Who Really Made Your Car?

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Abandoning Ohio: A Tale of Two Cities

It appears likely that the center of the country’s automotive production will remain near Toledo, and that a considerable portion of the community’s industrial function will continue to follow the trends of this industry. (Ballert 1947)

Ohio has long been the second-leading motor vehicle production state behind Michigan. The state has accounted for about 15 percent of total U.S. motor vehicle employment, parts plants, and final assembly plants. Unlike its Great Lakes neighbor to the north, Ohio increased (at least slightly) its share of the national totals during the late twentieth and early twenty-first centuries.

Ohio’s second-place position has partly been a legacy of Detroit 3 investment. As discussed in Part 1 of the book, the Detroit 3 built numerous powertrain and stamping facilities in Ohio, especially after World War II. Despite cutbacks and closures, the Detroit 3 combined still directly employed 42,298 in 22 Ohio facilities in 2006 (Ohio Department of Development Office of Strategic Research 2006).

The Detroit 3 decline has been largely offset in Ohio by growth in Japanese-owned production facilities. Honda of America employed 12,200 at its two assembly plants and three powertrain plants in Ohio in 2006 and another 3,174 at seven joint ventures with Japanese parts makers. The Ohio Department of Development identified another 55 Japanese-owned motor vehicle firms that together employed 22,785 in the state in 2006 (Ohio Department of Development Office of Strategic Research 2006).

Ohio’s initial ascendancy in motor vehicle production came prior to the emergence of the Detroit 3, let alone Japanese carmakers. During the 1890s, the state had its share of pioneer carmakers, such as Alexander Winton, Henry Joy, and William Packard. Had venture capital been as readily available in Ohio in 1900 as it was in Detroit, Cleveland or
Cincinnati could have emerged as the center of automotive production (Rubenstein 1992, p. 41; Smith 1970, p. 31; Wager 1975, p. xiii).

Instead, Ohio became the center for production of two key parts: tires and glass. U.S. tire production concentrated in the northeastern Ohio city of Akron and glass in the northwestern city of Toledo. Just as Detroit became known as Motor City, Akron became Rubber City and Toledo became Glass City.

Tires and glass have shared similar positions in the auto industry:

- They are the two largest and most visible parts not made of metal.
- Applications and key technology breakthroughs predated the auto industry.
- Tires and glass are relatively self-contained and freestanding portions of the vehicle and are less integrated with other parts.
- They have been regarded by carmakers as not essential to their core competency.
- They have consistently been outsourced to independent suppliers, even at the height of vertical integration (with the exception of Ford, which once made glass).

The U.S. motor vehicle industry continues to depend on U.S.-made tires and glass in the twenty-first century. Neither of these large, bulky, low value-added parts is amenable to overseas outsourcing. But few tire and glass facilities remain in Ohio. As with Detroit, heavy dependence on one industry left both Akron and Toledo vulnerable to global shifts, especially globalization of ownership.

RISE AND FALL OF RUBBER CITY

Tire manufacturers may be the best-known suppliers among the broader public. Alone among suppliers, the tire maker emblazons its name in four places on the exterior of the vehicle, often in much bolder lettering than the name of the vehicle itself. Because of heavy advertising, the Michelin Man and the Goodyear Blimp are familiar icons even to people with no interest in motor vehicles.
Consumers typically purchase new sets of tires several times during the lives of their motor vehicles and replace flat ones periodically (although much less frequently than in the past). Above all, the purpose of the round rubber tire is understandable to even the most mechanically challenged individuals who have no comprehension of how the rest of a motor vehicle operates.

Hundreds of companies made tires in the United States during the 1910s and 1920s. As the tire became a low-cost, high-quality, long-lasting commodity, with little differentiation among competitors, suppliers succumbed to global consolidation during the late twentieth century. In the early twenty-first century, two-thirds of the world’s original equipment tires were supplied by just four firms: Bridgestone/Firestone Inc.; Continental AG; Goodyear Tire & Rubber Co.; and Michelin Tire & Rubber Co. (Deutsch 1999; Miller 1996).

The variety of tires produced by the four large companies has proliferated as each company has tried to match the precise performance needs of the carmakers’ wider variety of vehicle offerings. The big four tire companies have retained brand names of acquired companies that were already familiar to consumers. Brand names have also been used to distinguish between “premium” and “standard” tires, as well as between original equipment and aftermarket tires. Premium tires typically are first to get such innovations as run-flat capability.

Reflecting the globalization of the tire industry, Bridgestone/Firestone had its headquarters in Japan, Continental in Germany, Goodyear in the United States, and Michelin in France. Goodyear held about one-third of the North American original equipment tire market, and Michelin had one-fourth. Within the United States, all four produce at facilities that are clustered in the South.

**Tires: Where the Rubber Meets the Road**

The word “rubber” first became a popular term in England in the late eighteenth century to refer to a substance used to erase or rub out something written with a lead pencil, what Americans later called an eraser. Europeans called the substance *caoutchouc*, adapted from words heard by explorers in the Western Hemisphere, possibly from the Maïnas in Peru or the Tupi in Brazil.
Charles Goodyear, a bankrupt Philadelphia hardware merchant, is said to have become obsessed with rubber experiments during the 1830s. Rubber—the distinctive gummy elastic material isolated from the milky fluid or latex of various plants—was known in the West Indies and Central America at least since 1600 BCE, and rubber balls were seen by the earliest European explorers of the region.

Goodyear mixed raw rubber with sulfur to create an elastic substance resistant to heat and cold. The process was later called vulcanization, named for the Roman god of fire and metalworking. Until then, rubber’s usefulness had been severely limited by its tendency to melt in summer heat and become brittle in winter cold. Goodyear had tried mixing latex with various drying agents such as magnesia, quicklime, and nitric acid, before stumbling by accident in 1839 on the successful combination.

British histories of rubber allocate partial credit for successful vulcanization experiments to Thomas Hancock. Given samples of Goodyear’s vulcanized rubber in 1842, Hancock was able to replicate the process in a masticator machine he had invented to mix rubber with other materials. More importantly, Hancock made a commercial success of rubber, whereas Goodyear’s rubber obsession left him broke and frequently in jail for inability to repay debts. He died in 1860, $200,000 in debt, having failed to either defend his vulcanization patent from pirates or invest in successful manufacturing applications.

With the rapid growth of the motor vehicle industry into the twentieth century, the tire became the principal use for natural rubber. Sixty percent of rubber was used to make tires in 2000, the remainder for components in motor vehicles, as well as in aircraft, appliances, medical equipment, and electrical and electronic devices. Synthetic rubber, developed in the 1930s, accounted for 50 percent of the rubber content in tires in 1950 and 60 percent in 2000.

**Tire Production Clusters in Akron**

Five companies were the leaders in U.S. tire production for much of the twentieth century: U.S. Rubber, Goodrich, Goodyear, Firestone, and General. All but the first of these were based in Akron.
U.S. Rubber

U.S. Rubber Company was founded in Naugatuck, Connecticut, in 1892 by Charles R. Flint and held three-fourths of the U.S. market for rubber boots and shoes during the 1890s. As motor vehicle production expanded, the company was the early market leader because it owned a patent on a “clincher,” in which rubber beads held in place by air pressure “clinched” the rim (Epstein 1928). The Clincher Tire Association, controlled by U.S. Rubber, required tire makers to pay for a license to use the “clincher,” which was the most common method of attaching the tire to the rim.

This monopoly had the beneficial effect of forcing standardization of tire sizes in the United States. But it kept tire prices high in the early years of motoring. Consumers in 1910 paid $30 to replace each tire on a small car like the Ford Model T, $50 per tire for a medium-sized car, and $80 per tire for a large car. Because tires lasted less than 3,000 miles, owners were paying more for replacement tires than for the car itself.

U.S. Rubber lost its dominant position when the Akron-based companies developed better methods of securing the tire to the rim. The use of cord increased the life of a tire to 13,000 miles in 1920 and reduced the price of a tire to $15. U.S. Rubber remained the largest tire maker outside Akron and GM’s principal tire supplier during the 1920s and 1930s. Not by coincidence, controlling interest in both U.S. Rubber and GM was owned at the time by du Pont (Bernstein 1970).

Goodrich

B.F. Goodrich was the first rubber maker to locate in Akron, in fact the first to locate west of the Appalachians. Philadelphia physician Benjamin Franklin Goodrich and John P. Morris were friends and business associates involved in real estate. Goodrich became president of one of their joint acquisitions, the Hudson Rubber Co. After the business failed twice, Morris refused to invest further in it unless Goodrich moved the operation west, away from competitors.

Goodrich’s search for a suitable location brought him to Akron, where he found enthusiastic investors, so he opened a rubber factory in Akron in 1871. Goodrich began supplying pneumatic tires in 1896 to Cleveland-based Alexander Winton, maker of one of the best-selling
cars before 1900. On the advice of his doctor because of tuberculosis, Dr. Goodrich himself moved from Akron to Arizona in 1888.

**Goodyear**

The Goodyear Tire & Rubber Co. was founded in 1898 by Frank A. Seiberling, the son of an Akron businessman. Seiberling selected the name to honor the inventor of vulcanization, but Charles Goodyear had no connection with the company named for him nearly 40 years after his death. Goodyear Tire initially produced bicycle and carriage tires, made its first motor vehicle tire in 1899, and passed U.S. Rubber as the world’s largest tire maker during the 1910s.

Early tires were made of stiff woven fabric glued to the wooden wheel rim. The ride was much too jarring for passengers, and the wheel broke frequently. Goodyear employee P.W. Litchfield applied for a patent in 1903 covering the two principal elements of the contemporary tire: an outer portion made of rubber called the tread and an inner casing made of belts (bands of cords or plies) wrapped around a bead (steel wire shaped in a hoop). Litchfield, a chemical engineer, worked at Goodyear for more than a half-century, including as president (1926–1930) and chairman (1930–1956).

The smooth rubber tread on early car tires provided little traction. Goodyear Tire was credited with first cutting grooves in the hard tread surface to improve traction in 1908. The concept of wrapping cords around a bead evolved from a process to stretch fabric invented for the clothing industry by New York businessman Alexander Strauss in 1894. In 1911 Philip Strauss, treasurer of the Hardman Tire & Rubber Co., applied his father’s process to making a tire by reinforcing a hardened rubber tube with fabric. Cords were originally made of cotton, and synthetic fibers such as nylon and rayon were introduced during World War II.

Overextended in the recession that followed World War I, Frank Seiberling lost control of Goodyear in 1921 to New York bankers Dillon, Read and Co., which also took over Dodge at about the same time. Forced out of Goodyear, Seiberling started the Seiberling Rubber Company in 1922 in Barberton, Ohio, near Akron, and it became the country’s seventh-largest tire maker. He remained its chairman until retiring in 1950 at the age of 90.
Goodyear’s well-known symbol, the blimp, derived from a company interest in aviation dating back to the 1920s. It gained patents from the German company Zeppelin in 1924 to build airships in the United States and built its first (the Pilgrim) in 1925. Goodyear painted its name on the side of the blimp and flew it around the country to promote aviation as well as the tire brand. Goodyear built 300 airships, mostly during the 1940s and 1950s for military surveillance and aerial photography, and sold the Aerospace division in 1986.

**Firestone**

Harvey S. Firestone sold buggies in Columbus, Ohio, from 1890 to 1895, manufactured rubber tires in Chicago from 1896 to 1900, and moved production to Akron in 1900. Firestone Tire’s success was linked unusually closely to that of the Ford Motor Co. Harvey Firestone and Henry Ford met during the 1890s when Firestone persuaded Ford to buy four carriage tires. The two men became close friends. For most of the twentieth century, Ford bought most of its tires from Firestone, making it Firestone’s largest customer.

Ford and Firestone were both fighting their respective industry associations during the first decade of the twentieth century. The Association of Licensed Automobile Manufacturers rejected Ford’s application for a license to build cars, and the Clincher Tire Association rejected Firestone’s application to make tires. Instead of clinchers, Firestone secured the tire tightly to the wheel by riveting plates and bolts. Ford tested Firestone tires, decided they were superior to the clincher, and placed what in 1906 was the auto industry’s largest single tire order to date, 2,000 sets at $55 each. Members of the Clincher Tire Association monopoly had all quoted Ford the same price of $70 per set.

**General**

General Tire was founded in Akron in 1915 by William F. O’Neil and Winfred E. Fouse, originally to produce premium replacement tires. O’Neil sold Firestone tires in Denver and Kansas City before setting up General with financial support from his father, owner of Northeast Ohio’s leading department store chain.

General was more diversified than Akron’s other leading tire makers, with interests in radios, aviation, plastics, and chemicals. The com-
pany began producing original equipment tires in 1955, primarily for GM.

**Impact on Akron**

Propelled by booming tire production, Akron was the fastest-growing city in the United States during the 1910s. It grew from an isolated Midwestern town of 69,067 (eighty-first largest in the United States) in 1910, best known as a manufacturing center for Quaker Oats, to the Rubber Capital of the World, with a population of 208,435 (thirty-second largest) in 1920.

At its peak in 1920, Akron had 60,000 workers employed in the tire plants, and it was home to the four of the five largest tire suppliers: Goodyear, Goodrich, Firestone, and General. Akron was more dominated by a single industry than any other large city in the country, even Detroit, which “merely” doubled in population from 1910 to 1920.

The founders of the major tire companies—Firestone, Goodrich, O’Neil, and Seiberling—were known as Akron’s “rubber barons.” They built or bequeathed the city’s parks, museums, and hospitals, as well as neighborhoods for their workers with such names as Goodyear Heights and Firestone Park. Seiberling was probably the “rubber baron” with the most impact on Akron, in part because he outlived the others. After his death, Seiberling’s home (Stan Hywet Hall) became Akron’s leading tourist attraction.

**Tire Makers Abandon Akron**

Akron’s decline as the center of U.S. tire production came in two waves. First, Akron’s Big 4 tire makers opened factories elsewhere in the United States, especially during the 1960s. The location decisions were motivated by labor cost considerations; the tire makers were in the vanguard of looking south for cheaper labor. Three of Akron’s four leading tire makers were then sold to foreign companies during the 1980s.

When General closed its last tire plant in Akron in 1982, the city that had been synonymous with rubber and tire production through the twentieth century was left without any active tire plants.
France’s tire competitor: Michelin

U.S. Rubber and B.F. Goodrich merged in 1986 to form Uniroyal Goodrich; the merged company was sold four years later to Michelin. The acquisition made French-based Michelin the second-largest U.S. tire supplier behind Goodyear.

Brothers Edouard and André Michelin founded the company bearing their name in Clermont-Ferrand, France, in 1889. The company entered the tire business two years later when a cyclist asked for help in repairing an English-made tire that was glued to the wheel rim. Michelin started making tires for bicycles in 1891, for horse-drawn carriages in 1894, and for motor vehicles in 1895.

Michelin made two particularly important contributions to tire technology. First was the demountable tire, which Michelin patented in 1891. The practicality of an easy-to-change tire was quickly established when the winner of the 1891 Paris–Brest–Paris bicycle race, Charles Thery, was the only competitor to use it. Michelin’s other important innovation during the 1890s was the pneumatic tire. However, it did not perform well in early races, so it was not adopted by carmakers until the 1910s.

The pneumatic tire—an air-filled rubber “balloon” or tube placed between the fabric and the rim—had been originally patented by a Scottish engineer, Robert W. Thomson, in 1845, only a few years after vulcanization. But no practical ideas existed at the time for actually using it, and the patent expired. Another Scot, John B. Dunlop, living in Belfast, Ireland, equipped his son’s tricycle with tires made by pumping air into thin rubber sheets covered with fabric. Dunlop secured a patent for this version of the pneumatic tire in 1888, and it was quickly adopted for most bicycles. Dunlop himself had no connection to the tire maker bearing his name because he sold the idea of making pneumatic tires to Harvey du Cross Jr., who founded Dunlop Tyres in 1888.

Michelin’s domination of the French tire market was solidified by distinctive marketing. To promote motoring, in 1900 the company compiled and gave away a Red Guide that rated hotels in France and provided street plans for many towns that were so detailed and accurate that they helped the Allied army during World War II. During the 1920s, the Red Guide dropped advertising, added restaurant reviews, and was sold in bookstores rather than given away. The company produced road
maps beginning in 1910 and sightseeing information guides beginning in 1926, which became known as Green Guides beginning in 1938. Bibendum, better known in the United States as the Michelin Man, first appeared in 1898.

Michelin patented the radial tire in 1946. Most tires at the time were bias-ply, with body or carcass cords arranged diagonally to the center line of the tread. Better quality bias tires also wrapped around the diagonal body cords an outer layer of belt or crown cords arranged in a herringbone pattern. Radial tires also had belt cords arranged in a herringbone pattern, but the inner body cords were arranged at right angles to the center line of the treads rather than diagonally.

The radial tire provided better handling than the bias-ply tire, especially at high speeds and around corners. By placing the body cords at right angles, the sidewalls on radial tires could flex, whereas they remained stiff on bias-ply tires. As a result, the radial tire tread maintained a larger surface contact with the road during turns.

Radials were popular in Europe by the 1960s, but they faced resistance in the United States because they produced a stiffer and noisier ride. However, the energy crisis of the 1970s stimulated the use of radials in the United States because they yielded higher gas mileage than bias-ply tires. When U.S. firms were slow to introduce competitive radial tires during the 1970s, Michelin grabbed a much larger share of the U.S. market.

Michelin opened four tire plants in South Carolina and one in Alabama during the late 1970s and early 1980s. The company also retained five plants inherited from Uniroyal, including two in Alabama and one each in Indiana, Oklahoma, and Virginia.

**Japan’s tire competitor: Bridgestone**

In 1988 Firestone was sold to Japanese-based Bridgestone, which outbid Italian tire maker Pirelli for it. The Firestone acquisition made Bridgestone the world’s largest tire maker.

Bridgestone Tire Co. was Japan’s first tire company, founded in 1931 by Shojiro Ishibashi, who had been producing traditional rubber-soled footwear known as *tabi* since 1923. Ishibashi called the tire company Bridgestone, because his own surname literally meant stone-bridge in Japanese. He transposed the syllables to produce a corporate
name similar to Firestone, which he admired. Bridgestone became Japan’s largest tire maker in 1953.

Although Ford Motor Co. bought some of its tires from other suppliers, and Firestone sold some of its tires to other carmakers, the two companies conducted a disproportionately high percentage of business with each other throughout the twentieth century. After all of the mergers and acquisitions of the 1980s and 1990s, Bridgestone/Firestone still provided Ford with 40 percent of its tires in 2000. Bridgestone/Firestone supplied one-third of Honda’s tires and one-fifth of those purchased by GM, Nissan, and Toyota.

Firestone’s downfall in the United States followed its inability to compete in the radial tire market. The National Highway & Traffic Safety Administration implicated Firestone “500” radial tires in 41 fatalities. Although Firestone never agreed that the tires were defective, it agreed to recall 14.5 million of them in 1978 due to tread separation.

The century-long close relationship between Ford and Firestone came to an end in 2001, when Ford Explorers equipped with Firestone Wilderness AT tires rolled over following tread separation, resulting in 271 deaths. Bridgestone argued that the Explorer’s design made it prone to rollovers because Explorers had a tire failure rate 10 times higher than other Ford vehicles equipped with Firestones. Ford countered that it had 1,183 tread separation claims involving Firestone tires and only two involving Goodyear tires.

The dispute damaged both parties. Sales of Firestone replacement tires declined 40 percent in the year after the dispute (Akron Beacon Journal 2000). For its part, Ford offered to replace the 6.5 million tires on all of its vehicles. Still, Explorer sales dropped rapidly from their peak in 2000—as did Ford stock. With the overall quality of tires generally very high, the Ford Explorer’s problem with Firestone Wilderness tires was especially devastating.

Through the merger, Bridgestone inherited Firestone plants in Decatur, Illinois; Wilson, North Carolina; Oklahoma City, Oklahoma; and LaVergne, Tennessee. Under Bridgestone leadership, the only northern plant, Decatur, was closed, whereas new southern facilities were added in Graniteville, South Carolina, and Morrison, Tennessee. Only a token facility was retained in Akron to produce a handful of tires for race cars.
**Germany’s tire competitor: Continental AG**

General Tire was sold to German-based Continental in 1987. Continental’s early history in Germany was similar to that of Michelin in nearby France. Continental-Caoutchouc und Gutta-Percha Compagnie was founded in 1871 in Hanover, Germany, to produce solid tires for carriages and bicycles, as well as other rubber products. Continental was the first German company to manufacture pneumatic tires for bicycles in 1892, then for motor vehicles in 1898. The company even emulated Michelin by publishing a popular road atlas in German, beginning in 1907.

Continental’s tire products evolved through the familiar pattern: the world’s first tire with patterned tread in 1904, the world’s first detachable rim in 1908, the first German cord tire in 1921, the German patent for tubeless tires in 1943, and the first German radial tire in 1960. Continental took over small German rubber companies during the 1920s, Uniroyal’s European operations in 1979, and then tire makers elsewhere in Europe, including Austria, Czech Republic, Slovakia, and Sweden, during the 1980s and 1990s.

Continental held a small share of the U.S. market until 1987, when it acquired General Tire, the third-largest U.S. tire maker. The combined company held 14 percent of the U.S. tire market in 2000. Continental General’s most important customer in the United States was Nissan, which bought about half of its tires from the German company. Continental General also supplied Ford and GM with about one-fifth of their tires.

**The U.S. survivor: Goodyear**

Goodyear was the world’s largest tire and rubber company from the 1920s until overtaken by competitors’ mergers during the 1980s. Goodyear purchased Kelly-Springfield Tire Co. in 1935 in order to offer a lower-priced replacement tire brand. But when other leading U.S.-owned tire makers were sold during the 1980s, Goodyear was struggling financially and unable to buy any of them. British-French financier James Goldsmith had acquired 11.5 percent of Goodyear in 1986 in an unsuccessful takeover attempt; to fend off the effort, the company made a tender offer for the shares the following year that strapped it financially and compelled it to sell noncore divisions and close plants.
Goodyear reclaimed the title of world’s largest tire producer in 1999 by acquiring a controlling interest in Sumitomo Rubber Industries, Japan’s second-largest and the world’s fifth-largest tire maker. The alliance gave Goodyear the right to use the Dunlop name, which Sumitomo had acquired in 1986.

The company’s major tire-making facilities were in Gadsden, Alabama; Topeka, Kansas; Lawton, Oklahoma; Statesville, North Carolina; Union City, Tennessee; and Danville, Virginia. The Gadsden plant was one of the first parts-making facilities in Alabama when it opened in 1929. Corporate headquarters and research facilities were retained in Akron but not production facilities.

Faced with the loss of the rubber plants, Akron attracted 400 companies involved in polymer research and production during the late 1990s. With 35,000 employees, the polymer plants did not completely replace all of the jobs lost in the rubber plants, but the new jobs were better paid and demanded more skills than the old jobs. A key to attracting firms involved in polymer technology was creation of the Edison Polymer Innovation Corporation in 1984 and a School of Polymer Science and Engineering at the University of Akron.

RISE AND FALL OF GLASS CITY

Glassmaking is an ancient art—Egypt became a center of glass production in the second millennium BCE, and knowledge of glassmaking diffused through Europe during the Roman Empire. Glass was blown, pressed, and drawn into many shapes, primarily household objects such as plates, bowls, goblets, and bottles. Venice, the center of glassmaking in medieval Europe, specialized in decorative glass as well as household objects.

Rolling molten glass into thin flat sheets was a difficult craft, limiting the use of windows prior to the nineteenth century. Because windows were expensive, the number found in a house was a good indicator of the owner’s wealth. The square footage of windows in a house was a common measure for calculating property taxes, so to lower their taxes, homeowners reduced the size of their windows. Large expanses of windows were limited to important public structures, notably
churches, where (tax exempt) brightly colored stained glass windows were installed.

Early motor vehicles were open carriages without windshields. Wearing goggles was the driver’s principal protection against dirt and mud. A glass windshield was introduced as an extra-cost option on luxury vehicles in 1904. The first windshields consisted of two horizontal panes of glass connected by hinges. The top half could be tipped open for an unobstructed view when the bottom half was completely splattered.

The surface area of glass increased rapidly during the 1920s, when the enclosed compartment replaced the open carriage as the predominant body style. Glass was now needed for the rear and side windows of the passenger compartment, not just for the front windshield. Consumer acceptance of closed body vehicles had been slowed by fear of being injured in an accident from shattered glass. The introduction of laminated safety glass for motor vehicles helped consumers to overcome that fear.

French scientist Edouard Benedictus discovered in 1903 that a glass flask coated with an adhesive film made of nitrocellulose (a liquid plastic) did not shatter when he accidentally dropped it. British inventor John C. Wood introduced Triplex in 1905, a “sandwich” that prevented shattering by cementing a layer of celluloid between two pieces of glass. Two decades later, the process was applied to motor vehicle glass.

Toledo’s Glassmakers

Glass manufacturers clustered in Toledo during the late nineteenth century, a decade before the start of commercial motor vehicle production. Glassmakers were first attracted to Toledo by proximity to critical inputs. They solidified their leadership through proximity to the increasingly important customer base in Detroit, only 50 miles to the north.

Three materials account for 99 percent of inputs into glassmaking: silica sand, soda ash, and limestone (dolomite). Glass manufacturers did not wish to incur the expense of long-distance shipping of a ubiquitous resource like sand, and in the nineteenth century, the sandy soil of northwest Ohio seemed to offer an abundant source of silica, which is the most important of the three inputs. But “impurities made this source unsatisfactory shortly after the turn of the century,” so Toledo glass-
makers instead brought in silica from Ottawa, Illinois, by rail. Soda ash was obtained from northeastern Michigan. Only limestone was mined locally in northwestern Ohio (Ballert 1947, p. 190).

As glassmaking was transformed from a handicraft to an industrial process in the late nineteenth century, access to low-cost energy became especially important. Toledo sat atop what at the time appeared to be an unlimited field of natural gas—the largest in the northeastern United States. “A survey of fifty [Toledo] glass plants [published in 1937] showed twenty-three indicating fuel as the most important factor for locating their industries” (Lezius 1937, cited in Ballert 1947, p. 188). Compared with coal, the principal energy source at the time, natural gas proved to be a more efficient, lower-cost means of providing the heat needed to keep glass molten. “By the end of the [nineteenth] century, this supply largely was exhausted and many glass factories in the smaller communities south of Toledo moved to new sources of fuel. Toledo, however, retained her glass industry, though natural gas had to be piped from increasingly distant fields” (Ballert 1947, p. 188).

Toledo’s three leading glass-making firms in 1900 were Libbey Glass Company (originally New England Glass Company), Toledo Glass Company, and Edward Ford Plate Glass Company.

New England Glass was founded in East Cambridge, Massachusetts, in 1818, to produce blown, pressed glass for household products, as well as engraved glass. Edward Drummond Libbey (1854–1925), who had succeeded his father William L. Libbey as manager in 1883, relocated the business to Toledo in 1888, along with 100 workers, to escape labor unrest. The company name was changed to Libbey Glass in 1892. Into the twentieth century, Libbey was the leading producer of glass tableware.

Toledo Glass was incorporated in 1895 by Michael J. Owens (1859–1923), who had been one of the first hired at the new Libbey plant in 1888 and was promoted after three months to supervisor. In 1899 Owens created a glass-blowing machine that made mass production of glass bottles possible. Through growth and acquisitions, Owens was the world’s largest glass company in 1929.

Recognizing the growing market for windows, Owens and Libbey together organized a firm in 1916 to make flat glass. Libbey-Owens Sheet Glass Company (“Sheet” was later dropped from the name) be-
gan production in 1917 in a plant in Charleston, West Virginia, near Owens’s birthplace in Mason County.

Toledo’s other major late-nineteenth-century glassmaker, Edward Ford Plate Glass Company, also had out-of-town origins. The Star Glass Works was founded in 1867 in New Albany, Indiana, on the Ohio River, near Louisville, Kentucky, by John Baptiste Ford (1811–1903), his sons Edward (1843–1920) and Emory, and his cousin Washington C. DePauw. When the New Albany venture failed, the Fords started New York Plate Glass Company in Creighton, Pennsylvania, 18 miles up the Allegheny River from downtown Pittsburgh, in 1880. The Fords left the Creighton firm in 1897 because of a dispute over distributorships. Edward headed west for Toledo, where he started construction on a plant in 1898 and began production in 1899.

Ford built the flat glass plant in Rossford, on the opposite bank of the Maumee River from Toledo. Rossford became a company town for the glass company, with housing and services for the workers, as well as the factory.

Toledo’s glassmakers came together during the Great Depression. The two leading flat glass producers, Libbey-Owens and Edward Ford, merged in 1930 to form Libbey-Owens-Ford (L-O-F). Flat glass production was consolidated at Edward Ford’s Rossford complex. On the houseware side, Owens acquired Libbey in 1935.

Toledo’s important function in the glass industry has brought it the title of “Glass Capital of America” and “Glass Center of the World.” Such illustrious phrases rightfully are deserved, although in terms of actual production the word “capital” perhaps is better chosen than is “center,” for although four of the country’s leaders in the glass industry have their executive offices and research laboratories in Toledo [in 1947], two of the group have all of their production elsewhere. (Ballert 1947, p. 187)

The Big 3 in World Glass

Toledo still calls itself the Glass City, and the city’s football stadium is named the Glass Bowl. But most of the automotive glass production has moved elsewhere. As in Akron, globalization hit Toledo in the 1980s; L-O-F was acquired by the British glassmaker Pilkington in 1985, leaving none of the surviving U.S.-owned glassmakers based in Toledo.
Two trends have favored globalization of the glass industry. First, demand for auto glass has grown relatively rapidly, not only because of increased worldwide vehicle production but also because the amount of glass per vehicle has increased. Glass usage has increased as a means of reducing vehicle weight and as a styling trend. In a typical vehicle, roughly 3 percent of weight is now devoted to glass, compared to 2 percent in the 1970s. The best-selling midsized sedans had 20 percent more glass in 2006 than they did 20 years earlier (NSG/Pilkington 2006, p. 28).

Second, carmakers have increasingly demanded complete “glazing systems” rather than pieces of glass. Glazing systems “use innovative finishing technologies, such as encapsulation or extrusion, which enhance the vehicle’s styling and in certain cases, aerodynamics, as well as adding functionality . . .” (NSG/Pilkington 2006, p. 28). Much of the value added in glazing systems is to integrate tinting that reduces solar glare (NSG/Pilkington 2006, p. 29). Glass suppliers also have responsibility for design and assembly of modules such as tailgates that include wipers, latches, and hinges, as well as glass (NSG/Pilkington 2006, p. 28).

Motor vehicles consume about 10 percent of the world’s flat glass. Windows for buildings account for 70 percent of demand, and interior applications such as mirrors account for the remaining 20 percent.

World production of automotive glass into the twenty-first century was dominated by three companies based in Europe and Japan: Asahi Glass Company, Saint-Gobain Group, and NSG/Pilkington. The three held 65 percent of the world automotive glass market in 2006, up from 49 percent in 1992 and 63 percent in 1998 (NSG/Pilkington 2006, p. 25).

Asahi

Asahi, Japan’s largest glassmaker, was founded in 1907 by Toshiya Iwasaki, the second son of the second president of the original Mitsubishi Corporation. The company started supplying the auto industry in 1956, and it ranked as the world’s largest auto glass supplier into the twenty-first century.

Asahi started U.S. production in 1985 through AGC Automotive (originally AP Technoglass), a joint venture with PPG Industries. The
two companies had already come together in 1966 in a joint venture (Asahi Penn Chemical Company) to make chlorine products.

**Saint-Gobain**

Saint-Gobain, Europe’s largest glass supplier, was founded in 1692 on the site of Saint-Gobain château near Soissons, France. The company combined in 1695 with the Mirror Glass Factory, established even earlier, in 1665, by Jean-Baptiste Colbert (1619–1683), Louis XIV’s powerful contrôleur général. The combined company, known simply as the Glass Factory, produced mirrors for the Royal Court at Versailles and pioneered innovative industrial processes that enabled it to dominate European glass production for several hundred years.

Saint-Gobain began to make automotive glass for French cars during the 1930s, and it entered the U.S. market as a GM supplier during the 1990s. The company was better known in the United States for supplying glass to the rail industry, including the Acela high-speed northeast corridor trains, the New York City subway, and the Las Vegas monorail. Saint-Gobain also supplied the glass for the pyramid designed by I.M. Pei as the entry into the Louvre museum in Paris. Half of the company’s revenues come from materials other than glass, including insulation, building materials, pipes, containers, ceramics, and abrasives.

**NSG/Pilkington**

Pilkington’s origins date from efforts orchestrated by the British government to reduce Saint-Gobain’s domination of the European market. The British Cast Plate Glass Company was established in 1773 with financial backing from the British government. The company constructed a large factory at Ravenhead, where it started producing Britain’s first plate glass in 1786.

A competitor, St. Helens Crown Glass Company, was founded near Ravenhead in 1826, financed by three local families—William and Richard Pilkington, Peter Greenall, and James Bromilow. The company was renamed Greenall & Pilkington in 1829, then Pilkington Brothers when the one family became the sole investor in 1849.

Pilkington entered the twentieth century as Britain’s sole producer of flat glass after acquiring its competitors, including the Ravenhead facility in 1901. Pilkington remained a privately held firm until 1970, and a family member ran the company until 1992.
Pilkington’s operations were merged in 2007 with those of Nippon Sheet Glass Co., the second-largest Japanese glassmaker behind Asahi. Nippon acquired 10 percent of Pilkington in 2000 and increased its stake to a controlling interest in 2006. Completing the circle to Toledo, when Nippon was established in 1918, it produced glass with technology from Libbey-Owens-Ford.

Leading U.S. Glass Suppliers

Four companies together held more than three-quarters of the U.S. auto glass market in 2007. Two of the four market leaders were NSG/Pilkington and Asahi. The other two leading U.S. glass suppliers, Ford Motor Company and PPG, were both sold in 2007 to private investors Glass Products and Platinum, respectively, and both faced uncertain futures (NSG/Pilkington 2006).

Glass Products (Ford Motor Company)

Glass Products was formed in 2007 through acquisition of Ford Motor Company’s glass plants. That ended Ford’s involvement in making glass, an activity that had begun with the company’s founder. Henry Ford’s obsession with controlling raw materials played a major role in the decision, especially when glass proved expensive and hard to obtain during and after World War I (Nevins and Hill 1957, p. 230). Even at the height of vertical integration, Ford was the only automaker producing its own glass.

Ford spent more than a decade trying to sell its glass facilities. After several failed attempts, Ford finally found a buyer in 2007, a new company called Glass Products formed by private investor Robert Price (Automotive News 2007b). Price was described in Ford’s press release as “a Tulsa-based private investor and experienced business leader with a strong record of success in the natural gas industry, logistics, and medical facility management” (Ford Motor Company 2007).

Platinum (PPG)

Before he left New York Plate Glass Company, John Ford had changed its name to the Pittsburgh Plate Glass Company (PPG) in 1883. PPG was the first commercially successful producer of plate glass in
the United States and became the leading independent supplier outside Toledo during the early twentieth century. PPG was the second-leading supplier of glass to the U.S. auto industry in 2007, although glass accounted for only one-fourth of revenues; more than half came from paint and coatings (see Chapter 4).

In 2007, PPG sold its glass business to Platinum Equity, a private equity group. PPG chose to focus on its coatings sector, which it considered to have better earnings prospects than glass (Nussel 2007).

As for Toledo, NSG/Pilkington continued to operate the Toledo-area glass plant at Rossford, but other than that, the four leading U.S. glass suppliers were firmly entrenched elsewhere in Auto Alley:

- Asahi’s first U.S. plant was opened in 1986 at Bellefontaine, Ohio, to supply windshields to Honda’s Marysville assembly plant 20 miles away, and a second plant was opened in 1989 at Elizabethtown, Kentucky, 75 miles from Toyota’s Georgetown assembly plant. Until 1989, the plants were operated as a joint venture with PPG.
- Glass Products had plants in Tulsa, Oklahoma, and Nashville, Tennessee, built by Ford after World War II.
- Platinum produced OEM glass at five U.S. facilities in Evansville, Indiana; Evart, Michigan; Crestline, Ohio; and Creighton and Tipton, Pennsylvania.
- NSG/Pilkington had facilities in Lathrop, California; Ottawa, Illinois; and Laurinburg, North Carolina; as well as Rossford, Ohio.

OUTLOOK AND UNCERTAINTIES

Ballert’s 1947 dissertation concluded that Toledo would remain at the center of the country’s motor vehicle production. Among the reasons for this conclusion were the following four (Ballert 1947, p. 184):

1) The automobile companies and the producers of parts and equipment are mutually dependent upon one another, and this provides a deterrent to the dispersion of the industry.
2) The ubiquitous unionism in the automotive industry nullifies any reason for moving to obtain cheaper labor.

3) There is continued availability of skilled and semiskilled labor.

4) Toledo has a central position with respect to assembling raw materials and distributing the goods produced.

The future of Toledo’s motor vehicle glass production seemed especially assured in 1947. “Continued prominence in the glass industry appears to be assured for Toledo, both from the standpoint of production and administration . . . Transportation costs are important for these bulky items, and Toledo is located excellently with respect to the market for such products, especially safety glass for automobiles.” When this was written in 1947, Libbey-Owens-Ford was the sole supplier of glass to GM and, along with PPG, supplied 85 percent of the safety glass in the United States (Kennedy 1941, cited in Ballert 1947).

Toledo has in fact remained an important center for motor vehicle production. Sixty parts suppliers are located in northwest Ohio, including 16 in Lucas County where Toledo is located. Motor vehicles have been assembled in Toledo since the nineteenth century, most recently at an assembly plant opened for Jeep production in 2001. Toledo is even attempting to reinvent itself by leveraging its deep roots in the glass industry in light of rising demand for alternative energies (Carlton 2007).

On the other hand, Summit County, where Akron is located, had only two remaining suppliers in 2007, one making wheels and the other plastic parts. Akron has moved on to become a center for polymer production.

The experiences of Toledo and Akron show that communities at the northern end of Auto Alley face an increasing challenge in retaining suppliers. Locations further south offer greater proximity to the plants of growing carmakers as well as lower costs of doing business, without sacrificing equally good access to national markets and raw materials.