

Chicago Fed Letter

Who really made your car?

by Thomas H. Klier, senior economist, and James M. Rubenstein, professor, Miami University

In the past few decades, the evolving relations between automakers and their parts suppliers have resulted in shifts in the location of production across North America. The authors explore the ongoing structural changes to the automotive industry and explain their local, regional, and international implications.

These are challenging times for the U.S. motor vehicle industry.¹ Employment in this industry declined by 26% during the first seven years of the twenty-first century—from 1,160,000 in 2000 to 860,000 in 2007.² During the same period, the share of the U.S. market held by the U.S.-owned Detroit Three

carmakers (Chrysler LLC, Ford Motor Co., and General Motors Corp.) declined from 65% to 51%.³

While the focus has traditionally been on the carmakers, they now provide just 22% of industry jobs: In 2007, employment in the motor vehicle parts sector in the United States totaled 673,000, compared with 186,000 in final assembly (figure 1).

Suppliers also provide approximately 70% of the value added of vehicles.⁴ We know relatively little about the parts suppliers, despite their importance to the motor vehicle industry. Our new book—titled *Who Really Made Your Car? Restructuring and Geographic Change in the Auto Industry*—sheds light on the parts suppliers by focusing on the changing structure of the motor

vehicle industry, as well as the resulting changes in the geography of production.⁵

The book’s analysis is based on a unique database. It includes observations from several thousand individual parts plants in the United States, Canada, and Mexico. A large number of variables have been collected for every factory operated by the 150 largest North American suppliers, as well as more than a thousand smaller companies. The starting point for constructing the database was information acquired from ELM International Inc., a Michigan-based vendor of information about automotive suppliers.⁶ We have data for 3,179 parts plants located in the United States plus 416 in Canada and 673 in Mexico. Together, these plants account for the overwhelming majority of parts production in North America (see figure 2). This *Chicago Fed Letter* provides an overview of some of the issues covered in our book.

Structural changes in the auto industry

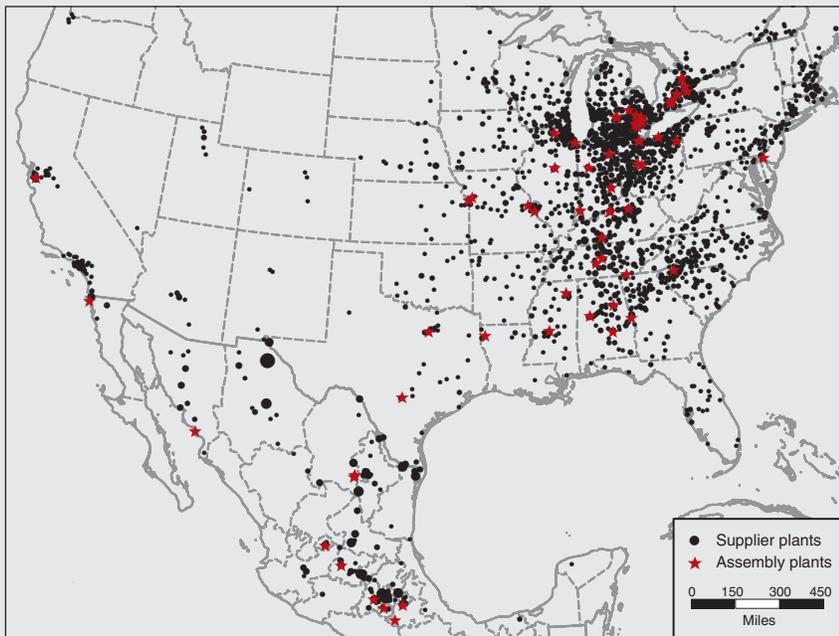
Until the late twentieth century, U.S. carmakers produced most of their own parts and dominated the suppliers from whom they purchased their parts. In the twenty-first century, responsibility for making most of the parts has been passed to independently owned suppliers.

1. U.S. auto assembly and parts supplier employment, 2007

	Employment (thousands)	Share (percent)
Assemblers		
Total light vehicle assembly	186.0	21.7
Parts suppliers		
Electronics	83.9	9.8
Exterior	153.0	17.8
Powertrain	139.3	16.2
Chassis	76.4	8.9
Interior	61.4	7.1
Other	159.0	18.5
Total parts suppliers	673.0	78.3

NOTE: Light vehicles are passenger cars and light-duty trucks, such as minivans and sport utility vehicles.
SOURCE: Authors’ calculations based on data from the U.S. Bureau of Labor Statistics from Haver Analytics.

2. Auto parts supplier plants and assembly plants in North America



NOTES: Supplier plant locations reflect information from 2006. Assembly plant locations are current and forward-looking; Assembly plants slated for closure are excluded from this map, whereas assembly plants announced to be built or currently under construction are included.

SOURCES: Authors' adaptation of data from Ward's AutoInfoBank (database by subscription), ELM International Inc., and auto company websites.

Underlying the increased role played by parts suppliers are structural changes, which include the following:

- Instead of gathering together thousands of individual parts and components at their final assembly plants, carmakers are now purchasing large modules and systems ready to be installed on the final assembly line.
 - Instead of buying from thousands of suppliers, carmakers are offering large contracts to a handful of suppliers, which are consolidating into fewer larger firms and driving smaller firms out of the industry; these larger suppliers in turn interact with the remaining smaller suppliers.
 - Instead of awarding contracts annually to the bidders that offer the lowest prices, carmakers are developing long-term relationships with suppliers—at least for the multiple-year life of specific vehicle models, if not longer.
 - Instead of providing detailed specifications, carmakers are giving their direct suppliers responsibility for
- research and development to design and build innovative modules and systems.
 - Instead of maintaining a large inventory of parts, carmakers are requiring suppliers to deliver modules and systems on a just-in-time basis, often within only a few minutes before they are needed on the final assembly line.

These structural changes have dramatically altered the geography of motor vehicle production since the early 1980s. We discuss the specific impacts in the subsequent sections.

Impact on Michigan

Fifty years ago, when the Detroit Three sold more than 90% of the vehicles in the United States, southeastern Michigan was the center of the industry's manufacturing, research, and administration. The decline of the Detroit Three automakers has hit employment in Michigan especially hard. During the 1950s, three-quarters of all auto parts were made in or near Michigan, whereas the state is now responsible for only one-quarter.

As recently as 1990, Michigan had 191,000 jobs in the motor vehicle parts industry, compared with 131,000 in 2007.

Yet, not all motor vehicle parts production has abandoned Michigan. The state still houses a disproportionate share of the production of engines, transmissions, and bodies, as well as the parts that go into them. In addition, the industry's research and headquarters continue to be centered in Michigan.

Local-scale networks

Close linkage between an assembly plant and its network of suppliers is crucial for efficient operation in the environment of lean inventory or just-in-time delivery. To achieve and maintain this close linkage, most suppliers' factory sites must be within a one-day delivery range of the assembly plant; typically around three-fourths of an assembly plant's suppliers are situated within that distance.

At the same time, close linkage does not mean suppliers must locate next door to the assembly plant. In fact, only a few suppliers are found within a one-hour drive of an assembly plant. The seat supplier is invariably close by, as are some stamping and trim shops and some light manufacturing and logistics functions. However, most other parts are delivered from farther away.

The fact that most suppliers are within a one-day drive but not within a one-hour drive of an assembly plant is pertinent to local governments' attempts to entice new assembly plants. Government subsidies exceeding \$100,000 per job for final assembly plants have been justified with the fact that each new assembly job generates several new supplier jobs. However, most of the new supplier jobs are destined for political jurisdictions other than the one enticing the final assembly plant.

Auto alley

Though Michigan's dominance has waned, it continues to be the industry's hub. Today's U.S. auto industry remains very highly clustered in a small portion of the country. More than three-fourths of auto industry jobs and facilities are

located in a narrow corridor between the Great Lakes and the Gulf of Mexico formed by two north–south interstate highways, Interstate 65 and Interstate 75. This corridor is commonly referred to as “auto alley.”

In 1979, the United States had 55 assembly plants—34 in auto alley and 21 elsewhere.⁷ In 2008, the number of assembly plants in auto alley had increased to 43, while their number declined to seven elsewhere.⁸

Auto alley has become the home of the U.S. auto industry primarily because of transport costs. The most critical transport factor for carmakers is the cost of shipping vehicles from final assembly plants to customers. Because assembled

As recently as the 1980s, 90% of production workers in the U.S. motor vehicle industry belonged to a union, and their wages were 50% higher than the national average for production workers. However, in 2006, only one-third of supplier plants had union representation. Also, in that year, approximately three-fourths of production workers at assembly plants belonged to a union; virtually all of those assembly plants were owned by the Detroit Three.¹¹ But as the Detroit Three share of vehicle sales has declined, they have had to close some of their unionized plants, whereas foreign-owned carmakers have been opening nonunion ones.

Leading the move southward within auto alley have been foreign-owned

equipment in North America: The number of U.S.-owned companies on the list declined from 108 in 1994 to 59 in 2007, illustrating the globalization of the U.S. motor vehicle parts industry. According to the United States International Trade Commission, the largest sources of foreign parts were Mexico and Canada, followed by Japan. China accounted for just under 9% of motor vehicle parts imports in 2007. The widespread belief is that most imports are price-sensitive generic parts that can only be produced competitively in low-wage countries. In reality, a large share of imports arriving at U.S. final assembly plants consists of engines and transmissions made by highly skilled workers in wealthy countries, such as Canada and Japan.

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vehicles are bulky and fragile and tie up a lot of capital, it is imperative that they are delivered to customers as quickly as possible.

North–South shift within auto alley

The southern states of Alabama, Georgia, Kentucky, North Carolina, South Carolina, and Tennessee together had 7.5% of automotive employment in 1979. Twenty-four years later, these states’ share had grown to 15%.⁹

The South’s growing importance can be seen in both assembly and supplier plants. The number of *assembly* plants in the South increased from five to 13 between 1979 and 2008. In addition, 67% of all *parts* plants in the South were opened between 1980 and 2006, compared with only 40% in the rest of the United States.¹⁰

The auto industry has been moving southward in auto alley primarily because of labor considerations. Wage rates for this industry have been lower in the South than in the Midwest, and union membership has been lower as well.

parts suppliers. Foreign-owned parts plants accounted for 44% of all plants in the South, compared with only 26% in the rest of the country. Lower wage rates and a nonunion atmosphere have attracted foreign-owned firms to the South.

Globalization

Imported parts captured 27% of the U.S. new vehicle market in 2002, according to the U.S. Census Bureau, and foreign-owned factories in the United States captured another 17%.¹² That left U.S.-owned factories in the United States with the remaining 56%.

The share of parts supplied by U.S.-owned, U.S.-based factories has declined since then, although the precise level can’t be calculated until results of the U.S. Census Bureau’s 2007 *Census of Manufactures* are released. The U.S. imports of parts (those destined for both new vehicles and aftermarket sales) increased from \$63 billion in 2002 to \$87 billion in 2007—a much faster rate of growth than the overall parts market.¹³

Since 1994, *Automotive News* has identified the 150 largest suppliers of original

Conclusion

The growing importance of the parts suppliers has led to the recent restructuring of the motor vehicle production process. Based on our analysis, we believe that the fundamental geography of auto assembly in North America is not likely to change anytime soon: Most vehicles sold in North America will continue to be assembled in North America. But more parts will be produced in other parts of the world and imported

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from there. In addition, more of the parts made in North America and vehicles assembled in North America will be produced by corporations with global headquarters outside of this continent.

¹ A slightly different version of this article was published earlier by the W. E. Upjohn Institute for Employment Research: Thomas Klier and James Rubenstein, 2008, "Who really made your car?," *Employment Research*, Vol. 15, No. 2, April, pp. 1–3.

² These are authors' calculations based on data from the U.S. Bureau of Labor Statistics from Haver Analytics.

³ Ward's AutoInfoBank (database by subscription).

⁴ According to the U.S. Census Bureau's 2002 *Economic Census*, the cost of materials in light vehicle manufacturing represents 69% of the value of shipments.

⁵ Thomas Klier and James Rubenstein, 2008, *Who Really Made Your Car?: Restructuring and Geographic Change in the Auto Industry*, Kalamazoo, MI: W. E. Upjohn Institute for Employment Research.

⁶ The ELM International Inc. website can be accessed at www.elm-intl.com.

⁷ Harry A. Stark (ed.), 1980, *Ward's Automotive Yearbook*, Detroit: Ward's Communications Inc.

⁸ Ward's AutoInfoBank.

⁹ Authors' calculations based on data from Stephen Cooney and Brent D. Yacobucci, 2005, "U.S. automotive industry: Policy

overview and recent history," CRS Report for Congress, Congressional Research Service, No. RL32883, April 25, p. CRS-33.

¹⁰ These are numbers derived from our own unique supplier database.

¹¹ The exceptions are New United Motor Manufacturing Inc. (NUMMI), AutoAlliance, and Diamond Star (the precursor to Mitsubishi Motors North America). All three were set up as joint ventures between the Detroit Three and international carmakers.

¹² The 17% is an estimate based on our supplier database.

¹³ These are authors' calculations based on data from the United States International Trade Commission, available at <http://dataweb.usitc.gov/>.