competition. Thus, the automotive parts industry has increased its efforts to employ more advanced manufacturing techniques through the installation of new machinery and equipment, and to improve facility utilization with the goal of lowering overall production unit costs and improving productivity. The average annual

Table 3-5
Automotive parts: U.S. producers' capital expenditures in the United States, and by foreign country, 1982-86 1/

Item	1982	1983	1984	1985	1986	Average annual change, 1986 over 1982
	-----------------1,000 dollars-----------------					Percent
United States....	1,656,822	1,478,574	2,424,943	2,622,908	2,782,159	13.8
Canada...........	47,667	63,139	210,295	507,249	200,944	43.2
Japan............	8,359	40,492	14,747	106,470	126,651	97.3
United Kingdom...	39,161	40,977	49,078	89,754	100,077	26.5
Mexico...........	16,212	8,898	17,225	23,212	94,529	55.4
Brazil...........	31,350	22,961	35,782	89,638	80,407	26.5
West Germany.....	26,535	25,042	32,281	47,761	51,586	18.0
France...........	12,121	11,994	15,491	31,733	42,686	37.0
Italy............	6,318	7,280	15,557	14,949	13,056	19.9
Taiwan...........	-	-	-	45	107	-
All other........	150,520	105,519	148,186	176,581	256,116	14.2
Total........	1,995,065	1,804,876	2,968,585	3,710,300	3,748,318	17.1
United States as a percentage of total world..........	83.3	82.2	82.2	71.0	74.5	-

1/ Reported in U.S. dollars by questionnaire respondents.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

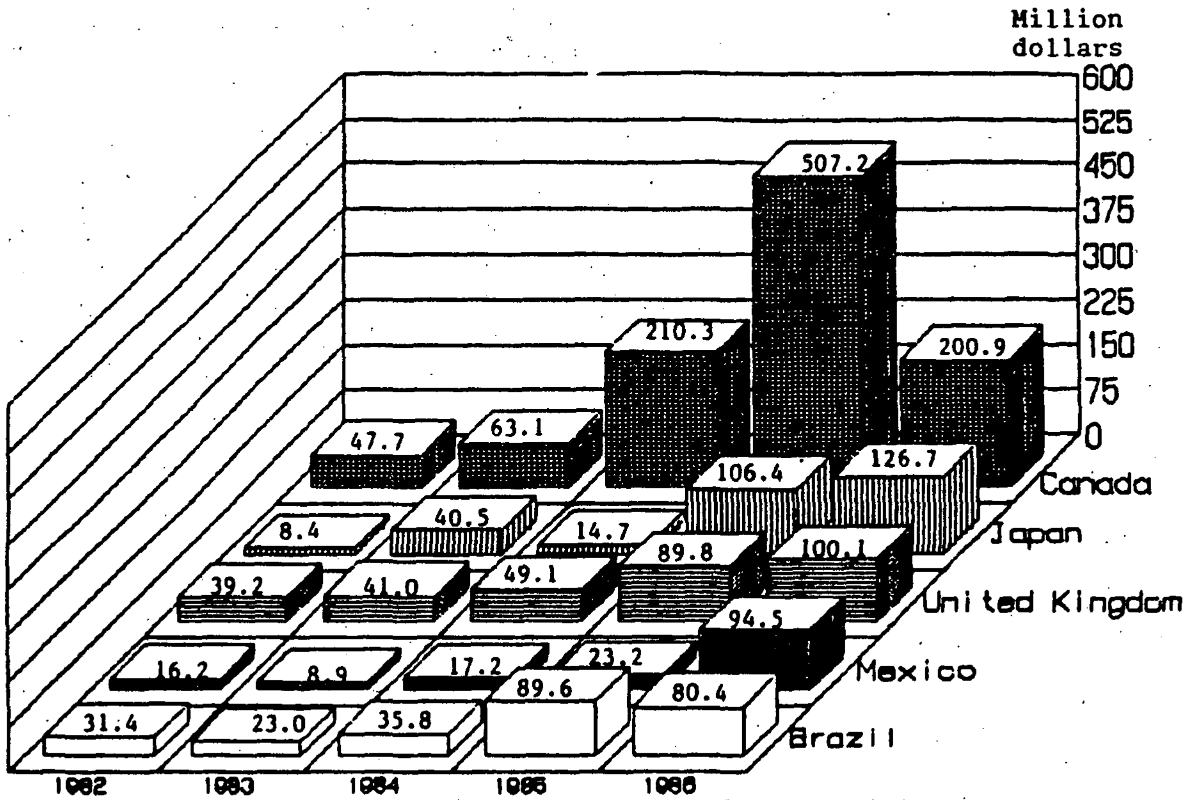
increase in capital expenditures during the period 1982-86 amounted to 14 percent. Capital expenditures in U.S. facilities as a percent of net sales amounted to 4 percent over the period of 1982-86.

However, several respondents to the questionnaire noted that changes in the Federal tax law in 1986 and the resulting loss of investment tax credit will make it less likely that many new plants will be built. Moreover, a number of respondents stated that the low wages paid to workers in Korea, Taiwan, and Brazil could not be matched with increased investment in capital equipment and the resulting price competition would make it difficult for many U.S. firms to start/continue recapitalization efforts.

U.S. producers' capital expenditures in domestic facilities declined from 83 percent of their total world expenditures in 1982 to 74 percent in 1986. The decline in investment in domestic facilities and the almost tripling of investment in foreign-based facilities is representative of the shift by U.S. manufacturers to offshore production facilities. Reasons given by U.S. manufacturers for this trend include lower labor costs, lower cost of production facilities because of the value of foreign currency relative to the dollar, and joint ventures in manufacturing and technology.

According to respondents to the Commission's questionnaire, Canada reportedly received the largest influx of capital expenditures, rising from $47.7 million in 1982 to $200.9 million in 1986, representing a threefold increase (fig. 3-6). Japan received a fourteenfold increase in capital expenditures, from $8.4 million in 1982 to $126.7 million in 1986. The United Kingdom received the third largest amount of expenditures from U.S. manufacturers of automotive parts for production facilities and tooling, with a 1 1/2-fold increase from $39.2 million in 1982 to $100.1 million in 1986. Other countries in which U.S. automotive parts producers made direct investments include Mexico, which experienced a fivefold increase to $94.5 million, Brazil, which received a 1 1/2-fold increase to $80.4 million, and West Germany, which doubled to $51.6 million.

Figure 3-6
Automotive parts: U.S. producers' annual foreign investment, by countries, 1982-86



Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Research and development

Respondents to the Commission's questionnaires reported that research and development (R&D) expenditures on pure research, developing new or improved products and manufacturing methods, and on testing new materials produced in domestic automotive parts facilities increased steadily to $2.1 billion in

1986, a 63-percent increase over the 1982 level (table 3-6). During the same period, R&D expenditures committed to U.S.-owned facilities in foreign countries increased to $282 million in 1986, or by 99 percent. U.S.-owned firms' expenditures on R&D of domestically produced automotive parts as a percent of their total world expenditures remained fairly stable at approximately 90 percent throughout the period 1982-86. The average annual increase in R&D amounted to 14 percent during 1982-86.

Table 3-6
Automotive parts: U.S. producers' research and development expenditures in the United States and abroad, 1982-86 1/

Item	1982	1983	1984	1985	1986	Average annual change, 1986 over 1982
	1,000 dollars					Percent
United States	1,269,035	1,354,846	1,596,968	1,641,754	2,073,774	13.0
United Kingdom	31,099	27,810	28,719	31,606	54,104	14.9
West Germany	21,108	21,872	21,473	24,281	35,234	13.7
France	13,861	13,112	14,048	16,936	29,598	20.9
Canada	10,262	12,735	22,181	23,092	26,191	26.4
Brazil	6,514	5,884	6,458	7,260	8,513	6.9
All other	58,836	55,696	78,332	100,849	128,567	21.6
Total	1,410,715	1,491,955	1,768,179	1,845,778	2,355,981	13.7

1/ Reported in U.S. dollars by questionnaire respondents.

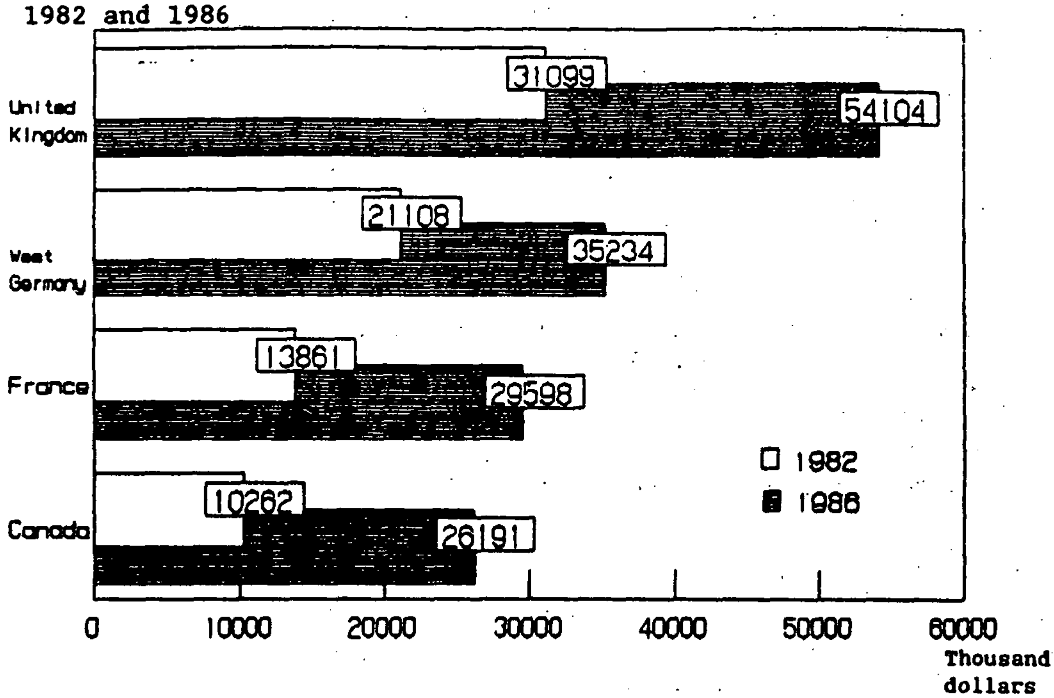
Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

The increase in R&D spending in the United States parallels the 68-percent rise in capital investment in domestic facilities over the period. Respondents indicated that efforts are being made to engineer, build, and test new products through computer processes such as computer-aided-design/computer-aided-manufacturing (CAD/CAM), and to evaluate new materials and production methods that will result in better performance and reduced manufacturing costs.

U.S. producers reported that facilities in the United Kingdom received the largest overall spending on 1986, amounting to $54.1 million, up 74 percent from the 1982 level (figs. 3-7 and 3-8). Respondents indicated that plants in West Germany received the second largest amount of R&D expenditures, amounting to $35.2 million, an increase of 67 percent over the 1982 level. Production facilities located in France and Canada also received increases in R&D funds.

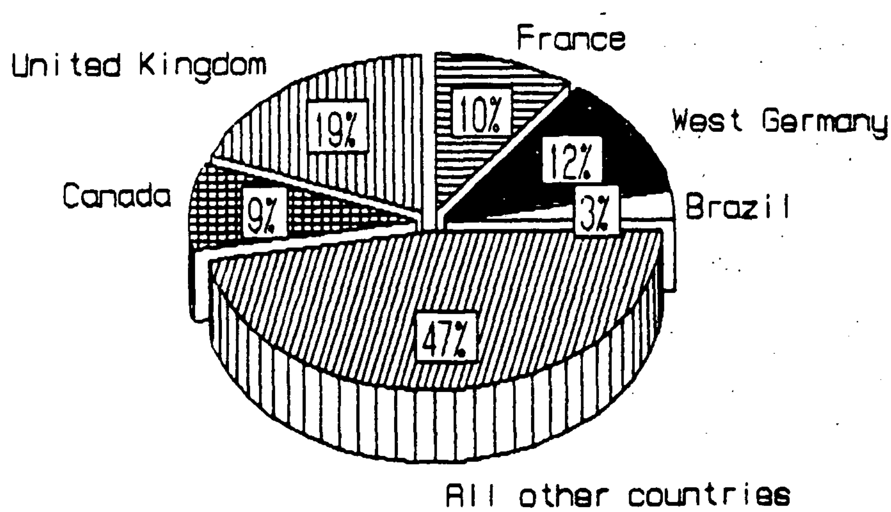
The increase in R&D spending on foreign-based facilities reflects an increase in joint ventures with industrialized and newly industrialized countries. Producers responding to the questionnaire indicated that automotive parts producers engage in joint ventures in the area of R&D to spread the risk and cost of development.

Figure 3-7
Automotive parts: U.S. producers R&D spending in major foreign countries, 1982 and 1986



Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Figure 3-8
Automotive parts: U.S. producers' R&D spending in foreign countries, 1986



Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Although R&D expenditures as a percent of net sales in the United States remained relatively constant at about 2 percent over the period during 1982-86, the Japanese Auto Parts Industry Association (JAPIA), claims that Japanese parts makers invest in R&D at a higher rate (about 3 percent in 1986) than U.S. firms. 1/ Further, a U.S. industry source stated that U.S. suppliers must increase R&D-related spending to re-engineer and test parts if they are to meet the requirements of and increase sales to Japanese-owned automakers.

U.S. employment, hours worked, and wages

Total U.S. employment in the automotive parts industry, as reported by questionnaire respondents, climbed steadily, rising 21 percent between 1982 and 1985 to 610,570 persons, before declining by 3 percent to 591,638 persons in 1986 (table 3-7). Paralleling the trends in employment, the number of hours worked rose by 35 percent from 736 million to 996 million hours during 1982-85, and then declined by 4 percent to 953 million hours in 1986.

Table 3-7
Automotive parts: Number of U.S. employees, man-hours worked, and wages paid, 1982-86

Item	1982	1983	1984	1985	1986	Average annual percentage change, 1986 over 1982
Number of employees:						
All persons....	504,580	537,045	596,283	610,570	591,638	4.0
Production and related workers......	445,344	459,352	554,965	563,334	554,117	5.5
Man-hours worked (1,000 hours)..	736,171	828,849	969,518	996,185	952,794	6.6
Wages paid (1,000 dollars)..	9,007,879	10,671,047	14,125,443	15,453,365	16,400,786	16.2

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

The gradual rise in employment in the automotive parts sector from the low recessionary levels in 1982 reflects a recovery in the auto industry,

1/ Interview with JAPIA officials, Tokyo, Japan, Apr. 20, 1987.

which generated increased activity in related industries. Respondents to the Commission's questionnaires allege that much of the recent decline in employment levels can be attributed to increased imports. Other industry sources indicate that the slight decline in employment during 1985-86 partly reflects increased efforts by U.S. suppliers to incorporate labor saving equipment.

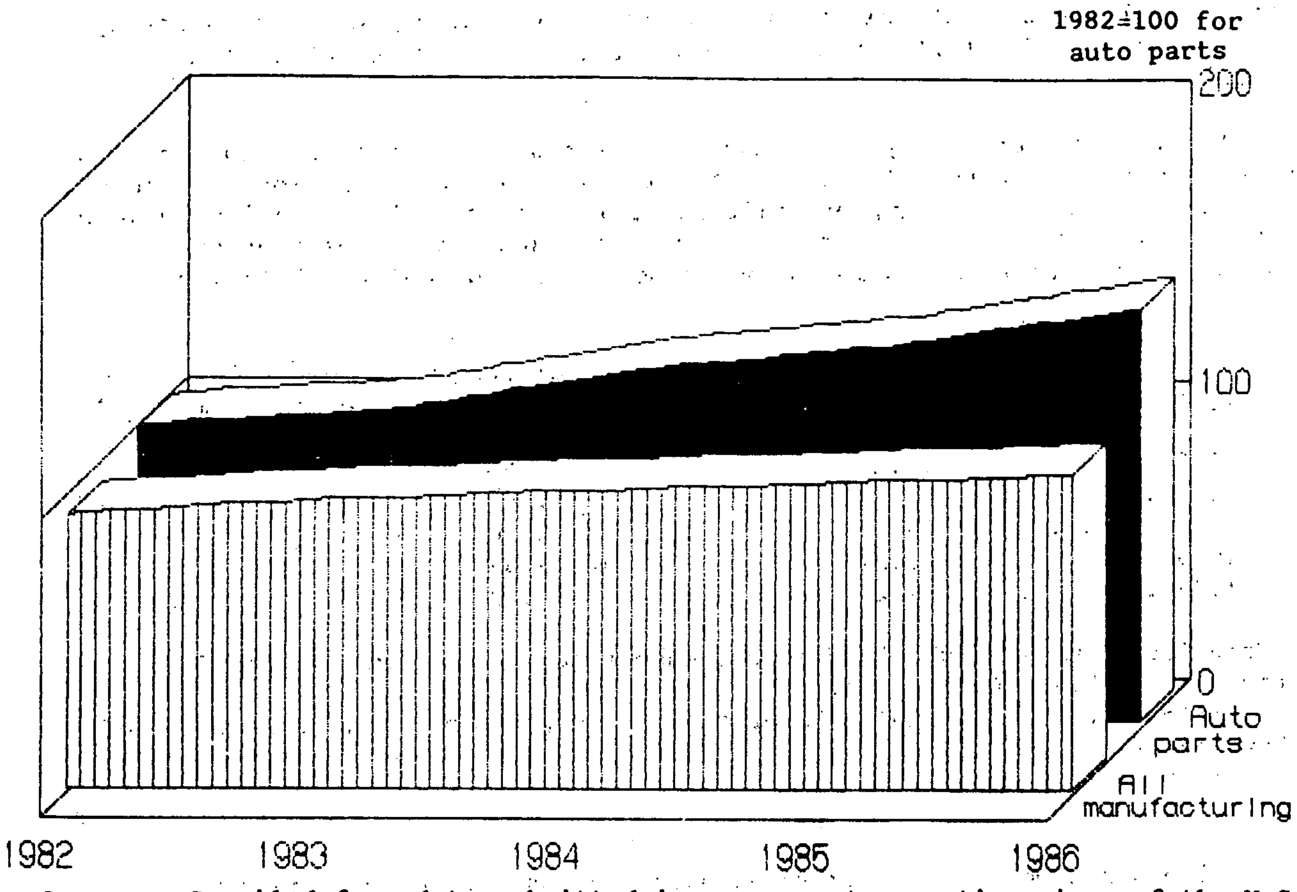
A comparison of hourly wages and compensation paid to production workers in the automotive parts industry and hourly wages and compensation paid in all operating U.S. manufacturing establishments indicates that production workers in the automotive parts industry are receiving wages above the average for U.S. manufacturing establishments, as shown in the following tabulation:

Year	U.S. automotive parts workers 1/	Workers in all operating manufacturing establishments 2/
1982............	$12.24	$11.50
1983............	12.90	11.97
1984............	14.57	12.40
1985............	15.51	3/ 12.82
1986............	17.21	3/ 13.09

1/ Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.
2/ Compiled from unpublished data of the U.S. Department of Labor, Bureau of Labor Statistics.
3/ Estimated.

Automotive parts workers hourly wages have increased by 41 percent over the 5-year period, where all workers' wages rose by 14 percent over the same period (fig. 3-9). The average annual percentage change amounted to 9 percent for U.S. automotive parts workers and 3 percent for workers in all operating manufacturing establishments.

Figure 3-9
Automotive parts: Index of U.S. automotive parts workers' wages to all U.S. manufacturing workers' wages, 1982-86



Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission and from unpublished data of the U.S. Department of Labor.

CHAPTER 4. MAJOR FOREIGN COMPETITORS

Major foreign competitors of the U.S. automotive parts industry are Canada, Japan, Mexico, and West Germany. In recent years, however, competition has increased from Brazil, Korea, and Taiwan, as well as from other newly industrialized countries.

Brazil

Industry structure.--The Brazilian automotive parts industry, established in 1957, consists of some 2,000 firms. About 600 of these are located in the Sao Paulo region, close to the auto assembly facilities of Ford, General Motors, and Volkswagen. 1/ A number of Brazilian auto parts producers are subsidiaries of U.S.-owned parts makers, the majority of which established operations in Brazil to supply original-equipment parts to the major Brazilian auto assemblers. However, many of these U.S.-owned firms have since established export programs. Many did so to take advantage of the incentives of the BEFIEX program. 2/

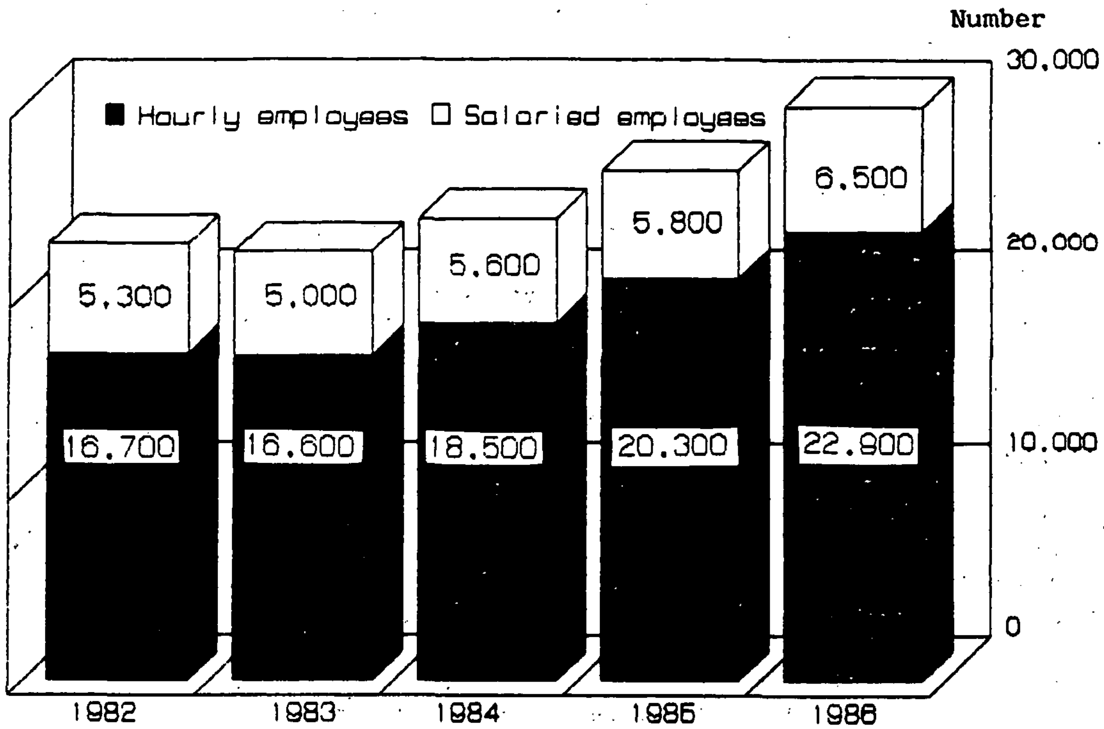
The Brazilian automotive parts industry employs about 30,000 workers (fig. 4-1). Average wages, including fringe benefits, vary between U.S. $3.60 and $5.20 per hour for skilled workers and $1.85 to $3.16 per hour for semi-skilled and nonskilled employees. Although the typical employee works 8 hours a day, 5 days a week, many production workers work 6 days a week. 3/ In general, overtime during working days carries a 50-percent premium, and Sundays and holidays carry a 100-percent premium up to a total of 8 hours a day; above 8 hours, the premium rises to 150 percent. Principal fringe benefits provided by certain major companies include a Social Security-type pension plan administered by the Government of Brazil, government medical and dental services, accident insurance, a termination pay fund, sick pay, maternity leave, yearly vacations, and uniforms and other accessories needed for specific work categories. Additional benefits provided by certain firms include free medical, hospital, dental, and medicine services beyond that which is provided by the government; subsidized transportation; and subsidized meals. 4/

Brazilian automotive parts producers' capital expenditures for new plant and equipment increased irregularly from $271 million in 1982 to $400 million in 1986 as shown in the tabulation on the following page. 5/

Most Brazilian parts makers devote less than 3 percent of sales to research and development (a ratio similar to that of the U.S. industry and

1/ USITC staff interview with General Motors do Brasil officials, Sao Paulo, Brazil, May 11, 1987.
2/ Ibid.
3/ USITC staff interview with Cofap officials, Sao Paulo, Brazil, May 13, 1987.
4/ USITC staff interview with U.S. Department of State officials, Sao Paulo, Brazil, May 11, 1987.
5/ Report from the U.S. Consulate, Sao Paulo, Brazil, June 1987.

Figure 4-1
Automotive parts: Brazilian hourly and salaried employees, 1982-86



Source: Report from the U.S. Consulate, Sao Paulo, Brazil, June 1987.

Year	Value (Million dollars)
1982	271
1983	189
1984	232
1985	254
1986	400

many foreign industries). 1/ Industry sources state that Brazilian subsidiaries of multinational corporations benefit greatly from the transfer of technology from parent companies.

According to industry sources, the unpredictable nature of the Brazilian economy makes future capital investment projections difficult. High real interest rates during January-June 1987, for example, made financing new investments extremely expensive. Industry sources also indicate that investment incentives are inhibited by Government-enforced price controls on

1/ USITC staff interview with Sindipecas officials, Sao Paulo, Brazil, May 12, 1987; and USITC Publication 1950, report on The Effect of Developing Country Debt-Servicing Problems on U.S. Trade, March 1987.

domestic sales. 1/ In addition to the high cost of capital and the cyclical demand in the Brazilian market, exchange rate trends have had a negative impact on the international competitiveness of Brazilian auto parts producers. Despite these problems, industry sources stated that Brazilian parts producers are expected to invest in new plants and equipment at a steady rate in order to remain competitive in the global market. Most investment is carried out via commercial lending. Bond issuances or stock issuances are also commonplace. The National Development Bank (BANDES) is the principal Government of Brazil source available for financial lending to auto parts producers.

Brazil's large foreign debt has resulted in a growing trend toward "debt for equity swaps" by U.S., European, and Japanese banks. 2/ The exchange takes place when a creditor bank offers Brazilian Central Bank paper at face value for Brazilian cruzados, then assumes an equity position (with a partner) in a local firm. With an increasing number of swaps planned for the automotive parts sector, it is likely that U.S. firms' equity interest in the Brazilian automotive parts industry will grow in the near future.

Domestic market.--The Brazilian domestic market for automobiles is about 1 million vehicles per year, amounting to about $5.5 billion. The principal purchasers of automotive parts are Brazilian automakers. The four largest, which account for almost all domestic production, are subsidiaries of Ford, General Motors, Volkswagen, and Fiat. 3/

Brazilian production of automotive parts climbed by 27 percent during 1982-86 to $6.5 billion in 1986 (table 4-1). About 60 percent of domestic production is for the OEM market. Capacity utilization rates increased from 71 percent in 1982 to 84 percent in 1986.

Table 4-1
Automotive parts: Brazilian production and capacity utilization, 1982-86

Item	1982	1983	1984	1985	1986	Average annual percentage change, 1986 over 1982
Production (billion dollars)....	5.1	3.8	5.9	5.6	6.5	6.3
Capacity utilization (percent).........	71	70	78	80	84	4.3

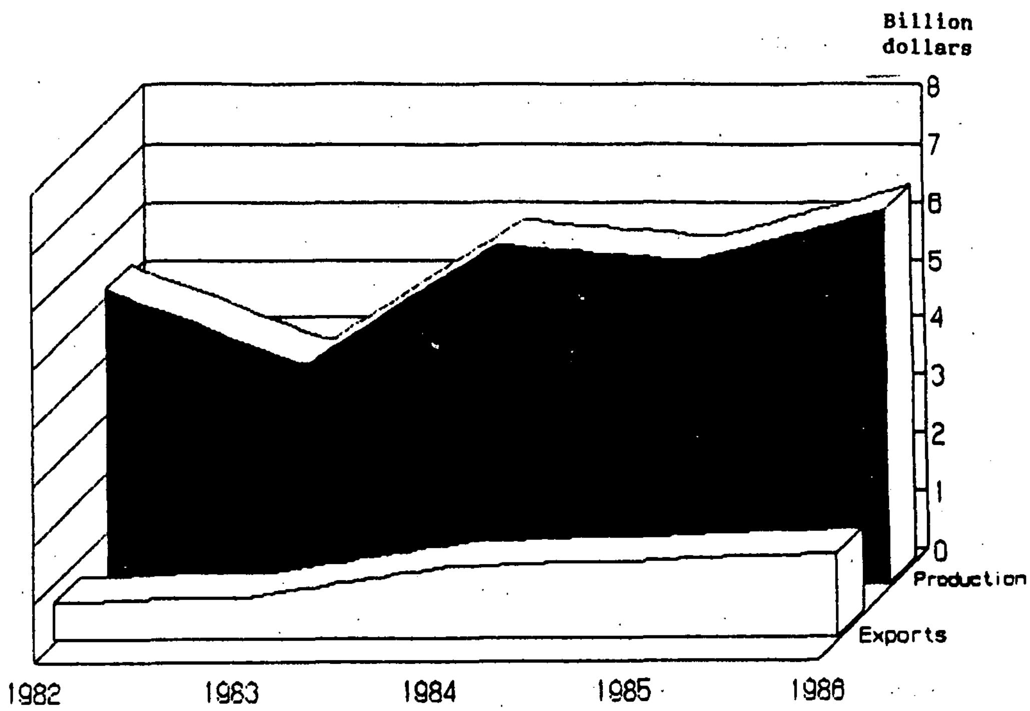
Source: Report from the U.S. Consulate, Sao Paulo, Brazil, June 1987.

1/ USITC staff interview with Sindipecas officials, Sao Paulo, Brazil, May 12, 1987; and USITC Publication 1950, report on The Effect of Developing Country Debt-Servicing Problems on U.S. Trade, March 1987.
2/ USITC staff interview with U.S. Department of State officials, Sao Paulo, Brazil, May 11, 1987.
3/ USITC staff interview with Sindipecas officials, Sao Paulo, Brazil, May 12, 1987.

Trade.--Approximately 200 Brazilian manufacturers export automotive parts to more than 100 countries. Brazilian exports 1/ of automotive parts rose by 114 percent (fig. 4-2) during the period to $1.5 billion in 1986, as shown in the following tabulation:

Year	Value (Million dollars)
1982	700
1983	800
1984	1,300
1985	1,400
1986	1,500

Figure 4-2
Automotive parts: Brazilian production and exports, 1982-86



Source: Report from the U.S. Consulate, Sao Paulo, Brazil, 1987.

Exports to the United States, the largest export market, ranged from 37 percent of total exports in 1982 to 60 percent in 1984 and 1986 (table 4-2). Exports destined for Latin American countries fell during 1982-86, largely because of declining economic conditions in that region. 2/

1/ Report from the U.S. Consulate, Sao Paulo, Brazil, June 1987.
2/ Transportation costs amounted to 8.4 percent according to USITC Publication 1375, Report on Investigation No. 332-141 on Transportation Costs of U.S. Imports, April 1983.

Table 4-2
Automotive parts: Major export markets for Brazilian-produced automotive parts, 1982-86

Market	1982	1983	1984	1985	1986	Annual average change, 1986 over 1982
	----------------1,000 dollars----------------					Percent
United States....	243.0	418.0	763.9	808.6	870.0	37.6
Italy............	79.7	79.9	125.2	162.0	145.0	16.1
West Germany.....	78.4	-	-	65.6	72.3	-2.0
Argentina........	-	45.6	59.4	-	72.5	12.3

Source: Estimated from the report from the U.S. Consulate, Sao Paulo, Brazil, June 1987.

U.S. industry sources claim that the Government of Brazil has undertaken programs that restrict the importation of automotive parts while developing local industries and strategic sectors to conserve foreign exchange reserves. For example, Brazil limits imports by levying high tariffs; Brazilian tariffs for automotive parts range from 8 to 205 percent ad valorem, with the tariffs on most products ranging between 25 and 90 percent (the average U.S. tariff rate for parts is 3.1 percent). In addition, there are important surcharges (extrapolated from the tariff rate) on imports of certain products. Tariffs, along with the relatively high transportation costs between the United States and Brazil, 1/ render most U.S.-produced parts nonprice competitive in the Brazilian market. 2/

In addition to high tariff rates, import licenses are mandatory for most automotive parts. Licenses are issued by the Foreign Trade Department of the Banco de Brasil (CACEX). An important facet of obtaining import licences is the fact that the Brazilian "law of similars" can be used to limit imports of products that are already manufactured in the country. Although there are many exceptions to this rule, the application of any specific exemption from this rule is not automatic and is subject to negotiation between the Government of Brazil and the importer. However, it should be noted that there is a duty drawback system commonly used by Brazilian parts makers that permits the Brazilian Government to suspend or reimburse import duties and other taxes on certain imports when they are used in the manufacturing of a product for export. 2/

Government programs.--The Government of Brazil has initiated several noteworthy programs to encourage domestic competition, promote alternative fuels, control automotive emmissions, and stimulate exports. A 1979 Government of Brazil decree restricted new parts making projects by Brazilian auto assemblers. However, these limitations can be relaxed if a particular

1/ Ibid.
2/ Report from the U.S. Consulate, Sao Paulo, Brazil, June 1987.

automotive part is not produced by a Brazilian firm. This decree has had the effect of stimulating an increase in the number of independent producers. 1/

Brazil has a special program to promote the development of an alcohol-burning engine. The research that led to the development of this engine was the result of a joint effort by the Government of Brazil and auto manufacturers. The Brazilian Government has also announced controls to reduce auto emissions; thus, there has also been research efforts aimed at reducing alcohol engine emissions. 2/

The BEFIEX program is the most important Government of Brazil program for encouraging exports of automotive parts. BEFIEX is a contractural agreement between the Government and a specific manufacturer. Under a BEFIEX contract, a firm can receive exemptions from import duties as well as a direct rebate, based on the percentage of local value added, of the industrial products tax (IPT). In exchange for these incentives, the firm commits to a certain level of exports over a period of time (typically 10 years). The value of imports receiving tax benefits is typically a percentage of the value of exports pledged. 3/ For example, in exchange for $300 million of imports that receive tax benefits, a firm might commit to $800 million of exports. Auto parts manufacturing subsidiaries of multinational firms account for approximately one-third of all BEFIEX contracts. Potentially, if a firm did not comply with its contractual obligations, strict financial penalties could be enforced. However, in practice, if a firm is unable to comply, a contract is typically renegotiated with the Government.

Another less frequently used government program, Resolution 68 of the "Conselho Nacional do Comercio Exterior" (CONCEX), permits the Foreign Trade Department of the Bank of Brazil (CACES) to draw upon the resources of the Fundo de Financiamento a Exportacao (FINEX) to provide financing for exports. Financing can be extended to exporters or foreign importers. Exporters can receive financing for up to 85 percent of the value of the merchandise. 4/

Canada

Industry structure.--There are over 2,000 firms producing automotive parts in Canada, employing some 84,000 persons. They are generally categorized as captive suppliers of major automobile assemblers (all of whom are foreign owned), independent foreign-owned companies, and independent Canadian-owned companies. In-house original equipment parts (e.g., engines and transmissions) produced by the major auto assemblers accounted for about 40 percent of total Canadian production in 1984-85. Industry sources report that General Motors (GM) manufactures approximately 70 percent of its auto parts in-house, Ford approximately 45 percent, and Chrysler about 25 percent. 5/

1/ USITC staff interview with U.S. Department of State officials, Sao Paulo, Brazil, May 11, 1987.
2/ USITC staff interview with U.S. Department of State officials, Sao Paulo, Brazil, May 11, 1987.
3/ Ibid.
4/ Report from the U.S. Consulate, Sao Paulo, Brazil, June 1987.
5/ USITC staff interview with officials of the Canadian Automotive Parts Manufacturers Association, Toronto, Canada, Apr. 30, 1987.

Other Canadian suppliers range from large multinational companies to small jobbers. According to industry sources, approximately 20 multinational suppliers account for about 25 percent of total original equipment production. About 500 other firms account for most of the rest. The center of the industry is located in Southern Ontario, and the bulk of production is destined for export to the United States. 1/

According to industry sources, the largest independent auto parts manufacturers in Canada include Canadian-owned firms such as Magna International Inc., Woodbridge Group, A.G. Simpson, and ABC Plastic Moulding; and U.S.-owned firms like Budd Canada Inc., Hayes-Dana Inc., Kelsey Hayes Inc., Rockwell International, and TRW Canada. 2/

There has been a noteworthy increase in investment in the Canadian automotive industry in recent years, resulting in additional capacity of up to 700,000 automobiles by 1992. Industry sources indicate that recent investments include (1) $3 billion investment by GM to expand a truck plant in Oshawa, Ontario; (2) $300 million Honda plant in Alliston, Ontario, creating additional capacity of 80,000 units annually; (3) $400 million Hyundai facility in Bromont, Quebec, resulting in an additional 250,000 units, (4) $500 million Toyota plant in Cambridge, Ontario, with new capacity of 50,000 to 100,000 units annually; (5) over $1 billion investment by AMC Renault in Bramalea, Ontario; and (6) $700 million GM-Suzuki joint venture in Ingersoll, Ontario, with an annual output of 20,000 units a year. 3/ Many foreign-owned automakers invested in Canada because the average Canadian assembly plant wage cost is nearly US$8 per hour less than in the United States. 4/

Domestic market.--The total Canadian market for automotive parts was about $13 billion in 1984 (table 4-3). The market is expected to reach $20 billion by 1989, reflecting a compound growth rate of nearly 10 percent in nominal terms. 5/ Shipments, imports, and exports are all projected to expand during 1986-89 (fig. 4-3). The principal cause of this anticipated growth is continued economic expansion, which is providing for increased vehicle usage and an increase in the number of vehicles per capita. The Canadian original-equipment market accounts for about 75 percent of industry consumption; the aftermarket accounts for the remaining 25 percent.

The three major end users of automotive parts in Canada are the original-equipment manufacturer (OEM) (motor vehicle assemblers); the aftermarket, and commercial fleet operators. The major auto assemblers purchase about 85 percent of Canadian auto parts output. The principal end user of replacement parts is retail trade for the consumer market, which includes retail service stations, new car dealers, and auto parts and accessories outlets. About 50 percent of the retail trade in aftermarket products is conducted through service stations. With longer warranty periods, new car dealers are offering more servicing facilities and are increasing their sales of auto parts.

1/ Ibid.
2/ Ibid.
3/ Country Marketing Plan, Post Commercial Action Plan, Canada, 1987, p. 1.
4/ Ibid.
5/ The Coopers & Lybrand Consulting Group, Report on the Canadian Automotive Parts, Accessories and Services Equipment Market, Sept. 24, 1986. pp. 6 and 9.

Table 4-3
Automotive parts and accessories and automotive service equipment: Canadian net apparent market, 1984-89

Item	1984	1985	1986 1/	1989 1/	Average annual change, 1984-89
	Million dollars				Percent
Automotive parts and accessories:					
Net apparent market	12,665.0	14,495.0	16,220.0	20,080.0	12.2
Original equipment share	10,765.2	12,320.7	13,787.0	17,068.0	12.2
Aftermarket share	1,899.8	2,174.3	2,433.0	3,012.0	12.2
Automotive service equipment:					
Shipments	15.5	19.7	21.2	24.0	11.6
Imports	45.2	79.7	81.7	84.3	16.9
Exports 1/	7.5	7.8	8.1	11.4	11.0
Net apparent market	53.2	91.6	94.8	96.9	16.2
Total net apparent market	12,718.2	14,586.6	16,314.8	20,176.9	16.2

1/ Estimated by The Coopers & Lybrand Consulting Group.

Source: Statistics Canada, Manufacturing Division, External Trade Division Industry Estimates, The Coopers & Lybrand Consulting Group.

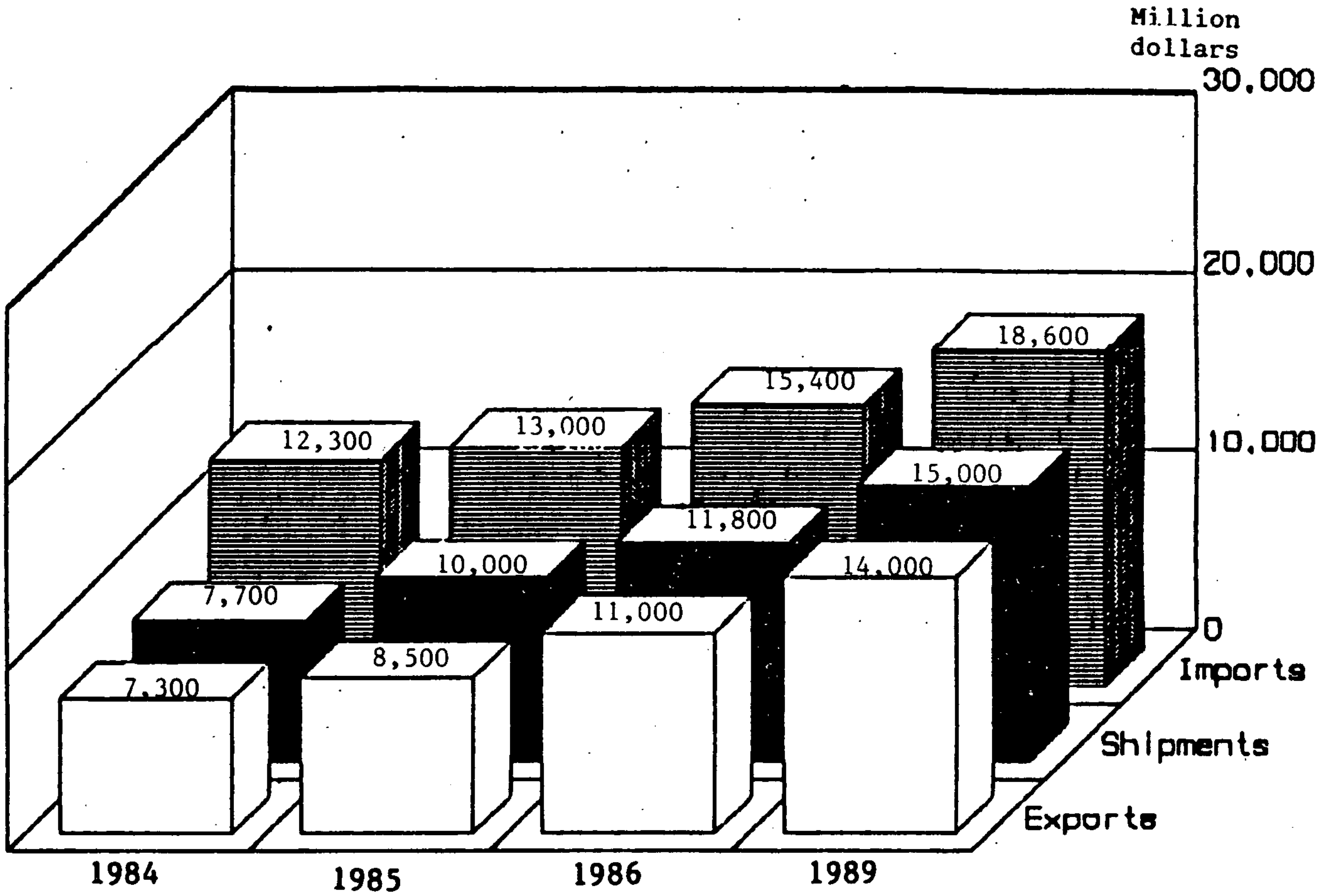
Canadian owners of imported autos go to dealers for service about twice as often as U.S. auto owners, because it is perceived that an imported auto requires specialized repair knowledge. The dealers typically install imported components provided by the manufacturer. In 1984, there were 47 major mass merchandisers with approximately 1,700 outlets, which accounted for nearly 30 percent of the sales of aftermarket products. Demand in this sector should remain strong through 1990 as the aftermarket continues to expand. 1/

The third major end users--commercial fleet operators--describes service or manufacturing firms with their own vehicle fleets. Demand for vehicles in this market is gradually contracting; thus, parts for trucks and buses will not be in high demand.

Trade.--Because of the Automotive Products Trade Agreement (APTA), which provides duty-free trade between the United States and Canada in original-equipment auto parts (p. 6-7), the United States is the major supplier of auto components to the Canadian market. In 1985, the U.S. import share of auto parts was about 90 percent, whereas Japan accounted for less than 5 percent. Canadian imports from Japan, Korea, and Mexico will continue to grow as sales of automobiles from these countries continue to expand.

1/ Country Marketing Plan, Post Commercial Action Plan, Canada, 1987, p. 3.

Figure 4-3
Automotive parts and accessories: Canadian shipments, imports, and exports, 1984-86 and 1989 1/



1/ Data for 1986 and 1989 estimated by the Coopers & Lybrand Consulting Group.

Sources: Statistics Canada, Manufacturing Division, External Trade Division. Industry estimates, The Coopers and Lybrand Consulting Group.

Canadian imports of aftermarket parts from the United States currently enter Canada at a duty of 9.2 percent ad valorem, whereas original-equipment parts enter duty free. Imports from "developing countries" such as Korea and Mexico enter Canada at a rate approximately two-thirds of the rate levied against "developed countries" such as the United States and Japan. Canadian Customs also requires that all auto parts shipped to Canada meet certain import mandates such as bilingual labeling in French and English and metric sizing.

Government programs.--The Canadian Government provides aid to the Canadian automotive industry to develop process technology through the Auto Centre for Automotive Parts Technology. During 1984-86, the Centre aided some 700 firms, and provided approximately 10,000 person days of training. Firms receiving loans from the Centre can be eligible for partial deferral of principal and interest payments for up to 3 years. To date, about 50 Canadian firms have received such loans. 1/

France

Industry structure.--There are approximately 350 companies in France that produce automobile parts, employing approximately 108,000 persons. During 1986, five of the largest French auto parts suppliers were either sold to, or entered into joint ventures with foreign companies. Valeo, the largest French auto parts producer, with 1985 sales of about $1.3 billion, was taken over by Carlo de Bendetti, the manager of the Italian firms Olivetti and Fiat. De Carbon, France's leading manufacturer of shock absorbers, with 1985 sales of $27 million, entered into a joint venture with Delco Products. Allinquant, France's second largest producer of shock absorbers, was sold to Fichtel and Sachs of West Germany. Matra, with its two equipment subsidiaries, is negotiating a joint venture with Fiat of Italy. Renault and Bendix recently formed a joint-venture subsidiary (Renix) for the production of electrical and electronic auto parts in France. 2/

Domestic market.--Apparent consumption of auto parts in France decreased from $7.2 billion in 1983 to $5.2 billion in 1984 before increasing to $7.0 billion in 1986 (table 4-4). About 53 percent of the market was accounted for by the OEM. 3/

Table 4-4
Automobile parts: French production, exports, imports and apparent consumption, 1983-86

Year	Production	Exports	Imports	Apparent consumption	Ratio of imports to consumption
	Million dollars				Percent
1983	9,245	5,063	2,995	7,177	41.7
1984	7,222	4,518	2,468	5,172	47.7
1985	7,097	4,396	2,558	5,259	48.6
1986	9,430	5,904	3,468	6,994	49.6

Source: The Department of Commerce Post Commercial Action Plan of France.

France's automotive parts market ranked fourth worldwide in 1985, after the U.S., Japanese, and West German markets. It is expected to grow at an average annual rate of 3 percent through 1990. The expansion of the parts market is reportedly due to the aging of the French automobiles, new regulations in France controlling the sale of used cars, new EC regulations regarding pollution controls, a general trend towards increased comfort,

1/ Ibid.
2/ Report from U.S. Embassy, Paris, France, April 1987.
3/ Country Marketing Plan, Post Commercial Action Plan, France, 1986, p. 17.

quality, and safety in automobiles, and new demands for fuel efficiency. 1/ Import penetration, which reached almost 50 percent in 1986, is expected to grow by an additional 3 percentage points by 1990.

Sales of selected automotive parts in France fluctuated upward by 29 percent during 1982-86 to an estimated $6.8 billion in 1986 (table 4-5). Sales of chassis equipment showed the highest average annual increase, rising from $2.6 billion in 1982 to $3.6 billion in 1986.

Trade.--Exports of auto parts increased by 17 percent during the period 1982-86 to $5.9 billion. The United States was the principal export market, followed by the EC countries. The growth in exports in 1986 was primarily related to increased foreign activity by a French-based automaker. Imports of auto parts increased from the 1982 level by 16 percent to $3.5 billion in 1986.

Table 4-5
Automotive parts: French sales of selected products, 1982-86

Item	1982	1983	1984	1985	1986	Average annual change, 1986 over 1982
	Million dollars					Percent
Electrical equipment	915	871	1,008	858	1,082	4.3
Engine equipment	765	715	840	824	952	1.9
Chassis equipment	2,565	2,587	2,954	2,643	3,564	8.6
Body equipment	870	806	882	755	1,068	5.3
Tooling for motors and garages	150	130	126	103	144	1.0
Total	5,265	5,109	5,810	5,183	6,810	6.6

Source: Estimated from the report from the U.S. Embassy, Paris, France, April 1987.

Imports from the United States rose from $317 million in 1983 to $550 million in 1986. The increase in imports from the United States and other countries is largely related to an expansion in the transfer of technology. 2/

1/ Country Marketing Plan, Post Commercial Action Plan, France, 1986.
2/ Country Marketing Plan, Post Commercial Action Plan, France, 1987, p. 5.

Import duties on selected automotive parts entering France range from about 5 to 14 percent ad valorem; the value-added tax ranges from almost 19 percent to 33 percent, as shown in the following tabulation: 1/

	Import duty	Value-added tax
Bearings: iron, self-lubricating, and porous...	4.9	18.6
Shock absorbers.............	8.2	18.6
New car tires...............	5.8	18.6
Car radios with speakers....	14.0	33.3

Government programs.--Although the industry does not receive direct Government assistance, the Government is nevertheless present through the nationalized automaker, Renault. Industry sources indicate that there is some discussion of changing Renault's legal status from "state agency" to "nationalized company." The change may be one step towards the company's privatization.

Japan

Industry structure.--There are over 10,000 producers of automotive parts in Japan employing some 600,000 persons. Approximately 8,000 of these producers are small firms having 29 workers or less, about 1,300 are medium-sized firms having 30 to 99 workers, and about 600 are large companies having 100 or more workers. 2/

Most Japanese auto parts producers are affiliated with one of the 11 Japanese automakers. Most of the auto producers are linked to larger networks of Japanese companies representing a wide range of industries. These networks are known as "keiritsu" industrial groups. The keiritsu structure links firms in different industries to form conglomerations of companies. The keiritsu structure is an interweaving of companies through equity exchanges, interlocking directorates, intra-group financial commitments, joint R&D efforts, and membership to exclusive management councils or clubs. The objective of these groups is to work collectively to increase total group sales and employment. Member companies generally have a strong tendency to purchase from other member companies; this structure makes it difficult for potential outside suppliers (domestic or foreign) to sell to companies in the group. 3/

1/ According to an April 1987 report from the U.S. Embassy.
2/ The Structure of the Japanese Auto Parts Industry, Dodwell Marketing Consultants, 1986, and Stephan B. Wickman, "The Character and Structure of the Economy," Japan: A Country Study, ed. Fredericka Bunge (Washington, DC: The American University, 1983), pp. 141-196.
3/ The Structure of the Japanese Auto Parts Industry, Dodwell Marketing Consultants, 1983.

There are six major keiritsu groups in Japan. At the core of each is a major Japanese bank. 1/ Tied to the bank and to each other are such diverse operations as raw material producers, manufacturers of intermediate and final products, and service providers such as trading companies, insurance firms, shipping lines, construction companies, and other ancillary service providers. In 1984, these six groups accounted for almost 18 percent of net profits of all Japanese businesses, almost 17 percent of total sales, over 14 percent of paid-up capital, and almost 5 percent of the Japanese work-force (fig. 4-4). 2/ The groups and their affiliated auto producers are Mitsui (Toyota Motor Co.) 3/, Mitsubishi (Mitsubishi Motors), Sumitomo (Toyo Kogyo, commonly known as Mazda), Fuyo (Nissan), 4/ Sanwa (Daihatsu), 5/ and Dai-chi Kangyo (Isuzu Motors). Other Japanese auto producers are associated with smaller, less organized industrial groups such as Suzuki Motors, part of the Tokai group. The largest Japanese auto producer that has no apparent group affiliation is Honda Motor Co.

The Japanese auto producers, together with their affiliated auto parts producers, are typically large enough to be considered "keiritsu" style groupings. 6/ The major auto producing groups are the Toyota group (includes Daihatsu Motors and Hino Motors through equity interest), the Nissan Group (includes Fuji Heavy Industries Group and the Nissan Diesel Group through equity interest), the Toyo Kogo Group, Honda Motors, Mitsubishi Motors, Isuzu Motors, and Suzuki Motors.

Japanese auto producers rely more heavily on noncaptive suppliers than U.S. auto producers. The U.S. average for outsourcing of parts by automakers is 50 to 55 percent; for Japanese automakers, the average is about 75 percent. The auto producers typically set up associations of their parts suppliers known as "Kyoryokukai" to enhance cooperation and solidarity. Although the recent trend has been towards a slight relaxation of group ties, members of these associations typically sell most of their output to their one, affiliated auto producer. Parts producers are usually very specialized, and produce only one or two types of parts. On the other hand, each particular automobile part used by an automaker is typically produced by several companies within each Kyoryokukai, so that the auto producer has multiple suppliers, thus encouranging competition in price and quality. 7/

The Toyota Motor Co., Japan's largest auto producer (with 3.7 million vehicles produced in 1985), has 220 primary auto parts suppliers and over 1,000 secondary and tertiary suppliers. Toyota has formed two auto parts

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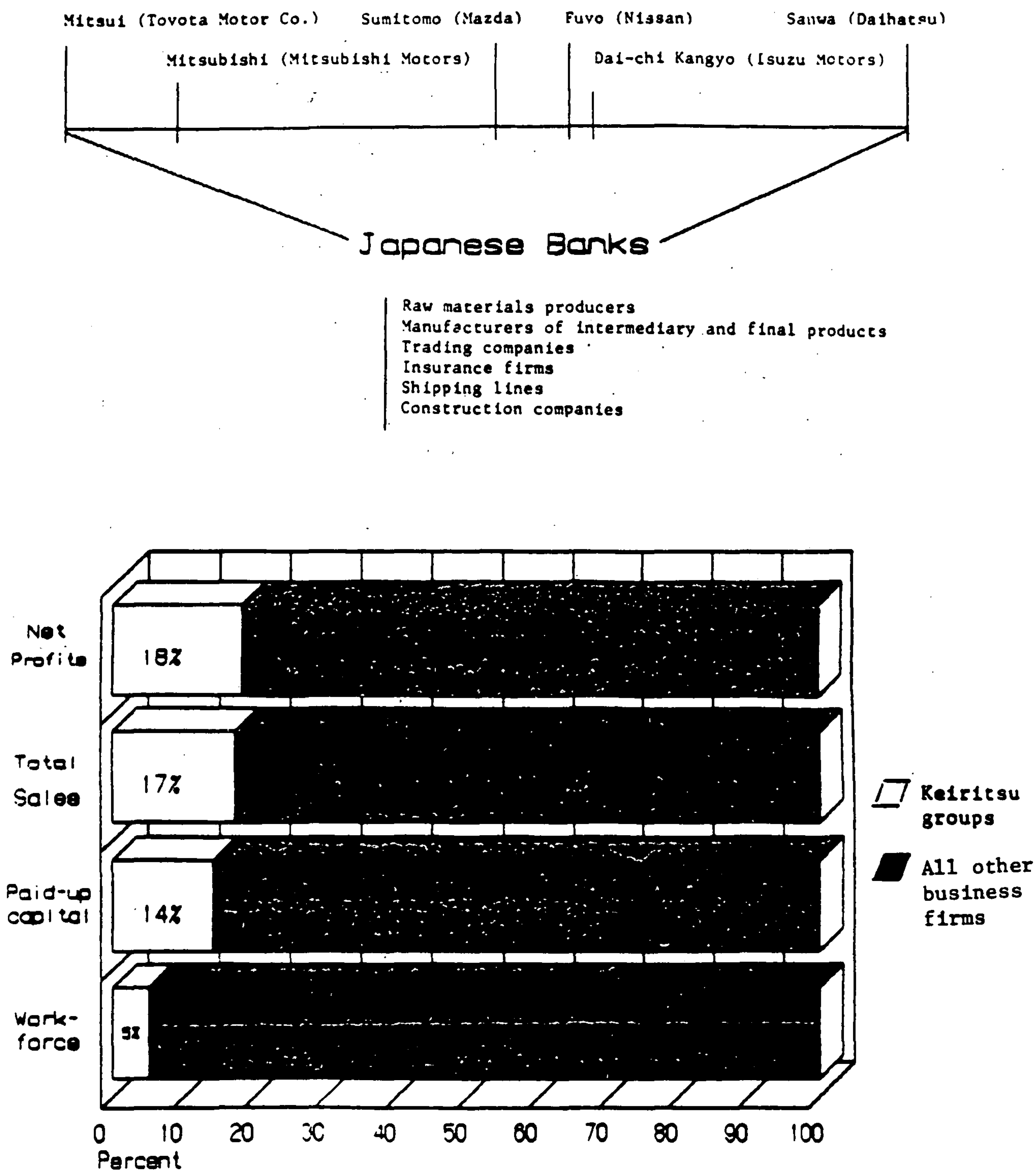
1/ Henry C. Wallick and Mable Wallick, "Banking and Finance," Asia's New Giant, How the Japanese Economy Works, ed. Hugh Patrick and Henry Rosovsky (Washington, DC: The Brookings Institute, 1976) p. 294.
2/ Masaichi Hiogami, "Industrial Groups," Japan Economic Yearbook, 1986.
3/ Toyota is a significant grouping unto itself and only loosely connected to the Mitsui Group.
4/ Nissan is also a significant group unto itself and only loosely connected to the Fuyo Group.
5/ Toyota has equity interest in Daihatsu.
6/ Industrial Groupings in Japan, Dodwell Marketing Consultants, 1985.
7/ "The Relationship Between Japanese Auto and Auto Parts Makers," prepared by Mitsubishi Research for the Japan Automobile Manufacturers Association, 1987, and USITC staff interview with the Ministry of International Trade and Industry officials, Tokyo, Japan, Apr. 20, 1987.

Figure 4-4
Keiritsu groups: Structure of the six Keiritsu groups and their role in the Japanese economy, 1984.



Source: Masaichi Hiogami, "Industrial Groups," Japan Economic Yearbook, 1986.

supplier groups: Kyoho-Kai and Eiho-Kai. Toyota's equity interest in its affiliated suppliers ranges from 1.4 percent to 60.4 percent, with the average around 25 to 30 percent. Toyota has a 14.6 percent interest in Daihatsu, Japan's ninth largest automaker (with 1985 production of 579,000 vehicles), and a 10.4 percent interest in Hino Motors, a leading Japanese truck manufacturer (with 1985 production of 69,063 vehicles). Daihatsu Motors has approximately 140 primary suppliers, and its parts association is called Daihatsu Kkoyu-Kai. Hino Motors has some 220 primary suppliers that form the parts association Hino Kyoryoku-Kai. 1/

The Nissan group is comprised of Nissan Motor Co., Nissan Diesel, and Fuji Heavy industries. Nissan Motor Co., the second largest Japanese auto producer (with production of 2.5 million vehicles in 1985), has about 160 primary auto parts suppliers and some 800 secondary and tertiary suppliers. Nissan's two supplier associations are Takara-Kai and Shoho-Kai. Nissan Diesel has 60 parts suppliers that form the association Nissan Diesel Yayoi-Kai. Nissan Diesel produced 36,351 trucks and buses in 1985. Fuji Heavy Industries, which ranked eighth in vehicle production in 1985 with 584,384 vehicles, has a total of more than 700 suppliers that are divided into three Kyoryokukai's: Gunma Kyoryoku-Kai, Kyoryoku-Kai, and Isesaki Kyoryoku-Kai. 2/

The Toyo Kogyo group, which ranked third in production of automobiles in 1985 (with almost 1.2 million vehicles), has some 250 primary suppliers that form two supplier associations, Yoko-Kai and Toyu-Kau. Mitsubishi Motors, the fourth ranking Japanese auto producer in 1985 (with almost 1.2 million vehicles), has 340 primary parts suppliers that form the Kashiwa-Kai association. Honda, ranked fifth in 1985 (with production of slightly more than 1.1 million vehicles), has some 400 to 500 suppliers, but does not have them grouped into supplier associations like the other major auto producers. Suzuki Motors has some 101 primary suppliers grouped into the Suzuki Kyoryoku Kyodo Kumiai auto parts association. In production, Suzuki was ranked as the sixth largest Japanese auto producer in 1985 (with production of 781,901 vehicles). Isuzu, the seventh largest Japanese producer of automobiles in 1985 (with 587,015 vehicles), has 279 primary suppliers grouped into the Isuzu Kyowa-Kai parts association. 3/

Even though there seems to be some movement in Japan to relax the relationship between parts producers and automakers, each parts supplier is still heavily dependent on purchases from the patron automaker. This whole concept of industrial grouping along the lines of the keiritsu structure has caused problems for foreign producers trying to penetrate the Japanese market. 4/

1/ World Motor Vehicle Data, 1987, Motor Vehicle Manufacturers Association; and The Structure of the Japanese Auto Parts Industry, Dodwell Marketing Consultants, 1983.
2/ World Motor Vehicle Data, 1987, Motor Vehicle Manufacturers Association; and The Structure of the Japanese Auto Parts Industry, Dodwell Marketing Consultants, 1983.
3/ Ibid.
4/ Indicated from responses to Commission questionnaires. See also Rodney Clark, The Japanese Company (New Haven, CT: Yale University Press, 1979) pp. 73-87.

The Japanese Auto Parts Industries Association (JAPIA) has about 300 members who account for approximately 80 percent of industry production. 1/ Most member companies have direct transactions with major automakers. JAPIA members' production increased by 50 percent during 1982-85 to $49.1 billion in 1985 (table 4-6). Production of original equipment parts increased at a faster rate than did production of aftermarket products; production for export rose by 131 percent to $3 billion in 1986 (fig. 4-5). The total number of employees increased from 280,000 in 1982 to 329,000 in 1986; the number of production workers rose by 14 percent during 1982-86 to 199,000 in 1986. In addition, shipments and R&D expenditures increased during 1982-86, as did R&D as a percentage of sales (table 4-7).

Table 4-6
Automotive parts: JAPIA members' production and employment, 1982-86

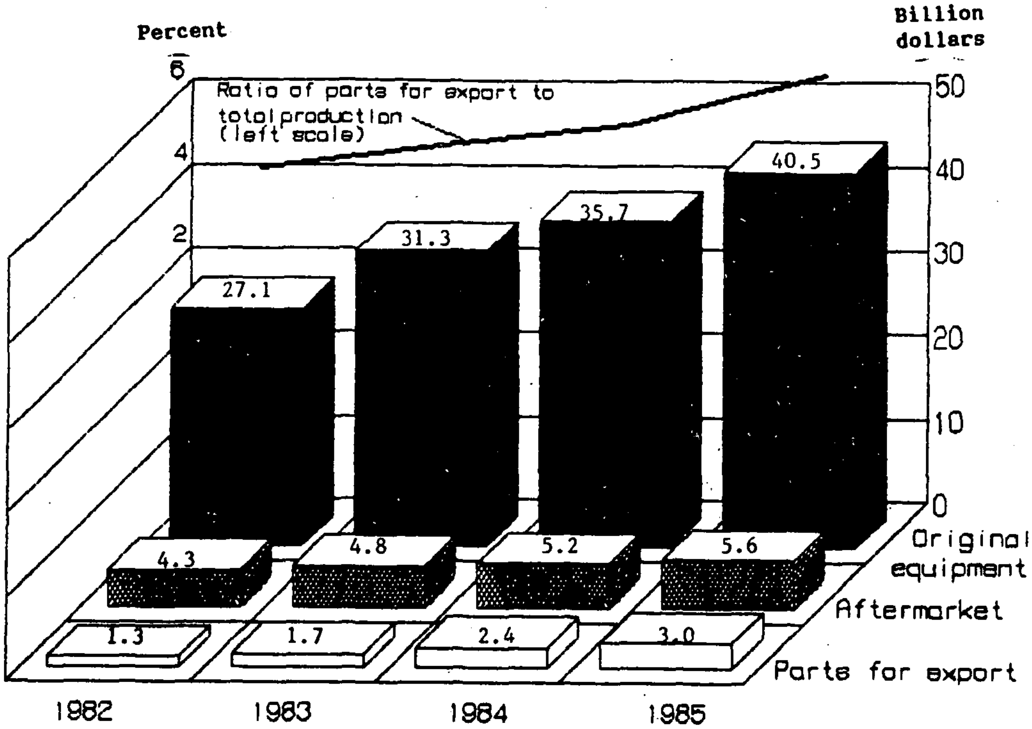
Item	1982	1983	1984	1985	1986	Annual average percentage change, 1986 over 1982
Total production						
(billion dollars)...........	32.7	38.8	43.3	49.1	1/	10.7
Employment:						
Production workers (number).	173,912	174,3/7	182,192	192,105	198,702	3.4
Office workers (number).....	105,737	113,412	112,930	125,943	130,269	5.4

1/ Not available.

Source: Report from the U.S. Embassy, Tokyo, Japan, March 1987.

1/ USITC staff interview with JAPIA officials, Tokyo, Japan, Apr. 20, 1987.

Figure 4-5
Automotive parts: JAPIA members' production of original equipment parts, aftermarket parts, parts for export, and ratio of parts for export to total production, 1982-85



Source: Report from the U.S. Embassy, Tokyo, Japan, 1987.

Table 4-7
Automotive parts: JAPIA members' sales and research and development expenditures, 1982-85

Item	1982	1983	1984	1985	Average annual percentage change, 1985 over 1982
Shipments (million dollars)........	37,692.4	37,900.2	42,435.1	47,413.6	5.9
Research and development expenditures (million dollars)...	893.4	920.7	1,068.9	1,233.8	2.4
Ratio of research and development expenditures to sales (percent)...	2.4	2.4	2.5	2.6	2.0

Source: Report from the U.S. Embassy, Tokyo, Japan, March 1987.

Most of the larger Japanese parts makers spend a larger percentage of sales on R&D than do smaller firms. Larger firms may also focus more on development of new materials rather than mechanical improvement of motor vehicles. In addition, Japanese parts firms are also spending R&D funds on the development of electronic instruments for automotive use. 1/

Domestic market.--The Japanese market for automotive parts increased irregularly from $33.2 billion in 1982 to $45.0 billion in 1986, or by 36 percent (table 4-8). By far the largest purchasers of autoparts are the Japanese automakers.

Table 4-8
Automotive parts: Japanese shipments, exports, imports, and apparent consumption, 1982-86

Years	Shipments	Exports	Imports	Apparent consumption	Ratio of imports to consumption
	Million dollars				Percent
1982.......	37,692	4,607	150	33,235	0.5
1983.......	37,900	6,384	295	31,811	.9
1984.......	42,435	7,369	379	35,445	1.1
1985.......	47,413	9,003	375	38,785	1.0
1986....... 1/	54,524	10,000	491	45,015	1.1

1/ Estimated by the staff of the U.S. International Trade Commission.

Source: Shipments, report from the U.S. Embassy, Tokyo, Japan, March 1987.

Japanese automakers claim that they purchase parts in terms of price, quality, delivery, and other terms irrespective of national or corporate origin. 2/ According to Ministry of International Trade and Industry (MITI) officials, the central characteristics of these procurement policies include the following:

(1) Emphasis on the role of parts makers in parts development and design. In many cases, when a new part is developed, the automaker will join the parts supplier in designing the part. It also frequently occurs that an automaker will give a parts supplier a general idea of the part and then the supplier will do the actual design and development work.

(2) Emphasis on applying the "just-in-time" delivery system. "Just-in-time" means producing the exact volume required, when it is required, with minimal defects. Just-in-time permits a flexible response to market demand, and reduced costs through sharply reduced inventories.

1/ Report from U.S. Embassy, Tokyo, Japan, March 1987.
2/ USITC staff interview with JAMA and JAPIA officials, Tokyo, Japan, Apr. 20, 1987.

(3) Emphasis on developing capabilities for model changes. Japanese automakers introduce model changes every 4 years; it is imperative that parts makers develop the appropriate parts quickly and at a competitive price.

(4) Efforts by Japanese automakers to import parts and local procurement of parts. For example, Japanese automakers have improved in-house parts import organization, including the establishment of import promotion teams and sponsored seminars and meetings to explain parts purchasing policies and procedures. 1/

Seven Japanese automakers have built, or are planning to build auto assembly facilities in the United States; their total output should approximate 2 million units by the mid-1990's. At present, about 150 Japanese-based parts makers have set up manufacturing plants in the United States; according to an internal report by the U.S. Department of Commerce, approximately 300 Japanese-owned parts firms will locate in the United States by 1990 (see Japanese foreign direct investment in the United States, p. 5-1).

Japanese parts makers also have factories in about 36 other countries (e.g., the United States, Taiwan, Korea, Thailand, Malaysia, and Indonesia). Japanese auto producers are evaluating the possibility of importing auto parts from such neighboring countries to balance the effects of the rising yen. Such strategic reassessments are affecting the long-term planning of Japanese automakers, with obvious repercussions for Japanese parts makers. For example, industry sources indicate that Japanese parts firms are reducing capital expenditures in anticipation of continued sluggishness in the Japanese market. 2/

Industry sources claim that Japanese automakers have asked certain suppliers to participate in foreign purchasing by making investments, providing technology, and building up production systems suitable for labor skills in countries that ensure the same level of product technology as in Japan. Moreover, further restructuring in the Japanese parts industry is evidenced by some second-tier automakers moving to create new tieups in parts sharing. For example, in 1986, Mitsubishi Motors Corp. and Mazda Motor Corp. agreed to share about 15 parts, chiefly electrical; in addition, four Japanese truck producers began a program to share standardized parts in medium- and heavy-duty trucks. 3/

1/ USITC staff interview with MITI officials, Tokyo, Japan, Apr. 20, 1987.
2/ Report from U.S. Embassy, Tokyo, Japan, March 1987.
3/ Frank Gawronski, "Sayonara to Parts Suppliers," Automotive News, Dec. 15, 1986, p. E6.

Trade.--According to JAPIA, Japanese exports of all automotive parts rose from $4.5 billion in 1982 to $8.2 billion in 1985, as shown in the following tabulation:

Year	Exports 1/ (Million dollars)
1982	4,518
1983	5,831
1984	7,353
1985	8,200

1/ Publication of the Japan Auto Parts Industries Association.

During 1984-85, the bulk of Japanese exports (47 percent) went to North America, followed by Europe (11 percent) and Southeast Asia (9 percent) (figure 4-6 and 4-7, table 4-9).

Japanese imports of automotive parts have increased from $150 million in 1982 to $491 million in 1986 (table 4-8). As a share of the market, imports have increased irregularly from 0.5 percent in 1982 to 1.1 percent in 1986. The largest source of such imports in 1986 was the United States ($145 million) followed closely by West Germany ($142 million).

Government programs.--In an effort to address the growing U.S. trade deficit with Japan in automotive parts, provide U.S. parts makers greater access to the Japanese market, and promote better understanding of the role of the keiretsu system, in May 1986, the Japanese Government and the United States Government agreed to add auto parts to the so-called market-oriented sector-selective (MOSS) talks, a higher level forum than previously accorded auto parts talks (see description of MOSS talks, p. 6-16).

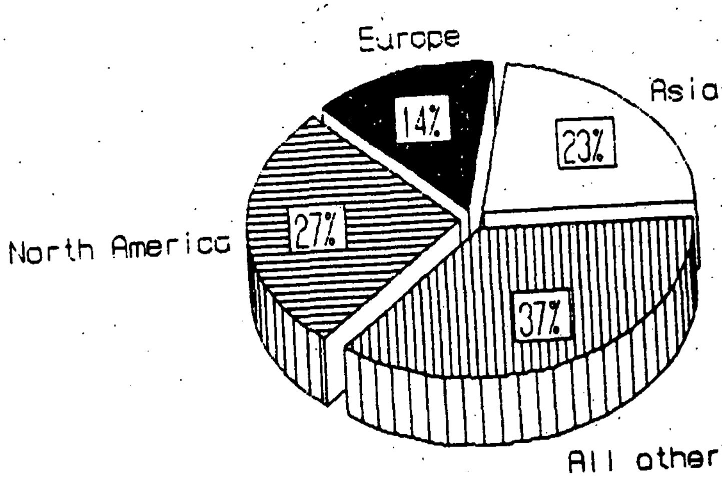
Korea

Industry structure.--Industry sources indicate that about 800 Korean parts makers manufacture about 200 major automotive parts, principally tires, batteries, engine parts, shock absorbers, bearing caps, rearview mirrors, brake pistons, combination lamps, cooling fans, control cables, body stampings, pumps, parking brake levers, and tube connectors. The bulk of Korean parts are manufactured by Korean automakers, or by diversified producers that produce auto parts along with other products.

Prior to 1985, Korean automakers produced mostly for the Korean market, exported little (predominantly to the Middle East), and imports were tightly controlled. Beginning in 1985, however, exports of automobiles to the United States and Canada increased dramatically. Total auto production expanded rapidly and growth in the Korean automotive parts industry expanded accordingly. 1/

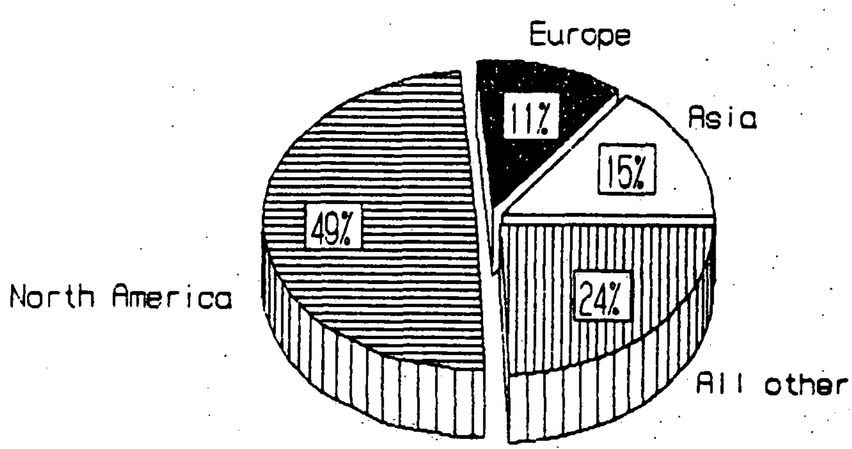
1/ USITC staff interview with Korean Government officials, Seoul, Korea, Apr. 29, 1987.

Figure 4-6
Automotive parts: Japanese exports by major markets, 1982



Source: The Japanese Ministry of Finance.

Figure 4-7
Automotive parts: Japanese exports by major markets, 1985



Source: The Japanese Ministry of Finance.

Table 4-9
Automotive parts: Japanese exports by markets, 1982-85 1/

(In thousands of dollars)

Market	Fiscal year ending Mar. 31-- 1982	1983	1984	1985
East Asia	376,846	532,928	555,558	593,686
Southeast Asia	690,470	740,287	678,878	773,285
Middle East	476,765	525,881	523,482	545,884
Europe	629,373	739,361	786,184	1,035,248
North America	1,228,148	2,491,063	3,333,348	4,402,472
Central America	175,476	197,260	261,461	293,570
South America	159,812	145,452	125,482	129,588
Africa	455,122	482,376	419,619	370,955
Oceania	284,973	373,490	493,280	578,116
Communist countries	130,123	156,376	194,808	280,497
Total	4,607,111	6,384,478	7,369,105	9,003,304

1/ The Japanese fiscal year ends Mar. 31.

Source: The Japanese Ministry of Finance.

Korean parts makers are increasing their emphasis on R&D. For example, Hyundai is focusing on the development of high-end items for the Excel model such as engine screw terminals, rollback springs, steering assemblies, and air-conditioners. Daewoo reportedly is producing knuckle carburetors and aiming to export more advanced components through its affiliated companies. 1/

In addition, 32 Korean technology agreements were formed with foreign firms in 1986, up over 40 percent from 1984. The bulk of such agreements (about 75 percent) were with Japanese firms, and the rest were split between the United States and West Germany. Ten joint ventures were formed in 1986; an example, Mando, established Halla Climate Control Co. to produce oil coolers and compressors for radiators in a 50/50 joint venture with Ford Motor Co. 2/

Labor disputes at Korean parts making facilities during August 1987 interrupted supplies of parts to Korean automakers. Korean parts workers have been seeking higher wages and representation in company management. Labor uprisings could force Korean automakers to reexamine their parts procurement procedures. Problems with timely supply could force Korean auto producers to consider alternate sources of parts. 3/

1/ "Auto Parts Industry," Korea Buyers Guide, p. 68.
2/ USITC staff interviews with Korean automakers and Korean Government officials, Seoul, Korea, Apr. 29-May 1, 1987; and "Auto Parts Industries," Korea Buyers Guide, p. 69.
3/ USITC staff interview with Korean Government officials, Seoul, Korea, Apr. 29, 1987.

Domestic market.--Korean production of complete automobiles rose from 162,500 vehicles in 1982 to 601,000 units in 1986 (930,000 units are projected for 1987) (fig. 4-8). Korean exports of complete automobiles increased from 20,284 vehicles in 1982 to 306,000 units in 1986 (600,000 units are projected in 1987).

Trade.--Korean exports of automotive parts followed export sales of finished vehicles, rising from $68 million in 1982 to an estimated $247 million in 1986 (table 4-10). During 1986, Korean exports were shipped to 130 countries. The most prevalent items included bearings, car stereos, gears, leaf springs, and radiators. 1/ Total sales of Korean automotive parts

Table 4-10
Automotive parts: Korean sales, exports, and imports 1982-86

Item	1982	1983	1984	1985	1986	Average annual change, 1986 over 1982
	Million dollars					Percent
Sales	783	949	1,155	1,379	2,272	30.5
Exports	68	74	108	149	1/ 247	38.1
Imports	-	340	331	301	-	2/ -2.9

1/ Estimated.
2/ Average annual change, 1985 over 1983.

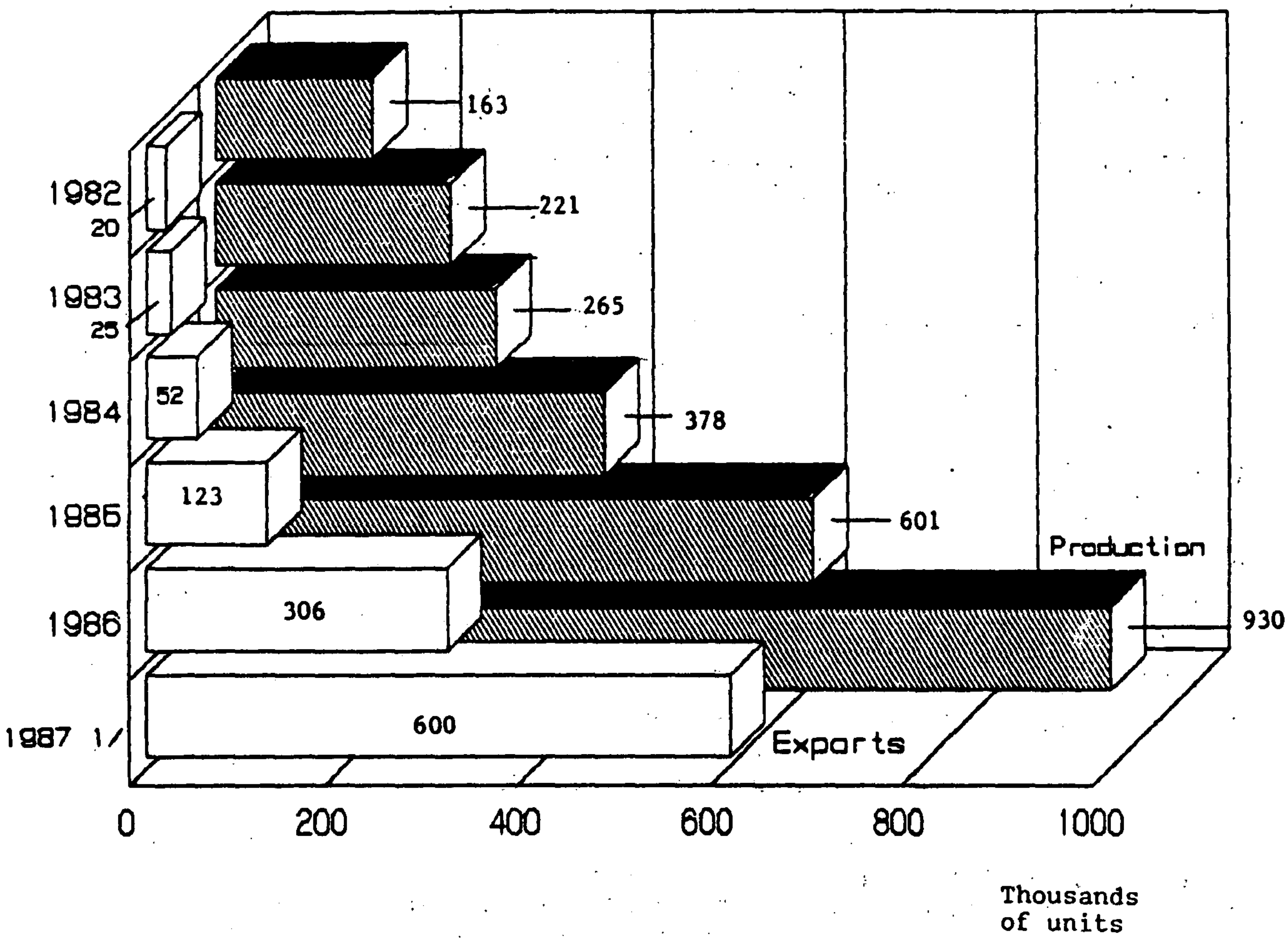
Source: Report from the U.S. Embassy, Seoul, Korea, March 1987.

rose from $783 million in 1982 to $2.3 billion in 1986. Korean imports decreased from $340 million in 1983 to $301 million in 1985, and were primarily from Japan, reflecting the working relationship between Korean and Japanese producers. 2/

Korean imports of auto parts are dutiable at tariff rates ranging from 5 to 60 percent ad valorem and require an import license issued by a Korean foreign-exchange bank. Requests for licenses generally have been approved without delay, unless the product was restricted under Korea's Official Trade Plan covering the period July 1, 1986-June 30, 1987. Imports of regulated items were permitted under the plan only if approval was granted by the Korean Automobile Industry Cooperative Association (KAICA). Certain auto parts products were restricted under the plan as follows: internal combustion engines, pumps for liquids, and other parts and accessories, except those of tractors for agricultural use. However, the restrictions on these items were

1/ "Auto Parts Industry," Korea Buyers Guide, p. 68.
2/ USITC staff interview with U.S. Embassy officials, Seoul, Korea, Apr. 29, 1987.

Figure 4-8
Automobiles: Korean production and exports, 1982-87



1/ Estimated

Source: Report from the U.S. Embassy, Seoul, Korea, 1987.

lifted effective July 1, 1987, under the Government of Korea's import liberalization plan. 1/

Government programs.- The Government of Korea has instituted a 5-year localization program, under which efforts are made to increase domestic production of imported products. The localization program has two key goals: (1) to restructure Korean industries; i.e., to shift from simple assembly to more complex production; and (2) to improve international competitiveness and

1/ Report from U.S. Embassy, Seoul, Korea, March 1987.

reduce the bilateral trade deficit with Japan (Korea's principal source of auto parts imports). 1/

Both large and small Korean firms are participating in the local production program. For example, Lucky is planning to produce engineering plastics such as PET, PBT, polymer, nylon, and ABS; Kolon has completed its production facilities for engineering plastics; Dongyang Nylon has developed a fire-retardant nylon resin; Hyundai Cement and Daehan Ink Paint are gaining expertise in the production of engine parts; and Pacific Development plans to manufacture reinforced plastic components for gears and gear boxes. 2/ Under the program, about 1,800 auto parts and components (estimated value at $1.1 billion) that are currently imported will be localized during 1987-91. In 1986, 78 Korean firms manufactured 111 products (valued at $58 million) under the plan; in 1987, 380 items are targeted to be similarly produced.

The Government of Korea has also developed a Korean Industrial Standard (KIS) that is adapted from similar foreign systems--e.g., Japan (JIS), U.S. (U.L.), and the guidance of International Standards Organization (ISO), and the International Electrotechnical Commission (IEC). At present, over 7,000 items in the KIS are classified into 15 categories. The central aim of the KIS marking mandatory system is to ensure safety control. 3/

Mexico

Industry structure.--The Industria Nacional de Autopartes (INA), a Mexican trade association, categorizes approximately 105 Mexican producers of automotive parts. The INA reports annual sales of $2.0 billion in 1986.

Following the Mexican economic crisis of 1981-82, production levels of nearly all manufactured goods in that country declined to about 50 percent of their previous levels. The automotive industry was particularly affected, since major manufacturers had been expanding capacity in anticipation of a growing domestic market. Production of automotive parts, however, fluctuated upwards during 1982-86, reflecting the slowly recovering Mexican automotive market (table 4-11).

Total employment in the Mexican motor-vehicle industry increased by 2 percent to 234,000 in 1986 (table 4-12). Although the minimum wage rose in terms of the Mexican peso during 1982-86, because of the peso depreciation it fell to about US$1.00. Highly skilled maintenance and technical workers received approximately US$3.00 per hour; however, the majority of workers were compensated at approximately US$1.00 per hour. Total hourly wage and compensation for the automotive industry declined during the period by 42 percent to an estimated $1.48 per hour in 1986 (table 4-12).

1/ USITC staff interview with Korean Government officials, Seoul, Korea, Apr. 29, 1987.
2/ "Auto Parts Industry," Korea Buyers Guide, p. 69.
3/ Report from U.S. Embassy, Seoul, Korea, March 1987.

Table 4-11
Automotive parts: Mexican production of selected products, 1982-86

Item	1982	1983	1984	1985	1986	Average annual change, 1986 over 1982
	1,000 units					Percent
Batteries........	3,103	2,798	3,616	3,611	3,636	2.0
Bearings.........	5,700	5,250	5,050	7,750	1/	2/ 7.9
Autosound components:						
AM radio receivers without tape players....	274	128	116	148	1/	2/ -14.3
AM/FM stereos without tape players.........	30	12	17	10	1/	2/ -23.9
AM/FM stereos with tape players.........	6	5	7	12	1/	2/ 19.5
Shock absorbers.....	1/	3,300	1/	4,214	3,800	3/ 3.6
Tires...............	1/	1/	9,861	10,381	9,173	4/ -1.8

1/ Not available.
2/ Average annual change, 1985 over 1982.
3/ Average annual change, 1986 over 1983.
4/ Average annual change, 1986 over 1984.

Source: Report from U.S. Embassy, Mexico City, Mexico, March 1987.

Table 4-12
Automobiles and automotive parts: Mexican employment and hourly wages, 1982-86

Item	1982	1983	1984	1985	1986	Average annual change, 1986 over 1982
						Percent
Total employment (1,000)..........	228.3	206.4	204.3	209.0	234.0	0.6
Hourly wages......	$2.55	$1.97	$2.56	$2.39	$1.48	-12.7

Source: Report from U.S. Embassy, Mexico City, Mexico, March 1987.

During July-August 1987, the Mexican automotive industry was affected by labor disputes. On July 1, 1987, 10,500 workers at Volkswagen de Mexico initiated an 8-week strike, which ended with the company granting a 78-percent wage increase. 1/ (The inflation rate in Mexico for 1986 and 1987 was

1/ USITC staff telephone interview with staff of Automotive News, Sept. 24, 1987.

estimated at about 140 percent annually.) Production of 1988 models was delayed because of powertrain and sheet metal component shortages caused by the strike. 1/

Ford Motor Co. of Mexico has noted significant improvement in the quality of parts provided by Mexican suppliers. According to Ford's Director of Supply and Planning Policies, the average quality rating of Ford Mexico's suppliers has improved by approximately 50 percent in the past 18 months. Additionally, some 45 Mexican suppliers sold approximately $344 million worth of materials to Ford of North America in 1986. 2/

Despite the downturn in the Mexican market for auto parts during 1982-86, one sector of the industry, the maquiladora program, has prospered in recent years. Established in 1965, this program allows for in-bond production, and relaxes Mexican foreign investment restrictions, allowing for 100 percent control of maquiladora operations by foreign companies. The principal proviso is that virtually all production must be exported. The two most significant reasons for companies locating assembly operations in maquiladoras are low wage rates and close proximity to the United States. The labor rate in maquiladoras is typically less than US$1.00 per hour. Currently, over 90 percent of the maquiladoras are located along the border. By the end of 1985, there were about 735 maquiladoras, employing over 200,000 persons.

Although the industries that are represented in maquiladoras vary widely, typical articles produced include products which are highly competitive in the U.S. market, have an easily segmented production process, and are comparatively labor intensive. Automotive wiring harnesses, for example, are assembled extensively in maquiladoras, with General Motors, Ford, and Chrysler all having maquiladoras producing these parts (e.g., General Motors has about six such firms). In addition to the Big Three, almost all of the U.S.-based independent producers of wiring harnesses operate in maquiladoras. Other automotive products produced in maquiladoras include autosound components, seat belts, automotive electrical articles, engine parts, radiators, steering wheel covers, brake pads, and seat belts.

Domestic market.--Sales of new motor vehicles in Mexico fell sharply, from about 470,000 units in 1982 to less than 275,000 in 1983, and then climbed slowly to about 400,000 in 1986. 3/ The heavy drop in sales and production of new cars had a strong impact on Mexican auto parts production, which fell from $1.2 billion in 1981 to less than $1 billion in 1983. 4/ Offsetting the decline in demand from motor-vehicle producers was the steadily rising demand for auto parts in the replacement market. Additionally, Government measures designed to restrain imports protected Mexican auto parts

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1/ "Mexican Police Turn Back Striking VW Workers," Automotive News, Aug. 24, 1987, p. 52.
2/ Stephen Downer, "Mexico to Cut Auto Parts Tariff to 30% from 40%," Automotive News, July 13, 1987.
3/ World Motor Vehicle Data Book, Motor Vehicle Manufacturers Association, Detroit, MI, eds. 1982-87.
4/ Report prepared for the U.S. Department of Commerce by Batres, Valdes, Wygard y Asociados, S.C., Mexico City, Mexico, November 1983.

producers and the import penetration ratio fell from almost 30 percent in 1982 to less than 10 percent in 1983. 1/ According to industry officials, greater emphasis has been placed on production for export because of Government pressure and the depressed state of the local economy. Industry sources estimate that of the 500,000 cars and trucks that will be sold in Mexico in 1988, one-half are destined for export.

Trade.--Complete data for Mexico's imports and exports are not available. However, since the United States is by far Mexico's largest trading partner, official U.S. trade statistics can be used as an approximation. U.S. imports from Mexico increased from $648 million in 1982 to $2.3 billion in 1986, or by almost 255 percent. Much of this increase can be attributed to an increase in the use of maquiladora facilities by U.S. based producers. U.S. exports to Mexico increased from $1.1 billion in 1982 to $1.7 billion in 1986, or by 55 percent. This increase is also due to an increase in maquiladora activity. According to the Director of Industrial Relations for General Motors de Mexico, because of the falling value of the Mexican peso, Mexico "could replace Korea as a components supplier. It has the raw materials, cheap labor, (and) market adjacency to the United States." 2/

Car and truck assemblers are required to earn at least 50 percent of the net foreign exchange needed to cover their foreign-exchange budget by exporting automotive parts manufactured domestically (parts used in finished autos and trucks can be included in this 50 percent). A maximum of 20 percent can be earned by the export of automotive parts from maquiladora operations. 3/ Imports by Mexican parts firms or Mexican auto assemblers are controlled by import licenses issued only to approved companies. The Mexican Government currently levies a 40-percent import duty on all parts imported by automakers, which is scheduled to be reduced to 30 percent by October 1988. 4/

Government programs.--The most significant Government of Mexico policy affecting automotive parts operations is the Automotive Decree of 1983. The two major components of the decree affecting the automotive parts industry are local content and balance of trade requirements. The minimum local content requirement in 1987 for Mexican-produced automobiles is 60 percent, and ranges from 60 to 90 percent for trucks and buses. Moreover, Mexican parts makers are required to adhere to a similar 60 percent local content minimum; further, they are mandated to average 80 percent local content across their entire range of their product lines, including those for direct exports. 5/ Mexican auto parts firms (nonmaquiladora) are restricted to 40 percent foreign ownership by the Government.

1/ Ibid.
2/ Stephen Downer, "Mexico to Cut Auto Parts Tariff to 30% from 40%," Automotive News, July 13, 1987.
3/ Stephen Downer, "Mexico to Cut Auto Parts Tariff to 30% from 40%," Automotive News, July 13, 1987.
4/ Report from U.S. Embassy, Mexico City, Mexico, March 1987.
5/ Stephen Downer, op. cit.

Spain

Industry structure.--Automobile production and automotive parts production are major industrial sectors in Spain, with six firms engaged in the production of automobiles, and about 1,000 more engaged in the production of automotive parts. Although Spanish parts makers' net sales fell by 19 percent to $3.2 billion in 1985 from the 1982 level, capacity utilization remained steady at about 74 percent during 1982-85 (table 4-13).

Table 4-13
Automotive parts: Spanish capacity utilization, net sales, total workers, production workers, wages, capital expenditures, and research and development expenditures, 1982-85

Item	1982	1983	1984	1985	Average annual percentage change, 1985 over 1982
Capacity utilization (percent)	74.5	73.0	74.0	2/	3/ -0.2
Net sales (million dollars)	4,007	3,350	3,265	1/ 3,235	-5.2
All workers (number)	90,676	89,156	87,658	1/ 86,185	-1.3
Production workers 1/ (number)	69,800	68,650	67,496	66,362	-1.3
Hourly wages	$4.42	$3.76	$3.61	$3.69	-4.4
Capital expenditures (1,000 dollars)	160,285	134,009	98,601	78,805	-21.1
Research and development expenditures (1,000 dollars)	59.6	49.4	2/	2/	-

1/ Estimated by the U.S. Embassy, Madrid, Spain.
2/ Not available.
3/ Average annual change, 1984 over 1982.

Source: Report from the U.S. Embassy, Madrid, Spain, February 1987.

Ford and GM are two of the four largest automakers in Spain. Foreign-owned firms in the Spanish automotive parts industry accounted for 56 percent of Spanish sales during 1982-83.

The number of production workers employed in the Spanish automotive parts industry decreased from an estimated 69,800 workers in 1982 to 66,362 in 1985. Average hourly wages for total industry workers declined from US$4.42 in 1982 to US$3.69 in 1985. Aggregate capital expenditures decreased by 51 percent to $78.8 million in 1986.

Industry sources report that the Spanish automotive industry is not highly advanced with respect to technological development and depends to a great extent on the transfer of foreign know-how, foreign investment, and imports of strategic parts. Because most major parts manufacturers in Spain are also subsidiaries or affiliates of large, multinational corporations, very little R&D for the automotive parts industry is undertaken in that country. Development expenditures by Spanish automotive parts firms totaled about $50,000 annually. 1/

Domestic market.--Renault, Talbot-Peugeot, Citroen, Ford, GM, and Seat-Volkswagen are the six major Spanish car manufacturers. Together, their production of passenger cars rose from 927,500 in 1982 to about 1.2 million in 1985. Spain has become Europe's most significant source of subcompact passenger cars; exports as a percentage of production rose from 53 percent in 1982 to 62 percent in 1985. Motor-vehicle production of all types is projected to increase significantly from 1988 to 1990. Apparent consumption of passenger vehicles rose about 8 percent during the period.

The aftermarket for automotive parts is more important in Spain than in other western European nations because of the age of the automotive stock (about three-fourths of all cars and trucks are over 5 years old). 2/ Spanish consumption of automotive parts is expected to grow substantially during 1988-90 to about $8 billion, more than twice the 1985 level.

Trade.--Spanish domestic content provisions require that 60 percent of the value of the parts used to manufacture a car must be made in Spain. Except for these requirements, industry sources report no other nontariff barriers, e.g., quotas and licenses affecting imports of automotive parts. 3/ Since 1972, Spain has been a member of Europe's automobile and automotive parts production system, where each country produces certain parts and exports the parts to other European countries for local vehicle manufacture. Exports account for about 26 percent of all Spanish parts production and are shipped almost solely to EC countries. 4/ In 1984 and 1985, Spanish imports and exports of automotive parts and equipment were virtually identical, at about $1.3 billion.

Government programs.--The Government of Spain owns minimal shares in certain Spanish parts firms though the National Institute of Industry (a state-owned holding company). Moreover, the Spanish Government has made known its desire to divest itself of those shares in recent years. The Government provides funding for projects in the automotive parts field through its Center for Industrial Technology and Development.

Taiwan

Industry structure.--The Taiwan Transportation Vehicle Manufacturers Association (TTVMA) estimates that there are over 2,000 Taiwan firms producing automotive parts. 5/ Most of these firms are small in size, with 70 percent

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1/ Report from the U.S. Embassy, Madrid, Spain, February 1987.
2/ Ibid.
3/ Ibid.
4/ Report from the U.S. Embassy, Madrid, Spain, February 1987.
5/ Interview with officials of the Taiwan Transportation Vehicle Manufacturers Association, Taipei, Taiwan, Apr. 27, 1987.

capitalized at less than $1.5 million each. Industry sources state that only seven firms produce original equipment parts. 1/

Prior to 1985, Taiwan authorities provided incentives for foreign automakers to construct assembly plants in Taiwan by creating import barriers and levying a 70-percent domestic content requirement on the auto assemblers in order to develop the Taiwan automotive parts industry. By year end 1986, eight auto assembly plants were established in Taiwan, including a joint venture with Ford, five joint ventures with Japanese automakers, and two technical cooperation agreements--one with a French firm and one with a Japanese company.

In March 1985, Taiwan began a new auto industry development plan. Taiwan authorities indicated that a new plan was instituted because the Taiwan auto parts industry had become highly fragmented, with many small parts firms supplying each of the eight auto assembly plants. These small parts makers were unable to produce original equipment products; they produced lower value-added parts for the Taiwan aftermarket. The new auto plan is targeted at encouraging competition in the industry by lowering the domestic content ratio to 50 percent and lowering import duties on auto parts from about 70 percent to 50 percent. 2/ In addition, foreign investment was encouraged (no local equity investment is required for auto parts projects, 5-year tax holidays, duty-free import of machinery, and exemptions from export performance ratios). Moreover, exporters are able to get 180 to 360-day export loans from the EXIM Bank of Taiwan.

The TTVMA has about 344 member companies, almost one-third of which produce electrical parts for cars. TTVMA industry data are presented in table 4-14.

The Ministry of Economic Affairs (MOEA) estimates that Taiwan's auto parts output grew at a compound annual rate of 17 percent during 1975-86, reaching $769 million in 1986. Most of the growth occurred during 1975-80, when output rose 35 percent annually. Taiwan production of selected automotive parts is presented in table 4-15.

Taiwan parts makers have concentrated on lower value products; e.g., tires, jacks, light bulbs, sound and environment equipment, and other basic electrical items. 3/ The Industrial Economics Research Institute surveyed 177 of the largest Taiwan suppliers; the Institute's report shows the following product mix (table 4-16).

The power train/tires category is largely tires that accounted for approximately 69 percent, or $108 million, of the total production in 1984 by the 177 firms. The other major product in this group was rear axle assemblies, with output valued at $20 million in 1984. Wiring systems ($70 million in 1984) were the largest item in the relatively low-tech electrical category; batteries and lights were the next most important items with 1984 outputs of $16.8 million and $10.6 million, respectively. Seats ($23 million

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1/ Interview with officials of the American Institute in Taiwan (AIT), Apr. 27, 1987.
2/ USITC staff interview with the AIT, Taipei, Taiwan, Apr. 27, 1987.
3/ Interview with the American Institute in Taiwan, Taipei, Taiwan, Apr. 27, 1987.

Table 4-14
Automotive parts: TTVMA members' capital, employees, and firms, as of December 1985

Item	Capital	Employees	Firms
	Million dollars	Number	Number
Engine parts and fittings.......	151	10,732	54
Electrical parts for engine and body...........	250	40,785	103
Body..........................	219	9,594	68
Power train, steering, and brakes.......................	129	8,682	46
Body decoration................	8	1,548	14
Rubber and plastics............	11	1,875	15
Other parts....................	22	2,454	44

Source: Report from American Institute in Taiwan, Taipei, Taiwan, March 1987.

Table 4-15
Selected automotive parts: Taiwan production, 1976 and 1982-86

Item	1976	1982	1983	1984	1985	1986
Tires (1,000 pc).........	911	2,220	2,984	3,753	4,236	5,382
Tubes (1,000 pc).........	1,005	1,834	2,332	4,818	5,646	6,580
Bulbs (millions).........	65.7	163.1	302.4	328.7	436.0	559.3
Batteries (1,000 pc).....	794	3,023	3,919	4,102	4,336	5,534
Jacks (1,000 set)........	777	4,928	5,234	4,081	3,332	3,601

Source: Report from the American Institute in Taiwan, Taipei, Taiwan, March 1987.

Table 4-16
Automotive parts: Taiwan production, of 177 major auto parts firms, by products, 1982-84

(In millions of dollars)

Item	1982	1983	1984
Engine parts..............	37	39	47
Power train/tires.........	151	137	156
Steering..................	6	8	8
Suspension................	10	14	15
Brakes....................	12	14	17
Electrical................	81	115	148
Body......................	72	88	96
Accessories...............	59	72	84

Source: Report from the American Institute in Taiwan, Taipei, Taiwan, March 1987.

in 1984) were the most important item under body parts, followed by safety glass ($17 million), and instrument panel assemblies ($13 million). Jacks ($30 million) accounted for 36 percent of the accessory group, followed by air-conditioners ($16 million).

Foreign investment has been an important factor in the development of Taiwan's automotive parts industry. Many Japanese suppliers located production operations in Taiwan in order to meet Taiwan's domestic content requirements. A 1985 survey by the Industrial Economic Research Institute indicated that of the 177 factories it surveyed, 67 had some kind of technical cooperation with foreign firms, covering 88 products. Of the 88 products, three were made by subsidiaries (two Japanese and one American), 28 by cooperative ventures having foreign equity investment, and 57 on a "pure" (i.e., nonequity) technical cooperation basis. Of the product total, 74 were with Japanese firms and 6 were with U.S. companies. 1/ However, many Japanese firms concentrated investment in relatively unsophisticated products and restricted the transfer of technology with respect to certain products. Thus, these technical cooperation arrangements were often assembly-type operations.

Industry sources indicate that the above situation is changing at present. Japanese parts makers are reported to be increasing technical cooperation arrangements and emphasizing the production of top quality Taiwan-produced products in response to the appreciation of the yen. Japanese-owned firms may ship these Taiwan-produced auto parts to Japan for OEM production of autos, or for third-country export.

Domestic market.--Taiwan production of passenger cars, a significant market for Taiwan auto parts, grew from about 130,000 units in 1982 to just under 160,000 units in 1985. However, apparent consumption of auto parts in Taiwan fell from $581 million in 1982 to $391 million in 1986, or by 33 percent. The fall in apparent consumption was principally due to significantly increased exports, as both domestic production and imports of auto parts rose by about 25 percent in Taiwan from 1982 to 1986.

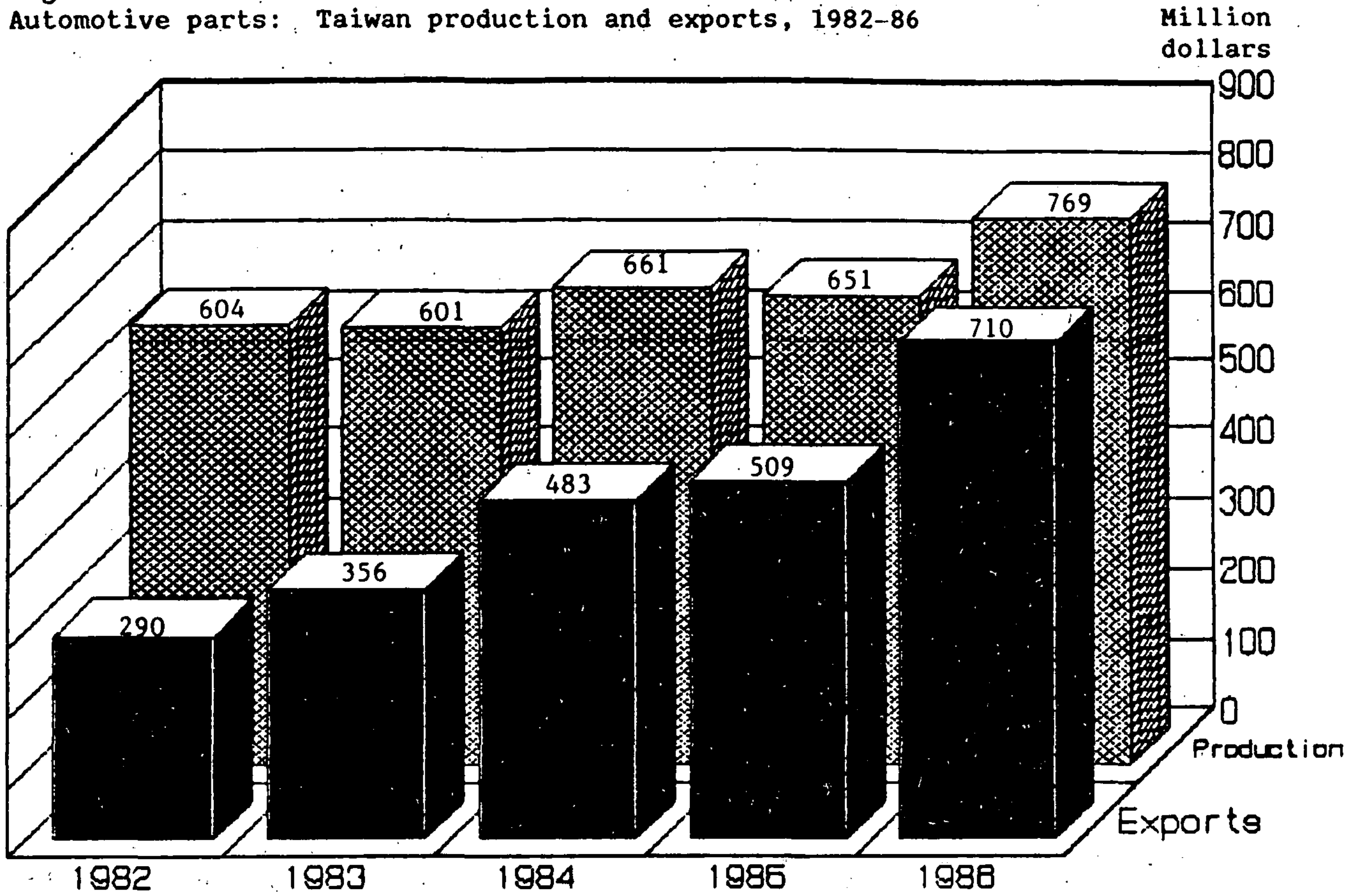
Trade.--As Taiwan's auto production stagnated between 1983-85, Taiwan parts makers began to increase exports. Total exports of automotive parts rose by 145 percent to $710 million in 1986. Exports have increased from 48 percent of production to 92 percent during 1982-86, as shown in figure 4-9.

The bulk of the growth in the Taiwan automotive parts industry has been in the electrical, body, and accessories segments. In 1984, export ratios for most of the products in these three groups ranged between 55 and 69 percent of output. Export ratios for groups such as engine parts, power train (including tires), and steering systems were lower--averaging about 20 percent of output. These products are typically used by the eight Taiwan auto assemblers for production of autos destined for the Taiwan market.

In 1985, parts and accessories accounted for the bulk (about 70 percent) of total Taiwan exports; auto electrical parts and rubber and plastic products accounted for about 15 percent and 11 percent, respectively (table 4-17).

1/ Report from the AIT, Taipei, Taiwan, March 1987.

Figure 4-9.
Automotive parts: Taiwan production and exports, 1982-86



Source: Report from the American Institute in Taiwan, Taipei, Taiwan, March 1987.

Table 4-17
Automotive parts: Percentage distribution of Taiwan exports among product categories, 1982-85

Item	1982	1983	1984	1985
Rubber/plastics....................	10.1	10.8	10.3	10.9
Metal parts........................	.8	.8	.4	.5
Power train and parts..............	7.7	4.5	3.9	3.2
Electrical parts...................	22.3	17.8	19.4	15.0
Accessories........................	57.8	64.9	64.9	69.1
Instruments........................	1.3	1.2	1.1	1.3
Total........................	100.0	100.0	100.0	100.0

Source: Report from the American Institute in Taiwan, Taipei, Taiwan, March 1987.

A TTMVA report indicates that Taiwan exported $546 million of auto parts in 1984. Products with export values of over $1 million are presented in table 4-18.

Table 4-18
Automotive parts: Taiwan exports, 1984

(In millions of dollars)

Item	1984
Accessories for motor vehicles	116.5
Parts of motor vehicles	115.3
Jacks	62.2
Wiring harnesses	58.5
Car sound equipment	54.3
Tire and tire products	49.8
Engines and parts:	
Complete engines	6.7
Engine parts	4.0
Pistons and pins	4.2
Inlet, exhaust valves	1.6
Subtotal, engines and parts	16.8
Auto bulbs	15.5
Motor electrical lighting equipment	11.1
Electrical signaling equipment	7.4
DC electric fans	5.9
Wheels	5.8
Instruments	5.2
Body parts	3.2
Radiators	2.2
Brakes, parts	2.0
Cables	1.3
Air filters	1.2
Auto air-conditioners	1.0
All other	10.8
Total	546.0

Source: Report from the American Institute in Taiwan, Taipei, Taiwan, March 1987.

Taiwan exports of certain automotive parts (including shock absorbers, rods and axles, chassis frames, transmission shafts, universal joints, brake systems, gears, steering racks, auto and manual transmissions, and miscellaneous parts) are shipped predominantly to the United States. The United States received about 66 percent (by value) of Taiwan exports of automotive parts in 1986; declining slighting from 67 percent in 1985, but up markedly from 42 percent in 1982. Saudi Arabia, Japan, Australia, Canada, Nigeria, and Singapore each absorb about 2 to 3 percent of exports, whereas other exports are scattered among an additional 50 countries. 1/

About 80 percent of Taiwan imports of automotive parts are used in domestic auto assembly plants. The TTVMA estimates that Taiwan imported about $332 million of auto parts in 1986, compared with $267 million in 1982.

1/ USITC staff interview with TTVMA officials, Taipei, Taiwan, Apr. 27, 1987.

Principal imports included automatic and manual transmissions, brake systems, cylinder blocks, and carburetors. Japan and the United States are the largest suppliers at about 80 percent and 6 percent, respectively. 1/

In July 1987, Taiwan authorities announced that tariffs on imported components would be reduced from 35 percent to 20 percent, and the 55-percent tax on most built-up imported cars would be cut by about one-third. U.S. industry sources claim that these moves were taken to reduce Taiwan's large balance of payments surplus and to offset further protectionist moves against Taiwan. 2/

Government programs.--The Taiwan authorities have established inspection and safety standards for 33 safety-critical automotive parts that are characterized as "strategic components" (e.g., bearings, camshafts, cylinder heads, connecting rods, disc brakes, and vacuum boosters). Taiwan producers manufacturing these products are eligible to receive tax holidays and certain R&D aid. Taiwan authorities have also taken definitive steps to reduce counterfeiting and trademark infringements. 3/ The chief means of crackdown in these areas include increased inspections and the enforcement of severe criminal and monetary penalties for convicted counterfeiters.

The United Kingdom

Industry structure.--There are currently about 300 major manufacturers of automotive components in the United Kingdom, in addition to approximately 2,000 small- to medium-sized companies. During 1982-86, about 28 British parts makers ceased operations, and 18 new firms began auto parts production. 4/

The British automotive parts industry employs about 275,000 workers. The average wage per week is US$232 after taxes, excluding fringe benefits. 5/ Fringe benefits for production workers include free membership to private health programs, subsidized meals, and subsidized travel to and from work.

Industry sources estimate that investment in new plant and equipment in the British auto parts industry during 1987-92 will exceed $160 million. The British Society of Motor Manufacturers and Agents indicated that about $16 million is spent on R&D annually. 6/

The United Kingdom's automobile industry experienced significant structural changes during 1977-87. These changes have had a major impact on the United Kingdom's parts makers. Automakers have reduced the number of vehicle models, thus, the number of different parts has been reduced.

1/ Ibid.
2/ USITC staff telephone interview with Automotive News officials, Aug. 25, 1987.
3/ USITC staff interview with TTVMA and BOED officials, Taipei, Taiwan, Apr. 27, 1987.
4/ Report from U.S. Embassy, London, England, May 1987.
5/ Ibid.
6/ Report from the U.S. Embassy, London, England, May 1987.

Domestic market.--Automakers in the United Kingdom are reexamining their parts procurement procedures. Automotive parts for different models are increasingly purchased from the same source, resulting in a trend towards the in-house purchase of certain products by many automakers. The trend toward greater commonality in auto parts is projected to reduce demand for most parts by 70 percent during 1987-94, according to industry sources. 1/

Ford and General Motors (which trade under the names of Vauxhall and Bedford in the United Kingdom) are significant factors in the United Kingdom market. Ford is the market leader in the United Kingdom, and Vauxhall occupies second place. Both firms have their own parts-making operations--Ford trades under the name "Motocraft" and Vauxhall under the name "Mopar".

Based on information obtained from a May 1987 report of the U.S. Embassy, in London, it is estimated that the total market for automotive parts was $12.7 billion in 1983, as shown in the following tabulation:

Item	Value (million dollars)
Automotive parts:	
Domestic production	8,034.0
Imports	8,186.4
Exports	3,486.8
Net apparent market	12,733.6

The automobile accessories 2/ market stood at $409 million:

Item	Value (million dollars)
Automotive accessories:	
Domestic production	388.5
Imports	123.1
Exports	102.3
Net apparent market	409.3

The service equipment market amounted to $100 million, as shown in the following tabulation:

Item	Value (million dollars)
Automotive service equipment:	
Domestic production	130.5
Imports	35.0
Exports	65.5
Net apparent market	100.0

1/ Ibid.
2/ This product grouping consists of mechanical and operational parts consisting of hundreds of different items.

United Kingdom parts makers' sales generally increased during 1982-86 (table 4-19). Although United Kingdom parts makers' sales of certain products decreased during 1982-86.

Table 4-19
Automotive parts: United Kingdom sales, by products, 1982-86

(In millions of dollars)

Item	1982	1983	1984	1985	1986 1/
Knock-down sets for cars and commercial vehicles......	194.5	295.0	212	132.0	72.0
Chassis frames and parts thereof and chassis without engines for commercial vehicles....................	51.7	46.0	43.0	43.0	113.3
Sheet metal (hoods, doors, etc.) including panels for vehicles.................	205.3	182.2	254.0	205.0	248.0
Fenders and fender overriders..	10.5	9.2	6.0	9.0	10.7
Muffler systems and parts......	71.1	63.7	59.0	73.0	132.0
Coils, suspension springs......	21.4	17.8	16.0	12.0	14.7
Oil filters.....................	69.8	64.2	67.0	83.0	96.0
Miscellaneous engine components..................	452.0	353.8	401.0	387.0	409.3
Gear boxes and parts...........	297.4	236.2	293.0	267.0	333.3
Radiators, complete and radiator blocks..............	82.9	75.0	87.0	90.0	85.3
Steering gear and parts........	166.1	160.6	152.0	158.0	181.3
Axles and half-shafts, propeller shafts, and universal joints and parts...	552.1	477.8	434.0	451.0	490.7
Wheels and parts...............	88.1	84.2	81.0	75.0	78.7
Brakes and parts...............	383.0	361.3	331.0	331.0	430.7
Clutches and parts.............	121.4	103.2	92.0	106.0	125.3
Shock absorbers, independent suspension units, and dampers and parts............	112.9	105.0	97.0	95.0	109.3
Motor-vehicle seats, complete	9.0	6.8	27.0	36.0	29.3
Motor-vehicle safey belts, complete.....................	57.6	66.8	57.0	88.0	129.3
Locks for motor-vehicle trailers, semi-trailers, caravans, and freight containers....................	28.8	24.7	33.0	46.0	50.7
Certain parts and accessories (including radiator grills, fuel pumps, fuel tanks, tipping gear complete, and parts of heaters)............	1,028.0	943.1	873.0	955.0	1,082.7

1/ Estimated by the staff of the U.S. International Trade Commission.

Source: Report from U.S. Embassy, London, England, May 1987, except as noted.

Trade.--There are no significant barriers to the import of automotive parts, accessories, and services equipment into the United Kingdom. Imports are, however, subject to a value-added tax of 15 percent ad valorem. The United Kingdom experienced a trade deficit of $4.7 billion in auto parts in 1983, with the value of exports nearly one-half of imports, which stood at $8.2 billion. The trade deficit for automotive accesories amounted to $21 million in 1983, with imports totaling $123 million. Automotive service equipment experienced a trade surplus of $31 million.

The bulk of Motocraft's and Mopar's production is sold in the United Kingdom market. Exports to developing countries account for about 18 to 25 percent of sales; there are no significant exports to the United States. U.S. firms account for about 12 percent of total United Kingdom imports of automotive parts. However, this share of the market is notably higher if manufacturing activities of the U.S. companies in both Europe and the United Kingdom are considered.

Government programs--The United Kingdom Government has a policy of encouraging qualified firms to invest in the United Kingdom. The Government offers grants, low-interest loans, tax incentives over limited periods, and ready-built factories and warehouses. Many U.S. parts firms are located in "industrial development" areas in which non-EC taxes are waived. There are a number of legal restrictions regarding the production and distribution of parts--mainly replacement components. British parts makers are concerned that independent firms are copying their systems without paying royalties. The United Kingdom Government is also devoting increased attention to improving quality of parts in the British market. In addition, exclusive arrangements between importers and vehicle producers are regarded as questionable practices and may soon be subject to United Kingdom Government antitrust action.

The United Kingdom Government maintains programs that encourage parts makers to export. For example, representatives of the Department of Trade and Industry and the Exhibitions Division of the Central Office of Information reserve space at most major trade shows throughout the world. Producers receive subsidized space, travel, freight, and hotel arrangements. Depending on the size and location of the show, subsidies can range from 15 to 100 percent of the total cost. U.S.-owned firms located in the United Kingdom also qualify for these incentives.

West Germany

Industry structure.--It is estimated that there are about 400 companies that produce automotive parts in West Germany, employing approximately 222,000 persons. 1/ West German parts producers have developed a strong position throughout the relatively open market of the European Community (EC). The largest German automakers--Audi/Volkswagen, Mercedes-Benz, and Bayresch Motorenwerke (BMW), have German-based and foreign parts manufacturing facilities. In addition, Robert Bosch GmbH and Knorr-Bremsen have established sales and manufacturing facilities throughout Europe and in the United States.

1/ Report prepared for the USITC by Mark Woodbridge GmbH, Munich, West Germany, April 1984.

GM (through its subsidiary, Adam Opel AG) and Ford both have significant manufacturing facilities in West Germany for passenger cars and automotive parts.

German automakers have long maintained a reputation for sophisticated engineering and high performance in their vehicles. They have created a high standard for auto parts dependent on long-term supplier relationships and quality. 1/ Although the automotive electronics sector has not reached the same technologically advanced level in West Germany as is available in the United States, German autosound components are considered to be among the best in the world.

Domestic market.--The West German market for automotive parts increased from $6.2 billion in 1984 to about $9.8 billion in 1986 (table 4-20). The market is projected to expand at about 7 percent a year through 1989.

Table 4-20
Automotive parts: West German production, total imports, imports from the United States, exports, and consumption, 1984-86 and 1989

(In millions of dollars)

Item	1984	1985	1986 1/	1989 2/
Production	9,209	10,067	14,059	17,709
Total imports	1,758	1,987	2,775	3,495
Imports from the United States	140	249	209	263
Exports	4,751	5,067	7,077	8,913
Consumption	6,216	6,987	9,757	12,290

1/ Estimated.
2/ Projected.

Source: Documents supplied by the U.S. Consulate, Stuttgart, West Germany, May 1986.

Trade.--Total imports rose by 56 percent from $1.8 billion in 1984 to about $2.8 billion in 1986; imports from the United States increased by 49 percent to $209 million in 1986. During 1984-86, U.S. firms increased exports of brake pads, fuse boxes/parts, and distributor coils. During 1985, France and Italy were the top sources of West German imports; however, the largest percentage increases in imports have been from the Benelux countries and Japan. 2/

Tariffs imposed by West Germany on imports of non-EC auto parts vary from 5.7 percent ad valorem for electrical equipment up to as much as 20.8 percent ad valorem for bus and truck chassis.

1/ Ibid.
2/ Documents supplied by the U.S. Consulate, Stuttgart, West Germany, May 1986.

Government programs.--Although the EC was formed to reduce trade barriers among member countries, France, Germany and the United Kingdom have all introduced measures to protect their domestic automobile industries from foreign competition. Since 1981, for instance, the West German Government has persuaded Japanese automobile companies to limit their share of the German market to 11 percent. Additionally, the German Government requires that many automotive parts conform to special technical and electrical safety standards. German Federal law requires that trucks and buses be subject to a rigorous annual inspection; passenger cars are tested every 2 years. Because of a growing problem with air pollution, the West German Government has mandated the incorporation of catalytic converters in future automobiles sold in that country and is planning to restrict the sale of leaded gasoline.

CHAPTER 5. INVESTMENT IN U.S. PRODUCTION FACILITIES BY FOREIGN PRODUCERS

Overview of the Industry

Recently, there has been an influx of Japanese motor vehicle and parts manufacturers building production facilities in the United States. By 1990-92, eight of Japan's nine automakers will have installed capacity to manufacture up to 1.8 million vehicles annually (table 5-1). The principal reasons why the Japanese have set up these new facilities are because of restraints on Japanese auto exports to the United States, threats of domestic content legislation, and the decline in the value of the U.S. dollar relative to the Japanese yen.

In January 1987, the Japanese Government announced that it was extending its automobile voluntary restraint agreement (VRA) (see p. 6-9) for the seventh straight year, thereby limiting the number of cars that the Japanese automakers can export to the United States. Since these export restraints only apply to cars and certain utility vehicles that have been produced in Japan, many Japanese auto companies have built, or are building, vehicle-assembly plants in the United States. 1/

The United Auto Workers (UAW) and U.S. parts manufacturers have proposed enactment of domestic content laws, which would require a specific percentage of U.S. content in automobiles produced by both foreign and domestically-owned auto manufacturers in the United States. Although it passed the House of Representatives twice (in 1982 and 1983), the Senate never considered it. Domestic content legislation, if passed, would limit the amount of auto parts that automakers located in the United States would import. At the same time, domestic content requirements could encourage more foreign-owned parts producers to establish U.S. operations.

As a result of the move of Japanese automakers to the United States, there has been an increased incentive for Japanese auto parts firms to move to the United States. Japanese auto manufacturers located in the United States claimed they were having difficulty procuring parts from the U.S. companies at the price and quality they sought. Thus, many Japanese parts makers that were exporting parts to the U.S.-based Japanese automakers believed that they would be better able to supply them if they also located in the United States. 2/ In addition, with the threat of domestic content legislation, Japanese firms making auto parts would have a better chance to continue to supply these firms if located in the United States.

1/ Some of these assembly plants have been joint ventures with existing United States auto companies, such as New United Motors Manufacturing, Inc; a joint venture of General Motors and Toyota, and others are wholly owned by Japanese vehicle manufacturers, such as the Nissan facility in Tennessee.
2/ USITC staff interview with U.S. Department of Commerce officials, July 22, 1987.

Table 5-1
Automobiles: Japanese automakers in the United States

Company name	Date open	Location	Capacity	Investment	Employment	Products
				Million dollars		
Honda of America 1/ Manufacturing Inc.	Nov. '82	Marysville, OH	360,000	615	3,600	Accord, Civic Honda
Nissan Motor Manufacturing Corp. U.S.A.	June '83	Smyrna, TN	265,000	850	3,000	Sentra, Pickup Nissan
New United Motor Manufacturing Inc.	Dec. '84	Freemont, CA	250,000	450	2,500	Toyota/GM Nova, FX16
Toyota Motor Manufacturing U.S.A. Inc.	Spring '88	Georgetown, KY	2/ 200,000	800	3,000	Toyota Camry
Mazda Motor Manufacturing U.S.A. Inc.	Fall '87	Flat Rock, MI	2/ 240,000	550	3,500	Mazda 626, Mustang IV
Mitsubishi/Chrysler Motors Corp.	Fall '88	Bloomington, IL	2/ 240,000	700	2,900	Diamond-Star H2X hatchback
Fuji/Isuzu Automotive Inc.	Fall '89	Lafayette, IN	2/ 240,000	600	3,000	Subaru-Isuzu Leone, P'up/Trooper
Total United States	–	–	2/ 1,795,000	4,565	21,500	

1/ In September 1987, Honda announced that it will build a second U.S. assembly plant in Ohio. Construction on the $380 million facility will begin in February 1988 and production will begin in August 1989.
2/ Projected.

Source: Automotive Industries, June 1987.

Exchange-rate changes have also had an effect on both the purchasing of parts by auto firms and the feasibility of Japanese parts makers' decisions to move production to the United States. The fall of the dollar and the expectation that it will remain near its current level has reduced much of the traditional price advantage found in purchasing auto parts from Japan, by both domestic and Japanese companies located in the United States.

Effect of Foreign Direct Investment on Employment in the Automotive Parts Industry

The impact of Japanese direct investment in the United States on employment in the U.S. automotive parts industry has been the subject of much recent controversy. Some have argued that incoming foreign firms will create overcapacity in an industry where forecasts project relatively low growth rates during the next decade. 1/ In addition, a major claim directed at Japanese parts makers already located in the United States is that they are not producing the parts in U.S. plants, but instead are importing many of the components and only assembling them in the United States, thereby reducing U.S. employment in the auto parts industry. 2/

Others have argued that the increase in foreign investment will stimulate the U.S. auto parts industry. The increased competition will increase efficiency in production, and as a result, the U.S. parts manufacturers will be better able to compete in the world market. A study sponsored by the CATO Institute argues that "the presence of lower-cost Japanese auto parts suppliers...makes the auto parts industry more competitive... Lower cost parts will hold down the cost of American-made automobiles, which will make them more competitive in international markets." 3/ The effect would be to increase employment in the industry, since demand for U.S. automotive parts would increase.

As a means of exploring these issues the Commission staff have studied information provided by independent consultants, State governments, city governments, foreign governments, the U.S. Department of Commerce (Commerce), industry trade associations, and a wide variety of published sources on foreign-owned automotive parts manufacturers that have located in the United States, or are planning to do so. The staff contacted hundreds of firms and compiled a comprehensive listing of approximately 260 foreign-owned parts companies located in the United States; detailed information on these firms is presented in appendix G.

Commerce reports employment in the U.S. auto parts industry in 1987 to be about 721,000 workers. The Commission estimates that about 81,000 workers are employed by foreign-owned parts producers or foreign-owned firms involved in

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1/ In discussing the attempt of state governments to attract foreign investment, John Peters, in a study done for the Foreign Commercial Service-Osaka, comments that "...the excess capacity generated (by foreign auto parts companies moving to the United States) may well smother local American manufacturers," p. 1. He goes on to say Japanese parts firms currently operating or now building in the U.S. will expand or build new U.S. production facilities even if it means overcapacity," p. 3.
2/ USITC staff interview with MEMA officials, Washington, DC, Aug. 12, 1987.
3/ Posthearing submission by the CATO Institute, pp. 14-15.

joint ventures in the United States. Of these, about 26,000 are employed by wholly owned Japanese automotive parts makers and about 5,000 are employed by joint ventures between U.S. and Japanese firms. 1/

Japanese parts firms have located in the United States mainly to supply Japanese automakers that have built plants here. It seems clear that Japanese investment in U.S.-based auto parts production has expanded net U.S. auto parts employment. As explained below, parts produced in the United States largely substitute for those that would otherwise have been imported, mitigating any job losses in the parts industry caused by Japanese output of vehicles in the United States which compete with U.S.-made vehicles.

It would not be surprising if, as Japanese parts producers develop more first-hand familiarity with the U.S. market, they begin to compete in the U.S. aftermarket and possibly in the OEM's as well. To the extent that their employment expands to supply these markets in competition with U.S.-owned producers, these would not be net increases but would be at the expense of employment by U.S. parts producers. It is not possible to estimate to what extent that may be true of the current 31,000 jobs.

Assembly of imported parts in the United States.--It was not feasible to collect data needed to investigate concerns about the extent to which Japanese parts firms in the United States may be importing components and raw materials and assembling them here. Such a study would require an analysis of each auto part. However, if the amount of U.S.-produced components used is lower for U.S.-based Japanese parts makers than for U.S.-owned parts firms, it would lessen the positive impact that incoming Japanese investment has on employment in the industry.

Technology and employment.--A number of respondents to the Commission's questionnaires indicated that incoming Japanese auto parts firms may use more sophisticated production technologies, the effect of which would be, at best, to reduce the number of jobs gained by production of parts substituting for imports. At worst, more efficient Japanese producers might need fewer workers than those displaced, to the extent that their parts substitute for parts produced by U.S.-owned domestic plants. It is difficult to determine the net effect of technology on employment in a given industry. Moreover, productivity gains in U.S.-owned plants, whether larger or smaller than those in Japanese-owned plants, may be a main reason for observed decline in the U.S. auto parts industry employment in 1986. However, productivity gains from technology usually permit not only reduced labor inputs, but also usually reduce production costs, which, if passed along, can stimulate auto production, and thus expand production of auto parts. A determination of the net employment effect, depending on which of these counteracting forces is strongest, is also beyond the scope of this study.

Factors influencing substitutability

Testimony at Commission hearings and staff plant visits and interviews support, but cannot conclusively document, the argument that the initial

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1/ Estimated by the staff of the U.S. International Trade Commission, based on company-supplied information and information from the U.S. Department of Commerce.

impetus for Japanese parts plant investments here has been to supply U.S.-based Japanese automakers. Progressive appreciation of the yen against the dollar since these investments began would further enhance the attraction of U.S.-based substitution for imported parts from Japan. These indications point to the likelihood that to date the greater effect of these comparatively new investments has been to substitute for imports and to produce net gains to U.S. employment in the parts industry.

The following section elaborates factors which determine substitutability and underscores the numerous advantages that U.S.-based Japanese parts producers have in substituting for parts imports from Japan. These advantages do not preclude that Japanese parts makers may create future U.S.-based capacity aimed at competing for the U.S. aftermarket and U.S.-owned OEM purchasers; to that extent they will make further employment expansion at the expense of U.S.-owned producer employment.

However, determination of U.S. employment levels is obviously not dependent solely on Japanese auto parts producers. These current Japanese areas of advantage can also be read as areas where progress by U.S. firms to meet the competition will increase their capabilities to substitute particularly for auto parts imports from Japan, and to make net additions to U.S. auto parts industry employment in that way. Other chapters of this report detail progress of U.S. auto parts firms in some of these areas.

<u>Substitutability in demand</u>

There are many factors that determine product substitutability. One important factor is quality. In addition, there are several other factors of particular importance in the auto parts industry, such as the ability to participate in the research and design of the parts, ability to provide just-in-time service, and the effect of established purchaser/producer relationships (see description of the Japanese keiritsu system, pps. 4-12 to 4-14).

It is difficult to obtain an aggregate measure of the quality of auto parts because of the diversity in types of parts. A part-by-part analysis of quality differences would be preferable, but the diversity of the industry would require the collection of such a mass of data as to be impractical. However, it is possible to obtain important information about the quality of U.S.- and Japanese-made auto parts from the Commission's questionnaires, interviews with representatives from all of the major automotive companies, published sources, and testimony at the hearing.

Quality was listed as one of the primary considerations affecting buying decisions of auto assembly firms purchasing the seven specific auto parts covered in the Commission's questionnaire. For example, New United Motor Manufacturing, Inc. (NUMMI) initially found their "reject rate for American parts was six times that of domestic (Japanese) parts." 1/ U.S.-based Japanese automakers claim that after much assistance to U.S. plants with education and training, the defect rates are now about equal for U.S.-owned producers selected as qualified suppliers. 2/

1/ Transcript of the hearing, p. 142.
2/ Ibid.

Differences in supplier relationships between U.S.- and Japanese-owned firms give rise to several other factors of particular importance in the automotive industry that influence the substitutability of auto parts. One factor is the degree of willingness and ability of auto parts firms to engage in some of the research and design involved in producing a given auto part. There are many reasons why this difference exists. Historically, U.S. automakers performed all of their own research and design. They then gave the parts firms the performance specifications of the part to be produced, and the parts maker produced it. In Japan, on the other hand, the automakers require the parts firms to be involved in the research and design of the desired parts. As a result of this structural difference, Japanese auto assemblers moving to the United States have found it difficult to find U.S. parts manufacturers that can take a general idea or design for an auto part, and from it create a final product of acceptable quality as rapidly as the auto manufacturer requires. A representative from Honda said that his company is having major difficulty in finding firms that can produce the type or quality of parts Honda needs. 1/

Some U.S.-owned auto parts firms have been able to make this adjustment with the assistance of the auto companies. NUMMI's General Counsel and Corporate Secretary testified before the Commission that NUMMI is helping to restructure U.S. parts makers that are willing to make these changes. 2/ In addition, U.S. parts firms are increasing their in-house research and design; one company representative said that the only way a U.S. parts firm will survive in this increasingly competitive industry is if the U.S. firms can develop the capability to perform part of the research and design. 3/

The ability to provide just-in-time delivery (see p. 7-15) is another factor of increasing importance in the industry. This is the ability of a parts supplier to deliver required quantities when needed, with minimal defects. This allows the auto manufacturer to lower its inventory costs. Just-in-time delivery is a practice that Japanese automakers have been using for some time and thus the U.S.-based Japanese manufacturers are experienced with this system.

U.S. firms are moving toward this system, but many of the domestic parts manufacturers have little experience with it. The Big Three have made commitments to just-in-time delivery, but are proceeding with caution, as it is critical for its success that the auto part be delivered on time, and not be defective. Chrysler's program, set up 3 years ago, mandates that vendors must guarantee quality, consistency, and meet the production schedule. 4/ In addition, before Chrysler contracts for just-in-time delivery, the parts manufacturer must go through a training program to aid in the implementation of the program. 5/

1/ USITC staff telephone interview with Honda officials, Marysville, Ohio, Aug. 10, 1987.
2/ Transcript of the hearing, p. 143.
3/ Arthur Andersen & Company, Cars and Competition: Management Challenges, August 1987.
4/ USITC staff telephone interview with Chrysler officials, Aug. 12, 1987.
5/ Ibid.

A location close to the assembly plant is also important for just-in-time delivery to be effective. A parts company has a natural disadvantage if it does not have facilities near an assembly plant for which it is producing a part, especially if shipping costs are a major factor or where just-in-time service is expected. This is a critical issue for NUMMI since it is not located near most auto parts production. 1/ NUMMI has found that purchasing parts from east of the Rocky Mountains can be more expensive than bringing them in from Japan or Mexico. 2/

Shipping costs are more important for a low-cost part than for a high-cost part. The consulting firm Booz-Allen & Hamilton, Inc., estimates that shipping costs for an average part (whose price ranges from $30 to $40) is generally between 4 and 7 percent of the cost. If a part is more expensive, i.e., $100 or more, the percent of transportation costs to the total price is lower. Given that, shipping costs will be a greater barrier in the decision to import small items such as shock absorbers than for large items such as engines. As a result, if a parts firm is unwilling to relocate close to the plant, at least for the more expensive items, the automaker is more likely to import.

New Japanese parts firms entering the United States have an advantage over U.S. parts firms since they can locate close to the new assembly plants without employee termination or relocation costs, whereas for a U.S.-based firm, having to relocate from an existing United States location is often difficult and may not be feasible financially.

Another important factor in choosing an auto parts supplier is the reliability of the supplier. The existing relationship that an automobile company has with its automotive parts suppliers, based on years of experience in dealing with a company, provides valuable information about supplier reliability. Since there is always an inherent risk involved in dealing with an unknown entity, firms, in general, try to work with companies with which they have an established relationship. Indeed, in both the purchasers' questionnaire and in interviews with representatives of Japanese automakers, this was one of the most frequently cited reasons as to why they decided to purchase from U.S.-based Japanese companies. In spite of this advantage to existing suppliers, however, automakers have been willing to consider new sources.

Japanese auto assemblers located in the United States have been purchasing many of their auto parts from Japanese parts suppliers, whether based in Japan or in the United States. Given the importance of product quality, as well as the uncertainty involved in dealing with a new firm, it has been logical for Japanese auto producers to contract with firms with which an established relationship already exists. One U.S. auto producer suggested that Japanese automakers, in an attempt to reduce risk and uncertainty as a result of dealing with all new suppliers, were encouraging Japanese parts firms to locate production facilities in the United States. 3/

1/ NUMMI is located in Fremont, CA, and most automotive parts production is centered in the Midwestern United States.
2/ USITC staff telephone interview with NUMMI officials, August 1987.
3/ Comment in response to questionnaires of the U.S. International Trade Commission.

This discussion indicates that there are several important differences between the products of U.S.- and Japanese-owned parts makers. There has been a lower defect rate for parts from Japanese parts firms, whether imported or produced in the United States. Japanese parts companies have more research and design experience and engineering staff than do U.S.- owned parts makers. Japanese parts companies have had much more experience in providing just-in-time delivery. Japanese parts firms have an existing relationship with Japanese automakers, minimizing the risk and uncertainty associated with dealing with a new supplier.

In summary, this discussion of substitutability suggests that the two groups (U.S. and foreign parts producers) do produce differentiated products, although the degree of differentiation is narrowing. Thus, the absence of the U.S.-based Japanese parts firms will generally imply an increase in imports.

Union Relations and Workforce Management

Along with the controversy surrounding the impact of foreign investment on employment in the U.S. parts industry, the advent of Japanese parts firms locating in the United States has raised questions regarding union relations and trends in workforce management. For example, union and management often have conflicting views regarding Japanese-style management systems. Automakers increasingly feel that greater flexibility in work rules is essential for survival. In contrast, union members are often opposed to these systems because team production and reduced classifications often curb transfer and seniority rights. A spokesman for the UAW stated that he is not opposed to new work rules and team production methods if there is a structural problem at the plant, however, he adds that management practices may be at fault as well. 1/

Most Japanese automotive plants in the United States are not unionized, whereas all of the U.S. assemblers are. Honda and Nissan operate without unions as will the new Toyota plant. NUMMI is a UAW plant, and the new Mazda plant also will be organized by the UAW. Japanese investors favor the Midsouth region in part to avoid union strongholds. These plants operate with reduced management levels, team production, and flexible work rules. However, industry sources indicate that the UAW may have to agree to nontraditional labor practices in order to unionize Japanese-owned firms.

Most Japanese parts suppliers located in the United States and most smaller domestic parts producers operate with smaller local unions or none at all. However, the component divisions of GM, Ford, and Chrysler are organized by the UAW. Ford executives said that a major obstacle to competitiveness was the need to pay automotive wages though competing in industries such as steel, paint, and electronics. For example, Ford Glass has labor costs of $27 an hour, while two of its major domestic competitors are Japanese joint ventures (A.P. Technoglass and United LN Glass) paying workers approximately $12 an hour. 2/

1/ USITC staff interview with UAW officials, Washington, DC, July 1987.
2/ USITC staff interview with Ford officials, Washington, DC, July 1987.

GM officials indicate that 54,000 of GM's parts workers make items other automakers buy from outside companies. About 120,000 of GM's hourly workers are employed by its parts-producing divisions. GM's president says GM will have to pay parts workers competitively with outside suppliers or the automaker will reduce some parts operations in addition to the stamping and assembly plant closings it announced in November 1986. 1/

In an effort to close this wage gap, some parts makers are experimenting with two-tier wage systems. This system (commonly used in Japan) involves paying lower wages to component plant employees than to assembly workers and basing pay on seniority. An example of a two-tier contract is an agreement negotiated in 1984 between the international union of Electronic Workers and GM Packard Electric Division. The company promised current workers at the Warren, OH, plant their jobs for life, but the local union was forced to accept a multitiered wage system where new workers start out earning 55 percent of the amount that veterans are paid and reach parity after 10 years. 2/ However, it will be increasingly difficult to initiate widespread application of such a plan in the United States; for example, the UAW resolved in its 1987 collective bargaining convention to reject two-tier agreements.

Union priorities are shifting to employment security rather than wages, work rules, and working conditions. (Permanent employment and flexible work rules are regular features of some large Japanese firms; however, the Japanese supplier industry is made up of smaller firms that are typically not on a permanent employment system.)

Employees in the automotive component sector won a major job-protection promise in September 1987, when the UAW reached a tentative labor agreement with Ford Motor Co. 3/ The key provision in the contract is a guaranteed employment program designed to protect the jobs of Ford's 104,000 UAW-represented employees over the next 3 years. Part of the provision limits Ford's ability to outsource the production of automotive components through the use of non-UAW domestic and foreign labor. (On October 12, 1987, the UAW overwhemingly approved a new three-year contract with GM that was patterned after the Ford agreement.)

Much has been made of the management techniques employed by Japanese-owned automotive firms located in the United States. The key ideas of the Japanese-style participative management system are team production, flexible work rules, and delegating responsibility to production employees. Employees are trained to do several jobs in one work area instead of doing one job on the assembly line. The team can coordinate its tasks in an effort to keep pace with robotics and computer processes.

The idea of production teams can be extended to include groups in all areas of the plant. For example, input from research, design, production engineering, and marketing personnel can be combined to enhance development efforts. These flexible work rules and reduced job classifications broaden

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1/ "If UAW Strikes, It's Apt to be GM," Washington Times, Sept. 8, 1987.
2/ Jacob Schlesinger, "Job Guarantee Contracts are Becoming More Common," The Wall Street Journal, June 29, 1987, p. 6.
3/ Warren Brown, "UAW Flush With Success, Turns Attention to GM," The Washington Post, Sept. 22, 1987, p. E3.

the scope of individual jobs and allow employers to reassign workers where they are most needed. In contrast, in some U.S. labor contracts, job classifications are very narrow, requiring the use of many workers to complete a given process. 1/

Worker input is especially important in quality control. For example, in continuous quality control systems workers are expected to catch problems at their own stations. It may also be advantageous for management to share marketing goals, sales targets, and other corporate strategies with workers in order to give them a better idea of the goals and achievements of the firm. Traditional management is not always willing to give up this kind of power and responsibility, but in order to make participative systems work, management must modify its practices as well. The President and Chief Executive Officer of Nissan Motor Manufacturing U.S.A. said "the key to making participative management work is giving responsibility to the line worker. Management must trust the employees enough to give them responsibility. Without that trust, the system won't work. A participative style is a bottom up style in which the people at the top give up some control of the process and concentrate instead on managing the people." 2/

State Incentives

There is increasing competition between U.S. State governments to attract Japanese automakers and auto parts firms to locate in their States. A spokesman for the Automotive Parts and Accessories Association (APAA) claims that the Japanese Ministry of International Trade and Industry is orchestrating with Japanese parts firms as to which firms will open production facilities in the United States. 3/ State governments offer incentives in the form of reduced taxes, low interest loans, assistance in site acquisition, site improvement, road improvement, English instruction for Japanese workers and their families, and worker training programs. In return for financial incentives, State governments hope to increase their tax base, gain jobs, and promote economic development. A summary of the financial support offered to Japanese auto assemblers in the United States is given in table 5-2. The actual cost, however, is frequently much higher than the original estimate due to unforeseen expenses. Data in the table also do not take into account various indirect benefits such as tax incentives and lower interest payments on tax exempt industrial development bonds. For example, for the State of Kentucky, the actual cost of its financial support for the Toyota plant could be as high as $325 million over 20 years. 4/

The Kentucky-Toyota deal is illustrative of the effects of a transplant assembly facility on a State economy. According to a Kentucky State Government official, a study by the University of Kentucky indicates that there are direct, indirect, induced, and derived effects on the local economy as a result of Toyota's presence in Kentucky. Direct effects are the spending and employment of Toyota and its suppliers. Full employment and production

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1/ USITC staff interview with Kentucky and Ohio State Government officials, Washington, DC, August 1987.
2/ "Runyon Eyes Component Work," Automotive News, June 8, 1987, p. 46.
3/ USITC staff interview with APAA officials, Washington, DC, July 28, 1987.
4/ USITC staff interview with Kentucky State Government officials, Washington, DC, August 1987.

Table 5-2
U.S. State support for U.S. plants of Japanese automakers

Japanese investor	State	Type of financial support	Value
			Million dollars
Toyota Motor ($800 million planned investment; plant to be completed in 1988 and to employ 3,000 workers)	Kentucky	Total support	125.0
		Site acquisition	15.0
		Site improvement	20.0
		Technology center construction	10.0
		Worker training	33.0
		Road improvement	47.0
Mitsubishi Motor (joint venture with Chrysler; $500 million planned investment; plant to be completed in 1988 and to employ 2,500 workers)	Illinois	Total support	83.3
		Road improvement	17.8
		Site acquisition	11.0
		Water system improvement	14.5
		Worker training	40.0
Mazda Motor (joint venture with Ford; $450 million planned investment; plant to be completed in 1987 and to employ 3,500 workers)	Michigan	Total support	52.0
		Worker training	19.0
		Road improvement	4.0
		Low interest loans for site and sewerage improvements	20.0
		Loans to small municipalities	.5
		Federal subsidy	1.0
		Railway improvement	7.5
Nissan Motor ($450 million planned investment ($745 million actual); plant completed in 1983; planned employment of 2,600 workers (3,100 actual))	Tennessee	Total support	19.0
		Worker training	7.0
		Road improvement	12.0
Honda Motor 1/ ($250 million planned investment ($490 million actual); plant completed in 1982; planned employment of 2,000 workers (3,300 actual))	Ohio	Total support None announced, but some believe $22 million was provided in subsidies	

1/ In September 1987, Honda announced that it will build a second U.S. auto assembly plant in Ohio. Starting in August 1989, about 1,800 employees will produce 150,000 cars annually. No announcement was made regarding State assistance for the new plant.

Source: Takeo Miyauchi, "The Man Who Lured Toyota to Kentucky," The Economic Eye, March 1987, pp. 23-27.

levels will be attained by 1990, at which time, 3,000 employees will produce 200,000 automobiles annually. In addition, 21 new Japanese automotive-related plants will employ approximately 3,500 workers in the State. Governor Martha Collins of Kentucky added that Toyota also has $600 million in contracts with suppliers in other States creating more U.S. employment. Indirect effects result from expenditures by Toyota and its suppliers. Induced effects are felt as employees of Toyota and its suppliers spend their earnings in Kentucky. Derived effects are additions to the economic service base generated by construction and the startup of Toyota and its suppliers. 1/

The study estimates that when the plant is operating at full capacity and its effects are multiplied throughout the economy, 35,520 jobs will be created and an additional $3,792 million in output and $768 million in annual earnings will be generated. Tax revenues to the State are calculated to be approximately $633 million after 20 years. 2/

Supplier firms also receive financial incentives to locate within a State or community. As an example, the State of Ohio, Department of Development reported that from January 1983 to May 1984, it offered $8 million in financial support to foreign-owned parts firms. In return, 22 foreign firms invested approximately $244 million in Ohio, and employed approximately 2,800 workers. Currently, 18 of the 22 foreign-owned automotive-related firms in Ohio are Japanese transplant companies. As a supplier's location is dictated to an extent by the location of the assembly firm, incentives to supplier firms have less impact on investment decisions. The competition becomes one of city versus city and possibly between two or three States rather than many States. 3/

Opponents of incentives question whether U.S.-owned companies that choose to invest in a specific location are given the same treatment as foreign-owned companies. A spokesman for the State of Kentucky said that financial incentives are determined on a case-by-case basis regardless of country of origin. Ford's new truck assembly plant in Louisville received $13.3 million for worker training; $1.7 million in road improvements, and $100,000 in drainage assistance. This was a much smaller package than the State offered to the Toyota plant in Georgetown, principally because of the greater infrastructure development needs of Georgetown. States do offer specialized programs that are not applicable to U.S.-owned firms such as English language courses for Japanese families in the United States. 4/

Finally, a spokesman for the U.S. Treasury Department questions the overall effectiveness of incentives, stating:

1/ USITC staff interview with Kentucky State government officials, Washington, DC, August 1987.
2/ Ibid.
3/ USITC staff interview with Ohio State government officials, Washington, DC, August 1987.
4/ USITC staff interview with Kentucky State government officials, Washington, DC, August 1987.

"It may appear to be ludicrous where a foreign producer receives an incentive to build a plant while a domestic competitor with excess capacity is not in a position to use such an incentive. We doubt that these incentives are very effective in attracting investment and jobs to the United States. A recent study by the International Finance Corporation suggests that this type of competition in providing incentives simply shifts the location of production and jobs between states." 1/

1/ Hearing before the House Committee on Small Business, Washington, DC, July 22, 1987.

CHAPTER 6. BARRIERS TO TRADE AND U.S. GOVERNMENT INVOLVEMENT

Barriers to Trade

Industry sources claim that unfair trade practices and nontariff barriers by their leading competitors serve as competitive impediments in both the U.S. market and foreign markets.

Unfair trading practices affecting imports

The Automotive Service Industry Association (ASIA) alleges that the U.S. parts industry faces unfair trade practices such as underpricing, dumping, subsidies, targeting, and strict distribution practices. 1/ The Motor and Equipment Manufacturers Association (MEMA) and ASIA also allege that the 1965 U.S.-Canada Automotive Products Trade Agreement (APTA) (see p. 6-7) puts the U.S. industry at a competitive disadvantage. ASIA claims that Canadian motor-vehicle manufacturers supported by the Canadian Government have extensively increased their Canadian vehicle and original-equipment component production and exports. ASIA alleges that "other provisions protect Canada from potential U.S. dumping practices." 2/

MEMA claims that counterfeiting (see p. 6-17) is a common form of unfair trade. 3/ MEMA claims that the production of cheap imitations of U.S. products by foreign manufacturers has become a low-risk, high-profit business. In addition, ASIA cited the failure to mark country of origin, neglecting to properly identify the manufacturer, and the unauthorized use of proprietary part numbers as other forms of unfair trade practices. 4/

During 1986-87, the Commission considered a number of unfair trade complaints involving automotive parts. Final affirmative antidumping determinations were made in cases involving imports of tubeless steel disc wheels from Brazil (investigation No. 731-TA-335) (Final), tapered roller bearings and parts thereof, and certain housings incorporating tapered rollers from China, Romania, Hungary, Italy, Japan, and Yugoslavia (investigations Nos. 731-TA-341-346) (Final), and certain forged steel crankshafts from West Germany and the United Kingdom (investigations Nos. 731-TA-351 and 353) (Final). In addition, a final affirmative countervailing duty determination was made in a case involving imports of certain forged steel crankshafts from Brazil (inv. No. 701-TA-282 (Final)).

At a hearing held by the House Committee on Small Business on July 21, 1987, the Undersecretary for International Trade at the U.S. Department of Commerce (Commerce) suggested that Japanese auto parts manufacturers are dumping their products in the U.S. market. He explained that the administration would prefer that U.S. parts makers formally request an investigation. On July 28, 1987, Auto International Association, a trade

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1/ Transcript of the hearing pp. 90-91.
2/ Ibid., p. 90.
3/ USITC staff interview with MEMA officials, Washington, DC, Aug. 26, 1987.
4/ Transcript of the hearing, p. 91.

group of parts importers, indicated that they may file a dumping complaint against Japanese automakers "for their alleged underpricing of parts in the U.S. market." 1/ (As of November 1987, no such complaint has been filed.)

Trade barriers to exports

Because of the importance of exports to the automotive parts industry, free and fair access to foreign markets is critical to the U.S. industry's international success. Despite bilateral and multilateral agreements providing a framework for free trade in automotive parts, U.S. producers consistently assert that numerous countries have erected nontariff barriers in certain overseas markets. Control of distribution networks through the use of tightly regulated "authorized" captive outlets, quotas, unreasonable standards and specifications, exhaustive inspection and approval techniques, and discriminatory tariffs are examples of the serious barriers to U.S. exports of automotive parts. 2/

U.S. producers responding to the Commission's questionnaire alleged that restrictions such as licensing requirements, quotas, export restraints, embargos, and exchange controls are most prevalent in certain South American countries (table 6-1). Restrictive business practices and discriminatory purchasing were alleged to exist in Japan and Korea. Local content requirements, price regulations, and nontariff charges on imports were frequently mentioned as barriers for U.S. producers when exporting to Mexico, Brazil, and Canada. Problems with counterfeiting of U.S. auto parts has also emerged as a significant concern of U.S. exporters, especially in Taiwan, India, Singapore, Hong Kong, Korea, and Thailand. 3/

Many of the barriers mentioned above have been encountered in countries that have a motor-vehicle industry, or are attempting to develop such an industry. For example, the executive vice president of Maremont Corp. claimed that Japan has followed an "infant industry" approach to development in the automotive parts industry; that is, "Japan built up its automotive industry until it reached a level of world competitiveness by ensuring that vehicles could not be imported nor could U.S. parts firms participate to any significant degree in the Japanese automotive market." He added, "in the U.S., we have a relatively open market for vehicles and parts. In Japan, this has not always been the case, and indeed it is not the case today." 4/ Other noted examples of countries using nontariff measures (NTM's) to protect so-called infant industries are Mexico, Brazil, Korea, and Taiwan. Other countries, particularly in South America, have enacted embargoes and currency restrictions in response to their severe international debt crises.

1/ Richard Lawrence, "Official Suggests Japan Dumping Auto Parts in U.S.," The Journal of Commerce, July 23, 1987.
2/ Appendices to the statement of the President, Automotive Parts and Accessories Association, Inc., presented to the U.S. International Trade Commission, Feb. 24, 1987.
3/ Statement of the president, Automotive Parts and Accessories Association, Inc., before the U.S. International Trade Commission, Feb. 24, 1987.
4/ Transcript of the hearing, pp. 80-81.

Table 6-1
Automotive parts: Nontariff barriers experienced by U.S. producers in foreign markets, by countries, 1982-86

Category	Country(ies)	Percentage of total respondents
Quantitative restrictions and similar specific limitations:		
Licensing requirements	Colombia	23
	Mexico	20
	Venezuela	19
	Brazil	19
Quotas	Venezuela	6
	Mexico	5
Embargos	Mexico	5
Export restraints	Brazil	7
Exchange and other monetary or financial controls	Venezuela	27
	Brazil	17
	Mexico	15
	Canada	15
Maximum/minimum price regulations	Venezuela	3
	Mexico	2
	Argentina	2
Local content requirements	Mexico	33
	Brazil	18
	Venezuela	13
	Korea	10
Restrictive business practices	Japan	20
	Korea	9
	Mexico	6
Discriminatory bilateral agreements	West Germany	3
	France	3
Discriminatory sourcing	Japan	16
	Korea	3
	Brazil	3
Nontariff charges on imports:		
Border taxes	Mexico	15
	Canada	8
Port and statistical taxes	Canada	2
	Venezuela	2
	Brazil	2
Nondiscriminatory use and excise taxes and registration fees	West Germany	2
Discriminatory excise taxes, government controlled insurance, use taxes, and commodity taxes	Brazil	3
	Israel	2

Table 6-1
Automotive parts: Nontariff barriers experienced by U.S. producers in foreign markets, by countries, 1982-86--Continued

Category	Country(ies)	Percentage of total respondents
Nontariff charges on imports--Con.		
Nondiscriminatory sales tax	Canada	2
Discriminatory sales tax	Mexico	2
Other taxes and fees	Australia	2
	Canada	2
Government participation in trade:		
Subsidies and other aids	Japan	14
	Brazil	8
	Mexico	8
	Venezuela	7
State trading, government monopolies, and exclusive franchises	Venezuela	5
	Hungary	5
	Mexico	3
	Romania	3
Trademark, patent, and other intellectual property laws which discourage imports	Mexico	3
Government procurement	Iraq	5
	Iran	3
Standards:		
Health and safety standards	Australia	2
Product content requirements	Mexico	5
	Brazil	3
	Korea	3
Processing standards	Venezuela	1
	Japan	1
Industrial standards	Japan	2
Requirements on weights and measures	Japan	2
Labeling and container requirements	Canada	3
	Mexico	2
Marketing requirements	Canada	2
Packaging requirements	Canada	1
	Japan	1
Trademark problems	Taiwan	3
	Brazil	2
Customs procedures and administrative practices:		
Antidumping practices	Spain	2
	West Germany	2
Customs valuation	India	3
	Brazil	3

Table 6-1
Automotive parts: Nontariff barriers experienced by U.S. producers in foreign markets, by countries, 1982-86--Continued

Category	Country(ies)	Percentage of total respondents
Consular formalities	United Arab Emirates	6
	Kuwait	5
	Saudi Arabia	5
Documentation requirements	Japan	3
	Canada	2
	Brazil	2
	Mexico	2
Administrative difficulties	Japan	2
	Venezuela	2
Merchandise classification problems	Japan	2
Regulations on samples, returned goods, and re-exports	Venezuela	3
	Colombia	3
Countervailing duties	Brazil	1
	Japan	1
	Israel	1

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

More than any other country, Japan has been accused of erecting barriers to U.S. auto parts exports. Specific actions consistently noted by U.S. companies include alleged unfair links between Japanese suppliers and Japanese automakers, unreasonable delays in negotiations for contracts, difficulty in obtaining the information necessary for bids, unreasonable engineering or design standards, and frequent product modification requests.

According to Commerce's Assistant Secretary for Trade Development, the primary barrier to U.S. auto parts sales to Japanese vehicle manufacturers are not Government barriers, but rather the traditional family-like manufacturer-supplier relationships that exist in Japan (see description of the Japanese keiritsu system, pps. 4-12 to 4-14). He claimed that these relationships apply not only in the Japanese market (estimated to be a $50 billion market), but also at the new Japanese vehicle assembly plants in the United States. He adds that these ties "have effectively precluded many U.S. suppliers from participating in this huge, fast-growing market." 1/ The difficulties encountered in trying to penetrate the Japanese market have recently prompted political negotiations (see MOSS talks, p. 6-16) to improve the situation. However, several U.S. manufacturers argue that the Japanese vehicle producers are not serious about buying U.S.-made parts, but are showing interest only because of pressure exerted by both the Japanese and U.S. Governments. 2/

1/ Transcript of the hearing, pp. 6-8.
2/ "Counterfeit Parts: A $3 Billion a Year Industry," Automotive Parts International, Dec. 30, 1986, p. 6.

Japanese automakers stress that their purchasing decisions are made strictly based upon price, quality, and delivery. 1/ They state that U.S. firms must be equal or better than their Japanese competitors with respect to these three criteria. 2/ Nissan's president states that national or corporate origin is of no consideration to Nissan in choosing suppliers. He emphasizes that the notion that so-called family relationships "dictate their sourcing decisions is, to be blunt, ridiculous." He adds that Nissan cannot afford and could not survive by basing their parts procurement decisions on noneconomic criteria. 3/

JAMA denies that Japanese automakers operate under a "cozy" system in making their parts purchasing decisions; rather, JAMA describes the system as dynamic, interactive, and competitive. JAMA officials add that Japanese automakers welcome all competitive suppliers, Japanese, U.S., and others as long as they are able to meet the vigorous competitive requirements of the system. 4/

The Competitive Enterprise Institute (CEI), a private research group, rejects claims by U.S. parts firms that noneconomic barriers are their primary impediment to sales to Japanese automakers. For example, Honda of America stated that it terminated its contract with one U.S. plastic parts supplier when the latter failed to adequately supervise the performance of its employees after Honda itself had identified the workers responsible for defective parts. CEI claimed that not one U.S. industry representative at the Commission's hearing attempted to offer a specific counterexample that might have demonstrated real noneconomic bias; that is, a case where a domestic firm was truly competitive on a specific part (in terms not only of price, but of reliability, delivery flexibility, and other factors) and yet was unable to obtain a contract. 5/

Additionally, the Commerce Undersecretary noted that at the July 21, 1987 House Committee hearing, unfair trade practices may not be the primary cause of U.S. producers' inability to sell to Japanese automakers. He also stated that certain U.S. parts makers seem "uninterested or incapable of supplying the Japanese." The Undersecretary explained that during the MOSS talks Commerce received only 10 complaints (of unfair trade practices) that we could act on." He added that Commerce had received more instances from the Japanese "of American companies falling short on quality." 6/

Other foreign government officials claim that their countries will continue to make efforts to promote the importation of U.S.-produced auto parts and U.S. investment in their countries. For example, Korean Government

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1/ USITC staff interview with JAMA officials, Tokyo, Japan, Apr. 20, 1987.
2/ USITC staff interview with officials of Toyota Motor Co., Toyota City, Japan, Apr. 23, 1987.
3/ Transcript of the hearing, p. 162.
4/ Transcript of the hearing, p. 197, and USITC staff interview with JAMA officials, Tokyo, Japan, Apr. 20, 1987.
5/ Posthearing brief, Competitive Enterprise Institute, pp. 1 and 2.
6/ Geoff Sundstrom, "Hot Time on the Hill, Parts Trade Sparks Lively Exchange," Automotive News, July 27, 1987, p. 67.

officials and Taiwan authorities indicated that restrictions on imports of automotive parts from the United States are being liberalized, and companies in Korea and Taiwan are being encouraged to form joint ventures and technical cooperation agreements with U.S. firms. 1/

U.S. Government Trade Policies

The principal Government trade policies that have affected the U.S. auto parts industry are the U.S.-Canada Automotive Products Trade Act of 1965 (APTA), the Japanese Voluntary Restraint Agreement (VRA), the Generalized System of Preferences (GSP) program, the 806.30/807.00 program, the implementation of foreign trade zones (FTZ's), and the market-oriented, sector-specific (MOSS) talks. These policies differ considerably in their focus. The APTA was aimed at expanding automotive trade between the United States and Canada, and the VRA was intended to provide temporary protection for the U.S. automobile industry by reducing imports. The GSP assists less developed countries to expand their export industries, and the 806.30/807.00 tariff provisions make it easier for domestic manufacturers to internationalize parts of their operations to take advantage of lower costs abroad. FTZ's were initially envisioned for warehousing and/or reexporting foreign goods. The MOSS talks are aimed at eliminating alleged import barriers in the Japanese market for U.S.-made automobile parts.

U.S.-Canada Automotive Products Trade Act

Prior to 1965, the extent and nature of the trade between the United States and Canada in motor-vehicle parts and the production in Canada of motor-vehicle parts were greatly influenced by the tariff structures of the two countries. The Canadian tariff schedule for automotive parts was designed to encourage the manufacture of motor vehicles and parts in Canada, and did so in several ways. First, the basic most-favored-nation (MFN) tariff rates of Canada were quite high for complete motor vehicles (17.5 percent ad valorem) and parts (17.5 to 25 percent ad valorem). The tariff encouraged Canadian production and discouraged imports of motor vehicles and parts. Second, for a large number of articles generally used in the production of motor vehicles, the basic tariff rate would not apply. Articles would be entitled to duty-free entry if they were of a class or kind not made in Canada and were imported by a Canadian producer of motor vehicles meeting a certain Canadian content requirement.

At the same time, the Canadian motor-vehicle industry could not competitively export motor vehicles to the United States because of the relative inefficiency of the Canadian industry, coupled with the duty of 6.5 percent ad valorem imposed by the United States on imported vehicles. The inability of Canada to offset its increasing deficit in automotive trade with

1/ USITC staff interviews with Korean Government officials and Taiwan authorities, Seoul, Korea, and Taipei, Taiwan, Apr. 27 and 29, 1987.

the United States led to the adoption of an export incentive (duty-remission) plan in Canada. 1/

The full impact of the duty-remission plan upon automotive trade between the two countries was not immediately apparent. Net direct investment expenditures on plant and equipment in Canada by the Canadian affiliates of General Motors, Ford, and Chrysler increased substantially after the duty-remission plan became effective.

U.S. industry sources claim that before the impact of the duty-remission plan on automotive products trade between the two countries could be fully assessed, the U.S.-Canadian agreement was signed by President Johnson and Prime Minister Pearson on January 16, 1965. Fundamentally, the APTA obligates each of the contracting parties to accord duty-free treatment to imports from the other party of specified motor vehicles and parts for use as original equipment in the manufacture of such motor vehicles. 2/

The obligation of the United States to accord duty-free treatment to imports from Canada applies to the following automotive products. First, it applies to motor vehicles, with the exception of certain "special-purpose" vehicles, such as electric buses, three-wheeled vehicles, and motor vehicles specially constructed and equipped for special services and functions (e.g., fire engines). 3/ Second, it applies to parts (fabricated components) for use as original equipment in the manufacture of the specified motor vehicles, but does not apply to replacement parts. In addition, trailers, tires, and tubes are specifically excluded. 4/ Third, the products of Canada specified in the agreement must meet a requirement that they contain no more than a certain percentage of "foreign" content (the content of materials produced in non-North American countries (i.e, in other than the United States or Canada)). 5/ For any article, the measure of such "foreign" content will be the percentage of the appraised customs value of the article upon entry into the United States accounted for by the aggregate value of such imported materials contained in the article. 6/

1/ In November 1962, the Canadian Government initiated a program of duty remissions, or tariff-rebates to stimulate automotive products exports. Under the plan, duties were remitted on imports of motor vehicles and original-equipment parts to the extent that a company increased the Canadian content of its exports of all automotive products during a specified time period.
2/ The Government of Canada implemented the agreement in Canada through two Orders in Council Establishing Duty-Free Treatment (P.C. 1965-99 and P.C. 1965-100, The Motor Vehicles Tariff Orders of 1965) and simultaneously terminated the duty-remission plan. (Canada has since initiated another duty-remission plan that covers imports of certain non-APTA vehicles.) The Government of the United States implemented the agreement with the signing of the Automotive Products Trade Act of 1965 on Oct. 21, 1965, applying duty-free treatment retroactive to Jan. 18, 1965.
3/ USITC staff telephone interview with Department of Commerce official, Aug. 12, 1987.
4/ Ibid.
5/ For the purposes of the APTA, Mexico is not considered to be part of North America.
6/ USITC staff telephone interview with Department of Commerce official, Aug. 12, 1987.

In 1986, auto parts accounted for $22.1 billion in two-way trade between the United States and Canada and favored the United States by $3.3 billion (table 6-2). However, the large trade deficit that the United States has with Canada in complete vehicles is greater than the U.S. surplus in parts. The overall Canadian trade surplus registered a balance of $1.1 billion in the first quarter of 1987. 1/

Table 6-2
Automotive parts: U.S.-Canadian trade in auto parts, 1984-86, January-March 1986, and January-March 1987
(In millions of dollars)

Item	1984	1985	1986	January-March 1986	January-March 1987
U.S. imports from Canada....	8,728	9,347	9,411	2,407	2,624
U.S. exports to Canada 1/...	11,924	13,100	13,083	3,277	3,282
Trade balance...............	3,196	3,753	3,672	870	658

1/ Derived by using official Canadian Government statistics.

Source: Compiled from official statistics of the U.S. Department of Commerce and the Canadian Government.

A free trade agreement was reached in October 1987, between the United States and Canada that would eliminate all tariff and nontariff barriers between the two countries within 10 years, beginning January 1, 1989. The agreement permits APTA to be retained, eliminates replacement parts tariffs over 5 years, and addresses concerns of U.S. automakers by disallowing foreign auto companies from assembling cars in Canada using Canadian auto parts, then shipping duty-free to the United States. 2/ Additionally, the agreement establishes a bilateral panel to assess the state of the North American automotive industry and to propose public policy measures and private initiatives to improve the competitiveness of the industry in domestic and foreign markets. The trade agreement must be approved both by Congress and the Canadian Parliament. 3/

Voluntary export restraints

Japanese automobile exports are currently restricted in virtually every major industrialized country of the world. 4/ U.S. restrictions were imposed

1/ "Decision to Be Made Soon on U.S.-Canada Free-Trade Agreement and on Future of the Auto Pact," Automotive Parts International, July 3, 1987, pp. 2-3.
2/ See appendix K for elements of the U.S.-Canada Free Trade Agreement pertaining to automotive trade.
3/ USITC staff telephone interview with Office of the United States Trade Representative official, Aug. 13, 1987.
4/ In 1969, Italy was the first major automobile-producing country to restrict Japanese automobiles. The United Kingdom followed with restraints in 1975, France did in 1977, and West Germany in 1981.

in 1981 following an unsuccessful escape clause case. 1/ Following numerous meetings with U.S. Government officials, the Japanese Ministry of International Trade and Industry (MITI) announced on May 1, 1981 a VRA on Japanese auto exports to the United States. The MITI stated that Japan's car exports to the United States would be reduced by 7.7 percent for the Japanese fiscal year of April 1, 1981, through March 31, 1982, from those in the previous fiscal year. The VRA, in effect, reduced Japan's U.S. exports sales from the 1980 level of 1.82 million units to 1.68 million units. The MITI indicated a second year of restraint would be considered after observing 1981 U.S. market performance. At a later date, the Japanese announced that exports to the United States of vehicles such as four-wheel-drive station wagons and jeep-type vehicles would be limited to 82,500 units, and exports to Puerto Rico would not exceed 70,000 units. Thus, total Japanese exports of autos and the above types of vehicles to the United States and Puerto Rico for the Japanese fiscal year 1981 were set at 1,832,500 units. There were no changes in these restraint levels during the next two Japanese fiscal years (1982-83).

In November 1983, the Japanese Government announced that it would increase its voluntary export limit from 1.68 million to 1.85 million automobiles during its fiscal year 1984. In addition, it also announced that the four-wheel-drive and jeep-type vehicle limit would be increased to 90,848 units and exports to Puerto Rico would rise to 77,083 units. Thus, the total number of Japanese automobiles (excluding automobile trucks but including jeep-type vehicles and exports to Puerto Rico) exported to the United States and Puerto Rico increased to 2,017,931 units, or by 10 percent.

On March 1, 1985, the President announced that the United States would not ask the Japanese Government to renew the VRA for 1985. On March 28, 1985, the Japanese Government told the administration that it would limit annual (fiscal year) auto exports to the United States to 2.3 million units. This represents an increase of about 25 percent over the previous year's quota of 1.85 million. The restraints were extended at the same level of 2.3 million units in April 1986 and 1987. 2/

In October 1987, the MITI indicated that Japanese vehicle manufacturers may reduce car shipments to the United States by 10 percent in 1988. During 1981-86, the quantity of Japanese exports of autos to the United States closely followed the voluntary export limits. Japanese industry sources state that most Japanese automakers will not meet their 1987 quotas, and that a reduction in exports may only be a political gesture to the United States. 3/

1/ In June 1980, the United Auto Workers Union filed a petition for relief from imports under sec. 201 of the Trade Act of 1974 with the U.S. International Trade Commission (USITC). The Ford Motor Co. subsequently became a co-petitioner. On Nov. 10, 1980, the USITC determined that imports of passenger automobiles were not being imported into the United States in such increased quantities as to be a substantial cause of serious injury, or threat of serious injury, to the domestic industry (see Certain Motor Vehicles and Certain Chassis and Bodies Therefor, USITC Publication 1110).
2/ "Automobile Industry: Who Will Survive?" Tokyo Business Today, April 1987, p. 45.
3/ Geoff Sundstrom, "Japan Considers 10% Cut in '88 Auto Exports to U.S.", Automotive News, Oct. 12, 1987, p. 2.

Generalized System of Preferences

The GSP program was initiated on January 1, 1976 (authorized under the Trade Act of 1974), for a 10-year period. The authorization was renewed through July 4, 1993, by the Trade and Tariff Act of 1984. Currently, there are over 3,000 categories of articles eligible for GSP. 1/ Approximately 115 of these categories are applicable to motor vehicles and parts.

The GSP provides preferential duty-free entry to certain products from designated developing countries. As of June 1, 1987, 141 countries were eligible for GSP treatment. 2/ The imported article must be shipped directly from the beneficiary country to the United States without passing through the territory of any other country. 3/ However, under the statutory competitive need provisions, a country loses GSP duty-free treatment for a product if its shipments of the product in the preceding calendar year equaled or exceeded 50 percent of the value of total U.S. imports of the product exceeded a certain dollar value ($71.4 million in 1986).

Imports of automotive parts under GSP provisions rose steadily from $457 million in 1982 to $516 million in 1986, representing an increase of 13 percent (see app. H). Imports increased by 19 percent during January-September 1987 to $454 million, from $381 million during the corresponding period of 1986.

Mexico ranked first in 1986 imports of auto parts under GSP, with $118 million, representing 23 percent of total GSP imports, nearly doubling the 1982 level of $60 million. Tempered and laminated glass were the principal auto parts, imports of which doubled to $48 million in 1986 from the 1982 level. Parts of engines and air conditioning parts were also major import items.

Brazil was the second largest source of duty-free automotive parts imported under the GSP, accounting for 19 percent of GSP imports in 1986, or $98 million. This represents a decrease of 49 percent compared with the 1982 level of $191 million. Parts of piston-type internal combustion engines were the primary auto parts product, imports of which amounted to $58 million in 1986, representing an increase of nearly 50 percent compared with the 1982 level of $39 million. Other major import items include articles for make and break circuits, and electrical parts.

Taiwan ranked third in GSP imports in 1986, with $95 million, representing a 6-percent decline over the level of imports in 1982. Tires were the primary auto parts product, imports of which amounted to $16 million in 1986, representing more than an eightfold increase compared with the 1982 level of $2 million. Electrical lighting equipment and parts of piston-type internal combustion engines were also sizable in terms of imports.

1/ U.S. International Trade Commission, A Guide to the U.S. Generalized System of Preferences (GSP), July 1986, p. i.
2/ U.S. International Trade Commission, Tariff Schedules of the United States annotated 1987, Supp. I, USITC Publication 1910, June 10, 1987.
3/ USITC staff telephone interview with Office of the United States Trade Representative official, Aug. 13, 1987.

Korea accounted for 14 percent of total U.S. imports of automotive parts under GSP provisions in 1986, or $73 million, up 185 percent over the level of $26 million in 1982. Principal auto parts include radiators, which rose sevenfold from the 1982 level to $6 million in 1986, and electrical equipment and parts, including motors and lighting equipment.

Tariff Provisions 806.30 and 807.00

Tariff items 806.30 and 807.00 are included in schedule 8 of the Tariff Schedules of the United States Annotated. Under provision 806.30, articles of metal (except precious metal) that have been manufactured, or subjected to a process of manufacture, and then returned to the United States for further processing are subject to duty only on the value of the foreign processing. Under item 807.00, imported articles assembled in foreign countries with fabricated components that were manufactured in the United States are subject to duty upon the full value of the imported product less the value of the U.S.-fabricated components contained therein. No further processing in the United States is required for articles imported under tariff item 807.00. However, imports cannot be accorded partial exemption from duty under more than one of these tariff items. 1/

Automotive importers make extensive use of 807.00 provisions. In 1985, the largest single product imported under item 807.00 was motor vehicles imported primarily from Japan, West Germany, Sweden, and Korea. However, unlike most 807.00 imports, which are labor intensive and manufactured in less developed countries, motor-vehicle production is capital intensive and generally takes place in developed countries. Therefore the actual portion of the imported automotive product that is duty free tends to be quite small. 2/ Motor-vehicle imports under tariff item 807.00 contained an average duty-free portion of less than 5 percent during 1982-86.

U.S. imports of automotive parts entering under 807.00 provisions rose gradually from $762 million in 1982 to $3.2 billion in 1986, representing an increase of 326 percent (see app. I). Imports during January-September 1987 totaled $5.4 billion up from $2.3 billion during the corresponding period of 1986, representing an increase of 132 percent.

Mexico accounted for 60 percent of U.S. auto parts imports in 1986, or $1.9 billion. Piston-type engines accounted for almost one-third of imports, totaling $578 million. Ignition wiring sets and radios make up most of the remaining imports. West Germany accounted for 10 percent of U.S. imports of auto parts under the 807.00 provision, with imports amounting to $310 million in 1986.

1/ U.S. International Trade Commission, Imports Under Item 806.30 and 807.00 of the Tariff Schedules of the United States, 1982-85, USITC Publication 1920, December 1986, p. 1-1.
2/ Ibid.

Foreign-trade zones

FTZ's were authorized by the Foreign-Trade Zones Act of 1934 (19 U.S.C. 81a et seq.). 1/ The act authorized a Foreign Trade Zone Board to grant to private and public corporations the privilege of establishing and operating FTZ's. Although the act did not define the term, an FTZ was envisaged to be a segregated area located in or near a customs port of entry that would be secured through Customs supervision. An FTZ was to be considered outside the customs territory for purposes of the tariff laws, but still subject to other laws applicable to public interest, health, and safety. Since the area within the FTZ was "foreign," goods entering the FTZ were not subject to formal customs entry requirements. It was expected that FTZ's would be used primarily for warehousing and transshipment, or for minor processing and subsequent exportation, thus encouraging transport activity and reducing administrative burdens connected with the use of bonded warehouses and the processing of drawback claims. 2/ Manufacturing and exhibition in FTZ's were prohibited by the 1934 act. In 1950, the act was amended (Boggs Amendment) to permit manufacturing and exhibition in FTZ's. The amendment was designed to eliminate administrative difficulties in deciding whether or not proposed FTZ operations constituted "manipulation" or "manufacturing"--the former operation being permitted since 1934.

A further change occurred in 1952 when the Board amended its regulations to authorize "zones for specialized purposes" (special-purpose subzones) in addition to "general-purpose zones" created by the original act. The essential distinction between the two types of zones is that the individual subzones, in practice, are used by only one firm, whereas there is no limitation on the number of firms that can operate in a general-purpose zone. Subzones were established to assist companies that were unable to relocate to or take advantage of an existing general-purpose zone. In 1980, custom's valuation practice was changed so that all costs incurred within an FTZ are excluded upon entry from the appraised value of FTZ merchandise.

Foreign-trade subzones have become increasingly important in the U.S. auto industry since Volkswagen started production at the first auto assembly subzone in 1979. Now there are more than 20 subzones in the United States where automobiles or automobile parts are assembled. This trend reflects the increase in international purchasing of automotive parts, the opening of foreign-owned auto assembly plants in the United States, and the advantages afforded by FTZ's to assembly operations using imported parts.

U.S. imports of automotive parts through FTZ's rose tenfold, from $225 million in 1982 to $2.6 billion in 1986 (see app. J). Such imports increased by 64 percent, from $1.8 billion during January-September 1986 to $3.0 billion during January-September 1987.

1/ Much of the following background information on FTZ's is taken from The Implications of Foreign Trade Zones for U.S. Industries and for Competitive Conditions Between U.S. and Foreign Firms, USITC Publication 1496, February 1984.
2/ Statement of Emmanuel Celler, hearings on H.R. 3657, Mar. 6 and 7, 1984, pp. 4-16.

Japan accounted for 70 percent of total imports of auto parts through FTZ's in 1986, or $1.8 billion, up from $41 million in 1982. Piston-type engines and parts, transmissions, and articles for making-and-breaking circuits composed the bulk of these imports.

Mexico was the second largest source of auto parts in 1986 with 13 percent of the import share, accounting for $343 million in 1986, up from $28 million in 1982. Piston-type engines and radios are the principal auto parts products imported.

Brazil ranked third as a supplier of imports in 1986, with 7 percent of the import share, totaling $181 million. Radios and piston-type engines are the major products imported.

Because FTZ's are not considered to be within the U.S. customs territory, shipments into an FTZ from foreign sources are not considered imports, and shipments from the United States to an FTZ are considered exports from the United States. It is at the time goods are shipped from an FTZ into the customs territory that they are considered imported into the United States and are subject to the tariff laws.

There are special rules governing tariff treatment according to the U.S. or foreign origin of the goods or their components and whether or not "privileged" status for the articles has been claimed and granted. In its regulations, customs regulations refer to the four status categories as--

(1) domestic status merchandise,
(2) privileged foreign status merchandise,
(3) nonprivileged foreign status merchandise,
(4) zone-restricted status merchandise.

Products entering the U.S. customs territory after assembly in an FTZ or subzone can be assessed duty rates in several different ways in order to obtain the most favorable duty treatment on all parts and components incorporated into the finished product. When the tariff rate on a component used in assembly is lower than the rate of the finished product into which it has been incorporated, it is to the advantage of the importer to request privileged foreign status for the component. For example, a company assembling automobiles in an FTZ would be required to pay a duty rate of 2.5 percent ad valorem upon an auto's entry into the U.S. customs territory, but, if granted privileged status, the company could declare the value of items such as certain cast-iron parts at their duty-free entry rate. Having claimed privileged status confers the lower tariff rate of duty upon the component value of the product, even when it has been altered in production or assembly.

Another way companies can pay duty on shipments from FTZ's into the United States is by entering parts and components as nonprivileged foreign status merchandise. This is more clearly the favorable option when component tariff rates are higher than that of the finished product. Such is the case with many foreign automobile parts and components, such as engines, tires, and cassette players. In this case, the duty paid on the value of such parts is not their normal, higher rate but rather the lower automobile rate of 2.5

percent ad valorem. This inverted tariff structure exists for other products as well, especially for electronic goods.

During July 1987, the Commission staff interviewed Ford Motor Co. officials at Ford's FTZ subzone assembly plant in Lorain, OH. In fiscal year 1986, Ford's Lorain plant shipped the highest value of (nonprivileged) foreign parts of any FTZ subzone in the United States. Three models are assembled at the plant--Thunderbirds, Cougars, and Econoline trucks. No nonprivileged foreign parts (with the exception of some audio equipment) are used in the assembly of Cougars, Econoline trucks, and certain Thunderbirds, although these models are assembled in the subzone. 1/

The following nonprivileged foreign parts are used in the assembly of the Thunderbird Turbo model: 2/

1) A 4-cylinder turbo engine is made by a Ford subsidiary in Brazil. The engine block is produced in Brazil and the engine is assembled there and entered under TSUS item 807.00. About one-half the Customs value of these engines consists of the value of U.S.-made parts.

2) Automatic transmissions used with turbo engines are made by a Ford subsidiary in France.

3) A 16-inch aluminum wheel is made by Reynolds aluminum in Italy. A Ford representative said that no 16-inch aluminum wheels are made in the United States.

4) An antilock brake system is made by Alfred Teves in West Germany.

In addition, Ford officials explained that audio equipment assembled in a Ford FTZ subzone in Lansdale, PA, partly from parts made in Brazil, is installed in some of the vehicles assembled at the Lorain plant. This audio equipment is transferred from the Lansdale subzone to Lorain without entering the U.S. customs territory.

Norfolk and Baltimore are the main ports of entry for the nonprivileged foreign parts used at the Lorain plant. The parts arrive as containerized cargo. The containers are shipped to the subzone by rail and/or truck.

Among foreign parts used at Lorain, but entered as privileged domestic merchandise, are plastic engine fans from Japan and coil springs from Germany. A Ford representative said that such items were not worth entering as foreign parts because the duty rate differential was too low, or because the value of the parts and consequent duty were too low. The costs of monitoring such items required by FTZ regulations were greater than the potential savings from entering these items as privileged or nonprivileged foreign merchandise. A Ford representative said that Ford would still use the same foreign-made parts without FTZ benefits.

1/ USITC staff interview with Ford officials, Lorain, OH, July 1987.
2/ Ibid.

In August 1987, Chrysler Corp. requested that the U.S. Department of Commerce impose domestic content requirements on all users of foreign-trade subzones, limiting the definition of domestic content to the actual value of domestically produced parts and components. 1/ The definition would apply to shipments of automobiles leaving FTZ's. Every auto assembly plant in the United States is either currently in a subzone, or has an application pending. Chrysler indicated that domestic manufacturers are placed at a competitive disadvantage relative to foreign auto transplant companies that enjoy FTZ benefits of up to $40 per vehicle produced in the subzone, compared with Chrysler whose benefits from its FTZ operations are worth approximately $5 per vehicle. Chrysler's request was filed as part of the public record on the application of Toyota Motor Manufacturing, U.S.A., for a foreign-trade subzone in Georgetown, KY, where Toyota is building an automobile assembly plant.

Market-oriented, sector-specific talks

On January 2, 1985, President Reagan and Prime Minister Nakasone agreed to begin a series of negotiations to uncover and eliminate all barriers to U.S. exports to the Japanese market. Initially, the talks, called market-oriented, sector-specific, or MOSS talks, focused on telecommunications, forest products, medical equipment, and pharmaceuticals. 2/ In response, however, to the large and growing trade deficit between the United States and Japan in auto parts, a new set of negotiations was initiated in May 1986. The goal of these talks was to increase U.S. auto parts sales to Japanese carmakers while fostering long-term design, engineering and supply relationships between U.S. suppliers and Japanese original-equipment manufacturers.

U.S. parts manufacturers have reported increased receptivity to their marketing efforts with Japanese firms in both the United States and Japan as a result of the MOSS talks. These talks concluded during August 1987; The major results of these negotiations included: 3/

(1) a voluntary Japanese data collection system to track both short-term sales and provide leading indicators of the development of long-term business relationships (in Japan and in the United States) between U.S. parts firms and Japanese automakers;

(2) an official notification issued in July 1987 by the Japanese Ministry of Transport to end discriminatory treatment of foreign-produced parts during Japan's required periodic vehicle inspection;

(3) a list of purchasing representatives in Japanese auto firms for the use of U.S. parts suppliers;

1/ Geoff Sundstrom, "Chrysler Seeks Content Requirement for Subzone Vehicles," Automotive News, Sept. 7, 1987, p. 3.
2/ "Nakasone Pledges Further Market Access Efforts In Meeting With Reagan," Japan Economic Institute Report, Jan. 11, 1985, p. 1.
3/ Unpublished documents supplied by the U.S. Department of Commerce.

(4) the exchange of case studies of actual commercial transactions between U.S. and Japanese firms, which identified both generic problems and factors for success. In several cases, misunderstandings were resolved; and

(5) Japanese Government and private industry backing for trade promotion actions and events including the Indianapolis seminar (May 1987), the opening of an auto parts industry office in Japan (June 1987), and the Tokyo Motor Show (October 1987).

Trademark Counterfeiting Act of 1984

U.S. parts makers may seek redress regarding packaging and marking counterfeiting through the Trademark Counterfeiting Act of 1984. The law provides for Federal criminal penalties against persons who intentionally deal in goods and services that they know to be counterfeit. Individuals convicted under the law can be imprisoned for up to 5 years or fined up to $250,000; corporations found guilty can be fined up to $1 million. For second convictions, fines and/or prison terms are even more severe. 1/

However, industry sources declare that there are still a large number of firms producing, distributing, and retailing counterfeit products. According to a spokesman for Automotive Parts International, counterfeit components are often of inferior quality and have cost U.S. firms annual sales losses estimated at over $3 billion. The direct loss of U.S. jobs is projected to be 120,000 workers. 2/

Although a large number of products are counterfeited, the most common include oil, air, and gas filters; sparks plugs; radiator and gas caps; engine belts; brake cylinders and linings; body stampings; cooling fans; tapered roller bearings; suspension and steering parts; and ignition parts. Taiwan is most often cited as a source of counterfeits; other countries also commonly named are India, Singapore, Hong Kong, Korea, and Thailand. Taiwan industry sources indicate that production of counterfeits began in the 1970's when the country's rapid economic growth surpassed an outdated legal system wherein trademarks were of little importance. 3/ However, the Taiwan Government has recently enacted legal reforms directed at closing loopholes that have permitted counterfeiters to thrive. 4/ Counterfeit parts may be packaged in boxes that closely resemble those of the legitimate product and are often mistaken as the genuine article. Most counterfeits allegedly are purchased by independent U.S. middlemen, rather than by domestic representatives of the foreign exporter. Obvious violations of U.S. law occur when foreign parts are being falsely marked with the logo of well-known manufacturers. 5/

1/ Trademark Counterfeiting Act of 1984, P.L. 98-473, 98 Stat. 1837, Title 2, 1501 et seq., Oct. 12, 1984.
2/ "Counterfeit Parts: A $3 Billion a Year Industry," Automotive Parts International, Dec. 30, 1986, p. 7.
3/ USITC staff interview with the Taiwan Transportation Vehicle Manufacturers Association, Taipei, Taiwan, Apr. 27, 1987.
4/ USITC staff interview with Taiwan authorities, Taipei, Taiwan, Apr. 27, 1987.
5/ "Counterfeit Parts: A $3 Billion a Year Industry," Automotive Parts International, Dec. 30, 1986, pp. 6, 7.

Export promotion and financing

Like other major industrial nations, the United States offers a variety of export promotion programs to assist domestic business in selling their products abroad. The U.S. Department of Commerce (Commerce), International Trade Administration (ITA), organizes overseas commercial exhibitions of domestic products and conducts trade missions, catalogue shows, and sales seminars. Recently the Office of Automotive Industry Affairs of Commerce, sponsored Autovak (Amsterdam, March 1987), Automotive Parts and Accessories (Seoul, April 1987), Automechanica (Mexico, June 1987), and Automotive Products & Services (Sydney, July 1987). 1/ This agency also collects and publishes information on new business opportunities abroad and assists U.S. firms in competing for major foreign projects. Worldwide, Foreign Commercial Service (FCS) personnel in U.S. Embassies work with the ITA in pursuing export opportunities for U.S. firms. 2/ The FCS will frequently identify products that will sell in the international marketplace and then encourage and assist manufacturers in their efforts to seek overseas customers.

The Foreign Sales Corp. (FSC) program is an example of a U.S. tax deferral system that benefits domestic exports. 3/ The FSC program (which replaced a similar program called the Domestic International Sales Corp. (DISC) on Jan. 1, 1985) allows firms to establish special subsidiaries that can exempt a portion of their export income from Federal income tax. The purpose of this program, according to U.S. Government officials, is to increase exports. Although the U.S. automobile parts industry is not a primary user of this arrangement, it, like all U.S. exporters, is eligible for benefits.

The Eximbank of the United States provides direct loans, loan guarantees, and loan insurance to public or private foreign banks to finance U.S. exports. Table 6-3 illustrates Eximbank support for automobiles, trucks, buses, and parts during fiscal years 1982-86 and October 1, 1986-March 31, 1987. The total support given the automotive products area has declined significantly during the 5-year period. Whereas approximately $42.8 million in loans, $91.4 million in guarantees, and $565.9 million in insurance was extended for the motor-vehicle and parts industry in 1982-86, total annual support fell by over 83 percent during the period. Eximbank assistance amounted to only $4.5 million during October 1, 1986-March 31, 1987. In fiscal year 1982 automotive parts' support constituted 57 percent of Eximbank support for the motor-vehicle industry, compared with 38 percent in fiscal year 1986. Egypt, Colombia, and Israel were some of the countries that received assistance during 1986. 4/

1/ USITC staff interview with officials of the U.S. Department of Commerce, Office of Automotive Industry Affairs, Washington, DC, July 16, 1987.
2/ The FCS Program was enacted as part of the Tax Reform Act of 1984.
3/ U.S. Department of Commerce, International Trade Administration, Serving American Business, April 1983, p. 2. These export promotion activities are available not only for the U.S. automotive parts industry, but also to any domestic firm interested in exporting its products or services.
4/ USITC staff interview with officials of the U.S. Eximbank, Washington, DC, July 1987.

Table 6-3
Eximbank authorized support for U.S. exports of automobiles, trucks, buses, and parts, fiscal years 1982-86, and Oct. 1, 1986-Mar. 31, 1987

Program	1982	1983	1984	1985	1986	Oct. 1, 1986-Mar. 31, 1987	Average annual change, 1982-86
	1,000 dollars						Percent
Discount loans 1/	27,832	12,259	2/	2/	2/	2/	2/
Medium-term credits	2/	2/	1,772	60	873	2/	2/
Financial guarantees	30,361	24,804	20,688	1,393	14,173	2/	-17.3
Medium-term insurance	100,611	38,282	6,216	2,695	4,539	48	-53.9
Short-term insurance	165,515	92,200	67,800	53,010	34,900	4,450	-32.2
Total 3/	324,319	167,545	96,476	57,158	54,485	4,498	-36.0

1/ In 1982, the discount loan program was replaced by the medium-term credit program.
2/ Not available.
3/ May be overstated because of the funding of certain exports under several programs.

Note.--These data are the authorized amount of export financing. The actual export value of the automotive products supported will generally be higher.

Source: Export-Import Bank of the United States.

Nontrade Related Policies

The U.S. automotive parts industry benefits from and is regulated by a variety of nontrade related policies of U.S. and State governments. These actions are sponsored by a number of agencies including the U.S. Department of Defense, the U.S. Department of Commerce, the U.S. Department of Labor, the U.S. Department of Transportation, the U.S. Department of Energy, and the Export-Import Bank (Eximbank). Assistance is provided in the areas of research and development and tax benefits. Government regulation of safety, emissions, and fuel economy also effects the automotive industry.

Research and development

The U.S. Department of Defense has extensive research and development (R&D) programs oriented to manufacturing technology. The Manufacturing Technology (ManTech) Program is a broad-based, production-oriented program, the goal of which is to improve production methods to lower procurement costs. The ManTech Program will not buy capital equipment, but will provide "seed money" for projects for which feasibility has been demonstrated. ManTech results are frequently distributed to industry through the Manufacturing Technology Journal, the National Technical Information Service, the Defense Technical Information Center, and end-of-contract briefings. 1/

1/ "Potential Fund Shift Stirs Some Concern About ManTech," American Metal Market, Mar. 21, 1983, p. 3A.

Although the ManTech projects tend generally to concentrate on the particular needs of individual weapons systems, some work is done in areas that apply to motor vehicles and all manufacturing. These include advanced auto engines, composite parts, and new fabrication techniques. However, U.S. Department of Defense sources note that there was little direct benefit to individual automotive projects from the ManTech Program during 1982-86. 1/

Production and financial assistance

The U.S. Government does not provide direct production subsidies or grants to manufacturers of automotive parts. However, tax benefits, available to all U.S. industry do provide some measure of assistance in R&D and capital investment.

The Economic Recovery Act of 1981 (ERTA) amended the U.S. tax code in 1981 to provide businesses with a tax credit of 25 percent of the actual increase in R&D expenditures over a 3-year base period. Other provisions of the ERTA in the area of R&D include a corporate charitable deduction for used R&D equipment 2/ and revised rules pertaining to deductions allocated against U.S. source income. 3/

The ERTA also provided other tax incentives to spur new investment in production facilities, such as the safe-harbor leasing rules, which allowed firms in a financially precarious situation to sell their unused tax credits. However, since the ERTA's enactment in 1981, the U.S. Congress has put new limits on the investment tax credit, repealed increases in ACRS benefits scheduled for 1985 and 1986, abolished safe-harbor leasing as of January 1, 1984, 4/ and eliminated the investment tax credit altogether in 1986.

State governments have also recently become involved in promoting industries, including automotive parts. Several states use incentives such as exemptions from State and local taxes for specified periods, tax-exempt revenue bonds, site acquisition and improvement assistance, worker training programs, and low- interest loans and grants, to encourage domestic and foreign producers to locate production facilities in their jurisdictions (see pp. 5-10 to 5-13).

Other policies and assistance

Trade adjustment assistance for employees and firms is authorized by title II, chapter 3 of the Trade Act of 1974. The Trade Adjustment Assistance (TAA) Program assists employees in situations where increased imports of foreign-made products have contributed importantly to their loss of jobs. To ensure that the benefits go to such workers, the law requires the U.S.

1/ Data provided by Dr. Lloyd Lehn, U.S. Department of Defense, July 23, 1987.
2/ 26 U.S.C.A. 170 (e) (West 1978 and Supp. 1983).
3/ 26 U.S.C.A. 861 (Supp. 1983).
4/ Richard I. Kirkland, Jr., "Taxing the Business Lobby's Loyalty," Fortune, Oct. 18, 1982, p. 144.

Department of Labor to determine whether or not imports contributed importantly to job reductions in a particular company or subdivision of a company. Labor makes this determination in response to petitions from workers that have been laid off or threatened with layoffs. If the Department of Labor decides that imports were an important factor, it certifies the affected workers in that firm as having group eligibility for adjustment assistance.

The TAA provides cash benefits called "trade readjustment allowances" (TRA), training, job search and relocation allowances, and other services of employment. 1/ The automobile and automotive parts industry have been significant users of the TAA Program. Table 6-4 indicates major parts sectors that have filed for assistance. During 1982-June 1987, there were 1,561 investigations conducted by the Department of Labor in response to petitions by workers in the automotive industry for trade adjustment assistance. Of these cases, 355 were certified (affecting 380,124 workers), 22 were partially certified (affecting 9,328 workers), 1,101 were denied (affecting 187,236 workers), 81 were terminated by the petitioners (affecting 3,788 workers), and 2 petitions were withdrawn (affecting 2,913 workers). 2/

The TAA Program also authorizes financial assistance for certified firms in the form of direct and guaranteed loans. This program is administered by the Department of Commerce. In addition to the financial assistance, this program provides technical assistance to firms, including (1) guidance and preparation of certification petitions; (2) general diagnosis of a firm's problems and its opportunities for recovery; (3) examination of specific problems recognized by a firm's management; and (4) indepth assistance to firms in carrying out their adjustment proposals. This program provides technical assistance to a variety of trade-impacted industries to help them deal on an industrywide basis with problems and opportunities concerning marketing, management, export promotion, production operation, and technological innovations. Table 6-5 shows the trade adjustment assistance cases submitted to Commerce during the period. Of the 22 petitions, Commerce certified 16 firms for assistance; the remaining 6 firms withdrew their requests.

Regulations and standards

The U.S. Government is actively involved in regulatory policy affecting the motor-vehicle industry. The three primary categories of regulation cover emissions, fuel economy, and safety. The Environmental Protection Agency (EPA) and the U.S. Department of Energy administer emission and fuel economy standards (which have been set by Congress), and the National Highway Traffic Safety Administration (NHTSA) of the U.S. Department of Transportation has responsibility for motor-vehicle safety.

The Motor Vehicle Pollution Control Act of 1965 gave the EPA authority to regulate automotive emissions beginning with model year 1968. Originally, only carbon monoxide and hydrocarbons were controlled. However, in 1973

1/ USITC staff interview with officials of the U.S. Department of Labor, Trade Adjustment Assistance Program, Washington, DC, 1987.
2/ Ibid.

Table 6-4
Trade adjustment assistance for automotive parts workers, by SIC codes, 1982-86

SIC codes	Products 1/	Number of petitions	Certifications		Partial certifications		Denials		Terminations		Withdrawals	
			Number	Workers	Number	Workers	Number	Workers	Number	Workers	Number	Workers
3011	Tires and inner tubes	141	54	27,427	8	5,922	79	19,198	–	–	–	–
3069	Fabricated rubber products, not elsewhere classified.	89	25	3,040	–	–	59	3,716	4	125	1	12
3465	Automotive stampings	224	24	10,658	4	891	186	16,493	10	355	–	–
3592	Carburetors, pistons, rings, and valves.	52	10	1,606	–	–	40	4,174	2	11	–	–
3647	Vehicular lighting equipment.	112	21	10,788	2	618	83	6,828	6	1,146	–	–
3691	Storage batteries	20	3	269	–	–	17	1,720	–	–	–	–
3694	Electrical equipment for internal-combustion engines.	92	35	7,960	–	–	57	9,512	–		–	–
3714	Motor-vehicle parts and accessories.	831	183	318,376	8	1,897	580	125,595	59	2,151	1	2,901
Total		1,561	355	380,124	22	9,328	1,101	187,236	81	3,788	2	2,913

1/ These groupings may include some nonautomotive products.

Note: Data may underestimate number of workers.

Source: U.S. Department of Labor, Trade Adjustment Assistance Program.

Table 6-5
Trade adjustment assistance for motor vehicle and automotive parts manufacturers, 1982-86, and January-June 1987

Year	Number of cases	Disposition Certified	Disposition Withdrawn	Products	Locations of firms
1982......	4	4	0	Trailers, truck bodies, ignition parts, stampings, springs, and wheel covers.	Michigan, Iowa, New York, and New Jersey.
1983......	5	2	3	Stampings, springs, carburetors, plastic parts, and seat covers.	New Jersey, Iowa, California, and Illinois.
1984......	6	6	0	Seat and wheel covers, trucks, carburetors, and miscellaneous parts.	Massachusetts, Illinois, New York, Pennsylvania, and Wisconsin.
1985......	3	3	0	Truck bodies, tires, and miscellaneous parts.	Ohio, Virginia, and North Dakota.
1986......	2	0	2	Electrical switches and engine parts.	Indiana and Ohio.
Jan.-June 1987 1/.	2	1	1	Seat covers and fasteners.	Michigan and California.
Total.	22	16	6		

1/ Estimated from U.S. Department of Commerce data.

Source: U.S. Department of Commerce, International Trade Administration, Office of Trade Adjustment Assistance.

restrictions on nitrogen oxide, as well as further reductions in carbon monoxide and hydrocarbons, were put into effect. These standards were last amended by the Clean Air Act of 1977. Most recently, public pressure has been put on Congress and the EPA to tighten tailpipe pollution and to control gasoline vapors at the filling station. 1/ A Senate bill under consideration in 1987 would mandate vehicle inspection/maintenance programs in all geographic areas that are unable to attain required levels of air quality. The EPA opposes this proposal, favoring larger onboard canisters and lowering the volatility of gasoline. 2/

Under the Energy Policy and Conservation Act, automotive manufacturers are subject to minimum average fuel economy standards. These regulations,

1/ "Environmental," 1987 Ward's Automotive Yearbook, Wards Communications, Inc., 1987, p. 22.
2/ "EPA Opposes Senate Proposal to Tighten Emissions Rules," Automotive News, Aug. 3, 1987, p. 16.

called Corporate Average Fuel Economy (CAFE) standards, calculate fuel economy averages for domestic and imported automobiles. 1/ Table 6-6 lists CAFE requirements for passenger automobiles and light trucks. The fuel-economy requirement will remain at 26.0 miles per gallon for model year 1987 and increases to 21.5 miles per gallon for light trucks.

Table 6-6
Automobiles and light trucks: CAFE standards, model years 1978-1986

(In miles per gallon)

Model Year	Automobiles: Average of domestic standards	Automobiles: Average of import standards	Automobiles: Industry standard	Light trucks: Average of domestic standards	Light trucks: Average of import standards	Light trucks: Industry standard
1978...	18.7	27.3	18.0	1/	1/	1/
1979...	19.3	26.1	19.0	17.7	20.8	17.2
1980...	22.6	29.6	20.0	16.8	24.3	2/
1981...	24.2	31.5	22.0	18.3	27.4	2/
1982...	25.0	31.1	24.0	20.5	27.0	17.5
1983...	24.0	31.9	26.0	20.7	27.1	19.0
1984...	24.9	31.5	27.0	20.6	26.6	20.0
1985...	25.6	30.9	27.5	20.6	26.4	19.5
1986...	26.5	31.4	26.0	21.5	26.2	20.0

1/ There were no CAFE requirements for light trucks prior to model year 1979.
2/ Not available.

Source: National Highway Traffic Safety Administration.

The maximum fuel economy levels take into account technological feasibility, economic practicability, the effect of other motor-vehicle standards on fuel consumption, and the need of the nation to conserve energy. 2/ If a manufacturer does not meet the required standards, substantial penalties must be paid. The fine for noncompliance is based on a $5 per vehicle penalty for each tenth of a mile shortfall from the CAFE standard. 3/

The National Traffic and Motor Safety Act of 1966 authorizes NHTSA to issue safety standards for new motor vehicles and equipment. All automotive

1/ Under the law, a domestic manufacturer must have at least 75 percent North American content in order to be included in the domestic fleet, otherwise that particular automobile is considered an imported model. The intent of this provision was to keep U.S. manufacturers from importing small, fuel-efficient models in order to meet the CAFE standards, while continuing to produce only larger, fuel-efficient models in the United States and Canada.
2/ "Fuel Economy Act," Automotive News Market Data Book 1976, Craine Communications, Inc., 1976, p. 70.
3/ "CAFE Standards," 1985 Wards Automotive Yearbook, Wards Communications, Inc., 1985, p. 16.

products manufactured or imported for sale in the United States must comply with these requirements. Safety regulations pertain to tires, vehicle and manufacturer identification numbers, seat belts, bumpers, and theft prevention. Motor-vehicle manufacturers are also required to notify purchasers of any safety-related defects, and to make certain consumer information is available to the public. 1/

Industry's view of the role of the U.S. Government in structural change

U.S. industry sources claim that it has been a difficult endeavor to get the U.S. Government to recognize the competitive impediments they face. Industry trade associations believe the U.S. Government should have a better understanding of the restructuring of the U.S. industry; for example, they cite the U.S. Government's role in the MOSS talks as a helpful and necessary intervention. In addition, several U.S. producers responding to the Commission's questionnaire reported that the U.S. Government's intervention in aiding Chrysler Corp. in the late 1970's permitted many U.S. suppliers to survive the 1980's.

The Automotive Parts and Accessories Association (APAA) believes that the U.S. Government should ask the Japanese Government to reinstate the principles of the 1980 nonquota Orderly Marketing Agreement (OMA) on auto parts trade. According to the APAA, the principles of the OMA stated that U.S. exports of parts to Japan were to increase from $105 million in 1980 to $300 million in 1981 and to follow with significant increases in purchases each year thereafter (U.S. exports of auto parts to Japan totaled $225 million in 1986). However, when the Japanese voluntary restraint agreement (VRA) (see p. 6-9) on auto exports was inaugurated on April 1, 1981, the APAA claims that Japan unilaterally reneged on its parts purchasing commitments. 2/

Industry trade associations also want the U.S. Government to address the U.S.-Canada Automotive Products Trade Agreement (APTA) (see p. 6-7) in the U.S.-Canada Free Trade Agreement negotiations. The APAA claims that duty-free access for shipments of original equipment parts allowed under the APTA has become a selling point to newer Japanese suppliers to Canada. 3/ The Automotive Service Industry Association also objects to Canadian use of a duty-remission program wherein an automotive manufacturer can receive a remittance of a portion of the duty paid on imports if it buys some components for Canadian assembly from domestic companies. 4/ Although foreign auto manufacturers have not yet made extensive use of the duty-remission program, the APAA believes that it could offer attractive incentives to foreign-owned

1/ U.S. Department of Transportation, National Highway Transportation Safety Administration, "Information for New Manufacturers of Motor Vehicles and Motor Vehicle Equipment," September 1985, and "Safety," 1987 Wards Automotive Yearbook, Wards Communications, Inc., 1987, p. 23.
2/ Transcript of the hearing, pp. 113-114, and interview with APAA officials, Washington, DC, July 28, 1987.
3/ Transcript of the hearing, p. 117.
4/ Posthearing brief, Automotive Service Industry Association, pps. 1-2.

firms that are considering locating in Canada. 1/ According to a professor at the University of Maryland, "if Canada does not eliminate the duty-remission program, a U.S. countervailing duty case on Canadian exports of Asian cars seems probable by the early 1990's." 2/

Respondents noted that in many other countries revenue is generated by either the sales tax or the value-added method. U.S. suppliers said that by using this method, exports to the United States are not taxed by their country of origin. Domestic parts makers claimed that because U.S. firms are taxed on income and foreign firms are taxed on value added, it creates cost inequalities that result in a competitive advantage for foreign suppliers.

Other respondents cited a wide range of U.S. Government policies that put U.S. parts makers at a competitive disadvantage. Environmental, safety, and product liability and workers' compensation concerns, as well as changes in U.S. tax laws that have eliminated the advantages of using U.S. surplus equipment as equity in joint ventures with foreign companies were all noted as obstacles to U.S. competitiveness.

During May 27-28, 1987, Senator Dan Quayle (R-IN), Senator Richard Lugar (R-IN), and the U.S. Department of Commerce (Commerce) sponsored a seminar for U.S. parts firms on how to sell parts to Japanese automakers. Several representatives of Japanese auto producers explained to U.S. parts makers what they expect from their suppliers in the Japanese procurement system. For example, U.S. suppliers were told that they must reach a level of near zero defects in their JIT deliveries. A Mitsubishi Motor Corp.'s purchasing official said that if a defective part were found in a sample inspection, the whole delivery would be shipped back to the supplier and a representative of the U.S. firm would be asked to go to Japan and discuss the source of the problem with Mitsubishi's quality control engineers. In addition, the official said that if a defect is attributable to a supplier, then expenses incurred in correcting the problem are to be borne by the supplier. 3/

In May 1987, Senator Quayle introduced legislation that would require the Secretary of Commerce to appoint and chair a special advisory committee on auto parts trade with Japan. The panel, which would be comprised of industry, labor, and Government leaders, would be charged with monitoring auto parts sales data, reporting to the Secretary on barriers to Japanese markets, counseling him during consultations on auto parts trade issues with the Japanese Government, and reporting to Congress annually on developments of Commerce's auto parts sales-promotion program. 4/

Representative John LaFalce (D-NY) introduced three auto parts-related bills in August 1987, and Senator Paul Simon (D-IL) and members of the congressional auto parts taskforce also are planning to introduce bills in the final months of 1987. One of LaFalce's bills (H.R. 3212) would require that

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1/ Transcript of the hearing, p. 123.
2/ Paul Wonnacott, U.S. and Canadian Auto Policies in a Changing World Environment, July 1987, p. 28.
3/ "U.S. Partsmakers Learn How to Sell Auto Parts to Japan at 2-Day Conference," Automotive Parts International, June 5, 1987, p. 6.
4/ "Legislation Introduced to Increase Sales of U.S.-Made Parts to Japanese Automakers," Automotive Parts International, June 5, 1987, p. 7.

vehicles assembled in foreign trade zones (see p. 6-13) which contain less than 80 percent U.S. content on a value-added basis be charged the duty normally assigned to auto parts, which is a higher rate then the duty charged for autos. Furthermore, autos produced in foreign trade zones by foreign automakers in the United States that exceed 20 percent foreign content would be counted against the quota of the home country of the foreign company. In addition, Representative LaFalce has introduced a bill (H.R. 3211) that would eliminate TSUS items 806.30 and 807.00 (see p. 6-12) and a bill (H.R. 3210) that would prevent Commerce from using U.S. taxpayer money to sponsor trade conferences promoting programs such as the Mexican maquiladora program. Finally, Senator Simon is considering a bill to require automakers to disclose the level of foreign content in all cars, and the congressional auto parts taskforce may further advocate legislation to eliminate any tariff breaks for foreign parts assembled in cars that are then sold domestically. 1/

Government policies viewed by the U.S. industry as obstacles to international competitiveness

There are a number of U.S. Government policies and regulations that the domestic industry perceives as hindering the U.S. automotive industry's international competitiveness. Foremost are general economic policies resulting in high interest and dollar exchange rates. Also included are more specific policies such as U.S. tax laws; environmental, health and safety regulations; and antitrust laws.

According to industry sources, the U.S. Department of Labor's Occupational Safety and Health Administration (OSHA) has numerous regulations that affect producers in the areas of worker safety and health, noise, metal fumes and dust, and other emissions. Also, the industry must comply with environmental regulations regarding air and water pollution imposed by the EPA. U.S. companies are also subject to numerous State regulations, which, according to industry officials, may exceed Federal standards. A majority of the U.S. automotive parts firms that responded to the Commission's questionnaire cited Government safety regulations as adversely affecting the competitive position of the U.S. industry. U.S. firms view such requirements as hindering their competitiveness, because many foreign manufacturers do not have to adhere to these types of regulations or bear their associated costs.

Also indicated as adversely affecting U.S. manufacturers are U.S. antitrust laws. The uncertainty caused by their interpretation and application can make collaborative ventures too complicated, time consuming, and expensive. However, proposals have recently been discussed to remove unwarranted regulatory obstacles to joint ventures between U.S. manufacturers in the R&D area.

1/ "Congressional Ire Over Outcome of MOSS Talks to Lead to New Bills," Inside U.S. Trade, Aug. 21, 1987, p. 8.

CHAPTER 7. MANUFACTURING TECHNIQUES AND TECHNOLOGY

The production of auto parts in the United States is increasingly dependent upon the development and implementation of new manufacturing techniques and technologies, as domestic producers seek to improve their products with respect to price, quality, design, availability, and serviceability. U.S. producers are utilizing state-of-the-art manufacturing processes using highly automated machinery and equipment developed in-house, modeled from other manufacturing industries, and developed by outside hardware and software vendors. New manufacturing processes and techniques are enabling the U.S. parts industry to improve its international competitive position, according to industry sources. 1/

Machinery used to produce auto parts are numerous and vary according to the type of part being produced and the raw material used. Metals account for the bulk of raw material used in auto parts production, followed by plastic, which is steadily growing in usage. Other materials used in automotive parts production are rubber (used in tires, engine electrical uses, and pedals) and nylon (used in tires, wiring, seat covers, and exterior uses). The following sections present a description of the production processes used to manufacture parts from these materials, industries developing new machinery, as well as innovative technology currently in use.

Metals

Steel, iron, and aluminum parts comprise, by weight, about three-fourths of the total components in a typical passenger vehicle (see p. 9-4). 2/ The production of metallic automotive components is dependent on both the machinery used in the production and forming of metals, and machine tools that stamp, cut, weld, and otherwise perform finishing operations.

Material forming

Virtually all automotive parts made of metal are formed originally by material forming operations such as casting, forging, and stamping. Except for small castings that are ready for use after forming operations, most automotive parts undergo further finishing processes.

Casting

Casting is a manufacturing process by which liquid metal is poured or injected into a mold cavity, allowed to cool and solidify, and then released

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1/ U.S. Department of Commerce, 1987 U.S. Industrial Outlook, pp. 36-10.
2/ Al Wrigley, "Substitute Materials Gain More Ground in '86 Models," 1986 Ward's Automotive Yearbook, ad. H.A. Stork (Detroit: Ward's Communications, Inc., 1986).

from the mold for finishing and use. 1/ Casting is a widely used method of manufacturing metal products because it affords the producer significantly larger operations, in terms of product size, constituent materials, surface texture, complexity of design, and shape than other metal- forming methods such as metal forging and stamping. Casting remains an important means of producing auto parts requiring precision and intricacy of design (e.g., rotors, suspension brackets, and engine blocks).

Sand casting, the simplest and the most widely used casting process, accounts for more than 90 percent of all metal poured. Nonsand casting methods include plaster-mold casting, investment casting, permanent-mold casting, and die casting. Each of these methods has its particular advantages and disadvantages with regard to dimensional accuracy, surface quality, complex configurations, size and weight limitations, tooling costs, and other criteria.

Forging

Parts that experience high levels of stress in end-use, such as axles, rods, and structural parts, are produced by forging. Machines controlled by a variety of methods and using either continuous pressure or intermittent hammering are used to forge these metal parts. Controls can be sophisticated and computer-guided or can be manually operated through levers and switches. There has been some development of cold-forging methods, but most auto parts continue to be forged at high temperatures to facilitate shaping. Generally the heated piece is inserted into a die or mold, and is worked until it conforms exactly to the desired specifications. This method, called impression die forging, accounts for the bulk of automotive parts produced through forging. 2/

Stamping

Most automotive stampings are created by placing metal blanks into performed dies and applying either mechanical or hydraulic pressure. A recent study indicated that, of all companies classified as belonging to SIC 364 (Metal Forgings and Stampings), over one-third owned hydraulic presses and over three-fourths owned mechanical presses. 3/ Unlike forging, which can alter the chemical properties of metal, stamping merely alters the shape of the raw material without affecting its structural capabilities. The stamping of an automotive part is usually accomplished in one motion, with the finished product being immediately ejected. In some operations, presses simultaneously punch or cut the metal blank during the shaping process. The advantage of producing auto parts with presses is that a wide variety of metals can be used, a large number of shapes can be produced, and there are no seams or joints to weld.

1/ Certain Metal Castings, USITC Publication 1849, June 1986.
2/ USITC staff telephone interview with officials of the Forging Industry Association, June 1987.
3/ American Machinist, 1983 Survey, McGraw-Hill, New York, NY.

Machine tools

The machine tool industry is strongly linked to production of metal automobile parts. Expenditures by the motor-vehicle and equipment industries for new machinery reached $7.5 billion in 1981, fell to $2 billion in 1983, and rose to an estimated $4 billion in 1986. 1/ Machine tools accounted for the bulk of these expenditures as manufacturers worked to modernize production and update technology and design to increase their competitiveness.

Machine tools used in automobile parts production fall into three main categories: (1) material removal (e.g., cutting, shaping, drilling, grinding); (2) assembly (e.g., welding, riveting, soldering, painting); and (3) inspection and testing.

Material removal

The largest category of machine tools in use is represented by material removal apparatus. 2/ Whereas, originally all such machinery was guided manually, during the 1960's and 1970's, engineers developed numerically controlled tools whose movements are guided by instruction from either a punched card or, more recently, by computer tape. In the production of parts and assemblies for automotive use, numerically controlled machines have become especially important for the manufacture and machining of engine components such as pistons, cylinders, and valves. The precise fit of such pieces is central to the function and proper operation of the engine over an extended period of time. Similiar levels of uniformity and precision are necessary for structural components, such as the chassis, axles, and suspension systems.

Assembly

Machine tools used to assemble body parts for motor vehicles are generally owned and operated by the major automakers. The welding and soldering of assemblies and components are directly related to the final shape of an automobile, bus, or truck and is thus likely to be controlled by the original-equipment manufacturer. Exceptions to this are the assembly of motors and transmissions, both of which require significant amounts of welding, jointing, and painting. Significant percentages of these products are outsourced in order to manage capacity and output levels of motor-vehicle manufacturers.

Heating, ventilating, and air-conditioning equipment, braking systems, radiators, alternators, and other under-the-hood components also require the use of assembly tools. Industrial power handtools such as welders and screwdrivers are especially important in the more labor-intensive operations.

1/ "Expenditures for New Machinery and Equipment by Major Machine Tool Consuming Industries, 1947 to Date," The Economic Handbook of the Machine Tool Industry 1986-87, 1987, National Machine Tool Builder's Association, McLean, VA, p. 18.
2/ "Machine Tools in Use," The Economic Handbook of the Machine Tool Industry, 1986-87, p. 266.

Inspection and testing

Before any automotive part can be used in motor-vehicle assembly, the manufacturer must be sufficiently convinced of its performance, durability, and overall quality. Since the early 1980's, automakers have been under increased pressure to demonstrate the efficiency and reliability of cars, trucks, and buses. This pressure is a direct result of competition from well-built, lower priced imports, which have caused U.S. companies to emphasize quality as well as cost in the market place. This emphasis on quality has in turn put tremendous pressure on automotive parts makers to guarantee that their products are durable, function well, or add to a vehicle's efficiency. Traditional mechanical and electromechanical testing machines have not proved to meet the new demands of parts consumers, and are largely being supplemented with and supplanted by computer-aided tools.

As a result, car makers and their parts suppliers have spent hundreds of millions of dollars in recent years purchasing computers and software that test more and more aspects of different parts and components. Although sophisticated diagnostic tools are principally geared toward measuring the quality of automotive electronics, they are also important in the testing of dimensional tolerances, stress loads, and performance characteristics of metal components.

Machine tool industry data

Key statistics of the U.S. metalworking machine tool industry declined significantly during 1982-86. U.S. producers' shipments decreased irregularly from $5.7 billion in 1982 to an estimated $4.4 billion in 1986, or by 22 percent (table 7-1). Overall, U.S. exports decreased during 1982-86 but appeared to begin a recovery in 1984. Apparent U.S. consumption followed a similar trend, decreasing from $6.1 billion in 1982 to $4.4 billion in 1983, before generally increasing thereafter to $6.1 billion in 1986. U.S imports of machine tools decreased from $1.5 billion in 1982 to $1.1 billion in 1983 before rebounding in 1984 and increasing thereafter to $2.5 billion in 1986. As a share of consumption, imports increased every year during the period from 24.3 percent in 1982 to 41.1 percent in 1986.

About 600 major firms produced machine tools in 1982. Although there are no official statistics indicating the number of firms operating in 1987, industry sources state that because of mergers and acquisitions, there has been a reduction in the number operating. Employment in the industry in 1982 was already low compared to historic levels, at about 85,000, and fell even further to about 69,000 in 1983. As the industry began to show small signs of improvement, employment rose to about 72,000 in 1986. The average hourly earnings for production workers in the machine tool industry rose from about $9.83 in 1982 to about $10.80 in 1986, or by 10 percent. 1/

Production and demand in this industry are cyclical in nature. This has caused labor problems, as training periods for skilled workers tend to take longer than the duration of an upswing in demand. Younger production employees, generally the first to be laid off in slack times, have migrated

1/ U.S. Department of Labor, Bureau of Labor Statistics, Employment and Earnings, 1982-86.

Table 7-1
Metal cutting and forming machine tools: U.S. producers' shipments, exports of domestic merchandise, imports for consumption, and apparent consumption, 1982-86

Year	Producers' shipments	Exports	Imports	Apparent consumption	Ratio of imports to consumption
	Million dollars				Percent
1982.........	5,689	1,026	1,500	6,163	24.3
1983.........	4,023	697	1,093	4,419	24.7
1984.........	4,521	744	1,663	5,440	30.6
1985.........	4,920	778	2,117	1/ 6,259	33.8
1986.........	1/ 4,426	830	2,510	6,106	1/ 41.1

1/ Estimated by the staff of the U.S. International Trade Commission.

Source: Compiled from official statistics of the U.S. Department of Commerce, except as noted.

away from this industry. As technological advances change the manufacturing process, fewer skilled operators performing traditional jobs will be needed in the future.

In March 1983, the National Machine Tool Builders' Association petitioned the Secretary of the U.S. Department of Commerce to impose quotas on imports of machine tools under section 232 of the Trade Expansion Act of 1962. The President instead sought Voluntary Restraint Agreements (VRA's) in May of 1986 with four supplying countries (Japan, West Germany, Taiwan, and Switzerland). The types of machines restricted under these agreements include machining centers, lathes, milling machines, and punching and sheering machines. 1/

Plastics

A small but growing element of the automotive industry is the use of plastics, now accounting for about 7 percent of the average passenger vehicle, by weight (see p. 9-10). 2/ Plastics have traditionally been used in the manufacture of parts, commonly in extruded plastic wire casings and in the passenger compartment where they replaced wood, textile, and metals in dashboards, seats, and steering wheels. The use of plastics in the engine has become more pervasive in recent years in tubes, hoses, tanks, and other parts, especially as requirements for efficiency and emission controls have become more stringent. These new developments have arisen as a result of the discovery of composite plastics, which are similar to alloy metals in their ability to perform functions not possible with simple materials. Plastic composites have been introduced in body panels, engine components, and

1/ U.S. Industrial Outlook, 1987.
2/ Al Wrigley, "Substitute Materials Gain More Ground in '86 Models," 1986 Ward's Automotive Yearbook, ad. H.A. Stork (Detroit: Ward's Communications, Inc., 1986).

structural assemblies in recent years, with some plastics industry officials predicting the use of the plastic structural components by 1990, and perhaps later an all plastic superstructure.

According to one industry source, motor-vehicle and equipment manufacturers currently account for about 230 of 14,800 U.S. plastics processing plants. 1/ The two firms with the largest output of all plastics manufacturing in the United States are General Motors, with 11 plants, and Ford Motor Co., with two plants.

Production processes

The principal manufacturing processes for plastics include injection molding, pressing or rolling, casting, and extrusion. Developments in injection molding have arisen with the new composites used as alternatives to steel and aluminum.

Injection molding

By far the largest consumption of plastics for production of motor-vehicle parts is for use with injection molding machinery. These machines take plastic material from a hopper, pass it through a heating mechanism until it becomes molten, and then force the liquid into a mold cavity with a plunger or ram. After the plastic has cooled (generally less than one-half a minute) the mold is opened and the formed part is removed. The automotive industry processed between 900 million and 1 billion pounds of plastic with injection-molding machinery in both 1985 and 1986. Parts produced in this manner are principally nonstructural, such as knobs, switches, caps, gaskets, housing, grilles, and a myriad of other small and medium-sized pieces and components.

The most recent development in auto parts production in the plastics industry has been in reaction injection molding (RIM). This process takes advantage of many of the procedures of injection molding but requires the use of two or more separate plastic substances that react when injected simultaneously into the mold. Hardening or curing is then achieved chemically, and products of this process are harder, more stable, and able to withstand higher stress and heat than other plastics. These composites are being rapidly developed as alternatives to steel and aluminum in bumpers and fenders, while use in structural parts is still largely experimental.

Pressed or rolled plastics

Pressed or rolled plastics are another important source of motor-vehicle parts. In this process the unworked plastic is chemically or mechanically treated until it achieves a slightly fluid state and is then forced through calenders (rollers) into uniform sheets of material. Then, several sheets of different materials are run through the calenders again to create a layered or coated sheet, from which patterns can be cut and pressed or sewn into various

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1/ The Rauch Guide to the U.S. Plastics Industry, Rauch Associates Inc., 1986.

components. Covers for all padded interior surfaces and fabrics for exterior use on roofs are produced in this manner. Automakers processed about 100 million pounds of pressed or rolled plastics in 1985. 1/

Casting

For plastic components destined for use in engines and other uses involving high stress or heat, the casting method is used. Similar to the casting of metal, the casting of plastic parts takes place with the aid of machines that insert material into performed molds until it cures into a solid, either through cooling or heating and pressing. Typical plastic items produced through casting are rods, tubes, and small gears.

Extrusion

Another significant process in producing plastic auto parts is the extrusion method. This method, like injection molding, requires that unworked plastic be heated to a fluid state at which point it is forced through an opening. In the extrusion process, it is the shape of the orifice (die) from which the material flows that creates the desired form of the final product, which is cooled immediately and stretched onto a conveyor belt. Almost all plastic-encased wire used in motor vehicles is coated in this manner. Other important products of this method are trim and molding for doors, windows, and other frames. General Motors is the largest plastic extruder in the United States, where automotive use of such materials was estimated at around 100 million pounds in 1985. 2/

Plastics machinery industry data

The U.S. plastics processing machinery industry experienced growth during 1982-86. U.S. producers' shipments increased by 61 percent, from $870 million in 1982 to $1.4 billion in 1986 (table 7-2). U.S. exports of such machines experienced fluctuations within a narrow range during 1982-86, amounting to $299.0 million in 1982 and $304.2 million in 1986. U.S. imports of plastics and rubber working machines increased steadily from $179.1 million in 1982 to $574.9 million in 1986, and increased as a share of apparent U.S. consumption from 23.9 percent to 34.4 percent during the period.

The types of processing equipment manufactured by firms in this industry range widely; thus it is difficult to determine a particular cause for swings in demand. The demand for machinery used to produce plastic consumer-related goods such as plastic packaging, household furniture, and plastics for motor-vehicle use is closely related to the economy overall, and especially to consumer income and spending. Demand for machines used in the production of industrial plastic goods follows a different cycle, and is more dependent upon interest rates, economic forecasts, and the substitution of plastics for metals in manufacturing.

1/ The Rauch Guide.
2/ Ibid., p. 209.

Table 7-2
Machines used for molding or otherwise forming rubber or plastics articles and parts thereof: U.S. producers' shipments, exports of domestic merchandise, imports for consumption, and apparent consumption, 1982-86

Year	Producers' shipments 1/	Exports	Imports	Apparent consumption	Ratio of imports to consumption
	-------------Million dollars-------------------				Percent
1982.............	870.0	299.0	179.1	750.1	23.9
1983.............	1,000.8	206.3	189.1	983.6	19.2
1984.............	1,243.6	249.7	338.1	1,332.0	25.4
1985.............	1,292.6	269.3	420.0	1,443.3	29.1
1986.............	1,400.0	304.2	574.9	1,670.7	34.4

1/ Estimated by the staff of the U.S. International Trade Commission.

Source: Compiled from official statistics of the U.S. Department of Commerce, except as noted.

Although statistics relating to the number of companies producing rubber and plastics-working machines are not available for 1986, the number of such firms in 1984 was approximately 150. About 80 percent of those firms in 1984, were exclusively engaged in the manufacture of plastics-working machinery, 18 percent were exclusively engaged in the manufacture of rubber-working machinery, and about 2 percent were producing both types. The industry producing plastics-working machinery is not highly concentrated with about 30 firms accounting for 65 percent of production.

Establishments in this industry are concentrated in the Northeast (Massachusetts, Connecticut, New York, Pennsylvania, and New Jersey) and in Ohio. The vast majority of rubber-working machinery production is in Ohio. Companies with plants producing rubber- and plastics-working machinery range from several large, highly diversified companies with annual sales of over $1 billion to small single plant firms with annual sales around $250,000.

In 1986, the three largest categories of plastics-working machinery produced in the United States were injection-molding machines, at 58 percent of the total, single screw machines, with 15 percent, and blow-molding machines at 14 percent.

Robotics Industry

One of the most important advances in auto parts manufacturing in the last 10 years has been in the field of robotics. Initially conceived as an answer to labor problems, many automotive planners in the early 1980's sought to install robots extensively in plants for a wide variety of functions. Experience quickly showed that robots were far too limited in their abilities, and far too expensive to purchase and install, to be used indiscriminately on production lines. Nevertheless, U.S. auto producers have become the single largest customer of the robot manufacturers, having installed roughly 10,000 robots by 1986. 1/ In fact, the largest producer of robots for automotive application is GMF, which was formed by a joint venture between General Motors and Fanuc, a Japanese robot manufacturer.

Operations

A study of the robotics industry published by the Commission in 1983 listed the following categories or robots, classified by end use: 2/

Spot welders.--Spot welders are resistance devices capable of joining metal articles through the use of a low-voltage, high-current power source.

Arc welders.--Arc welders are devices capable of joining articles of metal through the use of an electrode in the presence of an inert gas.

Coaters.--Coaters are spraying devices that apply paint, lacquer, or other liquids to articles requiring surface treatment.

Assemblers.--Assemblers are devices utilized to fit or joint together manufactured articles to make a subassembly or completed product. These operations are usually accomplished through the use of screws and nuts, rivets, pins, or similar fasteners.

Material handlers.--Material handlers are devices used to move and store materials and parts during various stages of production.

Metalworking apparatus.--Metalworking apparatus are metal-removing devices, such as lathes, mills, boring machines, punch presses, and drill presses.

Loaders/unloaders.--Loaders/unloaders are devices used to supply and remove parts or material from other machines (metalworking machines, molding apparatus, and so forth) which perform the manufacturing operation.

Other.--"Other" includes devices fitting the definition for robots, but not described above. Such devices may be combinations of robots listed above or other types of robots for measuring, inspection, and testing.

It is estimated that U.S. automotive companies spent about $200 million a year in 1985 and 1986 on robots. 3/ In their current stage of development, robots have proved to be most valuable in spot welding of automotive parts. The unique ability of a robot to endlessly perform a precise and repetitious operation requiring relatively little dexterity has lent itself well to the welding of auto body parts. In these operations it is not so much the

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1/ Lori Valigra, "Users Closely Defining Robot Use," Manufacturing Week, Apr. 20, 1987, p. 22.
2/ Investigation No. 332-155, USITC publication 1475, December 1983.
3/ Valigra, op. cit., p. 26.

manipulation of the parts, but rather the movement of the spot welder around the part to the proper location for welding that allows a robot to be used. In other operations, such as machining, it is necessary to add "machine vision," which allows the robot to "see" the part and detect the progress of the job. For that reason, the installation of a robot in an auto part assembly operation can be costly. According to research done at the University of Michigan, the price of the robot itself often accounts for only one-half of the eventual outlay necessary for installation, considering such factors as programming, tooling, and assembly line reorganization (table 7-3).

Table 7-3
Robotic's portion of total system cost, 1985, 1990, and 1995

(In percent)

System	1985	1990 1/	1995 1/
Machine tending	50	40	40
Material transfer	50	50	50
Spot welding	50	40	41
Arc welding	50	50	45
Spray painting and coating	60	60	60
Processing	40	35	40
Electronics assembly	30	33	34
Other assembly	35	30	30
Inspection	45	40	38
Other	50	35	30

1/ Estimated by the staff of the University of Michigan.

Source: University of Michigan.

Robots used for assembly are the most prevalent in overall manufacturing, but are not as important in the production of motor-vehicle parts. Some products that do lend themselves to robotics assembly are engine components and electronics. Otherwise, robots are important in testing and inspecting auto parts, especially for mechanical apparatus and in the transfer and handling of parts between manufacturing operations.

Robotics industry data

The state of the U.S. robotics industry is difficult to ascertain because of the lack of complete statistical series in many areas and because different sources define robotics in different ways, so that comparability between sources is tenuous. U.S. Department of Commerce data for U.S. imports of robots was first available in 1983, and official statistics on U.S. output were not available until 1984. Such sources showed an increase in imports, principally from Japan, from $15 million in 1983 to $171 million in 1986, and an increase in producers' shipments from $143 million in 1984 to $317.7 million in 1985. Manufacturers of robots have not made significant profits in recent years, and several companies have gone out of business. The number of robots installed in factories around the country has increased over 200 percent from about 6,000 units in 1982 to 20,000 units in 1986. New orders for robots fell in 1985, however, and it is estimated that 1986 unit shipments were down about 15 percent. This has driven some U.S. producers to move part or all of their operations outside the United States to low-wage countries.

One largely unanticipated area of growth for robotics producers has been in customizing and adapting their machines to customers' existing manufacturing lines. Industry sources estimate that purchasers of robots spent between $300 million and $400 million in 1985 on programming, customized machinery (e.g., carts and conveyor belts), and other items directly related to the integration of robotics in manufacturing. These services, however, are generally provided in full by only the largest robotics producers. Many of the largest customers also have in-house staff to guide the purchase and installation of robots.

Whereas the overall market for robotics is projected to grow by about 20 percent annually over the next five years, foreign manufacturers appear poised to capture an increasing share of domestic sales.

Computers

The ability of manufacturers to design, engineer, and produce motor-vehicle parts is increasingly dependent upon the use of computers. In recent years, developments in this area have centered on the use of computer-aided-design and computer-aided-manufacturing (CAD/CAM) systems (see p. 7-20). CAD/CAM systems are especially useful in drafting auto parts designs and implementing them with greater control. The design and accuracy of production requirements are achieved with greater precision through the use of computer graphics, modeling, and simulation techniques. The cost of the hardware for a typical CAD/CAM system has decreased from about $400,000 in 1980 to around $250,000 in 1987. 1/

Computers have become essential in coordinating flexible manufacturing systems, statistical quality control, inventory management, and a variety of other production related tasks as well as nonproduction related tasks like personnel management, financial analyses, and marketing research. As computers increase in power and memory and decrease in cost and size, computerized planning and control capabilities in the manufacture of auto parts are becoming available to more and more firms.

The major manufacturers of automobiles, buses, and trucks have spent billions of dollars in the last 10 years on data processing machines from the most sophisticated, such as the one purchased by Ford Motor Co. in 1985, which cost $8 million and is capable of more than 100 million calculations per second, to the thousands of smaller, simpler microprocessors costing only a few thousand dollars. 2/

1/ U.S. Industrial Outlook, 1986, p. 21-6.
2/ Ward's Automotive Yearbook, 1986, p. 25.

Manufacturing Systems

In the manufacture of motor-vehicle parts, as well as in overall manufacturing, there have been important developments in recent years that deal more with the way materials are moved, stored, and manipulated than with the actual operations performed. Manufacturers have sought new means of reducing costs, improving quality, and increasing efficiency of production through greater use of computers and advanced manufacturing processes. Primarily, this has meant the creation of work "cells," where groups of interconnected or coordinated machine tools have been arranged to perform a particular operation or series of operations. These cells are often managed through computer-integrated-manufacturing (CIM) systems that assist in the flow of materials and ensure that machines have the proper equipment to perform the required operation (see p. 7-18). This central control, when connected to the entire manufacturing cycle, allows for better use of machines, materials, and labor. Known as a flexible-manufacturing-system (FMS), this system has been considered the key to automation in manufacturing. In some FMS configurations, automatic guided vehicles (AGV's) are employed to retrieve materials from storage and transfer them between machines. 1/

The use of FMS in the manufacture of automotive parts is currently restricted to operations where human handling of materials is made difficult because of size and weight, especially when steel sheets are the materials. Increased automation of this type, though attractive to planners, initially involves large capital outlays for machine tools, conveyer belts, and computer equipment. The smaller independent manufacturers of automotive parts have not had sufficient capital resources in recent years to invest in FMS. On the other hand, major automakers have included FMS in their "reindustrialization" programs that started in earnest in late 1984 and are still in progress. General Motors has been a leader in promoting these advancements, having invested heavily in automation at plants such as its Saginaw Division axle facility, which is designed to operate at times without human supervision.

Competitive Factors Affecting Industries Producing Machinery for Auto Parts Production

The most significant industries producing machinery for auto parts production are the metal-working machine tool industry, the plastic- and rubber-working machinery industry, and the robotics industry. All three industries in the United States face significant competition in the U.S. market from foreign producers, principally from Japan and West Germany.

In general, the competitive factors that influence the sale of these types of machines are technology, performance, availability, traditional supplier relationships, price, and servicing. U.S. producers have advantages in many of these areas, especially in technology, availability, and traditional supplier relationships. West German producers are noted for machines of high-performance technology, and Japanese-made machines are also known for performance, technology, as well as availability.

1/ Al Wrigley, "U.S. Manufacturers Reap Dividends of Manufacturing Technology," Ward's Automotive Yearbook, 1985.

Since U.S. producers have many competitive advantages, industry sources have indicated that the most important factor that has allowed foreign producers to increase their U.S. market share has been price. Reportedly, much of the price advantage of foreign producers was achieved due to the high level of the dollar that existed for several years. With the recent decline in the value of the dollar in relation to many foreign currencies, industry sources expect that U.S. producers will regain some of the market share that was lost.

Technology and Management

The automotive industry is in the process of undertaking major programs to improve the quality and reliability of its products, and to increase its production flexibility and efficiency. Automation and integration are considered the keys to reducing labor and material costs, improving quality, speeding product introductions, and improving customer service. Automobile manufacturers are now requiring from many of their suppliers new systems such as computer-aided-design (CAD), statistical process control (SPC), and just-in-time (JIT) inventory. Such operations require extensive communication within company operations and between companies.

U.S. parts firms are increasingly implementing techniques developed by Japanese firms that are aimed at simplifying the design and production process by using an integrated organizational structure. At the same time, many U.S. firms are also working to incorporate CIM, which electronically integrates marketing, design, manufacturing, ordering, and inventory systems. Although there is no formal definition of CIM, the concept is now being applied as the means to electronically share information on both an inter- and intra-company basis.

Standardization of automated systems (to allow communication both within and between companies) is the first major obstacle being faced by the industry. Industry sources indicate that cooperation between manufacturers in their attempts to standardize automation is the key for success of the industry as a whole.

Japanese Methods and the U.S. Automotive Industry
Focus on Quality

In interviews, automobile industry parts and materials buyers stated that price is the main criteria for a purchase. 1/ At the same time, they stated that company policy puts a priority on quality as the strategy to compete against foreign engineered automobiles. In an Arthur Andersen and Co. survey on the automotive industry, improved quality was named as a major action the industry could take to increase world competitiveness. 2/ In this context, quality goes beyond product characteristics; it includes improvements in production efficiency and the lowering of costs. Quality has been defined as

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1/ USITC staff interview with U.S. automobile manufacturers.
2/ Arthur Andersen & Co., Cars and Competition: Management Challenges, July 1987, p. 24.

any cost of manufacture or service that would not have been incurred had the product been built and supplied exactly right the first time. 1/ Many see this emphasis as simply getting back to already known fundamentals. In addition, U.S. business leaders are studying the success of Japanese manufacturing methods as a model for their own organizations.

U.S. occupation forces introduced statistical quality techniques in Japan following World War II. Their motivation was not only to assist the Japanese rebuilding effort, but to improve on the poor, unreliable quality of Japanese equipment. 2/ In the 1950's, two Americans, W. Edward Deming and J.M. Juran, pioneered the direction of modern Japanese quality and process control techniques in seminars and speeches to Japanese business leaders. Japanese management embraced these methods and perfected them for use in their own organizational structures. The goal of Japanese automobile manufacturing became quality, with the ultimate objective of zero defects. 3/

In the 1950's, U.S. automobile manufacturers reportedly used many of these same quality control techniques. At present, with increasing competitive pressures, GM, Ford, and Chrysler now recognize quality not just as a product characteristic, but as an organizational framework.

Statistical process control

As an initial step to improve quality, U.S. automakers are exerting pressure on parts manufacturers to use the factory floor quality technique called SPC. SPC is a continuous quality measure used to monitor the production process and detect any significant nonconformance from predetermined product standards and specifications.

For example, a machine operator may periodically sample a part, measure its weight or diameter and graphically plot obtained values. If the part is found to deviate from a set range of tolerances, the appropriate machine or procedure is then adjusted to bring the part into tolerance. This preventative function is in contrast to traditional U.S. inspection methods to identify defective parts. One report suggests that a typical U.S. factory spends 20 to 25 percent of its operating budget to find and fix mistakes, which SPC is meant to prevent. 4/

The Taguchi method

Whereas SPC can ensure a part meets specifications, it does not address the quality of the part (or manufacturing process) in terms of design or function. The ultimate goal of quality improvement is to manufacture a part with an inherent quality that is not susceptible to the manufacturing process fluctuations that necessitate SPC.

1/ J. Campanella and F.J. Corcoran, "Principles of Quality Costs," Quality Progress, April 1983, p. 17.

2/ Kaoru Ishikawa, translated by David J. Lin, What is Total Quality Control, Prentice-Hall, Inc., 1985, p. 15.

3/ The concept of "Zero defects" was also originated in the United States in the early 1960's.

4/ Otis Port, "How to Make it Right the First time," Business Week, June 8, 1987, p. 132.

The Taguchi method, originated by Genichi Taguchi of Japan, simplifies widely used "design of experiments" techniques by allowing engineers to find those few variables most susceptible to unwanted product or process variation, out of the possible hundreds or even thousands of variables that might otherwise require testing. With crucial variables identified, engineers can then run fewer experiments, refine areas found to be most susceptible to variation, and more assuredly change or add variables in formulating part design. The Taguchi method, used by many large Japanese parts firms, has not yet been widely accepted within the U.S. parts industry; however, the American Supplier Institute, a creation of the Ford Motor Co., now offers seminars on the Taguchi techniques. 1/

Quality functional deployment

For Japanese firms, the concept of quality extends to product conception. One respondent to the Commission's questionnaire indicated that "up-front planning is where the Japanese beat us." Quality functional deployment (QFD) addresses this need by using market research to serve as a blueprint for product development.

Using QFD, data on purchaser preferences dictates part specifications. This information is then translated into tabular form, matched against how the company can best achieve these specifications constrained by technical considerations. Clearly presented in this way, QFD can be especially useful in "systems as complex as automobile design because it allows a large organization to react quickly and with a single purpose in developing products that meet the ever changing needs of the market." 2/ This contrasts with traditional purchaser surveys in the United States which measure satisfaction after production. Customer satisfaction is considered by the industry as the top measure of world class quality performance. 3/ The Ford Motor Co. is encouraging suppliers to use QFD, with Kelsey Hayes and the Budd Co., already implementing the method. 4/

Just-in-time

Although usually thought of as an inventory cost control method, just-in-time inventory (JIT) is a management philosophy dependent on product quality. Successful JIT requires delivery of the needed automotive parts, in the proper quantities, at a specified time. With such precision, the delivery of defective parts will delay, or could stop, vehicle assembly. For this reason, many analysts see improved quality as a motivation to use JIT. Keeping a large inventory is simply a way to cover quality shortfalls in what the industry calls "just-in-case" stockpiling.

1/ According to Institute brochures, the American Supplier Institute was created in 1981 as "a nonprofit organization dedicated to quality management and the competitive improvement of U.S. industry."
2/ Lance Early, Automotive Industries, July 1987, p. 21.
3/ Arthur Andersen & Co., Cars and Competition: Management Challenges, p. 7.
4/ John McElroy, "For Whom Are We Building Cars?," Automotive Industries, June 1987, p. 69.

To facilitate JIT, Japanese firms emphasize materials handling. The production process is organized so that parts and materials may automatically move, as needed, to the proper point in the assembly line. In general, the JIT philosophy is to eliminate all activities that do not add value, thereby simplifying the production process and exposing those areas of waste that may delay the JIT production schedule.

JIT also leads to closer integration between suppliers and automotive manufacturers, as supplier quality and reliability are vital. Instead of negotiating specific unit contracts, long-term agreements are signed stipulating quality requirements, delivery schedules, and price.

Although the vehicle manufacturers and certain large parts suppliers are enthusiastic about JIT, most suppliers are only following the new methods in an ad hoc way. Automobile manufacturers are receiving an estimated 70 percent of their high value-added parts just-in-time to the assembly line. However, industry sources state that an overwhelming percentage of those claiming to use JIT are merely delivering to the schedules of their customers, and not actually following a similar production pattern. A survey by the Automotive Industry Action Group (AIAG) asserts that between 1981 and 1985 "there has been little real implementation of Just-in-time in the internal manufacturing operations of automotive suppliers." 1/ Arthur Andersen & Co.'s Delphi Survey found that 60 percent of vehicle manufacturers believe that automotive suppliers viewed JIT as a way of transferring costly inventories to them. 2/

Industry representatives involved in implementing JIT for their firms indicate that achieving the Japanese model in practice is not necessarily the goal of their programs. 3/ They see the contribution of JIT as simply providing a framework for an awareness of waste and the elimination of unnecessary costs. From this perspective, JIT is more of a specific management tool, and not an organizational philosophy.

Japanese focus on flexibility

By accounting for customer preference and controlling quality from product design through manufacture, a firm strives for "total quality control" (TQC). According to industry sources, it is the cooperation involved in focusing the entire organization on a single known goal, through the use of techniques such as the Taguchi method and QFD, which is credited with giving Japanese automobile manufacturers a product development lead time of 2-1/2 to 3 years versus the 5 years it takes U.S. vehicle manufacturers. 4/

Industry sources state that Japanese firms maintain a clear vision of manufacturing objectives. In the 1960's, quality was the primary goal. As quality became assured, dependability, then cost reduction were emphasized. Now the goal is on flexibility. 5/ Reducing leadtimes to respond more quickly

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1/ AIAG, Five Year Survey of the Automotive Industry.
2/ Arthur Andersen & Co., p. 8.
3/ USITC staff interviews with parts producers.
4/ John McElroy, "For Whom Are We Building Cars," Automotive Industry, June 1987, p. 69.
5/ USITC staff interview with Professor Robert Hall, University of Indiana School of Business.

to changing demands of the market is considered vital in meeting global competition. The underlying reason for JIT is to continuously improve response to changes in the marketplace with minimum waste. 1/

Tactics to eliminate idle processes, such as simplified tool changeover procedures, now halt production for only minutes, instead of hours. For example, in metal stamping shops replacement dies are kept on specially designed carts so that the used dies can be pushed out of the press as new ones are pushed in. 2/ At the same time, Japanese firms are willing to make large strategic capital investments to enhance flexibility. Japanese firms use robots extensively; moreover, Japanese engineers take full advantage of the programability of robots to quickly change product mix in response to changes in consumer demand, and to accommodate model changes without extensive plant shutdowns and retooling. 3/ The Japanese are reportedly the major users of flexible machine tools in the world with an estimated 40 percent of the world's total. 4/

Japanese methods in the U.S. auto industry

According to many automobile analysts, implementing JIT and other Japanese manufacturing methods requires profound changes in labor-management and management-management relations, which are not forthcoming in current U.S. business culture. 5/ Implementing the Japanese style of management means a breakdown in the corporate hierarchy so that all employees are focused toward a common goal.

A beginning engineer in Japan may first serve the company on the factory floor, then in manufacturing engineering, and finally in product design engineering. This is in contrast to the emphasis on professional specialists found in the United States, Western Europe, and the Soviet Union. A product designer in the United States will probably have little knowledge of how a design or subsequent change in that design will affect the manufacturing process. 6/

Factory workers in Japan are encouraged to make contributions and advise on process improvement. 7/ Employee involvement necessarily increases under SPC, QFD, and JIT. In JIT, workers may be involved in the ordering process by means of monitoring inventory control cards, and SPC requires workers to constantly measure the precision of the production process. Experience with computers, statistical methods, problem solving, and increased interpersonal communication skills characterize workers under Japanese management methods.

1/ William A Sandras, Jr., "Just in Time and Total Quality Control," Productivity Centers International, Johnstown, Co.
2/ USITC staff interview with executives of Japanese automotive manufacturers in Japan.
3/ Jeffery Bairstow, "Automated Automaking," High Technology, August 1986, p. 25.
4/ "Survey, The Factory of the Future," The Economist, May 30, 1987, p. 12.
5/ USITC staff interview with parts producers.
6/ Ibid.
7/ Ibid.

Consultants indicate that some U.S. managers are resisting the Japanese method of increasing the responsibility of workers. 1/ Although U.S. companies can be taught to follow Japanese techniques, it may be impossible, at least in the short term, to implement them fully without corresponding changes in corporate culture.

U.S. Manufacturing

Computer integrated manufacturing

The success behind Japanese automobile manufacturing has been called a "three legged stool." 2/ Two of the legs, automation and quality, are being vigorously pursued by U.S. firms through increased spending and additional training. The third leg, the Japanese assembly line worker, cannot be simply bought or taught. Although many U.S. firms are applying selected Japanese techniques, the requisite loosening of organizational structure to allow widespread human integration in the design and manufacturing processes and a team concept among workers is largely absent in the U.S. automobile industry. The Delphi survey found the "biggest obstacles to improving quality in U.S.-produced parts are management practices and employee attitudes." 3/

Communication between machines, or CIM, may be a strategy better suited to U.S. organizations. Integrated machines lack the mobility of workers and therefore, the corporate structure and divisions of U.S. firms can be preserved using CIM. Moreover, sources indicate that the United States leads the world by perhaps two years or more in the development of the computer and telecommunications software necessary for CIM. 4/

The parallel pursuit of Japanese methods and CIM will converge into a manufacturing solution unique to the United States, one which may be more effective than following either track alone. For instance, when applying the JIT philosophy of eliminating waste and simplifying the production process, sources report that the ability to identify those areas that can most effectively be automated is enhanced.

There is no formal definition of CIM, as it may apply to computer coordination of a single task, or more ideally, complete computer integration between the factory floor, engineering, corporate offices, customers, and suppliers. The linkage of these diverse functions is data. Dr. Joseph Harrington, Jr., in his book Computer Integrated Manfacturing, first enunciated CIM by saying "every atom of the manufacturing process can be expressed as data. In the ultimate analysis, all manufacturing can be seen as a continuum." 5/ CIM integrates already established and future "islands of automation"; Japanese methods are usually included as "islands" to be tied in as part of CIM.

1/ Ibid.
2/ Jeffrey Bairstow, "Automated Automaking," High Technology, August 1986, p. 26.
3/ Arthur Andersen & Co., Cars and Competition: Management Challenges, p. 24.
4/ USITC staff interview with parts producers.
5/ "The Promise of CAD/CAM," Industry Week, Mar. 23, 1987, p. 50.

The high cost of the necessary hardware, software, and implementation of CIM are forcing companies to institute it in a gradual fashion. CIM is currently being applied in the following manners:

1) Inside to outside: Integration between suppliers and customers for the passing of information such as on-line ordering, or reports on quality ratings of delivered parts.

2) Beginning to end: Development and sharing of data from product design, planning, and engineering to manufacture.

3) Top to bottom: Coordination of data flow from top management to middle management and between departments, including the flow of information from the factory floor upward. 1/

As with Japanese methods, much of the focus on CIM involves linking design, analysis, and manufacturing engineering functions. The increasing power and decreasing costs of computer hardware, combined with advances in computer software are merging engineering functions into what General Motors calls "simultaneous engineering." 2/

MRP II

Manufacturing resource planning (MRP II) is a computer-based planning tool some consider a step ahead of Japanese quality control and JIT production schemes. 3/ It is one management technique, sources say, the Japanese have much to learn from the United States.

Originally conceived in the 1960's as Material Requirements Planning, or MRP, the logic of the system asks:

(1) What are we going to make?

(2) What does it take to make it?

(3) What do we have?

(4) What do we have to get? 4/

As a company builds a data base through MRP II software, calculations are then made on cash in/cash out, equipment needs, labor needs, and when to change tooling. 5/ Simulation can then be used to answer "what if" types of questions, given already stored parameters and data.

1/ Jeffrey Zygmont, "Manufacturers Move Toward Computer Integration," High Technology, February 1987, p. 28.
2/ "MRP II: Managing a Manufacturing Company," Industry Week, Mar. 23, 1987, p. 44.
3/ Ibid.
4/ Ibid.
5/ Richard J. Schomberger, World Class Manufacturing, 1986, p. 186.

MRP II is considered a vital management control tool for CIM. However, as U.S. firms begin to adopt JIT, there is some controversy as to the role of MRP II. JIT is a pull system, where a firm reacts only when there is customer demand; whereas production is planned in MRP II, or "pushed." The prevailing attitude is that the two can be complimentary. MRP II provides a master schedule and planning mechanism, and JIT is the execution of that plan. 1/

CAD/CAM/CAE

Unlike CIM, CAD, CAM and computer-assisted-engineering, (CAE), are established well defined engineering tools. Use of CAD/CAM/CAE is generally considered an integral first step in starting a CIM system.

CAD replaces the need for manual drafting by creating a graphical representation of a product from inputted geometric data, which can then be printed. CAD systems allow easy modification of a drawing, and storage for later retrieval and manipulation. In this way, product design does not have to be recreated by different departments as was previously the case. Therefore, the engineering of the product is coordinated, faster and more precise.

Beyond the pictorial representation on the computer screen, data defining product characteristics can be subjected to engineering calculations. For instance, finite element analysis can be applied to mathematically determine the stress point in the product's structure, thereby eliminating some later prototype testing. Such analysis also aids in the selection of appropriate materials for product composition. Companies using CAD report design time may be reduced up to 50 percent and testing reduced by one-third. 2/

From CAD, a CAM program may be generated in minutes to run numerically controlled machinery. Whereas CAD use is widely used by the U.S. automobile industry, particularly with the advent of inexpensive microcomputer CAD software, CAM is still a few years away from widespread use. 3/

CAD is a requirement from U.S. vehicle manufacturers to certain suppliers. The increasing design responsibility of suppliers adds importance to the exchange of product data between supplier and customer. CAD meets this need by encoding necessary data for transfer by either magnetic tape or telephone lines. However, standards need to be further developed so that different CAD/CAM systems can communicate with each other. 4/ Other uses of CAD often cited by questionnaire respondents include plant layout and tool design.

CAE includes analytical tools such as the Taguchi method and finite element analysis, but is quickly expanding into the use of simulation and artificial intelligence. By using CAD/CAM/CAE, U.S. firms are attempting to design the product correctly from the beginning, by finding the optimal design

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1/ Douglas Williams, "JIT vs. MRP: The Push Pullers Call a Truce," Automotive Industries, July 1986, p. 30.
2/ "The Competitive Edge in Brake Development," Automotive Industries, December 1986, p. 93.
3/ USITC staff interview with the CAD/CAM project Chairman for the Automotive Industry Action Group (AIAG).
4/ Ibid.

to improve the inherent quality of the product. CAE speeds up the engineering process, and eliminates much of the time-consuming and expensive trial-and-error steps of prototype building and design, possibly reducing development costs and testing-time by a factor of 10. 1/ However, savings are often reduced as many companies insist on using traditional testing methods to verify the validity of CAE results.

Simulation

Whereas finite element analysis largely applies to testing an individual part, the increasing emphasis on building modular systems has focused attention on computer system modeling. Equations of motion, which previously required weeks of skilled analysis, can now be quickly generated and solved by computer software. Simulation of the system under various conditions and using different product variables allows the testing of more design possibilities, and eliminates several iterations of prototype design and testing. By animating the results of the simulation, engineers can actually watch the behavior of a system model using computer graphics.

Computer simulation is also becoming a popular method to organize the increasing complexity on the factory floor, and to simulate production runs under varying speeds and product mix, thus optimizing the production process. 2/ This is becoming particularly important with the complexity of CIM. Again, animation can be used to watch the factory in action. Personal computers and relatively inexpensive software are making simulation a reality for many firms.

Artificial intelligence

Some view artificial intelligence (AI) as perhaps the "most important ingredient for the realization of true CIM." 3/ A branch of AI, expert systems, is computer software that uses reasoning techniques and knowledge gained from human experts to solve problems.

Expert systems programs are based on "if-then" rules that logically progress through an application to obtain a solution. The information collected in an expert system can be continually broadened and updated as the knowledge of employees and ex-employees becomes a corporate asset. The uses of AI are just being explored but already include: financial advisement, part design, process control, and robot maintenance. Expert system programs can be developed inexpensively and by nonprogrammers using "expert system shells." This user friendly off-the-shelf software allows the simple development of custom expert systems. Ford Motor Co. is considered to be the automotive industry leader in expert systems. 4/

1/ Dave Zola, "Computer aided engineering said to cut product development time, cost 90 percent," Automotive News, June 23, 1986, p. 30.
2/ William G. Wild, Jr., and Otis Port, "This Video Game is Saving Manufacturers Millions," Business Week, Aug. 17, 1987, p. 82.
3/ George H. Schaffer, American Machining and Automated Manufacturing, August 1986, p. 84.
4/ Dwight B. Davis, "Artificial Intelligence Goes to Work," High Technology, April 1987, p. 84.

Facilitating CIM with manufacturing automation protocol (MAP)

Passing data between islands of automation to create a CIM environment is hampered by a lack of communication standards. To facilitate communication, firms now go to the expense of either wiring hardware interfaces from machine to machine (which in the automobile industry is particularly difficult because each new model has a different wiring configuration), writing custom software, manually reentering data from machine to machine or, if practicable, single sourcing to ensure equipment compatibility. 1/

Each of these solutions can be inefficient and costly. Using these methods, the cost of integrating automation accounts for about one-half of total automation budgets. 2/ With a multitude of vendors competing in the growing automation industry, and each possessing proprietary communications standards, a market solution appears unlikely in the near future.

The automobile industry is taking the lead in addressing this U.S. industrywide deficiency. GM initiated and is coordinating a factory floor, multivendor communications standard called MAP. 3/ When implemented, MAP will connect all programmable devices, robots, and computers via a common network. To achieve MAP, GM has lobbied for widespread cooperation among users and vendors. Currently 890 U.S. automotive and nonautomotive related companies and organizations are involved with MAP user groups, including Ford, Chrysler, American Motors Corp., Nissan Motor Manufacturing, Mitsubishi International Corp., and many of the larger U.S. auto parts suppliers. As a nonproprietary system, there are no restrictions on who may use MAP. GM, however, is leading the effort and reportedly plans to spend up to $25 billion on MAP through 1990. 4/

European automakers are well into implementation of MAP. 5/ The MAP users group in Europe has 220 members in 15 countries, with all major European auto manufacturers, except Porsche, joining. 6/ In addition, the European Community (EC) is supporting efforts to develop CIM, or as it is called in Europe, Advanced Manufacturing Technology (AMT). EC projects include a proposal to spend $1.3 billion over the next 5 years on AMT, and $900 million on communications research. 7/

In Japan, there is some hesitance in developing MAP products over concern for changes in technology. However, Nippondenso Co., an affiliate of Toyota Motor Corp., will install MAP in a $650 million plant to produce fuel-injection

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1/ Information provided by the MAP/TOP users group, secretariat: Society of Manufacturing Engineers.
2/ Ibid.
3/ Technical and office Protocol or TOP, is a program similar to MAP, but for use in data processing, engineering and business office environments. TOP was introduced by Boeing Computer Services and integrated into MAP users groups in 1985. Work is being undertaken to integrate MAP with TOP.
4/ Jon Swartz, "Suppliers Interested in MAP Must Follow Beat From GM Drummers," Communications Weekly, May 11, 1987, p. 18.
5/ Information provided by the MAP/TOP users group, Secretariat: Society for Manufacturing Engineers.
6/ "European Automakers Chart, Their Future With MAP," Ward's Automotive International, May 1987, p. 5.
7/ "Factory of the Future Survey," The Economist, May 30, 1987, p. 15.

units and semiconductor chips. 1/ A joint venture between Electronic Data System (EDS), a subsidiary of GM, and Nippon Information Industry Corp., recently announced plans to market MAP in Japan. 2/

Industry integration

JIT delivery, increased design responsibility and quality-control requirements force suppliers to adapt to a multitude of fast changing procedures and communication methods. To avoid duplication of effort in meeting various requirements from customers and other suppliers and alleviate cost burdens on each firm, industrywide cooperation and standardization is required, and bar coding is one method being used to solve these problems.

The U.S. industry has made great strides in incorporating bar-coding techniques. Bar coding eliminates excessive paperwork and less precise manual part log-in procedures. For example, when using JIT, high value-added parts, such as engines, can be readily identified for in-sequence delivery and production. Bar code scanning today is considered the most widely used method of data collection. With PC software to print and scan bar-codes, even small companies can benefit from its use. However, nearly 50 different types of bar codes are currently being applied, and some form of standardization has to be adopted by the industry. 3/

The AIAG, an association of automobile vehicle manufacturers and suppliers based in Detroit, has developed standards for bar coding and is working on facilitating its use. The AIAG's self-proclaimed mission is to educate its members and develop standards. Other AIAG efforts include industry cooperation for JIT, returnable containers, CAD/CAM, continuous quality improvement, electronic communications, schedule standardization, and nonstandard product items.

1/ "Nippondenso to Use GM's MAP System," Automotive News, Aug. 18, 1986, p. 36.
2/ "EDS, Nippon to Operate Joint Venture in Tokyo," Automotive News, Apr. 27, 1987.
3/ J.R. Loeffler, "Barcode Standards Aid Detroit," American Machinist and Automated Manufacturing, December 1986, p. 73.

CHAPTER 8. COMPARISONS OF INTERNATIONAL COMPETITIVENESS BETWEEN U.S. AND FOREIGN INDUSTRIES

In order to assess the competitive status of U.S.-produced automotive parts in both the domestic market and major foreign markets, automotive parts producers were asked for their viewpoints on global market competitiveness. The following provides information obtained from the Commission's questionnaires concerning overall competitiveness, structural factors of competition between U.S. and foreign industries, and marketing strategies employed in the United States, along with a presentation of foreign industry labor compensation costs and an analysis of domestic inflation and exchange rate effects on U.S. competitiveness. U.S. producers responding to the questionnaire received equal weight in the compilation; that is, sales or other factors were not used to weight the responses. It should be noted that firms at the leading edge of technology are probably less likely to perceive foreign countries as having a competitive advantage, and vice versa.

Industry Rating of Overall Competitiveness

Fifty-four percent of U.S. producers responding to the Commission's questionnaire indicated that their firms are competitive in the U.S. market. Of the 69 firms responding to this question, 32 percent rated their firms as highly competitive and 14 percent labeled their firms as noncompetitive. Many respondents expressed concern that imports will comprise an increasing share of the U.S. market, thereby reducing U.S. parts makers' ability to invest in capital equipment and remain competitive in the U.S. market.

Fifty-one percent of respondents indicated that their firms are competitive in major foreign markets. Of the 64 firms responding to this question, 20 percent rated their firms as highly competitive and 29 percent classified their firms as noncompetitive. Many respondents indicated that the U.S. industry is increasingly becoming globally oriented and that competition would intensify in foreign markets because of world overcapacity in most automotive parts.

Forty-three percent of respondents listing Japan as a primary foreign market stated that their firms were not competitive in the Japanese market. In contrast, a large number of U.S. producers rated themselves as reasonably competitive in the Canadian, West German, Mexican, and Saudi Arabian markets.

U.S. producers' assessment of key factors of competition in the U.S. market

U.S. parts suppliers and importers were requested, through the Commission's questionnaires, to provide an overall assessment of how effectively domestic and foreign products competed in the U.S. market. Both producers and importers accorded foreign producers an overall advantage, or viewed U.S. and foreign producers as equally competitive (table 8-1). Both producers and importers gave foreign producers an overall competitive advantage in bearings and autosound components principally because of product cost advantages.

Table 8-1
Automotive parts: U.S. producers' (P) and importers' (I) competitive assessment of U.S.-produced and foreign-produced automotive parts in the U.S. market, 1/ and the principal factors (X) underlying overall competitive advantages, by selected product categories, 1986

Item	Batteries		Bearings		Engines		Autosound components		Shock absorbers		Tires		Transmission transaxles	
	P	I	P	I	P	I	P	I	P	I	P	I	P	I
Overall competitive advantage	S	S	F	F	S	F	F	F	S	S	F	S	S	F
Product cost advantages:														
Lower purchase price (delivered)	F	S	F	F	F	D	F	F	F	D	F	S	F	F
Favorable exchange rates	F	F	F	F	F	S	F	F	F	S	F	D	D	S
Nonprice factors:														
Shorter delivery time	D	D	S	F	D	2/	S	F	D	D	D	D	D	2/
Engineering/technical assistance	D	S	S	F	D	F	F	F	D	S	D	D	D	F
Favorable terms of sale	D	F	F	F	S	2/	S	2/	S	2/	F	D	F	S
Production technology	D	F	F	F	D	F	F	F	S	F	D	S	D	F
Marketing practices	D	F	F	F	D	F	F	F	D	D	D	S	D	S
Reliability of supplier	D	F	S	F	D	F	S	F	D	S	D	D	S	S
Shorter new product development time	D	2/	F	F	S	2/	F	F	D	F	D	D	D	2/
Willingness to supply required volumes	D	F	F	F	F	F	F	F	F	F	D	S	D	F
Ability to supply metric sizing	D	F	F	F	S	F	S	F	S	F	S	D	F	2/
Ability to meet specifications	D	D	F	F	S	F	S	F	D	F	S	D	D	F
Product innovation	D	F	F	F	D	F	S	F	F	F	S	D	D	F
Quality	D	F	F	F	D	F	F	F	F	S	S	F	D	F

1/ D=60 percent or more of total respondents accorded domestic parts makers an advantage; F=60 percent or more of total respondents accorded foreign parts makers an advantage; S=competitive position the same.
2/ Insufficient data.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

On a country-by-country basis, U.S. producers generally accorded foreign suppliers an overall competitive advantage, whereas U.S. importers were more prone to see U.S. producers and their primary foreign competitors as equally competitive (table 8-2). However, both producers and importers gave Japan an overall competitive advantage, primarily related to pricing and production technology.

The advantages accorded foreign producers were most heavily concentrated in areas such as pricing. Price was cited by U.S. purchasers as the single most important factor influencing their decisions to purchase foreign-produced parts, followed by product quality, production technology, and ability to meet specifications (table 8-3). Decisions by purchasers to buy domestic parts, on the other hand, were influenced most by shorter delivery time, reliability of the supplier, quality, and marketing practices.

U.S. producers' assessment of key competitive factors in foreign markets

According to foreign industry sources, the level of U.S. exports of all automotive parts, which accounted for about 11 percent of producers' shipments during 1982-86, is adversely affected by their higher price compared with that of most foreign-produced products. U.S. producers of automotive parts responding to the Commission's questionnaire identified Canada, Saudi Arabia, West Germany, Brazil, and Australia as key foreign markets (table 8-4).

In the Canadian market (the largest export market for U.S. parts firms), U.S. producers gave Canada and Japan an overall competitive advantage largely because of lower purchase prices. U.S. firms reported that they had an overall competitive advantage over Korean parts makers in the Canadian market principally because of quality-related factors.

In the West German market, U.S. firms gave West German companies an overall competitive advantage attributable to lower purchase prices and a variety of nonprice factors. U.S. producers indicated that Brazilian firms had a price-related comparative advantage in the Brazilian market, and they saw themselves on equal footing with Canadian companies selling in Brazil. In addition, U.S. firms gave themselves a comparative advantage over Taiwan producers in the Saudi Arabian market (chiefly attributable to superior production technology), and ranked themselves as equally competitive with Japanese and West German companies in the Australian market.

Table 8-2

Automotive parts: U.S. producers' (P) and importers' (I) competitive assessment of U.S.-produced and foreign-produced automotive parts in the U.S. market, 1/ and the principal factors (X) underlying overall competitive advantages, by major foreign sources, 1986

Item	Brazil		Canada		Japan		Korea		Taiwan		West Germany	
	P	I	P	I	P	I	P	I	P	I	P	I
Overall competitive advantage	S	S	F	S	F	F	F	2/	F	S	S	F
Product cost advantages:												
Lower purchase price (delivered)			X		X	X	X		X			
Favorable exchange rates			X		X		X		X			
Nonprice factors:												
Shorter delivery time												
Engineering/technical assistance						X						X
Favorable terms of sale												
Production technology					X	X						X
Marketing practices												
Reliability of supplier												X
Shorter new product development time					X							
Willingness to supply required volumes					X							
Ability to supply metric sizing					X							
Ability to meet specifications						X						X
Product innovation					X	X						
Quality					X	X						X

1/ D=60 percent or more of total respondents accorded domestic parts makers an advantage; F=60 percent or more of total respondents accorded foreign parts makers an advantage; S=competitive position the same.
2/ Insufficient data.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table 8-3
Automotive parts: Ranking of U.S. purchasers' reasons for purchases of U.S.-produced and foreign-produced automotive parts, 1982-86 1/

Reason for purchase	U.S.-produced automotive parts	Foreign-produced automotive parts
Lower purchase price (delivered)	11	1
Quality	3	2
Production technology	8	3
Reliability of supplier	2	4
Ability to meet specifications	9	4
Engineering/technical assistance	5	6
Marketing practices	4	7
Product innovation	10	8
Favorable exchange rates	14	9
Ability to supply metric sizing	13	10
Willingness to supply required volumes	6	11
Shorter new product development time	12	11
Favorable terms of sale	7	13
Shorter delivery time	1	13

1/ Ranking numbers range from 1 to 14, number 1 indicating the most important reason for purchase and number 14 indicating the least important reason for purchase.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Structural Factors of Competition Between U.S. and Foreign Industries

Producers responding to the questionnaire evaluated selected cost items and accorded either domestic or foreign automotive parts producers an advantage for each of the product areas examined.

According to U.S. producers responding to the Commission's questionnaire, the United States' overall competitive position in industry structural comparisons with its major foreign competitors is the same for four of the seven product areas examined (table 8-5). The United States maintains a comparable position or greater competitive advantage with major foreign industries in fuel costs; however, foreign industries were given a competitive advantage in labor costs and alleged government subsidies. In responding as to how these competitive assessments might change during 1988-92, U.S. producers indicated a strong concern regarding possible fluctuations in exchange rates.

Table 8-4
Automotive parts: U.S. producers' competitive assessment of U.S.-produced and foreign-produced automotive parts in the major foreign markets, 1/ and the principal factors (X) identifying overall competitive advantages, by top competitor nations, 1986

Item	Canadian market			West German market		Brazilian market		Saudi Arabian market			Australian market	
	Japan	Korea	Canada	West Germany	France	Brazil	Canada	Korea	Taiwan	Japan	Japan	West Germany
Overall competitive advantage	F	D	F	F	S	F	S	S	D	S	S	S
Product cost advantages:												
Lower purchase price (delivered)	X		X	X		X						
Favorable exchange rates	X		X									
Nonprice factors:												
Shorter delivery time		X		X								
Engineering/technical assistance		X		X								
Favorable terms of sale												
Production technology	X	X		X					X			
Marketing practices	X	X		X								
Reliability of supplier		X		X								
Shorter new product development time												
Willingness to supply required volumes	X			X								
Ability to supply metric sizing												
Ability to meet specifications	X			X								
Product innovation		X		X								
Quality		X										

1/ D = 60 percent or more of total respondents accorded domestic parts makers an advantage; F = 60 percent or more of total respondents accorded foreign parts makers an advantage; S = competitive position the same.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table 8-5
Automotive parts: U.S. producers' competitive assessment of structural factors of competition for the U.S. industry and foreign industries, 1/ by selected product categories, 1986

Item	Batteries	Bearings	Engines	Autosound components	Shock absorbers	Tires	Transmissions
Overall competitive advantage	F	F	F	S	S	S	S
Product cost advantages:							
Fuel cost	S	D	D	D	D	D	D
Raw materials cost	S	S	S	S	S	S	S
Domestic inflation rates	S	F	S	S	S	D	S
Labor costs	F	F	F	F	S	F	F
Exchange rates	F	D	S	S	F	S	S
Taxes	F	S	F	S	S	S	S
Equipment costs	S	F	F	S	S	S	S
Interest rates	S	F	F	S	S	D	S
Government involvement:							
Subsidies	F	F	F	S	S	F	F
U.S. Government regulations that increase costs	F	S	S	S	S	S	S
Foreign government regulations that increase costs	S	S	S	S	S	S	S

1/ D = 60 percent or more of total respondents accorded domestic parts makers an advantage; F = 60 percent or more of total respondents accorded foreign parts makers an advantage; S = Competitive position the same.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

In a country-by-country comparison, U.S. producers perceived themselves at a competitive disadvantage with most all principal foreign industries except West Germany (table 8-6). The U.S. industry again generally believed that it had a competitive advantage in fuel cost; however, foreign industries were given a competitive advantage in labor costs, exchange rates, taxes, alleged subsidies, and U.S. Government regulations (e.g., emissions and safety standards), which increase costs.

Although exceptions to these structural factor assessments may be cited by U.S. producers for individual product areas or foreign competitors as discussed in the analyses of the seven key products (see chapter 12), these conclusions are based on the aggregate responses to the Commission's questionnaire. Specific information on competitive positions of specific types of auto parts producers is discussed in each of the product sections of the report.

Table 8-6
Automotive parts: U.S. producers' competitive assessment of structural factors of competition for the U.S. industry and foreign industries, 1/ by major competing countries, 1986

Item	Brazil	Canada	Japan	Korea	Taiwan	West Germany
Overall competitive advantage	F	F	F	F	F	S
Product cost advantages:						
Fuel cost	D	S	D	D	S	D
Raw materials cost	F	S	S	S	S	S
Domestic inflation rates	D	D	F	S	S	S
Labor costs	F	F	F	F	F	S
Exchange rates	F	F	S	F	S	S
Taxes	F	S	F	F	F	S
Equipment costs	S	S	S	S	S	S
Interest rates	D	D	F	S	S	S
Government involvement:						
Subsidies	F	F	F	F	F	S
U.S. Government regulations that increase costs	F	F	S	F	F	S
Foreign government regulations that increase costs	S	F	S	S	S	S

1/ D = 60 percent or more of total respondents accorded domestic parts makers an advantage; F = 60 percent or more of total respondents accorded foreign parts makers an advantage; S = Competitive position the same.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Marketing Techniques and Strategies

Respondents to the questionnaire provided information on marketing techniques and strategies which they relied on, as well as marketing strategies employed by domestic or foreign competition. Respondents reported that product quality, delivery, and pricing policies were their most important marketing techniques and strategies in the U.S. market during 1982-86. The following tabulation summarizes these results: 1/

Rank	U.S. firms' domestic marketing strategies	Percentage of firms responding
1	Product quality	65
2	Delivery	55
3	Pricing policies	53
4	Technical service	38
5	Product innovation	26

1/ There were 66 firms responding to this question in the Commission questionnaire.

Respondents indicated that pricing policies, product quality, and certain export techniques were the key marketing techniques or strategies employed by their foreign competition in the U.S. market. The following tabulation summarizes these results: 1/

Rank	Foreign firms' marketing strategies
1.........	Pricing policies
2.........	Product quality
3.........	Export techniques:
	Under own license
	By broker
	Intracompany movements
	Delivery
4.........	Sales techniques
5.........	Delivery

Respondents reported that their foreign competition was increasingly practicing a number of techniques, including the establishment of service and distribution outlets to supply customers, greater product diversification, increasing promotion budgets, and broadening sales coverage.

By comparison, many U.S. suppliers noted that they are increasingly applying a number of customer service techniques, including increasing their willingness to respond flexibly to customers, providing better service, signing long-term contracts with major accounts, increasing inventories in sales locations, providing rebates, and lengthening warranty programs.

Labor

Hourly compensation costs paid to production workers in motor-vehicle and equipment manufacturing in the United States are higher than those paid to workers in other major producing countries. Table 8-7 shows data on hourly compensation costs for U.S. production workers in automotive and equipment manufacturing compared with those of workers in major producing countries. Although the figures include compensation for the broad category, motor-vehicles and equipment manufacturing, they are believed to be indicative of the differences in compensation costs for the automotive parts industry. Generally, higher labor costs are associated with higher productivity. Although information is not available for all countries during 1986, data indicate that compensation paid in the various producing countries ranged from 11 percent (for Korea) of the U.S. compensation level of $19.87 per hour to 86 percent (for West Germany) (fig. 8-1). Part of the change in labor costs for motor vehicles and all manufacturing is a result of exchange rate changes. Wages in U.S. parts firms, which are largely non-union, are generally below wages in U.S. assembly plants. Hourly compensation costs for all manufacturing during 1986 were lower than such costs for motor-vehicle and equipment manufacturing in all major foreign producing countries (table 8-8).

1/ There were 64 firms responding to this question in the Commission questionnaire.

Table 8-7
Motor-vehicles and equipment manufacturing: Hourly compensation costs for production workers, by specified countries, 1982-86 1/

Country	1982	1983	1984	1985	1986	Average annual change, 1986 over 1982
						Percent
United States.....	$17.99	$18.23	$18.92	$19.73	$19.87	2.5
West Germany......	13.03	13.16	11.92	12.17	17.04	6.9
Canada............	12.46	12.82	13.18	13.10	13.50	2.0
Sweden............	10.36	9.18	9.64	10.14	12.36	4.5
Japan 2/..........	7.22	7.83	7.92	8.04	11.81	13.1
France............	9.09	9.03	8.42	8.61	11.61	6.3
Italy.............	7.76	7.94	7.72	8.05	10.75	8.5
United Kingdom....	7.60	7.11	6.67	7.07	8.68	3.4
Korea.............	1.60	1.78	1.94	1.99	2.12	7.3
Mexico 3/.........	3.56	2.61	2.55	2.66	4/	5/
Brazil............	2.90	1.92	1.68	1.73	4/	5/
Spain 6/..........	2.65	2.58	4/	4/	4/	4/

1/ Hourly compensation is defined as all payments made directly to the worker, including bonuses and overtime, and employer contributions to legally required insurance programs and contractual and private benefit plans.
2/ Including motorcycle manufacturing.
3/ Motor vehicle assembly and car bodies only.
4/ Not available.
5/ Average annual percent change, 1985 over 1982: Mexico -9.3, and Brazil -15.8.
6/ Transportation equipment.

Note.--Data are in U.S. dollars.

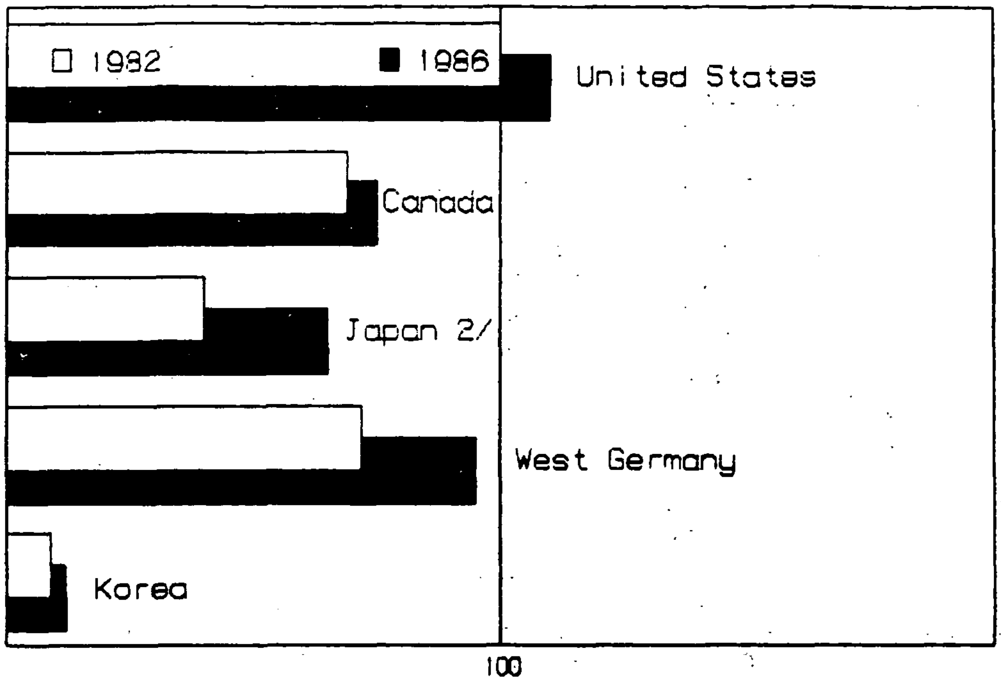
Source: U.S. Department of Labor, Bureau of Labor Statistics-unpublished statistics, February 1987.

Domestic Inflation and Exchange-Rate Effects

There was very little inflation in the United States from early 1983 to early 1987 as measured by the Producer Price Index. U.S. inflation therefore has had little effect on U.S. competitiveness in auto parts. Other countries have had different experiences with inflation over this time period. Where inflation in those countries has been especially rapid (e.g., Brazil and Mexico), exchange-rate movements have largely paralleled the course of inflation.

When the effects of differential inflation rates are removed, the resulting "real" exchange rates better illustrate changes in the international

Figure 8-1
Motor-vehicle and equipment manufacturing: Indexed hourly compensation costs 1/ for production workers, by specified countries, 1982 and 1986, United States, 1982=100



1/ Hourly compensation is defined as all payments made directly to the worker, including bonuses and overtime, and employer contributions to legally required insurance programs and contractual and private benefit plans.
2/ Including motorcycle manufacturing.

Source: U.S. Department of Labor, Bureau of Labor Statistics, unpublished statistics, February 1987.

terms of trade than do nominal rates. In tables 8-9 and 8-10 indices of the "real" value of the dollar in terms of foreign currencies are presented for the major producers of auto parts, along with indices of producer prices and nominal exchange rates. The dollar generally rose in value over the period until reaching a peak against most currencies in January-June 1985. 1 The U.S. industry was losing price competitiveness during this period, which is reflected in the trade statistics.

1/ The major exception to this pattern are Brazil and Mexico. In Brazil, the pattern is roughly a flat real exchange rate through 1985, with fluctuations around the flat trend probably caused by the volatility of Brazilian inflation and problems in measuring it. In Mexico, inflation was catching up with an earlier sharp depreciation of the peso, producing a rise in the real value of the peso until January-June 1985.

Table 8-8
All manufacturing: Hourly compensation costs for production workers, by specified countries, 1982-86 1/

Country	1982	1983	1984	1985	1986	Average annual change, 1986 over 1982
						Percent
United States......	$11.50	$11.97	$12.40	$12.82	$13.09	3.3
West Germany.......	10.28	10.23	9.44	9.60	13.44	6.9
Sweden.............	10.07	8.89	9.17	9.66	12.23	5.0
Canada.............	10.22	10.98	11.09	10.89	10.96	1.8
France.............	8.01	7.92	7.48	7.71	10.45	6.9
Italy..............	7.41	7.79	7.38	7.65	10.27	8.5
Japan..............	4.43	6.13	6.35	6.45	9.50	21.0
United Kingdom.....	6.76	6.32	5.88	6.14	7.46	2.5
Korea..............	1.25	1.32	1.41	1.44	1.55	5.5
Spain..............	5.35	4.64	4.58	4.79	2/	3/
Mexico 4/..........	2.54	1.85	2.04	2.07	2/	3/
Brazil.............	1.86	1.26	1.16	1.22	2/	3/

1/ Hourly compensation is defined as all payments made directly to the worker, including bonuses and overtime, and employer contributions to legally required insurance programs and contractual and private benefit plans.
2/ Not available.
3/ Average annual percent change, 1985 over 1982: Spain -3.6, Brazil -13.1, and Mexico -6.6.
4/ Average of selected manufacturing industries.

Note.--Data are in U.S. dollars.

Source: U.S. Department of Labor, Bureau of Labor Statistics-unpublished statistics, February 1987.

Since January-June 1985, the value of the dollar has generally fallen in real terms against the currencies of the United Kingdom, West Germany, Italy, Japan, and Brazil. The trend has been relatively flat against the Canadian and Korean currencies, and the dollar has risen against the Mexican peso as inflation there has been less than the depreciation of the peso. This means that the U.S. auto parts industry has improved its price competitiveness against producers in Europe, Japan, and Brazil as a result of real-exchange-rate changes, and has experienced little change with respect to Canada and Korea, and a loss of price competitiveness with respect to Mexico.

U.S. Producers' Assessment of Challenges From Foreign Competition and Their Responses

U.S. suppliers responding to the Commission's questionnaire indicated the greatest impact of foreign competition in 1987 was on their market share and

Table 8-9

Indexes of nominal-exchange-rate equivalents and real-exchange-rate equivalents of the United Kingdom pound, the French franc, the West German mark, the Italian lira, and the Canadian dollar, and producer price indicators in the United States, United Kingdom, France, West Germany, Italy and Canada 1/ by quarters, January 1983-March 1987

(January-March 1983=100)

Period	U.S. producer price index	United Kingdom: Producer price index	United Kingdom: Nominal-exchange-rate index	United Kingdom: Real-exchange rate index	France: Producer price index	France: Nominal-exchange-rate index	France: Real-exchange rate index	West German: Producer price index	West German: Nominal-exchange-rate index	West German: Real-exchange-rate index	Italy: Producer price index	Italy: Nominal-exchange-rate index	Italy: Real-exchange-rate index	Canada: Producer price index	Canada: Nominal-exchange-rate index	Canada: Real-exchange-rate index
			Pounds per U.S. dollar			Franc per U.S. dollar			Deutsche mark per U.S. dollar			Lira per U.S. dollar			Canadian dollar per U.S. dollar	
1983:																
Jan.-Mar.	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Apr.-June	100.3	102.0	98.5	96.8	103.9	108.5	104.6	100.3	103.2	103.1	101.6	105.6	104.2	101.5	100.3	99.1
July-Sept.	101.3	102.7	101.4	100.0	107.9	115.6	108.5	101.1	109.8	109.9	104.0	112.4	109.5	102.4	100.4	99.4
Oct.-Dec.	101.8	104.1	104.2	101.9	111.8	118.6	108.0	101.7	111.2	111.3	107.4	116.1	110.1	102.8	100.9	99.9
1984:																
Jan.-Mar.	102.9	105.9	106.8	103.7	115.6	120.6	107.3	102.7	112.2	112.4	110.8	118.8	110.2	104.5	102.3	100.7
Apr.-June	103.6	108.4	109.7	104.8	118.9	120.9	105.3	103.5	112.5	112.6	113.3	119.7	109.4	105.7	105.3	103.2
July-Sept.	103.3	109.0	118.1	111.9	121.6	130.1	110.5	103.9	121.2	120.5	114.7	128.6	115.8	106.4	107.1	104.0
Oct.-Dec.	103.3	110.4	126.0	117.6	123.5	135.9	113.4	104.7	126.8	124.8	117.0	135.1	119.0	106.6	107.4	103.8
1985:																
Jan.-Mar.	102.9	112.2	137.5	126.0	125.5	144.6	118.5	105.7	135.2	131.6	120.1	144.4	123.7	107.9	110.3	105.1
Apr.-June	103.0	114.4	121.8	109.6	126.6	136.6	111.1	106.2	128.2	124.3	122.7	140.8	118.1	108.5	111.6	105.9
July-Sept.	102.2	115.1	111.4	98.9	124.9	126.1	103.2	106.2	118.3	113.9	122.7	135.5	112.9	108.6	110.8	104.3
Oct.-Dec.	102.9	116.1	106.6	94.5	122.0	114.5	96.5	106.0	107.3	104.1	123.8	125.1	103.9	109.4	112.4	105.7
1986:																
Jan.-Mar.	101.3	117.7	106.4	91.5	2/	104.7	2/	105.0	97.4	94.1	123.2	114.2	94.0	110.5	114.4	104.9
Apr-June	99.4	119.6	101.5	84.3	2/	103.8	2/	103.4	93.3	89.7	121.0	110.0	90.3	108.7	112.8	103.1
July-Sept.	98.9	120.1	102.8	84.7	2/	98.4	2/	102.3	86.6	83.7	120.0	102.6	84.6	108.9	112.9	102.5
Oct.-Dec.	99.3	121.0	107.1	87.9	2/	95.4	2/	100.9	83.4	82.1	120.8	99.3	81.6	2/	112.8	2/
1987:																
Jan.-Mar.	100.5	122.6	99.4	81.5	2/	89.0	2/	100.6	76.4	76.3	2/	93.3	2/	2/	109.0	2/

1/ The real value of a currency is the nominal value adjusted for the difference between inflation rates in the United States and the respective foreign country. Producer prices presented in line 63 of International Financial Statistics were used in computing real exchange rates.

2/ Not available.

Source: International Monetary Fund, International Financial Statistics.

Table 8-10
Indexes of nominal-exchange-rate equivalents and real-exchange-rate equivalents, of the Japanese yen, Brazilian cruzado, Mexican peso, and Korean won and producer price indicators in the United States, Japan, Brazil, Mexico, and Korea, 1/ by quarters, January 1983-March 1987

(January-March 1983 = 100)

Period	U.S. pro- ducer price index	Japan Pro- ducer price index	Japan Nominal- exchange- rate index	Japan Real- exchange- rate index	Brazil Pro- ducer price index	Brazil Nominal- exchange- rate index	Brazil Real- exchange- rate index	Mexico Pro- ducer price index	Mexico Nominal- exchange- rate index	Mexico Real- exchange- rate index	Korea Pro- ducer price index	Korea Nominal- exchange- rate index	Korea Real- exchange- rate index
			Yen per U.S. dollar			Cruzados per U.S. dollar			Pesos per U.S. dollar			Won per U.S. dollar	
1983:													
Jan.-Mar...	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Apr.-June..	100.3	99.0	100.8	102.0	132.2	146.0	110.7	121.3	111.9	92.5	99.2	102.1	103.2
July-Sept..	101.3	99.2	102.9	105.0	189.4	195.7	104.6	137.0	123.6	91.4	98.4	104.2	106.8
Oct.-Dec...	101.8	98.6	99.4	102.6	266.9	98.6	101.4	152.0	135.3	90.6	98.9	105.5	108.6
1984:													
Jan.-Mar...	102.9	98.7	98.0	102.1	351.9	350.0	102.3	181.1	147.0	83.5	99.3	105.6	109.4
Apr.-June..	103.6	98.6	97.4	102.3	467.5	464.4	102.9	209.5	158.7	78.5	99.6	105.9	110.2
July-Sept..	103.3	99.4	103.3	107.3	623.8	615.0	101.9	227.2	170.3	77.4	100.4	107.6	110.7
Oct.-Dec...	103.3	99.1	104.4	108.5	871.7	838.0	99.1	251.5	182.1	74.6	100.5	108.8	111.5
1985:													
Jan.-Mar...	102.9	99.5	109.3	113.0	1205.2	1154.3	98.5	283.8	196.6	71.3	100.5	111.3	113.9
Apr.-June..	103.0	98.8	106.4	110.8	1541.5	1604.9	107.2	317.0	214.2	69.6	100.6	115.1	117.7
July-Sept..	102.2	97.7	101.2	105.9	2024.7	2085.3	105.3	343.5	269.3	80.2	100.8	117.2	118.8
Oct.-Dec...	102.9	95.5	87.8	94.6	2867.6	2763.5	99.1	390.5	327.0	86.1	101.4	118.3	120.0
1986:													
Jan.-Mar...	101.3	93.2	79.7	86.6	4351.3	3903.7	90.9	474.7	415.2	88.6	100.4	117.7	118.9
Apr.-June..	99.4	89.3	72.2	80.3	4522.3	4245.4	93.3	484.4	511.8	105.0	98.2	117.7	119.1
July-Sept..	98.9	86.8	66.1	75.3	4605.5	4245.4	91.1	672.9	652.5	95.9	98.2	117.1	118.0
Oct.-Dec...	99.3	85.4	68.0	79.0	4869.9	4358.3	88.6	816.7	819.1	99.6	97.8	115.4	117.2
1987:													
Jan.-Mar...	100.5	85.1	65.0	76.8	6330.2	5607.4	89.1	2/	2/	2/	98.1	113.6	116.4

1/ The real value of a currency is the nominal value adjusted for the difference between inflation rates in the United States and the respective foreign country. Producer prices presented in line 63 of International Financial Statistics were used in computing real exchange rates.
2/ Not available.

Source: International Monetary Fund, International Financial Statistics.

profitability (table 8-11). Producers reported that they were relatively comfortable with their ability to finance investment and R&D. A narrow majority of respondents believed that the adverse effects of foreign competition will last more than 5 years.

Table 8-11
Automotive parts: Number of responses from 72 U.S. producers of automotive parts regarding the seriousness of the present challenge from foreign competitors, 1987

Item	Grave-Severe	Substantial	Minor-Negligible	Number of responses
	--Percentage of total responses---			
High-rated				
Market share	27	41	31	70
Profitability	29	39	33	70
Capacity utilization	21	41	38	66
Employment	21	37	42	67
Low-rated				
Cash flow	11	30	59	66
Ability to finance:				
Investment	13	28	58	67
Research	9	27	64	66
Development	10	32	58	62

Source: Compiled from data submitted in responses to questionnaires of the U.S. International Trade Commission.

In looking to the future, respondents reported that they expect competitive relief from foreign competition to most likely come from reactions by their own firms, the declining value of the U.S. dollar, use of new technology, and U.S. Government action as shown in the following tabulation: 1/

Item	Number of firms responding
Source of competitive relief:	
Not a problem	8
Reactions by our firm	37
Declining value of the U.S. dollar	26
Use of new technology, products	25
Rising costs/problems of competitors	12
U.S. Government action	18
No solution in sight	6

Twelve percent of respondents said that they saw no source of competitive relief in sight, and 16 percent indicated that foreign competition was not a problem for their firm.

1/ Compiled from data submitted by 51 U.S. producers of automotive parts in response to questionnaires of the U.S. International Trade Commission.

Respondents indicated that they would respond to foreign competition in 1988 as well as 1989-92 by introducing labor-related and overhead cost-reduction efforts and product changes related to quality and design (table 8-12). Many respondents indicated that they expect to introduce labor-related cost reductions and improve quality by aggressively implementing new manufacturing technologies; e.g., a number of firms stated that they will introduce robotics into their plants. However, there were shifts reported in strategies between the two periods; for example, respondents stated a greater inclination to invest in R&D and plant and equipment during 1989-92. At the same time, U.S. parts firms more strongly believed in initiating product and/or product financing terms and cost reduction efforts in 1988.

Table 8-12
Automotive parts: Number of responses from 79 U.S. producers of automotive parts regarding their strategies for responding to competition from foreign companies, 1988 and 1989-92

Item	1988	1989-92
No special response required	8	5
Product orientation and marketing efforts	27	25
Pricing and/or product financing terms	32	27
Product changes: quality, design, diversity, etc	39	40
Production levels and product mix	17	18
Cost-reduction:		
Labor-related	40	33
Raw/intermediate materials	33	28
Production and transportation costs	31	28
Capital costs	18	18
Overhead	36	31
Business strategies:		
Investment in plant and equipment	30	34
Investment in research and development	27	33

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

In considering the effect of heightened competition, U.S. producers indicated that improving production efficiency, improving labor productivity, increasing market share, and expanding sales were their most important objectives in determining their strategic decisions during 1987. The following tabulation summarizes these results: 1/

Rank	Objective
1	Improve production efficiency
2	Improve labor productivity
3	Increase market share
4	Expand sales
5	Increase return on equity

1/ There were 56 firms responding to the question in the Commission questionnaire.

CHAPTER 9. EFFECTS ON SELECTED INDUSTRIES OF CHANGES IN U.S. AUTO PARTS COMPETITIVENESS

Global competitive pressures in the areas of technology, productivity, product quality, and exchange rates have altered the competitive position of the U.S. automotive parts industry. This section discusses the major industries that supply inputs to the parts industry and describes ways in which they are working to meet the challenges of foreign and domestic changes in materials usage. The section also presents current and future developments in various automotive parts design and composition.

Selected Basic Industries

Information derived from the latest U.S. input-output accounts (1977 data) published by the U.S. Department of Commerce indicates the industries most likely to be affected by shifts in competitiveness levels of the auto parts industry. However, the U.S. auto parts industry has experienced considerable change since 1977; thus, the data should be considered to be merely suggestive. It should be noted that some inputs are imported, but the accounts give total input requirements without a breakdown of whether they are imported or domestic. Major direct inputs to the motor-vehicle parts and accessories industry, along with industry expenditures on these inputs as a percent of the value of industry output, are as follows: blast furnaces and steel mills; iron and steel foundries; iron and steel forgings; miscellaneous plastics products; aluminum castings; and fabricated rubber products. As percentages of the total value of industry output, these amounted to 10.3 percent, 8.0 percent, 2.9 percent, 1.9 percent, 1.5 percent, and 1.1 percent, respectively.

Major industries affected by changes in the output of motor-vehicle parts and accessories and the percentages of each industry's output used to make motor-vehicle parts and accessories are as follows: electrometallurgical products, 25.1 percent; iron and steel foundries, 30.1 percent; iron and steel forgings, 34.6 percent; aluminum castings, 26.2 percent; nonferrous castings, n.e.c., 29.9 percent; and carburetors, pistons, rings, and valves, 31.2 percent. Consider the following examples to aid in interpreting these data. If the shipments of motor-vehicle parts and accessories were to drop 10 percent, demand for electrometallurgical products would drop 2.5 percent, and demand for iron and steel forgings would drop by 3.5 percent.

Selected Industries and Material Substitution

Downsizing of automobiles, material substitution programs involving plastics, aluminum, and composites, and re-engineering are responsible for the shift in materials content in the automotive industry within the past decade. 1/ Downsizing, which took place largely during the 1978-82 period, accounted for the bulk of reductions in steel content, as automakers were

1/ Al Wrigley, "Materials Mix," American Metal Market, Sept. 1, 1986, p. 4.

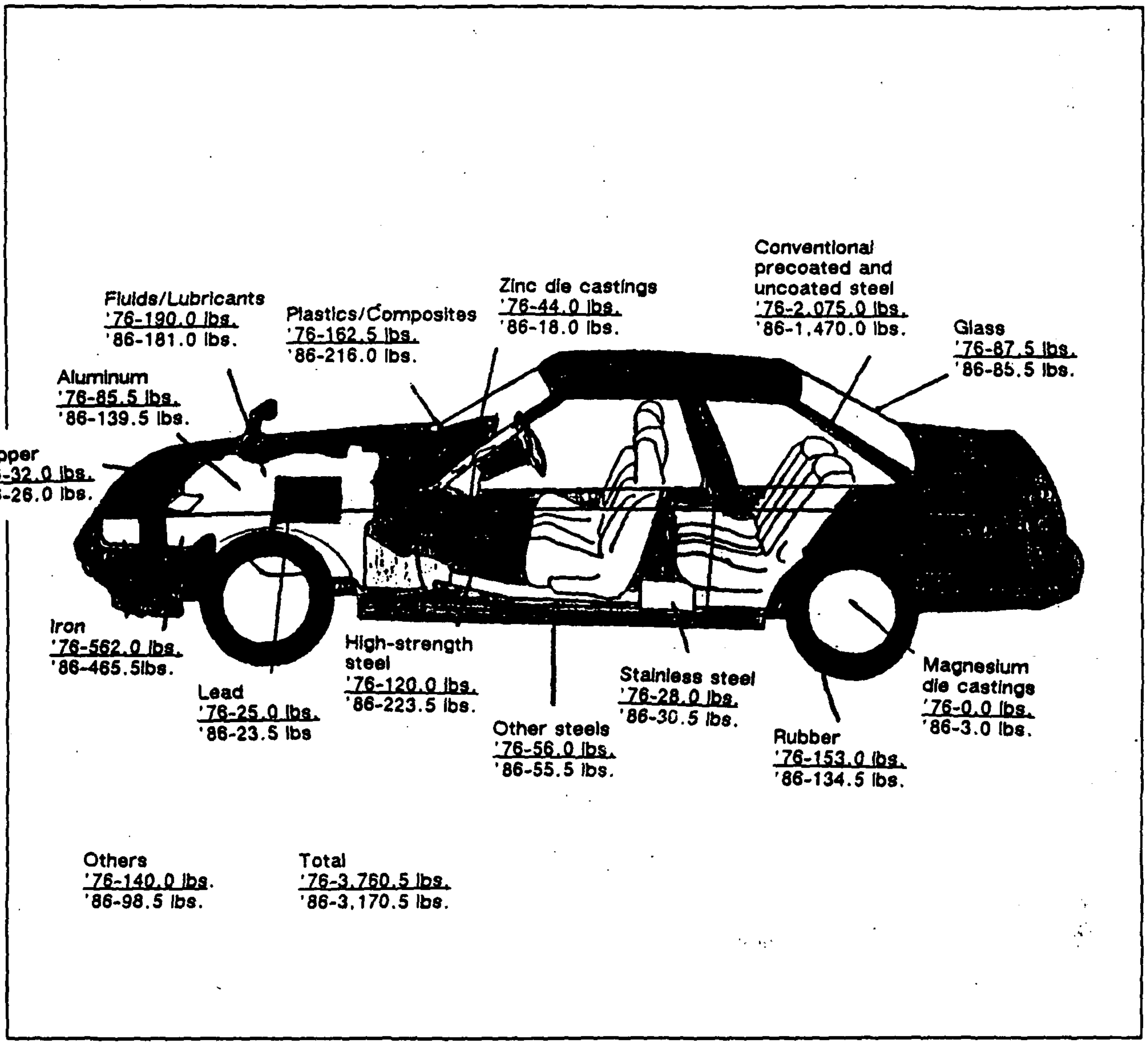
encouraged by Federal standards and competition to produce lighter weight, more fuel-efficient, better performing vehicles. 1/ The decline in the unit content of cast iron is largely the result of increased use of smaller engines, such as General Motors' (GM) 2.5 liter "fours." 2/

In 1976, the typical passenger car weighed approximately 3,762 pounds and contained about 2,075 pounds of carbon steel, 120 pounds of high-strength steel, and 562 pounds of cast iron. A decade later, the typical car weighed 3,175 pounds. The amount of carbon steel decreased by 29 percent to 1,470 pounds and the cast-iron content declined by 17 percent to 466 pounds. By contrast, high-strength steel content in cars increased to 224 pounds, or by 87 percent. During the same period, the plastics content in cars increased by 33 percent, from 163 pounds to 216 pounds, and aluminum increased from 86 pounds in 1976 to 140 pounds in 1986, or by 63 percent (table 9-1 and figure 9-1). 3/

By 1995, a comparable car is expected to weigh about 2,917 pounds and contain 1,225 pounds of carbon steel, an additional decrease of 17 percent. Cast-iron content is expected to fall an additional 10 percent. Plastics are predicted to increase an additional 28 percent, to 275 pounds per car in 1995, and aluminum is expected to increase an additional 13 percent. High-strength, lightweight steel will increase by an additional 12 percent during the period 1986-95, and glass and other weighty, nonsteel materials will decline by 25 percent during the same period. 4/ Although the largest gains in weight were seen in high-strength steel, aluminum, plastics/composites, and stainless steel, with the losses evident in zinc die castings, carbon steel, copper, and iron, it should be noted that comparison of materials by weight does not reveal actual gains in penetration of the automotive parts industry, as plastics weigh less than aluminum and high-strength steel. 5/ Although no data are available that indicate the increase in the application of plastics/composites on surface and dimensional areas, it is estimated to exceed 33 percent.

1/ Al Wrigley, "Materials Mix," American Metal Market, Sept. 1, 1986, p. 4.
2/ Al Wrigley, "Substitute Materials Gain More Ground in '86 Models," Ward's Automotive Yearbook, 48th ed., 1986, p. 27.
3/ Ibid.
4/ "One For the Road: Lite Cars," The Washington Post, Nov. 24, 1985, p. 64.
5/ Ibid.

Figure 9-1
Changes in materials content in U.S.-produced cars, 1976-86.



Source: *American Metal Market Magazine*, Apr. 7, 1986, p.4.

Table 9-1
Estimated raw materials usage in U.S. passenger cars, 1976-86 1/

Material	1976	1978	1980	1982	1984	1986	Change, 1986 over 1976
	Pounds						Percent
Plain carbon steel...	2,075	1,915	1,737	1,469	1,526	1,470	-29
High-strength steel..	120	133	175	203	210	224	87
Stainless steel......	28	26	28	27	29	31	11
Other steels.........	56	55	54	54	54	56	0
Iron.................	562	512	484	461	481	466	-17
Plastics/composites..	163	180	195	200	204	216	33
Fluids/lubricants....	190	198	178	179	189	181	-5
Rubber...............	153	147	131	135	138	135	-12
Aluminum.............	86	113	130	134	137	140	63
Glass................	88	87	84	84	86	86	-2
Copper...............	32	29	28	28	29	26	-19
Lead.................	25	25	23	24	25	24	-4
Zinc die castings....	44	31	20	16	18	18	-59
Other................	140	120	97	102	109	102	-27
Total............	3,762	3,570	3,364	3,116	3,235	3,175	-16

1/ Estimates based on U.S.-built models only, including family vans and wagons.

Source: Compiled from data published in Ward's Automotive Yearbook, 48th ed., 1986, p. 27.

Iron and Steel Industry

The U.S. iron and steel industry's status is closely tied to the health of the domestic auto industry, and at the same time is affected by the application of competitive materials in the auto parts industry. Although the overall picture for use of steel indicates that steel content in automobiles is declining at a rate of 50 pounds per year per car, the use of certain kinds of steel, i.e., high-strength steel and stainless steel, are expected to increase because of their associated weight savings, high-temperature resistance, and anticorrosion properties. 1/

According to steel industry executives, steel holds at least 10 advantages which could keep steel attractive to automakers in the near future--reluctance to change, the knowledge of metal stamping versus unknowns in plastic molding, the public's perception that steel is safer, steel's lower repair/replacement costs, steel's lower cost as a material, greater consistency of steel finishing, dimensional stability, paint-oven curing, and steel's better chemical and impact resistance. 2/

Because the auto industry is the steel industry's largest customer, the two are working closely in design and concept programs to develop better steel, and

1/ "One For the Road: Lite Cars," The Washington Post, Nov. 24, 1985, p. 64.
2/ Jack Walsh, "Plastics Hot, But Steel Execs Say 'Don't Panic'," Automotive News, May 19, 1986, p. 16.

new materials replacing the steel that is currently used in automotive applications. The steel industry has proposed that the following areas be investigated for developing the use of steel in the automotive industry: preprimed steel to boost quality and to improve corrosion resistance; plastic tooling instead of more conventional and expensive cast iron or zinc alloy tooling, to reduce costs in making low volume steel parts; light gage and high strength steel to save weight; roll forming; larger parts; and plastic bumpers and fenders for parts consolidation. 1/

Aware that the steel industry would face a loss of an estimated 1.65 million tons if all automakers switch to plastic for exposed body panels, and 7.15 million tons for unexposed body panels, the American Iron & Steel Institute (AISI) undertook a study to examine the technology and costs involved in steel processing. The study indicates that U.S. automakers could reduce overall steel processing costs by 35 percent through the adoption of Japanese steel converting methods. 2/

Presented in February 1987 at the Society of Automotive Engineers conference and exhibition, the study indicates that raw steel represents about 5-6 percent of the average car's sales price, yet accounts for 55 to 60 percent of the car's weight. Thus, improving the competitive position of the U.S. automakers lies not principally in the cost of buying steel, according to the study, but rather in steel processing costs. The study indicates that the average cost for body-in-white 3/ stamping (including acquisition, conversion, transportation, and handling) currently amounts to $947 per vehicle. Costs could be lowered by $200 by the use of thinner steel, which can be produced by improved dimensional control, by increased press uptime, and improved, lighter dies. 4/ The study also blamed higher domestic costs on poor maintenance and lack of quick die changes.

Additionally, the study indicates that domestic automakers use a "break-even" point of 120,000 to 175,000 parts annually as a reference in deciding whether or not a part should be made of steel or plastic. Higher volume parts are cheaper to make from steel, and lower volume parts are cheaper to make from plastic. Japan, however, uses a breakeven point of 6,000 parts annually in reference to whether or not a part should be made from steel or plastic, according to Toyota's executive chief engineer. This means that a part production run of more than 6,000 units in Japan is more cost efficient if produced from steel, indicating that cars built in Japan are made predominantly from steel, not plastic according to the President of AISI. 5/

AISI research shows that, when comparing the world standards for the cost of dies and molds, the tooling cost for steel parts may be less than for plastic molds. Thus, the tooling cost advantage reportedly held by plastics

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1/ Jack Walsh, "Plastics Hot, But Steel Execs Say 'Don't Panic'," Automotive News, May 19, 1986, p. 16.
2/ "Iron and Steel Study Says Automakers Could Cut Die Costs," Ward's Automotive Reports, Mar. 2, 1987, p. 67.
3/ An automobile body which has been assembled, but not painted.
4/ Al Fleming, "A Question of Survival," Automotive News, Mar. 23, 1987, p. E14.
5/ "Iron and Steel Study Says Automakers Could Cut Die Costs," Ward's Automotive Reports, Mar. 2, 1987, p. 67.

over steel may be overstated. 1/ To evaluate the differences between Japanese and U.S. tooling costs, AISI had the Industrial Development Division of the University of Michigan conduct a study to determine why dies built to Japanese standards costs 35 to 42 percent less than dies built according to U.S. standards by the Big Three captive shops. Preliminary data show that the Japanese employ smaller, lighter weight, and fewer overall dies to produce automobile panels that are shallower and less complicated than comparable parts built by the Big Three. In addition, Japanese use more technology in development and engineering of their dies, such as numerically controlled machinery and computer-aided design and computer-aided manufacturing. Japanese dies are also engineered for quick die change capability. Data indicate significant cost reductions in this area, with leadtime reduced by about 25 percent. 2/

To meet the challenge of foreign auto producers' developments in these areas, U.S. automakers are investing in steel processing equipment. General Motors has committed an unprecedented 1 billion dollars for new, highly automated, transfer-type stamping presses, line-type presses, and related equipment in its modernization program at GM's U.S. and Canadian metal-fabricating plants. 3/ GM is also spending over $200 million to upgrade its steel stamping die and tool facilities in the United States and Canada. The significant expenditures on stamping presses, which last more than 20 years, indicates the domestic automakers' intention to be in a competitive position with respect to foreign producers on a quality and cost basis, whatever direction their competitors may take. 4/

Additionally, GM is working with Armco, Inc., which will supply steel for the outer skin of GM's new luxury sports car, the Buick Reatta, which will be introduced in 1988. A spokesman for Armco indicated that Armco succeeded in obtaining the contract to supply steel for the low production (25,000 to 30,000 units per year) vehicle by working with GM from the early stages of design development, and by proving that steel was the best material for the project. 5/ This is an exception to the trend of making low-volume cars with plastic skins.

Cold-finished steel bar producers' biggest market, directly and indirectly, is the auto and truck industry. This includes cold-finished bar purchased from steel distributors along with bar contained in parts and components furnished to auto parts producers by suppliers. Quality and delivery continue to grow in importance for cold-finished bar customers. These competitive factors are reinforced by steel buyers like GM, which by focusing on quality and delivery in their purchases, increase the competitiveness of

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1/ Al Fleming, op. cit.
2/ Ibid.
3/ Al Wrigley, "Materials Mix," American Metal Market, Sept. 1, 1986, p. 5.
4/ Ibid.
5/ Gloria T. LaRue, "Armco to Supply Steel Skin for GM's Sportscar," American Metal Market, Apr. 19, 1987, p. 1.

the U.S. cold-finished steel bar producers. General Motors is reportedly the largest single consumer of cold-finished bar. 1/

Some examples of new, high-strength steel applications in 1986 models include frame cross-members, front bumper support bar, rear-wheel wells, and the control arms on the Ford Aerostar van. The underbody components on GM's E- and K-cars were made of high-strength steel, and the wheels of these and GM's new H-body cars were also made of high-strength steel.

Stainless steel exhaust systems were employed for the first time in the Olds Toronado, and stainless steel exhaust pipes and supports in Ford Taurus and Sable models. Stainless steel lasts longer than conventional aluminized or aluminum-coated steels, and its use is expected to grow.

New carbon steel components appeared in the 1986 models, including engine camshafts, which replaced cast-iron units, and roller hydraulic valve lifters.

Domestic automakers are also using more stamped components made from corrosion resistant, precoated sheet, such as galvanized steel and zincrometal. Zincrometal is a two-part coating system for steel that employs a chromium-content base coat and a zinc-rich primer top coat. GM's 1986 E- and K-body cars were the first U.S. passenger cars produced with two-sided galvanized steel sheet in corrosion-susceptible inner and outer body panels and hot-dip paintable two-sided galvanized sheet on all outer and inner body panels. The Cadillac Eldorado and Seville, Olds Toronado, and Buick Riviera models, and the Ford Aerostar, Taurus, and Sable models utilize galvanized steel in body and underbody components, including door frames, or apertures, underbody components, suspension arms, rear quarter panels, and roofs. The Buick Le Sabre and Olds 88 models use two-sided precoated steel in the upper and lower engine compartment rails, floorpans, inner door panels, and shock towers.

Prepainted steel, developed by the steel coil coaters, is a new product that allows the automotive industry to avoid the expense of postpainting the auto parts. Currently, prepainted steel is used in automotive parts such as valves and oil-pans, however, its applications could be extended to include outer body panels. This would require overcoming harm to the coating during welding and forming operations through advances such as welding pins on the back of panels that do not penetrate the coating on the front. The coil coating industry is testing metals that combine coil coating with electro-galvanizing and zincrometal processes to increase corrosion resistance. 2/ Coil coating industry representatives have indicated that use of these metals, which could be available in volume as soon as they are proven cost effective, will enable the automotive industry to produce a 10-year car. Coil-coaters have indicated that successful automotive use of prepainted coils requires cooperative engineering and design between coil-coaters, steelmakers, and the automobile industry.

The 1986 Honda Accord, produced in Marysville, OH, uses high-strength sheet steel (37,000 per square inch yield) for the fenders, hood, and deck-lid

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1/ Hi Howard, "Auto Sales Dip Worries Industry," American Metal Market, Mar. 5, 1987, p. 12.

2/ Andrew Collier, "Parts Design Vital for Automotive Pre-Painted Steel," American Metal Market, Mar. 5, 1987, p. 6.

outer panel. The stronger steel permits reducing gage thickness to a narrower gage than that used by U.S. automakers. Zincrometal and galvanized sheet is used on some, but not all body parts. The primary means for inhibiting corrosion of parts made from noncoated steel is the use of high-build E-coat (corrosion protection) and wax-injection systems. 1/

The United States Steel (USS) division of USX Corp. has been developing a plastic-coated steel that can be used for gas tanks. Terne sheet, a steel-based metal coated with lead is currently the material used to make gas tanks. The disadvantage with using terne sheet is that it is susceptible to corrosion from gasoline with a high methanol content. USS is also working on new side-impact bars made from strips of steel instead of steel stamping or roll-formed steel. Weight reduction and cost reductions are the primary advantages of this new product. 2/ Additionally, the steel industry is developing laminates, which are sheets of plastic sandwiched between two thin sheets of steel, for automotive applications such as air cleaner covers, oil pans, rocker covers, floor pans, and other underhood applications. 3/

Hybrid assemblies foreseen by the auto industry in future production include hoods, doors, and trunk lids that would have plastic inner structures covered by a steel skin. The plastic structure would reduce the vehicle's weight, and the steel skin would maintain smooth surface characteristics.

With respect to the Japanese industry, a Japanese industry spokesman indicates that the key to successfully competing with the world's automakers lies in developing and applying new materials for car production. This means that Japanese auto producers will continue to pursue technical innovations in new kinds of steel, plastics, metallic products, and other new materials. Steel is currently the predominant material used in car production in Japan, accounting for 76 percent of total materials content. Within the past decade, demands for cost reduction, however, have led to changes in materials composition of automobiles (table 9-2). In forged steel applications, demands for cost reduction prompted the shift from high- to low-mixture alloys or carbon steel, followed by molybdenum to boron steel in order to conserve on raw material costs. A growing demand for high performance materials resulted in the development of high-intensity and low-distortion steel. Concerns about safety measures and fuel cost reduction prompted the development of high-tensile steel. Although high-tensile steel is costly, the production of thinner and lighter plates limits overall cost increases in automotive applications. Japanese automakers view the future of high-tensile steel applications as focusing on the underside and structural parts rather than the outer parts. 4/

1/ "'86 Vehicles Rely on Coated Steels," American Machinist & Automated Manufacturing, April 1986, p. 94.
2/ Gloria T. LaRue, "More Steel-Plastic Parts in Autos Will Be Developed, USS Exec Says," American Metal Market, Apr. 20, 1987, p. 1.
3/ Ibid.
4/ Sakura Suzumoto, "Trend of Automobile Parts and New Materials," Digest of Japanese Industry & Technology, No. 215, 1986.

Table 9-2
Trends of ratio of materials used in compact cars produced in Japan

(in percent)

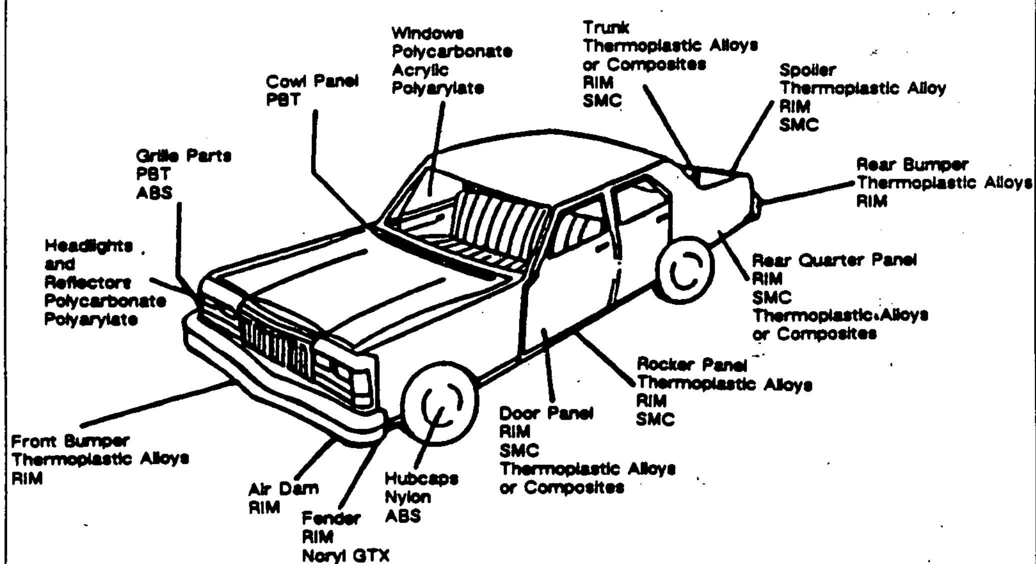
		1973	1977	1980	1983
	Pig iron	3.2	3.2	2.8	2.2
Ordinary steel	Hot rolled light steel sheets	6.9	7.1	6.9	7.6
	Hot rolled medium steel plates	7.6	7.7	6.8	6.4
	Cold rolled light steel sheets	38.9	37.9	33.8	29.4
	High tensile steel plates	-	0.5	1.4	4.1
	Galvanized steel plates	-	3.8	5.7	5.5
	Other surface treated steel sheets	-	0.6	1.4	2.3
	Steel pipes	2.3	2.2	2.3	2.3
	Others	4.7	1.8	2.2	1.9
	Total	60.4	61.6	60.5	59.5
Special steel	Carbon steel	7.9	6.8	6.1	6.0
	Alloy steel	5.6	4.6	3.8	3.6
	Free cutting steel	-	0.7	1.0	1.0
	Bearing steel	1.2	0.9	0.9	0.9
	Spring steel	2.2	2.0	1.5	1.5
	Stainless steel/heat resistant steel	0.4	0.9	0.9	0.9
	Others	0.2	0.2	0.5	0.4
	Total	17.5	16.1	14.7	14.3
	(Total of steel)	81.1	80.9	78.0	76.0
Nonferrous metals	Electrolytic cathode copper	1.0	0.9	0.8	0.9
	Lead base alloys	0.6	0.6	0.8	0.6
	Zinc metal	0.5	0.5	0.3	0.4
	Aluminium metal	2.8	2.6	3.3	3.5
	Others	0.1	0.1	0.4	0.2
	Total	5.0	4.7	5.6	5.6
Non metal	Paint	2.1	1.6	1.8	1.7
	Rubber	4.8	4.3	3.7	3.5
	Asbestos	0.1	0.1	0.1	0.1
	Glass	2.8	2.7	3.1	3.2
	Phenolic resins	0.1	0.1	0.1	0.2
	Polyurethane resins	0.5	0.5	0.8	0.9
	Polyvinyl chlorides	0.9	1.1	1.4	1.7
	Polyethylene resins	0.2	0.2	0.4	0.4
	Polypropylene resins	0.5	0.5	0.9	1.2
	ABS resins	0.4	0.7	0.5	0.5
	Miscellaneous resins	0.3	0.4	0.6	0.8
	(Synthetic resins total)	(2.9)	(3.5)	(4.7)	(5.7)
	Fibers	-	0.7	1.2	1.3
	Others	1.2	1.5	1.8	2.9
	Total	13.9	14.4	16.4	18.4
	Grand Total	100.0	100.0	100.0	100.0

Source: *Digest of Japanese Industry & Technology*, No. 226, 1986.

Plastics Industry

The plastics industry has grown and developed rapidly in response to demands from auto and automotive parts producers for the replacement of conventional material. Total consumption of plastics in automotive parts is predicted to grow from the current 458 million pounds, to 792 million pounds in 1991, and to 1.1 billion pounds in 1996, or by 140 percent overall. 1/ Domestic automotive parts producers increasingly appear to be turning to plastics in the form of advanced polymer composites as a substitute for steel in large part auto applications and in smaller parts and components (fig. 9-2).

Figure 9-2
Plastic content in exterior automobile bodies



Source: *Automotive News*, July 27, 1987, p. E40.

1/ "A Question of Survival," Automotive News, Mar. 23, 1987, p. E14.

Consideration of corrosion resistance, weight savings, surface quality, benefits from lower tooling and manufacturing cost, part consolidation, and adaptability to design and styling variations have prompted the automotive parts producers to seek additional uses for plastics. A primary benefit from the use of plastics is a significant reduction in the cost of production. Plastic parts can be made in such a way that doesn't require part-mold curing or secondary operations, such as sanding, deflashing, and filling. Moreover, auto manufacturers are seeking to create assemblies that take the place of several parts, not just a one-for-one exchange with steel.

Consequently, plastics suppliers are focusing on analyzing vehicle needs, choosing product advantages to meet the needs, testing products, and providing and testing prototypes. However, problems remain to be solved in the manufacturing and processing area, including developing faster mold times and more accurate injection machines, and in product functionality. The manufacturing process for large plastic auto components--injection molding and subsequent milling--is less expensive than that for conventional stamping presses and assembly lines. Although automakers can save approximately $250 per car at current labor rates using plastic skins, the production time required to produce a plastic shell (three to four minutes) compared with stamping a metal part (1 to 2 seconds) has made it impractical to use plastic shells on anything other than limited production models, according to the industry. Domestic automakers say that for plastic bodies to be cost effective in large volume assembly, the production time for plastic bodies needs to be reduced to at least one minute. 1/

A technological breakthrough in plastics that will give U.S. automakers and auto parts producers a competitive edge over their Asian and European counterparts was announced in the fall of 1986 by a U.S. plastics company. The firm has developed a high-productivity system that enables plastic sheet-molding compound (SMC) to be processed into parts such as grill-opening panels at assembly line speeds that are competitive with steel processing. This new 1-minute per part system is expected to save automotive and automotive parts producers tens of millions of dollars in the production of plastic parts and components. 2/

Plastics that have been developed and used successfully in the automotive industry include thermosets and thermoplastics. Thermosets, which include sheet molding compound and reaction injection molding (RIM), are formed in a press. Thermosets are structurally rigid and can withstand high temperatures in paint ovens. Because they are made primarily of limestone and sand, thermosets are not affected by the fluctuations in the price of crude oil on the world market. Thermosets, however, cannot be recycled and, when melted, degrade into a useless tar-like material.

Thermoplastic composites are reinforcing glass fibers embedded in a matrix of low-cost plastic resin. Thermoplastics are lightweight, easy to process, very flexible, able to be remelted for reuse, better at withstanding impacts than thermosets, and expected to be as durable as steel. The principal disadvantage is that they are not capable of withstanding the high

1/ Warren Broen, op. cit.
2/ "Part-a-Minute Plastic Challenges Steel," Automotive News, Oct. 20, 1986, p. D16.

temperatures of paint ovens. Thermoplastics are predicted to replace thermosets in automotive applications, and indeed, that is their primary marketing goal, according to automotive industry engineers.

Since plastic materials (thermoset and thermoplastic) are currently more expensive on a dollar-per-pound basis than mild- and high-strength steel, the plastics industry faces a challenge to develop materials that are cost competitive with steel. Carbon steel sells for about 30 cents to 40 cents per pound, and high-strength steel sells for 40 cents to 50 cents per pound. The least expensive polyester for sheet molding compound, bulk molding compound and thick molding compound formulations sells for 65 cents a pound. Higher performance thermoplastics cost $1.15 per pound for acrylonitrile butadiene styrene, $1.35 for polypropylene or polyethelene-based resins, and $1.85 per pound for either nylon or polycarbonate. 1/

Accordingly, research and development of cost-competitive automotive applications for plastics is increasing. Although plastics companies have been making resins for automobile parts for a number of years, DuPont Co. has developed Alcryn, a thermoplastic rubber that looks, feels, and recovers like vulcanized rubber. Alcryn is being tested by automakers and aftermarket suppliers for use in luggage rack rub strips, gear shift boots, and knobs, seatbelt sleeves, gas cap gaskets, steering wheel covers, hoses, body side moldings and truck wheel-hub seals. 2/ DuPont Co.'s Beloxy Automotive Engineering Resin Division opened its Worldwide Automotive Development Center in Troy, MI, in 1986 for application development of engineering polymers and to provide technical service to the automotive industry. DuPont predicts that by 1991, the largest automotive applications for engineering plastics will be exterior body panels, wheels, frame components, bumpers, fuel tanks, flush window mountings, and other interior underhood applications. 3/

DuPont has developed a plastic gas tank made of Selar Barrier resin with a nonpermeable skin of polyethelene. The gas tank passed GM's tests, and is expected to be used on automobiles in the 1990's. DuPont has a total of eight resins it has been developing for plastic automobile parts. 4/

Monsanto Chemical Co., which will soon have an automotive support facility in Detroit has developed various kinds of plastics whose potential applications include garnish moldings, carpet retainers, interior window trim, mirror housings, lamp rings, drip rails, fender skirts, and rear-wheel louvers. Additionally, U.S. and European automakers are evaluating the company's Santoprene rubber as a replacement material for components of automotive ignition wire assemblies. 5/

1/ "Automakers May Boost Use of Plastics," The Journal of Commerce," July 15, 1987.
2/ "DuPont Plastics," Automotive News, Mar. 23, 1987, p. E19.
3/ "Key Plastics Suppliers Still Firm on Composite Body Panels," Ward's Automotive Reports, July 14, 1986, p. 221.
4/ Robert Hilsdorf, "Plastics Said Gaining on Steel as Auto Panel Material," American Metal Market, Apr. 27, 1987, p.7.
5/ "Monsanto Santoprene," Automotive News, Mar. 23, 1987, p. E18.

Celanese Engineering Resins, Inc., recently opened a new automotive research and development center in Detroit, MI. Material processing, injection molding extrusion, and materials testing will be conducted at the center, in addition to prototype production of automobile parts. Celanese began field tests in 1986 on auto parts made from its thermoplastic resin Vandar. Potential applications for Vandar include components such as rear bumpers, fenders, body panels, spoilers, clips, and fasteners. 1/

Adzel, a joint venture formed between General Electric and PPG, is involved with developing new thermoplastic composites replacing steel for automotive use. The new thermoplastic composite will feature a smooth, steel-like finish that can withstand high oven temperatures needed for auto enamels. This plastic is being used in 1987 Buick LeSabre T-type front fenders and by Nissan in Japan, where it is being used on front fascia and rear bumpers. 2/ GE said it has performed engineering work on an all-plastic body, low-volume specialty car for one automaker and is involved in the design of a plastic-paneled sedan.

The Ford Aerostar models featured polycarbonate polyester alloy bumpers, polyethelene fuel tanks, nylon air cleaners, and polycarbonate headlamp covers. Other plastic components include the brake reservoir and inlet/outlet tanks for the radiators.

Polycarbonate bumpers were also employed on Ford's Taurus and Sable cars. First introduced in the United States in the fall of 1983 on certain Ford Escort models, these bumpers are about 35 pounds lighter in weight than comparable steel bumpers. The Taurus and Sable models employ nylon fuel lines for greater resistance to corrosion and plastic sheath buckles in place of metal units on the seat belts. The 1986 Taurus/Sable station wagons also use plastic rear load floor/seatback panel assemblies. Chrysler's 1986 Dodge models and Chevrolet's A-body Celebrity models feature new soft bumpers. Also, Chrysler's Jeep Commanche pickup truck features a front-end panel weighing approximately 8 pounds.

General Motors has announced that it is painting thermoplastic fenders for the Buick LeSabre T-Type on the assembly line. This is the first instance in North America of a thermoplastic being treated "like steel" on an assembly line. Plastics and auto industry officials have said that assembly line painting is critical for advanced materials to replace steel on autos. Although there are a few exterior body panels made from RIM and SMC being painted online, this is the first time an injection-molded thermoplastic piece has been able to withstand the 375 degree Fahrenheit temperature that occurs on the assembly line when parts are subjected to ELPO, an anticorrosion process. 3/

GM's decision in 1986 to put its GM-80 program on hold dealt a serious blow to plastics producers. The GM-80, originally scheduled for 1990's production, was the industry's first attempt to use plastic bodies in

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1/ Angela King, "Celanese Opening Car R&D Unit," American Metal Market, Apr. 13, 1987, p.5.
2/ "Adzel Reinforcing The Composites Market," High Technology, February 1987, p. 12.
3/ Robert Hilsdorf, "GM Painting Thermoplastics on Line," American Metal Market, June 1, 1987.

high-volume production cars. The program would have converted the Chevrolet Camaro and Pontiac Firebird to front-wheel drive, plastic-bodied cars. The production schedule was temporarily halted because of the difficulty in switching to front-wheel drive and technical difficulties with the plastic body construction, according to GM officials. The high cost of the car (approximately $20,000) was also a significant factor. 1/ GM also cancelled its GM 98 project in the fall of 1987, which was to convert 2 high-volume car lines from steel to plastic skins in the 1990's. Chrysler cancelled its Genesis project aimed at developing high-volume plastic-bodied cars, and disbanded its composite vehicle materials engineering group. Chrysler's decision was based on such factors as economics, resistance to change, and familiarity with conventional materials. 2/ The production of plastic-skinned Pontiac Fieros and Corvettes is scheduled to continue along with a new GM 200 plastic-skinned minivan. No other U.S. automaker has plans to introduce a plastic-bodied vehicle over the next 5 years.

Motor Wheel Corp., a U.S. company, has recently developed a fiberglass-reinforced thermoset resin wheel for cars that meet or exceed industry standards on fatigue. 3/

Chrysler will use an all-plastic clutch master and slave cylinders on a 1988 vehicle, according to industry sources. This will be the first time all-plastic master and slave cylinders will be used. The units are reportedly compact, are a fraction of the weight and cost of conventional cast cylinders, and solve cylinder porosity problems through the use of plastic. 4/

Because plastic components are light and generally bulky, it is costly to ship them overseas. Industry observers point out that these factors are likely to affect the level of imports from Japan. Additionally, a U.S. auto industry representative indicated that the United States has a significant lead over Japan in developing structural composites for automobiles. Although competition arising from imports of automotive parts from Japan is being monitored, Japanese auto manufacturers and suppliers have increased their commitment to U.S. facilities. 5/

Japanese manufacturers of the 2 million passenger cars and light trucks that are projected to be built in the United States by the early 1990's could purchase almost 400 million pounds of plastic resin and 140 million pounds of elastomer, according to industry observers. Because their manufacturing/supplier relationship is characterized by a high degree of loyalty and long-term relationships, it is most likely that Japanese auto manufacturers will seek suppliers who exhibit these same characteristics. 6/ It also has been

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1/ "Buick Boosts Plastics Use," Automotive News, Mar. 9, 1987, p. 27.
2/ Al Wrigley, "Chrysler Halts High-Volume Plastics Push," Automotive News, Sept. 21, 1987, p. 1.
3/ "Plastic Car Wheels From Motor Wheel," Automotive News, Apr. 20, 1987, p. E8.
4/ "Plastic Clutch Cylinders Near," Automotive Industries, July 1986, p. 8.
5/ "Plastic Products Division: 'Our Vision is That We'll Grow Through Diversification'," Automotive News, Dec. 29, 1986, p. D22.
6/ "Slicing the New Plastic's Pie," Automotive Industries, July 1986, p. 15.

suggested that the Japanese will exert pressure on Japanese auto parts suppliers to invest more heavily in U.S. facilities, to the extent that the Japanese original equipment manufacturers will insist that Japanese suppliers in Japan and Korea must also produce auto parts in the United States. 1/

Although U.S. auto parts producers are facing competition from shifting parts facilities to the United States, joint ventures between U.S. and Japanese companies have been formed to develop and market thermoplastic compounds. Exxon Chemical Co. and Mitsubishi Petrochemical Co. formed a joint venture to develop and market thermoplastic components for use in injection-molded automotive components made in the United States. 2/ Exxon will provide polymer production capabilities, and Mitsubishi will provide blending and compounding technology to produce automotive specialty interior and exterior applications. The joint venture will supply Japanese-owned vehicle plants in the United States first, then target GM, Ford, and Chrysler next. 3/

Nissan Motor Co. has developed, in conjunction with General Electric Co., a thermoplastic resin that will be used in lighter body panels in autos, replacing conventional steel for front fenders and front and rear body panels. The material, called Polyamide Modified PPo Alloy, will comprise 25 percent of the car's body, and is 25 percent lighter than automotive sheet. 4/ The future of the auto parts industry lies in the cooperation between the automotive, steel, and plastics industries. Many U.S. producers responding to the questionnaire indicated that in the near future steel will be the material of choice, and it will be at least 1995 before plastics will have a competitive impact on the industry. The balance of steel versus plastics will depend on the improvement of steel qualities and formability and on the tooling process. No massive substitutions for steel in automotive parts is foreseen, according to steel industry observers. Rather, substitution of hybrid auto components, part steel and part plastic, that would replace all steel parts, is projected.

Industry sources state that unless the cost difference between U.S. and Japanese vehicles is narrowed, it is predicted that the U.S. automakers' share of the domestic market will drop from 70 percent in 1985 to 50 percent in 1995, and Japan's will rise from 25 percent to 42 percent. 5/ Automakers are following two paths, evolutionary (1985-90) and revolutionary (1990-95), to narrow the cost gap. The development of new materials figures prominently in both strategies. The evolutionary stage calls for improvement in current facilities to improve quality, productivity, efficiency, and to cut costs. During this phase, automakers' planning and execution of most vehicle programs must be accomplished in existing facilities with existing manufacturing

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1/ "Asian Firms Seen Growing in American Plastics Sales," Automotive News, June 9, 1986, p. 26.
2/ "Exxon Unit, Mitsubishi Form Polymer Venture," Journal of Commerce, Feb. 11, 1984.
3/ "Composite Materials Plant for U.S.," Ward's Automotive Reports, Dec. 29, 1986, p. 413.
4/ "Nissan to use New Resin to Replace Heavier Metal Body Panels," Automotive News, Oct. 6, 1986, p. 51.
5/ Jack Walsh, op. cit., p. 16.

methods. The revolutionary phase begins with the implementation of drastic changes that provide innovative technology to reduce costs and improve quality further. 1/

Aluminum Industry

In 1976, the typical passenger car built in the United States contained approximately 86 pounds of aluminum, primarily in the engine and transmission. By contrast, the typical automobile in 1986 uses an estimated 140 pounds, and by 1991, an increase to 145 pounds is likely. 2/

Propelled by advantageous properties, new fabrication techniques, and the trend to reduce weight, which arose from energy concerns, aluminum has made in-roads into the auto component markets once held by iron and steel. The most promising applications lie in the cast, forged, and extruded components used in power trains, drive lines, wheels, and suspension systems.

The single-tube aluminum driveshaft produced by Ford for the 1986 Aerostar is the first high-volume (160,000 units per year) aluminum driveshaft in the world. Weighing 11 pounds (8 pounds less than similar steel units), the driveshafts are reportedly relatively free of imbalance and vibration problems common to steel units and less expensive than steel driveshafts, according to Ford engineers. 3/ In addition, aluminum driveshaft may also replace some glass/graphite fiber units and steel units in Ford's rear-drive vehicles.

In radiators and other auto heat exchangers, the replacement of copper/brass by aluminum is already underway, and it is probably only a matter of time before all automotive heat exchangers are made of aluminum. Aluminum brazing, which produces a joint as strong as materials being joined, has an added advantage of resistance to corrosion. 4/

Aluminum's ability to be cast into more intricate shapes with thinner walls than iron, better thermal conductivity, and its offering of equivalent strength at 40 percent of its weight, points to the future replacement of cast iron by aluminum in automotive intake manifolds, according to a spokesman for the foundry industry. 5/

New engine applications for aluminum are also underway, including cylinder heads weighing approximately 20 pounds, and blocks weighing 35 pounds or more. For example, GM has aluminum cylinder heads planned for its 2.8-liter V-6's, 2.0-liter 4-cylinder units, and the new 16-valve 2.3-liter engine due out in 1987. Additionally, the 1.9-liter Saturn 4-cylinder engines will use aluminum heads and blocks, and Pontiac's 2.4 "Manhattan" may contain integral block/head castings of aluminum. 6/

1/ Ibid.
2/ Ibid.
3/ Al Wrigley, "Substitute Materials Gain More Ground in '86 Models," Ward's Automotive Yearbook, 1986, p. 25.
4/ "A Closer Look at Aluminum," Automotive News, Apr. 20, 1987, p. E22.
5/ Ibid.
6/ Al Wrigley,"Materials Mix," American Metal Market, Apr. 7, 1986, p. 5.

The largest aluminum component to appear in 1986 was the housing or case for Ford's new 4-speed automatic AXOD transmissions. The cases, weighing 28.5 pounds after machining, are supplied by Ryobi Ltd. of Japan, Doehler-Jarvis Division of Farley Industries, and GM's central foundry division.

The new aluminum Postal Service Long Life Vehicle, designed by Grumman Olson, a body manufacturer, weighs one-half as much and is expected to last three times as long as a steel body. Although aluminum truck bodies are usually painted only on the outside, this vehicle is painted throughout the all-aluminum body. The only plastic used is contained in the heater, air-intake and distribution unit, and instrument panel.

Automakers are working to develop an all-aluminum or part-aluminum body for passenger cars for commercial application by the 1990's. Recently, West German automaker Audi AG and Aluminum Corp. of America (Alcoa), jointly built and tested an aluminum body, joined by a combination of riveting and adhesive bonding. The aluminum spaceframe uses a new die-casting process to produce aluminum extruded tubing that is connected by glue. The die-casting process simplifies production of structural components, and reduces the number of separate body parts from about 400 to 75. The spaceframe will result in a weight savings of 260 pounds through the replacement of 660 pounds of aluminum, resulting in a net savings of 500 gallons of fuel over the vehicle's lifetime. 1/

Another application for aluminum are wheels that are fabricated into one piece by impact extrusion (used in the Aerostar van), and wheels that are split-spun. Both wheels weigh less than comparable steel or cast aluminum wheels, and are more resistant to corrosion than steel wheels. The split-spun wheels are shaped from an aluminum disk into a wheel on a computer-controlled hydraulic spinning machine in 90 seconds. 2/

CNG Cylinder Corp., a subsidiary of Alcoa, has developed an aluminum composite fuel tank for compressed natural gas as a fuel source for cars. Weighing one-half as much as the customary steel gas tank, the aluminum composite features greater capacity and strength of material. 3/

The use of aluminum in Japan is expected to increase, even to exceed plastic parts in automotive components. Although aluminum is expensive in Japan, a relatively large volume of aluminum is used in parts such as cylinder heads and intake manifolds.

Other Industries

Effects on other industries such as adhesives, textile, magnesium, glass, and ceramics are significant as R&D increases in these areas and rapidly developing technology encourages materials shift.

1/ Gloria T. LaRue, "Spaceframe for Autos R&D Target at Alcoa," American Metal Market/Metalworking News, Nov. 10, 1986, p. 18.
2/ Ibid.
3/ Ibid.

The automotive applications for adhesives, both as replacements for welding and first-choice agents for joining metal and plastic parts, is expected to increase rapidly from approximately $17 million annually in 1986, to $80 million annually by 1992. 1/ The current market for adhesives for bonding components, such as windshields, is worth about $30 million. 2/

Adhesives are used to either supplement or replace conventional welding, and sometimes are preferable to spot welding because welded joints tend to break in service. Adhesives provide advantages of better corrosion resistance and load distribution, and may be preferred in applications where it is difficult for welding apparatus to gain access to the joint.

Examples of adhesive use include reinforcement brackets for the floor pans of the N-body Oldsmobile Calais, Buick Somerset, Buick Skylark, and Pontiac Bonneville cars. 3/ Additionally, Bertone and Aluminum Co. of Montreal have begun work on a project to create an all-aluminum car chassis that is glued instead of welded. 4/

An elastic polyester textile for automobile seatbacks, which works as a spring, has been jointly developed by Honda Motor Co. and DuPont Japan Ltd. The seatback is made by covering a steel frame with the textile, which is covered by a urethane case and vinyl or cloth upholstery. Although more expensive than conventional steel springs, the use of less urethan and other materials results in a weight cut by 1 kilogram and a 10 percent reduction in total cost for the complete seat. 5/

Magnesium alloys appeared in the 1986 Ford Aerostar clutch housing and brake-and-clutch pedal support brackets, supplied by Global Die Casting Inc. 6/ Dow Magnesium has recently developed a magnesium engine block for racing cars that weighs only 226 pounds, a 95-pound weight savings over conventional cast iron racing engines. The sand-cast, 3.0 liter, four-cylinder block generates 312 horsepower. It will be marketed by Pontiac Motorsport. 7/

The Aerostar makes use of wood fiber substrate materials in the interior trim and on the doors and quarter panels. Nylon-coated galvanized steel center floor track assemblies are used in the same vehicle for sliding side doors. 8/

The new "Insta Clear" windshield glass developed by Ford's Glass Division is an available option in Ford's Taurus and Sable cars. The windshield is

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1/ Al Wrigley, "Auto Market for Adhesives Expected to Quadruple," American Metal Market/Metalworking News, Nov. 10, 1986, p. 9.
2/ Ibid.
3/ Ibid.
4/ Automotive News, "Aluminum Car Chassis That's Glued Together?," p. 56.
5/ "Honda-DuPont Venture Develops Car Seatback Without Springs," Automotive Parts International, Feb. 13, 1987, p. 8.
6/ Al Wrigley, "Substitute Materials Gain More Ground in '86 Models," Ward's Automotive Yearbook, 1986, p. 25.
7/ "Pontiac Motorsports to Market Dow Magnesium Engine Block," American Metal Market, Mar. 5, 1987, p. 4.
8/ Al Wrigley, "Substitute Materials Gain More Ground in '86 Models," Ward's Automotive Yearbook, 1986, p. 27.

composed of a silver and zinc oxide coating, 100-billionths of a meter thick, applied to the inner surface of one of two sheets of glass sandwiched together. A thicker band of silver applied around the perimeter of the windshield is connected by wires to the car's alternator and acts as an electrical conductor. The windshields are capable of removing one-tenth of an inch of frost within 2 to 3 minutes at a temperature of $0^{o}F$ without using windshield wipers. 1/

Ceramics' use in automotive engine components is being examined by automakers the world over. New ceramics for vehicle use are composed of silicon and other traditional ceramic ingredients combined with carbide polymers alumine and other materials. The advantage of advanced ceramics for engine applications include extreme hardness, low density, high melting points, high corrosion resistance, lightweight, and good mechanical properties at high temperatures. The principal problems of ceramics include its brittleness (it is about 100 times more brittle than steel) and its characteristic for sudden and catastrophic failure. Other difficulties include reducing the cost of production through economies of scale, and gaining consumer preference. 2/

Ceramics are well suited to engines because they allow the compression and expansion of gases without the loss of heat or engine damage and improve fuel efficiency and emissions control. Because ceramics do not transfer heat, a ceramic engine would not need a cooling of the lubrication system, and, in fact could be radiatorless by 1995. 3/

Current use of ceramics in domestically produced engines include port liners, precombustion chambers, and rotors for turbochargers. Subsystems such as all-ceramic valve trains, which weigh less and can outperform their metal counterparts, are said to be about a decade away, as is a full ceramic-engine design. 4/

GM will incorporate ceramic materials in the engine of its 1991 Camaro/Firebird. Nissan announced in 1985 an upcoming sports car containing a ceramic turbocharger rotor, and Isuzu will introduce an automotive diesel with ceramic-coated components by 1990. 5/

The use of ceramics is expected to gradually increase, and by 1990, the content per vehicle could reach $10 and exceed $56 by 1995. 6/ The total market for ceramic parts in diesel and advanced gas-turbine engines is expected to amount to $90 million by 1990, and rise to $460 million by 1995. 7/

Japanese caremakers are currently the world leaders in the development of ceramic engine technology, and are expected to maintain that lead. Spurred on

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1/ Ibid.
2/ "Are Ceramics Worth Their Mettle?," Automotive News, May 11, 1987, p. E30.
3/ "Cenedyne Predicts Ceramics to Bow on Multi-Valve Engines," Automotive News, Dec. 15, 1986, p. 397.
4/ "Engines," Automotive News, Dec. 15, 1986, p. 397.
5/ Ibid.
6/ "Are Ceramics Worth Their Mettle?" Automotive News, May 11, 1987, p. E30.
7/ Scott Miner, "Japanese Said to Lead in Auto Ceramics R&D," Automotive News, Aug. 4, 1986, p. 64.

by its stronger demand for small-displacement, high-rpm, fuel-efficient, high-performance engines, Japan spent about $50 million in R&D for ceramics in 1984, compared with $30 million spent by the United States. 1/ The U.S. market for ceramic engines could grow to about $100 million in 1990 (providing an additional $35 billion in the gross national product and 245,000 more jobs) and to about $1.3 billion by the year 2000. 2/ In order to gain an increasing share of this growing market and to surpass Japan as the world leader in ceramics technology, the U.S. industry needs to concentrate R&D efforts on increasing the commercialization of advanced ceramic products, according to a ceramics industry representative. 3/

1/ Scott Miner, "Japanese Said to Lead in Auto Ceramics R&D," Automotive News, Aug. 4, 1986, p. 64.
2/ Matt Delorenzo, "Use for Ceramics Turned First Step Toward Leadership," Automotive News, June 22, 1987, p. 30.
3/ Ibid.

CHAPTER 10. IMPLICATIONS OF THE U.S. AUTOMOTIVE PARTS INDUSTRY'S COMPETITIVE POSITION

The U.S. automotive parts industry is undergoing a restructuring process that is resulting in a streamlined, more competitive industry. The Assistant Secretary for Trade Development of the U.S. Department of Commerce stated that U.S. parts firms have accepted the growing challenge from Japanese parts makers and can produce high-quality, competitively priced automotive parts. 1/ The Automotive Parts and Accessories Association (APAA) claims that independent studies show, and Japanese original-equipment manufacturers know, that there are highly competitive U.S. manufacturers in every single product category. 2/

Under the threat of losing customers, many U.S. parts makers have developed improved production controls in recent years. For example, a Portland, ME, plant of Parker Hannifan Corp.'s Nichols Group supplied over 1.6 million oil-pump parts for the Ford Escort without a single reject. "Yesterday, we might have referred to this as unbelievable," said the group President. "Today, it's that or don't compete." 3/

Other U.S. parts firms believe that they are ready to sell in the Japanese market. A window part designed by Sheller-Globe (Toledo, OH) for Nissan U.S.A. "was better than we could get in Japan," said the President and Chief Executive Officer of Nissan Motor Manufacturing U.S.A. He added, "I think it will (also sell) in Japan." Encouraged by such progress, about 23 U.S. companies now have offices in Japan, according to the Motor & Equipment Manufacturers Association's (MEMA) Tokyo office, which opened in June 1987. 4/

Indeed, data provided by the Japanese Automobile Manufacturers Association (JAMA) show that U.S. suppliers increased their sales of parts to Japanese automobile manufacturers and their U.S. companies during the 1985 and 1986 Japanese fiscal years (table 10-1). JAMA also noted that 807 U.S. parts makers were selling to Japanese automakers in April 1987 and that Japanese automakers had ordered 118 prototype/sample items for the purpose of importing from U.S. suppliers during August 1986-July 1987. 5/

Many U.S. parts makers have been able to markedly improve their competitive position in a very short period of time. In 1985, New United Motor Manufacturing Inc. (NUMMI) reported that their U.S. suppliers had six times more defective parts than did the auto producer's Japanese suppliers. In 1987, NUMMI's rejection rate for domestically produced parts is about equal with that of Japanese-supplied products. 6/

1/ Transcript of the hearing, p. 7.
2/ Ibid, p. 115.
3/ "U.S. Parts Makers Just Won't Say 'Uncle'", Business Week, Aug. 10, 1987, p. 76.
4/ Ibid.
5/ Unpublished documents supplied by the U.S. Department of Commerce, August 1987.
6/ Transcript of the hearing, pp. 142-143.

Table 10-1
Automotive parts: Japanese automakers' purchases of selected U.S.-produced products, Japanese fiscal years 1985-86 1/

(In thousands of dollars)

Item	1985	1986
Engine parts	205,830	238,507
Chassis and drive train parts	187,852	205,542
Body parts	396,367	775,955
Electrical/electronic parts	684,518	916,230
Accessories	76,046	106,542
Materials	175,883	246,659
Total	1,726,496	2,489,435

1/ The Japanese fiscal year ends March 31.

Source: Japanese Automotive Manufacturers Association.

Other Japanese-owned automakers based in the United States acknowledge improvement in U.S. quality; however, they still cite the need for decreasing the number of defective parts. In 1986, Honda rejected 0.817 percent of U.S.-supplied parts, compared with less than 0.5 percent from Japanese parts makers, according to Honda of America's purchasing manager. Nissan is rejecting 1 to 2 percent of the U.S.-produced parts it purchases, compared with less than 1 percent of the Japanese products, stated the vice president of product control and purchasing at Nissan U.S.A. 1/ In addition, JAMA relates that efforts by Japanese automakers to buy parts from some U.S. companies unfamiliar with their requirements have ended in frustration. 2/

JAMA notes that U.S. automakers are now trying to implement just-in-time (JIT) delivery (see p. 7-15) with increasing success, as reflected in decreasing inventories in relation to sales. Many U.S. parts makers are adjusting by opening satellite plants and often linking their operations to those of their customers by computer. 3/ Further, a number of U.S. producers responding to the Commission's questionnaire emphasized corporate objectives that included reductions in finished goods inventories and "goods in process" inventories.

JAMA also cites the trend in the United States toward greater reliance on suppliers for R&D support. Many U.S. parts makers are increasing their engineering support in recognition of the need to improve product quality and develop new technologies in order to meet Government regulations, cut costs, and build cars that will satisfy consumer demand. 4/

1/ Bryan Berry, Metalworking News, June 15, 1987, p. 13.
2/ Transcript of the hearing, p. 199.
3/ Prehearing brief, JAMA, pp. 28-29.
4/ Prehearing brief, JAMA, pp. 31-32.

U.S. Industry Responses to Competitive Developments

The U.S. parts makers that focus on the basic issues (reducing costs, improving quality, and increasing participation in product R&D, design, and flexible delivery systems) will be best prepared to survive the 1990s and to be part of a U.S. industry comprised of larger companies with smaller (150 to 300 employees), more flexible units within each company. Further, respondents also indicated that many U.S. producers must reevaluate their management practices in order to remain competitive in future years. One major U.S. automaker stated that Japanese suppliers have effectively reduced the layers of management and lowered production-to-staff ratios. Arthur Andersen & Co.'s 1987 survey of the auto industry reported that management practices and a well-defined management system were identified by 89 percent of North American vehicle manufacturers and 66 percent of North American parts suppliers as a major competitive advantage for Japanese-owned parts firms. 1/

Many respondents stated that U.S. firms must also better understand and incorporate certain Japanese business practices. The president of Variety Stamping Corp., notes that Japanese automakers typically provide an explicit timetable that outlines a supplier's every step from initial award to mass production. Suppliers once considered outside of the process now are required to become involved in preproduction meetings and seminars, indicated the official. In addition, he emphasized that the Japanese scrutinize management philosophy, explaining that they "want to see a good working relationship with employees so they can introduce change and new training procedures." 2/

Better management/labor relations.--The U.S. parts industry must also adjust labor relations smoothly in parallel with increased investment in new technology. Greater computer automation on the production floor and emphasis on improving productivity will often depend on relaxed work rules, retraining workers to improve skill levels, and wage packages that could include reduced wage rates and benefits, but with increases tied to either personal or company performance. Further, employees will become more productive when working with more efficiently designed equipment; thus, fewer workers will be needed to manufacture the same quantity of auto parts. In addition, one U.S. automaker responding to the questionnaire also emphasized the need to make better use of the salaried workforce and to reevaluate compensation programs.

Customer relations.--Changes in the U.S. industry will bring about different ways of doing business. For example, Milwaukee-based Johnson Controls Inc. operates 10 plants for the production of auto seats and trim near its major customers, including Toyota, Honda, GM, and Ford. These operations are run "Japanese style"; i.e., as separate units dedicated to a single customer. 3/

1/ Arthur Andersen & Co., Cars and Competition: Management Challenges, July 1987, p. 28.
2/ Barbara Weiss, "Japan Auto Transplants Look For 'Kaizen' in U.S. Suppliers," Metalworking News, June 8, 1987, p. 34.
3/ "U.S. Parts Makers Just Won't Say 'Uncle'," Business Week, Aug. 10, 1987, p. 76.

U.S. suppliers' increasing emphasis on quality in the coming years should be evident as more firms offer longer, more comprehensive product warranties. Moreover, the use of more sophisticated diagnostic test equipment should reduce service problems. Finally, vehicle manufacturers are currently extending warranties; thus, aftermarket service products increasingly will be sold directly through new vehicle dealerships.

Technical personnel.--U.S. suppliers must also attract top quality engineering personnel in their efforts to increase the focus on R&D and compete with foreign competitors. For example, although Japanese engineers earn about one-third less in relative salary than U.S. engineers, Japan is ahead of the United States per capita in educating engineers; that is, Japan has many more times the engineers per 1,000 (population). However, the real concern is for the coming years: "Right now, there is an ample supply of engineers," explains a former vice president of research for Ford Motor Co., adding, "I don't think there is any great deficiency in numbers, but there is uncertainty about the future." 1/

U.S. firms' investment in technical personnel will be increasingly important in preparing for future technical developments. For example, new discoveries in the field of superconductivity (i.e., the ability of electricity to flow through a substance with zero resistance) hold promise for increasing the energy efficiency and acceptance of electric vehicles. Thus the auto parts industry could be greatly affected, e.g., there could be tremendous changes in the powertrain of a vehicle, thereby forcing parts makers to revamp their product lines and production technology.

U.S. suppliers must continue to focus on coordinating production, technical developments, and their sales efforts with Japanese automakers' model changes. Japanese auto producers typically introduce full model changes once every 4 years and frequently make minor changes at shorter intervals; thus, suppliers are often required to develop parts that will be used for a limited duration in a relatively short period of time. In contrast, U.S. automakers do not introduce model changes as often as the Japanese. 2/ In fact, one U.S. automaker responding to the questionnaire stated that long development leadtimes in the U.S. industry inhibit flexibility and rapid reactions to changes in environment; therefore, U.S.-produced products are often introduced too late.

Production management.--Increased emphasis on technical ability will be evident as many U.S. companies may be forced to expand their product lines, as well as to design, engineer, and manufacture complete systems. Although this could be a feasible option for many large parts companies, many small firms do not have the resources and would be unable to consider such expansion by themselves. Moreover, certain types of large, complex systems would be beyond the scope of even large parts producers; for example, one U.S. producer of bearings responding to the Commission's questionnaire laments that bearings are increasingly being imported on entire component systems such as engines, transmissions, and axle assemblies. In addition, industry sources report that

1/ Matt DeLorenzo, "Enough Engineers Today, but Future Isn't Bright," Automotive News, May 18, 1987, p. 24.
2/ USITC staff interview with MITI, Tokyo, Japan, Apr. 20, 1987.

instrument panels and door systems will be increasingly subassembled in modules. 1/

Another development of limited potential application is the standardization of parts production. Industry sources report that Japanese auto producers Mitsubishi Motors Corp. and Mazda Motor Corp. have begun a joint study to identify the parts and components that could be standardized between them. Mazda and Ford reportedly also have reached an agreement on common component production. These parts could include fuel tanks, plastic products, electrical parts, and instrumentation parts. Recent negotiations among Japan's four major truck producers (Nissan, Mitsubishi, Hino, and Isuzu) were aimed at the common use of certain parts including brake systems and batteries. 2/

Industry outlook.--Major U.S. automakers responding to the questionnaire projected an uncertain vision of the U.S. parts industry during 1988-92. U.S. auto producers noted that exchange-rate adjustments will continue to be an important factor in U.S. competitiveness; however, they predicted that the industry will experience plant closings, consolidations, and elimination or absorption of small firms. One U.S. automaker predicted that even if U.S. suppliers implement techniques to synchronize flow, take advantage of new technology, and reduce costs, the U.S. parts industry could suffer a 10 percent drop in profits by 1992.

In such a complex, rapidly changing environment, some U.S. suppliers can foresee a scenario wherein the U.S. parts industry could decline in competitiveness during 1988-92. In 1986, foreign auto producers accounted for about 32 percent of U.S. sales, including both their U.S.-built and imported vehicles. Many questionnaire respondents declared that these cars contained very few U.S.-produced parts. Autos built by foreign-owned companies could account for 40 percent of U.S. sales in 1990, based on assumptions for 1988-90 that: (1) the auto import penetration level remains at the 1986 level; (2) production by foreign-owned automakers in the United States rises as predicted from about 550,000 units to nearly 2 million units, while U.S. production by GM, Ford, and Chrysler declines from approximately 8 million units to about 7 million autos; and (3) the total market for autos remains relatively flat at about 11 million vehicles. In fact, several questionnaire respondents projected that foreign-owned automakers (utilizing relatively few U.S.-produced parts) could even take 50 percent of the U.S. market by 1992.

U.S. suppliers producing commodity-type, high volume mechanical components such as wheels and small stampings will probably find themselves in a declining competitive position vis-a-vis other major parts-producing nations. Foreign industry sources predict that over the next 10 years commodity-type components will tend to move to countries such as Korea, Taiwan, and Brazil that have lower costs and increasingly capable manufacturing and technology bases. Several questionnaire respondents allege that Japanese parts firms

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1/ Arthur Andersen & Co., Cars and Competition: Management Challenges, July 1987, p. 5.
2/ "Common Use of Components Likely Among Japan's Automakers," Automotive Parts International, Nov. 14, 1986, p. 6, and interview with Mazda officials, Hiroshima, Japan, Apr. 24, 1987.

will receive financing incentives to build modern production facilities in Korea, Taiwan, and Mexico. As long as suppliers in these countries have at least a 15 percent cost advantage, they will provide significant competition for U.S. suppliers.

A number of questionnaire respondents also stated that U.S. companies must respond with short-term profits to satisfy investors whereas Japanese parts firms are willing to implement long-term planning and sacrifice short-term profits to establish market position. U.S. firms claimed that the growing threat of corporate takeovers often exacerbates these pressures.

Although the future U.S. parts industry will probably be comprised of fewer, but larger companies, the coming years do bode well for U.S. parts makers producing components requiring relatively high technology or the need for variability or responsiveness to end user demand. These types of products include assemblies, subassemblies, electromechanical components, highly stressed components, application-oriented parts, and integrating components.

CHAPTER 11. OVERVIEW OF AUTOMOTIVE ELECTRONICS

Automotive electronics represent the leading area of technological development in automotive parts and systems. Electronic componentry is being used not only in new electronic products, but is also being widely incorporated into other automotive parts and systems.

The U.S. market for automotive electronics is evolving rapidly as new products are introduced with virtually every new automobile model year. These products allow automakers to produce vehicles that are more fuel efficient and emit reduced pollutants and at the same time increase passenger safety, comfort, and convenience. Although there are a wide variety of automotive electronic products, they can generally be grouped into three categories: powertrain electronics, electronic vehicle controls, and body electronics including instrumentation panels. 1/ Because of the increasing importance of electronic components to the future of the global parts industry, automotive electronics will be discussed separately in this chapter whereas other selected auto parts will be discussed in chapter 12.

Powertrain Electronics

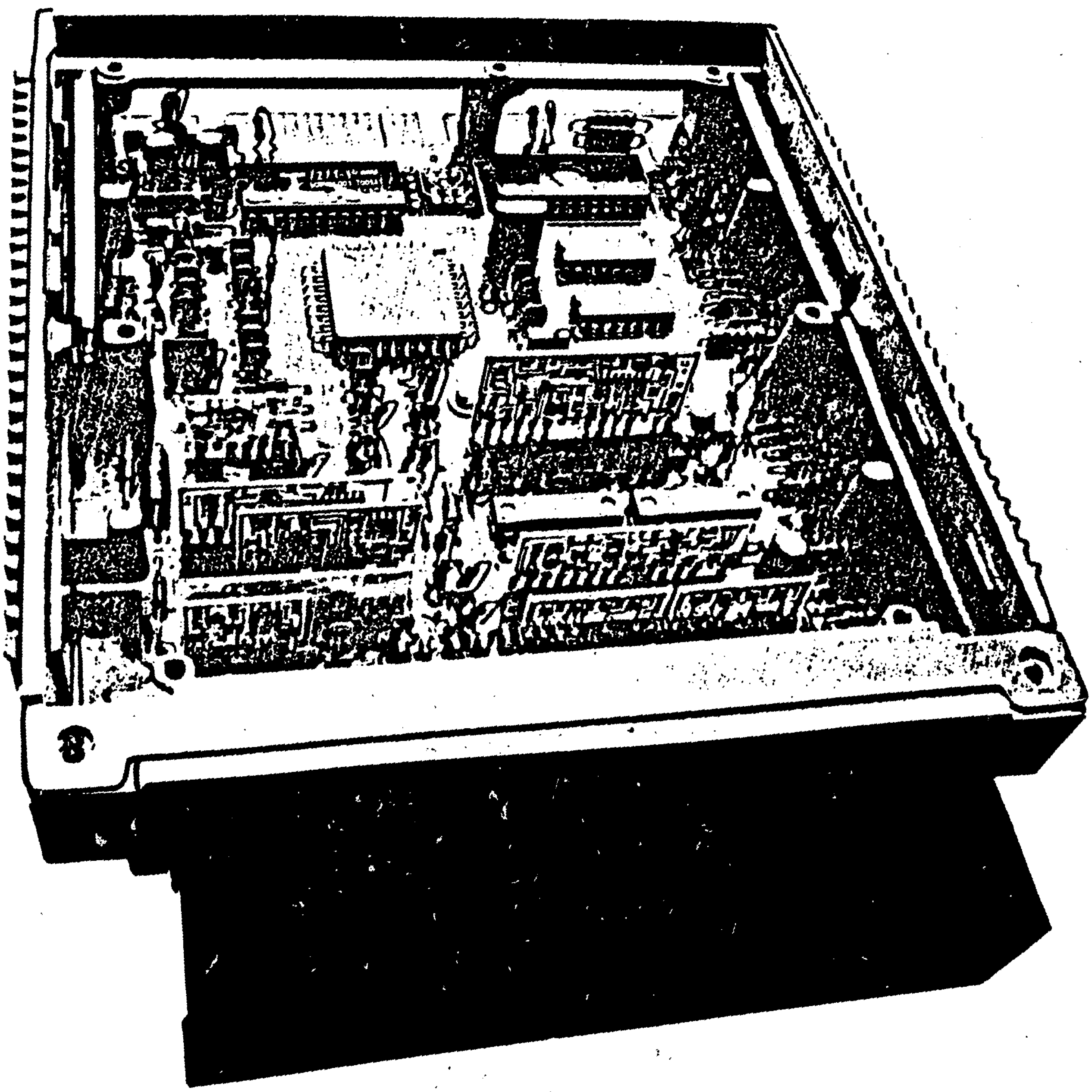
Powertrain electronics is the largest segment of the automotive electronics market. Powertrain electronic products control engine performance, ignition, and transmission functions. The engine control unit is the most pervasive of the powertrain electronic products (fig. 11-1). This unit varies between makes and models but, in general, controls the engine's efficiency and emissions output. It can use input from as many as 20 different sources (typically sensors) and its output can control actuators that perform as many as 22 different functions including fuel injection, spark control, emissions control, idle speed, self-diagnostics, and knock control (fig. 11-2).

A related function, sometimes considered a separate item, is electronic ignition. The engine control module commands the electronic ignition that replaces the traditional mechanical distributor. Electronic ignition is achieved with a solid state switching module that, based upon engine position sensors, determines the proper time to fire high-energy coils.

Another increasingly significant electronic powertrain product is electronic transmission control. This technology involves electronic shift points that provide quicker, smoother, and mechanically simpler gear shifting than conventional hydraulic valves. As an offshoot, electronically controlled continuously variable transmissions are being developed. This technology has the potential to optimize fuel economy and power levels and minimize exhaust emissions over a wide speed range. Once perfected, the technology will provide the automobile owner improved handling, lower fuel consumption, and a quieter ride. Manufacturers will benefit from reduced emissions and potentially lower manufacturing costs.

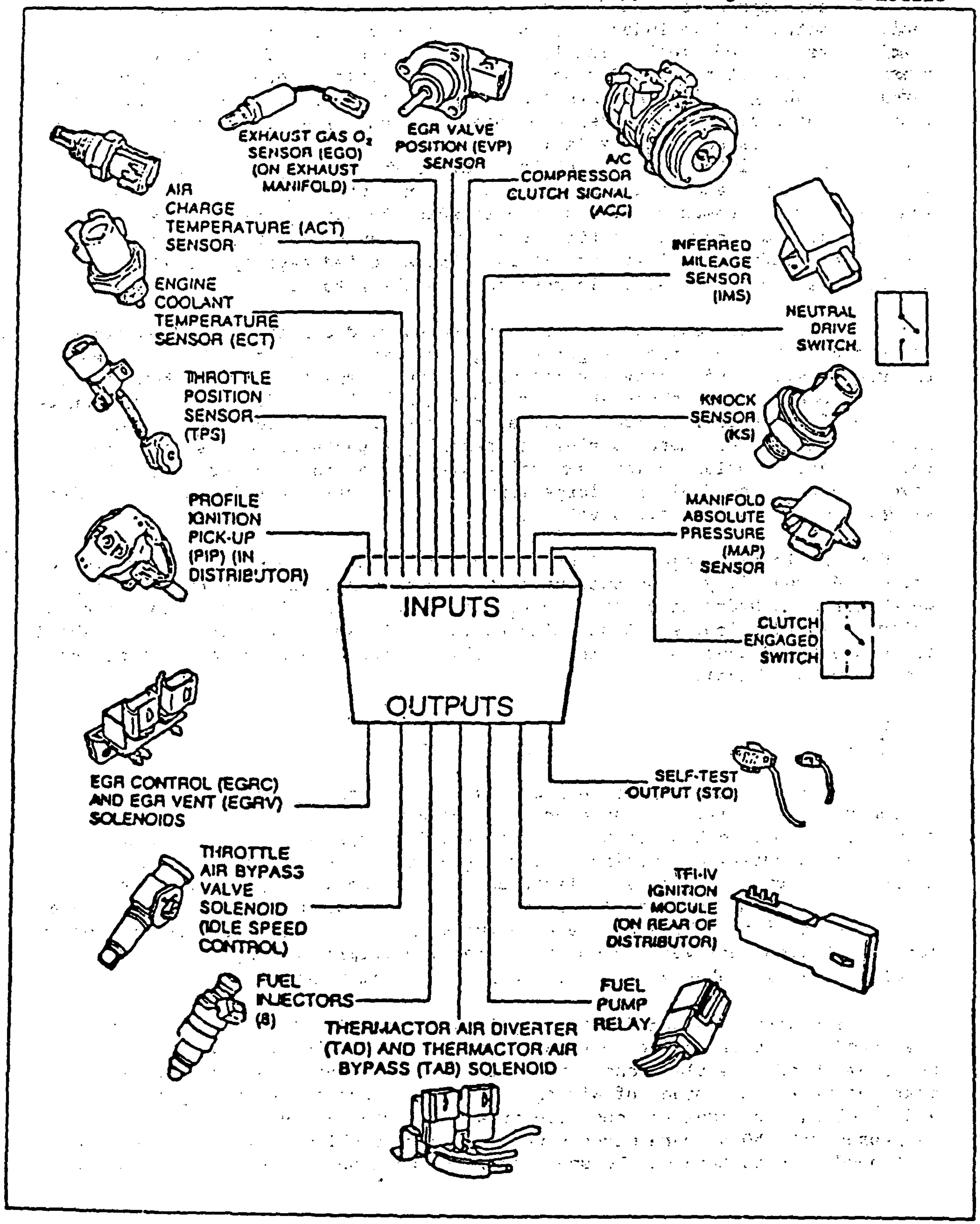
1/ Although frequently considered part of the automotive electronics market, autosound electronics are discussed elsewhere on p. 11-1.

Figure 11-1.--The engine control module currently in use by Ford Motor Co.



Source: Ford Motor Co.

Figure 11-2 --Significant inputs and outputs of a typical engine control module



Source: Motorola Inc.

Electronic Vehicle Controls

Another segment of the U.S. automotive electronics market involves vehicle control and includes such specific products as electronic antilock braking systems and electronically assisted suspension. These products are relatively new but are rapidly being accepted. This is especially true with antilock braking. With this system, a digital control computer continually monitors wheel speed versus vehicle speed and, during an emergency stop, the brake pressure is selectively limited to prevent wheel lockup. This allows the driver to maintain control of the vehicle while stopping in the shortest possible distance and in a straight line. Since wheel speed is continuously monitored by the computer, it is able to adapt to varying road surface conditions, thus providing better traction. Because this feature has significant safety implications, it is being accepted rapidly and will most likely be a standard feature in most cars in the future.

Electronically assisted suspension senses road conditions and maintains the vehicle at a specified height through automatic feedback. This increases the ride quality and improves handling. Another aspect of the system allows the adjustment of the shock absorber damping ability. A "soft" setting can be selected for a more luxurious ride, a "firm" ride can be selected for a sportier feel. The improved ride and handling aspects of this system are becoming very popular on more expensive small- and medium-sized cars. It gives the ride and feel of a large luxury car and still retains the economies associated with a down-sized vehicle.

On the leading edge in electronic vehicle controls are other products to improve driveability. One such product is electronically actuated steering, which replaces hydraulics with electronic control using torque sensors and DC motors. In addition, electronically assisted all-wheel steering and all-wheel drive are being developed to increase driver control in emergency situations and to improve handling.

Body Electronics

Body electronics refers to a wide variety of automotive electronic products and systems. Included are multiplex wiring, electronic voltage regulators, body control computers, digital displays and instrumentation, electronic security monitoring systems, keyless locks, voice-activated ignition, automatic mirrors, climate control, voice warnings, navigation systems, trip computers, collision avoidance systems, memory power seats, and passive restraints. Many of these features will probably remain as options on luxury vehicles; however, automatic mirrors, multiplex wiring, and voltage regulators will probably be installed in all automobiles.

An industry standard for the application of multiplex wiring is being developed. This technology may have significant implications on the development of more electronic and electrical features. As the number of features grow, the amount of wiring necessary to connect them to power sources and electronic control sources also grows. Currently, there are wiring harnesses with 50 or more wires bound together weighing as much as 100 pounds, that need to pass through the space between the inner and outer walls of the automobile. 1/ With cars getting smaller, that space is getting smaller and problems are developing in assembly, reliability, and servicing. The solution to this problem has come through the advent of mutiplex wiring. This type of wiring system combines an electrical conductor known as a bus with electronic modules and actuators or loads, each of which has a logical interface to the bus. An individual bus is able to carry the electrical signal between a number of different components. This significantly reduces the number of wires needed, which in turn, reduces the total weight of the automobile.

The electronic voltage regulator, first introduced in the 1970's, is now a standard feature on most new automobiles. This device is superior to its electromechanical predecessor because it eliminates the voltage limiter contact, the most significant cause of failure. In addition, because of more accurate voltage regulation, battery life is extended.

Components

There are two distinct component groups that are part of automotive electronic systems but are also unique electronic products: semiconductors and electronic sensors (fig. 11-3). Semiconductors, more specifically, integrated circuit (IC) semiconductor devices are the basic building blocks for all automotive electronic products. The microprocessor IC provides the intelligence or logic for the product and the memory IC allows specific instructions to be stored. Currently, the average memory capacity of an automobile's electronic system is approximately 11 kilobytes. 2/ Another type of semiconductor used in automotive applications is the power IC, which is used in multiplexing and in diagnostics for wiring harnesses.

Electronic sensors typically are devices utilizing silicon technology that enhance the application of other automotive electronic devices. These sensors typically monitor specific functions and feed information to the engine control module such as air and coolant temperatures, intake manifold pressure, the position of mechanical components, and exhaust composition. Most sensors now used in automobiles are not electronic, but as the monitoring of functions in an automobile becomes more sophisticated and precise, electronic sensors will be used more frequently.

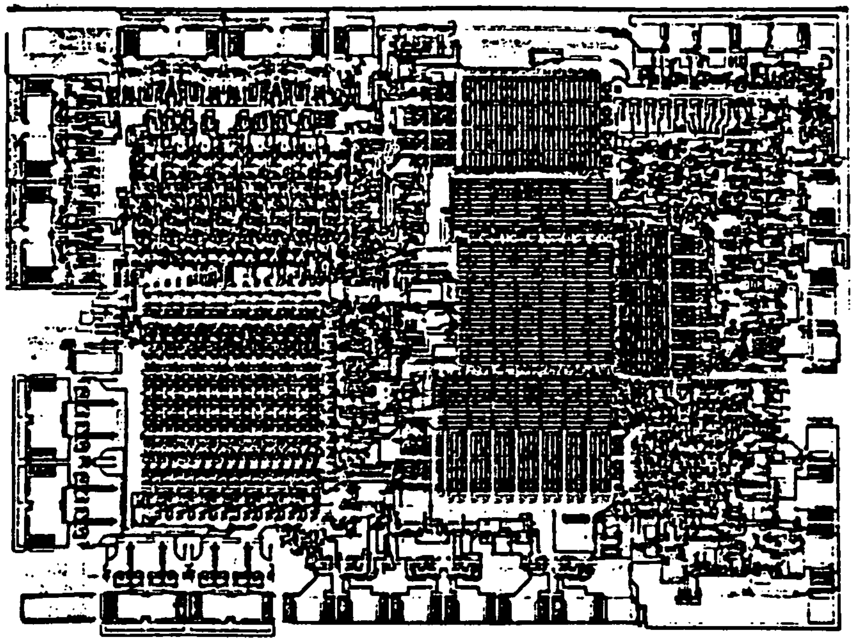
Production Process

There are different production techniques for the various types of electronic automotive articles. These processes generally fall into two distinct categories: the production of complete modules, such as the engine control units; and the production of components such as IC's, hybrids, and sensors. Most of the individual modules are produced in a similar way; the most complex is the engine control unit.

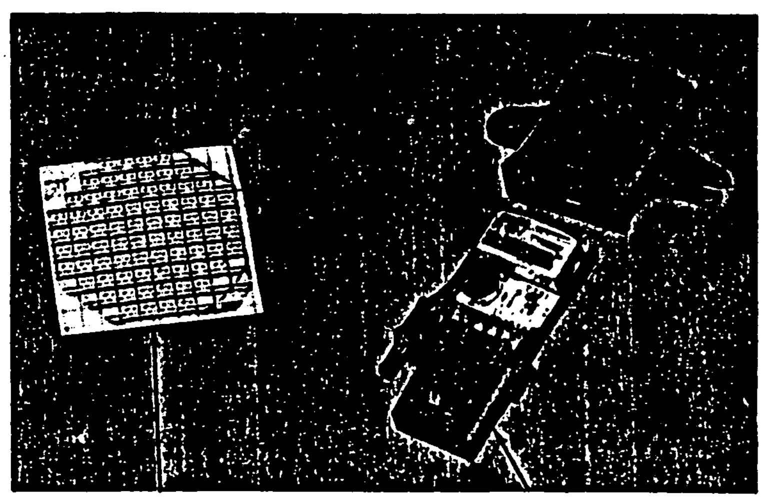
The first step in the assembly of the engine control unit is the automatic insertion of certain components onto blank printed circuit boards. Depending on the producer, the number of printed circuit boards comprising an

1/ Unpublished documents provided by Motorola.
2/ Unpublished documents provided by Ford Motor Co.

Figure 11-3.--Selected electronic components for automotive application



Microprocessor Integrated Circuit



ELEMENT WAFER SENSOR ASSEMBLY

Source: Intel and Ford Motor Co.

engine control unit varies from one to three. 1/ The components that can be automatically inserted range from simple discrete passive components like capacitors to very complex hybrid circuits. The automatic insertion machines used vary by producer and product. Typical machines include radial and axial insertion machines, pick-and-place machines, robots, surface mount machines, and other similar machines. Once the automatic insertion is completed, other types of components that do not lend themselves to automatic insertion must be placed on the board manually. The board is then wave soldered and cleaned. After the solder is inspected and touched up, the stuffed boards are ready for testing. These boards are then put in housings and tested again. Finally, a certain portion are "burned in," then there is further testing and mating of boards before they are packaged and shipped.

The production of components can be illustrated by the description of the process for integrated circuits, hybrids, and sensors, since they are the most important components. Integrated circuits are produced by using a silicon wafer that is cut from a silicon crystal and polished. Dopants are deposited onto the wafer. A photoresist, which provides the foundation for the mask design is then applied. Once the wafer is exposed and developed, it is rinsed and baked. The wafer is then ready to be stripped of its photo resistant material, thus leaving only the individual layer of circuitry. Other layers can be added depending on the complexity of the design. Each wafer, typically four inches in diameter, can contain hundreds of chips, or potential IC's. After the circuits have been applied to the wafer and the defective chips have been identified, the wafer is broken into the individual chips. The chips are then assembled into packages, which usually involves wire bonding and encapsulation in plastic chip mounts.

The hybrid circuit is basically a miniature printed circuit board onto which discrete components (such as capacitors and resistors) and integrated circuits are applied. The main difference between the hybrid circuit and the stuffed printed circuit board is that the basis of the hybrid is a ceramic substrate rather than a resin board. With the thick film technique, one of the most effective production techniques of hybrid circuits, pastes of different electrical resistances are deposited on the ceramic substrate by a method similar to silk-screen printing. These resistors are then connected by tracks of palladium paste. After each operation, the paste is hardened by heating. The discrete components and IC's are then automatically mounted to the surface of the substrate directly to the palladium silver tracks. This process lends itself to highly automated manufacturing with high levels of reliability. In addition, the size of the module containing the hybrid can be greatly reduced.

One of the most commonly used sensors today for automotive application is the silicon capacitance absolute pressure sensor. These sensors are used to sense the absolute air pressure of the intake manifold. Such data can be used to compute the required fuel to provide a desired air/fuel mixture. These sensors are produced in a batch method similar to that for integrated circuits. However, instead of etching circuits onto them, the silicon wafers are processed using laser drills to produce a small cavity. Anodic bonding of

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1/ USITC staff tour of Ford Motor Co.'s production facility in Lansdale, PA, Mar. 16, 1987.

glass to the silicon creates a diaphragm over the cavity. The smallest change in pressure causes the diaphragm to expand or contract and can be precisely measured electronically.

In general, the manufacturing process for automotive electronics is very capital intensive. This is especially true for integrated circuit, hybrid, and electronic sensor production. The processes for these products involve a great deal of up-front engineering using state-of-the-art computer-aided-design techniques. In addition, the production process itself requires a very controlled environment to reduce the possibility of component failure. This control is achieved through the use of "clean rooms," where the air is constantly exchanged and purified and the employees must take "air showers" and wear special garments. Also, because of the size and complexity of the components, there is a great deal of automation in the production process to ensure precision handling. Most U.S. automotive electronics producers have similar production techniques and equipment. Some may be slightly more automated than others, especially in terms of the use of robotics. However, when a new technology becomes available that will improve their product quality and reduce manufacturing costs, they will typically all begin using it. For example, when surface-mount component technology became available in 1985, all of the major producers realized the potential benefits and have incorporated it into their production processes.

U.S. Industry

The U.S. industry can be considered at two different levels: producers of principal electronic components and producers of electronic modules. Many of the components that are used in the modules are "off-the-shelf" type items that are purchased in various places, depending on market conditions. Other components, such as IC's, hybrids, and sensors, are more complex and are application specific.

There are nine U.S. producers that are either already making IC's for automotive applications, or have announced their intention to enter the market for these products. They are Motorola, Cherry Semiconductor, General Instrument, RCA, Sprague, Texas Instruments, Intel, National Semiconductor, and Delco. 1/ Delco makes a significant amount of IC's but only for use by itself and other GM facilities. Most U.S. producers supplement their U.S.-produced IC's with lower technology IC's made offshore. In addition, many U.S. producers have foreign assembly facilities where IC's are wirebonded and encapsulated. Most of the highest technology production, however, has remained in the United States.

The hybrids that are used in electronic modules tend to be made by the company that makes the module itself. This is because individual hybrids are application specific products and require a great deal of control by the end user to enable the hybrid to meet stringent requirements.

Because electronic sensors use relatively new technology, there are few U.S. companies that can currently produce them in the volumes that are required

1/ Jerome G. Rivard, "Challenges in Automotive Electronics," a paper presented at the Semiconductor Industry Conference in Tucson, AZ, Oct. 16, 1985.

by the auto producers. Therefore, GM went to its electronic division, Delco, which now produces much of GM's needs for electronic sensors. Although Ford also makes some of it's own needs, Motorola, the largest independent producer of electronic sensors, also supplies a certain portion of Ford's needs. 1/

Delco produces virtually all of GM's requirements for electronic modules such as engine control units. 2/ Although Ford is self sufficient for a significant portion of its own needs, Motorola also supplies part of Ford's requirements. 3/ Chrysler makes virtually all of its own needs. For other electronic modules, especially in the area of powertrain electronics, a similar supply breakdown also applies.

There are several other U.S. producers of automotive electronic products. They include United Technologies, TRW, and, to a certain extent, Bendix (Bendix's automotive electronic products are principally supplied from a facility in France). These producers supply niche markets, typically in the area of body electronics and, to some extent, vehicle electronics. These companies and other smaller producers are more significant in the area of electrical rather than electronic systems.

In general, for all products taken collectively, industry sources rank Delco as the largest U.S. automotive electronic producer, followed by Ford, Motorola, and Chrysler. The auto producers generally prefer to keep the production of automotive electronics in-house; however, in certain product areas, they have not had the electronics expertise to develop highly sophisticated electronic products. In order to diversify and to increase their ability in electronics for automotive applications, U.S. automobile producers have been active in pursuing aerospace technology. GM's purchase of Hughes and Chrysler's purchase of Gulfstream in 1985 exemplify the trend towards technology transfer from aerospace to automotive applications. In addition, Ford can rely on Ford Aerospace for that type of technology. Some very exotic and esoteric products are emerging in automotive electronics as a result of this technology transfer. For example, the purchase of Hughes has given GM access to heads-up displays, night-vision systems, collision-avoidance systems, position-locating equipment, advanced antenna design, and technology assistance in antilock braking and multiplex wiring system engineering.

U.S. Market

The U.S. market for automotive electronic products has grown rapidly over the past few years. In the early 1970's, there were virtually no electronics in an automobile. During the mid-1970's, gas prices increased dramatically and consumers became very conscious of fuel efficiency. In addition, the U.S. Government became concerned about dependence on potentially unstable foreign oil supplies and determined that the nation should try and reduce the increasing rate of consumption of oil products. To that end, the U.S. Government adopted the Corporate Average Fuel Economy (CAFE) standard for car

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1/ USITC staff interview with Motorola officials, Seguin, TX, Apr. 14, 1987.
2/ USITC staff interview with Delco officials, Lansburg, PA, July 17, 1987.
3/ USITC staff interview with Motorola officials, Seguin, TX, Apr. 14, 1987.

model years beginning in 1975 (see p. 6-24). This mandated that, overall, new passenger cars and light-duty trucks had to meet certain miles-per-gallon levels. The levels were increased every year. At the same time the U.S. Government was mandating fuel efficiency, it also began to require strict emission controls.

Because of these developments, U.S. automakers had to devise ways to meet both objectives. Starting in the mid-1970's, auto manufacturers attacked the problem with electronic products to make the engines more efficient. The time line below illustrates the significant developments in automotive electronics.

Electronic ignition		Electronic voltage regulator		Electronic instrument cluster and trip computer		Electronically assisted suspension		Antilock braking	
1970		1975		1980		1985		1990	
	Digital clocks		Electronic engine control		Improved electronic engine control			Hard/soft suspension	

Source: Ford Motor Co.

The average content of automotive electronics per vehicle totaled between $500 and $550 in 1986. This translates to a total U.S. market of approximately $3.7 billion to $4.3 billion in 1986. Industry sources have estimated that the annual growth rate of the U.S. market for automotive electronics will be approximately 10 percent through the year 2000. Using that estimate, the U.S. automotive electronics market will be at least $5.4 billion in 1990 and $14.0 billion by the turn of the century. 1/

In terms of market penetration of certain automotive electronic products installed in 1986 model passenger cars, Ward's Automotive Yearbook reports that digital clocks were installed in 76.3 percent of all automobiles; trip computers were installed in 3.2 percent; memory seats were installed in 0.3 percent; some type of electronic engine control module was installed in 72.4 percent; some type of fuel injection was installed in 66.4 percent; and electronic ignition was installed in 66.0 percent. 2/

The U.S. market for automotive electronic products is dominated by U.S. producers. This is especially true for electronic modules where electronic subsidiaries of U.S. auto producers predominate. Foreign companies have yet to make significant inroads into the market at this level. However, two potential Japanese competitors, Nippondenso and Hitachi have facilities in the United States. In addition, Mitsubishi has recently announced its plans to

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1/ Interviews with and unpublished documents provided by Motorola, Ford, and Delco officials during March-June 1987.
2/ Ed Bas, "Age of Electronics Has Arrived; Second Stage on Tap," in Wards Automotive Yearbook 1987, ed. H.A. Stark (Detroit: Ward's Communications, Inc., 1987).

establish a facility in the United States to supply the U.S. automotive electronics market. Industry sources suggest that these companies initially intend to concentrate on Japanese-owned automakers in the United States (transplants) with which they already have ties; for example, Nippondenso would supply Toyota. However, these sources also expect that Japanese-owned, automotive electronic suppliers will soon be trying to sell electronic modules to GM, Ford, and Chrysler.

For automotive electronic components, Japanese producers have already been successful in selling in the U.S. market. The Semiconductor Industry Association estimates that Japanese semiconductor companies supplied 30 percent of the U.S. automotive semiconductor market in 1986. In addition, a Japanese company is reportedly supplying a certain percentage of a major U.S. auto producer's requirements for electronic sensors.

Significant factors that affect the competitiveness of U.S. producers in automotive electronics are quality, technology, and traditional supplier relationships. U.S. firms have an advantage with respect to these factors because they have been producing these products for more than 10 years. U.S. regulations concerning emissions control and fuel efficiency are older and more stringent than those of most of the rest of the world. Traditionally, U.S. imports of autos, especially from Japan, have had smaller engines that already met emissions and fuel-efficiency standards without electronic controls. However, as the regulations continually become more stringent in the United States, Europe, and Japan, foreign auto producers are developing more experience with automotive electronics.

Foreign Markets

The market for automotive electronics in foreign countries is currently relatively small compared with that of the United States. Industry sources estimate that the U.S. market accounted for over 60 percent of the $7 billion worldwide market for automotive electronics in 1986. 1/ These sources also estimate that foreign markets will grow more rapidly than the U.S. market in the coming years. The European market, estimated at a little less than 20 percent of the world market for 1986, is currently dominated by U.S. producers with an estimated 70 percent market share. Principal European-owned producers include Bosch, Lucas, Magneti/Marelli, and Siemens. The Japanese market for automotive electronics is estimated to have also accounted for almost 20 percent of the world market in 1986. This market is totally dominated by Japanese suppliers with about 99 percent of the total. Principal Japanese producers include Nippondenso, Hitachi, Mitsubishi, Yazaki, and Japan Electronic Control Systems Co. The market in the rest of the world is estimated to have accounted for less than 3 percent of the world market in 1986.

Ford and General Motors have automobile production facilities in Europe and their U.S. subsidiaries producing automotive electronics supply significant portions of their European needs. Motorola, which has been successful in Europe, supplies automotive electronic products to Audi, Rover Group, Citroen,

1/ Motorola, Inc.

Fiat, Ford of Europe, Peugeot, Saab, Renault, and Volkswagen. European suppliers do fairly well in Europe because of extensive supplier relationships with European auto producers in other product areas, especially electrical systems. Japanese producers are beginning to make inroads into Europe based on price and quality. 1/

In Japan, a significant factor that controls the distribution of market shares for automotive electronics is the traditional network or family of suppliers that work closely with the Japanese auto companies. Ties are not only traditional cultural relationships but frequently involve swapped equity ownership. This structure, known as keiritsu (see p. 4-12), allegedly severely limits the opportunities for companies outside any particular keiritsu (including other Japanese firms) from selling automotive electronics to the auto producer within that keiritsu.

U.S. Government Efforts to Increase U.S. Exports of Automotive Electronics

There have been two significant efforts recently to assist U.S. producers of automotive electronic products wishing to export to Japan. One effort involves a semiconductor arrangement with Japan, initiated by pressure from the U.S. industry, that was signed on September 2, 1986. The agreement stipulates that Japanese producers cease dumping in the United States and third-country markets. An unwritten part of the agreement provides U.S. semiconductor producers an increased share of the Japanese semiconductor market (20 percent by 1991). If successful, U.S. producers may increase their share of the Japanese market for automotive semiconductors. However, according to Commerce, the Japanese producers have continued to dump in third-country markets. In retaliation, the U.S. Government imposed penalty duties on imports of certain products from Japan that contain semiconductors. 2/ At the Venice Summit in June 1987, the President eliminated the penalty duties on certain Japanese-made products because it was determined that the Japanese were making some effort to reduce third-country dumping.

The second attempt at opening the Japanese market for U.S. automotive electronics producers was the MOSS talks (see p. 6-16). Several U.S. electronics producers actively encouraged the inclusion of automotive electronics in the discussions.

Future Trends

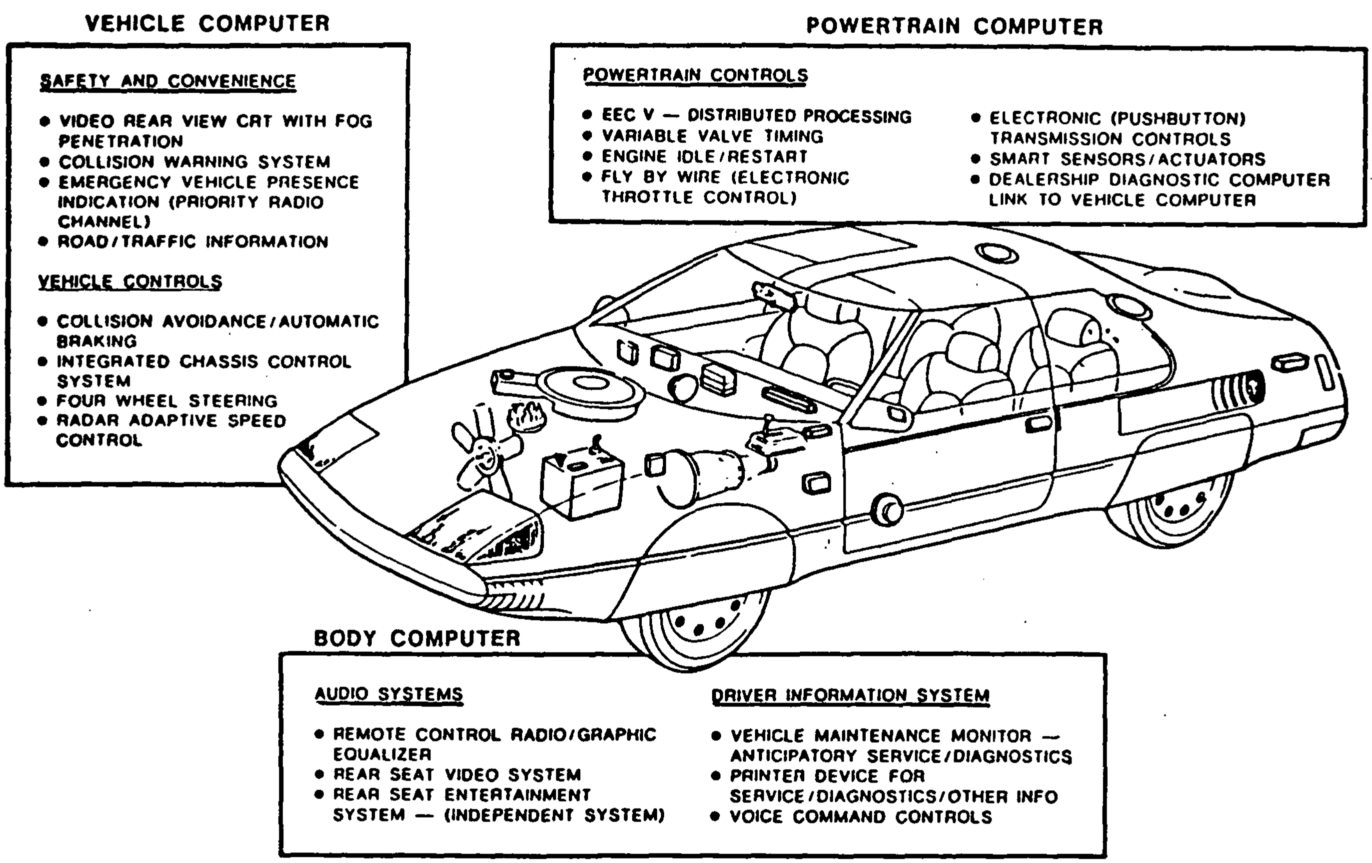
The electronic content of automobiles is expected to continue to increase for the foreseeable future. New safety devices like antilock braking systems will readily gain acceptance when perfected. Other exotic features will most likely remain options, but will undoubtedly gain fairly significant market penetration. According to Ford, products that will be common features in cars by 1990 will include electronically heated windshields, remote keyless entry systems, keyless ignitions, driver alertness controls, quick-heat systems,

1/ USITC staff discussions with various industry sources.
2/ Presidential Proclamation No. 5631, effective Apr. 17, 1987.

multiplex wiring, and load-sensitive braking. By 1995, Ford expects even more advances, like video rear-view CRT's with fog penetration, heads-up displays, collision warning systems, navigation systems, electrochromic glass, four-wheel steering, electronic throttle control, and voice command controls.

In general, Ford sees three electronic systems emerging to control virtually every aspect of driving (fig. 11-4). These systems for powertrain, chassis, and body control will have powerful computers at their core. In order to meet the ultimate objective of improving vehicle reliability, performance and driver comfort, multiplex wiring, smart sensors, data sharing, and backup control will all be features that will be incorporated into the next generation of automotive electronic products.

Figure 11-4.--Ford Motor Co.'s interpretation of the future developments of automotive electronics



Source: Ford Motor Co.

CHAPTER 12. OVERVIEW OF SELECTED AUTOMOTIVE PARTS

The key products analyzed in the following sections were selected for their importance to the U.S. automotive parts industry (representing about 36 percent of industry shipments) and their representativeness of different segments of the industry in terms of manufacturing process, import competition, marketing, and financial condition. As shown in tables 12-1 and 12-2, all product lines experienced a loss of market share and, except for batteries, a rise in trade deficit during 1982-86. The ratio of net operating profits before taxes to net sales rose in each product line during 1982-86, with the largest increase registered in autosound components and the smallest, in tires. Transmissions/ transaxles had the highest shipment index in 1986 and tires the lowest.

AUTOSOUND COMPONENTS

Description and uses

Autosound components are the chief articles of a motor vehicle's audio entertainment system. The principal products are tape players, radio/tape player combinations, and radio receivers, all of which are designed to be mounted in a motor vehicle. Certain ancillary products include amplifiers, equalizers, power boosters, and radio frequency (RF) boosters. Not included are speakers, antennas, wires, mounts, and other parts and accessories. Autosound components are sold in several configurations with many different features. A typical audio entertainment system installed in a new automobile since 1985 would have an AM/FM stereo radio/cassette player with electronic tuning and possibly a built-in digital clock. The unit would be mounted in the dash and, depending on design, would have average dimensions of 3-5 inches in height, 9-12 inches in width, and 6-10 inches in depth.

In comparison with U.S.-produced autosound components, imported autosound components have traditionally covered more of the product spectrum, from simple monaural AM radio receivers to highly advanced, sophisticated sound systems. However, since U.S. manufacturers tended to produce simpler units, foreign producers concentrated on higher end products. More recently, U.S. producers have been manufacturing more sophisticated and technically advanced autosound components. However, very high-end autosound components are still produced predominantly abroad.

Manufacturing process

The manufacturing process of an AM/FM radio cassette player is basically the assembly of electronic, electric, and mechanical components with formed metal and plastic parts. The assembly process is conducted along a production line, where each worker performs a specific operation. The process begins with a blank printed circuit board. Components are inserted into the board either by hand or automatically. The extent and nature of automatic insertion varies from producer to producer but generally involves the more standard size components such as capacitors, resistors, and integrated circuits. The types

Table 12-1
Certain automotive parts: Selected industry indicators and indexes, 1982

Item	Batteries	Bearings	Engines	Autosound components	Shock absorbers	Tires	Transmission/ transaxles	All other parts	Total
Shipments (million dollars)..	1,537	678	6,857	487	653	8,013	3,200	31,470	51,146
Shipment index (1982=100)....	100	100	100	100	100	100	100	100	100
Sales index (1982=100).......	100	100	100	100	100	100	100	100	100
Employment of production and related workers index (1982=100)...........	100	100	100	100	100	100	100	100	100
Average hourly wages.........	$9.08	$12.08	$13.68	$12.75	$12.13	$12.76	$13.80	$11.92	$12.24
Ratio of net profit or (loss) to net sales (percent).....	4.4	(1.9)	4.6	8.0	10.7	4.7	(1.2)	8.3	6.7
Profit index (1982=100)......	100	100	100	100	100	100	100	100	100
Ratio of imports to apparent consumption (percent)......	1.1	15.7	17.7	59.3	4.5	10.4	14.7	10.5	13.3
Ratio of exports to shipments (percent)........	1.7	10.3	10.2	10.4	6.3	2.5	20.9	14.1	11.3
Trade balance (million dollars)..........	9.7	(43.5)	(626.4)	(583.0)	11.5	(704.8)	(230.3)	950.2	(1,168.8)

Source: Calculated from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table 12-2
Certain automotive parts: Selected industry indicators and indexes, 1986

Item	Batteries	Bearings	Engines	Autosound components	Shock absorbers	Tires	Transmission/ transaxles	All other parts	Total
Shipments (million dollars)..	1,788	1,295	11,456	592	1,013	9,116	6,628	53,518	82,992
Shipment index (1982=100)....	116.3	191.0	167.1	121.7	155.0	113.8	207.2	170.1	162.2
Sales index (1982=100).......	119.1	126.0	190.2	121.6	151.3	113.0	206.3	210.3	187.4
Employment of production and related workers index (1982=100)...........	102.0	101.4	109.1	134.3	106.1	92.3	138.3	148.0	136.8
Average hourly wages.........	$11.19	$15.64	$17.19	$16.24	$15.50	$15.54	$18.19	$17.71	$17.21
Ratio of net profit or (loss) to net sales (percent).....	6.2	5.1	8.0	21.9	13.6	5.5	5.9	7.3	7.5
Profit index (1982=100)......	168.6	1/ 338.5	334.1	333.3	191.9	132.6	1/ 105.4	185.7	208.1
Ratio of imports to apparent consumption (percent)......	1.5	29.6	27.2	78.8	20.6	14.1	15.3	15.5	20.4
Ratio of exports to shipments (percent)........	1.9	10.7	6.0	13.0	5.8	1.8	13.4	13.1	10.7
Trade balance (million dollars)..........	8.1	(347.7)	(3,347.0)	(1,531.0)	(18.7)	(1,300.5)	(151.7)	(251.0)	(10,035.7)

1/ Undefined.

Source: Calculated from data submitted in response to questionnaires of the U.S. International Trade Commission.

of automated insertion machines that are used include radial and axial insertion machines, pick-and-place machines, robots, surface mount machines, and other similar machines. Parts that cannot be automatically inserted are manually mounted onto the board. The board is then ready to be wave soldered. When completed and the boards tested, they are put into housings and tested again. Once the quality of the product is assured, it is ready for shipment.

U.S. producers typically purchase the parts and components used in the assembly process from outside suppliers. Certain of the complex, custom-integrated circuits are designed by the autosound producer, but the production is done by an outside supplier. Delco Electronics (a subsidiary of General Motors Corp.) is the most vertically integrated U.S. producer of autosound components and makes many of the integrated circuits used in its production of autosound components. In addition, Japanese producers tend to be more vertically integrated than U.S. producers. They typically produce their own tape transport mechanisms and other mechanical and electrical parts, whereas U.S. producers do not.

Customs Treatment

U.S. tariff treatment

Autosound components are classified for tariff purposes under various Tariff Schedules of the United States (TSUS) item numbers (table 12-3). Tape players and radio/tape player combinations are classified under TSUS 678.50. The column 1 rate of duty is 3.7 percent ad valorem. The column 2 rate of duty is 35 percent ad valorem. Products covered by the item are eligible for preferential tariff treatment under the Caribbean Basin Economic Recovery Act (CBERA), The United States-Israel Free Trade Area Implementation Act (UIFTA) and the Generalized System of Preferences (GSP). Hong Kong, Mexico, the Republic of Korea (Korea), and Taiwan have exceeded competitive need limits for 678.50 and so cannot receive preferential duty treatment under the GSP for those products. Under the proposed Harmonized System (HS) the classification number is 8527.21.10, with no change in the duty rate.

Amplifiers and power boosters are classified for tariff purposes under TSUS item 684.70. The column 1 rate of duty is 4.9 percent ad valorem. The column 2 rate is 35 percent. Imports of such products are eligible for preferential tariff treatment under CBERA, UIFTA, and GSP. Korea and Taiwan are considered to be competitive and are no longer eligible for GSP treatment for TSUS 684.70. Under the HS, the classification number is 8518.40.20, with no change in duty rate.

Automobile radios not combined with other articles are classified under TSUS item 685.12. The column 1 rate is 8 percent ad valorem, the column 2 rate is 35 percent. U.S. imports of these products are eligible for preferential treatment under the UIFTA and CBERA. Under the HS, the classification number is 8527.29.00, with no change in the duty rate.

RF boosters are classified under TSUS item 685.32. The column 1 rate of duty is 6 percent ad valorem, the column 2 rate of duty is 35 percent. Such products are eligible for UIFTA, CBERA, and GSP treatment. For this item, Mexico, Korea, Singapore, and Taiwan have exceeded competitive need limits and

Table 12-3
Autosound components: U.S. rates of duty, by TSUSA item

(Percent ad valorem)

TSUSA item No. 1/	Description	Pre-MTN col. 1 rate of duty 2/	Col. 1 rate of duty 1987	Col. 2 rate of duty
678.50A*	Machines not specially provided for and parts thereof:			
	Audio tape players:			
01	Designed exclusively for motor vehicle installation.	5%	3.7%	35%
	* * *			
	Combination machines containing radio and tape player designed exclusively for motor vehicle installation:			
09	Cartridge type...........	5%	3.7%	35%
12	Other, including cassette.	5%	3.7%	35%
684.70A*	Microphones; loudspeakers; headphones; audio frequency electric amplifiers; electric sound amplifier sets, etc:			
	* * *			
30	Audio-frequency electric amplifiers (pt).	7.5%	4.9%	35%
	* * *			
685.12	Solid state radio receivers:			
	Designed for motor vehicle installation:			
	Entertainment broadcast band receivers:			
10	AM only..........	12.5%	8%	35%
15	AM/FM............	12.5%	8%	35%
25	Other............	12.5%	8%	35%
50	Other..............	12.5%	8%	35%
	* * *			

See footnotes at end of table.

Table 12-3
Autosound components: U.S. rates of duty, by TSUSA item--Con.

(Percent ad valorem)

TSUSA item No. 1/	Description	Pre-MTN col. 1 rate of duty 2/	Col. 1 rate of duty 1987	Col. 2 rate of duty
685.32	Other			
	* * *			
77	Other (pt.).............	10.4%	6%	35%
	* * *			
	Electrical articles and parts of electrical articles, not specially provided for:			
	* * *			
688.42A*	Other:			
	* * *			
80	Other.....................	5.5%	3.9%	35%

1/ The designation "A*" indicates that the item is currently designated as an eligible article for duty-free treatment under the Generalized System of Preferences (GSP) and that certain of these countries, specified in general headnote 3(c)(v)(D) of the Tariff Schedules of the United States Annotated, are not eligible.
2/ Rate effective prior to Jan. 1, 1980.

are no longer eligible for GSP treatment. The appropriate HS item number is 8527.90.80, with no change in the duty rate.

Equalizers and power boosters are classified for Customs purposes under TSUS item 688.42. The column 1 rate of duty is 3.9 percent ad valorem. The column 2 rate is 35 percent. U.S. imports of these products are eligible for preferential tariff treatment under the GSP, UIFTA, and CBERA. U.S imports from Mexico, Korea, and Taiwan are no longer eligible for GSP treatment because they have surpassed competitive-need limits. The HS item number is 8543.80.90, with no change in the duty rate.

Aside from the staged duty-rate reductions negotiated under the Tokyo Round of Multilateral Trade Negotiations and certain nonsubstantive number changes, there has been no change in tariff treatment of autosound components since 1982. There have been no investigations by the Commission or the U.S. Department of Commerce on the subject articles during the time period. Canadian original-equipment products covered by this section are accorded duty-free treatment under the Auto Parts Trade Agreement (APTA) and have specific APTA classification numbers in the TSUS.

Foreign tariff treatment

U.S. exports of autosound components are minimal. The only significant market for U.S. exports is Canada, where U.S.-based producers have motor-vehicle assembly facilities. Because of the APTA, there is no Canadian duty on OEM autosound components, which account for the bulk of U.S. exports. The duty rate on aftermarket products in Canada is 9.5 percent ad valorem, as shown in the following tabulation:

Item	Description	Country	Present rate of duty
			(Percent ad valorem)
85.15	Autosound components	United Kingdom	14%
		West Germany	14%
		Mexico	40%
		Brazil	105% plus 10% surcharge
44533-1	Aftermarket autosound components.	Canada	9.5%

Profile of the U.S. Industry

Overview

Through 1986, the U.S. industry producing autosound components was dominated by three firms that are subsidiaries of the three major U.S. automakers. Delco, based in Kokomo, Indiana, is a subsidiary of GM; Hughes Electronics Corporation is also a subsidiary of General Motors Corporation. The Electrical and Electronics Division (EED) of Ford Electronics and Refrigeration Corporation, headquartered in Dearborn, Michigan, produced autosound components in Lansdale, Pennsylvania until it was phased out in mid 1986, and began importing from a Brazilian subsidiary. Accustar, Inc., a subsidiary of Chrysler Corporation, produces autosound components in Huntsville, Alabama. Other smaller U.S. producers, distributed across the United States, supply particular segments of the autosound market. In addition, in 1987, Japanese-based companies began to set up U.S. subsidiaries to manufacture autosound components in various locations in the United States. To date, six Japanese companies have announced plans to open U.S. autosound production facilities. The total announced monthly capacity of these six plants is about 120,000 units. The various companies have announced startup dates during 1987-89.

U.S. producers of autosound components tend to be located away from their major customers (table 12-4). This is due to the relatively small number of U.S. autosound production sites compared with the larger number of automobile and truck assembly plants to which these items are sent to be installed. 1/ According to U.S. producers responding to the Commission's questionnaires, the predominant means of shipping autosound products is by truck. Manufacturers estimated that the transportation costs they incur in shipping these items to

1/ Producers that responded to Commission questionnaires represented an estimated 90 percent of the total U.S. industry.

Table 12-4
Autosound components: U.S. producers' rating of predominant modes of transportation used to ship autosound components, the marketing area generally serviced, and average percentage of transportation costs in the total delivered value of their firm's shipments

(In percent)

Item	Responses
Predominant mode(s) of transportation:	
Truck	53
Rail	18
Water	18
Other	12
General marketing area (radius):	
Up to 100 miles	-
101 to 200 miles	-
201 to 500 miles	13
Over 500 miles	87
Average transportation costs (as a percentage of sales):	
0 to 5 percent	60
6 to 10 percent	40
11 to 15 percent	-
16 to 20 percent	-
Over 20 percent	-

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

customers are generally 5 percent or less of the sales value because of their light weight and high value.

The hourly wage rates paid to production and related workers producing autosound components were consistently higher than the average for all U.S. manufacturing facilities during 1982-86, as shown in the following tabulation:

Year	Production and related workers producing autosound components 1/	All automotive parts 1/	All operating U.S. manufacturing establishments 2/
1982	$12.75	$12.24	$11.50
1983	13.56	12.90	11.97
1984	14.38	14.57	12.40
1985	15.47	15.51	3/ 12.82
1986	16.21	17.21	3/ 13.09

1/ Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.
2/ Compiled from unpublished data of the U.S. Department of Labor, Bureau of Labor Statistics.
3/ Estimated.

Except for 1986, the wage rates paid to autosound production workers were roughly the same as the average for all auto parts production workers. The reason for this is that autosound workers are employed almost exclusively by the three principal domestic automakers and are in the same union (UAW) and paid the same wages as other workers employed by these companies.

Capacity and employment

The movement offshore of autosound product lines by the major U.S. producers diminished U.S. capacity to produce these items, from 16 million units in 1982 to 11.1 million units in 1986, or by 31 percent (table 12-5). The tendency to maintain U.S. production of only the newest products, combined with the increasing sophistication of these products, has led to both higher wages paid to U.S. workers and an increase of almost 50 percent in the number of worker-hours necessary to manufacture such items.

Table 12-5
Autosound components: U.S. capacity, number of production and related workers, man-hours worked, wages, and hourly wage rates, 1982-86

Item	1982	1983	1984	1985	1986	Average annual percentage change, 1986 over 1982
Capacity (1,000 units)........	16,332	15,165	13,767	12,985	11,105	-9.2
Employment of production and related workers:						
Number...............	4,314	4,856	6,102	6,070	5,795	7.7
Man-hours worked (1,000 hours)......	8,628	11,132	13,702	13,317	12,275	9.2
Wages (million dollars)..	110	151	197	206	199	15.9
Hourly wage rate.....	$12.75	$13.56	$14.38	$15.47	$16.21	6.2

Source: Estimated by the staff of the U.S. International Trade Commission on the basis of data submitted in response to the Commission's questionnaires.

Delco, EED, and Accustar all produce other products (generally on separate production lines) related to electric and electronic automotive applications. Some examples are electronic engine control modules, electronic ignition modules, electronic voltage regulators, and electric alternators. The level of technology of the autosound components, as well as the production technique itself has traditionally been roughly comparable among the three main U.S. autosound producers.

Financial data

Net sales of autosound components produced in the United States rose by 52 percent, from an estimated $487 million in 1982 to about $738 million in 1985 before falling by 20 percent to approximately $592 million in 1986 (table 12-6).

Table 12-6
Autosound components: U.S. producers' total net sales and total net profit or (loss), 1982-86

Item	1982	1983	1984	1985	1986	Average annual percentage change, 1986 over 1982
Net sales (1,000) dollars.....	487,000	617,000	667,000	738,000	592,000	5.0
Net profit (loss) (1,000) dollars.....	39,000	113,000	145,000	174,000	130,000	35.1
Ratio of net operating profit (loss) to net sales (percent)..	8.0	18.3	21.7	23.6	21.9	28.6

Source: Estimated by the staff of the U.S. International Trade Commission on the basis of data submitted in response to the Commission's questionnaires.

A rise in reported net profits of 333 percent during the period was due at least in part to the increasing use of offshore facilities for the production of subassemblies. This has helped to increase profitability. In addition, the level of profitability can be partly attributed to the accounting procedures of producers, many of whom provide data only as intracompany transfers to their parent corporations.

Major foreign competitors

The most significant foreign autosound industry is located in Japan, having some 20 major autosound producers, and a dozen or more smaller specialty producers. Most of the major manufacturers are large multinational corporations, producing a variety of electronic and electrical products. For some companies like Matsushita, Hitachi, Mitsubishi, Sony, and Sharp, the car audio business represents a relatively small part of total sales. For other companies such as Clarion, Fujitsu Ten, and Alpine Electronics, car audio sales account for a substantial portion of their total sales.

Other significant foreign autosound industries are in Europe and include Philips, Blaupunkt (a subsidiary of Bosch), and Grundig. These producers hold fairly significant market shares in Europe but only concentrate on the high-end niche of the U.S. market for autosound components.

Certain East Asian countries (besides Japan) have industries producing autosound components. These include Hong Kong, Korea, Taiwan, Singapore, and Malaysia. Many companies in these countries are subsidiaries of Japanese firms and typically produce low-end units for export.

Structural Factors of Competition Between U.S. and Foreign Industries

According to U.S. autosound producers, their Japanese competitors enjoy production-cost advantages in labor rates, taxes, equipment costs, and interest rates (table 12-7). Similarly, they felt that companies in Korea producing autosound components have an advantage in labor rates, raw-material costs, and equipment costs, and also benefit from Government subsidies. U.S. companies also stated that West German producers of these items have lower labor costs, whereas French firms do not have any clear production-cost advantages. At the same time, domestic firms claimed to have lower fuel costs than Japan, West Germany, and France, lower equipment costs than West Germany and France, and lower interest rates than South Korea.

Table 12-7
Autosound components: U.S. producers' competitive assessment of structural factors of competition for the U.S. and foreign industries, 1/ by major competing countries, 1986

Item	Japan	South Korea	West Germany	France
Product cost advantages:				
Fuel cost	D	S	D	D
Raw materials cost	S	F	D	S
Domestic inflation rates	S	S	S	S
Labor cost	F	F	F	2/
Exchange rates	S	S	S	S
Taxes	F	S	S	D
Equipment costs	F	F	D	2/
Interest rates	F	D	D	D
Government involvement:				
Subsidies	S	F	S	2/
U.S. Government regulations that increase costs	S	2/	S	2/
Foreign government regulations that increase costs	S	2/	S	2/

1/ D=60 percent or more of total respondents accorded domestic producers an advantage; F=60 percent or more of total respondents accorded foreign producers an advantage; S=Competitive position the same.
2/ Insufficient data.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

The U.S. Market

Overview

The U.S. market for autosound components is dependent on new-car sales and on consumers choosing to replace their existing car audio systems. Because most new cars come with an audio system, the total market for autosound components can easily be segregated into two parts, the factory-installed segment and the aftermarket. During 1982-86 the portion of all U.S.-produced automobiles having factory-installed autosound systems rose from 88 percent in 1982 to 92 percent in 1986. 1/ The market for factory-installed autosound components during 1982-86 was dominated by the units produced and/or installed by Delco, EED, and Accustar.

The total market for autosound components increased from $1.1 billion in 1982 to $2.1 billion in 1986 (table 12-8). About 60 percent was accounted for by factory-installed or OEM autosound components in 1986, up from about 35 percent in 1982. 2/ Industry sources estimate that the product mix has changed so that in 1982, two-thirds of the units shipped were radios only, whereas in 1986, two-thirds of the units shipped were radio/tape player combinations.

Table 12-8
Autosound components: U.S. producers' shipments, exports of domestic merchandise, imports for consumption, and apparent consumption, 1982-86

Year	Shipments	Exports	Imports	Apparent consumption	Ratio (percent) of imports to consumption
	Quantity (units)				
1982......	4,296,000	700,000	1/	1/	1/
1983......	4,873,000	582,000	1/	1/	1/
1984......	5,209,000	782,000	1/	1/	1/
1985......	5,575,000	836,000	1/	1/	1/
1986......	4,219,000	823,000	1/	1/	1/
	Value (1,000 dollars)				
1982......	487,000	51,000	634,000	1,070,000	59
1983......	617,000	50,000	859,000	1,426,000	60
1984......	667,000	75,000	1,146,000	1,738,000	66
1985......	738,000	77,000	1,196,000	1,857,000	64
1986......	592,000	77,000	1,608,000	2,123,000	76

1/ Not available.

Source: Estimated by the staff of the U.S. International Trade Commission on the basis of data submitted in response to the Commission's questionnaires.

1/ Statement submitted to the Commission by the Car Audio Specialist Association.
2/ "Autosound," Automotive Electronics, 1986 Directory, 1986, vol. 7, No. 12, pp. 13-14.

U.S. imports

U.S. imports accounted for an increasing share of the total U.S. market for autosound components, from about 59 percent in 1982 to 76 percent in 1986, or from $634 million to $1.6 billion (table 12-9).

Table 12-9
Autosound components: U.S. imports for consumption, by principal sources, 1982-86

Country	1982	1983	1984	1985	1986	Average annual change, 1986 over 1982
	1,000 dollars					Percent
Japan...........	517,000	499,000	674,300	766,000	970,000	17.0
Brazil 1/.......						
Mexico 1/.......						
South Korea.....	77,000	83,000	97,000	87,000	82,000	1.6
West Germany....	2,000	7,500	22,000	8,600	36,000	105.9
All other.......	38,000	269,500	352,700	334,400	520,000	92.3
Total.......	634,000	859,000	1,146,000	1,196,000	1,608,000	26.2

1/ Combined with "all other" to avoid disclosing operations of individual companies.

Source: Estimated by the staff of the U.S. International Trade Commission on the basis of data submitted in response to the Commission's questionnaires.

The largest foreign source throughout the period was Japan. Japanese producers, on the basis of quality and technology, dominate the U.S. aftermarket for autosound components. 1/ In addition, they are principal suppliers to Japanese-based U.S. automakers. Japanese producers export approximately 70 percent of their total production, the bulk of which is shipped to the United States and Europe. U.S. imports from Japan increased from an estimated $517 million in 1982 to about $970 million in 1986, although as a share of the total, these imports from Japan decreased from 82 percent in 1982 to 60 percent in 1986. U.S. imports from Mexico increased more than tenfold from 1982 to 1985 before decreasing somewhat in 1986. The large increase was due principally to a major U.S. producer setting up assembly facilities in Mexico. The decline in 1986 was due to a shift in the product mix of that producer. Brazil, the third largest source of imports, is the principal production site for a major U.S.-based producer that has recently shifted production out of the United States. Such imports from Brazil increased irregularly from 1982 to 1986.

Competitive Assessment of Key Factors of Competition in the U.S. Market

Because much of the competitive advantage in consumer-electronics production has shifted to Japan and other Asian countries, U.S. purchasers of

1/ "Autosound," Automotive Electronic, vol. 7, No. 12, (1986), p. 13.

autosound components often find those countries to be the best source of up-to-date products. U.S. producers responding to the questionnaire indicated that price and quality were the most important reasons they purchased these items from foreign sources (table 12-10). They further responded that the ability of foreign manufacturers to meet product specifications was the third most important reason for importing.

Table 12-10
Autosound components: U.S. producers' ranking of factors that were the principal reasons for their imports, 1982-86

Reason for importing	Ranking 1/
Lower purchase price (delivered)	1
Shorter delivery time	2/
Engineering/technical assistance	4
Favorable terms of sale	2/
Favorable exchange rates	5
Reliability of supplier	5
Intra-company and affiliated company transfers on a basis:	
Competitive with unaffiliated firms	5
Noncompetitive	2/
Ability to meet specifications	3
Willingness to supply required volumes	5
Ability to supply metric sizing	2/
Quality	1

1/ Ranking numbers range from 1 to 5, number 1 indicating the most important reason for importing and number 5 indicating the least important reason for importing. Some factors were ranked equally in importance.
2/ Insufficient data.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

In response to questionnaires sent by the Commission, U.S. autosound producers stated that Japanese and Korean manufacturers of these items enjoy an overall competitive advantage (table 12-11). In the case of Korea, respondents indicated that the sole advantage of components from that country is their lower delivered price. U.S. companies felt that Japanese producers, however, benefit not only from lower prices, but also from such factors as engineering, production technology, innovation, and marketing practices. These U.S. firms stated that West German companies maintain a similar competitive position in the U.S. market as domestic producers. In addition, they stated that U.S. autosound companies have an overall competitive advantage against French manufacturers, especially in regard to price, production technology, and quality.

U.S. importers responding to the questionnaires indicated that manufacturers of these products in Japan, South Korea, and West Germany hold a

Table 12-11
Autosound components: U.S. producers'(P) and importers' (I) competitive assessment of U.S.-produced and foreign-produced products in the U.S. market, 1/ and the principal factors (X) underlying overall competitive advantages, by top competitor nations, 1986

Item	Japan		Korea		West Germany		France	
	P	I	P	I	P	I	P	I
Overall competitive advantage......	F	F	F	F	S	F	D	S
Product cost advantages:								
Lower purchase price (delivered).	X	X	X	X		X	X	
Favorable exchange rates.........				X			X	
Nonprice factors:								
Shorter delivery time............				X				
Engineering/technical assistance.	X	X		X				
Favorable terms of sale..........								
Production technology............	X	X		X		X	X	
Marketing practices..............	X					X		
Reliability of supplier..........		X				X		
Shorter new product development time..........................	X	X		X				
Willingness to supply required volumes.......................	X	X		X			X	
Ability to meet specifications...		X				X	X	
Product innovation...............	X	X		X		X		
Quality..........................	X	X		X		X	X	

1/ D=60 percent or more of total respondents accorded domestic producers an advantage; F=60 percent or more of total respondents accorded foreign producers and advantage; S=Competitive position the same.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

competitive advantage over U.S. firms. Importers felt that the products of these countries had an advantage based on delivered price, production technology, product innovation, and quality. U.S. importers also stated that autosound products from France maintain the same competitive position as U.S.-made products.

U.S. purchasers responding to the questionnaires indicated that purchases of U.S.-produced autosound components were made on the basis of a variety of factors, including the reliability of the supplier, shorter delivery time, supplier marketing practices, and favorable terms of sale (table 12-12). In contrast, purchases of foreign-made autosound components were made principally on the basis of price. Quality, production technology, supplier reliability, and product innovation were cited as significant factors as well.

Table 12-12
Autosound components: Ranking of U.S. purchasers' reasons for purchases of U.S.-produced and foreign-produced autosound components, 1982-86 1/

Reason for purchase	U.S.-produced	Foreign-produced
Product cost advantages:		
Lower purchase (delivered)	7	1
Favorable exchange rates	2/	9
Nonprice factors:		
Shorter delivery time	2	14
Engineering/technical assistance	9	6
Favorable terms of sale	4	9
Production technology	2/	3
Marketing practices	3	6
Reliability of supplier	1	3
Shorter new product development time	9	9
Willingness to supply required volumes	8	9
Ability to supply metric sizing	2/	2/
Ability to meet specifications	9	9
Product innovation	6	3
Quality	5	2

1/ Ranking numbers range from 1 to 14, number 1 indicating the most important reason for purchase and number 14 indicating the least important reason for purchase. Some factors were ranked equally in importance.
2/ Insufficient data.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Competitive Assessment of Key Factors of Competition in Foreign Markets

The major markets for autosound components outside the United States include Japan and Europe. The value of the Japanese market in 1986 was approximately $625 million, about half of which were units that were factory installed. 1/ The Japanese market is composed of virtually 100 percent domestic products. This is due to several factors, including the advanced level of Japanese producers vis-a-vis foreign producers. U.S. industry sources claim that a more important factor is the keiritsu structure that ties certain Japanese auto producers to specific autosound component suppliers. This structure allegedly forecloses virtually all opportunities for other domestic and foreign suppliers, according to U.S. producers. 2/

The European market is dominated by European and Japanese producers. There are some imports from Brazil as well: those units are from Ford's Brazilian subsidiary that produces most of Ford's North American autosound requirements and a certain portion of the requirements for Ford of Europe.

1/ "Overseas Market Report," Electronics, Jan. 22, 1987, pp. 68-74.
2/ USITC staff interview with Motorola officials, Apr. 7, 1987.

The only significant U.S. exports of autosound components during 1982-86 were to Canada. Such exports fluctuated during the period and amounted to $83.6 million in 1982 and $87.3 million in 1986. U.S. exports of autosound components to Canada reflect intracompany shipments to Canadian subsidiaries of U.S. automakers.

BATTERIES

Description and uses

Batteries for automotive use are of the 12-volt lead-acid type. Automotive batteries form an essential part of a motor vehicle's electrical system, providing a reservoir of electricity to power a vehicle's starting, lighting, and ignition systems, as well as various electrical accessories. Original equipment (OE) and replacement batteries are essentially the same product. However, depending on customer specifications, a small quality difference may favor the OE product.

Automotive batteries are constructed of cells, each of which has a nominal output of two volts. Each cell consists of cast antimony-lead or calcium-lead grids (or "plates") coated with baked lead oxide. The plates are alternately given negative and positive charges and are separated by insulators. Negative and positive plates are then connected to provide the necessary voltage. Automotive batteries can be stored indefinitely in a dry condition, and must be activated by the addition of sulfuric acid prior to use.

Automobile starting currents and electrical systems require a battery to be rated at a minimum of 35 ampere-hours. Automotive batteries are generally classified by the Battery Council International (BCI) by group size and electrical specifications. The BCI group size indicates physical dimensions as well as terminal positions and cell layouts within the batteries. The current BCI Battery Replacement Data Book identifies 50 group sizes of 12-volt automotive batteries. The electrical specifications of automotive batteries may be measured by cold cranking amps (CCA), by ampere-hours, or by the number of plates in the battery. CCA is the most common measurement in the U.S. market and is a measure of the battery's power available to start a car in cold weather.

In structure, most batteries are similar. Quality variations among batteries are a function of materials used and control over the manufacturing process. For example, an even application of a predictable amount of lead oxide paste over battery grids is a crucial step in battery production. Automated machinery and quality-control techniques have enabled the U.S. industry to attain close control over pasting operations and, in general, high product standards. Battery imports from developed countries are generally considered on a par with U.S. products, and according to industry sources, imports from Korea are rapidly approaching U.S. quality standards. 1/ The quality of imports from most other countries do not meet U.S. quality levels.

1/ USITC staff interview with U.S. battery manufacturers.

Manufacturing process

The production of 12-volt lead-acid automotive storage batteries begins with the casting of the grids that serve as support for the active battery material and that conduct much of the electric current through the battery. Grid-casting equipment molds and then cools molten lead into the desired grid configuration. All automotive battery grids are designed with open spaces between their interlocking cross bars in order to lock the active material in place. The lead employed in the grids of most modern automobile batteries consists of either a high antimony (around 5-6 percent), a low antimony (typically less than 2.5 percent), or a calcium lead (usually less than 1 percent calcium) alloy. Calcium or antimony is used as an alloying material to stiffen the otherwise very soft lead grid during production and to decrease the warping of plates over the operating life of the battery. When low antimony or calcium alloy grids are employed in the construction of batteries, the finished products are commonly referred to as "low maintenance" or "maintenance free" batteries.

Following casting, the grids are covered, or "pasted," with an active material consisting of lead oxide, or a blend of oxides, which has been treated with sulfuric acid. The use of sulfuric acid results in the formation of lead sulfate, which helps to bind the active material to the grid and improves the operating characteristics of the pasted grid by expanding or "bulking" the paste. The pasting operation is most commonly performed automatically by equipment that presses the paste into the grids. The pasted grids, or plates, are then cured for approximately 2 days in a closely controlled hot and humid curing environment. This process is called hydrosetting. The high heat and humidity not only toughen the bond of the active material to the grid, but also are designed to increase the homogeneity of the active material on the plate. The latter procedure helps to improve the flow of current through the plate.

The dry-charged plates are immersed in a weak sulfuric acid solution in large forming tanks. By applying an electric charge to the plates in the tanks, the positive plates become the anode and the negative plates become the cathode of what amounts to a large battery. The slow "forming charge" is normally applied to the plates for 1 to 2 days during which time the composition of the active materials on the plates changes to create a potential electrical difference between the positive and negative plates. When the plates have been completely formed, they are rinsed and dried to prepare them for the "stack and burn" phase of production.

In the "stack and burn" operation, positive and negative plates are alternately stacked on either side of an electrically insulating separator and welded, positive to positive and negative to negative to create an individual cell of the battery. Six of these 2-volt cells are placed in the preformed individual pockets or partitions of the bottom portion of the battery container. Electrical connections between the cells are usually made either automatically by "through the partition" automated welding techniques, or by manual "over the top" welds. After these internal connections are made, the top of the battery case is applied to the battery and sealed, usually either by a heated epoxy glue or by thermal sealing techniques. The battery is then tested for leaks in the seal of the case and for internal electrical faults.

At this point a preformed dry-charged battery is ready for use following the addition of the sulfuric acid electrolyte and a recommended 15-minute "booster charge" to bring it up to its full operating voltage.

Customs Treatment

U.S. tariff treatment

Imports of 12-volt automotive batteries are currently classified in TSUS item 683.01, which covers all 12-volt lead-acid storage batteries. In January 1987, at the request of the U.S. Battery Trade Counsel (BTC), under section 484(e) of the Tariff Act of 1930, item 683.01 was revised in an attempt to separate batteries for automotive use from other type 12-volt lead-acid batteries. To accomplish this, batteries "of a kind used in starting piston engines" were separated out and subdivided into item 683.0110, batteries not over 13 pounds in weight; and item 683.0120, batteries over 13 pounds in weight. With these new breakouts, imports of the three major types of 12-volt lead-acid batteries--motorcycle, automotive and industrial--can be approximated. Automotive-type batteries generally enter the United States under item 683.0120 with a small amount of other piston-type batteries mixed into the import statistics (table 12-13). Batteries imported from Canada under the Automotive Products Trade Act (APTA), enter duty free under item 683.02.

Table 12-13
Batteries: U.S. rates of duty, by TSUSA item

(Percent ad valorem)

TSUSA item No. 1/	Description	Pre-MTN col. 1 rate of duty 2/	Col. 1 rate of duty 1987	Col. 2 rate of duty
683.0120A*	Lead acid type storage batteries and parts thereof. 12-volt batteries of a kind used in starting piston engines: Over 13 lb in weight.	8.5%	5.3%	40%
683.0200	Canadian article and original motor-vehicle equipment.	Free	Free	3/

1/ The designation "A*" indicates that the item is currently designated as an eligible article for duty-free treatment under the Generalized System of Preferences (GSP) and that certain of these countries, specified in general headnote 3(c)(v)(D) of the Tariff Schedules of the United States Annotated, are not eligible.
2/ Rate effective prior to Jan. 1, 1980.
3/ Not applicable.

Before the establishment of item 683.01 in 1985, imports of 12-volt automotive batteries were classified in TSUS item 683.05, which covered all 12-volt lead-acid storage batteries. This item was established by Executive Order 12354, effective March 31, 1982, as the result of a petition filed with the Office of the United States Trade Representative by the Yuasa-General Corp. Yuasa-General successfully requested that 12-volt lead-acid batteries from Taiwan be removed from eligibility for duty-free treatment under the Generalized System of Preferences (GSP) program; in addition, Korea was removed from GSP eligibility status with respect to TSUS item 683.01 by Executive Order 12413, effective March 31, 1983, as the result of a second Yuasa-General petition. Imports of batteries under TSUS item 683.01 from all other designated beneficiary developing countries are currently eligible for duty-free treatment under the GSP.

Batteries classified in TSUS item 683.01 from countries afforded most-favored-nation (MFN) treatment are currently dutiable at the Column 1 rate of 5.3 percent ad valorem. This represents the final staged rate negotiated under the Tokyo Round of Multilateral Trade Negotiations (MTN) for column 1 rates.

Batteries imported under TSUS item 683.01 from certain countries that the President has designated as being under Communist control or domination (but not including the People's Republic of China, Hungary, Yugoslavia, and Romania) are dutiable at the TSUS column 2 rate of 40 percent ad valorem. Finally, products covered by the item are eligible for preferential tariff treatment under the Caribbean Basin Economic Recovery Act (CBERA), and the United States-Israel Free Trade Area Implementation Act (UIFTA).

In 1985, General Battery International Corp., filed an antidumping petition against Korea on behalf of the Puerto Rican automotive replacement-battery industry. The Commission determined that there was no reasonable indication that the U.S. battery industry was materially injured or threatened with material injury by the reason of less than fair value imports of 12-volt lead-acid type replacement batteries from Korea (investigation No. 731-TA-2610). It was determined that the Puerto Rican industry did not qualify as a "regional industry" under the antidumping law.

Foreign tariff treatment

Canada is the only significant market for the export of automotive-type lead-acid batteries. Nearly all exports to Canada are OEM batteries and are therefore not assessed a duty because they enter Canada under the duty-free provisions of the APTA of 1965. The tariff rate on aftermarket batteries is more than double the U.S. rate, or 10.8 percent ad valorem. The rates of duty for Canada and other principal export markets are shown in the following tabulation:

Item	Description	Country	Present rate of duty
			(Percent ad valorem)
85.03	Lead-acid batteries	Taiwan	15%
		South Africa	75 cents
		Mexico	40%
		Saudi Arabia	4%
		Venezuela	35% plus 5% surcharge
44512-1		Canada	10.8%

Low levels of battery exports are due primarily to the high cost of transport and the lack of significant market opportunities, rather than high tariff barriers.

Profile of the U.S. Industry

Overview

There are approximately 50 U.S. producers of lead-acid automotive batteries in the United States. Most producers manufacture batteries solely for replacement use and are located throughout the United States. Many of the smaller manufacturers either serve primarily the local market, or they provide "niche" batteries that the larger producers do not manufacture because of limited demand. Replacement niche markets and significant freight costs resulting from the heavy weight of batteries, have enabled many small producers to survive. Seven out of the 18 firms responding to the Commission's questionnaire, accounting for about 90 percent of industry shipments, indicated that transportation costs amounted to over 5 percent of sales (table 12-14).

Producers of OE batteries are centered in the Midwest and Eastern United States and are much more highly concentrated than aftermarket producers. Two firms provide the bulk of OE shipments, with eight firms reporting OEM shipments between 1982-1986. Each OEM firm also supplies the aftermarket.

The top four battery producers will account for an estimated 84 percent of all OEM and replacement shipments by 1988. This figure contrasts with a level of 68 percent in 1975. 1/

1/ Richard Amistadi, "Battery Shipment Review and Five Year Forecast," Presented to the Battery Council International 99th Convention, Apr. 28, 1987.

Table 12-14
Batteries: U.S. producers' rating of predominant modes of transportation used to ship batteries, the marketing area generally serviced, and the average percentage of transportation costs in the total delivered value of their firms' shipments

Item	Number of responses
Predominant mode(s) of transportation:	
Truck	14
Rail	4
Water	-
Other	-
General marketing area (radius):	
Up to 100 miles	1
101 to 200 miles	1
201 to 500 miles	9
Over 500 miles	7
Average transportation costs (as percentage of sales):	
0 to 5 percent	11
6 to 10 percent	5
11 to 15 percent	2

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Hourly wage rates for automotive-battery production and related workers increased 23 percent during 1982-86 to $11.19 an hour in 1986, as shown in the following tabulation:

Year	Production and related workers producing automotive batteries 1/	All automotive parts 1/	All operating U.S. manufacturing establishments 2/
1982	$ 9.08	$12.24	$11.50
1983	10.04	12.90	11.97
1984	10.60	14.57	12.40
1985	11.01	15.51	3/ 12.82
1986	11.19	17.21	3/ 13.09

1/ Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.
2/ Compiled from unpublished data of the U.S. Department of Labor, Bureau of Labor Statistics.
3/ Estimated.

At the same time, hourly wages for all workers producing automotive parts increased by 41 percent, exceeding those for workers producing batteries by over $6 an hour in 1986. Wages in the battery industry are also below the average for all U.S. manufacturing establishments, although the gap has closed slightly since 1982. Most battery plants are reportedly unionized. However, many of the operations required in the production of batteries do not require high skill levels; and most battery manufacturing operations are located in low-wage areas.

There are currently no Japanese-owned automotive-battery manufacturing plants in the United States. However, in testimony at the Commission's hearing, the BTC, a self-described "ad-hoc" coalition of U.S. automotive battery manufacturers, said that Yuasa, Japan Storage Battery, and Matsushita have announced plans to manufacture batteries in the United States. 1/ A joint venture between Yuasa Battery Co. and Exide Corp. currently produces motorcycle batteries in the United States and plans to produce automotive batteries in 1988 or 1989, reportedly to supply Japanese companies in the United States. 2/

Nearly all respondents to the Commission's questionnaire noted that, whereas U.S. producers are probably the most advanced and efficient in the world, the industry faces high Government regulatory costs not borne by most foreign competitors. Lead and sulfuric acid, the major active materials in an automotive battery, are considered potential health and environmental threats by the Environmental Protection Agency (EPA) and the Occupational Safety and Health Administration (OSHA). Industry sources indicate that company capital expenditures to comply with EPA and OSHA regulations ranged from 15 to 50 percent of overall capital investments in 1985 and 1986. 3/ Estimates on the unit cost per battery of adhering to Government standards range from 2 to 10 percent. 4/

In addition to these regulations that have added costs, the battery industry is subject to tax assessments under the Comprehensive Environmental Response, Compensation and Liability Act of 1980, and the Superfund Amendments and Reauthorization Act of 1986. 5/ These taxes apply to the sale of domestic and imported lead oxide and sulfuric acid (among other types of hazardous materials) as a means of generating revenue for the cleanup of hazardous waste sites. Since these taxes apply at the point of sale, only batteries made in the United States are subject to the taxes, whereas imported batteries, which also create hazardous waste, are exempt.

Capacity and employment

The U.S. battery industry has purchased automated machinery, thereby increasing productivity and capacity during 1982-86. During the same period, U.S. automotive battery capacity increased by 21 percent from 1982 to

1/ Transcript of the hearing, p. 4.
2/ Asian Wall Street Journal, Mar. 1, 1986, p. 26.
3/ USITC staff interview with battery manufacturers.
4/ USITC staff interview with U.S. BTC officials, March 1987.
5/ Post-Hearing brief of the U.S. BTC, Mar. 12, 1987.

85 million units (table 12-15). In addition, the number of employees and man-hours remained constant.

Table 12-15
Batteries: U.S. capacity, number of production and related workers, man-hours worked, wages, and hourly wage rates, 1982-86

Item	1982	1983	1984	1985	1986	Average annual percentage change, 1986 over 1982
Capacity (1,000 units)......	70,039	71,790	74,013	78,374	84,966	4.9
Employment of production and related workers:						
Number.............	13,313	12,803	13,411	13,442	13,573	.5
Man-hours worked (1,000 hours)....	27,110	25,505	26,874	27,490	28,006	.8
Wages (1,000 dollars)..	246,176	256,057	284,884	302,772	313,364	6.2
Hourly wage rate...	$9.08	$10.04	$10.60	$11.01	$11.19	5.4

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Industry sources see no reversal in this trend, but do expect an industry shakeout in the near future, which will eliminate some excess capacity and combine resources into fewer, stronger firms. Questionnaire respondents assert that increased imports and Japanese-owned firms locating in the United States will exacerbate the overcapacity problem and precipitate an industry shakeout. Employment increased by 2 percent, rising from 13,313 production and related workers in 1982 to 13,573 in 1986.

Financial data

U.S. producers' sales of automotive batteries increased erratically, from $1.5 billion in 1982 to $1.8 billion in 1986, or by 20 percent (table 12-16). Sales of OE batteries accounted for much of the growth in 1984, as automobile production increased by 15 percent. Replacement sales also rose during the period, but at a slower rate.

Whereas sales increased by 4 percent from 1984 to 1986, profits declined by 17 percent. In 1986, profits represented 6 percent of sales versus 8 percent in 1984. This figure is still above the 4-percent level for 1982. Industry sources stated that falling unit prices were due to increased foreign and domestic competition. 1/

1/ USITC staff interview with battery manufacturers.

Table 12-16
Batteries: U.S. producers' total net sales, total net profit or (loss), capital expenditures, and research and development expenditures, 1982-86

Item	1982	1983	1984	1985	1986	Average annual percentage change, 1982-86
Net sales (1,000 dollars)......	1,527,470	1,511,625	1,750,842	1,730,851	1,819,533	4.5
Net profit (loss) (1,000 dollars).......	66,509	95,611	135,206	120,553	112,166	13.9
Ratio of net operating profit (loss) to net sales (percent)..	4.4	6.3	7.7	7.0	6.2	8.9
Capital expenditures (1,000 dollars)......	29,498	32,626	41,135	55,036	52,064	15.3
Research and development expenditures (1,000 dollars)......	18,601	20,932	23,072	26,239	29,826	12.5

Source: Estimated by the staff of the U.S. International Trade Commission on the basis of data submitted in response to the Commission's questionnaires.

To meet Government regulations and competition, both capital expenditures and research and development spending grew at a faster pace than sales, increasing during the period by 77 percent and 60 percent, respectively. In 1986, capital spending amounted to $52.1 million, or 3 percent of sales, and research and development costs reached $29.8 million, or 2 percent of sales.

Major foreign competitors

Some domestic industry representatives see the penetration of imported automobiles into the United States as the major source for the growth and acceptance of foreign batteries. 1/ Respondents believe that each imported automobile with a battery is a lost sale to the U.S. industry and an advertisement to U.S. consumers. Industry sources state that the advent of "universal batteries," which fit a variety of specifications, will open the U.S. market to further foreign competition. 2/ Prior to its development, a manufacturer had to produce several different types of batteries in order to be considered a full-line manufacturer.

The Japanese automotive-battery industry, producing one-third of the world's total batteries, is second only to that in the United States. In contrast to the United States, where the bulk of battery production is

1/ USITC staff interviews with battery manufacturers.
2/ Ibid.

intended for the domestic replacement market, about one-half of battery sales by Japanese companies are for OEM use.

As Korean automobile sales increase in the United States, it is believed that Korean battery producers will increase sales in the U.S. market. Sources indicate that the Korean battery industry is not as technologically advanced as the domestic industry. However, there has been some technology transfer to the Korean industry by U.S. firms. In 1986, Delco-Remy, a subsidiary of General Motors, announced a joint venture with the Daewoo and Hyosung groups of Korea to produce batteries using technology not currently available in Korea. 1/

The European battery industry is on a par technologically with the United States. Whereas most imports from Europe are replacement batteries for European-produced vehicles and are designed to meet manufacturers' specifications, some batteries imported from Europe are intended for OEM use. Respondents to the questionnaire indicated that European producers are not price competitive with U.S. manufacturers.

Structural Factors of Competition Between U.S. and Foreign Industries

Respondents gave an overwhelming advantage to foreign battery industries with respect to U.S. Government regulations that increase costs (table 12-17). According to industry sources, no other country is saddled with the environmental regulations faced by the U.S. battery industry. U.S. producers also rated themselves at a competitive disadvantage in labor wage rates compared with every other major competing country.

Korea was given competitive advantages in labor costs, taxes, equipment costs, government subsidies, and regulation. Japan, Canada, and Taiwan were perceived as either having advantages or the same competitive position vis-a-vis the U.S. industry in every structural factor of competition listed on the questionnaire. U.S. producers were given an advantage over Brazil in fuel costs, inflation rates, and interest rates. However, the Brazilian industry was rated in a favorable position in several other factors, including equipment costs.

The U.S. Market

Overview

Discussion of the U.S. market for automotive batteries can be divided between replacement and OE end uses. The replacement market is considered "mature," with high concentration in a few large producers, several small

1/ "Automobile Storage Batteries: Delco-Remy Announces Joint Venture in Korea," Monthly Import and Business Review, U.S. International Trade Commission, February 1986, p. 36.

Table 12-17
Batteries: U.S. producers' competitive assessment of structural factors of competition for the U.S. and foreign industries 1/, by major competing countries, 1986

Item	Korea	Japan	Canada	Taiwan	Brazil
Product cost advantage:					
Fuel cost	S	S	S	S	D
Raw materials costs	S	S	S	S	S
Domestic inflation rates	S	S	S	S	D
Labor costs	F	F	F	F	F
Exchange rates	S	S	F	S	F
Taxes	F	F	S	F	F
Equipment costs	F	S	S	F	F
Interest rates	S	S	S	F	D
Government involvement:					
Subsidies	F	F	S	F	F
U.S. Government regulations that increase costs	F	F	F	F	F
Foreign government regulations that increase costs	S	S	S	2/	S

1/ D = 60 percent or more of total respondents accorded domestic producers an advantage; F = 60 percent or more of total respondents accorded foreign producers an advantage; S = Competitive position the same.
2/ Insufficient data.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

producers, and slow growth (about 2 percent per year). Nearly all imports compete in the aftermarket.

Determinants of demand for replacement batteries include the number of vehicles in service, the age of the automobile fleet, and the life expectancy of a battery. The annual growth in the U.S. vehicle fleet reportedly averages about 2-3 percent, with 157 million vehicles in service in 1985. The age of the U.S. automobile fleet has increased from 4.8 years in 1970 to 6.8 years in 1985. With improved factory-process control, the life expectancy of batteries has increased about 6 months; however, sources indicate that this has not had a significant impact on demand. 1/

The OEM market is between one-fourth and one-fifth the size of the replacement market. Demand in the OEM market fluctuates with U.S. automobile production and industry production is much more highly concentrated, with

1/ Richard Amistadi, "Battery Shipment Review and Five Year Forecast," presented to the Battery Council International 99th Convention, Apr. 28, 1987.

about five manufacturers. With the advent of increased automotive electronics, vehicle manufacturers are exploring the possibility of two-battery cars, which may raise production levels significantly. 1/

Overall battery apparent consumption increased 16.5 percent during 1982-86 to $1.8 billion in 1986 (table 12-18). Exports exceeded imports (in value) each year; however, the gap has been shrinking. The ratio of imports to consumption, in terms of value, grew from 1.1 percent in 1982 to 1.5 percent in 1986. Shipments, by units, grew at a faster pace than by value, indicating decreasing battery unit values.

Table 12-18
Batteries: U.S. producers' shipments, exports of domestic merchandise, imports for consumption, and apparent consumption, 1982-86

Year	Shipments	Exports	Imports	Apparent consumption	Ratio (percent) of imports to consumption
	Quantity (units)				
1982.....	55,061,418	868,591	343,667	54,536,494	0.6
1983.....	58,118,909	888,663	647,813	57,878,059	1.1
1984.....	61,681,923	1,313,489	740,498	61,108,932	1.2
1985.....	64,273,244	1,404,148	1,075,187	63,944,283	1.7
1986.....	67,477,665	1,327,175	1,555,696	67,706,186	2.3
	Value (1,000 dollars)				
1982.....	1,537,053	26,850	17,149	1,527,352	1.1
1983.....	1,553,654	27,484	18,074	1,544,244	1.2
1984.....	1,699,663	36,601	19,327	1,682,389	1.1
1985.....	1,679,408	36,804	25,912	1,668,516	1.6
1986.....	1,787,940	34,730	26,581	1,779,791	1.5

Source: Shipments and exports, compiled from data submitted in response to questionnaires of the U.S. International Trade Commission; imports estimated from questionnaire data and official statistics of the U.S. Department of Commerce.

U.S. imports

There is no accurate historical measure of U.S. imports of automotive lead-acid storage batteries, and because of insufficient responses, questionnaire data are inconclusive. On the basis of questionnaire data and U.S. Department of Commerce statistics, U.S. imports of automotive batteries are estimated to have increased by 55 percent over the 1982-86 period to $26.6 million in 1986 (table 12-19). Canada was the leading supplier each year. The majority of the imports from Canada are from subsidiaries of U.S. firms.

1/ USITC staff interviews with battery manufacturers.

Table 12-19
Batteries: U.S. imports for consumption, by principal sources, 1982-86 1/

Country	1982	1983	1984	1985	1986	Average annual change, 1986 over 1982
	1,000 dollars					Percent
Canada	12,800	13,240	11,433	12,060	12,886	0.2
European countries 2/	3,946	4,190	4,314	7,342	7,463	17.3
Korea	173	230	2,597	3,892	3,969	118.9
Latin America 3/	5	218	664	2,011	1,501	315.2
Japan and Taiwan	200	100	200	435	534	27.8
All other	25	96	119	172	228	73.8
Total	17,149	18,074	19,327	25,912	26,581	11.6

1/ Country groupings reported to avoid revealing the operations of a single firm.
2/ Countries include West Germany, France, Sweden, and the United Kingdom.
3/ Countries include Mexico, Brazil, and Venezuela.

Source: Estimated by the staff of the U.S. International Trade Commission on the basis of data submitted in response to the Commission's questionnaires, and official statistics of the U.S. Department of Commerce.

Import data for West Germany, France, the United Kingdom, and Sweden are aggregated so as not to reveal the operations of any individual firm. The bulk of imports in this category are from West Germany and to a lesser extent France. Sources indicate that most U.S. imports of batteries from Europe are replacement types, to meet manufacturers' specifications for European-made cars. Battery imports from these countries nearly doubled over the period to $7.5 million, following the trend in increased European car registrations in the United States.

Imports of batteries from Korea have shown the largest gain, increasing from $173,000 in 1982 to nearly $4.0 million in 1986. The U.S. BTC states that retail prices of Korean batteries in the United States are at or below U.S. manufacturing costs; however, certain industry sources state that Korean products are generally lower in quality than U.S.-made batteries. 1/ Whereas Korean firms reportedly hold cost advantages in wages and avoidance of regulatory spending, industry sources believe that these advantages alone do not account for the 30-50 percent margin of underselling claimed by industry representatives. 2/ The BTC points to the experience of Australia, where Korean imports grew from zero in 1981, to capture 40 percent of the Australian market by 1985. Statistics from the U.N. trade-data system support this claim, as Australian imports from Korea of all storage batteries (the majority of which are reported to be for automotive use), increased from $287,000 in 1982 to $14.6 million in 1985, before falling to $7.1 million in 1986. Korean exports of all storage batteries nearly tripled from 1982 to $43.8 million in 1986.

1/ Transcript of the hearing, p. 6; and comments submitted in response to questionnaires of the U.S. International Trade Commission.
2/ Ibid.

Industry sources point to the limited U.S. market penetration of Japanese batteries, less than $500,000 each year from 1982-86, to support their claim of Korean underselling. Japan possesses an efficient and technologically advanced battery industry that manufactures a product of superior quality. However, the fact that imports are so small indicates that high shipping costs make it prohibitively expensive for Japanese firms to export in significant quantities to the United States.

As developing countries establish their own battery industries, there is concern in the U.S. industry that, with the advantages of lower labor rates and the absence of regulatory costs, these countries may be able to sell competitively in the United States market. Taken together, imports from Mexico, Brazil, and Venezuela increased erratically from $5,000 in 1982 to $2.0 million in 1985 before falling to $1.5 million in 1986. Currently, these countries lack the capacity and product quality to be considered major competitors to U.S. producers.

Competitive Assessment of Key Factors of Competition in the U.S. Market

In telephone interviews, certain automotive battery producers indicated that imports to the United States are growing, but still are not a significant concern to the industry. U.S. producers experience little competition with respect to OEM sales. 1/

Automobile manufacturers require batteries to be shipped filled with acid for immediate insertion into assembled vehicles. A battery filled with acid becomes a perishable item as the shelf life is limited. It also adds weight and spillage concerns to shipping costs. At the same time, the U.S. industry produces a technologically advanced product at low cost. For these reasons, the imports of OEM batteries have been small thus far. This does not preclude the possibility of foreign producers opening facilities in the United States or Canada. Japanese battery producers are reportedly encouraged by Japanese auto manufacturers' transplant companies and State incentives to establish production facilities in the United States. Japanese vehicle manufacturers reportedly have an ownership stake in each major Japanese battery company. 2/

U.S. purchasers responding to the questionnaire indicated that reliability of supplier, quality, and shorter delivery time were the principal reasons for their purchases of domestically produced batteries during 1982-86 (table 12-20). These responses show that customer service and a high quality U.S. product provide U.S. producers with a substantial edge over foreign competition. Lower purchase price was ranked seventh in importance.

1/ USITC staff interviews with battery manufacturers.
2/ Ibid.

Table 12-20
Batteries: Ranking of U.S. purchasers' reasons for purchases of U.S.-produced and foreign-produced batteries, 1982-86 1/

Reason for purchase	U.S.-produced	Foreign-produced 2/
Lower purchase (delivered)	7	
Nonprice factors:		
Shorter delivery time	2	
Engineering/technical assistance	3	
Favorable terms of sale	5	
Production technology	6	
Marketing practices	3	
Reliability of supplier	1	
Shorter new product development time	10	
Willingness to supply required volumes	4	
Ability to supply metric sizing	11	
Ability to meet specifications	8	
Product innovation	9	
Quality	2	

1/ Ranking numbers range from 1 to 11, number 1 indicating the most important reason for purchase and number 11 indicating the least important reason for purchase. Some factors were ranked equally in importance.
2/ Insufficient data.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Competitive Assessment of Key Factors of Competition in Foreign Markets

U.S. producers of automobile batteries show little interest in foreign markets, as export potential is limited. Relatively high U.S. labor rates, Government regulation costs, and containerization and transportation fees are inhibiting factors to trade.

On a regional basis, Asia has three major producers of batteries: Japan, Korea, and Taiwan. These countries account for most of the Asian market, and they also export significant quantities of batteries. Market conditions in Europe are very similar to those in the U.S.--e.g., domestic firms supply the bulk of consumption although imports of batteries from Korea are allegedly imported at "abnormal prices." 1/ However, the European industry reportedly supplies the lion's share of Africa's consumption. South America has significant capacity relative to demand, with Brazil producing 4.3 million batteries in 1986, an increase of 16.2 percent from 1985. 2/

1/ Claude Darmon, "Major Trends in European Battery Industry," presented at Battery Council International 1987 meeting, Apr. 28, 1987.
2/ Report from the U.S. Consulate, Sao Paulo, Brazil, June 1987.

Some prospects for exports by U.S. companies in developing countries do exist. However, batteries can be manufactured using unsophisticated capital equipment and technology. Therefore, as the income level of a developing country rises and motor vehicle registrations increase, lead-acid battery industries are often the first enterprise to develop. 1/ Once the country begins to develop its own battery industry, the market will generally be closed to imports. General restraints on imports by debt-ridden developing countries also restrict foreign shipments to those countries. 2/

BEARINGS

Description and uses

Antifriction bearings are machine components that permit free motion between moving and fixed parts by holding or guiding the moving parts to minimize friction and wear. In a bearing, a series of rollers or balls are usually mounted in a separation or cage and enclosed between two rings called races. The rolling elements are very important, since they transmit the physical load or force from the moving parts to the stationary support. The two principal types of antifriction bearings are ball bearings and roller bearings. The principal differences between the categories are the rolling elements (balls or rollers) and their respective abilities to carry loads. Load, speed, required bearing life (expressed in hours at a designated number of rotations and load), environment, and lubricants are the most important variables considered when choosing the proper bearing for a given application. 3/

There are four basic components in ball or roller bearings: the cup, the cone, the cage, and the roller element. The cup, also called the outer ring, is the largest part of the assembly, and, in the case of a tapered roller bearing, its inner surface is tapered to conform with the angle of the roller assembly. The cage keeps the rollers equally distributed around the cup and cone. The roller elements fit into openings in the cage. The number of rolling elements is a function of the size of the cages, which is determined by the end usage of the bearings. The cage, rollers, and cone are joined together to form a cone assembly, which, when joined with a cup, forms a roller-bearing set.

Ball bearings.--Ball bearings may be radial (a bearing designed to support load perpendicular to the shaft axis) or contain integral shafts (a combination of radial and thrust loads). They also may be classified by a number of configurations, including single row, double row, self aligning, and angular contact. Ball bearings, having less contact between the rolling balls and the case, can withstand fairly high speeds. When load-carrying capacity is considered more important than high speeds, roller bearings are more likely to be used.

1/ David Stonfer, "The Storage Battery Market: Profiles and Trade Opportunities," April 1985, pp. 27-34.
2/ Ibid.
3/ "Bearings," 1985 Power Transmission Design Handbook, p. A/158.

Roller bearings.--Roller bearings can support greater loads than ball bearings because they have greater rolling-surface area in contact with the inner and outer race (the outer ring and inner ring of a bearing). They are able to absorb both radial and thrust loads, unlike ball bearings, which typically withstand only radial force. 1/ The most common types of roller bearings used in the auto industry are needle and tapered. Needle roller bearings are a special type of cylindrical bearing, distinguished by a comparatively small diameter and a high ratio of length to diameter. Needle bearings are used especially in universal joints.

Although ball and tapered roller bearings are not interchangeable, the original determination of which type of roller element (i.e., ball or tapered roller) to use is sometimes an engineering choice made at the initial design phase of the product incorporating the bearing (fig. 12-1). As stated earlier, the choice would depend on the amount and type of load-carrying ability, as well as other factors. Industry sources have indicated that as production of automobiles has trended toward smaller, lighter weight, front-wheel-drive vehicles, there has been some substitution of ball bearings for the tapered roller bearings that had previously been used. 2/ In contrast, in many industrial applications of both radial and thrust loads, there is a much lower degree of interchangeability between roller and ball bearings.

Self-contained tapered roller-bearing packages, also called bearing cartridge units and wheel-hub units, are prelubricated, preset, double-row tapered roller bearings that have been sealed. Bearing cartridge units began appearing on the U.S. market about 10 years ago, but have been extensively used in the European market for over 30 years. In Europe, these units incorporate a ball rolling element, as opposed to the U.S. practice of using tapered rollers. Bearing cartridge units, both the ball and tapered roller styles, are used almost exclusively in the United States on the front axle of front-wheel-drive cars. 3/ These units eliminate the need for adjustment of the close tolerances required with the traditional assembly of separate bearings and components, and are lighter and easier to assemble than the separate bearing components. Industry sources indicate the units were developed in response to requirements by the automobile industry for more modular assemblies, in addition to lighter weight components.

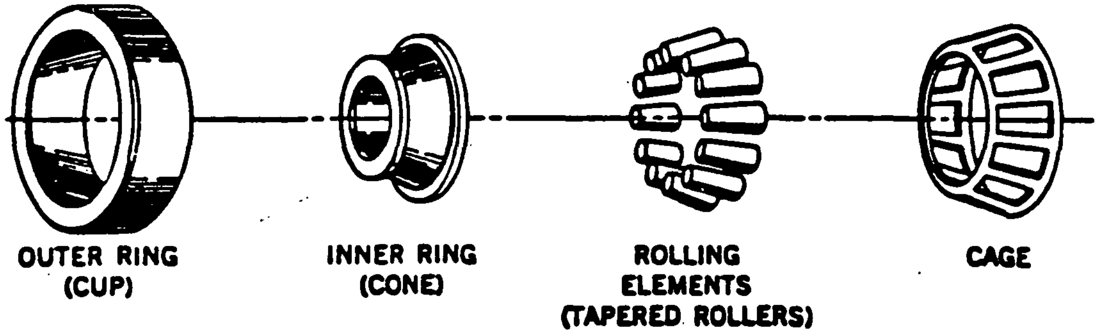
Manufacturing process

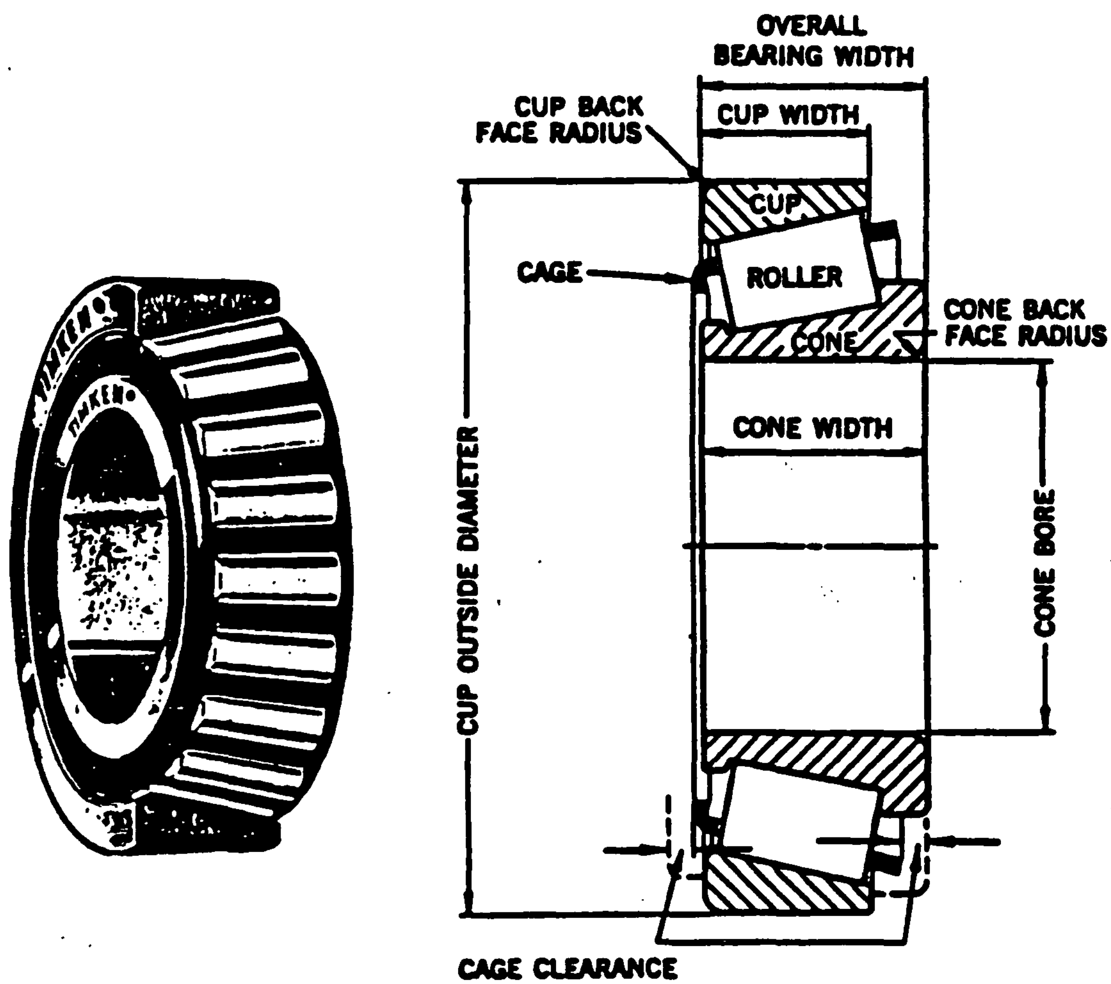
There are four major steps in the production of bearings: green machining, heat treating, finishing, and assembly and inspection. Special bearing-grade alloy steel in the form of 12- to 15-foot seamless tubing is the raw material utilized in the production of most cups and cones, whereas alloy wire, in the form of coils, is the base material for roller manufacture. There is a generally accepted minimum industry standard for the steel utilized in tapered roller-bearing production; however, the raw material used by most bearing manufacturers exceeds this standard in quality.

1/ Radial loads are those perpendicular to the axis of rotation, whereas thrust loads are normally parallel to the level of rotation. "Bearing, Antifriction," in McGraw-Hill Encyclopedia of Science and Technology, 1977, p. 129.
2/ "Availability is the Key for the 1980's," Purchasing, Feb. 10, 1983, p. 60.
3/ There is also limited application for these units for engine-hub fans.

Figure 12-1

Bearings: Tapered roller bearing





Source: The Timken Company training materials

Green machining is an industry term that relates to the machining operations performed on the raw materials prior to heat treatment for cups, cones, and rollers. 1/ The bearing components are then heat treated in a two-stage process to ensure durability, hardness, and shock resistance. The third phase of production, finishing, consists mainly of a series of grinding and honing operations to ensure the components are sized to the required precise tolerances and polished to ensure the smoothest possible rolling surface. In the assembly stage, cages are mounted on an assembly nest and the "hot forming" using steel bar or wire, from which slugs are cut, pierced, and stamped in a rapid succession of dies. The reported advantages to this process are cheaper raw materials and a faster hourly rate of production. Rollers are then placed in the openings or pockets of the cage. The cone is then inserted into the middle of the cage and put in a "close in" press that slightly presses or "crimps" the assembly together to keep the components intact. The cup and cone assemblies are then demagnetized, inspected, and coated with a protective antirust solution and packaged for shipment.

Bearing production involves a high degree of mechanization, in large part because of the very tight tolerances required in the products. The use of computer-aided manufacturing, microprocessor, laser gauging equipment, optical scanning devices, and highly automated material-handling equipment are often employed in the production of bearings. Employees perform very little of the actual production; they are primarily machine operators and quality control inspectors. Each worker is responsible for the product coming out of his or her station; consequently, there is a high percentage of gauging and inspection. All components are tested several times throughout the production process, and cone assemblies and cups are subject to 100-percent inspection.

Customs Treatment

U.S. tariff treatment

Ball and tapered roller bearings are classified under a number of Tariff Schedules of the United States Annotated (TSUSA) items depending on their type and size (table 12-21). There are five sizes of ball bearings broken out in the TSUSA: for bearings under 9 mm, the TSUSA number is 680.3704; for those 9 mm, but under 30 mm, the number is 680.3708; for those 30 mm but less than 52 mm, the number is 680.3712; for those 52 mm but under 100 mm, the TSUSA number is 680.3717; and for those over 100 mm, item 680.3718. Canadian parts imported as original motor-vehicle equipment are classified under 680.3820. These articles, if destined for original motor-vehicle equipment, enter duty free.

Tapered roller bearing cup and cone assemblies imported as a set are provided for in TSUSA item No. 680.3932. The column 1 rate of duty is 6.5 percent; the column 2 rate is 67 percent.

1/ Although there are major similarities in the production process between firms, especially with regard to heat treating and final finishing, a few U.S. producers reported that a popular alternative to the green machining process is the hot roll ring forming method.

Table 12-21
Bearings: U.S. rates of duty, by TSUSA item

TSUSA item No.	Description	Pre-MTN col. 1 rate of duty 1/	Col. 1 rate of duty 1987	Col. 2 rate of duty
	Radial ball bearings, having an outside diameter of:			
680.3704	Under 9 mm..............	1.7¢ per lb + 7.5% ad val.	11.0% ad val.	67.0% ad val.
680.3708	9 mm but under 30 mm.....	1.7¢ per lb + 7.5% ad val.	11.0% ad val.	67.0% ad val.
680.3712	30 mm but under 52 mm....	1.7¢ per lb + 7.5% ad val.	11.0% ad val.	67.0% ad val.
680.3717	52 mm but under 100 mm...	1.7¢ per lb + 7.5% ad val.	11.0% ad val.	67.0% ad val.
680.3718	100 mm and over..........	1.7¢ per lb + 7.5% ad val.	11.0% ad val.	67.0% ad val.
	Canadian articles:			
680.3820	Completed ball bearing sets..................	Free	Free	2/
680.4140	Completed tapered roller bearing sets...........	Free	Free	2/
	Tapered roller bearings:			
680.3932	Cup and cone assemblies imported as a set........	1.7¢ per lb + 7.5% ad val.	6.5% ad val.	67.0% ad val.

1/ Rate effective prior to Jan. 1, 1980.
2/ Not applicable.

Bearing cartridge units are classified with tapered roller bearings in TSUSA item No. 680.3932 or the basket automotive parts provision, TSUSA item No. 692.3295, depending on their configuration. These units, when incorporating ball bearings, have been subject to numerous classification rulings by U.S. Customs. Customs ruled that "a double row, angular contact ball bearing whose outer race has been expanded, flanged, and drilled in order to take over part of the wheel hub" and a similar bearing whose inner race was splined allowing it "to replace completely the conventional driven-wheel hub" and become a structural element of the suspension system both demonstrate functions that are in excess of those normally associated with ball or roller bearings and . . ." are classified under the provision for other parts of motor vehicles in item 692.32." 1/ Customs officials indicate that if the primary function of a bearing cartridge unit exceeds the reduction of friction, the article is not classified as a tapered roller bearing. 2/ When

1/ Sec. 177.1 (a)(1) of the Customs Regulations (19CFR 177.1 (a)(1)).
2/ Discussion with national import specialist, U.S. Customs Service, Commercial Operations Division, Sept. 15, 1986.

entered as 680.3932, the column 1 rate of duty is 6.5 percent ad valorem, whereas the column 2 rate of duty is 67 percent ad valorem. When this article enters under 692.3295, the column 1 rate of duty is 3.1 percent ad valorem; in column 2, it is 25 percent ad valorem.

The foregoing products are covered under the Caribbean Basin Economic Recovery Act (CBERA) and the United States-Israel Free Trade Area Implementation Act (UIFTA). Under the proposed Harmonized System (HS), the classification for ball bearings receives no change in duty rate, and are classified as follows:

Item	HS classification No.
Cup and cone as complete sets:	
Under 9 mm	8482.10.50105
9 mm to 30 mm	8482.10.50203
31 mm to 52 mm	8482.10.50301
53 mm to 100 mm	8482.10.50409
Over 100 mm	8482.10.50506

For tapered roller bearings, HS classification would be as follows:

Item	HS classification No.
Cup and cone as complete sets.	8482.20.00104
Bearing cartridge units	8482.20.00104

The Commission has had several investigations regarding imported tapered roller bearings and parts during 1986-87. Final affirmative antidumping determinations were made in cases involving tapered roller bearings and parts thereof, and certain housings incorporating tapered rollers from China, Romania, Hungary, Italy, Japan, and Yugoslavia. 1/

Foreign tariff treatment

The Customs Cooperation Council Nomenclature (CCCN) is used as the basis for tariff classification by most countries, except for the classifications used by the United States and Canada. Under the CCCN, ball and roller bearings and parts thereof, including balls and rollers, are classified under heading 84.63.

Imports into Canada are classified in its tariff schedule under item 42726-1, ball and roller bearings of a class or kind not made in Canada, not otherwise provided for (n.o.p.), and parts thereof; under item 42729-1, ball and roller bearings, n.o.p., and parts thereof.

1/ Investigations Nos. 731-TA-341-346. USITC publication Nos. 1983, 1999, and 2020, June August, and September 1987.

Selected rates of duty for ball and roller bearings for Canada, the European Community (EC), and Japan appear in the following tabulation:

Item	Description	Country	Present rate of duty
42726-1	Ball and roller bearings of a class or kind not made in Canada, n.o.p., parts thereof	Canada	Free
42729-1	Ball and roller bearings, n.o.p., parts thereof	Canada	9.2% ad val.
84.62	Ball, roller, or needle roller bearings	EC	9% ad val.
	Ball, roller, or needle roller bearings; parts	Japan	6.6% ad val.

Profile of the U.S. Industry

U.S. producers

There are 83 firms, operating a total of 140 manufacturing establishments, that produce ball and/or roller bearings in the United States. Of these, four major producers account for 56 percent of the value of industry shipments. 1/ Smaller "specialty" bearing producers, and firms producing for their own consumption, account for the remainder of U.S. production.

Most manufacturers produce either ball or roller bearings, though approximately 15 firms produce both. The General Motors Corp.; SKF Industries, Inc.; the Torrington Co.; and Federal Mogul Corp. manufacture ball and roller bearings, and the Timken Co. specializes in roller bearings.

According to industry sources, the large firms that compete across a broad range of product lines have been more affected by imports than the small firms, which have tended to supply in highly specialized markets. Import penetration has been less pronounced in these specialty markets. Economies of scale in production is more significant in low-value-added bearing markets than in "specialty" markets. Success in specialty markets tends to require an investment in servicing capability. Many end users of such bearings are willing to pay higher prices for reliable engineering support to service bearings in use. This has worked to the advantage of U.S. firms that have such capability and to the disadvantage of foreign firms, which often do not have such capabilities. 2/

According to U.S. producers responding to the Commission's questionnaires, the predominant means of shipping U.S.-made bearings is by truck (table 12-22).

1/ Investigation No. 332-211, USITC publication 1797, January 1986, p. 18.
2/ Ibid.

Table 12-22
Bearings: U.S. producers' rating of predominant modes of transportation used to ship bearings, the marketing area generally serviced, and the average percentage of transportation costs in the total delivered value of their firms' shipments

Item	Number of responses
Predominant mode(s) of transportation:	
Truck	27
Rail	10
Water	2
Other	-
General marketing area (radius):	
Up to 100 miles	2
101 to 200 miles	3
201 to 500 miles	8
Over 500 miles	12
Average transportation cost (as percentage of sales):	
0 to 5 percent	20
6 to 10 percent	2
11 to 15 percent	-
16 to 20 percent	-
Over 20 percent	-

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Manufacturers estimated that the transportation costs are generally 5 percent or less of the sales value.

The hourly wage rates paid to production and related workers producing automotive bearings were consistently higher than the average for all U.S. manufacturing facilities during 1982-86, as shown in the following tabulation:

Year	Production and related workers producing bearings 1/	All automotive parts 1/	All operating U.S. manufacturing establishments 2/
1982	$12.08	$12.24	$11.50
1983	12.24	12.90	11.97
1984	12.65	14.57	12.40
1985	15.97	15.51	3/ 12.82
1986	15.64	17.21	3/ 13.09

1/ Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.
2/ Compiled from unpublished data of the U.S. Department of Labor, Bureau of Labor Statistics.
3/ Estimated.

However, in every year except 1985, wages paid to those producing bearings were less than those wages paid to workers producing all automotive parts. One of the reasons for this discrepancy may be attributed to the lack of unionization of these workers vis-a-vis the auto industry as a whole.

Capacity and employment

Capacity increased annually during 1982-86 to 737 million units in 1986 (table 12-23). At the same time, the number of production workers remained relatively stable during the period, peaking at 13,936 in 1985.

Table 12-23
Bearings: U.S. capacity, number of production and related workers, man-hours worked, wages, and hourly wage rates, 1982-86

Item	1982	1983	1984	1985	1986	Average annual percentage change, 1986 over 1982
Capacity						
(1,000 units)......	631,833	678,543	695,041	698,046	737,233	3.9
Employment of production and related workers:						
Number.............	13,396	12,428	13,530	13,936	13,579	.3
Man-hours worked (1,000 hours)....	24,722	24,267	27,914	25,691	24,414	-0.3
Wages (1,000 dollars)..	298,643	296,918	353,005	410,156	381,871	6.3
Hourly wage rate...	$12.08	$12.24	$12.65	$15.97	$15.64	6.7

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Financial Data

Net sales of bearings produced in the United States rose by 36 percent, from an estimated $1.3 billion in 1982 to $1.7 billion in 1985 and then fell by 7 percent in 1986, to $1.6 billion (table 12-24). Net profit/loss ranged from a loss in 1982 of $24 million, to a profit in 1984 of $132 million. Industry sources indicate that price increases contributed, in part, to higher profit ratios of 7.9 percent in 1984 and 7.6 percent in 1985.

Research and development expenditures rose by 44 percent in 1986 when compared with 1982; capital expenditures rose by 31 percent during the same period.

Table 12-24
Bearings: U.S. producers' total net sales, total net profit or (loss), capital expenditures, and research and development expenditures, 1982-86

Item	1982	1983	1984	1985	1986	Average annual percentage change, 1986 over 1982
Net sales (1,000 dollars)....	1,270,495	1,342,386	1,695,543	1,725,014	1,601,305	5.9
Net profit or (loss) (1,000 dollars)....	(24,042)	6,071	131,996	131,546	81,383	-
Ratio of net operating profit or (loss) to net sales (percent)..........	(1.89)	.45	7.78	7.63	5.08	-
Capital expenditures (1,000 dollars)....	24,659	16,234	27,853	33,060	32,410	7.0
Research and development expenditures (1,000 dollars)....	40,174	39,586	45,666	50,997	57,752	9.5

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Major Foreign Competitors

Of the five leading Japanese producers of ball or roller bearings, the top four in each category produce both types of bearings. It is estimated that these four are responsible for over 90 percent of all production. 1/ Bearings are also imported into the United States from EC countries, notably West Germany and Italy, as well as the Far Eastern nations of Singapore and Thailand.

Structural Factors of Competition Between U.S. and Foreign Industries

According to U.S. producers responding to the questionnaire, their Japanese competitors enjoy advantages in all categories for which responses were solicited except for fuel cost and exchange rates (table 12-25). In terms of government involvement, respondents felt the Japanese Government subsidized the bearing producers, whereas Japanese regulations added less to product cost than did U.S. regulations.

1/ Investigation No. 332-211, USITC Publication 1797, January 1986, p. 47.

Table 12-25
Bearings: U.S. producers' competitive assessment of structural factors of competition for the U.S. and foreign industries, 1/ by major competing countries, 1986

Item	Japan	Germany
Product cost advantages:		
Fuel cost	D	D
Raw materials costs	F	S
Domestic inflation rates	F	F
Labor cost	F	S
Exchange rates	D	D
Taxes	F	F
Equipment costs	F	S
Interest rates	F	S
Government involvement:		
Subsidies	F	S
U.S. Government regulations that increase costs	F	S
Foreign government regulations that increase costs	F	S

1/ D=60 percent or more of total respondents accorded domestic producers an advantage; F=60 percent or more of total respondents accorded foreign producers an advantage; S=Competitive position the same.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

U.S. producers indicated that West Germany had advantages in domestic inflation rates and taxes, whereas U.S. producers had clear advantages in terms of fuel costs and exchange rates. In all other areas, U.S. producers felt the West German producers had no advantage.

The U.S. Market

The U.S. market for automotive bearings is primarily dependent on the original equipment motor-vehicle producers since most bearings in motor vehicles are not replaced during the life of the vehicle. During 1982-86, the U.S. market for these bearings increased as a result of increased U.S. motor-vehicle production (table 12-26). According to questionnaire data, the total U.S. market for automotive bearings was $722 million in 1982, rising to $1.6 billion in 1986, or by 128 percent. U.S. producers' share of this market, however, declined from approximately 85 percent to 70 percent. During this period, the number of units shipped by U.S. producers increased by 39 percent, and the dollar value increased by 91 percent.

Table 12-26
Bearings: U.S. producers' shipments, exports of domestic merchandise, imports for consumption, apparent consumption, and ratio of imports to consumption, 1982-86

Year	Shipments	Exports	Imports	Apparent consumption	Ratio (percent) of imports to consumption
	Quantity (1,000 units)				
1982.......	388,721	23,721	1/	1/	1/
1983.......	469,896	33,545	1/	1/	1/
1984.......	534,800	33,360	1/	1/	1/
1985.......	560,042	32,346	1/	1/	1/
1986.......	542,223	38,020	1/	1/	1/
	Value (1,000 dollars)				
1982.......	678,040	69,781	113,350	721,609	15.7
1983.......	728,700	71,433	124,952	782,219	16.0
1984.......	972,925	89,525	226,837	1,110,237	20.4
1985.......	1,369,450	109,199	309,930	1,570,181	19.7
1986.......	1,294,669	138,135	485,837	1,642,371	29.6

1/ Not available.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

U.S. Imports

U.S. imports of automotive bearings increased from $113 million in 1982 to $486 million in 1986. The ratio of imports to consumption also increased substantially, rising from 15.7 percent in 1982 to 29.6 percent in 1986 (table 12-26). Imports from Japan increased each year during 1982-1986 except 1983 (table 12-27). The other two principal sources of imports during the period were Italy and West Germany.

In terms of value, Japan's exports to the United States rose from $47 million in 1982 to $355 million in 1986, or by 660 percent. U.S. imports from West Germany rose from $5 million in 1982 to $16 million in 1986, and Italy's exports to the United States rose from $8 million to $14 million.

Competitive Assessment of Key Factors of Competition in the U.S. Market

U.S. producers of automotive bearings indicated the principal reason for importing such items was price (table 12-28). This was followed by the foreign producers' ability to meet the specifications of the buyer, and thirdly, by the foreign producers' willingness to provide the required

Table 12-27
Bearings: U.S. imports for consumption, by principal sources, 1982-86

Country	1982	1983	1984	1985	1986	Average annual change, 1986 over 1982
	1,000 dollars					Percent
Japan	46,738	37,311	103,121	178,473	355,338	66.1
Italy	8,350	9,166	11,028	12,813	14,051	13.9
West Germany	4,619	5,518	8,921	15,778	16,223	36.9
France	2,597	5,897	5,874	8,226	5,124	18.5
Canada	1,129	2,715	5,704	8,332	8,470	65.5
All other	49,917	64,345	92,189	86,308	86,631	14.8
Total	113,350	124,952	226,837	309,930	485,837	43.9

Source: Estimated by the staff of the U.S. International Trade Commission on the basis of data submitted in response to the Commission's questionnaire.

Table 12-28
Bearings: U.S. producers' ranking of factors that were the principal reasons for their imports, 1982-86

Reason for importing	Ranking 1/
Lower purchase price (delivered)	1
Shorter delivery time	2/
Engineering/technical assistance	7
Favorable terms of sale	2/
Favorable exchange rates	2/
Reliability of supplier	5
Intra-company and affiliated company transfers on a basis:	
Competitive with unaffiliated firms	2/
Noncompetitive	6
Ability to meet specifications	2
Willingness to supply required volumes	3
Ability to supply metric sizing	7
Quality	4

1/ Ranking numbers range from 1 to 7, number 1 indicating the most important reason for importing and number 7 indicating the least important reason for importing. Some factors were ranked equally in importance.
2/ Insufficient data.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

volumes. The fourth most important reason for importing bearings was quality. Discussions with industry officials involved in the purchases of bearings have highlighted these concerns, mentioning specifically the lack of flexibility in supplying small quantities.

In response to questionnaires sent by the Commission, U.S. producers of bearings stated that Romanian and Canadian producers had a competitive edge in the U.S. market. The Canadian advantage was that of favorable exchange rates, whereas the Romanian advantage was the result of lower purchase prices. U.S. producers felt they enjoyed a similar competitive position with producers from Japan, Italy, and West Germany.

Importers felt differently. They reported that producers from Japan and West Germany enjoyed a competitive advantage in the U.S. market. Importers felt Japan had an edge in all categories listed, except that of shorter delivery time. For West Germany, importers felt that country's industry enjoyed an edge in the U.S. market when it came to engineering/technical assistance, production technology, reliability of the supplier, producers' ability to meet specifications, and quality. There were insufficient responses from importers in regards to Canada, Italy, and Romania (table 12-29).

Table 12-29
Bearings: U.S. producers' (P) and importers' (I) competitive assessment of U.S.-produced and foreign-produced products in the U.S. market, 1/ and the principal factors (X) underlying overall competitive advantages, by top competitor nations, 1986

	Canada		Italy		Japan		Romania		West Germany	
Item	P	I	P	I	P	I	P	I	P	I
Overall competitive advantage	F	2/	S	2/	S	F	F	2/	S	F
Product cost advantages:										
Lower purchase price (delivered)						X	X			
Favorable exchange rates	X					X				
Nonprice factors:										
Shorter delivery time										
Engineering/technical assistance						X				X
Favorable terms of sale						X				
Production technology						X				X
Marketing practices						X				
Reliability of supplier						X				X
Shorter new product development time						X				
Willingness to supply required volumes						X				
Ability to meet specifications						X				X
Product innovation						X				
Quality						X				X

1/ D=60 percent or more of total respondents accorded domestic producers an advantage; F=60 percent or more of total respondents accorded foreign producers an advantage; S=competitive position the same.
2/ Insufficient data.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

U.S. purchasers responding to the questionnaire indicated that purchases of U.S.-produced bearings were based on a variety of factors, including the reliability of the supplier, quality, shorter delivery time, and marketing practices (table 12-30). In contrast, purchases of foreign-made automotive bearings were based, to a large extent, on lower delivered purchase price and quality. Less significant in the decision to purchase foreign-made automotive bearings was engineering/technical assistance, production technology, and marketing practices.

Table 12-30
Bearings: Ranking of U.S. purchasers' reasons for purchases of U.S.-produced and foreign-produced bearings, 1982-86 1/

Reason for purchase	U.S.-produced	Foreign produced
Product cost advantages:		
Lower purchase price (delivered)	10	1
Favorable exchange rates	14	6
Non-price factors:		
Shorter delivery time	3	2/
Engineering/technical assistance	5	3
Favorable terms of sale	7	2/
Production technology	7	3
Marketing practices	4	3
Reliability of supplier	1	6
Shorter new product development time	10	2/
Willingness to supply required volumes	6	2/
Ability to supply metric sizing	13	2/
Ability to meet specifications	9	2/
Product innovation	10	2/
Quality	2	1

1/ Ranking numbers range from 1 to 14, number 1 indicating the most important reason for purchase and number 14 indicating the least important reason for purchase. Some factors were ranked equally in importance.
2/ Insufficient data.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Competitive Assessment of Key Factors of Competition in Foreign Markets

Foreign industry sources almost unanimously felt the level of U.S. exports of all automotive bearings, which accounted for about 10 percent of producers' shipments in 1982-86, was adversely affected by their higher price compared with that of most foreign-produced products. U.S. producers of automotive bearings responding to the Commission's questionnaire identified Canada, the United Kingdom, West Germany, and Japan as key foreign markets (table 12-31).

Table 12-31
Bearings: U.S. producers' competitive assessment of U.S.-produced and foreign-produced automotive parts in major foreign markets, 1/ and the principal factors (X) identifying overall competitive advantages by top competitor nations, 1986.

	United Kingdom market		Japanese market	Canadian market	West German market	
Item	United Kingdom	Italy	Japan	Canada	West Germany	France
Overall competitive advantage.........	F	F	F	F	F	F
Product cost advantages:						
Lower purchase price (delivered)....	X	X		X	X	
Favorable exchange rates............				X		X
Non price factors:						
Shorter delivery time...............					X	
Engineering/technical assistance....	X		X		X	
Favorable terms of sale.............			X		X	
Production technology...............	X		X	X	X	
Marketing practices.................	X			X	X	
Reliability of supplier.............			X		X	
Shorter new product development time............................						
Willingness to supply required volumes..........................				X		
Ability to supply metric sizing.....			X			
Ability to meet specifications......			X			
Product innovation..................					X	
Quality.............................						

1/ D = 60 percent or more of total respondents accorded domestic parts makers an advantage; F = 60 percent or more of total respondents accorded foreign parts makers an advantage; S = Competitive position the same.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

In the Canadian market (the largest export market for U.S. parts firms), U.S. producers gave Japan an overall competitive advantage because of lower purchase prices, favorable exchange rates, production technology, marketing practices, and their willingness to supply the required volumes.

In the United Kingdom market, U.S. firms felt British and Italian producers had an advantage. British producers had an edge in the areas of lower purchase prices, engineering/technical assistance, production technology, and marketing practices, and the Italian producer benefited from favorable exchange rates.

In the West German market, U.S. firms gave West German companies an overall competitive advantage in all areas except foreign exchange rates, as well as a willingness to supply required volumes and quality. France also enjoyed an edge over the U.S. producers in the West German market because of favorable exchange rates.

In the Japanese market, only Japanese producers enjoyed an advantage, all derived from nonprice factors, including engineering/technical assistance, production technology, reliability of supplier, ability to supply metric sizing, and an ability to meet specifications.

ENGINES

Description and uses

Internal-combustion engines are the source of power used to move a motor vehicle and to provide power for many of the vehicle's accessories. They are designed to operate on specific fuels, predominantly gasoline or diesel. The size of the engine is determined by the combustion chambers' volume, measured in either cubic inches (ci) or cubic centimeters (cc). 1/ Currently, engines installed primarily in automobiles and lightweight trucks. The larger engines are used in buses and heavy trucks.

There are three basic cylinder configurations currently utilized in reciprocating piston automotive engines. The in-line configuration, in which each cylinder is behind the preceding cylinder, is produced with three, four, for automobiles, trucks, and buses that are sold in the United States range from 993 cubic centimeters, less than one liter, or 61 cubic inches, to 14.6 liters, or 893 cubic inches. Engines in the smaller size categories are five, or six cylinders. The v-configuration, in which the cylinders form a "V" shape, is produced with 6, 8, or 12 cylinders, and the opposed configuration, in which the cylinders are basically horizontal to each other, is built with 4, 6, or 8 cylinders. In addition to the above-mentioned reciprocating piston engines is the rotary engine, in which either two or three rotors revolve around a housing. This type of engine is currently produced by one Japanese automobile manufacturer.

The principal materials used in the manufacture of engines are cast iron, aluminum, steel, copper, some ceramic materials, and plastics. Cast iron, steel, and aluminum are used in the block, certain housings, and head

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1/ One thousand cubic centimeters is equal to one liter.

assembly. Forged steel is used in some crankshafts and camshafts, and alloy materials are used for certain engine accessory brackets. In addition, nylon and rubber are used for hoses; copper or aluminum for electrical wiring; and steel in air cleaners, exhaust manifolds, and other areas.

Manufacturing process

The manufacturing process for an engine is basically the assembly of mechanical and electrical components on a cast aluminum or iron engine block and cylinder head. These processes are conducted along an assembly line, on which each worker performs a specific operation. The process begins with the casting of the engine block and cylinder head. The pieces are then machined, cleaned, and bored to exact specifications prior to the piece being sent to the assembly line. The components are then fitted to either the cylinder head or block at each station along the assembly line. For the block, the principal components are the piston assembly (piston, connecting pin, connecting rod), crankshaft, main bearings, oil pump, and pan, electronic sensors for oil pressure and possible knock-detectors, and the water pump. The cylinder head assembly includes the valve train (valves, pushrods, springs/hydraulic actuators, rockers) and the camshaft. A gasket is placed on the engine block, and the cylinder head is then bolted onto the block.

At this point, the fuel system (which consists of a carburetor or fuel injection unit, intake manifold, fuel pump, and necessary belts and hoses) is added. The electrical system, consisting of spark plugs, distributor, and alternator is incorporated in a gasoline engine, whereas only the alternator is added to a diesel engine. Finally, the exhaust system is installed on the engine.

Customs Treatment

U.S. tariff treatment

Engines for automotive use are classified under four TSUSA item numbers, depending on the type of ignition system in the engine and whether the engine is eligible for duty-free treatment under the provisions of APTA (table 12-32). For internal combustion, compression-ignition, piston-type engines, the TSUSA number is 660.4220; for an engine eligible for APTA, the TSUSA item number is 660.4300. For internal combustion, piston-type engines, other than compression-ignition, specifically designed for automobiles, including trucks and buses, the TSUSA number is 660.4850; the APTA number is 660.4900.

The column 1 rate of duty is 3.7 percent ad valorem for compression-ignition engines from all countries except Canada, whose products enter duty free if for original-equipment use. Prior to 1980, the column 1 rate of duty was 5.0 percent ad valorem. For engines other than compression- ignition, the rate of duty is 3.1 percent ad valorem for all countries except APTA items. Prior to 1980, the column 1 rate was 4.0 percent ad valorem. The column 2 rate for TSUSA items 660.4220 and 660.4850 is 35 percent ad valorem.

Table 12-32
Engines: U.S. rates of duty, by TSUSA item

(Percent ad valorem)

TSUSA item No. 1/	Description	Pre-MTN col. 1 rate of duty 2/	Col. 1 rate of duty 1987	Col. 2 rate of duty
660.4220A*	Internal combustion, compression-ignition, for autos, including trucks and buses.	5.0%	3.7%	35%
660.4300	Canadian article, original motor vehicle equipment.	Free	Free	3/
660.4850A*	Internal combustion, Piston-type engine, other than compression-ignition, specially designed for automobiles including trucks and buses.	4.0%	3.1%	35%
660.4900	Canadian article, original motor vehicle equipment.	Free	Free	3/

1/ The designation "A*" indicates that the item is currently designated as an eligible article for duty-free treatment under the Generalized System of Preferences (GSP), and that certain of these countries, specified in general headnote 3(e)(v)(D) of the Tariff Schedules of the United States Annotated, are not eligible.
2/ Rate effective prior to Jan. 1, 1980.
3/ Not applicable.

Engines listed are covered under the Caribbean Basin Recovery Act (CBERA), the Generalized System of Preferences (GSP), and the United States-Israel Free Trade Area Implementation Act (UIFIA). Brazil has exceeded the competitive-need limit for both compression-ignition and other engines, and Mexico has exceeded the competitive-need limit for other engines.

Under the Harmonized System (HS), the classification number is 8408.20.10808 for compression-ignition (diesel) engines with no change in the rate of duty. For spark-ignition engines, there are two numbers depending on the displacement of the engine: (1) for those not exceeding 1,000 cc, it is 8407.33.20802; (2) and for those over 1,000 cc, it is 8407.34.20801, with no change in the rate of duty for the above HS classification numbers.

Foreign tariff treatment

The major markets for U.S.-made compression-ignition engines are Canada, Australia, Mexico, and the European Community. For other piston-type engines, the major markets for U.S.-made engines are Canada, Mexico, the Dominican Republic, Saudi Arabia, the United Kingdom, and Japan. Canada was by far the major importer, accounting for more than three quarters of all imports of piston-type, internal combustion engines made in the United States. The tariff numbers and rates of duty for the major U.S. markets for engines are shown in the following tabulation:

Item	Description	Country	Present rate of duty (Percent ad valorem)
84.06	Automotive engines	Mexico	10%
		United Kingdom	6.9%
		France	6.9%
		Australia	90% 1/
84.06		Dominican Republic	15% + 6% import tax + 15% surcharge
84.06		Saudi Arabia	Free
84.06		Japan	Free
43829-1		Canada	9.2%

1/ This rate declines yearly, beginning on Jan 1, 1988 through Jan. 1, 1992, to 57.5 percent.

Profile of the U.S. Industry

Overview

The market for engines is segmented according to vehicle type and is directly related to new vehicle production. 1/ For passenger cars and lightweight trucks the "Big Three" (GM, Ford, and Chrysler) account for the majority of U.S. engine production. The market for truck engines is based primarily on load-carrying ability. Trucks are classified according to the gross-vehicle-weight (GVW) rating. The industry normally classifies trucks as either lightweight (class 1, 2, 3), medium weight (class 4, 5, 6), or heavy weight (class 7, 8, 9). The Big Three produce most of their engines for lightweight trucks. In the medium and heavyweight range, the Big Three are joined by other domestic producers of trucks, such as Navistar and Mack, who also build engines. These trucks are typically equipped with engines from their producers. In addition, two U.S. companies, Cummins and Caterpillar, produce truck engines, but no motor vehicles. In the heavyweight class of over-the-road trucks, U.S. producers offer engines produced by other companies as well as their own.

U.S. producers of automotive engines tend to be located away from their customers (table 12-33). This is due to the relatively small number of producers in the U.S. market in relation to the large number of assembly sites for companies using these engines. According to producers responding to the Commission's questionnaire, the predominant mode of shipping U.S.-made engines

1/ Virtually all production of engines is destined for original-equipment use; the replacement market for engines accounts for less than 2 percent of total production.

Table 12-33
Engines: U.S. producers' rating of predominant modes of transportation used to ship engines, the marketing area generally serviced, and the average percentage of transportation costs in the total delivered value of their firms' shipments

Item	Number of responses
Predominant mode(s) of transportation:	
Truck	30
Rail	16
Water	3
Other	-
General marketing area (radius):	
Up to 100 miles	9
101 to 200 miles	5
201 to 500 miles	13
Over 500 miles	13
Average transportation costs (as percentage of sales):	
0 to 5 percent	26
6 to 10 percent	2
11 to 15 percent	-
16 to 20 percent	-
Over 20 percent	-

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

is by truck. As engines are a comparatively high-value auto part, manufacturers estimated that the transportation costs they incur in shipping these items to customers are generally 5 percent or less of the sales value. The hourly wage rates paid to production and related workers producing engines were consistently higher than the average for all U.S. manufacturing facilities during 1982-1986, as shown in the following tabulation:

Year	Production and related workers producing engines 1/	All automotive parts 1/	All operating U.S. manufacturing establishments 2/
1982	$13.68	$12.24	$11.50
1983	14.18	12.90	11.97
1984	15.78	14.57	12.40
1985	16.67	15.51	3/ 12.82
1986	17.19	17.21	3/ 13.09

1/ Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.
2/ Compiled from unpublished data of the U.S. Department of Labor, Bureau of Labor Statistics.
3/ Estimated.

Capacity and employment

Capacity fluctuated within a narrow range during 1982-86 (table 12-34). Beginning with 12.9 million units in 1982, capacity rose in 1984 to 13.3 million units, then fluctuated downward to 12.3 million units in 1986.

Table 12-34
Engines: U.S. capacity, number of production and related workers, man-hours worked, wages, and hourly wage rates, 1982-86

Item	1982	1983	1984	1985	1986	Average annual percentage change, 1986 over 1982
Capacity (units)....	12,897,897	13,103,995	13,267,779	12,096,310	12,322,723	-1.1
Employment of production and related workers:						
Number............	33,531	32,326	36,565	37,841	36,597	2.2
Man-hours worked (1,000 hours)...	69,163	70,700	83,129	86,248	81,690	4.2
Wages (1,000 dollars)........	946,139	1,002,268	1,311,749	1,437,700	1,404,375	10.4
Hourly wage rate..	$13.68	$14.18	$15.78	$16.67	$17.19	5.9

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Financial data

Net sales of automotive engines doubled during 1982-86, increasing from $5.8 billion in 1982 to $10.9 billion in 1986. Profits tripled, rising from $263 million in 1982 to $878 million in 1986 (table 12-35). Profit to sales ratios also increased, almost doubling, from 4.6 percent in 1982 to 8.2 percent in 1986. Part of this improved financial performance can be attributed to better productivity brought about by new, more automated assembly lines and the use of new techniques, such as CAD/CAM. The principal reason for the better performance, however, was the general recovery of the U.S. and Canadian economies, and the corresponding increase in demand for new vehicles.

Major foreign competitors

The most significant foreign competitor for automotive engines is Canada, followed by Mexico. The vast majority of the production of engines in these two countries is by subsidiaries of the Big Three. Ford and GM import significant numbers of engines from both Canada and Mexico. In addition,

Table 12-35
Engines: U.S. producers' total net sales, total net profit or (loss), capital expenditures, and research and development expenditures, 1982-86

Item	1982	1983	1984	1985	1986	Average annual percentage change, 1986 over 1982
Net sales (1,000 dollars)..	5,750,681	7,875,344	9,615,435	10,459,392	10,935,470	17.4
Net profit (1,000 dollars)..	262,835	569,466	851,000	852,665	878,182	35.2
Ratio of net operating profit to net sales (percent)......	4.57	7.23	8.85	8.15	8.03	15.1
Capital expenditures (1,000 dollars)..	428,018	211,425	574,119	485,181	500,536	4.0
Research and development expenditures (1,000 dollars)..	213,774	232,299	324,951	348,101	427,831	18.9

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

engines from Brazil are imported by Ford for their Turbo Thunderbird, and by GM for its Turbo Sunbird. 1/ Japan also exports engines for installation in vehicles assembled by Japanese subsidiaries located in the United States, such as the Honda facility in Marysville, OH, and the Nissan facility in Smyrna, TN. In addition, West Germany exports engines to its Westmoreland, PA, Volkswagen factory.

Structural Factors of Competition Between U.S. and Foreign Industries

According to U.S. automotive engine producers, Brazil has an advantage in the areas of fuel costs, raw-materials costs, labor costs, exchange rates, taxes, and Government involvement in the form of subsidies (table 12-36). Japanese competitors have an advantage in the areas of domestic inflation rates, labor costs, exchange rates, taxes, equipment costs, interest rates, and Government subsidies. West German competitors have an advantage in the area of labor costs.

1/ USITC staff telephone interview with GM official, Sept. 21, 1987.

Table 12-36
Engines: U.S. producers' competitive assessment of structural factors of competition for the U.S. and foreign industries, 1/ by major competing countries, 1986

Item	Brazil	Canada	Mexico	Japan	West Germany
Product cost advantages:					
Fuel cost	F	2/	2/	D	D
Raw materials costs	F			D	D
Domestic inflation rates	D			F	S
Labor cost	F			F	F
Exchange rates	F			F	D
Taxes	F			F	S
Equipment costs	S			F	D
Interest rates	D			F	S
Government involvement:					
Subsidies	F			F	S
U.S. Government regulations that increase costs	S			S	S
Foreign government regulations that increase costs	S			S	S

1/ D=60 percent or more of total respondents accorded domestic producers an advantage; F=60 percent or more of total respondents accorded foreign producers an advantage; S=Competitive position the same.
2/ Insufficient data was provided by respondents; producers of engines located in Canada and Mexico are largely subsidiaries of U.S. manufacturers.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

The U.S. Market

Overview

The U.S. market for automotive-engine sales is dependent on the sales of new motor vehicles. Few respondents indicated that they sold engines to the aftermarket in any significant numbers. During 1982-1986, all passenger-car engines were supplied by the producers of automobiles. The independent truck-engine producers are able to compete with U.S. domestic truck producers' own engines in the mediumweight and heavyweight ranges, according to industry officials.

U.S. consumption of engines doubled during 1982-86, from $7.5 billion to $14.8 billion (table 12-37). U.S. shipments almost doubled, rising from $6.9 billion in 1982 to $11.5 billion in 1986. Import penetration increased by approximately 54 percent during the period.

Table 12-37
Engines: U.S. producers' shipments, exports of domestic merchandise, imports for consumption, and apparent consumption, 1982-86

Year	Shipments	Exports	Imports	Apparent consumption	Ratio (percent) of imports to consumption
	Quantity (1,000 units)				
1982.......	7,022	731	1/	1/	1/
1983.......	8,246	713	1/	1/	1/
1984.......	10,000	619	1/	1/	1/
1985.......	10,674	630	1/	1/	1/
1986.......	10,775	641	1/	1/	1/
	Value (1,000 dollars)				
1982.......	6,856,653	700,495	1,326,886	7,483,044	17.7
1983.......	8,227,982	672,636	2,073,598	9,628,944	21.5
1984.......	9,939,809	662,813	3,379,779	12,656,775	26.7
1985.......	10,973,447	683,327	3,636,109	13,926,229	26.1
1986.......	11,455,898	683,126	4,030,874	14,803,646	27.2

1/ Not available.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

U.S. imports

The principal sources of imports for the 1982-86 period were Canada and Mexico. In 1982, they represented 69 percent, or $865 million, of the top five importing nations. In 1986, the value rose to $1.8 billion; however, the share of these two countries dropped to 59 percent of the total (table 12-38).

Table 12-38
Engines: U.S. imports for consumption, by principal sources, 1982-86

Country	1982	1983	1984	1985	1986	Average annual change, 1986 over 1982
	1,000 dollars					Percent
Canada.......	657,694	1,022,980	1,380,002	1,266,324	969,296	10.2
Mexico.......	207,578	446,631	547,100	807,938	795,332	39.9
Japan........	165,533	257,512	461,484	463,677	638,653	40.2
Brazil.......	128,202	186,723	206,579	237,522	196,286	11.2
West Germany.	39,063	154,480	169,790	220,587	332,846	70.9
All other countries..	48,582	124,020	136,069	103,114	57,127	1.8
Total....	1,246,652	2,192,346	2,901,024	3,099,162	2,989,540	24.4

Source: Compiled from official statistics of the U.S. Department of Commerce.

A sevenfold increase in West German imports, coupled with a threefold rise in Japanese imports, accounted for Canada's and Mexico's diminished market share. West German imports rose from $39 million in 1982 to $333 million in 1986, and Japanese imports rose from $166 million in 1982 to $639 million in 1986. The rise in Japanese imports can be attributed primarily to U.S. automobile production by Honda, Nissan, and NUMMI.

Competitive Assessment of Key Factors of Competition in the U.S. Market

Producers responding to the questionnaire indicated that the reliability of the supplier and the ability to meet specifications were the first and second most important reasons given for the importation of automotive engines (table 12-39). The third most important reason was the foreign producer's willingness to supply the required volumes, whereas quality was ranked as the fourth most important factor.

U.S. producers rated themselves as equally competitive with four of the top five exporting nations in the U.S. market (table 12-40). U.S. producers also indicated that the U.S. had a competitive advantage over West Germany in the areas of exchange rates, shorter delivery time, engineering/technical assistance, production technology, marketing practices, product innovation, and quality.

U.S. importers stated that both Japan and West Germany held overall competitive advantages over the United States. Importers reported Japanese producers as having advantages in the areas of price, engineering/technical assistance, production technology, reliability of the supplier, product innovation, and quality. Importers indicated West German engines as having an edge in the area of production technology.

U.S. purchasers of automotive engines indicated that purchases of U.S-produced engines were based on the reliability of the supplier, quality, shorter delivery time, and technical assistance (table 12-41). In contrast, purchasers of foreign-made engines listed production technology and ability to meet specifications as the foremost reasons for their purchase decisions.

Competitive Assessment of Key Factors of Competition in Foreign Markets

According to respondents, U.S.-produced engines compete with foreign-made engines in the Japanese, Saudi Arabian, Colombian, and West German markets. In Japan, U.S. producers indicated that the Japanese producers had the competitive advantage in the areas of shorter delivery time, engineering/ technical assistance, marketing practices, reliability of the supplier, willingness to supply the required volumes, ability to meet metric sizing, and quality (table 12-42). In Saudi Arabia, U.S. producers felt they enjoyed a competitive advantage over Taiwan, Japan, and the Republic of Korea (Korea), primarily because of production technology; in addition, U.S. firms stated that they had an edge over Japan and Korea in their ability to meet specifications. In Colombia, U.S. producers felt foreign producers had an

Table 12-39
Engines: U.S. producers' ranking of factors that were the principal reasons for their imports, 1982-86

Reason for importing	Ranking 1/
Lower purchase price (delivered)	6
Shorter delivery time	9
Engineering/technical assistance	6
Favorable terms of sale	9
Favorable exchange rates	9
Reliability of supplier	1
Intra-company and affiliated company transfers on a basis:	
Competitive with unaffiliated firms	4
Noncompetitive	6
Ability to meet specifications	2
Willingness to supply required volumes	3
Ability to supply metric sizing	12
Quality	4

1/ Ranking numbers range from 1 to 12, number 1 indicating the most important reason for importing and number 12 indicating the least important reason for importing. Some factors were ranked equally in importance.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

edge in areas such as lower purchase prices, favorable terms of sale, and marketing practices. In West Germany, U.S. producers reported that West German producers had an advantage with respect to shorter delivery time, engineering/technical assistance, marketing practices, reliability of supplier, and ability to supply metric sizing.

Table 12-40
Engines: U.S. producers' (P) and importers' (I) competitive assessment of U.S.-produced and foreign-produced products in the U.S. market, 1/ and the principal factors (X) underlying overall competitive advantages, by top competitor nations, 1986

Item	Brazil		Canada		Japan		Mexico		West Germany	
	P	I	P	I	P	I	P	I	P	I
Overall competitive advantage.......	S	2/	3/	3/	S	F	3/	3/	D	F
Product cost advantages:										
Lower purchase price (delivered)..						X				
Favorable exchange rates..........									X	
Nonprice factors:										
Shorter delivery time.............									X	
Engineering/technical assistance..						X			X	
Favorable terms of sale...........										
Production technology.............						X			X	X
Marketing practices...............									X	
Reliability of supplier...........						X				
Shorter new product development time..........................										
Willingness to supply required volumes........................										
Ability to meet specifications....										
Product innovation................						X			X	
Quality...........................						X			X	

1/ D=60 percent or more of total respondents accorded domestic producers an advantage; F=60 percent or more of total respondents accorded foreign producers an advantage; S=Competitive position the same.
2/ Insufficient data.
3/ Insufficient data were provided by respondents; producers of engines located in Canada and Mexico are largely subsidiaries of U.S. manufacturers.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table 12-41
Engines: Ranking of U.S. purchasers' reasons for purchases of U.S.-produced and foreign-produced engines, 1982-86 1/

Reason for purchase	U.S.-produced	Foreign-produced
Product cost advantages:		
Lower purchase (delivered)	9	2/
Favorable exchange rates	12	2/
Nonprice factors:		
Shorter delivery time	2	3
Engineering/technical assistance	4	3
Favorable terms of sale	5	2/
Production technology	11	1
Marketing practices	8	3
Reliability of supplier	1	3
Shorter new product development time	12	2/
Willingness to supply required volumes	5	3
Ability to supply metric sizing	12	2/
Ability to meet specifications	5	1
Product innovation	9	2/
Quality	2	3

1/ Ranking numbers range from 1 to 12, number 1 indicating the most important reason for purchase and number 12 indicating the least important reason for purchase.
2/ Insufficient data.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table 12-42
Engines: U.S. producers' competitive assessment of U.S.-produced and foreign-produced automotive parts in major foreign markets, and the principal factors (X) identifying overall competitive advantages, by top competitor nations, 1986

Item	Japanese market	Saudi Arabian market			Colombian market	West German market
	Japan	Taiwan	Japan	South Korea	Colombia	West Germany
Overall competitive advantage	[illegible]	D	D	D	F	F
Product cost advantages:						
Lower purchase price (delivered					X	
Favorable exchange rates						
Nonprice factors:						
Shorter delivery time	X					X
Engineering/technical assistance	X					X
Favorable terms of sale					X	
Production technology		X	X	X		
Marketing practices	X				X	X
Reliability of supplier	X					X
Shorter new product Development time						
Willingness to supply required volumes	X					
Ability to supply metric sizing	X					X
Ability to meet specifications			X	X		
Product innovation						
Quality	X					

1/ D = 60 percent or more of total respondents accorded domestic parts makers an advantage; F = 60 percent or more of total respondents accorded foreign parts makers an advantage; S = competitive position the same.

Source: Compiled from data submitted in response to the questionnaires of the U.S. International Trade Commission.

SHOCK ABSORBERS

Description and uses

A shock absorber is a cylindrically shaped device designed to limit unwanted oscillation and vibration in a motor vehicle. The industry classifies shock absorbers as dampers, which include several products:

Hydraulic damper -- the basic mechanism for most damper applications is the traditional oil-filled shock absorber used in the automotive suspension system. When mounted as a component in the suspension system, sometimes surrounded by a spring, the hydraulic damper is designed to dissipate energy from road disturbances. If a small amount of nitrogen is added to increase the hydraulic pressure and therefore the spring rate of the shock, it is commonly referred to as a gas shock absorber.

MacPherson Strut or strut -- a hydraulic damper with the addition of hardware to make it a structural component of the vehicle suspension system. Struts were developed primarily for front wheel drive vehicles to allow space for the transversely mounted engine and transaxle. The strut acts to absorb not only axial movement, but also side and rotational load. With the increasing use of front-wheel-drive vehicles, and the advantages of modular design capability, the strut is supplanting the conventional hydraulic shock absorber as the component designed into vehicle suspension systems.

Steering damper -- a small hydraulic damper that absorbs and dampens vibrations to the steering system.

Engine damper -- a small hydraulic unit used to stabilize the engine from vibrations.

For the purposes of this investigation, these products will collectively be referred to as shock absorbers, except where noted.

In addition to the above dampers, new microprocessor technology has been developed, which has aided in the development of new types of shock absorbers and computer-controlled suspension systems. Automatic computer-controlled struts employ road-surface and height sensors to continuously monitor road characteristics and adjust damping force. A manually controlled version allows the driver to adjust the vehicle's ride characteristics by designating the desired hydraulic resistance. Japanese producers reportedly have a technological lead in the design of adjustable suspension systems. 1/ These units are currently available; however, they are usually installed on more expensive models.

All shock absorbers are essentially sheet steel products, with the critical failure point, and therefore quality differences, revolving around leakages of the hydraulic fluid. Therefore, seal improvements in material and design is a major area of research. Advances are also being explored in oil technology, bushings, plastic casings, and dust shields. In general, imported dampers are considered equal to the U.S. products in terms of quality and performance.

1/ USITC staff interview with domestic producers of shock absorbers.

Manufacturing process

The manufacturing process for the shock absorber is highly automated and consists of two major fabrications (rod and reservoir tube) and two like subassemblies which are combined to form the final assembly. The rod is first cold formed, machined in multispindle chucking equipment and then prepared for subsequent finishing processes. The finishing process begins with an induction hardening and heat treatment operation, which feeds a series of grinding and finishing equipment. The rod is chrome plated in an automatic plater and finished in thru-feed "superfinishing" machines.

The rod assembly begins with the welding of a cold-headed piston to the rod. Valving components, which are made on high-speed presses, are then automatically assembled to the piston for each specific model, and the piston and rod subassembly is then ready for transfer to the final assembly area.

The reservoir tube subassembly begins with the formation of the basic tube in the tube-processing area, where the steel strip is rolled to the desired diameter and resistance-welded in one continuous operation. After heat treatment, automatic cranes transfer the "tubing bar" through the subsequent drawing and cutoff operations. The cut tubes are then end faced, chamfered, and washed to prepare for the subassembly and final assembly operations. At this point, a hydraulic damper made for use in a strut is sent to multistation assembly modules to finalize the reservoir sub assembly with automated assembly and welding stations for the strut spring, bracket, and base cup.

At the final assembly station, these parts, along with the cylinder tube (which is made like the reservoir tube but on different equipment), the compression valve is assembled, filled with oil, and stroke tested prior to painting and shipment.

Customs Treatment

U.S. tariff treatment

Imports of shock absorbers for automotive use are classified under TSUSA item number 692.3282 (table 12-43), with items from Canada that fall under the provisions of APTA entering under item 692.3380. In the proposed Harmonized System nomenclature, shock absorbers are classified as item 8708.80.50, suspension shock absorbers, for other vehicles. In general, designated beneficiary developing countries are eligible for GSP benefits for shock absorbers. However, Brazil, Mexico, and Taiwan have exceeded the competitive-need limits under TSUS item 692.32 (other motor vehicle parts) and are therefore ineligible for GSP benefits for shock absorbers. A change to the HS schedule is not expected to affect GSP status.

Shock absorbers classified in TSUS item 692.3282 from countries afforded most-favored-nation (MFN) treatment are generally dutiable at the column 1 rate of 3.1 percent ad valorem. This represents the final staged rate negotiated under the Tokyo Round of the Multilateral Trade Negotiations for column 1 rates. The column 2 rate of duty for shock absorbers classified under TSUS item 692.3282, is 25 percent ad valorem. Shock absorbers, if imported from designated beneficiary countries, are eligible for duty-free

Table 12-43
Shock absorbers: U.S. rates of duty, by TSUSA item

(Percent ad valorem)

TSUSA item No. 1/	Description	Pre-MTN col. 1 rate of duty 2/	Col. 1 rate of duty 1987 3/	Col. 2 rate of duty
692.3282A*	Shock absorbers	4% 3/	3.1%	25%
692.3380		Free	Free	4/

1/ The designation "A*" indicates that the item is currently designated as an eligible article for duty-free treatment under the Generalized System of Preferences (GSP), and that certain of these countries, specified in general headnote 3(e)(v)(D) of the Tariff Schedules of the United States Annotated, are not eligible.
2/ Rate effective prior to Jan. 1, 1980.
3/ Shock absorbers are also classified in the Appendix to the Tariff Schedules, Part 2, under item number 947.36, at a temporary rate of 2.6 percent ad valorem.
4/ Not applicable.

entry under the Caribbean Basin Initiative (CBI). In addition, shock absorbers are eligible for preferential tariff treatment under the United States-Israel Free Trade Area Implementation Act (UIFTA).

In December of 1983, in accordance with the General Agreement on Tariff and Trade (GATT), the President signed a proclamation of compensatory concessions to lower the tariff rates on a range of TSUS items, including shock absorbers. Pursuant to sections 203(a)(1) and 203(e)(1) of the Trade Act of 1974, and 2253(e)(1) in accordance with Articles I and XIX of the GATT, the President proclaimed temporary increased rates of duty on certain nonelectric cooking ware of steel, enameled or glazed with vitreous glasses, from Japan and Spain. To balance these tariff increases and restore the overall benefits of tariff concessions to Japan and Spain, the President designated shock absorbers to be included in one of 42 special categories of items to be assigned reduced rates of duties. 1/ For this purpose, shock absorbers are classified in the Appendix to the Tariff Schedules, under item number 947.36, axle spindles and shock absorbers for motor vehicles. The decrease in the rate of duty began in 1984 at 2.4 percent ad valorem, and the rate was scheduled to increase to 2.6 percent ad valorem by 1987. This temporary duty will terminate on December 31, 1987, at which time the duty rate on shock absorbers from Japan and Spain will revert to the regular column 1 rate of 3.1 percent ad valorem.

Foreign tariff treatment

U.S. exports of shock absorbers are relatively small, because U.S. firms face a number of foreign trade barriers. 2/ Instead, U.S. firms attempt to enter foreign markets through foreign investments. Duty rates for assembled

1/ Proclamation 5140 of Dec. 19, 1983, Federal Register, Vol. 48, No. 247, Dec. 22, 1983.
2/ USITC staff interview with domestic producers of shock absorbers.

versus nonassembled shocks, in two of the top five U.S. export markets--Mexico and Venezuela--are illustrative of U.S. business options:

Item	Description	Country	Present rate
87.06	Shock absorbers Unassembled	Mexico	Duty free, if for assembly and re-export
		Venezuela	1% ad val. plus 5% surcharge
	Shock absorbers Assembled	Mexico	33% ad val.
		Venezuela	100% ad val. plus 5% surcharge
		Brazil	100% ad val. 1/
		Netherlands	4.9% ad val.
		Saudi Arabia	4.0% ad val.
43829-1	Aftermarket shock absorbers	Canada	9.1% ad val.

1/ According to Department of Commerce sources, imports of shock absorbers into Brazil are by license only, and are currently prohibited.

Under such circumstances, companies wishing to sell to these markets must ship unassembled products and arrange for assembly in the specific country. A small amount of unassembled U.S. exports of shock absorbers to Mexico return to the United States under tariff provision 807.

Overall, exports in 1986 accounted for less than 6 percent of the value of U.S. shipments, with 59 percent of that total going to Canada. The bulk of exports to Canada are to U.S.-owned subsidiaries for assembly operations in Canada and many eventually are re-exported to the United States.

Profile of the U.S. Industry

Overview

There are currently three dominant producers of shock absorbers in the United States, with an additional three firms reporting that they produced shock absorbers at some time during 1982-86. Delco Products, a subsidiary of General Motors Corp. and Monroe, a wholly owned subsidiary of Tenneco, Inc., are the dominant U.S. original equipment suppliers. Maremont, recently acquired by Arvin Industries, and Monroe are the chief U.S. companies competing in the aftermarket, with Delco having a small share.

Sources indicate that up to the mid-1970's, all three major U.S. automobile manufacturers produced shock absorbers. Since that time, Ford and Chrysler have ceased most of their U.S. shock-absorber production.

Encouraged by contracts from automobile manufacturers in the United States and incentives from State governments, two Japanese shock-absorber producers have announced plans to establish production facilities in the United States. Showa plans to begin production of shock absorbers in 1987 to supply the Honda automobile facility in Marysville, OH. 1/ The new Showa plant will be located near Columbus, OH. Tokico, also a Japanese company, is currently a large exporter of shock absorbers to the United States, and has plans to begin producing in Berea, KY, beginning in the summer of 1988. Sources indicate that each plant, while built for the purpose of honoring current contracts, will have sufficient capacity to supply other demand. 2/

Shock-absorber manufacturing facilities are located throughout the United States, supplying both OEM and replacement customers from relatively central areas. The light weight and easy containerization of shock absorbers make long distance transportation economical. Respondents to the Commission's questionnaire, which accounted for 100 percent of sales of shock absorbers during 1982-86, indicated that shipments travel predominantly by truck, and the general marketing area was over 500 miles (table 12-44).

During 1982-86, hourly wages in the shock-absorber industry increased by almost 28 percent. In 1986, wages of shock-absorber production and related workers fell to 90 percent of the automotive parts industry average after being virtually equal in 1982 and 1983 as shown in the following tabulation:

Year	Production and related workers producing shock absorbers 1/	All automotive parts 1/	All operating U.S. manufacturing establishments 2/
1982........	12.13	12.24	11.50
1983........	12.89	12.90	11.97
1984........	13.10	14.57	12.40
1985........	14.63	15.51	3/ 12.82
1986........	15.50	17.21	3/ 13.09

1/ Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.
2/ Compiled from unpublished data of the U.S. Department of Labor, Bureau of Labor Statistics.
3/ Estimated.

One of the principal reasons for the lower average hourly wage rate in the industry is the increase in the proportion of nonunion facilities, which occurred when Ford and Chrysler ceased production of shock absorbers. In addition, a significant proportion of U.S. production is in the lower wage areas of the Southern United States.

Capacity and employment

U.S. capacity in the shock-absorber industry increased from 113 million units in 1982 to 121 million units in 1984, before falling to 106 million units in 1986 (table 12-45). Industry sources indicate that the capacity fluctuations reflect the change from traditional shock absorbers to increased usage of struts. U.S. manufacturers' capacity is expected to increase in the near term.

1/ Honda owns approximately 33 percent of Showa.
2/ USITC staff interview with domestic producers of shock absorbers.

Table 12-44
Shock absorbers: U.S. producers' rating of predominant modes of transportation used to ship shock absorbers, the marketing area generally serviced, and the average percentage of transportation costs in the total delivered value of their firms' shipments

Item	Number of responses
Predominant mode(s) of transportation:	
Truck	5
Rail	-
Water	1
Other	-
General marketing area (radius):	
Up to 100 miles	-
101 to 200 miles	-
201 to 500 miles	-
Over to 500 miles	6
Average transportation costs (as percentage of sales):	
0 to 5 percent	4
6 to 10 percent	1
11 to 15 percent	1
16 to 20 percent	-
Over 20 percent	-

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table 12-45
Shock absorbers: U.S. capacity, number of production and related workers, man-hours worked, wages, and hourly wage rates, 1982-86

Item	1982	1983	1984	1985	1986	Average annual percentage change, 1986 over 1982
Capacity (1,000 units)	113,092	116,628	120,617	115,014	105,981	-1.6
Employment of production and related workers:						
Number	5,076	4,985	5,700	5,313	5,385	1.5
Man-hours worked (1,000 hours)	10,623	11,036	12,992	11,829	11,663	2.4
Wages (1,000 dollars)	128,843	142,284	170,176	173,048	180,783	8.8
Hourly wage rate	$12.13	$12.89	$13.10	$14.63	$15.50	6.3

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Financial data

U.S. producers' total net sales in the shock-absorber industry increased each year during 1982-86, from $703 million in 1982 to $1.1 billion in 1986, or by over 50 percent (table 12-46). Growth in shipments of original-equipment shock absorbers was the cause of most of the increase, as the number of vehicles produced in the United States increased by about 65 percent during 1982-86.

Table 12-46
Shock absorbers: U.S. producers' total net sales, total net profit or (loss), capital expenditures, and research and development expenditures, 1982-86

Item	1982	1983	1984	1985	1986	Average annual percentage change, 1986 over 1982
Net sales (1,000 dollars)....	703,401	786,277	951,496	1,014,996	1,064,350	10.9
Net profit (loss) (1,000 dollars)............	1/	1/	1/	1/	1/	1/
Ratio of net operating profit to net sales (percent).....	1/	1/	1/	1/	1/	1/
Capital expenditures (1,000 dollars)............	26,745	27,994	44,109	48,622	48,745	16.2
Research and development expenditures (1,000 dollars)............	20,418	20,959	21,959	24,615	27,430	7.7

1/ Withheld to avoid disclosure of confidential business information.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Sales of replacement shock absorbers increased less than those of OE shock absorbers. Based on questionnaire responses, as a proportion of total industry shipments, aftermarket parts decreased from an estimated 63 percent in 1982 to 43 percent in 1986. Industry sources attribute the slower growth to improved quality of shock absorbers and a declining number of cars that were 4 to 10 years old, which most frequently require replacement shocks. 1/

Industry capital expenditures increased by 82 percent between 1982 and 1986, and research and development expenditures increased by 34 percent during the same period. According to industry sources, current production facilities are not compatible with the manufacturing of struts, therefore the shock manufacturers will have to invest in new equipment in order to produce struts.

1/ USITC staff interview with domestic producers of shock absorbers.

Major foreign competitors

The U.S. shock-absorber industry is the world's largest, producing from 45 to 50 percent of world output. However, companies in Europe and Japan are aggressively seeking to expand market share throughout the world, including the United States. Japanese firms currently provide an estimated one-third of world output, with European companies (principally West Germany) accounting for most of the remainder. Respondents to the questionnaire indicated that both European and Japanese producers have gained the financial, technological, and manufacturing capabilities for world competitiveness, primarily by dominating their home markets, while excluding U.S. shock-absorber producers from their markets. In the shock-absorber industry, investment and joint ventures are the two most common methods used to penetrate markets.

Structural Factors of Competition Between U.S. and Foreign Industries

U.S. producers' questionnaire responses show that foreign shock-absorber producers have an advantage in labor costs and exchange rates, but domestic producers have an advantage in fuel costs and domestic inflation rates (table 12-47). Overall, U.S. producers did not consider Government involvement a factor.

Japan is rated as having advantages in raw-material costs, inflation rates, exchange rates, equipment costs, and interest rates. For these reasons, one questionnaire respondent commented that Japanese manufacturers of shock absorbers are the world's most competitive in terms of cost. With inexpensive labor and abundant raw material, respondents stated that the Brazilian industry is able to produce a competitive product. In addition, the respondents stated that the Brazilian shock-absorber industry is protected by a 100-percent ad valorem tariff. Moreover, respondents said that the tariff rate into Brazil is misleading, since shock-absorber imports require licensing, which is nearly impossible to obtain. The European producers are generally considered to be competitive with U.S. firms.

The U.S. Market

Overview

Increased U.S. automobile production from 1982 to 1986 is largely responsible for a 61-percent gain in apparent consumption of shock absorbers over the period (table 12-48). In 1986, U.S. shipments reached $1.0 billion, an increase of 55 percent when compared with 1982. Consumption of replacement shocks is estimated to have fallen slightly over the period.

The ratio of imports to consumption increased from 4.5 percent in 1982, to 7.3 percent in 1986, after peaking in 1985 at 7.9 percent. When Japanese firms begin operations in the United States in 1988, the import to consumption ratio is expected to fall. Over the next several years, U.S. consumption of shock absorbers is expected to increase at a slow rate. The replacement market will continue its downward trend, as a result of the installation of the more durable strut, which is gradually replacing the standard shock absorber on automobiles and lightweight trucks.

Table 12-47
Shock absorbers: U.S. producers' competitive assessment of structural factors of competition for the U.S. and foreign industries, by major competing countries, 1986 1/

Item	Japan	Brazil	West Germany	All countries
Fuel cost	S	S	D	D
Raw materials costs	F	F	S	S
Domestic inflation rates	F	D	S	D
Labor costs	S	F	S	F
Exchange rates	F	F	S	F
Taxes	S	S	S	S
Equipment costs	F	S	S	S
Interest rates	F	D	S	S
Government involvement:				
Subsidies	S	F	S	S
U.S. Government regulations that increase costs	S	S	S	S
Foreign government regulations that increase costs	S	S	S	S

1/ D = 60 percent or more of total respondents accorded domestic producers an advantage; F = 60 percent or more of total respondents accorded foreign producers an advantage; S = Competitive position the same.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

U.S. imports

According to U.S. Department of Commerce data, U.S. imports of shock absorbers, which include the various types of hydraulic dampers, increased 68 percent during 1982-86 to $96 million in 1986 (table 12-49). Strong growth in U.S. automobile production in 1983 and 1984 was the principal cause of the large increases in imports of shocks in those years. Much of that growth came from Canada, as U.S.-owned firms manufacturing in that country increased production which was, in turn, exported to U.S. vehicle manufacturers. Since 1984, imports from Canada have dropped 18 percent to $22 million in 1986. In 1986, about 53 percent of imports from Canada entered under APTA, with another 20 percent entering under tariff provision 807.00, reflecting U.S. assembly operations in Canada.

Since 1984, West Germany and Japan have overtaken Canada as the leading foreign shock-absorber suppliers to the United States. West Germany has doubled shipments to the United States since 1984, to $29 million in 1986 to become the leading U.S. supplier. Industry sources report that Fichtel and Sachs of West Germany produces high-quality suspension components, and already has a strong OEM customer base in the United States. The company is currently the largest European producer of shock absorbers and McPherson struts.

Table 12-48
Shock absorbers: U.S. producers' shipments, exports of domestic merchandise, imports for consumption, and apparent consumption, 1982-86

Year	Shipments	Exports	Imports	Apparent consump- tion	Ratio (percent) of imports to consumption
	Quantity (1,000 units)				
1982.......	80,379	5,437	1/	1/	1/
1983.......	89,136	7,257	1/	1/	1/
1984.......	99,274	7,469	1/	1/	1/
1985.......	97,935	7,299	1/	1/	1/
1986.......	94,434	9,255	1/	1/	1/
	Value (1,000 dollars)				
1982.......	653,220	40,485	29,019	641,754	4.5
1983.......	738,772	45,446	41,114	734,440	5.6
1984.......	907,385	47,081	63,745	924,049	6.9
1985.......	970,499	45,965	79,350	1,003,884	7.9
1986.......	1,013,146	57,105	75,798	1,031,839	7.3

1/ Not available.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Imports from Japan have more than doubled since 1982, reaching $25 million in 1986. Most Japanese imports are being used by Japanese auto and truck manufacturers producing vehicles in the United States, or the shocks are for aftermarket use for imported Japanese vehicles.

Taken together, West Germany, Japan, and Canada accounted for 79 percent of U.S. imports in 1986; this ratio has not changed appreciably since 1982. Industry sources predict that Brazil, and to a lesser extent Korea and Taiwan, could become major sources of imports in the near future. In 1986, imports entering the United States under the GSP provision were negligible.

Competitive Assessment of Key Factors of Competition in the U.S. Market

According to respondents to the questionnaire, increased durability and the incorporation into modular designs are decreasing the size of the market for replacement shocks. European producers currently have an advantage in supplying "high-performance" shock absorbers to the U.S. market. Industry sources indicate that relatively small market for these types of shocks, coupled with the European lead in marketing and production, will continue to inhibit entry by U.S. firms into this market. At the same time, producers from developing countries, particularly Brazil, are expected to increase marketing efforts in the traditional shock absorber replacement market.

Table 12-49
Shock absorbers: U.S. imports for consumption, by principal sources, 1982-86

Source	1982	1983	1984	1985	1986	Average annual change, 1986 over 1982
	1,000 dollars					Percent
West Germany.......	8,467	9,745	14,085	23,073	29,335	36.4
Japan..............	12,199	15,562	21,939	24,301	24,799	19.4
Canada.............	23,870	18,524	26,274	23,751	21,504	-2.6
Spain..............	5,470	6,126	3,607	4,449	6,111	2.8
Netherlands........	922	3,197	4,284	2,715	3,277	37.3
Belgium and Luxembourg.......	1,590	1,583	2,671	2,875	2,263	9.2
All other..........	4,889	4,388	8,108	9,008	8,969	16.4
Total..........	57,407	59,125	80,968	90,172	96,258	13.8

Source: Compiled from official statistics of the U.S. Department of Commerce, except as noted.

U.S. purchasers responding to the questionnaire indicated that a lower purchase price, superior production technology, and superior quality were the major reasons for their purchases of foreign-made shock absorbers (table 12-50). On the whole, reasons for the purchase of both U.S.-made and foreign shock absorbers were largely the same; however, the U.S. industry was given an edge in shorter delivery time and the willingness to supply the required volume. As foreign producers locate in the United States, these advantages will diminish.

Competitive Assessment of Key Factors of Competition in Foreign Markets

Although rapidly increasing in sophistication, shock-absorber technology and manufacturing processes are relatively basic and well-known. Therefore, strong domestic shock-absorber industries can be found in most major world motor-vehicle markets. Europe has about 15 producers of shock absorbers, supplying the bulk of both OEM and replacement demand for the EC. Two West German firms, Fichtel and Sachs, and Boge, reportedly account for nearly one-third of European production. Sources indicate that Delco and Monroe together hold about 15 percent of the European shock-absorber market, primarily to supply the European OEM's. European firms reportedly capture the bulk of the African market and are expanding to ventures in Latin America.

Superior technology and quality have made Japan's three major shock-absorber producers--Showa, Kayaba and Tokico--dominant not only in the Asian market, but also worldwide. Business ventures of these firms include operations in Indonesia, India, Europe, South Africa, Brazil, and the United States.

Table 12-50
Shock absorbers: Ranking of U.S. purchasers' reasons for purchases of U.S.-produced and foreign-produced shock absorbers, 1982-86 1/

Reason for purchase	U.S.-produced	Foreign produced
Product cost advantages:		
Lower purchase (delivered)	10	1
Favorable exchange rates	12	2/
Nonprice factors:		
Shorter delivery time	3	2/
Engineering/technical assistance	4	2
Favorable terms of sale	5	2/
Production technology	6	1
Marketing practices	2	2
Reliability of supplier	1	2
Shorter new product development time	9	2/
Willingness to supply required volumes	5	2/
Ability to supply metric sizing	11	2/
Ability to meet specifications	8	2/
Product innovation	7	2
Quality	3	1

1/ Ranking numbers range from 1 to 12, number 1 indicating the most important reason for purchases and number 12 indicating the least important reason for purchase. Some factors were ranked equally in importance.
2/ Insufficient data.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

In Latin America, Brazil is considered a large, potential market. U.S. and Japanese firms do have ventures in Brazil; however, questionnaire responses indicate the Brazilian market is heavily protected by nontariff taxes, local content, and licensing requirements.

Representatives from a U.S. firm said that in order to continue to be competitive in shock absorbers, they would have to compete on a global basis. The U.S. industry is apparently attempting to meet this challenge by developing joint ventures and technical agreements, and by aggressively exploring new markets.

TIRES

Description and uses

Pneumatic tires are a rubber and fabric product that, when inflated to a designated pressure, provide traction and act as a cushion for the vehicle. Primary consumer applications for pneumatic tires include automobile, truck, and bus tires.

There are basically three types of tire construction: bias ply, bias-belted, and radial tires (figure 12-2). Bias-ply tires are constructed with two, four, or more plies (layers of fabric) of nylon, rayon, or polyester, with the cords in the plies running in a diagonal or bias direction. The cords are made of polyester, nylon, or rayon. Bias-ply tires required the use of inner tubes to hold air until 1947, when tubeless bias-ply tires were introduced.

Bias-belted tires add two or more reinforcing belts under the tread to the bias-ply construction. The belts are constructed of fiberglass, rayon, or steel. Until 1969, bias-belted tires were the original-equipment tire on most American-made cars.

Radial tires have tire body cords running at a 90° angle from the direction of travel. The belt plies run under the tread along the tire circumference, constricting the cords and adding rigidity. Radial tire cords are made of polyester, nylon, or rayon, and are used with belts of steel, fiberglass, rayon, or aramid.

In 1965, B.F. Goodrich became the first American company to introduce the radial tire. 1/ Radial tires did not become popular in the United States until the 1970's. During the first 6 months of 1984, approximately 75 percent of domestically produced passenger-car tires were radials. Radials are now used as original equipment on all American cars. Radial replacement tires increased from 64 percent of total tire construction types in 1982 to 88 percent of total tire types in 1986. The radial-ply construction made it possible to eliminate the friction between plies and stabilize the portion of the tire that contacts the road. The performance consequences of radial-tire construction include:

1. Twice the mileage of the bias-ply tire;

2. Improved traction as a result of structural change, not just tread design change;

3. Improved ride comfort and safety as a result of the casing having greater flexibility;

4. Reduced heat buildup, which increases the life of the tire cord; and

5. Reduced rolling resistance, which increases gasoline economy.

In designing a tire, engineers must weigh the needs of vehicle manufacturers and consumers, and generally settle on a compromise that

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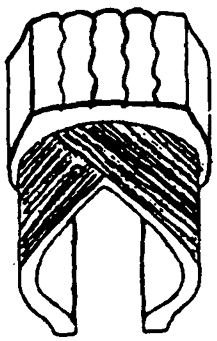
1/ Michelin began marketing radial tires in Europe in 1948. Michelin radials were available in the United States as early as 1952 for foreign cars and in 1957 for domestic cars.

Figure 12-2

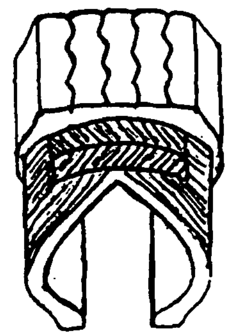
Tires: Basic tire constructions

BIAS-PLY CONSTRUCTION



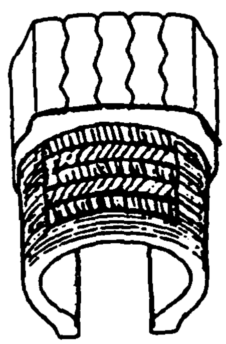
Note plies at 30°-40° angle

BIAS-BELTED CONSTRUCTION



Note addition of belts.

RADIAL CONSTRUCTION



Note arcwise orientation of plies, with the addition of belts.

Source: "Tires and Tubes," Summary of Trade and Tariff Information, USITC Publication 841, Control No. 7-12-12, March 1981, p.4.

emphasizes such characteristics as safety and tread life. Factors taken into consideration include:

1. Vehicle weight distribution, which determines the load-carrying capacity of the tire and the operating inflation pressure;

2. Axle height and clearance for the chassis, suspension, and braking system, which determines the diameter, section width, and bead diameter of the tire;

3. The vehicle suspension system, which determines the basic tire construction (radial or bias-ply construction); and

4. The speed capability and operating conditions (in relation to construction, composition, and tread pattern).

Depending upon the decisions of the tire designers, different types of tires are selected for specific functions.

Manufacturing process

The manufacturing process for radial tires consists of mixing rubber, natural or synthetic, commonly known as (elastomers), carbon black, pigments, anti-oxidants, process oils, and accelerators in a banbury mixer to form a rubber compound; processing the various fabrics and coating them in a calendering operation; extruding the treads, sidewalls, and other tire components; assembling the components on a tire-building machine; curing the tire under heat and pressure; and then finishing and final inspection.

The rotary mixing operation takes place in the banbury under tremendous heat and pressure to obtain a thorough, uniform dispersion of all compounding ingredients within the elastomer. The treads, sidewalls, and other tire components are then extruded to a specific contour and cut to length in the extruder.

The fabric, made of fibers such as nylon, rayon, polyester, and fiberglass, makes up the tire's body, or carcass. A calender is a heavy-duty machine equipped with three or more heated rolls revolving in opposite directions. The amount of rubber deposited onto the fabric is determined by the gap between the rolls. In the calendering operation, the textile fabric is coated on both sides with the rubber compound. The calendered fabric is then cut to certain widths and angles.

Another tire component, the bead, is the rigid base of the tire that fits against the wheel rim. The bead consists of high tensile steel wires that are passed through an extrusion die, where a coat of rubber is added. The rubber coated wires are wound into a ring-shaped bead that fits the rim of the wheel.

The calendered and cut carcass plies and belts, plus the extruded tread, sidewall, and beads are assembled at the tire-building machine. Radial-tire building requires complex and costly machinery, incorporating inflatable textile-reinforced diaphragms overlying a skeletal metal drum, to shape the carcass plies up to the diameter for belt fitting. On this drum, the "green" or uncured tire is built.

The tire-building process begins with a thin layer of rubber compound called the inner liner that will seal in air and make the tire tubeless. The carcass plies are placed on the drum one at a time, after which the beads are set in place and the plies set up around them. The green radial tire is then expanded from a cylindrical to a toroidal shape. At this point the belts and tread are added, the drum is collapsed, and the green tire is loaded into an automatic tire press to be cured (vulcanized) under heat and pressure for a certain period of time. Green tires cure at 300 degrees for 12 to 25 minutes. During this time, the vulcanization process converts the rubber and fabric into a tough, elastic product and bonds the various parts of the tire into a single unit. The compound flows into the mold-shape, which is engraved with the tread pattern and the many sidewall markings required by law.

After curing, the tire can be mounted on a rim and permitted to cool, while inflated to reduce internal stresses. Finishing involves trimming, buffing, balancing, and quality-control inspection.

Customs Treatment

U.S. tariff treatment

Tires are classified for tariff purposes under TSUS items 772.51 (table 12-51). Pneumatic passenger-car tires are classified under TSUSA item 772.5109 and 772.5112. On-the-highway truck and bus tires are classified under TSUSA item numbers 772.5127, 772.5129, 772.5136, and 772.5138. There is no separate TSUS number for original-equipment tires imported from Canada, since they were specifically excluded from the duty-free provisions of APTA when the agreement was originally negotiated. The column 1 rate of duty is 4.0 percent ad valorem. The column 2 rate of duty is 10 percent ad valorem. Imports of such products are eligible for preferential tariff treatment under the Caribbean Basin Economic Recovery Act (CBERA), The United States-Israel Free Trade Area Implementation Act (UIFTA), and the Generalized System Preferences (GSP). Brazil and Korea have exceeded competitive-need limits for item number 772.51 and so cannot receive preferential duty treatment under the GSP for those products. Under the proposed Harmonized System the classification numbers are 4011.10.00, 4011.20.0005, 4011.20.0010, 4011.20.0015, and 4011.20.0020 with no change in the rate of duty. Aside from the staged duty-rate reductions negotiated under the Tokyo Round of Multilateral Trade Negotiations (MTN), there has been no change in tariff treatment of tires since 1982.

On July 20, 1984, the Commission and the U.S. Department of Commerce received a petition from Armstrong Rubber Co., Cooper Tire & Rubber Co., Firestone Tire & Rubber Co., B.F. Goodrich Co., and Goodyear Tire & Rubber Co., alleging that imports of new radial-ply tires from Korea were being sold in the United States at less than fair value (LTFV). On August 13, 1984, the Commission determined in investigation No. 731-TA-200 (Preliminary) that there

Table 12-51
Tires: U.S. rates of duty, by TSUSA item

(Percent ad valorem)

TSUSA item No. 1/	Description	Pre-MTN Col. 1 rate of duty 2/	Col. 1 rate of duty 1987	Col. 2 rate of duty
772.51A*	Tires, and tubes for tires, of rubber or plastics: Pneumatic tires: other than airplane, bicycle, or for agricultural, or horticultural use, New Passenger car tires:	4%	4%	10%
09	Radial			
12	Other			
	On-the-highway truck and bus tires: Light Truck:			
27	Radial			
29	Other			
	Other:			
36	Radial			
38	Other			

1/ The designation "A*" indicates that the item is currently designated as an eligible article for duty-free treatment under the Generalized System of Preferences (GSP) and that certain of these countries, specified in general headnote 3(e)(v)(D) of the Tariff Schedules of the United States Annotated, are not eligible.
2/ Rate effective prior to Jan. 1, 1980.

was no reasonable indication that an industry in the United States was materially injured or threatened with material injury by reason of alleged LTFV imports from Korea. 1/

Foreign tariff treatment

Canada is the principal export market for tires, followed by Korea and Japan. The current rates of duty applicable to imports of tires for major foreign producing countries are shown in the following tabulation:

1/ Investigation No. 731-TA-200, USITC Pub. 1572, September 1984.

Item	Country	Present rate of duty
		(Percent ad valorem)
61815-1	Canada	10.2%
40.11	Japan	Free
40.11	Korea	25%
40.11	West Germany	5.8%

Profile of the U.S. Industry

Overview

There are 12 tire producers, operating approximately 40 plants, located primarily in the Southeastern and North Central States of Alabama (the top State in tire production), Tennessee, South Carolina, North Carolina, Ohio, and Illinois. The two largest tire manufacturers are multinational in scope, vertically integrated, and produce a wide variety of other rubber products. Two other large producers are highly diversified corporations that started as tire companies but are now involved in other industries. Three foreign-owned companies are also vertically integrated firms whose major U.S. operations are the production of tires. The remaining small manufacturers are not vertically integrated to any extent, and sell primarily in the domestic market.

The U.S. tire industry has been undergoing a restructuring process in the last two decades that has involved contracting and consolidating plants. More than 20 domestic tire plants closed during the period 1976-86, whereas in 1987, an additional 10 are either on the "distressed" list or will be closed. Tire-industry executives characterize the industry as being in a better position because of this realignment. 1/

Part of the restructuring followed takeover attempts and mergers. The target of a hostile takeover attempt in late 1986, Goodyear Tire & Rubber Co. trimmed itself of $1 billion worth of assets, including its Aerospace and Motor Wheel subsidiaries along with tire plants in Cumberland, MD, and New Toronto, Ontario. Additionally, Goodyear is attempting to shed its Celeron oil and gas exploration operations. The total cost of fending off the corporate raiders and preventing future takeover bids amounted to $2.6 billion.

Another target of a takeover attempt in 1985, Uniroyal fought the bid with a leveraged buyout, incurring almost insurmountable debts to retain control. Uniroyal sold off assets to reduce the debt, drastically changing the structure of the once $2 billion tire, chemical, and engineering products corporation. In early 1986, B.F. Goodrich and Uniroyal announced a joint venture forming Uniroyal-Goodrich, North America's second largest tire manufacturer. The merger combines a leading original-equipment manufacturer (Uniroyal) and a leading supplier in the replacement market (Goodrich),

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1/ Saul Ludwig, "Tire Production Dropped, But '86 Was Better Year Than Forecast," Modern Tire Dealer, Facts/Directory, January 1987, p. 10.

resulting in a company more competitive than either of its separate entities. 1/

The strengthening of the yen vis-a-vis the dollar, which pushed up prices of imports of tires from Japan and reduced the differential between Japanese- and U.S.-made tires, had the effect of cutting profits of Japanese tire producers. Tire producers sought to soften the effects of the stronger yen and maintain their profitability through diversification into nontire business operations. 2/ A particularly significant strategy employed by the Japanese to avoid exchange-rate fluctuations was the shifting of production facilities to the United States. Japan's Bridgestone Corporation, which opened its truck-tire manufacturing plant in LaVergne, TN, in 1983, announced in mid-1987 its plans to build a $70 million enlargement of the LaVergne plant for the production of radial passenger tires by the early 1990's.

Sumitomo Rubber Industries, Ltd., Kobe, Japan, acquired more than 80 percent of Dunlop Tire Industries in 1986. The $240 million transaction makes Sumitomo the first passenger-tire maker with facilities in the world's three markets--Europe, the United States, and Japan, thus giving Sumitomo a significant competitive advantage in the global market. 3/ Yokohama Tire Corporation of Japan has also expressed an interest in North American manufacturing facilities. 4/

According to producers responding to the Commission's questionnaire, the predominant mode of transportation used to ship tires is by truck, followed by water and rail service. The general marketing area is fairly large, having a radius of over 500 miles (table 12-52).

The majority of tire producers indicated that the average percentage of transportation costs were estimated to be 0 to 5 percent of the total delivered value of producers' sales. A respondent to the Commission's questionnaire commented that, whereas transportation costs are minimal to moderate for domestic producers, indirect costs related to transportation, such as shipping containers and just-in-time delivery programs, can be a greater influence. The location of a tire producer's plant in relation to the customer's facility affects producers in a number of ways, including inventories. All of the above-mentioned costs, along with other items, add to the actual shipped cost to tire customers.

Replacement tires (both wholesale and retail) are distributed primarily from tire manufacturers to independent dealers. Chain and department stores are the next major channel of distribution, followed by the manufacturer-owned company stores, and dealers supplied by oil companies, as indicated in table 12-53.

1/ Lloyd Stoyer "Reforms Must Separate Good from Bad Takeovers," Modern Tire Dealer, December 1986, p. 10.
2/ James R. Smith, Jr., "'86 Was No Tiger For Far Eastern Tiremakers," Modern Tire Dealer, May 1987, p. 14.
3/ Lloyd Stoyer, "Dunlop/Sumitomo Deal to Shake Up Tire Market," Modern Tire Dealer, November 1986, p. 9.
4/ James R. Smith, Jr., op. cit., p. 13.

Table 12-52
Tires: U.S. producers' rating of predominant modes of transportation used to ship tires, the marketing area generally serviced, and the average percentage of transportation costs in the total delivered value of their firms' shipments, 1982-86

Item	Percent of total responses
Predominant mode(s) of transportation:	
Truck	75
Rail	10
Water	15
Other	-
General marketing area (radius):	
Up to 100 miles	-
101 to 200 miles	-
201 to 500 miles	-
Over 500 miles	100
Average transportation costs (as percentage of sales):	
0 to 5 percent	78
6 to 10 percent	-
11 to 15 percent	22
16 to 20 percent	-
Over 20 percent	-

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table 12-53
Distribution channels of wholesale and retail tires, 1982-86

Channels	1986	1985	1984	1983	1982
Independent dealers	68	68	68	67	67
Oil companies	3	3	4	4	4
Tire company stores	13	12	11	11	10
Chain stores, dept. discount stores	16	17	17	18	19
Total	100	100	100	100	100

Source: 1986 Facts/Director, Modern Tire Dealer, January 1987, p. 42.

A comparison of hourly wages paid to production workers in the tire industry with hourly wages paid in all operating U.S. establishments indicates that production workers in this segment of the auto-parts industry are receiving wages above the average for U.S. manufacturing establishments.

However, in recent years, these wages were below those for all automotive parts producers, as shown in the following tabulation:

Year	Production and related workers producing tires 1/	All automotive parts 1/	All operating U.S. manufacturing establishments 2/
1982............	$12.76	$12.24	$11.50
1983............	13.38	12.90	11.97
1984............	13.90	14.57	12.40
1985............	14.68	15.51	3/ 12.82
1986............	15.54	17.21	3/ 13.09

1/ Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.
2/ Compiled from unpublished data of the Department of Labor, Bureau of Labor Statistics.
3/ Estimated.

Technology level of U.S. producers

U.S. producers recognize that their competitive ability is closely linked to state-of-the-art technology, which brings about lower unit costs. To improve their competitiveness, the tire industry is undergoing a revolution in both the modernization of facilities and in the design and engineering of new products.

Today's tire-production processes require a number of separate steps in assembly. Components of the tire's body are assembled on one machine, then the tread and belts are added at a second area. Virtually every tire company is installing machinery that allows the assembly to be completed at one station. This automated assembly process eliminates handling and transportation of components and is expected to provide the advantages of product uniformity and improved quality.

Computer technology is being used today to engineer, build, and test prototype tires. CAD/CAM (computer-assistance-design/computer assisted manufacturing) is used to design tread patterns, model the dynamics of treadwear to study treadwear mileage, and improve internal tire construction, i.e., mold shape, ply-line, and belt configuration. Additionally, computers are being utilized in finite-element analysis to examine and minimize stress in the belt and bead areas. 1/

New materials such as tailored polymers and polymer alloys will be utilized in the future. Additionally, tire producers have adopted a new perfection philosophy of "first class or scrap." Formerly, a tire that was not "first class" would be sold as a "second" or a blemished tire if the tire had only cosmetic defects.

According to a tire manufacturer responding to the Commission's questionnaire, tire innovations currently being developed or on the horizon include:

1/ Al Fleming, "Computers Design, Test Goodyear's Tires of Tomorrow," Automotive News, Feb. 2, 1987, p. 226.

(1) Universal tires for all vehicles in a global marketplace; (2) Trouble-free tires, which incorporate corrosion-resistant steel cords, compounds with greater adhesion, halobutyl innerliners, and nylon overlays. Trouble-free tires will incorporate features of run flat or no-flat construction for performance reliability; (3) Constant performance tires, which will be engineered to deliver equivalent input to the driver in all weather conditions at low and high speeds, and on various road surfaces; (4) Innovative tire construction that will minimize rolling resistance; (5) Aerodynamic tires; (6) Quiet tires; (7) Different tires for front and rear use on automobiles; (8) Twin tires for passenger vehicles. The twin-tire concept replaces one tire on the car with two narrower ones, resulting in eight tires per automobile. Advantages of twin tires include improved performance and safety capabilities; (9) "Sensor Tires" which would monitor tire pressure, treadwear, spring rate, traction, and lateral friction coefficients, leak and sealing rate, and alignment. This information would be transmitted from the tire to a computer on the car's instrument panel.

Capacity and employment

The domestic tire industry has been adversely affected by overcapacity in recent years. The restructuring of the tire industry by consolidating plants in an effort to reduce overhead and streamline distribution will have the effect of lowering the total cost of production, according to tire-industry executives. 1/ Capacity fluctuated within a narrow range over the period 1982-86, reaching a high in 1984, according to respondents to the Commission's questionnaire. Thereafter, restructuring had the effect of lowering capacity sharply (table 12-54).

Table 12-54
Tires: U.S. capacity, number of production and related workers, man-hours worked, wages, and hourly wage rates, 1982-86

Item	1982	1983	1984	1985	1986	Average annual percentage change, 1986 over 1982
Capacity (1,000 units)......	189,984	201,644	214,826	212,557	202,588	1.6
Employment of production and related workers:						
Number............	37,704	36,477	39,048	38,854	34,809	-2.0
Man-hours worked (1,000 hours)....	93,766	97,452	104,572	99,603	93,100	-0.2
Wages (1,000 dollars)..	1,196,183	1,303,859	1,453,818	1,462,142	1,446,292	4.9
Hourly wage rate...	$12.76	$13.38	$13.90	$14.68	$15.54	5.1

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

1/ Saul Ludwig, op. cit., p. 14.

Employment of production and related workers in this sector of the auto parts industry fluctuated from 37,704 workers in 1982 to a peak of 39,048 workers in 1984, then fell to a low of 34,809 workers in 1986, according to questionnaire respondents (table 12-54). Hours worked rose from 93.8 million hours in 1982 to 104.6 million hours worked in 1984, then fell to 93.1 million hours in 1986.

Financial data

U.S. producers responding to the Commission's questionnaires reported that total net sales of tires (table 12-55) rose from 1982 to 1984 by 16 percent, to $10.9 billion and then declined to $10.6 billion in 1986. The net profit margin for tires rose unevenly from 4.7 percent in 1982 to 5.5 percent in 1986. Capital expenditures amounted to $3.6 billion overall, representing 7 percent total net sales during the period 1982-86. Over the same period, research and development expenses of U.S. producers totaled $1.6 billion, or 3 percent of total net sales. According to questionnaire respondents, foreign tire producers are expanding their research and development expenditures. Respondents commented that this is evident in the increasing number of patents filed and issued to foreign competitors.

Major foreign competitors

Republic of South Korea (Korea)--The Korean tire industry experienced its worst downturn in 1981-82, as a result of a depressed global economy, resulting in a decline in automobile sales. The Korean tire industry recovered in 1983, aided by the improved world economy and rebound in the automobile industry. 1/ The Korean tire industry is dominated by three tire manufacturers, each of which exports to the United States. Hankook Tire America Corp., the U.S. distributor of Hankook Tire Manufacturing Co., distributes passenger, truck, and off-the-road tires. Korean-made tires are distributed by over 1,000 dealers across the United States. 2/

Sam Yang Tire exports passenger, truck, and off-the-road tires under the Trisun brand through Kumho U.S.A. Inc. Currently, about 250 dealers throughout the United States distribute the brand. The company has no immediate expansion plans in the United States. 3/

Wuopoong Industrial Co., the third Korean tire producer exporting to the United States, supplies mainly bias-ply truck tires and some off-the-road tires through Foreign Tire Sales Inc. About 54 tire dealers across the country distribute the YKS brand tires. There are no expansion plans because production capacity is limited. 4/

1/ Greg Smith, "U.S. Market Offers Viable Arena for Earth Tire Manufacturers," Modern Tire Dealer, April 1984, pp. 34-35.
2/ Greg Smith, "U.S. Market Offers Viable Arena for Earth Tire Manufacturers," Modern Tire Dealer, April 1984, pp. 34-35.
3/ Ibid.
4/ Ibid.

Table 12-55
Tires: U.S. producers' total net sales, total net profit or (loss), capital expenditures, and research and development expenditures, 1982-86

Item	1982	1983	1984	1985	1986	Average annual percentage change, 1986 over 1982
Net sales (1,000 dollars)....	9,403,905	10,216,486	10,901,746	10,489,868	10,624,663	3.1
Net profit (loss) (1,000 dollars)....	443,090	509,566	510,106	508,203	587,461	7.3
Ratio of net operating profit to net sales (percent)..........	4.7	5.0	4.7	4.8	5.5	4.0
Capital expenditures (1,000 dollars)....	496,604	626,355	759,998	893,407	831,101	13.7
Research and develop-ment expenditures (1,000 dollars)....	301,590	315,707	351,539	228,609	353,919	4.1

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Imports of tires from Korea more than doubled from 1982 to a high of $161.1 million in 1985 (table 8) but then declined to $143.6 million in 1986. The fall in tire imports can be related to a number of factors, including smaller pricing differentials between Korean, U.S., and Japanese products, the loss of U.S. private labels after midyear private label wars in Korea, and repercussions from the 1984 antidumping investigation of radial-ply tires for passenger cars from Korea. 1/

One of the principal reasons for the decline in the U.S. tire imports from Korea, however, is the move by Korea to limit the country's growing trade surplus with the United States, which reached $7.3 billion in 1986 and which may climb to $12 billion in 1987. 2/ With 35 percent of South Korea's gross national product tied to exports, and over 40 percent of the exports shipped to the United States, Korea wants to avoid trade disputes with the United States. Accordingly, Korea has begun to trim back exports of selected goods, bought over $2 billion in raw materials from the United States and has discussed a 5-percent revaluation of its currency against the U.S. dollar. 3/ Also, Korea has agreed to open its markets wider to U.S. imports and to ease regulations discouraging imports of auto parts.

1/ James R. Smith, op. cit., p. 15.
2/ Ibid.
3/ Ibid.

Korean products have not enjoyed the same consumer acceptance in the United States as Japanese products, the popularity of Korean goods is improving with the boom in Korea's technological capability and its marketing capability as evidenced by the well-marketed Korean computers, microwaves, and VCR's, along with South Korea's Hyundai Excel car. In a move to build up their images among foreign consumers, Korean tire manufacturers have signed technology and trademark-licensing agreements with non-Korean tire producers. In a related move, Korean tire producers are seeking to internationalize their tires, banking on improved quality and, in connection with this, are introducing new brand names and realigning various trademarks into one. 1/

Taiwan.--Taiwan has been the only tire producer in the Far East to show substantial growth over the past few years. Taiwan's total exports in 1986 were up 20 percent over 1985, and about half of Taiwan's exports are shipped to the United States. In 1986, Taiwan held a trade deficit with the United States, which was greater than Korea's trade deficit with the United States. Taiwan has become a cautious exporter, aware that the protectionist mood in the United States could result in trade measures against Taiwan. 2/

Taiwan has twice as many tire plants as Korea, including two owned by Bridgestone and one owned by Goodyear. Most of Taiwan's production is exported.

Japan.--The rise in the yen in 1986 relative to the dollar forced Japanese manufacturers to increase prices of U.S.-bound tires and encouraged them to redirect capital spending to areas outside tires. 3/ Additionally, tire production dropped, and capacity utilization declined to 85 percent.

Structural Factors of Competition Between U.S. and Foreign Industries

Canada, Japan, and Korea were cited by U.S. producers responding to the questionnaire as being the main foreign competitors in the production of tires. U.S. producers indicated that foreign tire producers generally held competitive advantages in the areas of exchange rates, labor costs, taxes, and government subsidies (table 12-56). The major competitive factor impacting on the domestic tire producers' ability to compete will continue to be the value of the dollar vis-a-vis currencies of major foreign producers, according to questionnaire respondents.

According to producers, labor costs in the United States continue to be high in relationship to productivity. Other factors contributing to the competitive advantage of foreign tire producers include subsidization by foreign governments and assistance in their recapitalization efforts. At the same time, questionnaire respondents cite the loss of the U.S. capital-investment credit as hindering domestic producers' ability to recapitalize. Producers commented that substantial capital investment is needed for newer U.S. plants and equipment.

1/ "Tire Manufacturers Seek Foreign Licensing to Boost Their Image," The Korea Herald, May 30, 1987.
2/ James P. Smith, Jr., op. cit., p. 15.
3/ Ibid, p. 10.

Table 12-56
Tires: U.S. producers' competitive assessment of structural factors of competition for the U.S. and foreign industries, 1/ by major competing countries, 1986

Item	Canada	Japan	Republic of Korea
Product cost advantages:			
Fuel cost	D	D	D
Raw materials costs	S	S	S
Domestic inflation rates	D	F	D
Labor cost	F	F	F
Exchange rates	F	D	F
Taxes	D	F	F
Equipment costs	S	S	S
Interest rates	D	F	D
Government involvement:			
Subsidies	F	F	F
U.S. Government regulations that increase costs	S	S	F
Foreign government regulations that increase costs	F	S	S

1/ D = 60 percent or more of total respondents accorded domestic producers an advantage; F = 60 percent or more of total respondents accorded foreign producers an advantage; S = Competitive position the same.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

The U.S. Market

Overview

Apparent consumption of tires fluctuated between $8.7 billion and $10.9 billion during the period 1982-86 (table 12-57). This slow-growth industry has been adversely affected by a number of factors over the past few years, including longer lasting radials (doubling the replacement cycle to every 4 years), increased imports of foreign-produced motor vehicles with foreign-made tires, and increased tire imports. 1/

1/ "Rubber and Plastics Products," U.S. Industrial Outlook, 1987, p. 184.

Table 12-57
Tires: U.S. producers' shipments, exports of domestic merchandise, imports for consumption, and apparent consumption, 1982-86

Year	Shipments	Exports	Imports	Apparent consump-tion	Ratio (percent) of imports to consumption
	Quantity (1,000 units)				
1982......	180,573	4,001	1/	1/	1/
1983......	197,920	4,341	1/	1/	1/
1984......	213,359	5,737	1/	1/	1/
1985......	209,819	5,846	1/	1/	1/
1986......	213,614	5,601	1/	1/	1/
	Value (1,000 dollars)				
1982......	8,013,278	200,022	904,829	8,718,085	10.4
1983......	8,894,936	160,255	1,031,489	9,766,170	10.6
1984......	9,724,702	209,903	1,368,438	10,883,237	12.6
1985......	9,471,715	177,503	1,423,923	10,718,135	13.3
1986......	9,115,694	165,212	1,465,690	10,416,172	14.1

1/ Not available.

Source: Estimated by the staff of the U.S. International Trade Commission on the basis of data submitted in response to the Commission's questionnaires.

U.S. imports

U.S. imports accounted for an increasing share of the total U.S. tire market, from $904.8 million in 1982 (10.4 percent of the market) to $1.5 billion in 1986 (14.1 percent of the market) (table 12-58). The largest foreign source throughout the period was Canada. Japan was the second largest source of imports, and Korea ranked third.

While imports from other countries are making inroads in the U.S. tire business, American tire producers are themselves importing tires. In 1985, of 139.6 million replacement tires sold in the United States, 30 million were imported. Goodyear sold 4.5 million imported tires, Firestone 2.3 million, and General, 232,000. 1/

1/ Joseph M. Callahan, "U.S. Tire Builders Make Tracks for the '90's," Automotive Industries, July 1986, p. 43.

Table 12-58
Tires: U.S. imports for consumption, by principal sources, 1982-86

Source	1982	1983	1984	1985	1986	Average annual change, 1986 over 1982
	1,000 dollars					Percent
Canada	424,956	393,332	467,109	388,298	458,834	1.9
Japan	148,518	220,680	328,200	350,358	402,078	28.3
Korea	72,053	110,543	141,002	161,087	143,582	18.8
Brazil	10,761	18,104	66,364	85,736	86,518	68.4
France	76,489	72,356	89,144	81,571	64,028	-4.3
All other	172,051	1,121,302	276,619	356,874	310,650	15.9
Total	904,829	1,031,489	1,368,438	1,423,923	1,465,690	12.8

Source: Compiled from official statistics of the U.S. Department of Commerce.

During 1982-86, import penetration as a share of the total U.S. market for passenger tires, light-truck tires, and other truck and bus tires has increased overall, as shown in the following tabulation (in percent): 1/

	1982	1983	1984	1985	1986
Passenger trucks	10.3	12.9	15.4	16.7	17.1
Light truck tires	3.9	4.8	6.8	9.7	9.5
Other truck and bus tires	25.0	24.5	31.6	35.2	35.5

1/ Compiled from official statistics of the U.S. Department of Commerce.

Imports comprised about 23 percent of the total domestic replacement-tire market in 1986, an increase of 12 percentage points from 1980.

In response to the questionnaire, U.S. producers of tires indicated that the primary reason for importing was an intra-company and affiliated company transfer on a basis that was competitive with unaffiliated firms. 1/ Shorter delivery times and ability to meet specifications were given equal weight, both being mentioned as the second most import factors (table 12-59). Producers responded that favorable exchange rates and ability to supply metric sizing were tertiary reasons for importing tires. Quality and the reliability of the supplier were also cited as important factors in their decision to import.

1/ Tires transferred from foreign subsidiaries or affiliated companies were competitive in price and non price factors to tires from unoffiliated firms.

Table 12-59
Tires: U.S. producers' ranking of factors that were the principal reasons for their imports, 1982-86

Reason for importing	Ranking 1/
Lower purchase price (delivered)	2/
Shorter delivery time	2
Engineering/technical assistance	2/
Favorable terms of sale	6
Favorable exchange rates	4
Reliability of supplier	8
Intra-company and affiliated company transfers on a basis:	
Competitive with unaffiliated firms	1
Noncompetitive	2/
Ability to meet specifications	2
Willingness to supply required volumes	6
Ability to supply metric sizing	4
Quality	8

1/ Ranking numbers range from 1 to 8, number 1 indicating the most important reason for importing and number 8 indicating the least important reason for importing. Some factors were ranked equally in importance.
2/ Insufficient data.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Competitive Assessment of Key Factors of Competition in the U.S. Market

According to U.S. producers and importers of tires, Canada, Japan, and Korea held overall competitive advantages vis-a-vis domestic producers in the U.S. market (table 12-60). The most important factors, according to both producers and importers, were product-cost advantages arising from lower delivered purchase prices and favorable exchange rates held by these countries in the early 1980's, which shifted to the benefit of domestic producers in 1986.

Domestic tire producers considered Japanese-produced tires to have the overwhelming competitive advantage compared with other countries, based on nonprice factors such as engineering/technical assistance, favorable terms of sales, shorter new-product development time, product innovation, and meet specifications. For much of the same reasons, tire importers accorded the domestic tire industry an advantage over the Japanese tire producers. Korea was viewed by U.S. tire producers as having favorable terms of sale and also was accorded a number of nonprice-factor advantages by U.S. tire importers.

As shown in table 12-61, U.S. purchasers consider shorter delivery time to be the most important factor in selecting U.S.-made tires. Next in importance come reliability of supplier, quality, willingness to supply required volumes, engineering/technical assistance, and marketing practices.

Table 12-60
Tires: U.S. producers' (P) and importers' (I) competitive assessment of U.S.-produced and foreign-produced products in the U.S. market, 1/ and the principal factors (X) underlying overall competitive advantages, by top competitor nations, 1986

Item	Canada		Japan		Korea	
	P	I	P	I	P	I
Overall competitive advantage	F	F	F	D	F	F
Product cost advantages:						
Lower purchase price (delivered)	X		X	X	X	X
Favorable exchange rates	X		X	X	X	X
Nonprice factors:						
Shorter delivery time				X		
Engineering/technical assistance			X	X		
Favorable terms of sale			X	X	X	
Production technology			X			
Marketing practices		X				X
Reliability of supplier				X		X
Shorter new product development time			X	X		X
Willingness to supply required volumes						X
Ability to meet specifications						X
Product innovation			X	X		
Quality			X	X		X

1/ D=60 percent or more of total respondents accorded domestic producers an advantage; F=60 percent or more of total respondents accorded foreign producers an advantage; S=Competitive position the same.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

U.S. purchasers' data indicate that the principal reason for their purchase of foreign-made tires is lower delivered purchase prices. Additional important reasons are superior quality, a readily available supply of metric sizes, a readily available supply of metric sizes, and a readily available supply of product that meet specifications.

Table 12-61
Tires: Ranking of U.S. purchasers' reasons for purchases of U.S.-produced and foreign-produced tires, 1982-86 1/

Reason for purchase	U.S.-produced	Foreign-produced
Product cost advantages:		
Lower purchase price (delivered)	8	1
Favorable exchange rates	13	5
Nonprice factors:		
Shorter delivery time	1	2/
Engineering/technical assistance	5	9
Favorable terms of sale	7	2/
Production technology	8	5
Marketing practices	5	2/
Reliability of supplier	2	5
Shorter new product development time	12	9
Willingness to supply required volumes	4	2/
Ability to supply metric sizing	13	2
Ability to meet specifications	8	4
Product innovation	11	5
Quality	3	2

1/ Ranking numbers range from 1 to 13, number 1 indicating the most important reason for purchase and number 13 indicating the least important reason for purchase. Some facters were ranged equally in importance.

2/ Insufficient data.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

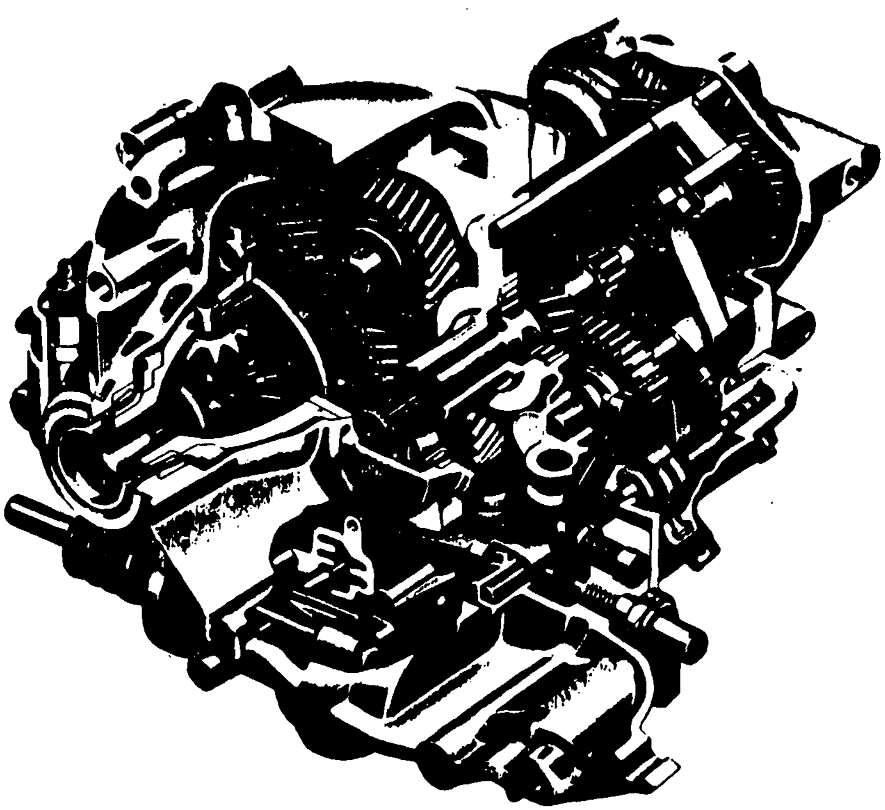
TRANSMISSIONS

Description and uses

Several types of transmission designs are used in passenger cars, trucks, and buses. The transmission transfers the rotation of an input shaft through to an output shaft. The input shaft receives its power directly from the rotating crankshaft in the engine. The output shaft's rotation is used to drive the power axle or axles of the vehicle through differential gearing arrangements incorporated into the axle assembly. The function of a transmission, then, is to translate the power of the engine and input shaft into rotation of the output shaft at a faster, slower, or identical speed, or in the reverse direction of the input shaft. Thus, a vehicle may travel forward or in reverse and accelerate smoothly through a wide range of speeds. This transmission of power occurs through the use of two basic gear systems.

Figure 12-3 illustrates a manual transmission. In this arrangement, the rotation of the input shaft can be routed through a countershaft, the gears of which then drive an output shaft called the main shaft. The different sizes and positions of the gears enable the main shaft to rotate at different speeds and directions from the input shaft. The gears are moved into the desired positions by shifter forks attached to the drive-operated gear shift lever.

ENGINEERING MECHANICAL FEATURES



Five-Speed Manual Transaxle for Escort/Lynx and EXP/LN7

Photo No. PR EM-2

- Chrome alloy steel gears, assembled into matched sets by a selective computerized inspection technique, provide long service life with minimal gear noise.
- The closed-end case eliminates potential leakage paths.
- A low viscosity transmission fluid with a friction modifier added is used as a lubricant to minimize lubricant drag that can affect fuel economy and cold start-up shifting.
- An aluminum transaxle housing and differential case reduce the weight of the transaxle design. Aluminum has excellent heat-transfer characteristics, contributing to the internal cooling of the transaxle.

FIVE-SPEED MANUAL TRANSAXLE GEAR RATIOS

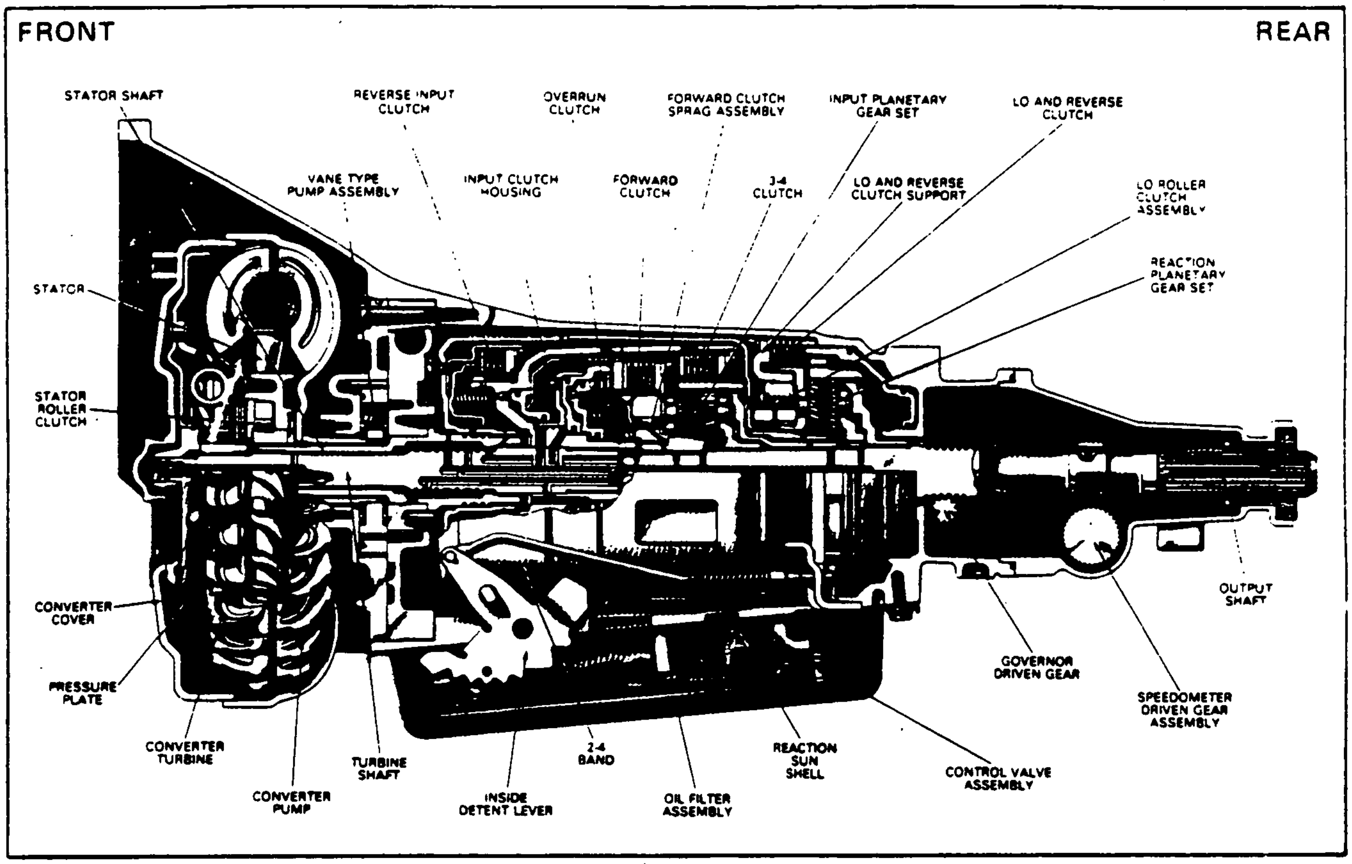
Gear Selection	1st	2nd	3rd	4th	5th	Reverse
All 1.6L Engines	3.60:1	2.12:1	1.39:1	1.02:1	0.76:1*	3.62.1

*Equivalent ratio

NOTE: Final Drive Ratio is 3.73:1

Figure 12-3
Transmissions: Five-speed manual transmission

Figure 12-4
Transmissions: Automatic transmission



Source: THM 700-R-4 Principals of Operation," Hydromatic Div., General Motors Corporation, 1983.

Figure 12-4 shows the gearing arrangement of an automatic transmission. In this system, the output shaft may be driven using two gears, called pinions, that rotate about the main shaft. This arrangement is known as a planetary system because of the pinions' movement around the main shaft gears, called sun gears. Bands and clutches are engaged using oil pressure to control the movement of these gears.

<u>Manufacturing process</u>

Transmissions for both front-wheel-drive (transaxles) and rear-wheel-drive vehicles are housed in one-piece aluminum or cast iron transmission cases weighing from 12 to over 100 pounds. Transmission cases have no typical dimensions as they are produced in various shapes and sizes as specified by the motor vehicle manufacturers on the basis of the requirements for different vehicle models.

Aluminum is used for producing most transmission cases because of its light weight, good corrosion resistance, ease of casting, good mechanical properties, and dimensional stability. The dies used to cast transmission cases are generally complex, weighing from 20,000 to 40,000 pounds. They have movable slides, cores, or other sections, depending on customer requirements. Once the die has been made, the proper aluminum alloy is prepared and melted, and the transmission cases are cast in 1,200- to 3,000-ton cold-chamber die-cast machines. Once cast, the transmission cases are then machined, finished, tested, and assembled by the motor-vehicle manufacturer. The machinery operations involve drilling, topping, milling, grinding, boring, or reaming. Finishing can include chemical treatments for a wide variety of decorative or mechanical finishes. Air and water testing is performed to detect holes that may be closed by chemical impregnations. Final assembly is performed, which involves heat staking, adhesive bonding, and other conventional fastening methods as necessary.

Most transmission gears are forged using mechanical presses. A trimming operation punches the center holes of each gear, and the gears are forged without teeth. Producers use hot forgings to produce shifter forks and levers.

Transmission shafts are forged using a cold-forming technique called splining. In the splining operation, rotating gears are pressed onto a steel shaft. As the shaft and gears rotate, the gear teeth press into the shaft, thus creating splines along the shaft. The internal teeth of transmission gears used on the shaft mesh with these splines in the final assembly.

Customs Treatment

U.S. tariff treatment

Transmissions are classified for tariff purposes under TSUS item 692.32 (table 12-62). The column 1 rate of duty is 3.1 percent ad valorem. The column 2 rate of duty is 25 percent ad valorem. Products covered by the item are eligible for preferential tariff treatment under the Caribbean Basin Economic Recovery Act, the United States-Israel Free Trade Area Implementation Act, and the Generalized System of Preferences. Brazil, Mexico, and Taiwan have exceeded competitive-need limits for item 692.32 and so cannot receive preferential duty treatment under the GSP for those products. Under the proposed Harmonized System (HS), the classification number is 8483.10.1030, with no change in the column 1 rate of duty but an increase in the column 2 rate of duty from 25 percent ad valorem to 35 percent ad valorem. The products covered by this section have specific APTA classifications in the TSUS. They are items 692.3374 and 692.3376.

Table 12-62
Transmissions: U.S. rates of duty, by TSUS items

(Percent ad valorem)

TSUS items No. 1/	Description	Pre-MTN Col. 1 rate of duty 2/	Col. 1 rate of duty 1987	Col. 2 rate of duty
692.32A*	Transmissions:	4%	3.1%	25%
	74 For automobile trucks and motor buses			
	76 For passenger automobiles			
692.33	If Canadian article and original motor-vehicle equipment.	Free	Free	3/

1/ The "A*" indicates that the item is currently designated as an eligible article for duty-free treatment under the Generalized System of Preferences (GSP) and that certain of these countries, specified in general headnote 3(e)(v)(D) of the Tariff Schedules of the United States Annotated, are not eligible.
2/ Rate effective prior to Jan. 1, 1980.
3/ Not applicable.

Foreign tariff treatment

The most significant market for U.S. exports of transmissions is Canada, where U.S. auto manufacturers have production facilities. The duty rates on transmissions in various countries are shown in the following tabulation:

Item	Country	Present rate of duty
43829-1	Canada	9.2% ad val.
8706A074	Mexico	22.5% Import license
40.11B II	United Kingdom	5.8%
8706	Japan	Free
87.06	Korea	25%
87.06	West Germany	4.9% ad val.

Profile of the U.S. Industry

Overview

GM, Chrysler Corporation, and Ford Motor Company all account for nearly 100 percent of U.S.-produced transmissions. Other smaller producers are located in Indiana, South Carolina, Pennsylvania, Ohio, and Michigan. Technology changes in transmissions are occurring rapidly. A new 5-speed manual transaxle, developed through the joint efforts of a West German transmission designer and a major U.S. company, appeared in the United States in 1987. The four-wheel drive, once used principally in off-road vehicles, is being offered on an increasing number of vehicles. The truck industry will be offering an electronic device designed to indicate to the driver when a gear change, and downshifting, would be advantageous. 1/ Major U.S. producers are currently working towards the production of a 4-speed automatic transmission for front-drive cars (transaxles). Additionally, the increasing market for high-performance, front-drive cars is creating a demand for the development of higher torque manual transaxles, eventually leading to 6-speed manual and automatic transmissions. 2/

Within 10 years, the U.S. industry could move away from the current transmission and begin producing the continuously variable transmission (CVT). According to an industry researcher, the CVT is a stepless automatic transmission for front-wheel-drive cars that continuously varies its gear ratios between the engine and the wheel. 3/ Conventional gear wheels are not used, and there is no torque converter. It is about 15 percent more efficient than conventional automatic transmissions, providing better performance and fuel economy. The new transmission is an outgrowth of the rubberbelt Variomatic transmissions used on D.A.F. automobiles in Holland from the late 1950's to the 1970's. The CVT has been produced by Japanese, Italian, and U.S. firms and may be in wide application by the mid-1990's.

U.S. producers, accounting for nearly 100 percent of U.S. production during 1982-86, reported that trucks were the predominant mode of transportation used to ship transmissions (table 12-63). The general marketing area was fairly evenly divided between 201 to 500 miles and over 500 miles. The average transportation cost as a percentage of sales was quite low and ranged between 0 and 5 percent of sales. The hourly wage rates paid to production and related workers producing transmissions were consistently higher than the average for all U.S. manufacturing facilities during 1982-86, as shown in the following tabulation:

	Production and related workers producing transmissions 1/	All automotive parts 1/	All operating U.S. manufacturing establishments 2/
1982	$13.80	$12.24	$11.50
1983	15.05	12.90	11.97
1984	16.72	14.57	12.40
1985	18.32	15.51	3/ 12.82
1986	18.19	17.21	3/ 13.09

1/ Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.
2/ Compiled from unpublished data of the U.S. Department of Labor, Bureau of Labor Statistics.
3/ Estimated.

1/ Roger Rowand, "Eaton Goes High Tech to Hike Transmission Share," Automotive News, July 6, 1987, p. 20.
2/ "6-Speed Transmissions Could Find Market Niche," Ward's Automotive Reports, Nov. 4, 1985, p. 1.
3/ Al Fleming, "Looking Ahead: New Engines, CVT's, More Plastic Bodies," Automotive News, Feb. 2, 1987, p. 56.

Table 12-63
Transmissions: U.S. producers' rating of predominant modes of transportation used to ship transmissions, the marketing area generally serviced, and the average percentage of transportation costs in the total delivered value of their firms' shipments

Item	Percent of total responses
Predominant mode(s) of transportation:	
Truck	85
Rail	8
Water	4
Other	3
General marketing area (radius):	
Up to 100 miles	12
101 to 200 miles	21
201 to 500 miles	30
Over 500 miles	37
Average transportation costs (as percentage of sales):	
0 to 5 percent	96
6 to 10 percent	4
11 to 15 percent	-
16 to 20 percent	-
Over 20 percent	-

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Capacity and employment

Domestic production capacity for transmissions rose 12 percent in 1984 over that in 1982 to 13.1 million units, declined in 1985, then increased to 13.5 million units in 1986 (table 12-64). Production capacity in this dynamic industry is closely tied to the production and scheduling of new models of cars and trucks.

Producers of transmissions try to maintain a proper product mix of types of transmissions and, at the same time, develop and utilize new technology in engineering and design of the product, as well as in efficient and cost-effective production processes. Whereas there may be overcapacity for the production of some types of transmissions, such as the 3-speed automatic transmission used in rear-drive models, other versions, such as the 5-speed transaxle, are in short supply. The 5-speed manual transmission dominates the list of the 12 fastest growing items in customer popularity over the past 12 years. 1/ These fluctuations in capacity to produce various kinds of

1/ "Survey Pinpoints 12 Fastest Growing Items Requested by Car Buyers," Ward's Automotive Report, 1985, p. 138.

transmissions are linked to the dynamics of the auto industry. Revisions in plans by automakers for the launching, scrapping, or delay in the production of a particular vehicle model directly affects transmission producers. However, while the cancellation of production plans for a vehicle model may signal a reduction in capacity for transmission producers, the substitution of other model designs may result in the boosting of additional capacity for other new transmissions.

The average number of production and related workers reported by questionnaire respondents generally remained constant between 1984-86, in spite of changes in capacity to produce transmissions. Employment has risen 40 percent, from 24,858 persons in 1982 to 34,833 persons in 1985, before declining to 34,386 persons in 1986 (table 12-64).

Table 12-64
Transmissions: U.S. capacity, number of production and related workers, man-hours worked, wages, and hourly wage rates, 1982-86

Item	1982	1983	1984	1985	1986	Average annual percentage change, 1986 over 1982
Capacity (1,000 units)......	11,636	12,869	13,054	12,771	13,474	3.7
Employment of production and related workers:						
Number....................	24,858	29,030	34,605	34,833	34,386	8.4
Man-hours worked (1,000 hours)...........	48,122	58,788	71,034	70,423	70,633	10.1
Wages (million dollars)..	664	885	1,188	1,290	1,285	17.9
Hourly wage rate..........	$13.80	$15.05	$16.72	$18.32	$18.19	7.1

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Financial data

Net sales, as reported by respondents to the Commission's questionnaire, more than doubled from 1982 to 1985 to $6.8 billion before declining to $6.5 billion in 1986 (table 12-65). The respondents reported a loss of $36.4 million in 1982, then profits peaked at $698.2 million in 1984 before dropping by 45 percent to $383.3 million in 1986. The ratio of net operating profit to net sales increased from a negative 1.2 percent in 1982 to 5.9 percent in 1986 as a result of firmer price levels and an increase in new-vehicle production levels. 1/ Capital expenditures amounted to $897.5 million, or 3.3 percent of total net sales during the period 1982-86. Research and development expenditures totaled $1.2 billion during the same period, representing 4.3 percent of total net sales.

1/ Varied transfer pricing practices of the Big Three during 1982-86 accounted for fluctuations in reported financial data.

Table 12-65
Transmissions: U.S. producers' total net sales, total net profit or (loss), capital expenditures, and research and development expenditures, 1982-86

Item	1982	1983	1984	1985	1986	Average annual percentage change, 1986 over 1982
Net sales... (1,000 dollars)....	3,150,686	4,451,386	6,139,959	6,821,714	6,499,873	19.8
Net profit (loss) (1,000 dollars)....	(36,376)	331,816	698,191	401,606	383,325	-
Ratio of net operating profit or (loss) to net sales (percent)........	(1.2)	7.5	11.4	5.9	5.9	-
Capital expenditures (1,000 dollars)....	103,271	98,754	159,537	254,070	281,835	28.5
Research and development expenditures (1,000 dollars)....	185,728	200,785	218,106	274,708	291,345	11.9

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Structural Factors of Competition Between U.S. and Foreign Industries

Major foreign competitors

Japan is a principal producer of transmissions, with production increasing from 29,644 million yen in 1982/83 to 213,793 million yen in 1984/85, a sixfold increase. 1/ There are four major producers of transmissions, and about 26 firms producing transmission parts in Japan. Of the four firms producing transmissions, Aisin-Warner Limited and Japan Automatic Transmission Co., Ltd., produce principally transmissions. Fuji Tekko Co., Ltd. produces transmission and gears and devices, and Aisin Seiki Co., Ltd., produces transmissions along with a wide variety of automotive components. 2/ Other important transmission industries are in Europe, with Getrag GmbH., and Zahnradfabrik Friedrichshafen AG, both of West Germany.

According to U.S. producers, their competitors in the United Kingdom enjoy production-cost advantages in labor cost, exchange rates, and Government subsidies (table 12-66). The respondents also felt that manufacturers in Japan held cost advantages in lower inflation rates, labor costs, exchange rates, taxes, and interest rates. U.S. companies also indicated that Korean firms

1/ Japan Auto Parts Industries Association, 1986, p. 11.
2/ Ibid., pp. 38-88.

Table 12-66
Transmissions: U.S. producers' competitive assessment of structural factors of competition for the U.S. and foreign industries, 1/ by major competing countries, 1986

Item	United Kingdom	Japan	West Germany	South Korea
Product cost advantages:				
Fuel cost	S	D	D	F
Raw materials costs	S	S	D	F
Domestic inflation rates	S	F	S	F
Labor cost	F	F	S	F
Exchange rates	F	F	S	F
Taxes	D	F	S	F
Equipment costs	S	F	S	2/
Interest rates	D	F	S	2/
Government involvement:				
Subsidies	F	S	S	2/
U.S. Government regulations that increase costs	F	S	S	D
Foreign government regulations that increase costs	S	S	S	2/

1/ D=60 percent or more of total respondents accorded domestic producers an advantage; F=60 percent or more of total respondents accorded foreign producers an advantage; S=Competitive position the same.
2/ Insufficient data.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

held competitive advantages in most production costs, whereas West German and U.S. producers appeared to be at the same level in most production-cost factors. Respondents claimed that they had lower fuel costs than Japan and West Germany, lower taxes and interest rates than the United Kingdom, and lower raw-materials costs than West Germany.

Additionally, U.S. legislation, e.g., mandates from OSHA, EPA, and DOT, has resulted in nonproductive incremental investment that has become part of the fixed-cost base, according to respondents.

The U.S. Market

Overview

The U.S. market for transmissions is dependent on the level of new-car and truck sales. The total market for transmissions rose from $3.0 billion in 1982 to $6.8 billion in 1986 (table 12-67).

Table 12-67
Transmissions: U.S. producers' shipments, exports of domestic merchandise, imports for consumption, and apparent consumption, 1982-86

Year	Shipments	Exports	Imports	Apparent Consumption	Ratio (percent) of imports to consumption
	Quantity (1,000 units)				
1982........	5,562	1,113	1/	1/	1/
1983........	7,812	1,187	1/	1/	1/
1984........	10,263	1,825	1/	1/	1/
1985........	10,649	1,752	1/	1/	1/
1986........	10,694	1,479	1/	1/	1/
	Value (1,000 dollars)				
1982........	3,199,481	667,731	437,412	2,969,162	14.7
1983........	4,391,383	712,127	637,154	4,316,410	14.8
1984........	6,047,010	912,481	843,154	5,977,683	14.1
1985........	6,650,394	1,051,021	906,937	6,506,310	13.9
1986........	6,627,944	887,642	1,039,372	6,779,674	15.3

1/ Not available.

Source: Shipments, compiled from data submitted in response to questionnaires of the U.S. International Trade Commission; exports and imports estimated by the staff of the U.S. International Trade Commission, based on data submitted in response to the Commission's questionnaires.

U.S. imports

U.S. imports of transmissions increased steadily during 1982-86, rising from $437.4 million to $1.0 billion (table 12-68). The largest foreign source throughout the period was Canada, followed by Japan, France, and the United Kingdom. Virtually all U.S. imports of transmissions are purchased by automakers, and are destined for the OE market.

Competitive Assessments of Key Factors of Competition in the U.S. Market

According to U.S. producers, responding to the questionnaire, lower prices were cited as the principal reasons for purchases of imported transmissions, followed by the foreign producer's ability to meet specifications, the reliability of the supplier, and product quality (table 12-69).

In response to the questionnaire, U.S. producers indicated that the imported transmissions from Taiwan and Brazil have an overall competitive advantage in the U.S. market when compared with domestically produced transmissions (table 12-70).

Table 12-68
Transmissions: U.S. imports for consumption, by principal sources, 1982-86

Country	1982	1983	1984	1985	1986	Average annual change, 1986 over 1982
	1,000 dollars					Percent
Canada..........	238,978	412,049	582,741	583,412	506,386	20.7
Japan...........	69,421	104,517	106,053	135,664	239,981	36.4
France..........	67,183	66,016	51,776	78,056	155,176	23.3
United Kingdom..	2,299	21,892	50,062	53,792	64,478	130.1
West Germany....	12,664	9,908	9,786	21,770	33,912	27.9
All other.......	46,867	22,772	42,736	34,243	39,439	-3.9
Total.......	437,412	637,154	843,154	906,937	1,039,372	24.2

Source: Estimated by the staff of the U.S. International Trade Commission on the basis of data submitted in response to the Commission's questionnaires.

Table 12-69
Transmission: U.S. producers' ranking of factors that were the principal reasons for their imports, 1982-86

Reason for importing	Ranking 1/
Lower purchase price (delivered)................................	1
Shorter delivery time...	9
Engineering/technical assistance................................	7
Favorable terms of sales..	9
Favorable exchange rates..	7
Reliability of supplier...	3
Intra-company and affiliated company transfer on a basis:	
Competitive with unaffiliated firms............................	6
Noncompetitive...	2/
Ability to meet specifications..................................	2
Willingness to supply required volumes..........................	5
Ability to supply metric sizing.................................	2/
Quality...	3

1/ Ranking numbers range from 1 to 9, number 1 indicating the most important reasons for importing and number 9 indicating the least important reason for importing. Some factors were ranked equally in importance.
2/ Insufficient data.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table 12-70
Transmissions: U.S. producers' (P) and importers' (I) competitive assessment of U.S.-produced and foreign-produced products in the U.S. market, 1/ and the principal factors (X) underlying overall competitive advantages, by top competitor nations, 1986

Item	Japan		Taiwan		Brazil		West Germany	
	P	I	P	I	P	I	P	I
Overall competitive advantage.......	D	F	F	S	F	2/	D	F
Product cost advantages:								
Lower purchase price (delivered)..		X	X		X		S	
Favorable exchange rates..........	X	X	X				S	
Non price factors:								
Shorter delivery time.............	X				X		X	
Engineering/technical assistance..	X	X					X	X
Favorable terms of sale...........					X		X	
Production technology.............	X	X					X	X
Marketing practices...............	X	X					X	
Reliability of supplier...........	X	X			X			X
Shorter new product development time...........................								
Willingness to supply required volumes........................					X		X	
Ability to meet specifications....	X	X			X		X	X
Product innovation................	X	X			X		X	X
Quality...........................		X			X		X	
Other.............................								

1/ D=60 percent or more of total respondents accorded domestic producers an advantage; F=60 percent or more of total respondents accorded foreign producers an advantage; S=Competitive position the same.
2/ Insufficient data provided from respondents; transmission manufacturers located in Brazil are largely subsidiaries of U.S. transmission producers.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

U.S. producers generally reported that the two major competitors enjoyed an advantage in lower delivery purchase prices. Brazil was reported to hold an advantage in nonprice factors such as favorable terms of sale, ability to meet specifications, and willingness to supply required volumes. One respondent indicated that the presence of foreign producers of bus and truck automatic transmissions (primarily West German) has contributed to Brazil's overall competitive advantage.

U.S. parts makers cited the domestic producers of transmissions as having overall competitive advantages over Japan and West Germany in the U.S. market, for a variety of price and nonprice reasons. Importers responding to the questionnaire indicated that Japan and West Germany held overall competitive advantages, principally in the areas of engineering/technical assistance, product technology, reliability of supplier, product innovation, and ability to meet specifications (table 12-70).

U.S. purchasers listed engineering/technical assistance, production technology, marketing practices, and quality as some of the primary reasons for buying foreign-made transmissions. U.S. buyers listed shorter delivery time, quality, and product innovcation as the principal reasons for purchasing domestically produced products (table 12-71).

Table 12-71
Transmissions: Ranking of U.S. purchasers' reasons for purchases of U.S.-produced and foreign-produced transmissions, 1982-86 1/

Reason for purchase	U.S.-produced	Foreign produced
Product cost advantages:		
Lower purchase (delivered)	3	2/
Favorable exchange rates	2/	2/
Non-price factors:		
Shorter delivery time	1	2/
Engineering/technical assistance	7	1
Favorable terms of sale	7	2/
Production technology	10	1
Marketing practices	7	1
Reliability of supplier	3	1
Shorter new product development time	2/	2/
Willingness to supply required volumes	3	2/
Ability to supply metric sizing	2/	2/
Ability to meet specifications	3	1
Product innovation	1	1
Quality	1	1
Other	10	2/

1/ Ranking numbers range from 1 to 10, number 1 indicating the most important reason for purchase and number 10 indicating the least important reason for purchase. Some factors were ranked equally in importance.
2/ Insufficient data.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

APPENDIX A

Request Letter From the Senate Committee on Finance

United States Senate

COMMITTEE ON FINANCE
WASHINGTON, DC 20510

February 12, 1986

The Honorable Paula Stern
Chairwoman
U.S. International Trade Commission
701 E Street, N.W.
Washington, D.C. 20436

Dear Madam Chairwoman:

The Committee on Finance requests that the United States International Trade Commission conduct a series of investigations under section 332 of the Tariff Act of 1930, on the international competitiveness of selected major United States industries.

The 99th Congress faces important decisions regarding a wide range of trade issues, including Administration efforts to launch a new round of multilateral trade negotiations aimed at reducing international barriers to trade in goods, services, and investment flows. To guide Congress in decisions about the future of the international trading system, the Committee needs to understand the competitive strengths and viability of key U.S. industries, the extent and nature of competition facing these industries in foreign and domestic markets, and the extent to which any current trade problems result from special situations such as the strong dollar, debt and interest rate problems, or from more fundamental competitive problems.

Several witnesses appearing before this Committee have stressed that U.S. competitiveness and industrial viability must be gauged in terms of performance in international as well as domestic markets. It is important for these studies to examine the viability of these industries and U.S. trade negotiation objectives from the vantage point of the global nature of competition and the internationalization of production and ownership.

For each of these industry studies the Committee requests coverage of:

1. Measures of the current competitiveness of the U.S. industry in domestic and foreign markets;

2. Comparative strengths of U.S. and major foreign competitors in these markets;

3. Nature of the main competitive problems facing the U.S. industry;

4. Sources of main competitive problems; to what extent from:

   a. special transitory or reversible situations such as exchange and interest rate problems, as opposed to

   b. fundamental or structural problems;

5. Competitive strategies; how important are foreign and U.S. markets to future competitiveness, in terms of economies of scale, growth rates, and pre-empting of market advantages.

The Committee decided not to identify specific industries or numbers of studies, but envisages up to seven studies. The Committee has instructed its staff to work out with ITC staff the specific industry selection and production schedule, depending on availability of appropriate staff to conduct them within the requested time. However, it requests that all studies be completed within 18 months and submitted to the Committee individually as completed.

The industries to be studied should be pivotal to overall U.S. industrial and technological strength, by virtue of being (a) either pathbreaking in the development of leading edge technologies that will shape future competitiveness of other U.S. industries, or (b) supplying critical equipment or materiel used in other important industries. The selection should be diverse enough that the range of their impact should reach broadly across the entire spectrum of U.S. industrial strength, represented by the seven tariff schedules. Examples would be key industrial agricultural commodities, selected synthetic organic chemicals, and textile fabrics, along with the equipment producing industries associated with each.

The Honorable Paula Stern
Page 3
February 12, 1986

The Committee recognizes that much of the information and data desired may not be available from secondary sources and that primary data gathering may prove essential to understanding global industry competition. It requests that in meeting the objectives of these studies the Commission develop new sources of information outside the United States through both interviews and questionnaires where possible, to assure effective assessment of the strengths and weaknesses of foreign competitors, and of the terms of competition in key foreign markets.

Sincerely,

Bob Packwood

BOB PACKWOOD

United States Senate

COMMITTEE ON FINANCE
WASHINGTON, DC 20510

April 2, 1986

Dr. Paula Stern
Chairwoman
United States International
  Trade Commission
701 E Street, N.W.
Washington, D.C. 20436

Dear Chairwoman Stern:

Pursuant to my February 12th letter to you requesting a series of investigations on U.S. international trade competitiveness under section 332 of the Tariff Act of 1930, this is to confirm that the following specific sector studies are requested within that general heading:

Auto parts and equipment
Optical fibers and associated technology and equipment
Steel sheet and strip and associated equipment
Textile mills and associated equipment
Building-block petrochemicals: Competitive implications for construction, cars, and other major consuming industries

The Committee still has under consideration additional requests within the overall survey, and will relay those to you shortly.

The Committee understands that the International Trade Commission cannot begin and complete all the studies simultaneously but requests that it begin them as soon as staff resources are available so the Committee will have results available as soon as possible for its consideration of the future of the trade agreements program.

Sincerely,

Bob Packwood

BOB PACKWOOD
Chairman

APPENDIX B

Notice of Institution of Investigation No. 332-232 in the Federal Register transmitted its report to the President on July 17, 1986. The information in the report was obtained from responses to Commission questionnaires, fieldwork and interviews by members of the Commission's staff, other agencies, information presented at the public hearing, briefs submitted by interested parties, the Commission's files, and other sources.

The view of the Commission are contained in USITC Publication 1866 (July 1986), entitled "Steel Fork Arms: Report to the President on Investigation No. TA-201-60 Under Section 201 of the Trade Act of 1974."

Issued: July 23, 1986.

By order of the Commission.

Kenneth R. Mason,

Secretary.

[FR Doc. 86-17100 Filed 7-29-86; 8:45 am]

BILLING CODE 7020-02-M

[332-232]

U.S. Global Competitiveness; the U.S. Automotive Parts Industry

AGENCY: United States International Trade Commission.

ACTION: Institution of investigation.

EFFECTIVE DATE: July 9, 1986.

FOR FURTHER INFORMATION CONTACT: Mr. Dennis Rapkins, Machinery and Equipment Division, Office of Industries, U.S. International Trade Commission, Washington, DC 20436 (telephone 202-523-0299).

Background and Scope of Investigation

The Commission, on July 9, 1986, approved the institution of investigation No. 332-232, following receipt of letters on February 13, 1986, and April 2, 1986, from the Chairman of the Committee on Finance, United States Senate, requesting that the Commission conduct a series of investigations under section 332(b) of the Tariff Act of 1930 (19 U.S.C. 1332(b)) concerning the international competitiveness of a broad range of selected major United States industries. Institution of this study is scheduled for September 1, 1986.

The Commission investigation will examine the U.S. automotive parts industry and its major foreign competitors to determine the impact of global competition on the industry, and to assess how the industry is responding to these dynamic forces. As requested by the Committee, the Commission's report will analyze and address: (1) Measures of the current competitiveness of the U.S. industry in domestic and foreign markets; (2) comparative strengths of U.S. and major foreign competitors in these markets; (3) the nature of major competitive problems facing the U.S. industry; (4) the sources of these problems, including the extent to which they arise from special transitory or reversible situations or are the result of more fundamental or structural problems; and (5) the importance of U.S. and foreign markets to the future competitiveness of U.S. and foreign producers, in terms of economies of scale, growth rates, and pre-empting of market advantages.

Public Hearing

The Commission will hold a public hearing on this investigation as well as the four others in this series requested by the Committee (investigation Nos. 332-229 through 332-233), at the U.S. International Trade Commission Building, 701 E Street, NW., Washington, DC, beginning at 10:00 a.m. on February 24, 1987. All persons shall have the right to appear in person or be represented by counsel, to present information and to be heard. Persons wishing to appear at the public hearing should file requests to appear and file prehearing briefs (original and 14 copies) with the Secretary, U.S. International Trade Commission, 701 E Street, NW., Washington, DC 20436, not later than noon, February 2, 1987. If the Commission decides to hold one or more hearings outside of Washington DC, it will issue a supplemental notice of hearing by January 16, 1987.

Written Submissions

Interested persons are invited to submit written statements concerning the investigation. Written statements should be received by the close of business on March 12, 1987. Commercial or financial information which a submitter desires the Commission to treat as confidential must be submitted on separate sheets of paper, each clearly marked "Confidential Business Information" at the top. All submissions requesting confidential treatment must conform with the requirements of § 201.6 of the Commission's *Rules of Practice and Procedure* (19 CFR 201.6). All written submissions, except for confidential business information, will be made available for inspection by interested persons. All submissions should be addressed to the Secretary, United States International Trade Commission, 701 E Street, NW., Washington, DC 20436. Hearing-impaired individuals are advised that information on this matter can be obtained by contacting our TDD terminal on (202) 724-0002.

Issued: July 22, 1986.

By order of the Commission.

Kenneth R. Mason,

Secretary.

[FR Doc. 86-17101 Filed 7-29-86; 8:45 am]

BILLING CODE 7020-02-M

[332-230]

U.S. Global Competitiveness: Building-Block Petrochemicals and Competitive Implications for Construction, Automobiles, and Other Major Consuming Industries

AGENCY: United States International Trade Commission.

ACTION: Institution of Investigation.

EFFECTIVE DATE: July 9, 1986.

FOR FURTHER INFORMATION CONTACT: Eric Land or James P. Raftery, Energy and Chemicals Division, U.S. International Trade Commission, Washington, DC 20436, telephone (202) 523-0491 and 523-0453, respectively.

Background and Scope of Investigation

The Commission, on July 9, 1986, approved the institution of investigation No. 332-230, following receipt of letters on February 13, 1986 and April 2, 1986 from the Chairman of the Committee on Finance, United States Senate, requesting that the Commission conduct a series of investigations under section 332(b) of the Tariff Act of 1930 (19 U.S.C. 1332(b)) concerning the international competitiveness of a broad range of selected major United States industries.

The Commission investigation will examine the U.S. building-block petrochemical industry and its major foreign competitors to determine the impact of global competition on the industry and to assess how the industry is responding to these dynamic forces. As requested by the Committee, the Commission's report will analyze and address: (1) Measures of the current competitiveness of the U.S. industry in domestic and foreign markets; (2) comparative strengths of U.S. and major foreign competitors in these markets; (3) the nature of major competitive problems facing the U.S. industry; (4) the sources of these problems, including the extent to which they arise from special transitory of reversible situations or are the result of more fundamental or structural problems; and (5) the importance of U.S. and foreign markets to the future competitiveness of U.S. and foreign producers, in terms of economies of scale, growth rates, and pre-empting of market advantages. In addition, the Commission will examine the competitive implications of its findings

APPENDIX C

Calendar of Public Hearing

CALENDAR OF PUBLIC HEARING

Those listed below appeared as witnesses at the U.S. International Trade Commission hearing:

Subject : Competitive Assessment of the U.S Automotive Parts Industry
Inv. No. : 332-232
Date and Time: February 24, 1987 - 9:30 a.m.

Sessions were held in connection with the investigation in the Hearing Room of the U.S. International Trade Commission, 701 E Street, N.W., in Washington, D.C.

H.P. Goldfield, Assistant Secretary for Trade Development, U.S. Department of Commerce

Collier, Shannon, Rill, & Scott—Counsel
Washington, D.C.
on behalf of:

The U.S. Battery Trade Council,
Washington, D.C.

Douglas Thompson, General Battery Corporation, Reading, Pennsylvania

James Sikora, East Penn Manufacturing Company
Lyon Station, Pennsylvania

David Harquist—OF COUNSEL

The United Automobile, Aerospace and Agricultural Implement Workers of America (UAW)
Washington, D.C.

Steve Beckman, International Economist

Motor & Equipment Manufacturers' Association
Washington, D.C.
John F. Creamer, Administrator, International Trade

Echlin, Inc.
Branford, Connecticut
Fred Mancheski, Chairman

Halfpenny, Harn & Roche—Counsel
Washington, D.C.
on behalf of:

The Automotive Service Industry Association (ASIA),
Chicago, Illinois

Halfpenny, Harn & Roche—continued

Robert Schutte, Manager, ASIA Manufacturers and Remanufacturers Division

Ireland Stewart, Executive Vice President, Maremont Corporation

Louis Marchese—OF COUNSEL

Gerson International Corporation
Ft. Wayne, Indiana
<u>on behalf of</u>:

Automotive Products Export Council (APEC) and the Overseas Automotive Club (OAC)
Ft. Wayne, Indiana

Joe R. Gerson, President

Automotive Parts and Accessories Association
Lanham, Maryland
Julian C. Morris, President

Linda J. Hoffman, Vice President, Government and International Affairs

Lee Kadrich, Director, Government and International Affairs

Adduci, Dinan, Mastriani, Meeks & Schill—Counsel
Washington, D.C.
<u>on behalf of</u>:

National Industries
Montgomery, Alabama

June M. Collier-Mason, President

V. James Adduci—OF COUNSEL

New United Motor Manufacturing, Inc.
Freemont, California

Dennis C. Cuneo, General Counsel and Corporate Secretary

Johnson Controls
Milwaukee, Wisconsin

Gene Goodson, Group Vice President, Hoover Automotive Group

Nissan Motor Manufacturing Corporation, U.S.A.
Smyrna, Tennessee

Marvin T. Runyon, President and Chief Executive Officer

Miller & Chevalier—Counsel
Washington, D.C.
on behalf of:

Honda of America Manufacturing, Inc.
Marysville, Ohio

Scott Whitlock, Senior Vice President and Manager, Automobile Plant

Susan Insley, Vice President for Corporate Planning

Mike Kaeglow, Assistant Manager of Purchasing

Donald Harrison—OF COUNSEL

Tanaka, Ritger & Middleton—Counsel
Washington, D.C.
on behalf of:

The Japan Automobile Manufacturers' Association, Inc.
Washington, D.C.

Dr. William C. Duncan, Deputy General Director

John Schnapp, Vice President

Temple, Barker & Sloane, Inc.
Washington, D.C.

H. William Tanaka—OF COUNSEL

Shapiro & Morin
Washington, D.C.
on behalf of:

The Car Audio Specialists Association, Inc.
Washington, D.C.

Cheryl L. Hollins, Executive Director

Sandra Lockhart, Director of Research

Sidney Dickstein—OF COUNSEL

APPENDIX D

Survey Design and Methodology

Survey Design and Methodology

Producers

A list of domestic producers of auto parts was extracted from the TRINET database for Standard Industrial Classification (SIC) code 3714 (Motor Vehicle Parts and Accessories). In order to be included in TRINET's listing, these establishments had to have at least 20 employees and 1985 shipments valued at a minimum of $500,000. The resultant list totaled 849 firms. A wide range in shipment values suggested stratified sampling as the method by which the most representative sample of this population could be achieved. The 849 firms were divided into three strata; optimum allocation techniques were used to determine the number of firms to be sampled within each stratum. The actual firms to be surveyed were then randomly selected.

The total number of firms within each stratum (N) and the number selected for inclusion in the sample (n) were as follows:

Stratum	N	n	Range of shipment values
1	46	46	$95.1 million–$7.8 billion
2	127	107	$21.4 million–$88.4 million
3	676	147	$800,000–$20.8 million
TOTAL	849	300	

The resultant producers sample size was thus 300 firms.

Importers

A Customs Net Import File (CNIF) extract was obtained for 128 auto part TSUSA items for imports entered during January–September 1986. Records were collapsed by consignee number and TSUSA item, so that a single value was obtained for each consignee's imports under every TSUSA number. This file was "cleaned" by eliminating foreign entities without apparent U.S. affiliation and deleting all entries without identifiable consignees. For the overall sample, TSUSA data was then collapsed to provide a single value for auto part imports for each consignee. The resulting list contained 6,829 importers, with a total value of $10.8 billion in imports. This list was divided into five strata as the initial phase of conducting a stratified sample; optimum allocation techniques were used to determine the number of firms to be selected within each stratum. The actual firms to be surveyed were then randomly selected.

The total number of firms within each stratum (N) and the number selected for inclusion in the sample (n) were as follows:

Stratum	N	n	Range of import values
1	114	114	$10.1 million–$2.1 billion
2	122	35	$3.2 million–$9.8 million
3	292	31	$976,000–$3.2 million
4	682	33	$195,000–$974,000
5	5,619	37	$300–$194,000
TOTAL	6,829	250	

Additionally, data were required for seven specific product groups (batteries, engines, radios, shock absorbers, tires, transmissions, and bearings—for TSUSA commodity assignments, see attached page), so additional firms were selected to ensure sufficient coverage of these commodity groups. Total import values for each of these commodity groups were calculated and the top firms within each group were selected so that at least 90 percent of total imports (by value) for each group would be accounted for by selected importers. A total of 154 firms were identified by this process; of these, 66 had already been selected in the overall sample, leaving 88 additional importers to be added to the list of companies receiving questionnaires. These were allocated to their original strata in the overall sample, resulting in a revised breakout of selected respondents:

Stratum	N	original n	added	revised n	Range of import values
1	114	114	0	114	$10.1 million–$2.1 billion
2	122	35	17	52	$3.2 million–$9.8 million
3	292	31	29	60	$976,000–$3.2 million
4	682	33	40	73	$195,000–$974,000
5	5,619	37	2	39	$300–$194,000
TOTAL	6,829	250	88	338	

The resultant total importers sample size was thus 338 firms.

LIST OF TSUSA'S USED TO CREATE IMPORTERS' UNIVERSE
(WITH COMMODITY GROUP BREAKOUTS IDENTIFIED)

Batteries	Bearings		Engines	Radios	
683.0100	680.3025	680.3820	660.4220	678.5001	685.1210
683.0200	680.3040	680.3830	660.4300	678.5009	685.1215
683.0500	680.3100	680.3932	660.4810	678.5012	685.1225
683.0600	680.3300	680.3960	660.4850	678.5072	685.1250
683.1300	680.3400	680.4140	660.4900	678.5100	685.5520
683.1600	680.3717	680.4170	660.5700		685.5540

Shock Absorbers	Tires		Transmissions
692.3282	772.5109	772.5146	692.3274
692.3380	772.5112	772.5157	692.3276
	772.5127	772.5161	692.3278
	772.5129	772.5165	692.3374
	772.5136	772.5169	692.3376
	772.5138	772.5173	692.3378
	772.5144	772.5177	

TSUSA's not assigned to specific commodity groups

544.4120	685.2810	692.2046	692.2220	692.3220	692.3295
544.4200	685.7100	692.2052	692.2240	692.3230	692.3310
646.9230	686.6010	692.2054	692.2260	692.3240	692.3320
646.9300	686.6020	692.2056	692.2280	692.3242	692.3330
647.0100	686.6100	692.2058	692.2320	692.3244	692.3340
647.0200	688.1200	692.2065	692.2340	692.3246	692.3350
652.8400	688.1300	692.2080	692.2360	692.3260	692.3360
652.8500	692.2010	692.2110	692.2380	692.3262	692.3372
661.1018	692.2020	692.2120	692.2400	692.3264	692.3390
661.1300	692.2030	692.2130	692.3207	692.3284	727.0600
683.6040	692.2042	692.2170	692.3209	692.3286	727.0700
683.6060	692.2044	692.2180	692.3215	692.3288	

APPENDIX E

Concepts of Competitiveness

Concepts of Competitiveness 1/

The deterioration of the U.S. trade balance has stimulated numerous discussions and articles on the competitiveness of U.S. industry and the nature of U.S. comparative advantage. Although these terms are discussed intuitively and are often interchanged, they are, in fact, terms that do not easily lend themselves to quantitative measures. Competitiveness, in particular, is an elusive concept. It has been said that competitiveness is an idea that everyone understands, but none can define. Therefore, quantifying the concept presents many problems. As discussed by Suomela, "we cannot say that a firm is twice as price competitive if it cuts all of its prices by 50 percent, only that the firm has become more price competitive". 2/

Comparative advantage and product life cycle.—Traditionally, the pattern of a country's imports and exports is explained by the principal of comparative advantage. 3/ The principal theory of trade is the factor-environment (Heckscher-Olin) theory. Building on a number of assumptions, this theory states that a country will export those products whose production intensively uses that country's relatively abundant resources and import those products whose production intensively uses the country's relatively scarce resources. Thus, capital-abundant countries are expected to export capital-intensive goods and labor-abundant countries are expected to export

1/ Parts of this section are taken from U.S. Global Competitiveness: Building-Block Petrochemicals and Competitive Implications for Construction, Automobiles, and Other Major Consuming Industries, USITC Publication 2005, August 1987. See app. F for a review of literature on competitiveness.
2/ John W. Suomela, "The Meaning and Measurement of International Price Competitiveness," Business and Economics Section, Proceedings of the American Statistical Association, 1978.
3/ For a review of the theory of comparative advantage, see Caves & Jones, World Trade and Payments: An Introduction, (Boston: Little, Brown) 1981.

labor-intensive goods. Whereas early theory used labor and capital as the explanatory variables, later studies included such factors as natural resources and distinguished between skilled and unskilled labor.

In a major review, Stern 1/ classified the determinants of comparative advantage into the following factions: factor endowment, technological differences, scale economies, market impediments and imperfections, and demand factors. Studies of comparative advantage are broad multi-industry, multicountry studies comparing the structure of trade over time. As such, these studies can overlook industry-specific institutional factors affecting international trade.

As more and more variables were tested empirically, new theories of international trade evolved emphasizing dynamic and technological influences such as differences in knowledge about productive opportunities, noncompetitive markets, and technological change. Perhaps the most significant theory to evolve from the empirical work was the "product life cycle" formulated by Raymond Vernon in 1966. 2/ The theory predicts that industries pass through four phases: introduction, growth, maturity, and decline. As these phases progress, the nature of competition changes. When the product matures and becomes more standardized, production will shift to low-cost areas--typically low-labor-cost developing countries. One flaw with a strict interpretation of this theory is that it assumes all industries follow the same course of events. There is neither theoretical nor empirical justification for such a strong conclusion. The theory does, however, emphasize that comparative advantage is dynamic and that expenditures on research and development are important to explaining trade patterns.

1/ R.M. Stern, "Testing Trade Theories," International Trade and Finance: Frontiers of Research, (1976) P.B. Kennen, editor, New York: Cambridge University Press.
2/ Raymond Vernon, "International Investment and International Trade in the Product Cycle," Quarterly Journal of Economics, 80 (1966), pp. 190-207.

According to U.S. producers responding to the Commission's questionnaire, fuel costs are the only clear comparative advantage that the United States maintains in industry structural comparisons with its major foreign competitors. As with many industries, technological advances are an increasingly important means of measuring competitiveness in the world auto parts industry. In this regard, the U.S. industry generally maintains a comparative advantage in product areas that require relatively high technology requirements (e.g., electromechanical components and highly stressed parts). Moreover, the skill of certain U.S. workers and management to add value to these parts also remains a key competitive factor.

Competing in world markets.—In general, competitiveness considers how successfully a country competes in world markets. Price and cost are obvious dimensions of competitiveness. Competitiveness is also influenced by many other factors including product quality and features, post-sales support and service, transportation costs, certainty of delivery, financing conditions, and market imperfections.

A 1984 New York Stock Exchange (NYSE) study listed the following four facets of international competitiveness:

1. Price (landed) - Is an industry cost competitive? Can it compete pricewise in world markets?

2. Quality - A good that can match or underprice its competitors at the expense of quality usually enjoys only short-term success.

3. Exchange rates - The value of a currency relative to foreign currencies has a major impact on its ability to sell abroad.

4. Trade policies and agreements - Some countries . . . subsidize exports; and penalize imports . . . Further, differences in tax policies translate into tax rebates - and lower total costs." 1/

1/ "U.S. International Competitiveness: Perception and Reality," New York Stock Exchange Office of Economic Research, August 1984, p. 8.

With the exception of company-specific strategies, most aspects of competitiveness can be listed under one of these categories.

For example, the falling value of the U.S. dollar during 1986-87 has improved the competitiveness of U.S. parts suppliers. This shift in exchange rates has caused cost increases in Japan-sourced parts, improved the price position of U.S. automakers relative to that of firms in Japan, and increased the motivation of U.S. automakers to accelerate sourcing from U.S. parts suppliers. However, at the same time (as the product life cycle suggests), General Motors, Ford, and Chrysler are increasingly producing prominent, high-value components such as engines and transmissions in countries such as Mexico and Brazil, then importing them for use in their U.S. assembly plants.

Analyzing competitiveness quantitatively involves constructing two types of measures. The first measure should indicate an industry's competitiveness (e.g., share of world trade); the second should quantify the major determinant of competitiveness. Although difficult to interpret, a number of measures have been used to indicate international competitiveness. One often-used indicator of U.S. international competitiveness is the trade balance. However, this measure is limited because "(1) It does not speak directly to the level or growth in U.S. exports; (2) U.S. trade deficits partially reflect the relative growth rates of the U.S. and its trading partners." 1/

A second indicator is the share of U.S. exports in world markets, which attempts to measure how well an industry does in world markets. This measure also suffers from a number of shortcomings. What is the appropriate base year? What are the influences of exchange rates? Is a large share in the world market a desirable goal from the standpoint of the country as whole?

1/ "U.S. International Competitiveness: Perception and Reality," New York Stock Exchange Office of Economic Research, August 1984, p. 9.

A third indicator of competitiveness is the profitability of a domestic industry. When an industry, such as auto parts, is partly composed of multinational companies with production facilities throughout the world, it can be difficult to equate industry profitability with geographic competitiveness. 1/ Furthermore, when a company produces a number of products in a vertically integrated environment, it is often difficult to relate profitability of the company to one production facility.

Specifically, many U.S. producers responding to the Commission's questionnaire reported return on sales ratios well above the generally accepted industry average. Whereas high reported net operating profits by large parts makers can be attributed to the increasing use of offshore facilities for the production of certain products, these results also can be partly explained by the accounting procedures of many of the largest firms, many of which provide data only as intracompany transfers to their parent corporations.

Since prices, ultimately based on cost considerations, are important determinants of overall international competitiveness (i.e., over all industries), a number of aggregate price indexes have been developed. Morgan Guaranty Trust Company has published ratios of wholesale price indexes for manufacturing. The U.S. Department of Commerce has used the ratio of U.S. wholesale price index for manufactured goods to the import unit value index for manufactured goods. The United Kingdom Treasury has used a variety of ratios including ratios of export unit values, wholesale price indexes, and wholesale prices to import unit values and unit labor costs. The OECD has also produced similar ratios that they call competitiveness indicators.

1/ Robert E. Lipsey and Irving B. Kravis, "The Competitive Position of U.S. Manufacturing Firms," Banca Nazionale del Lavoro Quarterly Review, No. 153, June 1985.

A more narrowly focused approach to analyzing international competitiveness is the industry-specific competitiveness study. For example, the Office of Competitive Assessment, U.S. Department of Commerce, published a competitive assessment study on the U.S. automotive parts industry in 1985. This study describes the structure of the domestic parts sector and analyzes its trade performance in recent years. 1/

Determinants of competitiveness

In a study of the U.S. steel industry, the Federal Trade Commission developed a number of unit-factor cost variables. They then compared the unit factor costs with those major international competitors of the U.S. industry. This study assumed steel technology was universally available and capital costs were constant throughout the world. Therefore, international competitiveness in the steel industry was dependent on changes in variable costs.

The numerous international competitive studies published in the past have focused on a number of factors influencing international competitiveness. Most can be listed under one of the catagories of the NYSE study. They also viewed these factors as conditions influencing either supply or demand. On the supply side, we are ultimately concerned with the cost of supplying the product, but this is very difficult to assess. Whereas it may be relatively easy to obtain data for the prices of major raw-material inputs, there are a number of other factors that are very difficult to quantify. These include such factors as quality of management, labor relations, quality of the workforce, availability of specialized resources, industry structure, product and production technologies, and marketing strategy. Some of these combined

1/ U.S. Department of Commerce, International Trade Administration, A Competitive Assessment of the U.S. Automotive Parts Industry, March 1985.

influences are often captured in some type of productivity measure such as output per worker. However, management studies typically assess these factors, along with company strategy, in greater detail.

The role of Government can be an important factor in influencing competitiveness. For example, Marvin Runyon, President and Chief Executive Officer of Nissan Motor Manufacturing Corp., U.S.A., stated that environmental and other Federal regulations made Nissan's plant in Smyrna, TN, more costly (to build) than a similar facility in Japan. 1/ In addition, the U.S. Department of Labor's Occupational Safety and Health Administration (OSHA) has numerous regulations that affect U.S. parts makers in the areas of worker safety and health, noise, metal fumes and dust, and other emissions. U.S. parts firms view many of these regulations as obstacles to competitiveness, because many foreign manufacturers do not have to adhere to these types of regulations or their associated costs.

Government can also provide benefits that promote competitiveness such as assistance in the areas of research and development, tax benefits, export promotion, and export financing. For example, the U.S. Department of Commerce organizes overseas commercial exhibitions of domestic auto parts, conducts trade missions, catalogue shows, and sales seminars. Further, U.S. industry trade associations and respondents to the Commission's questionnaire repeatedly alleged that foreign-government subsidies gave foreign manufacturers a competitive edge in the U.S. market. 2/

1/ Transcript of the hearing, p. 176.
2/ Ibid, p. 90.

Finally, foreign-industry sources agree that quantifying competitiveness in the global market for automotive parts is at best a tenuous undertaking. 1/ Moreover, Runyon of Nissan stated at the hearing: "Our experience has taught us two lessons. The first is that generalizations about the competitiveness in the U.S. auto-parts industry as it holds to the competitiveness of a single company has little validity. The second is that despite the exhaustive process we go through to select the best suppliers, our assessments are sometimes wrong. So we approach the task of advising the Commission with some humility." 2/

1/ USITC staff interview with the Japanese Ministry of International Trade and Industry, Tokyo, Japan, Apr. 20, 1987.
2/ Transcript of the hearing, p. 161.

APPENDIX F

Review of Literature on Competitiveness and Methodological Concerns

A. Previous studies of competitiveness

The studies discussed below are believed to be a representative sampling of the extensive recent economic literature on the issue of international competitiveness of U.S. industry. The listing should not, however, be taken to be exhaustive. The focus of the discussion will be on the basic methodologies and measures of competitiveness employed in these studies, rather than on their conclusions for the particular industries under investigation. 1/

1. Annotated bibliography

a. William H. Branson and James P. Love, "Dollar Appreciation and Manufacturing Employment and Output," NBER Working Paper No. 1972, 1986.

They estimate the responsiveness of U.S. manufacturing output and employment to changes in the real exchange rate, using quarterly data from 1963 to 1985, at the level of individual industries.

b. Dennis M. Busche, Irving B. Kravis, and Robert E. Lipsey, "Prices, Activity, and Machinery Exports: An Analysis Based on New Price Data," Review of Economics and Statistics, vol. 68 (May 1986), pp. 248-255.

Irving B. Kravis and Robert E. Lipsey, "Prices and Market Shares in the International Machinery Trade," Review of Economics and Statistics, vol. 64 (February 1982), pp. 110-116.

Robert E. Lipsey, "Recent Trends in U.S. Trade and Investment," in Miyawaki (ed.), Problems of Advanced Economies (Heidelberg: Springer-Verlag, 1984), pp. 58-79.

Robert E. Lipsey and Irving B. Kravis, "The Competitiveness and Comparative Advantage of U.S. Multinationals, 1957-83," NBER Working Paper No. 2051, 1986.

This series of papers examines changes in U.S. shares of world exports and investigates the causes. The first two listed make no explicit mention of competitiveness, but focus on determinants of the demand for U.S. exports of machinery and transport equipment. They find that changes in U.S. export prices relative to those of our competitors have a substantial effect on relative export quantities (and so shares of the world export market) but that the full effect may take up to 4 years to be felt—this suggests that it may take several years for the desirable trade balance effects of a currency depreciation to be felt.

1/ Parts of this section are taken from U.S. Global Competitiveness: Building-Block Petrochemicals and Competitive Implications for Construction, Automobiles and Other Major Consuming Industries, USITC Publication 2005, August 1987.

The paper by Lipsey and Kravis distinguishes between factors determining the competitiveness of the United States as a production location and those determining the competitiveness of U.S. firms (whatever the geographical distribution of their production). They identify two competing hypotheses for the loss of U.S. competitiveness: (1) macroeconomic factors, such as national price levels and incomes; and (2) factors internal to firms, such as research and development, technology, investment, or management strategies. These latter factors are transferable across countries, within firms, and so will be unlikely to contribute to national competitiveness of comparative advantage. Lipsey and Kravis suggest that a large difference between the trade performance of the United States and U.S.-based firms would allow one to determine the policy relevance of the two hypotheses. They report that although the U.S. share in world manufacturing exports fell from 22 percent to 14 percent over that period, the share of U.S.-based multinationals was steady at about 18 percent. The conclusion is that American management and technology remained competitive, maintaining export shares in rapidly growing world markets, and that the decline in the U.S. country share of world exports is largely because of relative price changes determined primarily by movements in exchange rates and inflation.

c. James M. Jondrow, David E. Chase, and Christopher L. Gamble, "The Price Differential between Domestic and Imported Steel," Journal of Business, vol. 55 (July 1982), pp. 383-399.

They discuss reasons why imports of a seemingly homogeneous product (steel) sell for a lower price than the domestic product without rapidly increasing their share of the market. The explanation supported by evidence is unfavorable service characteristics (e.g., long lead times required and insecurity of supply). This suggests that--in the absence of specifically controlling for all such relevant characteristics--domestic and foreign product are best treated as imperfect substitutes, with the demand for imports depending on the prices of both imports and domestic goods. To the extent changes in relative costs pass through into differences in the prices of imports and domestic goods, import penetration will be affected.

d. Robert Z. Lawrence, Can America Compete (Washington: Brookings Institution, 1984).

This study, looking only at the period up to 1980, analyzes the sources of structural change in U.S. manufacturing. The author finds changes in domestic consumption to be a more important cause of structural change than changes in international trade, with U.S. comparative advantage declining in products of unskilled labor and standardized capital-intensive products, but increasing in high-tech products. Lawrence mentions the terms "international competitiveness" and "U.S. industrial competitiveness" without explicit definition, but seems to perceive a country's "success" in international markets as synonymous with international competitiveness and focuses in his analysis on growth in exports compared with import growth, the trade balance, the U.S. share of world trade in manufacturing, productivity growth, investment and R&D spending, and profit rates as indicators of that success.

He compares U.S. industrial performance from 1973 to 1980 with that of other developed economies, and generally the U.S. manufacturing sector fares well—in terms of growth in production, employment, R&D, and capital spending. He estimates the effects of exchange rates on U.S. manufacturing and attributes most of the changes in U.S. exports and imports during 1980-83 to the dollar appreciation; however, by measuring real-exchange-rate movements with relative export and import prices (which may be related to relative costs and industrial structure) this doesn't rule out the importance of more industry-specific explanations for changes in U.S. competitiveness.

e. Richard Baldwin and Paul R. Krugman, "Market Access and International Competition: A Simulation Study of 16K Random Access Memories," NBER Working Paper No. 1936, 1986.

Marvin Lieberman, "Learning-By-Doing and Industrial Competitiveness: Autos and Semiconductors in the U.S. and Japan," NBER Working Paper, 1986.

John Zysman and Laura Tyson (eds.), American Industry in International Competition (Ithaca: Cornell University Press, 1983).

These works take a more dynamic view of industrial (and international) competition than that traditionally taken by economists.

Baldwin and Krugman model international competition in an oligopoly market with "strong learning effects," simulating the U.S.-Japanese rivalry in 16K RAM's from 1978 to 1983. Their results suggest that a protected home market was a crucial advantage to export performance of Japanese firms but that this policy produced more costs than benefits for Japan (through higher prices for consumers). Lieberman discusses the implications of "learning-by-doing" — "production technology undergoing continual improvement that is largely a function of accumulated experience" — which he claims to be a common feature of complex manufacturing industries. In these industries, the behavior of prices, profits, and shares of the market will depend on the slope of the learning curve (rate of productivity gains), the time horizon used by firms in decision making, and the rate at which learning diffuses among firms. A role for government in influencing these factors will be important in international competition.

The Zysman and Tyson volume is a series of industry case studies depicting the problems of adjustment and change in response to international competition in seven sectors: consumer electronics, steel, semiconductors, footwear, textiles, apparel, and autos. The editors, in their introductory essay, state that "[the] well-being of firms in these sectors depends on defending home markets against foreign firms and selling in markets abroad." This suggests at least an implicit view of international competitiveness in terms of export-shares and import-penetration. They do define "comparative advantage" as the relative export strength of a particular sector compared with other sectors in the same nation (and acknowledge the need to adjust for market-distorting government policies). On the other hand, "competitive advantage" is defined as the relative export strength of the firms of one country compared with the firms of other countries selling in the same sector in international markets.

Zysman and Tyson argue that in many cases a nation can create its own comparative advantage by the efforts of government and industry to create competitive advantage in the market; they refer specifically to government policies protecting a home market so as to allow either production economies of scale or learning curve economies. The case studies highlight the role of Japanese industrial policy in promoting expansion of growth-linked industries. Typical of competition between advanced countries is apparently that market success depends on the management of complex processes of product development and manufacturing, not simply national differences in factor costs such as wages or raw materials.

f. J. David Richardson, "Constant-Market-Shares Analysis of Export Growth," Journal of International Economics, vol. 1 (May 1971), pp. 227-239.

This is a critique of the constant-market-shares analysis, both in theory and in practice. This analysis attributes any change in a country's exports in a particular sector not due to growth in the market but to changed "competitiveness." Richardson questions the use of relative prices to measure relative competitiveness (ignoring quality, service, financing differences between the products of competing nations) and suggests that a measure of "a country's true competitiveness ... might be whether the country was increasing its export shares in rapidly growing commodities and markets" (the analysis assumes the commodity and geographic distribution of exports to be unrelated to competitiveness).

g. John W. Suomela, "The Meaning and Measurement of International Price Competitiveness," Business & Economics Section, proceedings of the American Statistical Association, 1978.

This paper discusses the ambiguities in the term "competitiveness," as it applies to firms, industries, and countries. It reviews several empirical studies that have attempted to measure "competitiveness" or "price competitiveness"-- these have interpreted the measures employed as predictors of relative export quantities or relative export shares or the balance of trade in an industry sector. These measures include ratios of wholesale price indexes, export unit values, relative unit labor costs, import prices divided by export prices, and relative profits. An import demand model is formulated to specify theoretically correct price indexes, which unfortunately do not correspond to available data.

h. U.S. Federal Trade Commission, Staff Report on the U.S. Steel Industry and its International Rivals; Trends and Factors Determining International Competitiveness, Bureau of Economics, 1977

Despite the title, no definition or strict measure of international competitiveness is given. At various places the study suggests the importance of exports, imports penetration, and rates of growth in production as indicators of a country's "competitive position" or "importance" in the world steel industry or "relative standing ... among the world's steel producing nations." However, in the summary chapter, the study is described as one attempting to explain the pattern of trade flows of the U.S. steel industry over a 20-year period.

Chapter 3 examines trends in the relative costs of producing steel in the United States, Japan, and the EC, respectively, and evaluates the impact of those relative costs on international trade flows. The authors' implied model seems to be that of a spatial oligopoly, i.e., they attribute changes in relative production costs among respective countries with strongly influencing the trade flows by allowing countries, as they reduce their relative production costs, to expand into areas formerly controlled by other countries. (This is not to say that relative cost changes do not play a role in spaceless models; there, cost changes imply supply shifts that are likely to lead to changes in export shares even if, in a homogeneous world market, price and marginal cost are unchanged.)

After comparing quantities and average prices for components involved in steelmaking in the United States and Japan and after covering 70 percent of the variable costs in the United States, comparisons of levels and trends in unit costs in the two countries were prepared. However, there were problems with the comparisons as follows: (1) the assumption that the relative costs of excluded inputs has not changed significantly over time has not been checked; and (2) price and quantity data are not exactly comparable for the two countries because of differences in industry definitions, product-mixes, and the use of spot vs. contract prices or arms-length versus transfer prices. The primary difference between U.S. and Japanese unit costs was found to be unit labor costs, mainly because of the wage-rate differential; the overall Japanese cost advantage increased from 1956 to 1968, but changed little during the 1968-76 period.

Less sophisticated methods, using product-specific average revenue less an overall-industry return on sales, were used to estimate the U.S./EC cost differential; results showed relative U.S. costs increasing from 1954 to the late 1960's and then decreasing. Some discussion of shipping costs is given but there is not analysis of changes over time.

Partly on the basis of a simple linear regression of Japanese and EC Import penetration in the United States on relative costs, the study concludes that primary explanation for increasing imports penetration is relative production cost changes. It should be noted that since exchange-rate effects are incorporated in the measured cost changes there is no allowance for a separate influence for these effects

i. U.S. Department of Labor, Office of Foreign Economic Research, Report of the President on U.S. Competitiveness, 1980.

This is essentially a study of U.S. export performance, although other indicators of international competitiveness used include the trade balance and the "term of trade," the latter is measured by the U.S. export/import price ratio. A long list if determining factors in considered: inflation, rates of investment, productivity growth, skilled labor resources, technological innovation, unit labor costs, tariff and nontariff barriers to U.S. exports, U.S. foreign investment and technology transfer, tax measures, energy factors, labor-management relations, the role of engineering, and other services in the export of capital goods. Of these factors, investment, technology, and productivity were seen as areas in which the United States had lagged behind its competitors; in addition, nontariff barriers and exchange-rate movements had major impacts on U.S. exports. As in the index of "revealed comparative advantage" the study adjusts the U.S. export-share in a particular product by the U.S. share of total world exports; similarly, for industries without much exporting, a relative import penetration ratio might be useful in judging comparative advantage among U.S. industries.

2. Summary of results

The conclusion to be drawn from these studies is that "international competitiveness" does not have a precise, theoretically derived definition, but rather is a term that different people use to mean somewhat different things. However, the unifying theme is that the interest is always in some measure of "success" in world markets. The most common measures of this success in particular product markets seem to be shares of world exports or production or the level and trends of a country's trade balance in a sector. Determinants of this success are the relative production costs and exchange-rate effects predicted by a simple static model of international competition, as well as more dynamic factors such as productivity growth, investment, and management (and perhaps government) strategies. The comparison of these studies should alert on to the importance of choosing appropriate statistics to answer a question: e.g., R.Z. Lawrence finds R&D in manufacturing grew faster in the United States than in other OECD countries, and the Labor Department study finds that the U.S. ratio of R&D to GNP has declined in the United States relative to other developed nations. Both of these results are correct yet they lead a reader towards opposite conclusions on the trend of U.S. investment in technology.

B. Methodological concerns

The preceding section found that discussions of international competitiveness of U.S. industries generally fail to precisely define how competitiveness should be measured. The problem is that there is no unique measure, but rather several dimensions of the issue. The purpose of this section is to set out an analytical framework relating several measures of competitiveness to determinants of industrial performance in world markets.

1. Definitions of competitiveness

Consider the U.S. industry facing a competing industry in world markets, with the two industries selling somewhat differentiated, though similar, products; for example, suppose the U.S. and Japanese automobile industries competed in markets throughout the world but were viewed by consumers as selling products not perfectly substitutable for each other. Separate but interrelated markets for the products of the two industries exist with price and quantities sold determined by elements of supply and demand. Given that the U.S. and foreign products are substitutes, anything that serves to lower the price of the U.S. [foreign] product will reduce the demand for the foreign [U.S.] product. In turn, the U.S. price will be determined by marginal costs, the sensitivity of demand to price (price elasticity of demand), and the market structure and strategic behavior of the U.S. industry.

Now, what is meant by competitiveness? At the most basic level, it is simply "success" in world markets, which can be measured by the share of the combined markets for U.S. and foreign-made products held by U.S. producers (or the U.S. share of world exports); this seems to be the most commonly adopted measure of international competitiveness. Clearly, by this measure, any change that increases world sales of U.S. products while reducing (or even increasing less than proportionally) sales of foreign-made products implies an increase in U.S. competitiveness; it should be recognized that competitiveness so defined includes the effects of all governmentally imposed aids and sanctions affecting both the U.S. and foreign industries. Such a measure, if examined over a period of years, will be quite sensitive to the changing stages of economic development occurring in both competitor and consumer nations. It has been argued, for example, that with the post-war re-emergence of Japan and the European Community, followed by the rise of the newly industrializing countries of the Pacific Rim, that one would expect to see the U.S. share of world exports declining (and whether we view this as a decline in competitiveness or not may be a matter of semantics).

An alternative measure of competitiveness is simply the profitability of the domestic industry, although, again, this measure is quite sensitive to government-imposed import barriers and export aids. Finally, net investment in the domestic industry is both an indicator of competitiveness and a predictor of future profitability and market share. These latter two measures are probably more directly affected by the overall state of the domestic economy than is the share of world consumption or world exports (although this will also be affected by macroeconomic factors influencing exchange rates and inflation). Whereas there are exceptions, generally all three of these indicators of competitiveness will move together and will be similarly affected by changes in circumstances of supply or demand.

2. Determinants and indicators

Suppose there is an increase in the cost of producing an additional unit of the domestic product. This could be the result of increases in resource costs, inefficiencies in management techniques, use of outdated or inappropriate technologies, increasing interest rates, higher regulation-related costs, or a depreciation of the domestic currency value (raising the cost of imported inputs). This increase in costs will be translated into reduced supply and a higher price for the U.S. product. The higher price will stimulate increased world demand for the foreign-made product. The result will be a reduced U.S. share of the world market (and of world exports), lower profits, and (especially if the lower profits are expected to persist) reduced investment in the U.S. industry. Similar results would ensue from reduced costs to the foreign industry: a lower foreign product price would lead to reduced demand for the U.S. product, a smaller world market share, and reduced profits and investments.

If transportation costs are an important consideration in world trade of a particular product (as in the case when the ratio of value to weight is relatively low), a reduction in costs in the industry of one country will enable it to expand the geographical area in which, including transport costs, it enjoys a cost advantage. We would expect to see this translated into increases in world export shares, profitability, and domestic investment. Similarly, a reduction in transportation costs specific to a particular producing country (as could occur if shipping costs were subsidized by the government) would expand that country's geographical marketing area and increase the three measures of competitiveness discussed above.

It should be emphasized that anything that affects the cost of production to the U.S. industry relative to foreign production will have an influence on competitiveness. The cost factors mentioned above are just examples and should not be taken to be an exhaustive list; different elements of cost will be more important in determining U.S. competitiveness in different products.

Changed conditions of demand, specific to one of the two countries' industries, would also have an impact on international competitiveness. An increase in demand for the product of the U.S. industry could be due to a change in consumer tastes or an improvement in the perceived quality either of the basic product or of service and distributional aspects related to the U.S. product; it could also be due to more rapid income growth in parts of the world targeted by the U.S. producers than in the rest of the world market. Regardless of the cause, an increase in demand for the U.S.-made product would increase sales and the price of that product. Although there may be a resulting increase in demand for the foreign-made product as well this should be of smaller magnitude, leading to the conclusion that the world-market share of the domestic industry will rise, as will profits and investment. Improved technology, resulting from increased research and development in the industry, may have the dual effect of reducing costs and improving quality (and, therefore, demand).

Finally, the nature of competition in the domestic industry may affect the industry's success in world markets. The U.S. industry will be better able to compete with imports and to sell abroad, to the extent that vigorous competition among domestic producers allows for pricing closely aligned to costs, and still allow for profits to be invested in research and development and capital equipment. Such competition may also stimulate improved management techniques, which by lowering costs will further reduce prices and enhance the U.S. industry's competitive position.

3. Summary

The brief discussion above suggests that international competitiveness is an issue that needs to be evaluated from a multidimensional perspective, examining both indicators and determinants of competitiveness. Three indicators of competitiveness are (1) world export shares (or shares of world consumption); (2) profitability of the domestic industry; and (3) trends in net investment in the domestic industry. Determinants of competitiveness are (1) cost factors, both specific to the industry (including resource costs, labor costs, interest rates) and economy-wide (such as capital costs, general input-cost inflation, exchange-rate changes); (2) demand factors, including the quality and reputation of the domestic product, as well as the growth of incomes in primary export markets; and (3) domestic market structure and conduct considerations. To the extent government actions influence any of these factors they will affect the international competitiveness of the industry. Of course, explicit nontariff barriers erected by governments will have more direct impacts on indicators of competitiveness.

Under the cost factors determining competitiveness, one may consider differing U.S./foreign trends in--

(a) wage rates and labor productivity, or unit labor costs (which effectively combine the two);

(b) intensity of use of inputs, which may be related to differing technologies, age of capital equipment, or the degree of vertical integration;

(c) transportation and distribution costs --their importance, and the geographical distance to major markets from U.S. and other suppliers. Note that to the extent cost measures are converted to dollar equivalents, the issues of general inflation and exchange rates are controlled for.

Under demand factors, one may consider whether the U.S. and foreign products are homogeneous or differentiated in some way, whether primary markets of the U.S. industry have grown at different rates than primary markets of foreign competitors, patterns and changes in delivery lags, service, and quality from competing sources.

Market structure can be evaluated by looking at the number of firms in the industry, the share of the top firms, conditions of entry into the global industry, the type of ownership, and the degree of vertical integration and diversification in the industry. Some qualitative assessment on the competitive environment, the extent to which firms compete or cooperate, is useful.

Finally, government aids such as subsidies (including subsidies to related industries), tariffs, quotas, and other nontariff measures should be mentioned, with some attempt at assessing their impact.

APPENDIX G

Foreign Direct Investment in the U.S. Automotive Parts Industry

Table G-1
Automotive parts:
Foreign owned U.S. manufacturing facilities,
by state

Manufacturer	Address	City and state	Parent and location	Items manufactured	SIC code	Year of initial production	Current number of employees	Anticipated employment at capacity	Major customers
Dunlop Tires Corp.	P.O. Box 1141	Huntsville Alabama	Sumitomo Rubber Japan	Tires	3011	1969	1250		Aftermarket Honda Isuzu
Michelin	P.O. Box 40	Dothan Alabama	Michelin et Cie France	Tires	3011	1979	600		Ford Chrysler AMC
Thermalex Inc.	2758 Gunter Park Drive West	Montgomery Alabama	Mitsubishi Aluminum Japan	Aluminum extrusion products	3354	1986	35		Big 3 Toyota, Mazda Mitsubishi
Acco Babcock, Inc.	One Acco Drive	Blytheville Arkansas	Babcock International United Kingdom	Cables	3357	1974	350		Big 3 AMC
Acco Babcock, Inc.	Rt. 2, Box 143A	Des Arc Arkansas	Babcock International United Kingdom	Cable	3357	1980	186		Big 3 AMC
Omega Tube & Conduit Corp	8523 Frazier Pike	Little Rock Arkansas	Sumitomo Metal Industries Japan	Steel pipe for: exhaust pipes,chasis, stabilizers, axles, steering wheel columns, etc.	3317	1987			
Alpine Electronics Mfg.	P.O. Box 2859	Torrance California	Alps Electric Japan	Audio equipment	3651	1978	125		
Amtex Inc.	P.O. Box 1620	Manteca California	Hayashi-telempu Co. Ltd. Japan	Carpets, interior trim, floor mats, trunk mats	2271	1985	50		
California Steel	1400 San Bernadino Avenue	Fontana California	Kawasaki Steel (50%) Japan	Steel parts	3714	1984	850		
Calsonic Inc.	#9 Holland	Irvine California	Nihon Radiator Co. Ltd. Japan	Air conditioning systems	3585	1980	50		Nissan
Curtis-Maruyasu America	P.O. Box 1081	Tracy California	Maruyasu Japan	Fuel line & hydraulic brake assembly	3714	1985	25		NUMMI
Mitsubishi Heavy Ind.	3070 East Victoria St.	Rancho Dominguez California	Mitsubishi Heavy Ind. Ltd Japan	A/C system subassemblies	3585	1987	10		Mitsubishi Chrysler
NGK Sparkplug	#6 Whatney	Irvine California	NGK Sparkplug Japan	Spark plugs	3694	1981	75		Aftermarket
Technotrim	3745 Peterson Road	Stockton California	Tachi-S Ltd. Japan	Seat covers	2531	1987	75		Johnson Control

VIAM Manufacturing Inc.	9440 Norwalk Blvd.	Santa Fe Springs California	Vilenc Co. Ltd. (60%) Japan	Floor mats	2271	1984	125		Toyota, Mazda Chrysler, GM Mitsubishi
Neoplan USA Corp.	700 Auwaerter Dr.	Lamar Colorado	Neoplan Family West Germany	Transit busses	3711	1981	650		
Airpax Electronics Inc.	Cheshire Industrial Park	Cheshire Connecticut	North American Philips Netherlands	Magnetic sensors, temperature sensors, blower motors	3714	1987	1000		Big 3 Cummins Bendix
Kamei USA, Inc.	300 Montowese Avenue	North Haven Connecticut	Kamei, GmbH West Germany	Aerodynamic car accessories		1978	25		Aftermarket
Newmet/Krebsoge	P.O. Box 68	Terryville Connecticut	Sintermetallwerk Kresboge West Germany	Filters	3714	1974	33		Aftermarket
Delaware Seat Company	31 Blevins Drive	New Castle Delaware	Woodbridge Group Canada	Seats	2531	1986	116		GM
Bekaert Steel Wire	P.O. Drawer G	Rome Georgia	Bekaert Belgium	Tire beadwire	3496	1970	607		All major tire manufacturers
Bundy Tubing	82 Swisher Drive	Cartersville Georgia	Usui Ko Kusai Sangwa Ltd Japan	Small diameter tubing, brake hoses, fuel lines	3079	1985	100		Big 3 Nissan
GMT International, Inc.	56 Conners Rd./P.O. Box 117	Villa Rica Georgia	Gummi-Metall-Technik West Germany	Anti-vibration devices, machinery & motor mounts	3714	1980	30		Aftermarket
General Tire	P.O. Box 190	Barnsville Georgia	Continental AG West Germany	Tire fabric cord	2296	1930	350		
Goetze Gasket Co.	1641 Forrest Avenue	La Grange Georgia	Goetze, AG West Germany	Engine/cylinder head gaskets, exhaust/intake manifold gaskets, & exhaust seal rings	3069	1981	100		Big 3
NOK Inc.	One NOK Place	La Grange Georgia	Nippon Oil Seal Co., Ltd.Japan	Oil seals, Mechanical seals	3293	1980	326		Big 3 AMC Navistar
Pacific Chloride, Inc.	901 Joy Rd./P.O. Box 3483	Columbus Georgia	Pacific Dunlop Australia	Automotive storage batteries	3691	1958	144		Aftermarket
Pacific Chloride, Inc.	904 Joy Road/P.O. Box 2165	Columbus Georgia	Pacific Dunlop Australia	Lead products for batteries	2819	1958	58		Mfg. plant
Siemens Energy & Auto Inc	150 Hambree Park Drive	Roswell Georgia	Siemens AG West Germany	Drive systems	3714	1984	292		GM Ford
ZF Transmissions, Inc.	1261 Palmour Drive, S.W.	Gainesville Georgia	Zahnradfabrik Friedric AG West Germany	Transmissions	3714	1987	50		Ford
Amkor Corp.	840 Peoria Savings Plaza	Peoria Illinois	Union Sanyo Japan	Oil filters, air filters, fuel filters	3599	1988	3		
Bloomington Seating Co.	2031 Warehouse Rd.	Normal Illinois	Namba Press Works Co. Japan	Seats	2531	1988	80	105	Diamond-Star

Diamond-Star Motors	301 Prospect Rd.	Bloomington Illinois	Mitsubishi Motors Japan	Cars	3711	1988	100	3000	Diamond-Star
Diesel Kiki USA	625 Southside Drive	Decatur Illinois	Diesel Kiki Co., Ltd. Japan	air conditioning components, auto heating components	3714	1988		380	
Eagle Wings Industries	P.O. Box 840/310 S. Murray Rd.	Rantoul Illinois	Nippon Eagle Wing Ind. Japan	Underbody parts	3714	1988		250	Diamond-Star
General Tire	P.O. Box 1029	Mt. Vernon Illinois	Continental AG West Germany	Tires	3011	1974			
Mitsubishi Belting Corp.	P.O. Box 147	Ottawa Illinois	Mitsubishi Belting Co LtdJapan	Belts, hoses	3041	1988		110	
NTN Bower Co.	711 North Bower Road	Macomb Illinois	NTN Toyo Bearing Co. Japan	Bearings	3562	1986	500		Big 3
Mascote Industries	P.O. Box 269	Nashville Illinois	Magna International Canada	Exterior parts, bumpers, fenders	3714	1988			
North American Lighting	020 Industrial Park	Flora Illinois	Westfalische Metall Ind. West Germany	Front, park, and rear lamps fog and license plate lamps	3647	1985	310		Ford, AMC, BMW Chrysler, VW Nissan
North American Lighting		Salem Illinois	Westfalische Metall Ind. West Germany	Vehicular lighting equipment	3647	1987			
Warner-Ishi Corp.	Route 16 West/P.O. Box 580	Shelbyville Illinois	Ishikawa-Jima Japan	Turbocharger housings	3714	1985	40		Ford
AE	22255 West Cleveland	South Bend Indiana	AE Group of Great Britain U.K.	Pistons	3592	1987	50	90	
Aisin USA, Inc.	5226 South East Street	Indianapolis Indiana	Aisin Seiki Japan	Automotive moldings	3465	1988	77	250	Toyota
Alpine Electronics Mfg.	P.O. Box 430	Greenwood Indiana	Alpine Electronics Japan	Automotive audio equipment	3651	1987	127		American Honda BMW
Budd Company, The		Kendallville Indiana	Thyssen Bornemisza West Germany	Body components: molding, ass'y, and painting	3714	1988			
Enkei America Inc.	Woodside Business Center	Columbus Indiana	Enshu Keigokin Co. Ltd. Japan	Aluminum wheels	3714	1987	100		Big 3 AMC
Fujitsu Ten Limited	616 Conrad Harcourt Way	Rushville Indiana	Fujitsu Ten Limited Japan	Car audio components	3651	1987	20		Toyota Mazda Isuzu
Int'l Packings Corp.	State Road 44 West/Box 38	Shelbyville Indiana	Carl Freudenberg West Germany	Fabricated rubber products	3069	1966	270		GM Ford
Int'l Packings Corp.	P.O. Box 245	Morristown Indiana	Carl Freudenberg West Germany	Fabricated rubber products	3069	1973	330		GM Ford
1/ Int'l Packings Corp.	P.O. Box 452	Scottsburg Indiana	Carl Freudenberg West Germany	Fabricated rubber products	3069				GM Ford

Keiper-Recaro, Inc.	1118 Gerber Street	Ligonier Indiana	Keiper-Recaro West Germany	Seats	2531	1983	30		Weimer Motor Executive MotorKnudsen
Nishikawa Standard Co.	P.O. Box 308	Topeka Indiana	Nishikawa Kasei Japan	Sponge rubber products	3069	1987	57	200	Honda
Sheller-Ryobi Inc.	800 Mausoleum Road	Shelbyville Indiana	Ryobi Ltd. (51%) Japan	Aluminum transmission housings	3714	1986	105		Ford GM
Toyoshima Service Spring	735 St. Paul Street	Indianapolis Indiana	Toyoshima, Inc. Japan	Suspension system leaf springs	3493	1919	100		Aftermarket
Benco Manufacturing, Inc.	West 8th Street	Belle Plain Iowa	Magna International, Inc. Canada	Oil strainers		1976	145		Ford Chrysler
Montezuma Manufacturing	P.O. Box 6	Montezuma Iowa	Magna International, Inc. Canada	Auto stampings	3465	1972	126		Big 3 Nissan Honda
NSK Bearing Co.	1100 North First St.	Clarinda Iowa	Nippon Seiko KK Japan	Bearings	3562	1975	215		Big 3 AMC
Traer Manufacturing	P.O. Box 56	Traer Iowa	Magna International, Inc. Canada	Auto stampings	3465	1983	125		Big 3 Nissan Honda
Victor Manufacturing	P.O. Box 338	Victor Iowa	Magna International, Inc.Canada	Auto stampings	3465	1979	122		Big 3 Nissan Honda
Williamsburg Mfg.	P.O. Box 808	Williamsburg Iowa	Magna International, Inc.Canada	Auto stampings	3465	1979	98		Big 3 Nissan Honda
Pacific Chloride	P.O. Box 15060	Kansas City Kansas	Dunlop Olympic Batteries Australia	Industrial batteries	3691	1970	80		Chrysler Ford
ATR Wire & Cable Co. Inc.	P.O. Box 908/U.S.-127 Bypass	Danville Kentucky	Tokyo Rope Mfg. Co.(60%) Japan	Steel wire tire cord, tire beadwire	3496				U.S. tire cos.
Ambrake Corp.		Elizabethtown Kentucky	Akebono Brake Ind. Co. Japan	Disc drums, disc brakes	3714	1989	100	400	Honda, GM
Budd Company, The	801 Highway 55 South	Shelbyville Kentucky	Thyssen AG West Germany	Sheet metal stampings	3465	1989	375		Ford, GM
Central Manufacturing	P.O. Box 6	Paris Kentucky	Central Motor Wheel(40%) Japan	Wheels	3714	1988	53		Toyota
Clarion Corp. of America	P.O.Box 240	Walton Kentucky	Clarion Co. Ltd. Japan	Audio equipment	3651	1987	35		Nissan
Curtis-Maruyasu		Lebanon Kentucky	Maruyasu Kogyo (50%) Japan	Gas & brake line tubing ass'y	3714	1988	20		Toyota
General Tire	One General Street	Mayfield Kentucky	Continental AG West Germany	Tires	3011	1987	2400		Nissan, Ford GM

Hitachi Auto. Prdcts. USA	P.O. Box 510	Harrodsburg Kentucky	Hitachi Auto. Prdcts. Inc Japan	Starters, alternators, ignition coils, pressure sensors	3694	1986	100		Big 3, Nissan
Ichikoh Industries		Shelbyville Kentucky	Ichikoh Industries Japan	Rear and sideview mirrors	3231	1988	59	90	Toyota Nissan
1/ Inoac U.S.A. Inc.		Bardstown Kentucky	Inoue MTP Co. Ltd. Japan	Exterior parts, trim, foam rubber padding	3714	1988	91		
Jideco of Bardstown	P.O. Box 816	Bardstown Kentucky	Jidosha Denkei Kogyo Co. Japan	Wiper motors, cruise control devices	3714	1987			Nissan
1/ Kokoku Rubber		Richmond Kentucky	Kokoku Ltd. Japan	Auto components	3714	1988	50		Toyota
NHK Associated Spring	3251 Nashville Rd.	Bowling Green Kentucky	NHK Spring Co. Ltd. Japan	Coil springs for suspensions	3493	1987	26		Nissan
Sumitomo Electric Wiring	P.O. Box 800	Morgantown Kentucky	Sumitomo Eletric Wiring Japan	Electric wiring harnesses	3694	1987	115	600	Honda
Tokico Ltd.	P.O. Box 8	Berea Kentucky	Tokico Ltd. Japan	Shock absorbers	3714	1988	80	200	Toyota
Topy Corporation	P.O. Box 1010	Frankfurt Kentucky	Topy Industries Ltd. Japan	Steel wheels	3714	1986	87		Honda, Mazda Nissan
Toyota Motor Corp.	Cherry Blossom Way	Georgetown Kentucky	Toyota Motor Corp. Japan	Auto assembly	3711	1988	270	3000	Toyota
United L-N Glass	102 Kuhlman Dr./US Rt. 60 Byps	Versailles Kentucky	Nippon Sheet Glass Japan	Laminated/tempered glass parts	3231	1987	250		Toyota, GM
Vuteq Industries Co. Inc.		Georgetown Kentucky	Chubu Industries Inc. Japan	Window assembly	3231	1988	20		Toyota
Woodbridge Inoac, Inc.	900 Nutter Drive	Bardstown Kentucky	Woodbridge Group Canada	Polyurethane instrument panels	3714	1988	12	220	Ford, Kantus Diamond Star Kusan
Lemforder Corp.	P.O. Box 219	Brewer Maine	Lemforder Metallwaren AG West Germany	Front end suspension parts	3714	1982	49		VW of America
ZF Steering Gears, Inc.	55 Baker Boulevard	Brewer Maine	Zahnradfabrik Friedric AG West Germany	Power steering pumps		1987	25		Chrysler
Mack Trucks	1999 Pennsylvania Avenue	Hagerstown Maryland	Renault France	Engines, transmissions	3714	1962	2316		Mack
Marada Industries	151 Airport Drive	Westminster Maryland	Magna International Canada	Auto stampings, rolled parts	3465	1984	130		GM AMC
Tri-Con Industries, Ltd.	2810 Lemone Industrial Blvd.	Columbia Maryland	Tokyo Seat Co. Japan	Car seats	2531	1983	200		Chrysler
Acco Babcock, Inc.	1022 E. Michigan Street	Adrian Michigan	Babcock & Wilcox United Kingdom	Cables	3357	1920	160		Big 3 AMC

American Fibrit Inc.	76 Armstrong Road	Battle Creek Michigan	Deutsche Fibrit West Germany	Instrument panels, door panels, trim components	3714	1982	750	Big 3 AMC
1/ American Yazaki	6700 Haggerty Rd.	Canton Michigan	Yazaki Corp. Japan	Wiring harnesses	3714	1975	200	Ford Chrysler Nissan
Asmo Co.	500 Fritz-Keiper Blvd.	Battle Creek Michigan	Asmo Co. Ltd. Japan	Windshield wipers, Reservoir tanks	3714	1987	5	Nippondenso
Automotive Products	6515 Cobb Drive	Sterling Heights Michigan	Automotive Products Plc. United Kingdom	Actuation units, hydraulic clutches, hydraulic brakes	3714	1978	172	Big 3 Renault, NissanSaturn
Benteler Industries	320 Hall, SW	Grand Rapids Michigan	Benteler Wisatechnik West Germany	sheet metal stampings, welded assemblies	3465	1956	150	GM Chrysler VW
CME Corporation	120 South University	Mt. Pleasant Michigan	Mitsuba Electric Mfg. Co. Japan	Windshield wiper systems, power window motors	3714	1988	8	
Delta USA	1000 Parnes Drive	Monroe Michigan	Delta Kogyo Co. Ltd. Japan	Seats	2531	1988	100	Mazda
Escan Corp.	2803 New Danforth Road	Escanaba Michigan	Freudenberg-Magulastic West Germany	Tortional vibration damper, water pumps, pulleys	3714	1973	150	Caterpillar Detroit Diesel GM, Ford
Hi-Lex Corp.	5200 Wayne	Battle Creek Michigan	Nippon Cable System Co. Japan	Control cables for: clutches, hood/trunk releases, brakes, accelerators	3357	1978	250	Big 3 Nissan, Honda Toyota
Hisan Inc.	P.O. Box 249/300 Water Street	Rochester Michigan	Sanah Industrial Co. Ltd. Japan	Tubing	3079	1936	135	Big 3
I.I. Stanley Co., Inc.	4950 West Dickman Road	Battle Creek Michigan	Kyokuto Boeki Kaisha Ltd Japan	Auto lamps	3647	1990	17	Big 3, Japanesetranspl ant
Isringhausen, Inc.	Fort Custer Industrial Park	Battle Creek Michigan	Gebr. Isringhausen West Germany	Driver seats, truck & bus seats	2531	1980	15	GM (Bus Div.)
Jost International	1800 Industrial Dr./PO Box 327	Grand Haven Michigan	Jost Werke GmbH West Germany	5th wheels for trailer trucks, ball bearing turntables, lining gears, axles	3714	1981	5	Volvo,Ford,SAAB Freightliner Peterbilt
Keeler Brass Co.	2929 32nd Street	Kentwood Michigan	Babcock International United Kingdom	Trim products, dashboard assemblies, instrument panels	3079	1983		
Keiper U.S.A., Inc.	5701 West Dickman Road	Battle Creek Michigan	Keiper Auto. Remscheid West Germany	reclining mechanisms, seats	2531	1976	200	Chrysler GM
Kux Manufacturing	12675 Burt Road	Detroit Michigan	Mitsubishi International Japan	Decorative trim	3465	1960	320	GM Ford
Labauto	2345 Petit Street	Port Huron Michigan	Precision Mecanique Labin France	Wiring harnesses	3714	1987	65	Ford

Mazda Motor Corp.	One Mazda Drive	Flat Rock Michigan	Mazda Motor Mfg. Corp. Japan	Cars	3711	1987	1400	3500	Mazda
Michigan Precision Ind.	8647 Lyndon Avenue	Detroit Michigan	Kloeckner-Wilhelmsburger West Germany	Fineblanked metal stampings	3465	1969	100		Big 3 AMC Toyota
Musashi U.S.A., Inc.	195 Bridges Drive	Battle Creek Michigan	Musashi Ltd. Japan	Lower control arms	3714	1985	5		Ford
Muskegon Piston Rings Co.	1839 Sixth Street	Muskegon Michigan	Goetz AG West Germany	Piston rings, castings, seals	3592	1921	162		Big 3
NSK Corp.	3861 Research Park Drive	Ann Arbor Michigan	Nippon Seiko KK Japan	Bearings	3562		302		Ford Chrysler
Nippondenso Mfg. USA, Inc	One Denso Road	Battle Creek Michigan	Nippondenso Co. Ltd. Japan	Evaporators and condensors forair conditioning units	3585	1986	450		Ford, Mazda Toyota
Ogihara America Corp.	1002A East Grand River	Howell Michigan	Ogihara Iron Works Co Ltd Japan	Sheet metal stampings	3465	1987	64		Ford Mazda
Oiles America Corp.	1491 Cleat	Plymouth Michigan	Oiles Ind. Co., Ltd. Japan	Bearings on the bushings	3562	1987	10	12	Big 3
1/ Pro Coil Corp.		Canton Township Michigan	Marubeni Group Japan	Stampings	3465	1988	50		GM
Signaltone-Neuman, Inc.	946 Frisbee	Cadillac Michigan	Signalvision SA France	Air/electric horns, windshield wipers, wiper refills	3714	1979	75		Big 3 AMC
Takata Fisher Corp.	33180 Freeway Drive	St. Clair Shores Michigan	Takata Corp. Japan	Seat belts	2399	1984	57		Honda, Nissan Projected:Mazda Diam. Star
Techni-Molders Inc.	34086 James Pompo Drive	Fraser Michigan	Techni-Molders Inc. France	Plastic part molds, electronic components	3079	1986	2		Valeo Labauto
Tokai Rubber Industries	12866 Ridgefield Ct.	Livonia Michigan	Tokai Rubber, Inc. Japan	Anti-vibration rubber parts	3069	1987	8		Ford
Webasto North America	2700 Product Drive	Rochester Hills Michigan	Webasto-werk West Germany	Sunroofs, roof systems	3714	1985	100		Big 3 AMC
Weyburn-Bartel USA	U.S. 31 at M-45	Grand Haven Michigan	Weyburn Eng. Co., Ltd. United Kingdom	Camshafts	3714	1983	300		Big 3 Hercules Eng. JP Inds.
PEP Industries	1000 PEP Drive/P.O. Box 326	Houston Mississippi	Fujikura, Ltd. Japan	Wire harnesses	3714				
PEP Industries Inc.	P.O. Box 658	Ripley Mississippi	Fujikura, Ltd. Japan	Wire harnesses	3714	1977	316		Ford
Pacific Chloride Inc.	250 Ellis Avenue	Florence Mississippi	Pacific Dunlop Ltd. Australia	Automotive batteries	3691	1967	220		Aftermarket

Pontotoc Spring Co.	160 Industrial Drive/PO Box 30	Pontotoc Mississippi	IFI International SA Luxembourg	Coil springs	3493	1984	50		Aftermarket
FAG Bearing Corp.	3900 Range Line	Joplin Missouri	FAG Kugelfischer West Germany	Ball bearings, roller bearings, spherical bearings	3562	1970	260		Aftermarket
Optec Daichi Denko	5701 Hwy. 54/P.O. Box 69	Mexico Missouri	Optec Daitich, Denko Japan	Magnet wire, copper wire used in condensors	3357	1987	53		Big 3 Toyota
Riverside Seating	500 NW Platte Valle Drive	Riverside Missouri	Woodbridge Group Canada	Seat cushions	2531	1987	21	150	GM
Tri-Con Industries Ltd.	334A North Broadview Street	Cape Giradeau Missouri	Tokyo Seat Co. Japan	Car seats (sews)	2531	1983	600		Chrysler
American Shizuki	301 West "O" Street	Ogallala Nebraska	Shizuki Electronic Co. Japan	Film capacitors	3675	1942	325		Big 3
Tri-Con Industries Ltd.	4001 NW 44th Street	Lincoln Nebraska	Tokyo Seat Corp. Japan	Van seats, motorcyicle seats	2531	1977	45		Small dealers
Disogrin Industries Corp.	Grenier Airpark	Manchester New Hampshire	Freudenberg & Co. GmbH West Germany	Custom molded products, bumpers, sealing systems	3714	1965	300		GM, Chrysler Delco
IPC Limited Partnership	P.O. Box B	Bristol New Hampshire	Freudenberg & Co. GmbH West Germany	Oil & grease seals, cups, molded gaskets & rubber parts,boots	3293	1949	725		Big 3
IPC Limited Partnership	RR #1/Box 265-F	Tilton New Hampshire	Freudenberg & Co. GmbH West Germany	Gaskets	3293	1985	210		GM Ford
Stone Mycal Corp.	240 South Main Street	South Hackensack New Jersey	Stone International Plc United Kingdom	Transit bus parts	3714	1976	75		Greyhound
Dunlop Tire Corp.	P.O. Box 1109	Buffalo New York	Sumitomo Rubber Japan	Tires	3011	1923	900		Aftermarket
Izumi Motors	P.O. Box 272	Patchoque New York	Izumi Motors Japan	Steering wheels	3714	1977	250		Big 3, AMC Nissan Mazda
Accuma Plastics	Route 7/Box 195	Statesville North Carolina	Accuma SpA Italy	Auto battery containers	3079	1986	17		Douglas Bat'ry Pacific Chlor. GNB Inc.
Butler Polymet, Inc.	P.O. Box 601/ Hibriten Drive	Lenior North Carolina	Guthrie Sanadian Inv. Ltd Canada	Thermoplastics	2641	1980	350		Ford GM
Freightliner Corp.	1400 Tulip Drive	Gastonia North Carolina	Daimler-Benz West Germany	Class 8 diesel truck parts	3714	1978	375		Freightliner
GKN Auto. Components, Inc	4901 Womack Road	Sanford North Carolina	GKN Plc. United Kingdom	Front wheel drive components	3714	1980	500		Ford
GKN Auto. Components, Inc	I-85 & Trollingwood Rd.	Mebane North Carolina	GKN Plc. United Kingdom	Jointed halfshafts	3568	1981			

Gas Spring Co.	1201 Tulip Drive	Gastonia North Carolina	Fichtel & Sachs Ind. Inc. West Germany	Gas springs	3714	1983	183		Big 3 AMC Volkswagen
General Tire	P.O. Box 7001	Charlotte North Carolina	Continental AG West Germany	Tires	3011	1968	1800		GM Ford Isuzu
Lutravil Company	P.O. Box 15910/Industrial Dr.	Durham North Carolina	Freudenberg & Co. West Germany	Carpet backing	2271	1985	120		Masland, C & A JP Stevens Magee
Precision Seals Co.	4307 S. York Road/PO Box 1767	Gastonia North Carolina	IFI Int'l SA Luxembourg	Oil seals	3293	1966	350		
Roederstein Electronics	2100 West Front St.	Statesville North Carolina	Firmengrupe Roederstein West Germany	Electrical capacitors, resistors	3629	1979	100		Chrysler Ford Delco
Shore Flyte Inc.		Elizabeth City North Carolina	Watson Jones United Kingdom	Suspension units	3714	1988			
Weber USA, Inc.	1120 Tate Blvd.	Hickory North Carolina	Weber SpA (owned by Fiat)Italy	Fuel system components	3714	1976	23		Sanford plant
Weber USA, Inc.	P.O. Box 548	Sanford North Carolina	Weber SpA (owned by Fiat)Italy	Carburetors, fuel systems	3592	1976	489		AMC Ford
AP Technoglass	1465 West Sanduskey Ave.	Bellefontaine Ohio	Asahi Glass (80%) Japan	Safety glass for autos	3211	1986	230		Honda, Isuzu Diamond-Star
Abbot and Company	1611 Cascade Drive	Marion Ohio	Brintec Netherlands	Electrical wiring harnesses	3694		615		GE
Aeroquip Automotive Inc.	1225 West Main Street	Van Wert Ohio	Yokohama Aeroquip Co. Japan	Hoses, fuel lines, oil cooler lines, couplings, tube connectors	3079	1987	75		
Belle Tech Corp.	700 W. Lake Street	Bellefontaine Ohio	Asahi Glass Co. Ltd. Japan	Glass assembly	3231		60		Honda Nissan
Bellemar Parts Industries	25000 U.S. Rt. 33	Marysville Ohio	Sanko Giken/Tokyo Seat Japan	Seat assemblies, exhaust systems	2531	1982	211		American Honda
Bellemar Parts Industries	6964 State Route 235 North	Brussels Point Ohio	Sanko Giken/Tokyo Seat Japan	Exhaust systems, catalytic converters, brake lines, door sashes	3714	1985	140		American Honda
Clevite Industries	33 Lockwood Road	Milan Ohio	Bridgestone Tire & Rubbr Japan	Rubber, metal suspension parts	3714	1987	15		
Greenville Technology	5755 S.R. 571 East/Box 974	Greenville Ohio	Mariroku Co., Ltd Japan	Plastic injection molded parts	3079	1987	86	116	Honda
1/ Hi Flo		Northwood Ohio	Toray Industries Japan	Plastic molding, interior door panels	3079		25		Mazda
Hisan	1849 Industrial Drive	Findlay Ohio	ITT Higbie (50%) Japan	Brake line tubing	3079	1988	20		Nissan, Honda Mazda

Honda of America Mfg. Inc	12500 Meranda Road	Anna Ohio	Honda Motor Co. Japan	Motorcycle & auto engines	3714	1985	257		Honda
Honda of America Mfg. Inc	12500 Meranda Road	Anna Ohio	Honda Motor Co. Japan	Engines, drivetrains, and components for Civic and Accord models	3714	1990		800	Honda
Honda of America Mfg. Inc	24000 U.S. Route 33	Marysville Ohio	Honda Motor Co. Japan	Metal stampings	3465	1982	3900		Honda
KTH Parts Industries Inc.	1111 North Route 235	St. Paris Ohio	Takao Seisakusho/Honda Japan	Metal stamping and welding	3465	1985	264		Honda
Kern Liebers U.S.A.	P.O. Box 396	Holland Ohio	Kern Liebers West Germany	Seat belt springs	3495	1977	75		TRW, Bendix
Libby-Owens-Ford	811 Madison Ave./P.O. Box 799	Toledo Ohio	Pilkington Brothers Plc. United Kingdom	Automotive glass	3211	1931			GM, Chrysler Nissan, Nummi Toyota
Lucas Girling	7241 Dani Drive	Cincinnati Ohio	United Kingdom United Kingdom	Truck brakes	3714	1983	98		Ford, GM
Luk Incorporated	3401 Old Airport Rd.	Wooster Ohio	Luk GmbH West Germany	Clutches	3493	1977	220		Ford Chrysler
Mason Melco Manufacturing		Ohio	Mitsubishi Electric Japan	Generators and alternators	3694	1988	60	250	
NAPCO	P.O. Box 547	Napoleon Ohio	NAPCO Sweden	Plastic parts	3079	1954	140		Big 3
Neaton Auto Products	975 S. Franklin St.	Eaton Ohio	Nihon Plastics Japan	Steering wheels	3714	1985	159		Honda Nissan
New Sabina Industries	P.O. Box 8	Sabina Ohio	Nippon Seiki Japan	Instrument panels, speedometers	3714	1987	80		Honda
Pioneer Industrial Compon	100 Pioneer Blvd.	Springboro Ohio	Pioneer Electric Corp. Japan	Audio equipment	3651	1986		200	
Showa Aluminum Corp.	10500 O'Day-Harrison Rd.	Mt. Sterling Ohio	Showa Aluminum Mfg. Japan	Air conditioner components	3585	1987	40	200	Honda Subaru-Isuzu
1/ Showa Manufacturing Co.		Sunbury Ohio	Showa Mfg. Co. Ltd. Japan	Shock absorbers	3714	1988	150		Honda
Stanley Electric U.S. Co.	1627 S.R. 142	London Ohio	Stanley Japan	Lighting equipment	3647	1982	86	100	Honda
T.D. Manufacturing	1600 North High Street	Hillsboro Ohio	Toyo Denso Japan	Electrical auto parts	3694	1988	100	350	
T.S. Trim International	Box 384/59 Gender Road	Canal Winchester Ohio	Tokyo Seat Company Japan	Seats, door covers, interior fabric panels	2531	1987	300		American Honda
Tomasco Mukiber Inc.	2001 Courtright Rd.	Columbus Ohio	Masuda Seisakusho Mfg. Japan	Pressed metal parts, engine mountings, bolts, brackets	3465	1987	30		Honda

Trutec Industries, Ltd.	4795 Upper Valley Pike	Urbana Ohio	Nihon Packerizing Co. Ltd Japan	Chemically treated repl. parts		1987	75	Honda U.S. Industry
Volvo-White Truck	1345 N. Main Street	Orrville Ohio	Volvo AB Sweden	Sheet steel & aluminum parts, truck cabs, bracketry	3465	1977	400	Volvo-White Western Star
Allen Bradley TDK Mgntcs.	5900 N. Harrison St.	Shawnee Oklahoma	TDK Japan	Magnets for motors	3499	1973	450	Big 3
Maremont Corp.	P.O. Box 988	Chickasha Oklahoma	Ausuisse Arvin Ind. Switzerland	Shock absorbers	3714	1972	500	Aftermarket Sears
Freightliner	P.O. Box 4027	Portland Oregon	Daimler-Benz West Germany	18 Wheeler truck & truck parts	3711	1947	2200	Freightliner
Johnson Matthey, Inc.	456 Devon Park Drive	Wayne Pennsylvania	Johnson Matthey & Co. Plc United Kingdom	Catalytic converters	3465		360	
Karl Schmidt Corp. (KSG)	151 South Warner Rd./Suite 305	Wayne Pennsylvania	Metallgesellschaft AG West Germany	Pistons, engine components	3592			
Mack Trucks, Inc.	P.O. Box M	Allentown Pennsylvania	Renault France	Heavy & medium trucks, truck parts	3713	1900	2500	Mack
Manley Valve Corp.	P.O. Box 1867	York Pennsylvania	Metallgesellschaft AG West Germany	Valves	3592	1933	155	Aftermarket
1/ The Budd Company	2450 Hunting Park Ave.	Philadelphia Pennsylvania	Thyssen AG West Germany	Auto body parts, stampings	3465	1912		Big 3
Carol Cable Company	P.O. Box 681/249 Roosevelt Ave	Pawtucket Rhode Island	Noranda Mining Canada	Wire and cable	3357			
American Koyo Corp.	P.O. Drawer 967	Orangeburg South Carolina	Koyo Seiko Co., Ltd. Japan	Ball bearings, roller bearings	3562	1975	188	
Bode Corp.	P.O. Box 4399	Spartanburg South Carolina	Gebr Bode West Germany	Door panels, drive systems	3465	1981	50	
Bosch Corp.--Auto Group	P.O. Box 10347	Charleston South Carolina	Robert Bosch GmbH West Germany	Fuel management systems	3714	1973	1500	John Deere Mack, Case Ford, GM
Ina Bearing Co., Inc.	One Ina Drive	Cheraw South Carolina	Ina Waelzhager Schaeffler W.Germany	Needle roller bearings, tripod bearings	3562	1964	700	
MPI Southern Fineblanking	801 N. Main Street	Cowpens South Carolina	Wilhelmsberger MaschinfabW.Germany	Transmissions, stampings, seat components, door, trunk, & hood components	3714	1979	100	Big 3
Mepco/Electra Inc.	6071 St. Andrews Road	Irmo South Carolina	Philips NV Netherlands	Film and variable capacitors	3675	1955	557	Delco Ford
Michelin	P.O. Box 5049	Spartanburg South Carolina	Michelin et Cie France	Truck tires	3011	1978	1500	Aftermarket
Michelin	P.O. Box 308	Sandy Springs South Carolina	Michelin et Cie France	Semi-finished rubber products	3069	1975	1200	Michelin mfg plants

	Michelin	P.O. Box 579	Lexington South Carolina	Michelin et Cie France	Passenger tires	3011	1981	620		Aftermarket
	Michelin	P.O. Box 2846	Greenville South Carolina	Michelin et Cie France	Passenger radial tires	3011	1975	2000		Aftermarket
	Robert Bosch Corp.	P.O. Box 2967	Anderson South Carolina	Robert Bosch GmbH West Germany	Fuel pumps, fuel rails	3714	1985	150		Nissan Chrysler Buick
	Saxonia-Franke of America	P.O. Box 3542	Spartanburg South Carolina	Saxonia Franke GmbH West Germany	Fineblanked parts, fuel injectors, electric fuel pumps	3465	1979	35		Bosch Corp GM
	ABC Group Inc.	400 ABC Blvd.	Gallatin Tennessee	ABC Plastic Molding Canada	Plastic parts, ducts and overflow bottles	3079	1987		100	
	ATC	624 Grassmere Pk. Dr./Suite 17	Nashville Tennessee	Ube Industries (60%) Japan	Plastic composites	3079	1987	4		Nissan
	Beckers Lay-Tech	Springfield Ind. Park	Springfield Tennessee	Beckers Lay-Tech Sweden	Noise controls & trim products	3714	1987		150	Nissan
1/	Bendix-Jidosha Kiki Corp.	375 Belvedere Dr.	Gallatin Tennessee	Jidosha Kiki Co. Japan	Vacuum power brake boosters	3714	1987		300	Nissan
	Bridgestone, USA	Tire Mfg. Group/P.O. Box 3000	LaVergne Tennessee	Bridgestone Corp. Japan	Heavy duty truck radial tires	3011	1983	1100		Firestone
	Budd Company, The	506 Milligan Highway	Johnson City Tennessee	Thyssen Bornemisza West Germany	Brake hubs, drums, and discs	3714	1980	400		Big 3 Dana
	CKR Industries	Route 3/Baxter Lane	Winchester Tennessee	Kinugawa Rubber Ltd.(45%)Japan	Rubber & plastic sealers, weatherstripping	3069	1986	97		Nissan
	Calsonic Manufacturing	P.O. Box 350/305 Stanley Blvd.	Shelbyville Tennessee	Nihon Radiator/Calsonic Japan	Air conditioning systems, exhaust assemblies	3585	1983	502		Nissan, Mazda Ford, GM
	Calsonic Yorozu	Box 369	McMinnville Tennessee	Yorozu Motor Japan	Stamped metal parts	3465	1988	50	135	Nissan Calsonic
	Dominion Auto Accessories	P.O. Box 676	Sevierville Tennessee	Dominion Auto Accessories Canada	Rear view mirrors	3231	1978	280		GM Chrysler
	Ikeda Interior Systems	1168 Park Avenue	Murfreesboro Tennessee	Ikeda Bussan Ltd.(51%) Japan	Interior parts	3714	1987	25		Nissan Honda
	Kantus Corp.	P.O. Box 799/201 Barret Pkwy.	Lewisburg Tennessee	Kanto-Seiki Japan	Plastic instrument panels, radiator grilles, consoles, dashboard pads	3714	1985	200		Nissan, Johnson ControlMatsushi ta
	M Tek	P.O. Box 545	Manchester Tennessee	Kasai Kogyo Japan	Indoor car panels & sun visors	3714	1987	40	80	Nissan
	Mahle Inc.	Highway 11 East, Cedar Creek Rd	Morristown Tennessee	Mahle GmbH West Germany	Pistons	3592	1978	640		GM, Chrysler

Nissan Motor Mfg.	812 Nissan Drive	Smyrna Tennessee	Nissan Motor Co. Japan	Light trucks & cars	3711	1982	3500		Nissan
Nuturn	1 Grisley Lane	Smithville Tennessee	Newall-Turner United Kingdom	Brake linings	3714	1979	350		
Recticel Foam Corp.	P.O. Box 1197	Morristown Tennessee	PRB Belgium	Seats	2531	1960	358		Big 3
Remington Industries	P.O. Box 271	Delano Tennessee	Canmark/Carpet Queen Canada	Auto floor mats and carpet	2271	1986	24		
Robert Shaw Controls	206 Industrial Drive	Carthage Tennessee	Siebe Plc. United Kingdom	Thermostats, emission control devices	3822	1986	1553		Big 3
Teksid	Route 7, Box 319	Dickson Tennessee	Teksid,STA,Italia,Inc. Italy	Aluminum cylinder heads	3714	1987	100		Oldsmobile
Tennex Industries	855 West College Street	Murfreesboro Tennessee	Tsuchiya Manuf. Co. Ltd. Japan	Air cleaners, air & fuel filters	3599	1988	45	200	Nissan, GM Honda Saturn
Tridon	I-24 & Almaville Rd.	Smyrna Tennessee	Tridon Ltd. Canada	Hose clamps, flashers, turn signals, windshield wipers	3714	1977	276		Foreign plants,Autoshac k,Ford Nissan, GM
Yamakawa Mfg. Corp.	P.O. box 799	Portland Tennessee	Yamakawa Industrial Co. Japan	Pressed metal parts, subassemblies	3465	1987	80		Nissan
American Yazaki	25 Butterfield Trail	El Paso Texas	Yazaki Corp. Japan	Wiring harnesses	3714	1985	25		Nissan Ford
Nippon Pigment	10900 Strang Rd.	LaPorte Texas	Nippon Pigment Ltd. Japan	Color compounds		1985	30		Honda Resin Mfrs.
Sanden Int'l USA Corp.	10710 Sanden Drive	Dallas Texas	Sanden International Japan	Components for a/c systems compressors, fans, evaporator coils	3585	1981	200		Big 3 AMC
Virginia KMP	4100 Platinum Way	Dallas Texas	Laiburg Holding Co. Norway	Components for a/c units	3585	1975	100		Everco Four Seasons
Wynn-Kiki Inc.	9320 Southwest Drive	Fort Worth Texas	Diesel Kiki Japan	Condensors for cooling units	3585	1984	150		Mazda
Auto. Industries of VA	P.O. Box 181	Strasburg Virginia	Redpath Industries Ltd. Canada	Plastic automotive components	3079	1987	800		Ford Chrysler
ITT-Alfred Teves, Inc.	P.O. Box 40/111 West Lovers La	Culpepper Virginia	Alfred Teves GmbH West Germany	Vacuum booster, front disc brake calipers	3714	1977	30		Ford Chrysler
Kaesor Compressors, Inc.	PO Box 7416/239 Industrial Dr.	Fredericksburg Virginia	Kaesor Kompresoren GmbH West Germany	Assembly of air compressors	3714	1984	25		
VDO Yazaki Corp.	P.O. Box 2897	Winchester Virginia	VDO Adolph Schindling AG West Germany	Instrument clusters	3714	1977	352		Big 3, Harley VW of America Navistar

Valeo Auto Parts, Inc.	P.O. Box 9368 Briarfield Sta.	Hampton Virginia	Valeo Group France	Auto radiators, heater cores, clutches	3714	1980	250	Big 3 VW of America AMC
Volvo-White Truck Corp.	P.O. Box 1126	Dublin Virginia	Volvo AB Sweden	Trucks	3713	1981	1000	Volvo
NA Philips Lighting Corp.	Route 3/P.O. Box 505	Fairmont West Virginia	North American Philips Netherlands	Light bulbs, headlights	3647	1941	1000	Deere GM (potential) Atlas
Borg Instruments, Inc.	501 Enterprise Drive	Delavan Wisconsin	Diehl GmbH & Co. West Germany	Clocks	3873	1940	200	Delco, AMC Ford, Honda Chrysler
Goetz Corp. of America	P.O. Box 190	Schofield Wisconsin	Goetz AG West Germany	Piston rings	3592	1921	200	GM
Muskegon Piston Ring Co.	P.O. Box 743	Manitowoc Wisconsin	Goetz AG West Germany	Piston rings	3592	1981	200	GM, Chrysler Caterpillar Cummins
Reinz Wisconsin Gasket	P.O. Box 23185	Milwaukee Wisconsin	Reinz Dichtungs GmbH West Germany	Gaskets	3293	1943	300	Big 3

Table G-1
Automotive related products:
Foreign owned U.S. manufacturing facilities,
by state

Manufacturer	Address	City and state	Parent and location	Items manufactured	SIC code	Year of initial production	Current number of employees	Anticipated employment at capacity	Major customers
JAI Mold & Machine Corp.	1303 Southfield Drive	Decatur Alabama	JAI Mold & Machine Corp. Canada	Tire molds	3544	1972	28		Goodrich Bridgestone Firestone
New United Motor Mfg. Inc	45500 Fremont Blvd.	Fremont California	Toyota (50%) Japan	Chevrolet Nova model cars Toyota Corolla SX	3711	1984	2500		Chevrolet Toyota
Nippondenso of L.A., Inc.	3900 Via Oro	Long Beach California	Nippondenso (80%) Japan	Air conditioning system ass'y alternators (remfg.), starters (remfg.)	3585	1984	250		
Fischer Technology Inc.	750 Marshall Phelps Road	Windsor Connecticut	Helmut Fischer GmbH & Co. West Germany	Coating thickness testers	3829	1979	30		Big 3 Diamond-Star Mitsubishi
Robert Bosch Sales Corp.	1560 Thornton Rd., Highway 6	Lithia Springs Georgia	Robert Bosch GmbH West Germany	Starters (remfg), alternators (remfg)	3694	1985	115		Aftermarket
1/ Alcan Toyo American Inc.	P.O. Box 920	Joliet Illinois	Toyo Aluminum KK Japan	Aluminum paint	2851	1988			
Morton Thiokol Inc.	5005 Bernard Mill Road	Ringwood Illinois	Yokohama Rubber Co. Japan	Windshield sealants	2891	1988	240		
United Globe Nippon Inc.	1001 State Street	Chicago Heights Illinois	UniNTS Japan	Sound control material, protective coatings, trunk linings	3079	1976	60		Diamond-Star American Honda
1/ Subaru-Isuzu	State Road 38 & I-6	Lafayette Indiana	Fuji Heavy Industries Japan	Auto & truck assembly	3711	1989	1700		
Certain Teed Products	P.O. Box 448	Corbin Kentucky	Saint-Gobjain-Pont France	Auto insulation, indust. fiberglass insulation	3079	1973	425		Big 3, AMC
EMS Togo	Bill Bryan Boulevard, Site 14B	Hopkinsville Kentucky	EMS Togo Switzerland	Auto body undercoatings	2851	1987	8		Nissan
Trinity Industrial Corp.	321 Triport Road	Georgetown Kentucky	Trinity Industrial Corp. Japan	Auto spray painting systems	3563	1987	15	45	Toyota
Mercedes Benz of N. Amer.	1 Mercedes Drive	Belcamp Maryland	Mercedes Benz West Germany	Prepares autos for dealers	7542	1983	84		Mercedes Benz
Akzo Coatings America	30 Brush Street	Pontiac Michigan	Sikenns Netherlands	Automotive paints	2851		120		Big 3 AMC Navistar

BASF	3301 Bourke	Detroit Michigan	Base F & S AG West Germany	Auto & industrial enamels, lacquers, synthetic resins, plastics & elastomers	2851		390		Big 3
FEC Incorporated	599 Mandoline	Madison Heights Michigan	Daiichi Dentsu Japan	Electronic fasting systems (used in ass'y of engines)	3623	1983	30		Ford GM
Sanyo Machine Works	950 Rochester Road	Rochester Hills Michigan	Sanyo Kiko Japan	Assembly equipment	3541	1987	15	100	GM
M.A.N. Truck & Bus Corp.	Highway 70 West	Cleveland North Carolina	M.A.N. AG West Germany	Articulated buses, 40-foot transit buses	3713	1981	400		Transit Auth. of Seattle & Chicago
Color & Composite Tech	Box 747	Sidney Ohio	Toyo Inc./Mitsui Toatsu Japan	Color concentrates, plastic compounds	3079	1987	16		Honda
Honda of America Mfg. Inc	24000 U.S. Route 33	Marysville Ohio	Honda Motor Co. Japan	Automotive assembly	3711	1982	3900		Honda
Le Blond Makino Machine	2690 Madison Road	Cincinnati Ohio	Makino Milling Co. Ltd. Japan	Tools, flexible mfg. systems	3541	1981	455		American Honda GM
1/ Mid-West Mold		Batavia Ohio	Tatematsu Mold Japan	Plastic injection molds	3079		30		
Sachs	909 Westlake Drive	Westlake Ohio	Victor Allen Sachs Inds. West Germany	Clutch assembly	3714	1980	20		Chrysler, GM VW
Teikuro	310 E. Columbia Road	Springfield Ohio	Teikuro Japan	Chrome plating of steel, stamping dies	3544	1988	60	300	Stamping plants
1/ Arco/JSP Co.	394 Frankfurt Rd.	Monaca Pennsylvania		Shock absorption material	3069				
Volkswagen of America Inc	P.O. Box VW	New Stanton Pennsylvania	Volkswagenwerk AG West Germany	Automobile assembly	3711	1978	2500		Volkswagen
Mack Trucks Inc.	P.O. Box 389	Winsboro South Carolina	Renault France	Truck bodies (assembly)	3713	1987	350	950	
NKC America, Inc.	1584 Brooks Road East	Memphis Tennessee	Nakanishi Metal Works Japan	Conveyor equipment, transfer equipment	3535	1980	100		Nissan Volkswagen Chrysler
Wyko of Tennessee	Highway 411 South	Greenback Tennessee	Wyko Group Ltd. United Kingdom	Drums (for building tires)	2655	1978	32		Goodwin, Dunlop Goodyear Armstrong
1/ General Tire	160 North Cotton	Odessa Texas	Continental AG West Germany	Retreads tires	7534	1984	3		Aftermarket
1/ Volvo-White Truck Corp.	1000 West 33rd Street	Ogden Utah	Volvo AB Sweden	Assembles class 8 Trucks	3711	1974	341		Volvo

1/ Company information not verified by USITC staff.

APPENDIX H

U.S. Imports of Automotive Parts under the Generalized System of Preferences

Table H-1
Automotive parts: Duty-free imports under GSP, by sources, 1982-86, January-September 1986, and January-September 1987

(In thousands of dollars)

Source	1982	1983	1984	1985	1986	January-September— 1986	January-September— 1987
Argentina	4,154	2,848	5,529	6,948	10,593	7,823	9,131
Belize	-	-	804	4,212	1,656	1,656	-
Brazil	191,212	119,682	162,675	151,722	98,437	77,373	57,672
Chile	123	313	255	1,079	528	152	2,100
Colombia	2,347	349	1,249	866	859	659	810
Costa Rica	17	16	31	48	295	165	535
Ecuador	-	-	-	-	34	34	-
Guatemala	5	4	8	5	76	59	76
Hong Kong	6,678	12,439	3,199	11,024	13,401	9,789	10,447
India	4,314	5,082	11,054	18,490	18,020	12,441	12,055
Israel	19,360	20,304	24,147	23,170	15,315	11,938	11,618
Kenya	-	-	-	92	246	49	1,888
South Korea	25,507	22,111	29,981	44,247	72,753	52,037	73,894
Macao	2	3	17	2	72	-	258
Malaysia	496	1,156	1,462	856	863	530	1,728
Mali	-	-	-	-	1	3	-
Malta and Gozo	-	-	47	-	181	149	207
Mexico	60,068	40,983	90,847	93,980	117,813	82,460	130,362
Morocco	2	1	2	10	819	402	1,267
Peru	1,466	558	409	1,701	1,482	1,180	991
Philippines	421	404	1,161	614	417	326	622
Portugal	1,286	1,101	1,419	3,425	379	360	19
Romania	448	693	1,390	1,130	893	666	262
Senegal	-	-	-		398	69	133
Singapore	23,637	24,807	33,871	38,779	35,421	27,902	27,108
Sri Lanka (Ceylon)	11	-	-	-	116	116	28
Swaziland	-	-	-	-	27	27	52
Taiwan	101,068	162,307	106,904	73,278	94,825	71,178	74,161
Thailand	501	775	565	1,917	3,588	2,883	5,420
Tunisia	-	-	-	53	79	79	2
Turkey	50	40	48	15	2,530	1,793	5,584
Uruguay	90	90	620	358	92	92	124
Venezuela	7,700	8,491	3,543	6,516	10,245	7,146	10,506
Yugoslavia	6,042	10,123	11,860	9,942	12,865	9,160	12,859
Zimbabwe (Rhodesia)	-	-	-	336	934	572	1,114
Total.other	245	439	905	247	129	99	689
World	457,249	435,119	504,002	495,060	516,380	381,367	453,722

Source: Compiled from official statistics of the U.S. Department of Commerce.

APPENDIX I

U.S. Imports of Automotive Parts under Tariff Item 807.00

Table I-1

Automotive parts: U.S. imports, by sources, 1982-86, January-September 1986, and January-September 1987

(In thousands of dollars)

Source	1982	1983	1984	1985	1986	January-September— 1986	1987
Australia	6	2	10	6	3	2	1,899
Barbados	4	4	3	-	144	80	-
Belgium and Luxembourg	-	213	918	1,421	923	923	1,146
Brazil	68,569	121,855	163,545	202,090	152,891	116,856	201,602
Canada	58,091	51,969	90,827	81,539	226,329	67,281	2,810,732
Christmas Island	-	-	-	-	689	689	-
Costa Rica	72	155	168	4	38	15	41
Dominican Republic	60	58	115	1,455	4,099	2,544	4,157
France	109,766	140,897	177,345	204,605	296,970	212,540	221,496
Germany, West	2,716	71,627	149,779	197,919	310,477	221,931	251,462
Haiti	6,256	7,127	10,750	9,307	5,429	4,790	635
Hong Kong	6,252	9,386	9,942	14,248	9,114	8,382	2,456
Hungary	-	-	-	-	7,781	5,571	16,428
Ireland	58	19	41	3,511	336	332	13
Israel	-	-	-	-	84	-	-
Italy	-	12	2,573	1	1,389	90	74,486
Japan	15,270	27,377	77,911	180,427	173,715	120,943	145,527
Kiribati (Gilbert Isl)	-	-	-	-	2	-	-
Korea, South	130	9	10	978	3,444	3,224	10,632
Malaysia	369	17	15	353	351	341	896
Mexico	479,635	1,031,622	1,267,095	1,827,962	1,948,242	1,485,915	1,569,460
Montserrat	-	-	1	114	73	72	38
Morocco	-	-	-	-	6	-	-
Mozambique	-	-	-	179	127	66	723
Netherlands	1,171	290	1,383	148	60	60	282
Panama	-	-	-	-	42	14	-
Philippines	454	1	4,180	8,827	16,320	8,757	20,320
Seychelles	-	-	-	-	28	28	-
Singapore	2,927	2,177	4,984	9,951	7,705	5,099	18,184
Swaziland	-	-	-	-	7	7	-
Sweden	-	21	119	148	557	309	2,761
Switzerland	-	8	-	-	14	9	14
United Kingdom	9,436	17,945	37,088	42,083	11,809	11,641	5,331
Total other	116	21	5,616	741	6	5	215
World	761,746	1,482,943	2,032,236	2,843,246	3,244,455	2,327,525	5,407,897

Source: Complied from official statistics of the U.S. Department of Commerce.

APPENDIX J

U.S. Imports of Automotive Parts into Foreign-Trade Zones

Table J-1
Automotive parts: Imports into U.S. foreign trade zones, by sources, 1982-86, January-September 1986, and January-September 1987

(In thousands of dollars)

Source	1982	1983	1984	1985	1986	January-September— 1986	January-September— 1987
Australia	-	-	5,283	7,489	5,685	4,498	5,235
Austria	-	571	637	388	387	76	133
Belgium and Luxembourg	-	30	323	749	669	631	138
Belize	-	-	-55	135	469	469	-
Brazil	896	7,370	4,656	79,918	180,740	122,638	194,845
Canada	6,925	8,096	8,587	12,296	19,944	14,498	14,914
China	406	-6	5	-145	161	162	462
France	78,696	284,451	288,857	226,685	131,357	95,707	94,932
Germany, West	55,527	76,015	71,373	112,214	83,001	55,577	74,407
Hong Kong	67	-95	131	651	537	301	51
Israel	-	-48	-	7	114	-	1
Italy	46	242	2,050	1,051	8,592	5,494	17,197
Japan	41,012	391,566	811,158	993,897	1,819,874	1,255,407	2,048,141
Korea, South	13	-765	1,265	750	1,429	846	1,503
Mexico	28,291	47,729	79,116	261,054	342,631	235,976	486,960
Netherlands	-651	49	261	102	207	136	262
Singapore	1,114	-178	485	1,820	2,347	2,020	2,125
Spain	77	665	279	99	124	334	905
Sweden	29	131	313	716	489	424	162
United Kingdom	3	2,439	7,461	12,103	4,384	3,141	9,355
Total other	-1,575	356	2,234	1,114	-2,024	-2,694	-812
World	224,876	819,618	1,293,421	1,713,098	2,601,117	1,795,661	2,950,916

Source: Complied from official statistics of the U.S. Department of Commerce.

APPENDIX K

U.S.-Canada Free Trade Agreement

Automotive Trade

The Parties have agreed to:

- o eliminate original equipment tariffs over 10 years, eliminate tariffs on tires over 10 years, and eliminate aftermarket parts tariffs over 5 years;

- o phase-out the embargo on the import of used cars into Canada over 5 years;

- o terminate duty waivers linked to exports to the other party upon implementation of the agreement;

- o not grant other automotive duty waivers and not expand existing arrangements; and

- o change duty drawback and Foreign Trade Zones consistent with the general provisions of the Agreement.

Canada has agreed to terminate production based duty waivers by 1996 or according to the schedules negotiated between the companies concerned and the Government of Canada, whichever is sooner.

Canada has agreed that no additional companies producing vehicles in Canada may qualify as eligible manufacturers under provisions similar to those in the Auto Pact. The United States undertakes not to introduce comparable programs without consultations.

The parties have agreed to apply a new rule of origin for vehicles traded under the provisions of the FTA Agreement based on 50 percent of direct cost of manufacturing.

The parties recognize the continued importance of automotive trade and production for the respective economies of the two countries and the need to ensure that the industry in both countries should prosper in the future. As the worldwide industry is evolving very rapidly, the two Governments have agreed to establish a Blue Ribbon Panel to assess the state of the North American industry and to propose public policy measures and private initiatives to improve its competitiveness in domestic and foreign markets. The Governments of the United States and Canada also agreed to cooperate in the Uruguay Round of multilateral trade negotiations to create new export opportunities for North American automotive products.

Canada and the United States each shall endeavor to administer the Auto Pact in the best interests of employment and production in both countries.