Automobiles and Light-Duty Trucks: Industry Profile

Final Report

Prepared for

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LIST OF ABBREVIATIONS

AAMA	American Automobile Manufacturers Association
ABS	advanced braking systems
CPI	consumer price index
CR4s	four-firm concentration ratios
CR8s	eight-firm concentration ratios
EIA	economic impact analysis
EPA	U.S. Environmental Protection Agency
HAP	hazardous air pollutants
HHIs	Herfindahl-Hirschman indexes
ISEG	Innovative Strategies and Economics Group
LDT	light-duty truck
MSRP	Manufacturers Suggested Retail Price
NAFTA	North American Free Trade Agreement
NAICS	North American Industry Classification System
NESHAP	national emission standards for hazardous air pollutants
NUMMI	New United Motor Manufacturing, Inc.
OAQPS	Office of Air Quality Planning and Standards
SBA	Small Business Administration
SIC	Standard Industrial Classification

SECTION 1

INTRODUCTION

The U.S. Environmental Protection Agency's (EPA's) Office of Air Quality Planning and Standards (OAQPS) is compiling information on plants that assemble automobiles and light-duty trucks (LDTs) as part of its responsibility to develop national emission standards for hazardous air pollutants (NESHAP) under Section 112 of the 1990 Clean Air Act Amendments.[1] The NESHAP will limit air emissions from the coating process for automobiles and LDTs and is scheduled to be proposed in early 2001. The Innovative Strategies and Economics Group within OAPQS is responsible for developing an economic impact analysis (EIA) that evaluates the economic impacts associated with the regulatory options considered for this NESHAP. This industry profile of the automobile and LDT assembly industry provides information that will be used to develop and implement the EIA methodology.

Although the NESHAP will most directly affect facilities that use coatings in automobile and LDT assembly operations, the rule will also indirectly affect the coatings manufacturers. For the automobile and LDT assembly industry, the relevant Standard Industrial Classification (SIC) and North American Industry Classification System (NAICS) codes are

- SIC 3711: Motor Vehicle and Passenger Car Bodies and
- NAICS 33611: Automotive and Light Duty Motor Vehicle Manufacturing.

Within the five-digit NAICS classification, the following six-digit NAICS codes are applicable:

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[1]Automobiles are defined as vehicles designed to carry up to seven passengers but do not include sport utility vehicles (SUVs), vans, or trucks. Light duty trucks are defined as vehicles not exceeding 8,500 pounds that are designed to transport light loads of property and include SUVs and vans (AAMA/AIAM/NPCA, 2000).

- NAICS 336111: Automobile Manufacturing and
- NAICS 336112: Light Truck and Utility Vehicle Manufacturing.

These codes include not only automotive assembly plants but also plants that manufacture automotive vehicle bodies. For the indirectly affected coatings manufacturing industry, the relevant SIC and NAICS codes are

- SIC 2851: Paints, Varnishes, Lacquers, Enamels, and Allied Products;
- SIC 2891: Adhesives and Sealants; and
- NAICS 3255: Paint, Coating, and Adhesive Manufacturing.

Within the four-digit NAICS classification, the following six-digit NAICS codes are applicable:

- NAICS 325510: Paint and Coating Manufacturing and
- NAICS 325520: Adhesive Manufacturing.

These codes include facilities that manufacture coatings for a variety of industries in addition to the automobile and LDT assembly industry.

The domestic automobile industry is a large, mature industry, but its size is expected to increase as foreign producers locate additional production facilities in the United States, and the LDT market continues to remain strong. In 1998 and 1999, the automobile and LDT assembly industry was comprised of 66 establishments, which are owned by 14 domestic and foreign companies and employ more than 160,000 workers. The coating operations of all of these facilities are major sources of hazardous air pollutant (HAP) emissions.[2] The majority of HAP emissions from the coating process are released in the priming and finishing operations. However, some emissions also occur during cleaning operations and miscellaneous activities such as applying adhesives. Some of these facilities also coat miscellaneous metal parts and miscellaneous plastic parts, which will be regulated under separate NESHAP rules.

This industry profile is organized into four additional sections. Section 2 describes the affected production process, inputs, outputs, and costs of production. Section 3 describes the industry organization, including market structure, manufacturing plants, and parent

[2] A major source of HAP emissions is defined as a facility that emits, or has the potential to emit, 10 or more tons of any HAP or 25 or more tons of any combination of HAPs.

company characteristics. Section 4 describes the uses and consumers of automobiles and light trucks. Finally, Section 5 provides market data on the automobile and light truck industry, including market volumes, prices, and projections. While the industry profile focuses on the automobile and light duty truck assembly industry, information is also provided on the indirectly affected coatings industry.

SECTION 2

SUPPLY-SIDE OVERVIEW

In this section, the supply side of the coating process for the automobile and LDT assembly industry is discussed. First, the production process for coating vehicles is described, including inputs used in the production process and final outputs produced. Second, the characteristics of the coatings are described. Finally, data on the costs of production are presented with particular emphasis on the costs of coatings.

2.1 Production Process

Motor vehicle assembly plants combine automotive parts from equipment manufacturers to produce finished vehicles for sale to consumers. Once they have assembled the components of the vehicle body, the body goes through a series of coating operations. In this section, the coating process and the characteristics of the coatings used are described.

2.1.1 Coating Process

As illustrated in Figure 2-1, the coating process for automobiles and LDTs consists of the following operations:

Step 1: surface preparation operations—cleaning applications, phosphate bath, and chromic acid bath;

Step 2: priming operations—electrodeposition primer bath, joint sealant application, antichip application, and primer-surfacer application; and

Step 3: finishing operations—color coat application, clearcoat application, and any painting necessary for two-tone color or touch-up applications (EPA, 1995).

Most releases of HAPs occur during the priming operations (Step 2) and the finishing operations (Step 3); thus, these steps are described in more detail here, followed by a description of the final vehicle assembly activities. However, the order and the method by

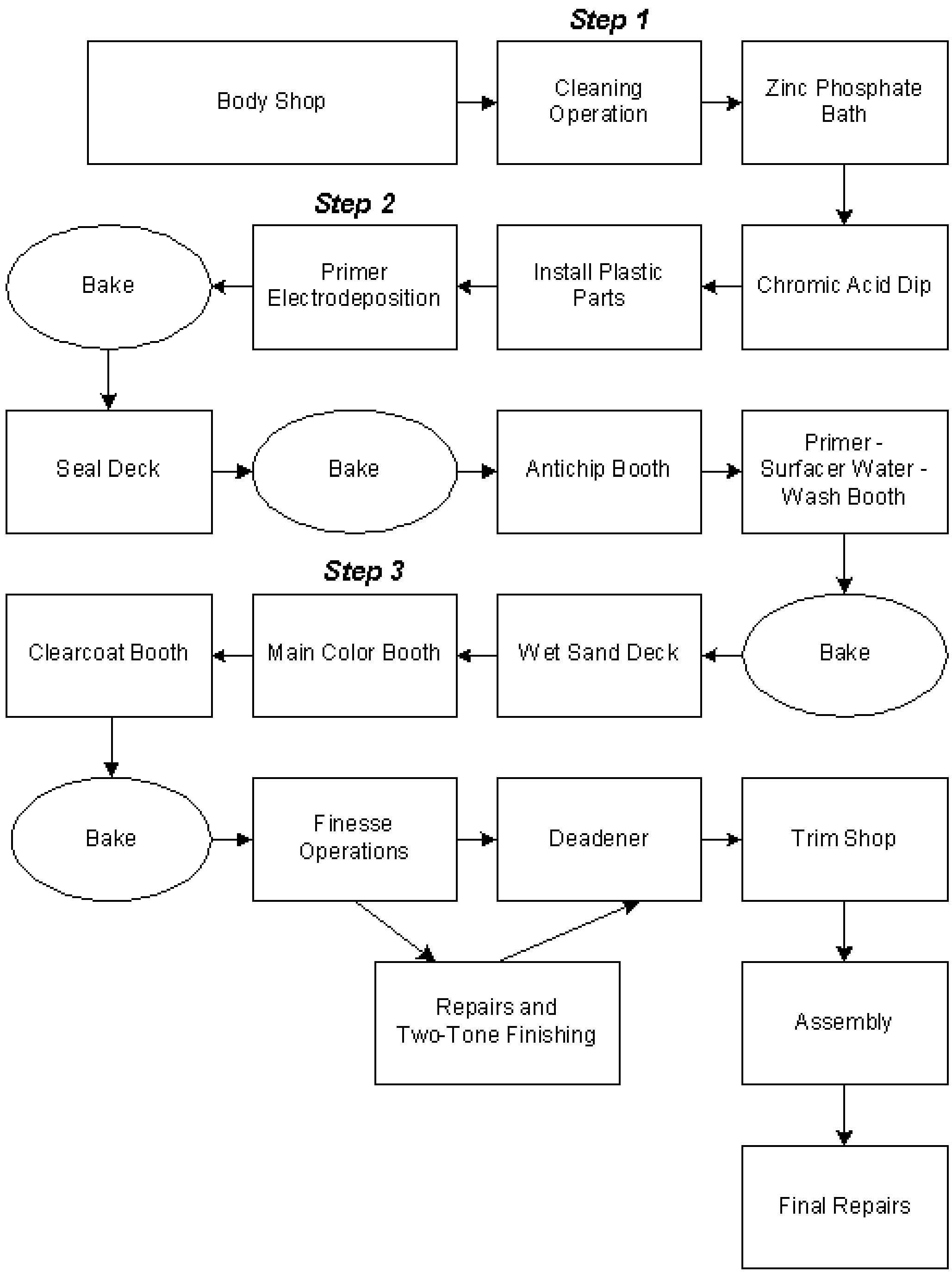

Figure 2-1. Car Painting Process

Sources: American Automobile Manufacturers Association. 1998. *Motor Vehicle Facts and Figures 1998.* Detroit: AAMA.

U.S. Environmental Protection Agency. September 1995. *Profile of the Motor Vehicle Assemble Industry*. EPA 310-R-95-009. Washington, DC: U.S. Government Printing Office.

which these operations occur may vary for individual facilities. Once completed, the coating system typically is as shown in Figure 2-2.

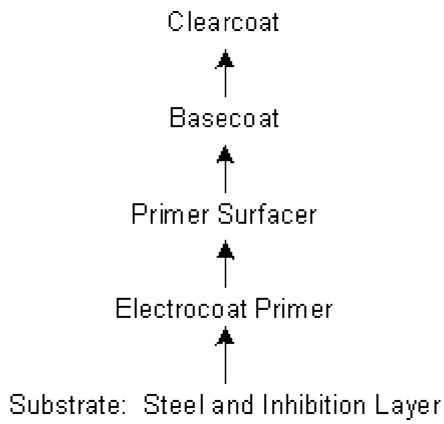

Figure 2-2. Priming Operations
Adapted from: Poth, U. 1995. "Topcoats for the Automotive Industry." *Automotive Paints and Coatings*, G. Fettis, ed. New York: VCH Verlagsgesellschaft mbH.

2.1.1.1 Primary Operations

After the body has been assembled, anticorrosion operations have been performed, and plastic parts to be finished with the body are installed, priming operations begin (Step 2). The purpose of the priming operations is to further prepare the body for finishing by applying various layers of coatings designed to protect the metal surface from corrosion and assure good adhesion of subsequent coatings.

First, a primer coating is applied to the body using an electrodeposition method in which a negatively charged auto body is immersed in a positively charged bath of primer for approximately 3 minutes (EPA, 1995). The coating particles migrate toward the body and are deposited onto the body surface, creating a strong bond between the coating and the body to provide a durable coating (EPA, 1995). Once deposition is completed, the body is rinsed in a succession of individual spray and/or immersion rinse stations and then dried with an automatic air blow-off (Vachlas, 1995). Following the rinsing stage, the deposited coating is cured in a electrodeposition curing oven for approximately 20 minutes at 350 to 380°F (EPA, 1995).

Next, the body is further water-proofed by sealing spot-welded joints of the body. A sealant, usually consisting of polyvinyl chloride and small amounts of solvent, is applied to the joints. The body is again baked to ensure that the sealant adheres thoroughly to the spot-welded areas (EPA, 1995).

After water-proofing, the body proceeds to the antichip booth. The purpose of antichip primers is to protect the vulnerable areas of the body, such as the door sills, door sides, under-body floor pan, and front and rear ends, from rocks and other small objects that can damage the finish. In addition, antichip primers allow for improved adhesion of the top coat. In the process, a substance usually consisting of a urethane or an epoxy ester resin, in conjunction with solvents, is applied locally to certain areas along the base and sill sections of the body (EPA, 1995; Vachlas, 1995).

The final step in the priming operation is applying the primer-surfacer coating. The purpose of the primer-surfacer coating is to provide "filling" or hide minor imperfections in the body, provide additional protection to the vehicle body, and bolster the appearance of the topcoats (Ansdell, 1995). Unlike the initial electrodeposition primer coating, primer-surfacer coatings are applied by spray application in a water-wash spray booth. The primer-surfacer consists primarily of pigments, polyester or epoxy ester resins, and solvents. Because of the composition of this coating, the primer-surfacer creates a durable finish that can be sanded. Primer-surfacers can be color-keyed to specific topcoat colors and thus provide additional color layers in case the primary color coating is damaged. Since water-washed spray booths are usually used, water that carries the overspray is captured and processed for recycling (Poth, 1995; EPA, 1995). Following application of the primer-surfacer, the body is baked to cure the film, control solvent releases, minimize dirt pickup, and reduce processing time.

2.1.1.2 Finishing Operations

After the primer-surfacer coating is baked, the body is then sanded, if necessary, to remove any dirt or coating flaws. The next step of the finishing process is the application of the topcoat, which consists of a color basecoat and a clearcoat. This is accomplished in a manner similar to the application of primer-surfacer in that the coatings are sprayed onto the body. In addition to pigments and solvents, aluminum or mica flakes can be added to the color basecoat to create a finish with metallic or reflective qualities. Instead of baking, the color basecoat may be allowed to "flash off," meaning that the solvent evaporates without the application of heat (EPA, 1995).[1] The pigments used in both primers and paints are an integral part of the paint formulation in that they provide the color of the coatings. The

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[1] In some facilities, an infrared heated flash zone is used to evaporate the solvent (Green, 2000c).

pigmented resin forms a coating on the body surface as the solvent dries. The chemical composition of a pigment varies according to its color, as illustrated in Table 2-1.

Table 2-1. Chemical Components of Pigments Found in Automobile and LDT Paint

Pigment Color	Chemical Components
White	Titanium dioxide, white lead, zinc oxide
Red	Iron oxides, calcium sulfate, cadmium selenide
Orange	Lead chromate-molybdate
Brown	Iron oxides
Yellow	Iron oxides, lead chromate, calcium sulfide
Green	Chromium oxide, copper, phosphotungstic acid, phosphomolybdic acid
Blue	Ferric ferrocyanide, copper
Purple	Manganese phosphate
Black	Black iron oxide
Metallic	Aluminum, bronze, copper, lead, nickel, stainless steel, silver, powdered zinc

Source: U.S. Environmental Protection Agency. September 1995. *Profile of the Motor Vehicle Assembly Industry*. EPA310-R-95-009. Washington, DC: U.S. Government Printing Office.

After the color basecoat is allowed to air dry, the final clearcoat is applied. The purpose of the clearcoat is to add luster and durability to the vehicle finish and protect the total coating system against solvents, chemical agents, water, weather, and other environmental effects. This coating generally consists of acrylic resins or melamine resins and may contain additives. Once applied, the vehicle body is baked for approximately 30 minutes. Following the baking of the clearcoat, the body is inspected for imperfections in the finish, and minor flaws are removed through light sanding and polishing and without any repainting at this stage (Ansdell, 1995; EPA, 1995).

2.1.1.3 Final Assembly Activities

Once the clearcoat is baked, deadener, which is a solvent-based resin of tar-like consistency, is applied to certain areas of the automobile underbody to reduce noise. In addition, anticorrosion wax is applied to other areas, such as the inside of doors, to further seal the automobile body and prevent moisture damage. Hard and soft trim are then installed on the vehicle body. Hard trim, such as instrument panels, steering columns, weather stripping, and body glass, is installed first. The car body is then passed through a water test where, by using phosphorus and a black light, leaks are identified. Soft trim, including seats, door pads, roof panel insulation, carpeting, and upholstery, is then installed (EPA, 1995).

Next, the automobile body is fitted with the gas tank, catalytic converter, muffler, tail pipe, bumpers, engine, transmission, coolant hoses, alternator, and tires. The finished vehicle is then inspected to ensure that no damage has occurred as a result of the final assembly stages. If there is major damage, the entire body part may be replaced. However, if the damage is minor, such as a scratch, paint is taken to the end of the line and applied using a hand-operated spray gun. Because the automobile cannot be baked at temperatures as high as in earlier stages of the finishing process, the paint is catalyzed prior to application to allow for faster drying at lower temperatures. Approximately 2 percent of all automobiles manufactured require this touch-up work (EPA, 1995).

2.1.2 Input Characterization

Coatings inputs are combined with other inputs, such as labor, capital, and energy, to complete the coating process for automobiles and LDTs. The coatings used in vehicle assembly that the NESHAP will likely affect are the electrostatic deposition liquid, the primer surface coating, the basecoat, and the clearcoat. Table 2-2 shows the coatings and their physical state, their purpose, and if they release HAPs.

As the table indicates, powder coatings used for primer surface coating do not release significant HAPs, but their liquid counterparts may (Green, 2000b); thus, automotive and LDT assembly plants may consider substituting powder coatings for liquid coatings in addition to installing control equipment to comply with the NESHAP. However, powder coatings tend to be more costly to use than liquid coatings because the technology has not been developed to allow powder to be applied as thinly as liquid coating. In particular, "the normal liquid film build-up for a clearcoat is 2 mils while for a powder clearcoat it takes 2.5

Table 2-2. Properties of Coatings Used in Automobile and LDT Assembly Facilities

Coating	Purpose	Physical State	Significant HAP Releases[a]
Cleaning agents	To clean spray baths and application equipment and purge lines between color changes	Solvent	Primarily specific aromatics (toluene and xylene), blends containing aromatics, MIBK
Electrodeposition primer coating	To prepare body for antichip and other preliminary coatings	Liquid—waterborne	Primarily glycol ethers, methanol, MIBK, xylene, MEK
Primer surface coating	To prepare body for paint	Liquid—solventborne	Glycol ethers, methanol, xylene, ethylbenzene, formaldehyde, MEK
		Powder	None
Basecoat	To add color	Liquid—waterborne or solventborne	1,2,4 trimethyl benzene, ethylbenzene, xylene, toluene, aromatic 100, naptha, formaldehyde, mineral spirits, glycol ethers, MEK, methanol
Clearcoat	To protect the color coat	Liquid—solventborne	Ethyl benzene, xylene, 1,2,4 trimethyl benzene, aromatic solvent 100, napthol spirits, MIBK, aromatic solvent, formaldehyde
		Powder[b]	None

[a] Although liquid coatings may be associated with significant HAP releases, all can be reformulated using non-HAP chemicals. MIBK = methyl isobutyl ketone; MEK = methyl ethyl ketone.
[b] Powder clearcoats are currently not used in the United States.

Sources: Adapted from U.S. Environmental Protection Agency. September 1995. *Profile of the Motor Vehicle Assembly Industry*. EPA310-R-95-009. Washington, DC: U.S. Government Printing Office.

Green, David, RTI. Personal communication with Mary Muth, RTI. April 6, 2000b.

to 3 mils or more to make it look good" (Galvin, 1999). As a result, using powder means using a larger quantity of coating, thus an increased cost. However, some believe the cost difference between powder and liquid may be eliminated for applications such as automobile primers over the next 5 years (RTI, 2000). Already, one coating manufacturer, PPG, is experimenting with charging automotive manufacturers based on the number of vehicles coated rather than the units of coatings used (Galvin, 1999).

The emissions associated with a coating application depend on both the HAP and VOC content of the coating material as well as on its transfer efficiency. Solventborne and waterborne coatings are available in a range of HAP and VOC content. It is possible for a waterborne coating to have a higher VOC content than a solventborne coating. In addition, solventborne coatings can have a better transfer efficiency relative to waterborne coatings in certain applications. Thus, the emissions from a waterborne coating may be higher, even if it has a lower HAP or VOC content compared to its solventborne counterpart.

2.2 Characterization of Coatings

As suggested in Table 2-2, automobile coatings enhance a vehicle's durability and appearance. Coatings therefore add value to the vehicle. Automotive assemblers desire and test for the following characteristics of the total coating system:

- adhesion: the coating adheres to the vehicle body, even after immersion in water;
- water resistance: the coating does not lose adhesion, blister, or lose gloss after immersion in water;
- humidity resistance: the coating does not lose adhesion, blister, or lose gloss after being subjected to high humidity;
- salt spray resistance: the coating does not blister or rust after exposure to salt spray;
- scab corrosion resistance: the coating prevents corrosion of a scab or defect that occurs on the vehicle body;
- stone chip resistance: the coating prevents paint removal from chipping when struck by stones (less than 5 percent removal of the coating); and
- impact resistance: the coating does not crack upon impact (Fettis, 1995).

2.3 Costs of Production

Economies of scale in automobile and LDT assembly are large because of the extraordinarily large capital costs associated with constructing a facility. The overall costs of production for automobiles and LDTs include capital expenditures, labor, energy, and materials. The costs of coating the vehicle are a subset of the overall costs of production and include the specific capital expenditures required for the coating operation, the labor associated with the coating process, energy costs associated with coating application, and the costs of the coatings themselves. This section provides data on the costs of production for the automobile and LDT assembly industries and on the costs of the coatings.

2.3.1 Costs of Production for the Automobile and LDT Industries

Costs of production, as reported by the Census Bureau for the relevant SIC and NAICS codes, include costs for automobile and LDT assemblers and for establishments that manufacture chassis and passenger car bodies. In addition, the relevant SIC code includes establishments that assemble commercial cars and buses and special-purpose vehicles for highway use, none of which are included in the NAICS code. In either case, the data presented here overstate the costs of production for plants that assemble vehicles. However, the hourly wages and the proportion of costs relative to the value of shipments provide us with information on relative costs in the industry.

Table 2-3 presents data on the value of shipments, payroll, cost of materials, and new capital expenditures for SIC 3711 and for NAICS 336111 (automobiles) and 336112 (LDTs). As indicated, payroll costs, which include wages and benefits, for these codes account for approximately 6 to 7 percent of the value of shipments. Materials account for a large portion of value of shipments at 64 to 73 percent. According to the Census definition, materials include parts used in the manufacture of finished goods (materials, parts, containers, and supplies incorporated into products or directly consumed in the process); purchased items later resold without further manufacture; fuels; electricity; and commission or fees to outside parties for contract manufacturing (U.S. Department of Commerce, 1996). The energy component of the materials cost averages less than 1 percent. Finally, new capital expenditures account for approximately 2 percent of the value of shipments.

Table 2-4 provides further detail on the labor component of production costs. Average hourly wages including benefits for production workers ranged from $21.66 per

Table 2-3. Number of Establishments, Value of Shipments, and Production Costs for the SIC and NAICS Codes that Include Automobile and LDT Assemblers, 1992-1997

Industry Code	Number of	Value of	Cost of Materials	New Capital Expenditures % of VOS
				2%
				2%
				2%
				2%
Total NAICS				2%
336111 and 336112				2%
(autos)				4%
(LDTs)				2%

NA = Not available

EC97M0-3361A. Washington, DC: Government Printing Office.

. EC97M-3361B. Washington, DC: Government Printing Office.

Table 2-4. Number of Establishments, Employment, and Payroll Costs for the SIC and NAICS Codes that Include Automobile and LDT Assemblers, 1992-1997

Year	Industry Code	Number of	)	Average Hourly Wage 1992$
				21.66
				22.67
				21.40
				22.54
				22.00
	Total NAICS 336111 and 336112			22.99
	336111 (autos)			22.99
	336112 (LDTs)			22.98

NA = Not available

Printing Office.

EC97M0-3361A. Washington, DC: Government Printing Office.

. EC97M-3361B. Washington, DC: Government Printing Office.

hour in 1992 to $26.30 per hour in 1997. However, real wages have been relatively constant over this time period.

2.3.2 Costs Associated with Coatings

According to the National Paint and Coatings Association (2000), the cost of paint on an average automobile accounts for approximately 1 percent of the showroom price. In addition to the costs of the coatings themselves, the total costs of coating a vehicle also include annualized capital expenditures for the "paint shop," labor, energy, and other material inputs. In this section, we describe the costs associated with the coating process in more detail.

2.3.2.1 Capital Costs for the Paint Shop

The capital costs associated with coating vehicles, or the "paint shop," include the cost of

- physical space within the assembly plant;
- conveyor system;
- sanding, paint spray, and demasking booths;
- vats for storing coatings;
- flash and cooling tunnels;
- electrocoat, sealer, and topcoat ovens;
- inspection and repair decks;
- pollution abatement system; and
- various other equipment (Graves, 2000).

The total capital costs of the paint shop in an assembly plant are likely in the $100 to $200 million range (Green, 2000b). Industry estimates that the capital costs for a new powder primer-surfacer system within an existing plant are $26 to $30 million (Praschan, 2000) and the total cost of removing and demolishing the previous equipment is in the range of $8 to $10 million. The expected life of a paint shop is approximately 15 years (Green, 2000b).

2.3.2.2 Variable Costs for the Paint Shop

The variable costs associated with coating vehicles include the coatings, labor, energy, and other material inputs. While specific information on the labor, energy, and other material input costs for the coating process could not be obtained, information on the costs of the coatings themselves is available. First, the relative size of the coating input cost can be estimated based on Census data. According to the 1997 Economic Census, establishments classified in NAICS 336111 Automobile Manufacturing, which includes both assembly plants and chassis manufacturing, spent $605.8 million on materials purchased from establishments classified in NAICS 32551 Paints, Varnishes, Lacquers, Stains, Shellacs, Japans, Enamels, and Allied Products. This implies that the coatings themselves accounted for approximately 0.9 percent of the cost of materials ($66.5 billion) and 0.6 percent of the value of shipments ($95.4 billion) in 1997. Correspondingly, establishments classified in NAICS 336112 Light Truck and Utility Vehicle Manufacturing, which also include both assembly plants and chassis manufacturing, spent $969.8 million on materials purchased from establishments classified in NAICS 32551. Thus, coatings accounted for approximately 1.4 percent of the cost of materials ($137.5 billion) and 0.9 percent of the value of shipments ($205.8 billion) in 1997.

Table 2-5 provides a breakdown of automotive coatings usage for both motor vehicle assembly and parts manufacturing establishments in 5-year increments from 1989 with projections to 2008. According to these data, a vehicle with a wholesale price of $20,000 in 1998 would require 54 pounds of coating. In 1998, the majority of coatings were solvent-based (67.5 percent in 1998). Water-based coatings accounted for 19.8 percent of coating usage and powder coatings accounted for 7.1 percent. Over the next 10 years, Freedonia projects that the relative quantities of both water-based and powder coatings will increase relative to solvent-based coatings.

When comparing liquid coatings to powder coatings, a general rule of thumb in the industry is to equate the cost of 3 pounds of powder, at a cost of $2.50 to $6.00 per pound, to 1 gallon of liquid coatings (RTI, 2000). Overall coatings used in the automobile industry averaged $3.74 per pound in 1998. Table 2-6 shows the pricing trends in automotive coatings, sealants, and adhesives in 5-year increments from 1989 with projections to 2008.

Table 2-5. Automotive Coatings Usage, 1989, 1993, and 1998 with Projections to 2008

Item	1989	1993	1998	2003	2008
Motor vehicle assembly and parts manufacturing shipments (10^9 \$1992)	\$246.1	\$255.1	\$337.6	\$388.0	\$448.2
Pounds of coatings per \$1,000 in shipments	3.69	3.32	2.70	2.44	2.19
Total automotive coating usage (10^6 pounds)	909	847	910	945	980
Coating weight by application (10^6 pounds)					
Solvent-based	765	675	615	560	505
Water-based	100	109	180	225	260
Powder	24	41	65	95	135
Other	20	22	50	65	80
Coating weight by resin (10^6 pounds)					
Acrylic	310	300	330	350	370
Urethane	285	280	290	305	320
Epoxy	89	90	110	115	120
Alkyd	150	110	100	90	80
Other	75	67	80	85	90

Source: Freedonia Group. September 1999. *Automotive Coatings, Sealants and Adhesives in the United States to 2003—Automotive Adhesives, Market Share and Competitive Strategies.*

Table 2-6. Pricing Trends in Automotive Coatings, Sealants, and Adhesives, 1989, 1993, and 1998 with Projections to 2008 (Dollars per Pound)

Item	1989	1993	1998	2003	2008
Weighted average	2.48	2.60	2.59	2.69	2.76
Coatings	3.36	3.66	3.74	3.92	4.08
Sealants	1.09	1.17	1.23	1.31	1.39
Adhesives	1.18	1.20	1.33	1.41	1.48

Source: Freedonia Group. September 1999. *Automotive Coatings, Sealants and Adhesives in the United States to 2003—Automotive Adhesives, Market Share and Competitive Strategies.*

SECTION 3

INDUSTRY ORGANIZATION

This section describes the market structure of the automobile and LDT assembly industries, the characteristics of the assembly facilities, and the characteristics of the firms that own them. In addition, we provide information on the market structure of the automotive coatings industry and the characteristics of the firms that manufacture the coatings used at the assembly facilities.

3.1 Market Structure

Market structure is important because it determines the behavior of producers and consumers in the industry. If an industry is perfectly competitive, then individual producers are not able to influence the price of the output they sell or the inputs they purchase. This condition is most likely to hold if the industry has a large number of firms, the products sold and the inputs purchased are undifferentiated, and entry and exit of firms are unrestricted. Product differentiation can occur both from differences in product attributes and quality and from brand name recognition of products. Entry and exit are unrestricted for most industries except, for example, in cases where one firm holds a patent on a product, where one firm owns the entire stock of a critical input, or where a single firm is able to supply the entire market.

The automobile and LDT assembly industry operates in a global marketplace and competes with foreign producers of vehicles. Many of the companies that own these facilities are foreign-based companies. Within the United States, the market for automobiles and LDTs is considered an oligopolistic differentiated products market (Berry, Levinsohn, and Pakes, 1995) because the facilities that assemble these vehicles in the United States are owned by only 14 companies and because the products produced are highly differentiated by manufacturer. Entry and exit of companies in the industry are difficult because the capital outlays required to begin manufacturing cars are extremely large; thus, entry depends on the ability of a new manufacturer to secure outside funding. Entry is also difficult because brand name recognition is critical for establishing a market for a particular vehicle.

Market structure of the industry is particularly influenced by the high degree of product differentiation. Vehicles vary in their functions as sedans, coupes, wagons, pickups, and minivans, and in their characteristics such as carrying capacity, gas mileage, safety features, comfort features, visual aesthetics, and reliability ratings. Brand names are also important in this industry in that they embody consumers' perceptions of the characteristics and reliability of the vehicles. The prices for similar type vehicles across manufacturers can vary based on multiple characteristics; thus, nonprice competition, if it occurs, would be particularly difficult to discern. Furthermore, the actual wholesale price received for a vehicle by the manufacturer is difficult to determine because invoice prices, which are readily available, do not directly reflect what manufacturers receive from the dealer. In particular, manufacturers may offer incentives to dealers, dealer holdbacks, and consumer rebates (*Consumer Reports*, 2000b).

In addition to evaluating the factors that affect competition in an industry, one can also evaluate four-firm concentration ratios (CR4s), eight-firm concentration ratios (CR8s), and Herfindahl-Hirschmann indexes (HHIs). These values are reported at the four-digit SIC level for 1992, the most recent year available, in Table 3-1. Also included in the table are the same ratios independently calculated from sales data for 1998/1999 for the 14 companies that own vehicle assembly plants. Comparing these two sets of numbers provides some insights into how the companies owning assembly plants differ from the rest of the SIC 3711 companies.

Table 3-1 suggests that companies that own assembly plants have similar concentration ratios compared to all companies in SIC 3711 based on the CR4s and CR8s. The values for both of these measures are high relative to other industries. The criteria for evaluating the HHIs are based on the 1992 Department of Justice's Horizontal Merger Guidelines. According to these criteria, industries with HHIs below 1,000 are considered unconcentrated (i.e., more competitive), those with HHIs between 1,000 and 1,800 are considered moderately concentrated (i.e., moderately competitive), and those with HHIs above 1,800 are considered highly concentrated (i.e., less competitive). The HHI as calculated by the Department of Commerce indicates that SIC 3711 is considered highly concentrated, whereas the HHI calculated based on the sales of companies that own assembly plants indicates that the industry is moderately concentrated. In general, firms in less-concentrated industries are more likely to be price takers, while firms in more-concentrated industries are more likely to be able to influence market prices. While the concentration

Table 3-1. Measures of Market Concentration for Automobile Manufacturers, 1992 and 1998–1999

Description	CR4	CR8	HHI	Number of Companies	Number of Establishments
SIC 3711 (1992)[a]	84	91	2,676	398	465
Companies that Own Assembly Plants (1998/99)[b]	72	94	1,471	14	65

[a] Concentration ratios, as calculated by the Department of Commerce, are based on value added for the SIC code.
[b] Independently calculated concentration ratios were based on overall sales for the companies that own assembly plants.
Sources: U.S. Department of Commerce. 1992. *Concentration Ratios in Manufacturing*. Washington, DC: Government Printing Office.
Hoover's Online. Company capsules. <http://www.hoovers.com>. As obtained on January 13, 2000.

measures are high for the automobile and LDT industries, the high degree of product differentiation is likely a more important determinant of the industry's structure.

As with the assembly industry, the automotive coatings industry is oligopolistic in that three companies provide nearly all of the coatings used by vehicle assemblers. These multinational companies—Dupont, BASF, and PPG Industries—provide coatings to a variety of industries. The coatings they provide to the vehicle assemblers are differentiated based on their uses and specific formulations. Because little information is available on how they market their products to the automotive industry, the degree of competition in the automotive coatings industry is not known.

3.2 Automobile and LDT Assembly Facilities

Facilities comprise a site of land with a plant and equipment that combine inputs (raw materials, fuel, energy, and labor) to produce outputs (in this case, automobiles and light trucks, and coatings). The terms facility, establishment, and plant are synonymous in this report and refer to the physical locations where products are manufactured. As of 1999, there were over 60 operating automobile and light truck assembly operations that include coatings processes. Total annual sales for facilities with data, as reported by HarrisInfo, are greater than $500 million. This section provides information on their characteristics, the vehicles manufactured at these facilities, and trends for these facilities.

3.2.1 Characteristics of Automobile and LDT Assembly Plants

As shown in Figure 3-1, most automobile and LDT facilities are located in Michigan (30 percent of plants) and six Midwestern and Southern states south of Michigan (50 percent of plants). The remaining plants are located primarily in California and on the Eastern seaboard. Automobile and LDT assembly plants range in age from 3 years to 92 years (see Table 3-2). Most assembly plants employ from 2,000 to 3,999 workers (see Table 3-3). However, the largest plant, a Honda plant in Marysville, Ohio, employs 13,000 people.

Capacity utilization indicates how well the current facilities meet current demand. In the automobile industry, including both assembly plants and parts manufacturers, capacity utilization is lower than it is in the manufacturing sector overall (see Table 3-4). However, capacity utilization is highly variable from year to year depending on economic conditions. In comparison to the data in Table 3-4, capacity utilization for automotive manufacturers, including those that make medium- and heavy-duty trucks, reached 91 percent in 1997 (U.S. Department of Commerce, 1999c).

Table 3-5 provides detailed information on automobile and LDT assembly facilities by company, including the location of each facility; production volume; its employment; its age, if available; and the models produced at the plant in 1998 and 1999. As Table 3-5 illustrates, a large number of models can be and are produced in a single plant. As a result of the ability to produce several models at one plant, many companies operate joint ventures. For example, the New United Motor Manufacturing, Inc. (NUMMI) facility is owned and used for manufacture by both Toyota and General Motors (GM). In other cases, the facility may be wholly owned by one company, while another company contracts with them to have their vehicles produced there. For instance, DaimlerChrysler contracts with Mitsubishi to produce its Sebring and Avenger models at Mitsubishi's Illinois facility. In this relationship, Mitsubishi assembles the vehicles for DaimlerChrysler based on Mitsubishi components (U.S. Department of Commerce, 1999c).

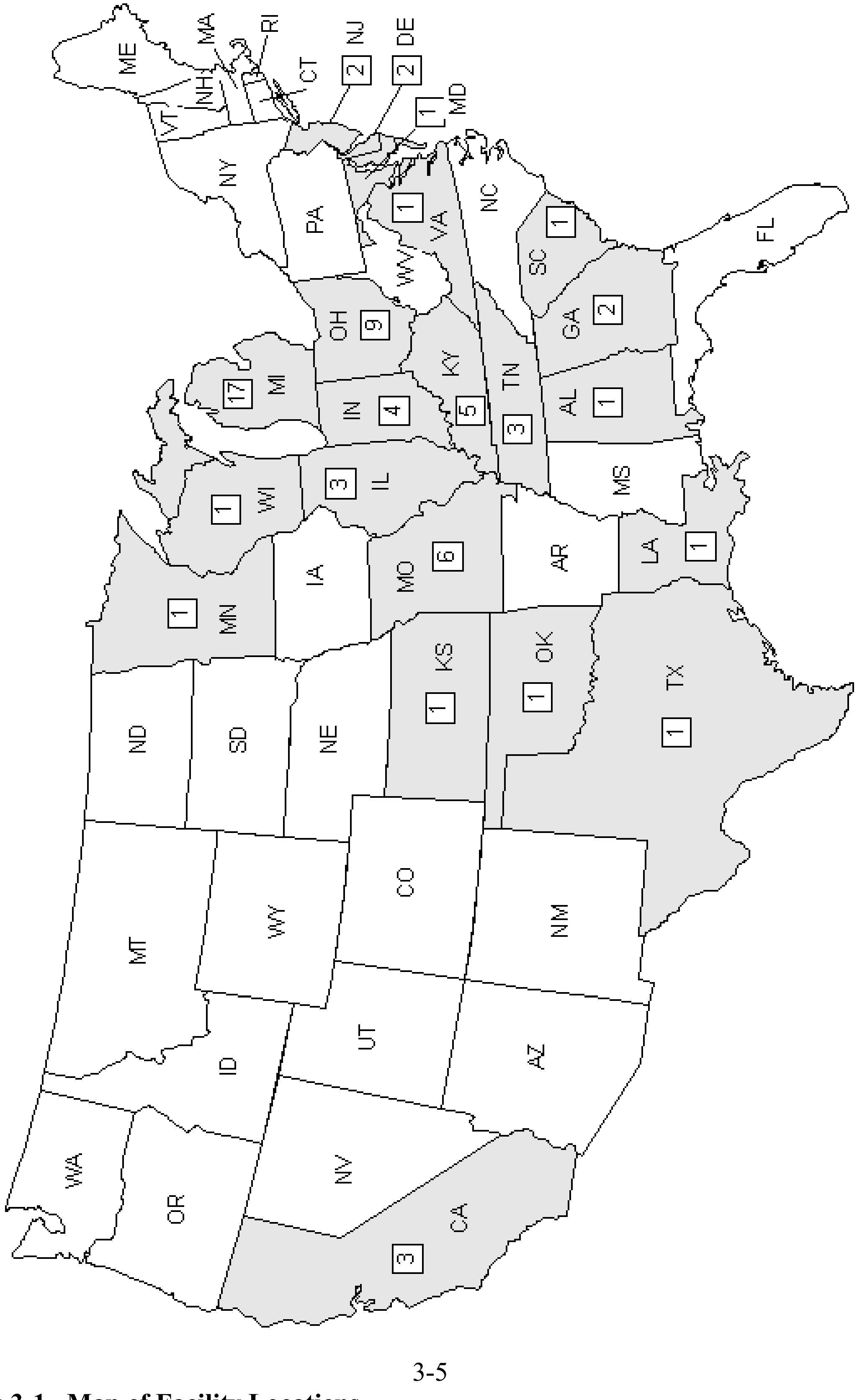

Figure 3-1. Map of Facility Locations

Source: Harris Info Source. Selected Online Profiles. As obtained January 2000.

Table 3-2. Number of Automobile and LDT Assembly Plants by Age Range, 1998-1999

Age Range	Number of Plants
0 to 9 years	3
10 to 19	9
20 to 29	5
30 to 39	5
40 to 49	8
50 to 59	5
60 to 69	3
70 to 79	5
80 to 89	1
90 and over	1
Not available	21
Total plants	66

Sources: Harris Info Source. 2000. Selected Online Profiles. As obtained on January 2000.
DaimlerChrysler web page. "Passenger Cars and Light Trucks."
<http://www.daimlerchrysler.com>. As obtained on February 25, 2000.

Table 3-3. Number of Automobile and LDT Assembly Plants by Employment Range, 1998-1999

Employment Range	Number of Plants
<1,000	1
1,000 to 1,999	6
2,000 to 2,999	13
3,000 to 3,999	14
4,000 to 4,999	5
5,000 to 5,999	5
6,000 or greater	3
Not available	19
Total plants	66

Source: Harris Info Source. 2000. Selected Online Profiles. As obtained on January 2000.

Table 3-4. Capacity Utilization

Year	All Manufacturing	Percent Change	Motor Vehicle and Parts Mfg.	Percent Change
1988	83.8	3.1	81.2	5.7
1989	83.6	-0.2	79.5	-2.1
1990	81.4	-2.6	71.6	-9.9
1991	77.9	-4.3	64.0	-10.6
1992	79.4	1.9	69.9	9.2
1993	80.5	1.4	77.3	10.6
1994	82.5	2.5	83.5	8.0
1995	82.8	0.4	76.9	-7.9
1996	81.4	-1.7	72.4	-5.9
1997	81.7	0.4	73.4	1.4
Average	81.5	0.1	75.0	-0.2

Source: American Automobile Manufacturers Association. 1998. *Motor Vehicle Facts and Figure 1998*. Detroit: AAMA.

3.2.2 Trends in the Automobile and LDT Assembly Industries

Because of the large capital outlays necessary to build a new plant, new plants come online on average only every few years. Most recently, Toyota finished construction of a new plant in 1999 to produce its new Toyota Tundra, which is a LDT. In 2000, GM announced that it will open two new plants near Lansing, Michigan. Honda is currently building a new auto and engine plant in Lincoln, AL (Honda, 2000). Both Nissan and Hyundai are also considering new facilities in the United States.

Although new plants are not built often, companies are constantly revamping old equipment in existing plants to replace aging equipment, upgrade to new technologies, and switch to new car models. The paint shops within assembly plants are refitted every 10 to 15 years. When refitted with new equipment, new technologies have allowed for lower pollutant emissions than the replaced equipment. The innovations for these new technologies come from both the coatings manufacturers as well as automobile assembly company engineers.

Table 3-5. Automobile and LDT Assembly Plant Locations, Production Volume, Employment, Age, and Models, 1998–1999

			State	Production	Vehicles Produced
					BMW Z3, BMW X5
					Dodge Neon, Plymouth Neon, Chrysler Neon
	DC Connor Assembly Plant (no paint shop)				Plymouth Prowler, Dodge Viper
	DC Jefferson North Assembly Plant				Jeep Grand Cherokee, Mercedes-Benz ML 320
					Dodge Durango
	DC St. Louis North Assembly Plant				Dodge RamQuad Cab pickup
	DC St. Louis South Assembly Plant				Chrysler Town and Country, Dodge Caravan, Plymouth Voyager, Grand Caravan, Grand Voyager
	DC Sterling Heights Assembly Plant	Sterling Heights			Chrysler Cirrus, Dodge Stratus, Plymouth Breeze
					Jeep Cherokee, ML 320, Jeep Wrangler Sport Utility
	DC Toledo Assembly Plant II (no paint shop)				Jeep Cherokee Sport Utility, Jeep Wrangler Sport Utility
	DC Warren Truck Assembly Plant				Dodge Ram pickup, Dodge Dakota, Dodge Dakota Extended Cab
	Mercedes-Benz U.S. International, Inc.				ML 320, DaimlerChrysler XJ (Jeep Cherokee), Mercedes-Benz M-class

Table 3-5. Automobile and LDT Assembly Plant Locations, Production Volume, Employment, Age, and Models, 1998–1999 (continued)

		State	Production	Vehicles Produced
				Ford Taurus Sedan, Mercury Sable Sedan, Ford Taurus wagon, Mercury Sable wagon
	Ford Avon Lake Assembly Plant			Mercury Villager, Nissan Quest
				Ford Taurus, Mercury Sable, Ford Taurus Wagon, Mercury Sable Wagon
	Ford Dearborn Assembly Plant			Ford Mustang
				Ford Rangers/B-Series
	Ford Kansas City Passenger Assembly Plant			Ford Contour, Mercury Mystique
				Ford F-Series
				Ford F-Series, Ford Excursion, Ford Explorer, Mercury Mountaineer
				Ford Econoline Van and Wagon, Villager
	Ford Louisville Assembly Plant			Ford Ranger, Explorer/Mountaineer

Table 3-5. Automobile and LDT Assembly Plant Locations, Production Volume, Employment, Age, and Models, 1998–1999 (continued)

			State	Production	Vehicles Produced
					Ford Expedition, Lincoln Navigator
					Sedan (unspecified), wagon (unspecified)
					Ford F-Series
					Ford Explorer, Mercury Mountaineer, Aerostar
	Ford Twin Cities Assembly Plant				Ford Ranger
					Lincoln Town Car, Lincoln Continental, Lincoln Mark
					Chevrolet pickups, GMC Sierra pickups, Cadillac Escalade, Chevrolet Suburban, Chevrolet Silverado, Chevrolet Tahoe, GMC Suburban, GMC Yukon
		Bowling Green			Chevrolet Corvette
	GM Buick City Assembly Center				Various Buick models
					Chevrolet Venture, Oldsmobile Silhouette, Opel Sintra, Pontiac Montana, Pontiac Trans Sport

Table 3-5. Automobile and LDT Assembly Plant Locations, Production Volume, Employment, Age, and Models, 1998–1999 (continued)

		State	Production	Vehicles Produced
General Motors (continued)				2dr Pontiac (unspecified), 4dr Pontiac (unspecified), 4dr Oldsmobile (unspecified)
				Chevrolet pickups, GMC Sierra pickups
				Chevrolet pickups, GMC Sierra pickups, Cherolet Silverado
	GM Hamtramck Assembly Plant			Buick Le Sabre, Pontiac Bonneville, Chevrolet Mulitstop, Chevrolet Van Express, GMC Multistop, GMC Savana, Cadillac Deville, Cadillac Eldorado, Cadillac Seville, Buick Le Sabre
				Cadillac Escalade, Chevrolet Suburban, Chevrolet Silverado, Chevrolet Tahoe, GMC Suburban, GMC Yukon, GMC Yukon XL, Isuzu W4/NPR
	GM Lansing Car Assembly—C Plant			Buick Skylark, Oldsmobile Calais/Achieva, Pontiac Grand Am, Chevrolet Malibu, Oldsmobile Alero, Oldsmobile Cutlass

Table 3-5. Automobile and LDT Assembly Plant Locations, Production Volume, Employment, Age, and Models, 1998–1999 (continued)

			State	Production	Vehicles Produced
General Motors (continued)	GM Lansing Car Assembly—M Plant				Buick Skylark, Oldsmobile Calais/Achieva, Pontiac Grand Am
	GM Lansing Craft Centre Plant #2				EV1
					Chevrolet Blazer S, GMC Jimmy S, Oldsmobile Bravada
	GM Lordstown Assembly Plant				Cavalier, Sunfire
					Chevrolet Blazer S, GMC Jimmy S, Oldsmobile Bravada
	GM North American Truck Group				Chevrolet Astro, GMC Safari
	GM Oklahoma City Assembly Plant	Oklahoma City			Pontiac Grand Am, Chevrolet Malibu, Oldsmobile Alero, Oldsmobile Cutlass
					Buick Le Sabre, Pontiac Bonneville
	GM Pontiac East Assembly Plant				Chevrolet pickups, GMC Sierra pickups, Cherolet Silverado
	GM Shreveport Assembly Plant				Isuzu pickups, Chevy/GMC pickups

Table 3-5. Automobile and LDT Assembly Plant Locations, Production Volume, Employment, Age, and Models, 1998–1999 (continued)

		State	Production	Vehicles Produced
General Motors (continued)	GM Wentzville Assembly Center			Chevrolet Mulitstop, Chevrolet Van Express, GMC Multistop, GMC Savana
	GM Wilmington Assembly Plant			Pontiac Grand Am, Chevrolet Malibu, Oldsmobile Alero, Oldsmobile Cutlass
				S-Series Coupes
General Motors and Toyota	New United Motor Mfg. Inc. NUMMI			
				Toyota Corolla, Chevrolet Prism
				Toyota Tacoma
				Honda Acura CL, Civic 2 dr, Civic 4 dr
			219,618 (Line 1) 207,965 (Line 2)	Honda Acura TL, Honda Accord
	Auto Alliance International Inc.			Mazda 626, Mercury Cougar, Ford Probe, Ford MX-6
Mitsubishi Motor Corporation	Mitsubishi Normal Assembly Plant			Galant, Eagle Talon, Mitsubishi Eclipse, Chrysler Sebring, Dodge Avenger

Table 3-5. Automobile and LDT Assembly Plant Locations, Production Volume, Employment, Age, and Models, 1998–1999 (continued)

		State	Production	Vehicles Produced
Nissan Motor MFG	Nissan Motor Manfacturing Corp., USA (2 car lines and 1 truck line)			Nissan Altima, Nissan 200SX, Nissan Xterra, Nissan Truck (unspecified), Nissan Sentra
Renco Group Inc.				Hummer, Humvee
Subaru and Isuzu Motors Limited	Subaru-Isuzu Automotive Inc. (1 car line and 1 truck line)			Suburu Legacy, Honda Passport, Isuzu Amigo, Isuzu Rodeo
				NA
	Toyota Motor Manufacturing Kentucky Inc. Paint #1		229,133 (Line 1) 218,608 (Line 2)	Toyota Camry, Toyota Solara, Toyota Avalon
				Toyota Tundra

NA = Not available

One example of new technology is a powder-slurry clearcoat. Powder-slurry clearcoat offers the emissions benefits of a powder but can be sprayed as a liquid; thus, it can be applied on conventional paint lines with relatively minor retrofitting (Galvin, 1999; BASF, 1999).

3.3 Companies that Own Automobile and LDT Assembly Facilities

Companies that own individual facilities are legal business entities that have the capacity to conduct business transactions and make business decisions that affect the facility. The terms "company" and "firm" are synonymous, and refer to the legal business entity that owns one or more facilities. This section presents information on the parent companies that own automobile and LDT assembly plants.

3.3.1 Company Characteristics

The 66 automobile and LDT assembly facilities listed in Table 3-5 are owned by 14 domestic and foreign companies (see Table 3-6). The largest number of facilities is operated by GM—23 facilities or 35 percent of the total—and by Ford Motor Company—16 facilities or 25 percent of the total. The foreign-based companies—BMW, DaimlerChrysler, Mitsubishi Motors Corporation, Honda, Nissan, and Toyota—own between one and 11 facilities in the United States. Isuzu and Subaru jointly operate one facility as do Mazda and Ford. NUMMI, which is wholly owned through a joint partnership between Toyota and GM, is not individually publicly traded; all of the remaining companies are publically traded.

Sales in the 1998 and 1999 time period for all lines of business at companies that own automobile and LDT facilities range from $4.7 billion for the jointly owned Toyota and GM company, NUMMI, to $161.3 billion for GM itself. With the exception of Nissan Motors, which generated a loss of $229 million in 1999, all of these companies generated positive returns ranging from $43 million for Mitsubishi to $22.1 billion for Ford. Profit-to-sales ratios ranged from 0.2 percent for Mitsubishi Motors Corporation to 15.3 percent for Ford.

Employment for all lines of business at companies that own automobile and LDT assembly facilities ranges from 4,800 workers for NUMMI to 594,000 for GM. The Small Business Administration (SBA) defines a small business in this industry as follows:

- NAICS 33611 (Automobile Manufacturing)—1,000 employees or less
- NAICS 336112 (Light Truck and Utility Vehicle Manufacturing)—1,000 employees or less.

Table 3-6. Financial Data for Companies that Own Automobile and LDT Assembly Facilities, 1998–1999

		Number of Assembly Plants	Company)	Company Profits)	Profit/Sales Ratio	Company Year
AAI (Auto Alliance International)	Joint Ownership					NA
Company						1998
						1998
Fuji Heavy Industries (owns Subaru)						1998
						1999
						1998
						1999
						1999
						1999
						1999
	GM-Toyota (50-50)					1999
						1998
						1999
						1999

Source: Hoover's Online. 2000. Company Capsules. <http://www.hoovers.com>. As obtained on January 13, 2000.

Based on these size standards and company employment data presented in Table 3-6, there are no small businesses within this industry.

3.3.2 Vertical and Horizontal Integration

Companies within the automotive industry may be horizontally and/or vertically integrated. Vertical integration refers to the degree to which firms own different levels of production and marketing. Vertically integrated firms may produce the inputs used in their production processes and own the distribution network to sell their products to consumers. These firms may own several plants, each of which handles these different stages of production. For example, a company that owns an automobile assembly plant may also own a plant that molds the dashboard or makes the seat coverings. An automotive company may be integrated as far back as the foundry that makes parts for an automobile, as in the cases of Ford, GM, and DaimlerChrysler. However, it may not be integrated into retail dealership operations because of various state franchise laws.

Vertical integration within the automotive industry has been decreasing as competition has increased and outsourcing has become a more attractive option. Outsourcing refers to hiring an outside company to produce some of the materials necessary for manufacture. As a result, companies may not produce a number of the inputs used in their automobiles. In 1997, Ford outsourced 50 percent of its vehicle content. GM was expected to have similar levels after it spun off Delphi automotive systems, a subsidiary of GM. And, finally, before Chrysler merged with Daimler-Benz, it outsourced 70 percent of its inputs (Brunnermeier and Martin, 1999). "Reduced vertical integration allows vehicle makers to buy parts from the best suppliers. The spun-off parts companies are assumed to operate more efficiently and become more competitive (and thus yield lower unit costs) as independent entities" (U.S. Department of Commerce, 1999c).

Horizontal integration refers to a company that produces a diversity of products. The companies may be directly integrated by direct ownership of additional facilities or indirectly integrated by owning additional facilities through affiliations with other companies and subsidiaries. Several of the automobile manufacturers have high degrees of horizontal integration. First, most of the companies are horizontally integrated within their own industry in that they own multiple assembly plants and produce multiple automobile and LDT models. Second, most companies are also involved in other activities including automobile rentals, automobile and other credit financing, and electronics manufacturing.

Table 3-7. Examples of Subsidiaries and Affiliates Owned by Automotive Companies

DaimlerChrysler AG	
Detroit Diesel Corporation	DaimlerChrysler Rail Systems GmbH
DaimlerChrysler Canada Inc.	Freightliner Corporation
Ford Motor Company	
Automobile Protection Corporation	Kwik-Fit Holdings PLC
Ford Motor Company of Canada, Ltd.	Mazda Motor Corporation
Ford Motor Credit Company	Visteon Automotive Systems
The Hertz Corporation	Ford Motor Company/Buffalo Stamping Division
General Motors Corporation	
Adam Opel AG	GM Corporation/Allison Transmission Divisions
GM Acceptance Corporation	GM Corporation/Powertrain
GM of Canada Ltd.	HRL Laboratories, LLC
Hughes Electronics Corporation	Hughes Network Systems
Integon Corporation	Hughes Space and Communications Company
Isuzu Motors Ltd.	Lexel Imaging Systems, Inc.
Saab Automobile AB	Packard Hughes Interconnect
AMI instruments, Inc.	Rockwell Collins Passenger Systems
Delco Defense Systems Operations	Spectrolab, Inc.
Delphi Harrison Thermal Systems	
Isuzu Motors Limited	
American Isuzu Motors Inc.	Tri Petch Isuzu Sales Company, Ltd.
Toyota Motor Corporation	
Daihatsu Motor Company, Ltd.	Toyota Motor Sales, USA, Inc.
New United Motor Manufacturing, Inc.	Toyota Motor Thailand Company Ltd.
Toyota Motor Credit Corporation	

Source: Hoover's Online. 2000. Company Capsules. <http://www.hoovers.com>. As obtained January 13, 2000.

Table 3-7 provides examples of the subsidiaries and affiliates associated with companies that assemble automobiles and LDTs (Hoover's, 2000).

3.3.3 Company Trends

Based on recent 1-year sales growth estimates, the companies that own automobile and LDT assembly plants are experiencing rapid growth rates (see Table 3-8). DaimlerChrysler's sales increased by 21.6 percent, followed by Toyota at 19.6 percent, Subaru at 15.9 percent, and Honda at 13.8 percent. The slowest growth rate was experienced

Table 3-8. One-Year Sales, Profit, and Employment Growth of Companies that Own Automobile and LDT Assembly Plants, 1998-1999

Company	One-Year Sales Growth	One-Year Profit Growth	One-Year Employee Growth
AAI (Auto Alliance International)	NA	NA	NA
BMW	13.3%	21.8%	5.8%
DaimlerChrysler AG	21.6%	–21.0%	47.1%
Ford Motor Company	6.0%	218.9%	5.1%
Fuji Heavy Industries (owns Subaru)	15.9%	22.6%	1.8%
General Motors Corporation	3.1%	55.9%	2.3%
Honda Motor Company, Ltd.	13.8%	28.3%	2.6%
Isuzu Motors Limited	0.5%	15.3%	360.0%
Mazda Motor Corporation	12.6%	NA	24.0%
Mitsubishi Motors Corporation	4.4%	NA	0.6%
Nissan Motor Co., Ltd.	9.3%	NA	4.7%
NUMMI	2.2%	NA	0.0%
Renco Group Inc.	2.0%	NA	36.4%
Toyota Motor Corporation	19.6%	8.9%	15.6%

NA = Not available

Source: Hoover's Online. 2000. Company Capsules. <http://www.hoovers.com>. As obtained on January 13, 2000.

by Isuzu at 0.5 percent. However, 1-year profit growth estimates do not match the sales growth rates. Since profits are a function of total revenue and total costs, growth in sales does not necessarily imply a growth in profits. This may be particularly true during periods of high growth rates of costs. In particular, even as DaimlerChrysler's sales increased by 21.6 percent, their profits decreased by 21.0 percent. Ford, which experienced a modest 6.0 percent sales growth had a 218.9 percent increase in profits, which is likely due to the success of its LDTs. Other profit growth rates were in the range of 8.9 to 55.9 percent, reflecting the overall health of the economy.

The employment growth rate of Isuzu is anomalous at 360.0 percent followed by DaimlerChrysler at 47.1 percent. The other employment growth rates are positive but smaller.

3.4 Companies that Manufacture Automotive Coatings

Three companies supply the majority of automobile coatings used in vehicle assembly plants: DuPont Performance Coatings, PPG Industries, and BASF Coatings AG. Sherwin-Williams is also a major player in automobile coatings, but they tend to supply auto body shops and other aftermarket operations rather than assembly plants. Other minor suppliers may supply adhesives and sealers to the vehicle assembly industry (Green, 2000a). In total, the industry had estimated sales of $3.4 billion in 1998 (Freedonia, 1999). Table 3-9 lists the market shares of U.S. automotive coating manufacturers, including both sales to assembly plants and to aftermarket users.

The parent companies for DuPont, PPG, and BASF, are all large with 1998 sales ranging from $7.5 billion for PPG to $32.4 billion for BASF (Hoover's, 2000). Table 3-10 shows sales, income, and employment for these three coating manufacturers. Based on the SBA definition of a small company for NAICS 32551 (paint and coating manufacturing) (i.e., 500 or fewer employees), none of these companies are small.

Table 3-9. Market Shares in the Automotive Coatings Industry, 1998

Company	Percent
DuPont	29.4
PPG Industries	28.8
BASF	15.9
Sherwin-Williams	8.8
Others	17.1

Source: Freedonia Group. September 1999. *Automotive Coatings, Sealants and Adhesives in the United States to 2003—Automotive Adhesives, Market Share and Competitive Strategies.*

Table 3-10. Company Data for Coatings Manufacturers, 1998

Company	Location of HQ	Sales (10^6)	Income (10^6)	Employment
BASF Aktiengesellschaft	Germany	$32,439	$1,994	105,945
E.I du Pont de Nemours and Co.	Wilmington, DE	$24,767	$4,480	101,000
PPG Industries	Pittsburgh, PA	$7,510	$801	32,500

Source: Hoover's Online. Company Capsules. <http://www.hoovers.com>. As obtained on January 13, 2000.

SECTION 4

DEMAND-SIDE OVERVIEW

In this section, the uses and consumers of the automobile and LDT are described. First, the consumers, product characteristics and the purpose of consumption are described. In addition, substitution possibilities are given, and demand elasticity estimates are provided.

4.1 Demand Characteristics

Individual consumers, companies, and the government lease or purchase automobiles and LDTs. Over the past several years, consumption by individual consumers, which accounted for 47 percent of 1997 sales, has decreased, while consumption by businesses, which accounted for 51 percent of 1997 sales, has increased (see Table 4-1). Government purchases make up 1 to 2 percent of consumption. While individuals generally purchase automobiles and LDTs for personal use, companies purchase automobiles so their employees may use them on work-related business or so their customers may use them, as in the case of automobile rental companies. Federal, state, and local governments purchase automobiles for use during government-related work, including military operations, escorting officials, and site visits. In general, government-purchased vehicles are more utilitarian than vehicles purchased by individual consumers and companies.

In 1997, sales of passenger cars and LDTs were approximately equal (AAMA, 1998). However, the individual consumers who purchase new passenger cars differ somewhat from those who purchase new LDTs. As shown in Table 4-2, purchasers of new passenger cars are fairly evenly split between male and female, but men make up three-quarters of the LDT purchasers. New passenger car purchases are greatest for the 45 to 54 age range, but LDT purchases are high for the broader 35 to 54 age range. The highest education level for vehicle purchases is similar for both vehicle types, with the high percentages for the categories of some college and college graduates. Passenger car purchases are higher in the Northeast but the differences in the North Central, South, and West, are minor. Finally, median household income for passenger car purchasers is lower at $59,900 compared to $68,000 for LTD purchasers.

Table 4-1. U.S. Car Sales by Market Sector, 1980–1997

Year	Units by Consuming Sector (10^3)				% of Total Sales		
	Consumer	Business	Government	Total	Consumer	Business	Government
1980	6,062	2,791	126	8,979	67.5%	31.1%	1.4%
1985	7,083	3,822	134	11,039	64.2%	34.6%	1.2%
1986	7,658	3,666	127	11,450	66.9%	32.0%	1.1%
1987	6,748	3,395	135	10,278	65.7%	33.0%	1.3%
1988	6,802	3,699	138	10,639	63.9%	34.8%	1.3%
1989	6,375	3,402	136	9,913	64.3%	34.3%	1.4%
1990	5,768	3,567	149	9,484	60.8%	37.6%	1.6%
1991	4,538	3,752	97	8,387	54.1%	44.8%	1.2%
1992	4,558	3,683	113	8,354	54.6%	44.1%	1.4%
1993	4,669	3,941	108	8,718	53.6%	45.2%	1.2%
1994	4,612	4,255	124	8,991	51.3%	47.3%	1.4%
1995	4,313	4,211	162	8,686	49.7%	48.5%	1.9%
1996	4,065	4,328	134	8,527	47.4%	50.7%	1.6%
1997	3,880	4,233	131	8,245	47.1%	51.3%	1.6%

Source: U.S. Department of Commerce, Bureau of Economic Analysis, as reported in American Automobile Manufacturers Association (AAMA). 1998. *Motor Vehicle Facts and Figure 1998*. Detroit: AAMA.

When choosing an automobile or LDT to purchase or lease, consumers consider the following characteristics:

- function of the vehicle (e.g., sedan, coupe, wagon, pickup truck, minivan, SUV);
- performance characteristics, such as capacity, mileage per gallon, horsepower, four-wheel drive versus two-wheel drive;
- aesthetic characteristics, such as design and visual appeal;
- comfort characteristics, such as seating, equipment adjustments, and air conditioning;
- safety characteristics, such as air bags and advanced braking systems (ABS);
- perceived reliability and durability; and
- price, including financing and leasing options.

Table 4-2. Demographics of New Automobile and LDT Buyers, 1998

Characteristic	New Passenger Car Buyers Total	New Light Truck Buyers Total
Gender		
Male	51.6%	71.2%
Female	43.1%	24.3%
No Answer	5.3%	4.5%
Total	100.0%	100.0%
Age of Principal Purchaser (in years)		
Under 25	7.0%	4.0%
25–29	7.7%	7.4%
30–34	8.3%	10.0%
35–39	8.0%	12.7%
40–44	9.3%	13.3%
45–49	11.5%	12.7%
50–54	11.0%	12.3%
55–59	7.6%	8.5%
60–64	6.7%	6.2%
65 and over	17.3%	8.7%
No Answer	5.6%	4.1%
Total	100.0%	100.0%
Highest Education Level		
8th grade or less	0.6%	1.1%
Some high school	2.1%	3.0%
High school/no college	15.5%	18.1%
Some college	23.5%	23.9%
College graduate	28.7%	25.5%
Post graduate	20.2%	16.1%
Trade/technical	4.7%	8.3%
Other	1.3%	1.0%
No answer	3.3%	3.1%
Total	100.0%	100.0%
Census Region		
Northeast	21.8%	17.2%
North central	28.4%	32.4%
South	31.6%	32.0%
West	18.2%	18.4%
Total	100.0%	100.0%
Median Household		
Income	$59,900	$68,000

Source: J.D. Power and Associates, *1998 Vehicle Quality Survey* as reported in American Automobile Manufacturers Association (AAMA). 1998. *Motor Vehicle Facts and Figure 1998*. Detroit: AAMA.

According to a survey conducted by Consumers Union, reliability, price, and appearance are the top three reasons why a consumer chooses a particular vehicle (*Consumer Reports,* 2000c).

Coatings obviously affect the appearance of a vehicle, but they also affect its durability since they provide protection from rust, acid rain, chipping, and scratching. A consumer can readily observe the appearance characteristics of coatings, including, most obviously, its color, shininess, and whether it is a metallic coating. For the year 2000, metallic silver is expected to make up 22 percent of car sales, followed by black at 17 percent, white at 15 percent, blue at 12 percent, and green at 11 percent (*Consumer Reports*, 2000a). In the future, metallic paints on vehicles are expected to remain popular and special effects coatings are expected to increase.

While the benefits of coatings for the appearance of vehicles are easily observable when a consumer purchases a car, the durability aspects of the coatings are only observable over time. The average age of a passenger vehicle on the road in 1997 was 8.7 years and has been increasing over time from an average age of 5.6 years in the 1970s (AAMA, 1998). As the vehicle ages, coatings that rust, chip, and scratch easily greatly diminish the appearance and could potentially diminish the integrity of the vehicle. Thus, because the quality of the coating cannot be entirely observed at the time of purchase, the reputation of the company that manufactures the cars is important. If the company has a history of problems with the durability of coatings on the cars they manufacture, then their ability to sell vehicles in the future could be reduced.

4.2 Substitution Possibilities in Consumption

The possibilities for substitution in the automobile and LDT industries arise from the choices among different makes and models of vehicles, between purchasing a vehicle versus leasing, between new versus used vehicles, and among different forms of alternative transportation. The quality of the coatings on a vehicle may subtly affect these choices. As described above, a company with a history of problems with its coatings may lose market share over time to companies that manufacture vehicles with durable coatings. In addition, if coating quality is an issue, a consumer may be more inclined to buy cars more often or to lease rather than purchase a vehicle because the consumer would be driving the vehicle during the years in which its appearance is best. The market for used vehicles may potentially be affected by the quality of coatings because consumers would be more willing to purchase a used vehicle if its appearance is satisfactory but less willing if the coatings are declining as the vehicle ages. Thus, the market for used vehicles may affect manufacturers of new vehicles in two opposite directions. If good quality used vehicles are available for purchase, consumers may purchase used vehicles as a substitute for new vehicles, thus reducing the size of the market for new vehicles. However, if the resale market for a particular model is good (i.e., the model retains its value over time), then the manufacturer may be able to obtain a higher price for the same model when it is new. The last possibility for substitution, the use of alternative forms of transportation such as buses, subways, and bicycles, is likely much less affected by appearance and quality of coatings because these forms of transportation tend to be lifestyle choices for particular individuals.

4.2.1 Demand Elasticity Estimates

Based on empirical estimates provided in the economics literature, the own-price elasticities of demand for automobiles are elastic, the cross-price elasticities of demand are inelastic, and the income elasticities are elastic (see Table 4-3). Trandel (1991) estimated an overall own-price elasticity of –2.42, which falls between the individual automobile model elasticities estimated by Berry, Levinsohn, and Pakes (1995) and the aggregate estimates for domestic, European, and Asian vehicles estimated by McCarthy (1996). The estimated cross-price elasticities, which are the cross-price elasticities of demand between similar class cars, range from 0.28 to 0.99. Both Trandel (1991) and McCarthy (1996) estimate “market-price” elasticities of demand that are the sum of the own-price and cross-price elasticities of demand. These represent the change in quantity demanded with respect to a 1 percent increase in all car prices, such as would occur with an excise tax. Their estimated “market-price” elasticity values range from –0.78 to –1.43. Finally, McCarthy (1996) is the only paper that reports income elasticities, which are estimated to be 1.62 for domestic vehicles, 1.93 for European vehicles, and 1.65 for Asian vehicles.

Table 4-3. Estimates of Elasticities of Demand for Automobiles from the Economics Literature

		Elasticity Estimates			
Source	**Data**	**Own-Price**	**Cross-Price**[a]	**Market-Price**[b]	**Income**
Trandel, 1991	1983-1985 aggregate data for 210 models	–2.42	0.989	–1.43	Not reported
Berry, Levinsohn, and Pakes, 1995	1971-1990 aggregate data for 2217 model/year combinations	–3.52 to –6.36 based on model	Not reported	Not reported	Not reported
McCarthy, 1996	1989 consumer data for 1,564 individuals				
Domestic vehicles		–1.06	0.28	–0.78	1.62
European vehicles		–1.85	0.76	–1.09	1.93
Asian vehicles		–1.42	0.61	–0.81	1.65

[a] The cross-price elasticity is taken with respect to price changes for similar class cars.

[b] The market-price elasticity equals the own-price plus the cost-price elasticity. It represents the change in quantity demanded with respect to a 1 percent increase in all car prices.

SECTION 5

MARKET DATA

This section provides data on domestic production, domestic consumption, imports, and exports of automobiles and light duty trucks. In addition, it also includes data on average retail prices and a discussion of the relationship between retail prices and the wholesale prices received by automobile and LDT assemblers. Finally, this section discusses trends and projections for the automotive industry.

5.1 Market Volumes

Data on the volumes of automobiles and light duty trucks produced and consumed annually in the United States, including imports and exports, are discussed below.

5.1.1 Domestic Production and Consumption

Table 5-1 provides data on domestic production, factory sales, change in inventory, imports, and exports of passenger cars, which includes both automobiles and LDTs, for the 10-year period 1988 through 1997. The change in inventory represents the difference between domestic production and factory sales. In years for which manufacturers make more vehicles than they sell, inventories increase, and likewise, in years for which they make fewer vehicles than they sell, inventories decrease. Apparent consumption is calculated from these data by adding factory sales and imports and subtracting the change in inventories and exports. As noted in Table 5-2, the annual percentage changes in production and consumption are highly variable from year to year. In recent years, domestic production and factory sales have decreased year to year, and changes in apparent consumption have been negligible (see Figure 5-1).

5.1.2 International Trade

As indicated in Table 5-1, international trade is a major component of the U.S. market for automobiles. Total annual U.S. imports and exports of passenger cars for the 1990s are graphed in Figure 5-2. Over the past decade, imports of cars into the United States

Table 5-1. Passenger Car Production, Factory Sales, Change in Inventories, and International Trade, 1988–1997

Year	Domestic Production	Factory Sales	Change in Inventory[a]	Total Imports	Total Exports	Apparent Consumption[b]
1988	7,113,137	7,104,617	8,520	NA	781,171	NA
1989	6,823,097	6,807,416	15,681	NA	778,373	NA
1990	6,077,449	6,049,749	27,700	3,944,602	793,757	9,200,594
1991	5,438,579	5,407,120	31,459	3,736,462	754,950	8,388,632
1992	5,664,203	5,685,299	–21,096	3,574,722	851,074	8,408,947
1993	5,981,046	5,961,754	19,292	3,808,460	864,238	8,876,684
1994	6,613,970	6,548,562	65,408	4,097,014	1,019,258	9,626,318
1995	6,350,733	6,309,836	40,897	4,113,917	989,367	9,434,386
1996	6,083,227	6,140,454	–57,227	4,064,447	973,634	9,231,267
1997	5,927,281	6,069,886	–142,605	4,357,220	1,075,303	9,351,803
Avg.	6,207,272	6,208,469	–1,197	3,962,106	888,113	9,068,490

NA = Not available
[a] Change in Inventory = Domestic Production – Factory Sales
[b] Apparent Consumption = Factory Sales + Imports – Exports

Source: American Automobile Manufacturers Association. 1998. *Motor Vehicle Facts and Figures 1998*. Detroit: AAMA.

Table 5-2. Annual Growth Rates of Passenger Car Production and Consumption, 1990–1997

Year	Domestic Production	Apparent Consumption
1990	–11%	—
1991	–11%	–9%
1992	4%	0%
1993	6%	5%
1994	11%	8%
1995	–4%	–2%
1996	–4%	–1%
1997	–3%	2%
Average Annual Percentage	–1.5%	0.4%

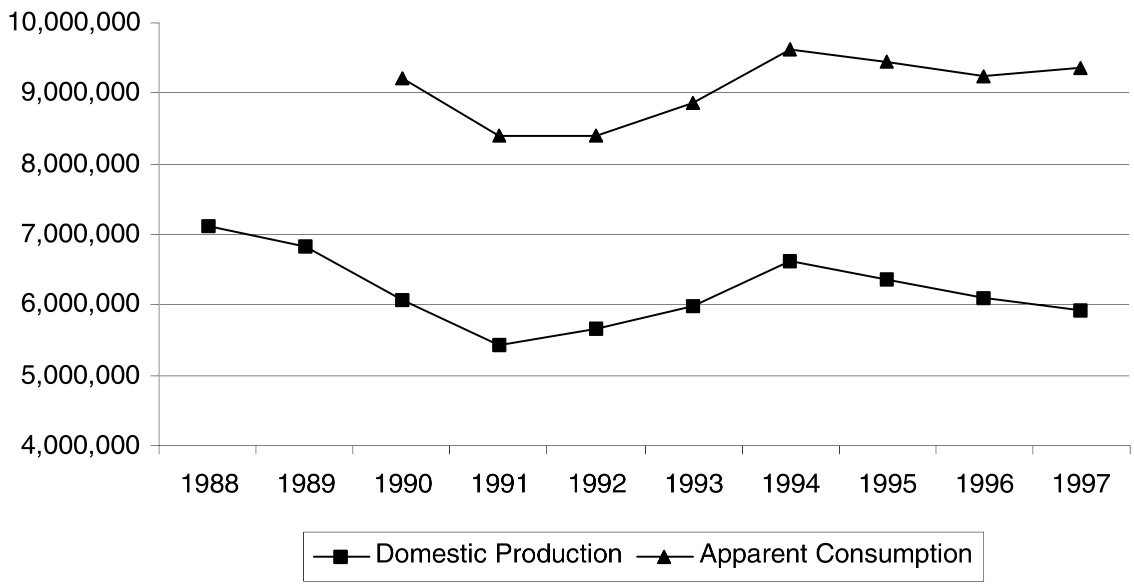

Figure 5-1. U.S. Domestic Production and Apparent Consumption, 1990–1997

have increased by approximately 10 percent. In comparison, exports of cars from the United States have increased by approximately 35 percent but are only one-fourth of the size of imports.

Table 5-3 provides data on imports of passenger cars by country during the 1990s. In 1997, imports from Canada made up nearly 40 percent of U.S. imports, followed by Japan at 32 percent, and Mexico at 12 percent. However, these import data do not include cars built in the United States for the U.S. market by foreign companies; these cars are considered domestic production. In addition, many of the vehicles produced in Canada and Mexico, the United States' largest trading partners, are produced by U.S. companies for the U.S. market. It has become easier for U.S. companies to locate production facilities in these countries in recent years because the United States has a special trading relationship defined under the North American Free Trade Agreement (NAFTA). Most recently, imports have jumped sharply as foreign automobile manufacturers have begun to offer SUVs in response to increased demand for SUVs by the American public (U.S. Department of Commerce, 1999c).

Table 5-4 provides data on U.S. exports of passenger cars by country during the 1990s. In 1997, exports to Canada made up the majority of U.S. exports at 58 percent, followed by Japan at 7 percent, Mexico at 6 percent, and Germany at 5 percent. Over time, exports may decline as U.S. manufacturers locate plants in the countries where the cars are to be sold or in countries with lower costs of production (U.S. Department of Commerce, 1999c).

5.2 Market Prices

Table 5-5 and Figure 5-3 illustrate the relative increases in prices for new and used cars compared to the overall price level. During the 1990s, the consumer price index (CPI) for new cars rose more slowly than the CPI for all items, even while new cars improved and added safety and emissions equipment. In comparison, the CPI for used cars rose faster than the CPI for all items as the market for used vehicles increased substantially. Specifically, from 1990 to 1997, the CPI rose by 23 percent for all items, by 17 percent for new cars, and by 28 percent for used cars.

Table 5-6 presents U.S. car prices in nominal and real 1992 dollars from 1991 to 1997. The average prices of import cars were nearly 60 percent higher than domestic cars in 1997. As shown, nominal market prices for domestic cars consistently increased from 1991

Figure 5-2. U.S. Imports and Exports of Passenger Cars, 1990–1997

to 1997 while the real prices have remained relatively unchanged. However, real prices for import cars have increased dramatically.

Another way to look at the price of a car is to calculate the number of weeks of the median family income that is required to purchase the average car. During the 1990s, the number of weeks increased slightly from 24.0 in 1991 to 25.4 weeks in 1994, but had declined back to 23.5 weeks in 1997. Thus, family incomes are rising faster than the price of the average car.

The relationship between the prices paid by consumers for cars and the wholesale prices received by car manufacturers is not readily known. The Manufacturers Suggested Retail Price (MSRP) is usually above the price that consumers actually pay for a vehicle and includes the markup received by the dealership that sells the vehicle. Invoice prices, which would appear to be a wholesale price, are readily available from automobile pricing services, such as Autobytel.com, nadaguides.com, and Edmunds.com, but do not reflect the actual prices received by manufacturers. The prices they receive may be below the invoice base price because of dealer holdbacks, dealer incentives, and rebates. Dealer holdback is a

Table 5-6. Market Prices for New Cars in Nominal and Real 1992 Dollars

	Average Expenditure Per New Car						Weeks of Median Family Earnings to Equal Average New Car Expenditure
	Domestic		Import		Average		
Year	Nominal	Real ($1992)	Nominal	Real ($1992)	Nominal	Real ($1992)	
1991	$15,775	$16,246	$17,019	$17,527	$16,083	$16,563	24.0
1992	$16,389	$16,389	$19,601	$19,601	$17,137	$17,137	25.0
1993	$16,673	$16,187	$21,477	$20,851	$17,678	$17,163	25.0
1994	$17,575	$16,643	$23,211	$21,980	$18,657	$17,668	25.4
1995	$17,767	$16,360	$24,617	$22,668	$18,957	$17,456	24.3
1996	$18,199	$16,278	$27,695	$24,772	$19,620	$17,549	23.8
1997	$18,624	$16,280	$29,708	$25,969	$20,447	$17,873	23.5

Source: American Automobile Manufacturers Association (AAMA). 1998. *Motor Vehicle Facts and Figures 1998*. Detroit: AAMA.

percentage of the MSRP that the manufacturer pays the dealer to assist with the dealer's financing of the vehicle while it is on the dealer's lot (Edmunds.com, 2000b). For year 2000 models, the amount of the holdback ranges from zero to 3 percent depending on the manufacturer. Incentives and rebates are programs offered by the manufacturer to increase sales of vehicles that are selling slowly. Rebates may be offered as either direct cash back to the buyer or low-rate financing (Edmunds.com, 2000a). For year 2000 models, the cash rebate amounts range from $0 to $4,000 per vehicle but are typically in the $500 to $2,000 range depending on the model. Low-rate financing is as low as 0.9 percent. Dealer incentives are dollar amounts passed directly to the dealership (Edmunds.com, 2000a). For year 2000 models, dealer incentives are as high as $10,000 per vehicle but are typically more in the $250 to $1,000 range for vehicles on which they are offered. According to Consumer Reports (2000b), the wholesale price of cars, after subtracting holdbacks, incentives, and rebates, ranges from zero percent below invoice prices for the BMW 323i four-door to 13.9 percent for the Lincoln Continental.

Table 5-3. U.S. Imports of New Assembled Passenger Cars by Country of Origin, 1990–1997

Year	Canada	Germany	Japan	South Korea	Mexico	Sweden	United Kingdom	Other	Total Imports
1990	1,220,221	245,286	1,867,794	201,475	215,986	93,084	27,271	73,485	3,944,602
1991	1,195,987	172,446	1,789,138	191,449	249,499	62,905	14,874	60,164	3,736,462
1992	1,200,358	206,124	1,637,066	133,244	266,149	76,832	11,007	43,942	3,574,722
1993	1,468,272	184,356	1,597,391	126,576	299,634	58,742	20,048	53,441	3,808,460
1994	1,591,326	187,999	1,593,169	217,962	360,370	63,867	28,239	54,082	4,097,014
1995	1,678,276	206,892	1,387,193	216,618	463,305	82,634	42,176	36,823	4,113,917
1996	1,688,123	234,480	1,190,581	225,613	550,622	86,595	43,616	44,817	4,064,447
1997	1,722,199	298,032	1,383,519	222,535	539,384	79,725	43,726	68,100	4,357,220
Avg.	1,470,595	216,952	1,555,731	191,934	368,119	75,548	28,870	54,357	3,962,106

Source: American Automobile Manufacturers Association (AAMA). 1998. *Motor Vehicle Facts and Figures 1998*. Detroit: AAMA.

Table 5-4. U.S. Exports of Passenger Cars by Country of Destination, 1990–1997

Year	Canada	France	Germany	Japan	Kuwait	Mexico	Saudi Arabia	Taiwan	Other Countries	Total Exports
1990	505,352	10,475	34,485	39,188	2,919	12,827	23,288	66,609	98,614	793,757
1991	495,373	5,563	38,284	28,160	16,312	10,592	28,270	44,934	87,461	754,950
1992	459,910	8,704	56,615	40,598	15,208	4,261	35,502	90,231	140,045	851,074
1993	480,909	2,942	44,038	56,741	7,923	4,036	32,827	71,332	163,490	864,238
1994	559,513	6,083	39,568	100,400	9,246	36,569	18,587	72,491	176,801	1,019,258
1995	492,107	2,538	26,690	130,524	6,661	18,649	12,523	61,002	238,673	989,367
1996	502,652	3,802	59,462	109,917	7,708	46,562	18,253	35,141	190,137	973,634
1997	626,629	2,514	57,426	71,789	2,565	62,911	10,146	24,697	216,626	1,075,303
Avg.	515,306	5,328	44,571	72,165	8,568	24,551	22,425	58,305	163,981	915,198

Source: American Automobile Manufacturers Association (AAMA). 1998. *Motor Vehicle Facts and Figures 1998*. Detroit: AAMA.

Table 5-5. Consumer Price Indexes (All Urban Consumers) for All Items and For New and Used Cars (1992 = 100), 1990–1997

Year	All Items	New Cars	Used Cars
1990	93.1	94.2	95.4
1991	97.1	97.6	104.3
1992	100.0	100.0	100.0
1993	103.0	102.4	108.7
1994	105.6	105.9	115.0
1995	108.6	108.3	127.0
1996	111.8	110.2	127.5
1997	114.4	110.4	122.6

Source: American Automobile Manufacturers Association (AAMA). 1998. *Motor Vehicle Facts and Figures 1998*. Detroit: AAMA.

5.3 Industry Trends

The motor vehicle industry in the United States is a large, mature market in which most of the vehicles produced are geared toward the preferences of U.S. consumers. U.S. consumers generally prefer larger, more powerful vehicles than consumers in other parts of the world, in part because gas prices are significantly lower in the United States relative to other countries. However, domestic production of motor vehicles in the United States is projected to increase in the next 5 years primarily due to two factors. First, foreign automobile manufacturers, such as Honda and BMW, are locating more of their production facilities in the United States to serve the U.S. market. Automobiles produced from these facilities would previously have been classified as imports, but after relocation of production facilities, they are considered domestic production. Second, the LDT market, in which U.S. manufacturers dominate, is surging especially as manufacturers are offering more car-like amenities in these vehicles. The U.S. Department of Commerce (1999c) projects that domestic automobile manufacturing facilities will have capacity utilization rates of 90 percent or more over the next few years.

Offsetting these increases in domestic production is the fact that U.S. manufacturers are expected to move some production facilities to locations with lower costs of production such as Mexico and Canada. Relocation to Mexico and Canada has become easier partly

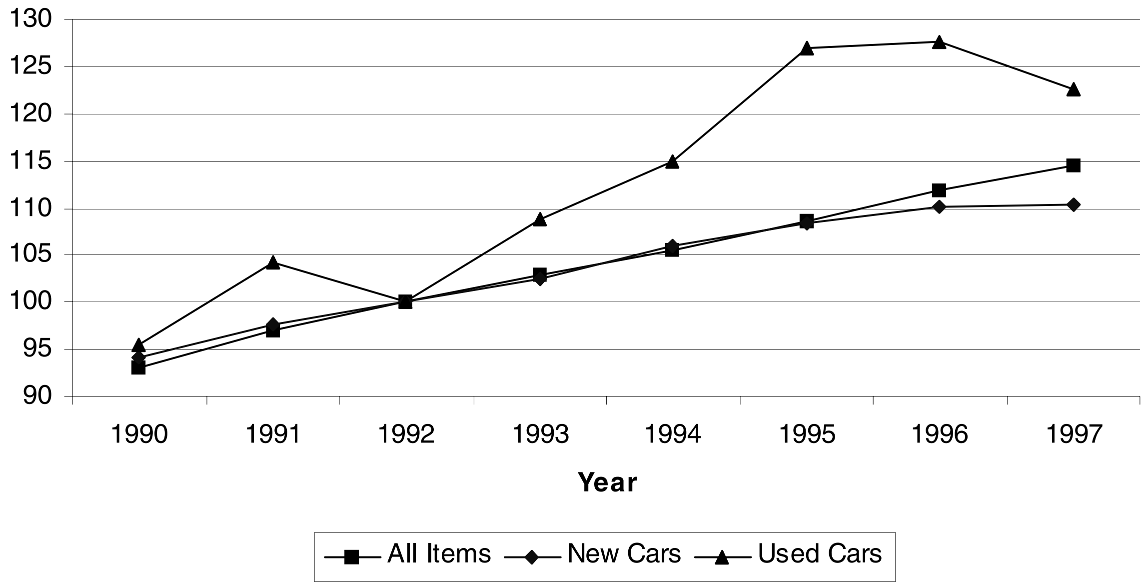

Figure 5-3. Consumer Price Indexes for All Items Compared to New and Used Cars (1992 = 100), 1990–1997

because of NAFTA. In addition to lower costs of production, other countries may have less-stringent environmental regulations than the United States' regulations, which translates into lower costs as well. When production facilities are relocated to other countries, what was formerly considered domestic production becomes imports if the vehicles are delivered to the U.S. market. However, if the vehicles are intended for the domestic country in which they are produced, they are no longer considered either "domestic production" or "imports." To serve the markets in other countries, however, U.S. manufacturers have developed and will continue to develop smaller, less costly models than those produced for the U.S. market. Most of the growth in the global vehicle market will be in less-developed countries such as China, India, Latin America, and eastern Europe in which the typical U.S. automobile is overly equipped and prohibitively expensive.

Over time, automobile manufacturers are adopting a more global approach to automobile manufacturing. This change in approach comes as the industry continues to consolidate and foreign and domestic firms merge or form joint ventures (e.g., Mazda and

Ford, Daimler-Benz and Chrysler). In the more global approach, automobile manufacturers are reducing the number of unique automobile platforms and using them throughout the world. This approach allows them to reduce product development costs and spread the development costs over a greater number of vehicles. In addition, under the global approach, automobile manufacturers can locate plants in the countries in which production costs are lowest.

Overall, the U.S. Department of Commerce (1999c) projects that the U.S. share of the world motor vehicle markets, including cars, trucks, and buses, will increase from 22 percent in 1997 to 27 percent in 2003. U.S. output in these markets is projected to rise an average of 4.6 percent per year from 1997 to 2003 with a corresponding net increase of 25 percent in value of shipments.

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