

The Evolving Geography of Production— Is Manufacturing Activity Moving out of the Midwest? Evidence from the Auto Industry

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Two kinds of manufacturers contribute to the production of motor vehicles. Thousands of companies make the parts that go into motor vehicles, and a handful of companies put the parts together at several dozen final assembly plants in the United States. The distribution within the United States of both types of plants has changed since the 1970s. This paper identifies trends in the location of the two types of motor vehicle plants within the United States and reasons for changing patterns.

Changes in motor vehicle production have had a mixed impact on the Midwest, the industry's traditional home, defined here as the states of Illinois, Indiana, Michigan, Ohio, and Wisconsin. Final assembly plants are more likely than in the past to be located in the Midwest, whereas parts suppliers are less likely. Both final assembly plants and parts suppliers are increasingly likely to locate in the Southeast (between Virginia and Texas). This paper will try to account for these seemingly contradictory trends. Changes in the location of final assembly plants are examined first, followed by changes in the location of parts suppliers.¹

Final assembly

Recent changes in the distribution of final assembly plants are easy to document. Because of the relatively small number of companies and final assembly plants, openings and closures can be identified on a case-by-case basis.

Regional distribution of assembly plants

In 1996, 58 plants for final assembly of passenger cars and light trucks were open or under construction in the United States, only two more than in 1979. This apparent stability belies extensive changes in the location and ownership of the assembly plants. Twenty-two of the 56 plants in operation in 1979 closed by 1996, while 24 new ones opened.

The Big Three U.S.-owned carmakers—Chrysler Corporation, Ford Motor Company, and the General Motors Corporation—were responsible for 21 of the 22 plant closures and for 12 of the 24 openings. GM closed 13 plants during the period and opened nine, Chrysler closed five and opened two, and Ford closed three and opened one.

A German company (Volkswagen) closed an assembly plant during the period, while two other German companies (BMW and Mercedes-Benz) opened two new plants. Japanese companies opened the remaining ten new plants, including three by Toyota, two by Honda, and one each by Nissan, a Mazda-Ford joint venture, a Toyota-GM joint venture, a Subaru-Fuji (Suzuki) joint venture, and a Mitsubishi-Chrysler joint venture (now solely owned by Mitsubishi).

In 1979, 27 of the 56 assembly plants were located in the Midwest, including 17 in Michigan, four each in Ohio and Wisconsin, and two in Illinois (figure 1). Six of the 57 assembly plants were in the Southeast, including three in Georgia, and one each in Kentucky, Texas, and Virginia. Fourteen were in western states, including six in Missouri, five in California, and one each in Kansas, Minnesota, and Oklahoma. Nine were in the Northeast, including three in New Jersey, two in Delaware, and one each in Maryland, Massachusetts, New York, and Pennsylvania (table 1).²

Figure 1 U.S. Assembly Plants 1979

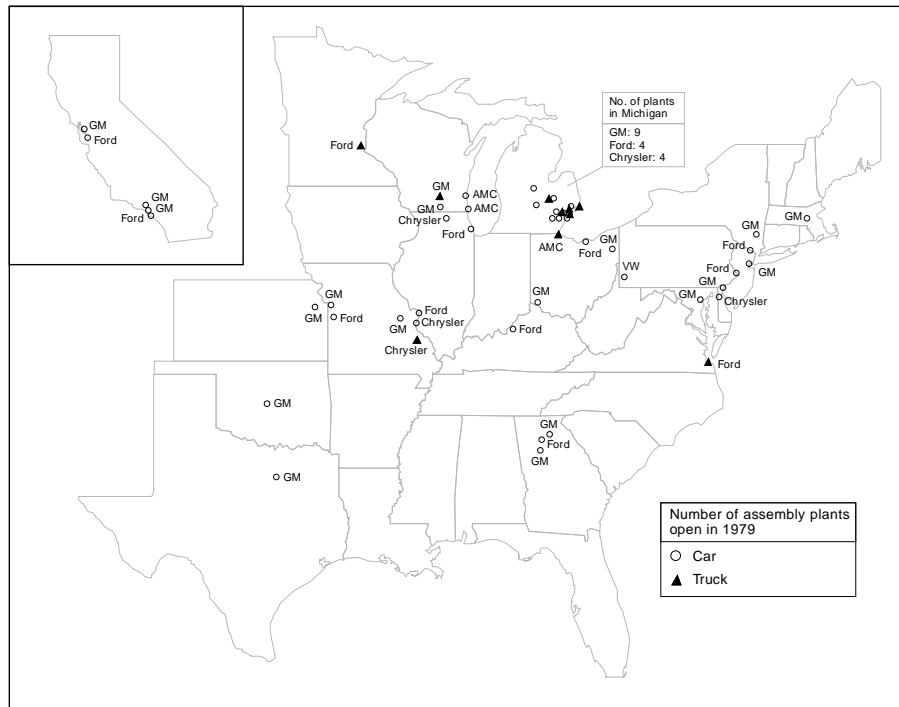
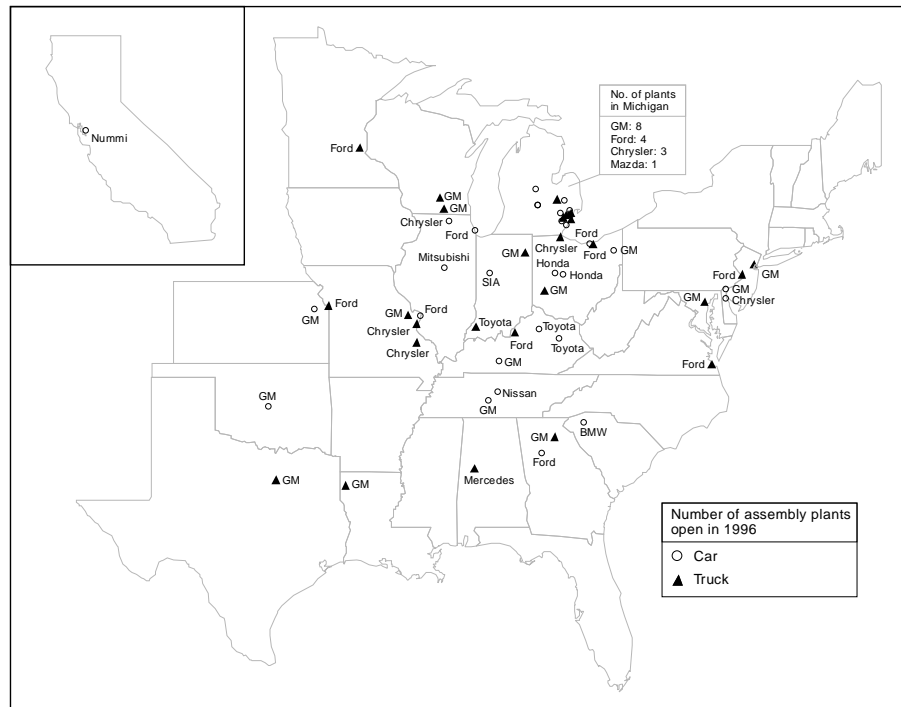


Table 1 Distribution of Auto Assembly Plants over Time, by Region

Region	Status of Plant			
	Open in 1979	Closed 1979-96	Opened 1979-96	Open in 1996
Midwest	27	9	13	31
Southeast	6	1	8	13
West	14	8	3	9
Northeast	9	4	0	5
Total	56	22	24	58
I-65/75 corridor	27	8	20	39
Other	29	14	4	19

The number of plants in the Midwest increased between 1979 and 1996 from 27 to 31 and in the Southeast from six to 13, while declining in the West from 14 to nine and in the Northeast from nine to five (figure 2). Thirteen assembly plants opened in the Midwest and nine plants closed. Eight assembly plants opened in the Southeast, and one closed. Three opened in the West, and eight closed. No plants opened in the Northeast, and four closed.

Figure 2 U.S. Assembly Plants 1996



A more effective way to depict the changing location of U.S. assembly plants is to identify assembly plants located near one of two north-south interstate highways, I-65 and I-75. Interstate 75 runs nearly 3,000 kilometers between Sault Ste. Marie in Michigan's Upper Peninsula and Miami, FL, passing through the cities of Detroit, MI; Toledo, Dayton, and Cincinnati, OH; Lexington, Kentucky, Knoxville, and Chattanooga, TN; Atlanta, GA; and Tampa, FL. Roughly 200 kilometers to the west, Interstate 65 runs 1,500 kilometers between Gary, IN, near Chicago, IL, and Lake Michigan, and Mobile, AL, near the Gulf of Mexico, passing through Indianapolis, IN; Louisville, KY; Nashville, TN; and Birmingham, AL.

Between 1979 and 1996, 20 of the 24 new assembly plants and only eight of the 22 closed plants were located in the I-65/I-75 corridor. As a result, the number of assembly plants located in the I-65/I-75 corridor increased during the period from 27 to 39, while the number elsewhere in the country declined from 29 to 19.

Reasons for changing distribution of assembly plants

As a fabricated product, a motor vehicle is much bulkier than the components that go into its construction and, therefore, is relatively expensive to ship. Consequently, motor vehicle producers locate final assembly plants to minimize the cost of shipping the assembled vehicles to consumers. Minimizing distribution costs has always been important for automotive companies, but the optimal location for assembly plants has changed several times during the 20th century.

When large-scale automotive production began around 1900, assembly plants clustered in the Midwest, especially near Detroit. During the World War I era, 80% of U.S. motor vehicles were assembled in southeastern Michigan, and nearly all of the remaining production was in adjacent midwestern states. The Ford Motor Company, which accounted for half of all sales, was responsible for much of Michigan's dominant position.

However, what Ford gave to Michigan it would soon take away; Michigan's share of national motor vehicle assembly fell within a few years from 80% to 40%. Assembly of low-volume models, such as Cadillac and Lincoln, remained in Michigan, but large-volume models, such as Ford and Chevrolet, were assembled at branch plants outside the Midwest. Ford pioneered the opening of branch assembly plants to produce its Model T cars. The company calculated that the cost of shipping Model Ts all over the United States from its Detroit assembly plant was greater than the cost of shipping parts to branch assembly plants located near major population centers. General Motors and Chrysler later emulated Ford's branch plant strategy for their most popular models.

For example, during the 1950s, GM produced Chevrolets at ten assembly plants. A Chevrolet purchased in Chicago had been assembled in Janesville, WI. New Englanders received their Chevrolets from an assembly plant in Tarrytown, NY, a few miles north of New York City. Other Chevrolet assembly plants were located in Baltimore, MD; Atlanta, GA; Flint, MI; St. Louis, MO; Kansas City, MO; Los Angeles and the San Francisco Bay area (in California). Regionalization was possible because all models produced under one nameplate, such as Chevrolet, differed in minor details like body trim or seat covers.

Beginning in the 1960s, the models of a particular nameplate began to vary in size, ranging from subcompacts less than 150 inches long to full-sized vehicles exceeding 210 inches. Further, vehicles classified as trucks, including pickups, sport utilities, and minivans, accounted for nearly half of all new vehicle sales during the 1990s. The number of different car and truck models sold in the United States increased eight-fold, from 30 in 1955 to 241 in 1995, while sales doubled from about 8 million in 1955 to about 16 million in 1995.

Assembly plants that had previously produced identical models for distribution within a regional market have been converted into specialized plants producing one or two models for national distribution. To minimize the cost of distributing products to a national market—and thereby maximize profits—automotive companies have

opened new plants in the interior and closed coastal ones. The geographic logic for an interior location is compelling: If a company wishes to minimize the cost of distributing a product to a national market and its entire output comes from one plant, then the optimal location for its plant is in the interior, specifically the I-65/I-75 corridor.

Parts suppliers

The relationship between carmakers and parts suppliers has undergone substantial restructuring during the past decade. Among the important changes:

- Many parts once made “in-house” by carmakers are now made by independent suppliers. General Motors currently buys about 30% of its components from outside suppliers, Ford about 50%, and Chrysler about 70%.
- The number of companies that supply parts directly to carmakers—known as tier one suppliers—has been slashed in half; many companies that once provided parts to carmakers now sell to tier one suppliers instead.
- Instead of awarding annual contracts to the lowest bidding suppliers, carmakers are signing multi-year agreements with suppliers to buy components for the lifespan of a model.
- Suppliers are being selected on the basis of ability to meet a variety of quality standards rather than only the lowest price.
- Carmakers have turned over to tier one suppliers responsibility for developing new components, and to facilitate the process they share information about new models once considered confidential.
- Tier one suppliers are being asked to provide large, complex modules, such as seats and instrument panels, instead of small parts, such as metal frames, foam, and knobs.
- Carmakers are reducing inventory in their final assembly plants by demanding just-in-time delivery of large modules from tier one suppliers.
- The largest tier one suppliers are transnational corporations that produce a wide variety of both automotive and nonautomotive components.

Given the large number of parts suppliers, systematic information on their national distribution is much more difficult to obtain than had been the case for final assembly plants. Secondary sources of information, such as the U.S. Census of Manufactures or County Business Patterns, do not give an accurate view of the distribution, because parts makers are represented in nearly all of the 20 standard industrial classifications (SICs) associated with manufacturing and in several dozen four-digit SIC codes.

Secondary sources also fail to distinguish between so-called original equipment manufacturers (OEMs), which produce components for new vehicles, and aftermarket manufacturers, whose products are sold to consumers and repair shops as replacements in older vehicles. The distinction is important because the customers for OEM suppliers are the final assembly plants clustered in the interior of the country, whereas the customers for aftermarket suppliers match the distribution of the U.S. population. Thus, the census shows that California contains a large number of automotive parts makers, but further investigation reveals that nearly all of them make parts for the large California aftermarket, and few are OEM suppliers.

For this study, the 150 largest suppliers (as identified by *Automotive News*, the industry's principal trade newspaper) were asked for the addresses of all of their U.S. factories that produced original equipment components, the specific products made at each plant, the number employed at each plant, and the year each plant was established. Information was compiled for 118 companies, including 88 of the top 100 companies. When the information from the company was incomplete—as in most cases—information was obtained from state industrial directories, most of which are published by the Harris Company, and by telephoning the company's public relations office. Altogether, addresses were found for 881 factories that manufacture components for new motor vehicles.

The restructuring of the automotive parts industry has encouraged two contradictory locational trends. On the one hand, suppliers want to be near the corporate offices, research centers, and production facilities maintained in Michigan by their customers, the Big Three carmakers. On the other hand, suppliers face pressure to locate some production in the Southeast to make use of the region's lower-cost, nonunion workforce and to deliver just-in-time to the region's new foreign-owned assembly plants. The large number of observations in this study enables some conclusions to be reached concerning the relative strength of the two contradictory locational pressures faced by parts suppliers.

Regional distribution of parts suppliers

The five midwestern states, the traditional core of the U.S. motor vehicle industry, contained 495, or 56%, of the 881 motor vehicle component plants. Michigan had the largest number of plants, 234, or 27% of the national total, followed by Ohio with 13% and Indiana with 11%. Illinois had 3% of the national total and Wisconsin, 2%.

Twenty-seven percent are in the 13 Southeast states between Virginia and Texas, including 6% of the national total in Tennessee and between 2.5% and 3.0% each in Georgia, Kentucky, North Carolina, South Carolina, and Virginia. Ten percent are in the West, with 3% of the national total in Missouri. Seven percent of the plants are in the Northeast, including about 2% each of the national total in Pennsylvania and New York. Forty-two states contain at least one motor vehicle components plant. No facilities were in the eight western states of Alaska, Colorado, Hawaii, Idaho, Montana, Nevada, North Dakota, and Wyoming.

The percentage of supplier plants in the Midwest has declined. The five midwestern states contain 77% of the currently operating plants that were built prior to 1960, compared to only 47% of the plants opened since 1970. Only 7% of the plants opened before 1960 are in the Southeast, compared to 37% of those opened since 1970 (table 2). The median year of opening for plants in the Midwest was 1965, compared to 1979 in the Southeast, 1976 in the West, and 1960 in the Northeast.

Two additional points about the changing regional distribution are important. First, the drift toward the Southeast has been underway for some time, certainly since the 1960s. General Motors in particular built a number of supplier and assembly plants in the Southeast during the 1960s with the goal of paying lower wages than in

Table 2 Supplier Plants by Region and Opening Date

Region	Before 1950	1950- 1959	1960- 1969	1970- 1979	1980- 1989	1990- 1995	Unknown	Total
Midwest	113	46	58	60	78	22	115	492
Southeast	7	8	25	50	65	11	69	235
West	9	1	13	15	21	2	28	89
Northeast	18	3	8	5	9	0	22	65
Total	147	58	104	130	173	35	234	881

its midwestern facilities. Once these plants were successfully organized by unions and covered under national contracts, GM abandoned its “Southern Strategy,” but other suppliers were able to open nonunion plants in the Southeast. The southern drift in the motor vehicle parts predated by more than a decade the widespread industrial restructuring (including the spatial division of labor) that followed the mid-1970s economic crisis.

Second, most of the supplier plants opened during the 1990s have been in the Midwest rather than the Southeast, although this trend must be approached cautiously because of the relatively small sample size. However, few new plants have been built in the Detroit metropolitan area or the other midwestern cities traditionally associated with motor vehicle production. Recently opened midwestern plants have clustered in southwestern Michigan, northeastern Indiana, and northwestern Ohio. Few new plants have been built even in the Detroit suburbs, let alone in the city of Detroit or Wayne County.

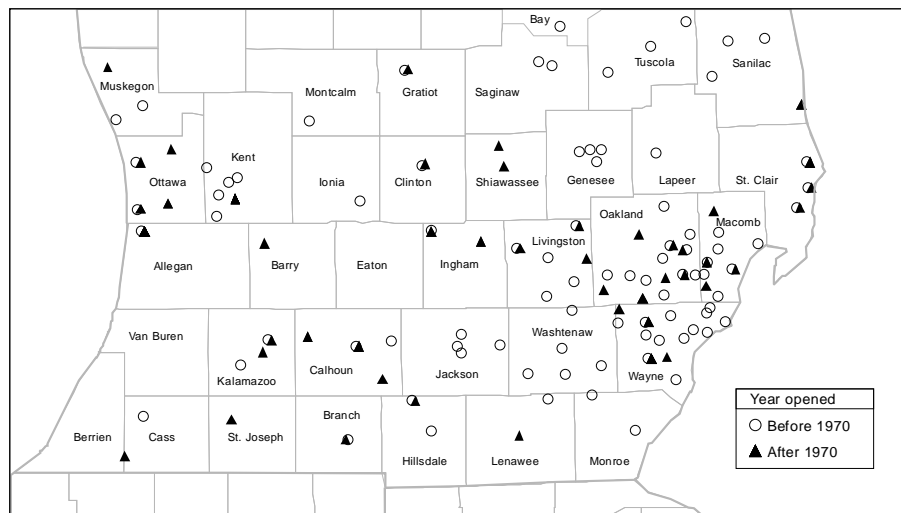
Small towns outside the Detroit metropolitan area offer suppliers the best of both worlds—proximity to the Detroit-area corporate offices, research facilities, and assembly plants, combined with the small-town benefits of lower land costs, uncongested access to long-distance interstate highways (especially I-69, 80, 90, 94, and 96), and a labor force lacking the dubious experience of building cars according to Fordist production methods. Thus, within Michigan about 70% of the plants opened before 1970 were in the southeastern part of the state, compared with about 50% since 1970 (figure 3).

Distribution of suppliers by owner

To understand why some components plants located in the Southeast whereas others remained in the traditional midwestern core region, two factors are significant: the plant’s owner and the specific type of component manufactured.

The top 150 suppliers were divided into three groups according to ownership. Five of the firms were owned by the Big Three U.S. carmakers—GM’s Delphi Automotive Systems, Ford Automotive Components Division, GM’s Delco Electronics Corporation, Chrysler Component Operations, and Ford Motor Co. Electrical and Fuel

Figure 3 Southern Michigan Plants of 150 Largest Suppliers of Motor Vehicle Components



Handling Division. Delphi, Ford, and Delco are the three largest suppliers, as measured by 1995 North American sales, Chrysler ranks tenth, and Ford Electrical twenty-fifth. The four divisions of the Big Three have 15% of the 881 components plants identified in this study.

In the past, the Big Three components divisions were “captives,” that is virtually all they produced was used elsewhere in the companies. This practice insulated the components divisions from market pressures—potential independent competitors were stifled, standards of quality and efficiency were low, and cost accountability was minimal.

Recently, the Big Three components divisions have been given considerable autonomy to act as independent suppliers. They are encouraged to bid for contracts to make components for other carmakers. At the same time, they must compete against independent suppliers to make components for their own company’s vehicles.

Foreign companies own 44 of the 150 largest suppliers. Seventeen of the companies are Japanese, twelve are German, seven are Canadian, three each are French and British, and one is Mexican. Foreign-owned companies ranking among the top 25 suppliers include three Japanese firms (Bridgestone/Firestone Inc., Denso, and American Yazaki), two German (Budd and Robert Bosch), and one Canadian (Magna). The foreign companies have 17% of the plants identified in this study.

The remaining 108 suppliers are U.S.-owned companies independent of the Big Three. The ten largest independent suppliers in 1995 were Dana Corp., Lear Seating Corp., TRW Inc., Johnson Controls, ITT Automotive, Inland Steel, DuPont Automotive, Allied Signal Automotive, United Technologies Automotive and American Axle & Manufacturing Inc. American-owned independent suppliers account for 69% of the surveyed plants.

Captive plants owned by the Big Three are more likely to be in the Midwest, whereas foreign-owned plants are more likely to be in the Southeast. The Midwest is the site of 80% of the Big Three components plants, compared with 54% of the independent U.S.-owned plants, and 41% of the foreign-owned plants. The Southeast has 9% of the Big Three captive plants, 27% of the independent U.S.-owned plants, and 40% of the foreign-owned plants (table 3).

Foreign-owned suppliers, lacking traditional roots in the Midwest, have been free to make “clean-slate” locational choices, whereas domestic suppliers have remained near their hometown to achieve agglomeration benefits, or at least because of inertia and loyalty. New European-owned suppliers gravitate toward the Carolinas and other southeastern coastal states to facilitate shipping between Europe and the United States. Many new Japanese-owned suppliers have been required to locate near Japanese-owned final assembly plants to which they are tied through the keiretsu system.

Distribution of suppliers by type of component

Classifying the thousands of components that go into a motor vehicle is rather arbitrary, especially with increasing production of large, integrated components that combine several functions. For this study, components were divided into ten systems based on their function in the vehicle, including six mechanical systems (engine, cooling, electrical, drivetrain, brake, and other mechanical systems) and four nonmechanical systems (body, interior, trim, and tires). A factory that made more than one type of component was classified according to its most important product.

Regional distribution varied widely according to system. The Midwest contained about three-fourths of the engine and brake plants and about two-thirds of the body, trim, and drivetrain plants. At the other extreme, only 9% of the tire plants and about one-third of the cooling, interior, and other mechanical plants were in the Midwest (table 4). Each of the ten systems is discussed in more detail in the following pages.

Table 3 Supplier Plants by Region and Nationality of Owner

Region	Big 3 subsidiary	Independent U.S.-owned	Foreign-owned	Total
Midwest	80	54	41	56
Southeast	9	27	40	27
West	4	12	9	10
Northeast	7	7	9	7
Total	129	603	149	881

Figures except totals are in percent. Columns may not add up to 100 percent because of rounding.

Table 4 Supplier Plants by Region and Type of Product

Region	Engine	Cooling	Electrical	Drive	Brake	Other	Body	Interior	Trim	Tires
Midwest	71	38	54	63	78	30	66	39	64	9
Southeast	13	32	31	21	22	39	18	33	25	74
West	10	18	9	8	0	19	9	22	4	13
Northeast	6	13	6	7	0	13	7	6	7	4
Total	94	56	93	163	41	80	82	79	170	23

Engine. Given the centrality of the engine to a motor vehicle's functioning, as well as its character, carmakers produce nearly all of their own engines—the Big Three almost entirely in the Midwest, the larger Japanese companies (Toyota, Honda, and Nissan) near their final assembly plants. Other foreign carmakers import their engines.

Independent suppliers manufacture such engine components as pistons, valves, cylinder sleeves, and camshafts, as well as components closely tied to engine performance, such as the fuel and exhaust systems. The largest independent suppliers of engine components are Dana Corporation, TRW Inc., and Eaton Corporation. Arvin Industries Inc. is by far the leading supplier of exhaust components.

Production of engine components has remained highly clustered in the Midwest, although relatively few new ones have been built. Critical factors in remaining in the Midwest include proximity to the main customers—the Big Three engine plants—and the region's highly skilled work force with a long tradition of manufacturing engines.

Cooling. An engine produces a large amount of waste heat, so it must be cooled to avoid destruction. Major producers of radiators and other engine cooling components include Valeo (a French company), Stant Corporation, and Modine Manufacturing Co.

Air conditioning, found only on luxury cars into the 1960s, is now installed on 99% of all cars sold in the United States. GM's Delphi Automotive Systems, Harrison Thermal Systems, and Ford Climate Control Division each have about 40% of the market. Three foreign companies—Denso, Calsonic North America (both Japanese), and Valeo—hold the remaining 20%.

Only one-third of the plants that make cooling components are in the Midwest, and one-sixth of the plants opened since 1970 (figure 4). Centers of production outside the Midwest include New York, Tennessee, Missouri, and California. The small percentage of midwestern plants may be related to the large number of foreign companies and the relatively new, stand-alone nature of air-conditioning technology.

Electrical. In 1975, motor vehicles contained only two electronic parts (a voltage regulator and a radio). By the early 1990s, the dollar value of electronics in a motor vehicle exceeded that of steel. New vehicles contain many electronic controls that regulate the engine and make passengers more comfortable.

Figure 4 U.S. Plants of Suppliers of Cooling Systems



By far the largest supplier of automotive electrical and electronics components—as well as many other components—is General Motors’ Delphi Automotive Systems division, followed by GM’s Delco Electronics Corporation. The largest independent supplier is UT Automotive, part of United Technologies. Ford and Chrysler also produce electronics.

More than half of the plants are in the Midwest, largely a function of GM’s dominance. Skilled workers are involved in the early and final stages of productions in GM’s long-standing midwestern electronics centers, such as Kokomo, IN, and Warren, OH. However, recently built plants are more likely to be in the Southeast and Mexico, where lower cost workers can do unskilled steps, such as bundling wire harnesses.

Drivetrain. The drivetrain uses the engine’s power to rotate the wheels at a desired speed. The most complex drivetrain component is the transmission, which houses several gears for changing the vehicle’s speed. As was the case with engines, carmakers manufacture most of their own transmissions because of their importance to the operation and character of the vehicle. High-performance models produced in low volumes may contain transmissions produced by Borg-Warner Automotive Inc. or New Venture Gear Inc. (a joint venture between Chrysler and General Motors).

Major domestic manufacturers of components for the transmissions that are assembled by carmakers include Hayes-Albion Corporation (a subsidiary of Harvard Industries), Simpson Industries, and SPX Corporation. Foreign companies active in supplying transmission components include ZF Industries (a German company), Aisin World Corporation (Japanese), Valeo (French), and Steyr Daimler Puch Fahrzeugtechnik (Austrian).

The transmission sends power along a driveshaft to the differential, which in turn relays power laterally through an axle to the wheels. The four largest drivetrain suppliers—American Axle & Manufacturing Inc., Dana, Eaton, and Rockwell Automotive—specialize in production of axles, the first two companies for cars, the second two for trucks. General Motors and Ford also make some of their own axles. On most newer cars and light trucks, the transmission turns the two front wheels, and the transmission, differential, and front axle are combined into one component, known as the transaxle.

Carmakers buy most of their wheels from six independent suppliers. Superior Industries International has about 40% of the U.S. market. The others are Reynolds Metals Co., NSK Corporation (Japanese), Hayes Wheels International Inc., Amcast Industrial Corporation, and The Budd Co. (now a subsidiary of the German company Thyssen AG).

When a car hits a bump, the suspension system makes certain that the wheels maintain contact with the road and provide passengers with a smooth ride. GM's Delphi is a major producer of suspension components, and Chrysler produces some suspension components. Tenneco Automotive is the largest independent supplier of suspension components. A.O. Smith is the largest supplier of frames to which the drivetrain and engine are attached.

Two-thirds of all drivetrain plants are in the Midwest, including nearly all of the Big Three transmission plants. The percentage of midwestern plants is high for independent suppliers of all other drivetrain components, with the exception of suspension systems. The Midwest has been the traditional center of production of highly skilled engineered components central to a vehicle's operation—the drivetrain as well as the engine.

However, less than half of new drivetrain plants are in the Midwest. Manufacturers of drivetrain components (figure 5) and axles (figure 6) are less likely to locate new plants in the Midwest, but the move out of the Midwest is detectable in all types of drivetrain components. American- and foreign-owned suppliers are equally likely to open new drivetrain plants outside the Midwest. The larger domestic companies have maintained older plants in their midwestern hometowns, such as Dana in Toledo, OH; and Eaton in Cleveland, OH. But these companies have built their newer plants in the Southeast.

Figure 5 U.S. Plants of Suppliers of Transmission Components

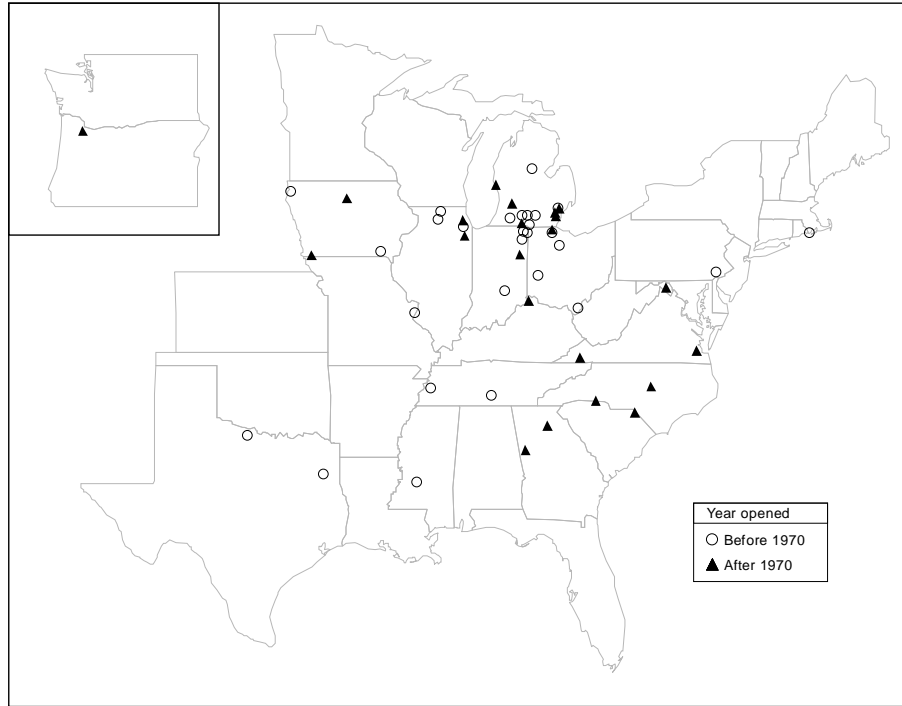


Figure 6 U.S. Plants of Suppliers of Axles

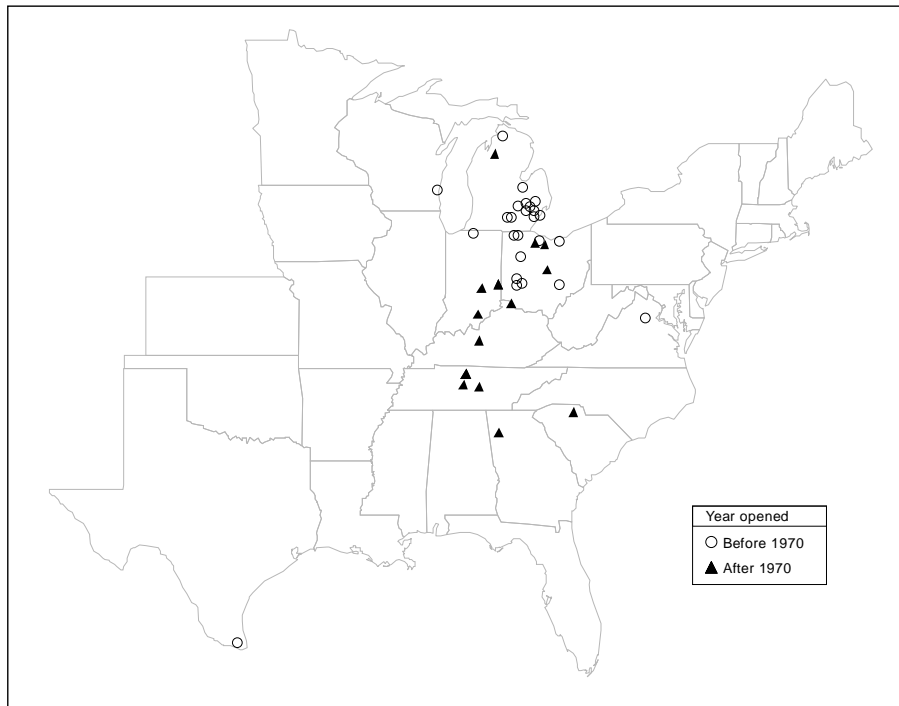


Brakes. Until recently, brake technology had changed little since the 1920s, when drum brakes became standard. During the 1970s, drums were replaced by disc brakes, which stop the vehicle by pressing flat disc-shaped rotors made of friction material against the inside and outside of the wheel. With antilock brakes (ABS), which have become common during the 1990s, a computer controls the amount of friction exerted on each wheel. The three large independent U.S. suppliers of brakes are ITT Automotive, AlliedSignal Automotive, and Kelsey-Hayes. GM is also a major brake manufacturer.

A relatively skilled operation, brake production is among the most highly clustered in the Midwest (figure 7). However, nearly half of the new plants are in the Southeast, the result of several foreign companies entering the U.S. brake market, including Lucas-Sumitomo (a joint British-Japanese venture), Ambrake Corporation (a joint venture between Japan's Akebono Brake Industry Co. of Japan and GM's Delphi Automotive Systems), and T&N Industries Inc. (a British company).

Other mechanical components. Components grouped here include hose, belts, gaskets, bearings, seals, and mounts. Coltec Industries and Federal-Mogul Corporation are major suppliers of gaskets, bearings, and other cast-iron parts. The Gates Corporation is the largest supplier of hoses and belts.

Figure 7 U.S. Plants of Suppliers of Brake Components



Only 30% of these plants and only 10% of the recently opened plants are in the Midwest. The Southeast contains a large number of gasket and bearing plants, whereas most of the hose and belt plants are clustered in Missouri, Iowa, Kansas, and Nebraska, classified here in the West. The distribution of plants making hose and belts reflects a widespread move away from the Midwest in the production of other rubber products, such as tires. In general, these suppliers are making large batches of small, standardized parts that may not need to be on just-in-time delivery.

Manufacturers of diesel engines and diesel engine components are also included here. Cummins Engine Company, the leading U.S. manufacturer of diesel engines, has its assembly plant and headquarters in Indiana, but most of its components plants are in the Southeast.

Body. The exterior body of a vehicle consists of several large panels stamped out of steel or in a few cases molded out of plastic. At the final assembly plant, the panels are painted and front and rear windows are attached. Door panels arrive with the glass already installed.

Carmakers stamp many of their own body panels and buy some from independent suppliers, such as Inland Steel, Budd, and GenCorp. Ford is a major producer of glass, along with two independent suppliers, PPG Industries Inc., and Libbey Owens Ford Co. Integrated window assemblies (including glass window, frame, seal, and regulator) are produced by Excel Industries Inc., Harvard's subsidiary Hayes-Albion, and Donnelly Corporation. Dupont is the largest supplier of automotive paints and finishes, followed by PPG.

Most of the panel and paint plants are in the Midwest. Bulky, fragile body panels have always been stamped near the final assembly plants. However, less than half of the glass plants are in the Midwest; Ford has long produced glass in Tennessee and Oklahoma, as well as in its hometown of Dearborn, MI.

Interior: Two interior components—airbags and seats—are included in this section because they are especially bulky, and their production reflects some of the recent changes in the industry. The installation of airbags has diffused rapidly during the 1990s. Leading manufacturers include GM, TRW, Morton International Inc., and Takata Automotive (a Japanese firm).

In the past, individual seating parts were put together at final assembly plants. Now, independent suppliers ship finished seats to the final assembly plants ready for installation. Lear Seating Corp. and Johnson Controls Automotive Systems Group are the two major suppliers of seats, followed by Magna, Findlay Industries, The Woodbridge Group, and Tri-Con Industries.

Only 33% of the airbags and 41% of the seats are made in the Midwest (figures 8 and 9). Airbag production, a relatively self-contained new technology, has few ties to the Midwest. Seats are relatively low value components for their bulk, and most of the production can be done by relatively unskilled workers.

Figure 8 U.S. Plants of Suppliers of Airbags



Figure 9 U.S. Plants of Suppliers of Seats



Trim. This group includes a diverse collection of manufacturers of nonmechanical components attached to the interior and exterior of the vehicle, primarily to enhance comfort and appearance rather than performance. Magna International Inc., the largest Canadian-owned supplier, is the leading U.S. supplier of original equipment trim products, such as bumpers, grilles, and mirrors. (Magna was the largest company that refused to provide plant location information for this study.) UT Automotive makes headliners, instrument panels, sun visors, and steering wheels. And so the list goes on—individual companies can supply hundreds of specific parts.

Despite the diversity of products and materials, trim plants share locational patterns. Two-thirds of the trim plants are in the Midwest. Trim plants have not drifted toward the Southeast—two-thirds of the newer ones are also in the Midwest. For these somewhat smaller companies, proximity to midwestern sources of raw materials and markets may be especially crucial.

Tires. Tires are made entirely by independent suppliers. Three companies dominate production of original equipment tires in the United States—Goodyear Tire and Rubber Co., Michelin (a French company), and Bridgestone/Firestone Inc. (a Japanese company).

Akron, Ohio, was the center of tire production for much of the century, but very few tires are still made in the city, or elsewhere in the Midwest for that matter. Tire suppliers have the lowest percentage of plants in the Midwest of any type of supplier. Only two of 23 original equipment tire plants are in the Midwest, whereas 17 are in the Southeast, including five each in Alabama and South Carolina.

Tires are especially bulky low-value-added products that are less integrated into the automotive production process than other components. The Southeast's non-union, lower-paid workforce has been especially important to tire makers, because labor costs constitute a higher percentage of tire production costs than for other components, and skilled workers are less critical (figure 10).

Headquarters of parts suppliers

Large parts suppliers are more likely to locate their headquarters in the Midwest than they are their factories. Three-fourths of the 150 largest parts makers have their headquarters in the Midwest, including one-half in Michigan. Nine are in the Northeast, including four in Pennsylvania; eleven are in the Southeast, with three each in Kentucky and Tennessee; five are in the West, and eleven have no offices in the United States (table 5).

The distribution of headquarters reflects a changing spatial division of labor within the U.S. motor vehicle industry. The industry's traditional southeastern Michigan core area has become less important as a center of manufacturing but more important as a center of corporate decision-making, research, and other professional services.

Figure 10 U.S. Plants of Suppliers of Tires



Table 5 Headquarters of Parts Suppliers by State, Region, and Country

Midwest	114	West	5
Michigan	79	California	1
Ohio	16	Colorado	1
Illinois	8	Minnesota	1
Indiana	8	Missouri	1
Wisconsin	3	Utah	1
Southeast	11	Northeast	9
Kentucky	3	Pennsylvania	4
Tennessee	3	New York	2
Florida	1	Connecticut	1
Mississippi	1	New Hampshire	1
North Carolina	1	New Jersey	1
South Carolina	1		
Virginia	1		
Foreign-owned with no U.S. office*	11		
Canada	7		
Mexico	2		
France	1		
Germany	1		

*Does not include foreign companies with offices in the United States.

Conclusions

1. Final assembly plants are increasingly likely to be located in the Midwest, although the more important geographic trend is location in the interior of the country, along interstates 65 and 75, encompassing portions of both the Midwest and Southeast. Interior locations help carmakers minimize transport costs, especially those from assembly plants to consumers, because the entire North American output for most vehicles is produced at only one (or in a few cases) two assembly plants.

2. Large U.S.-owned suppliers still produce most of their components in the Midwest. The drift toward the Southeast started back in the 1960s. High value-added components requiring highly skilled workers, such as engines and brakes, are most likely to remain in the Midwest. The Southeast has a higher percentage of factories making bulky, low value-added components, such as tires and seats, or components based on “stand-alone” new technology, such as air bags and air conditioners.

3. The drift to the Southeast has been sustained in recent years less by the relocation of U.S.-owned suppliers than by the arrival of a large number of foreign companies, including Japanese, European, Canadian, Mexican, and Brazilian. Some of the motivation to locate in the Southeast is proximity to new assembly plants for just-in-time delivery, but foreign companies appear especially eager to avoid the unionized, high-cost northern labor market. Just-in-time delivery can be maintained over a range of several hundred kilometers.

4. Within the Midwest, new facilities are less likely to be in the Detroit area and more likely to be in southwestern Michigan, northeastern Indiana, and western Ohio. Especially favored are smaller communities in nonmetropolitan or outer-metropolitan counties without a tradition of automotive production, such as those along Michigan’s Lake Michigan shore.

5. At a regional scale, the motor vehicle industry continues its tradition of agglomeration within the interior of the country, although the boundaries of the region cut across the traditional regional classifications, such as the Midwest and Southeast. Within the motor vehicle industry’s I-65/I-75 core region, individual firms are taking advantage of the diverse attributes offered by individual sites, such as proximity to Detroit and local labor market conditions.

Footnotes

¹ Material on assembly plants was updated from the author’s book *The Changing U.S. Auto Industry* (London: Routledge, 1992). Material on suppliers of components was based on preliminary findings of author’s survey. Miami students Kevin Leeson, Kenneth Guttman, and Michael Baker assisted in collecting information on suppliers.

² The regions are defined as follows: The Midwest includes Illinois, Indiana, Michigan, Ohio, and Wisconsin. The Southeast includes Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Texas, Virginia, and West Virginia. The Northeast includes Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. The West includes all others.