

Economic Contribution of the Ford Motor Company Michigan Assembly Plant to the Michigan Economy

Prepared for:

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All statements, findings, and conclusions in this report are those of the authors and do not necessarily reflect those of Ford Motor Company or MEDC.

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Executive Summary

Ford Motor Company's Michigan Assembly Plant (MAP) is a sign of things to come in the automotive industry and is a very important asset to the State of Michigan. In 2011, the plant produced more than 220,000 vehicles, and in 2012 it produced more than 300,000 vehicles. This year the plant is on track to produce more than 350,000 vehicles. Not only does this plant employ approximately 5,000 people building the latest fuel-efficient motor vehicles, it supports over 48,000 jobs nationally. Many of these jobs are located in firms that make and send parts directly to the assembly plant, and in many other small manufacturing-related firms. Additionally, much of the research & development and product development work that is necessary to design and produce parts for the vehicles being manufactured at Michigan Assembly is performed within the state at supplier technical facilities.

In the past two years, Ford Motor Company has invested over \$770 million to convert the former truck plant into a plant that is presently making the Ford Focus (4-door, 5-door), Focus Electric, Focus ST, C-MAX Hybrid, C-MAX Energi (plug-in hybrid). The substantial number of people employed at the Michigan Assembly Plant as well as at the companies in the state that do business directly or indirectly with the plant and the significant amount of spending by the plant within the state show the impact and importance of vehicle manufacturing facilities to the state.

CAR's research and analysis on MAP finds:

- **MAP significantly contributes to employment in Michigan and the United States**
 - Direct employment in Michigan is approximately 5,000
 - Total employment (Direct, Intermediate, and Spin-off) is nearly 24,000 in Michigan and more than 48,000 nationally
- **MAP significantly contributes to the wages and GDP of Michigan and the United States**
 - Wages and earnings in Michigan are nearly \$1.8 billion and nearly \$3.6 billion nationally
 - Contribution to GDP is 3 billion in Michigan and more than \$5.7 billion nationally
 - The majority of engines installed in vehicles produced at the plant, as well as a large share of the stamped components, are sourced from Ford facilities in Michigan.
- **MAP supports an extensive independent supplier and small businesses network.**
 - The Michigan Assembly Plant is served by 179 independent Tier 1 suppliers from across the United States, with 80 of these firms located in Michigan.
 - Tier 1 suppliers located within the state of Michigan accounted for the single largest share of the total purchase value, \$1.1 billion, or 34 percent of the \$3.2 billion total in annual parts purchases by the plant.
 - CAR's sampling of Tier 2 suppliers revealed that a majority of these firms are small businesses with a single location and employment of up to 100.
- **Global nature of vehicle manufacturing presents further opportunities for insourcing.**
 - To meet global demand, the Ford Focus is assembled at five facilities around the world including MAP. Because these vehicles share a global platform, opportunities exist to localize even more of the Michigan Assembly supply chain.

As Michigan considers policies to encourage economic development, particular focus should be placed on policies and programs which serve to strengthen the competitiveness of auto manufacturing facilities in the state. These facilities will continue to be major engines of economic growth and will require the talent and resources to maintain the competitive edge. It makes sense that the state and company work together to ensure the long-term viability of these plants and explore the opportunities to continue to localize the global supply chain.

Introduction

As flexibility becomes even more central to automotive operations, more assembly plants can be expected to install flexible assembly lines capable of seamlessly manufacturing different models with varying configurations. The industry is always changing to meet new demands; as consumer preferences evolve, assembly plants can no longer depend on manufacturing one or two models, but must be able to produce a variety of models to match market demand. The assembly plant of the future will be outfitted with all the high-tech equipment needed to support such flexibility and world class quality manufacturing.

Ford Motor Company's Michigan Assembly Plant (MAP) is a sign of things to come in the automotive industry. MAP is a very important asset to the State of Michigan. The plant produced more than 220,000 vehicles in 2011, 300,000 vehicles in 2012, and this year the plant is on track to produce more than 350,000 vehicles.¹ Not only does this plant employ approximately 5,000 people building the latest fuel-efficient motor vehicles, it supports another 19,000 jobs in the state. Many of these jobs are located in firms that make and send parts directly to the assembly plant, and in many other small manufacturing-related firms throughout the state. Fully one third of the \$3 billion annual spending by the plant is spent within Michigan. Given how important this plant and its state suppliers are to the company, and how much the state relies on the jobs that result, it makes sense that the state and the company work together to ensure the long-term viability of the plant.

As the state is concentrating many of its economic development efforts on economic gardening—a major emphasis on assisting companies already located within the state—this plant (and many other assembly plants statewide) is a natural fit for the type of attention economic gardening provides. In the case of an assembly plant, economic gardening should be aimed not only at the large iconic facility that assembles motor vehicles, but also to the many small- and medium-sized businesses that have a stake in the automobile business. Discussing with the parent company, in this case Ford Motor Company, the needs of the assembly facility and its suppliers can reveal early indicators of stress points within the state, the level of assistance the state can provide, and even targets for future investment, such as out-of-state companies, and new facilities.

The Michigan Assembly Plant was chosen as the focus for this study for several reasons. The plant is unique in its ability to produce vehicles with four different powertrain options: gasoline-powered, electric, hybrid, and plug-in hybrid. With MAP, Ford has created a new global standard for flexible manufacturing; indeed, MAP is the only assembly plant in the entire world that is building vehicles with such diverse powertrains. The assembly is a great example of how the "One Ford" plan has transformed both products and processes, standardizing vehicles globally while still giving customers an array of options. By choosing Michigan as the site to manufacture its global Ford Focus platform, Ford has indicated that Michigan is a globally competitive manufacturing location. Many of the global suppliers needed to assemble Ford vehicles are already located in Michigan, and even more global suppliers are

¹ LMC Automotive. (2012). LMC Automotive Database. Accessed December 7, 2012. <<http://lmc-auto.com/>>. and Ford. (2013). Personal Communication.

coming. The Ford Focus global platform also presents a great opportunity for suppliers already located in Michigan to export parts and components around the world to other Ford Focus production sites.

For the past dozen years, the Center for Automotive Research (CAR), through its Automotive Communities Partnership (ACP), has worked with many states, provinces, communities, and the automotive companies in the Great Lakes region, and has come to a high level of understanding regarding these relationships. CAR has found that in order to adequately ask for and provide assistance, the states and communities need to have a very good understanding of the auto industry, the position of the company within the industry and the status of the assembly plant within the company hierarchy. Additionally, the companies need to understand the pressure points within communities and states/provinces regarding incentives, employment targets, tax revenues, and the status of other state industries.

This report is intended to articulate the importance of the Michigan Assembly Plant to the economy of the State of Michigan. This study first provides a background on the auto industry, Ford's place in it, and details of the Michigan Assembly Plant, located in Wayne, Michigan. Later in the study, an analysis of the parts sourcing operation is discussed, followed by an estimation of the economic support the plant provides to the state economy, the surrounding states, and the national economy. Finally, key points from the study are detailed in the Conclusions section.

Section 1: North American Industry Overview

The North American Automobile Industry

For more than a century, the automotive industry has been a major contributor in shaping the identity of the U.S. economy by generating millions of jobs. Over the past two decades, the U.S. industry has been transformed by billions of dollars in new investments.² Though the 2007-2009 recession temporarily hampered new investments, over the subsequent years, companies have reinvested in U.S. facilities. Announced automaker investments in the United States have totaled approximately \$30 billion since January 2010.

The composition of the auto industry has transformed over the decades as vehicles produced by domestic automakers were joined by those made by international automakers who have opened manufacturing operations in the United States. Foreign direct investment has facilitated the expansion of the automotive industry beyond the industrial Midwest as international automakers erected plants in southern states such as Alabama, Georgia, Mississippi, and Tennessee. Though the industry has expanded and invested in the South, traditional manufacturing communities are also receiving significant reinvestment.

The economic performance of the automotive sector, as well as manufacturing more broadly, is extremely important for the continued development and growth of national and regional economies. Trends in manufacturing, and the automotive sector in particular, are indicators of the state of the economy, with periods of growth in automotive manufacturing followed by periods of growth in the economy as a whole. While the automotive industry may add only a few percentage points to the total Gross Domestic Product (GDP), the effects of the sector's activities extend beyond the direct impacts because the complex manufacturing supply chain supports activities throughout many tiers of suppliers and jobs across a wide array of industries.

Recent North American Developments

At the beginning of the 2000s, annual U.S. light vehicle sales peaked at 17.4 million, and remained at over 16 million units through 2007. This unprecedented sales activity was largely supported by factors that included access to low-interest credit, housing development patterns necessitating increased vehicle ownership, a booming stock market, post-9/11 manufacturer incentives, and an enhanced sense of personal wealth.

The surplus of vehicles produced in the early part of the 2000s decade, the ensuing credit crunch, and the recession are the central factors that drove the recent contraction of the automotive industry. In 2008, the motor vehicle bubble burst, as did other bubbles associated with debt financing. Because suppliers, dealers, and assemblers expanded capacity during the early part of the decade, many were vulnerable when sales suddenly began to drop off.

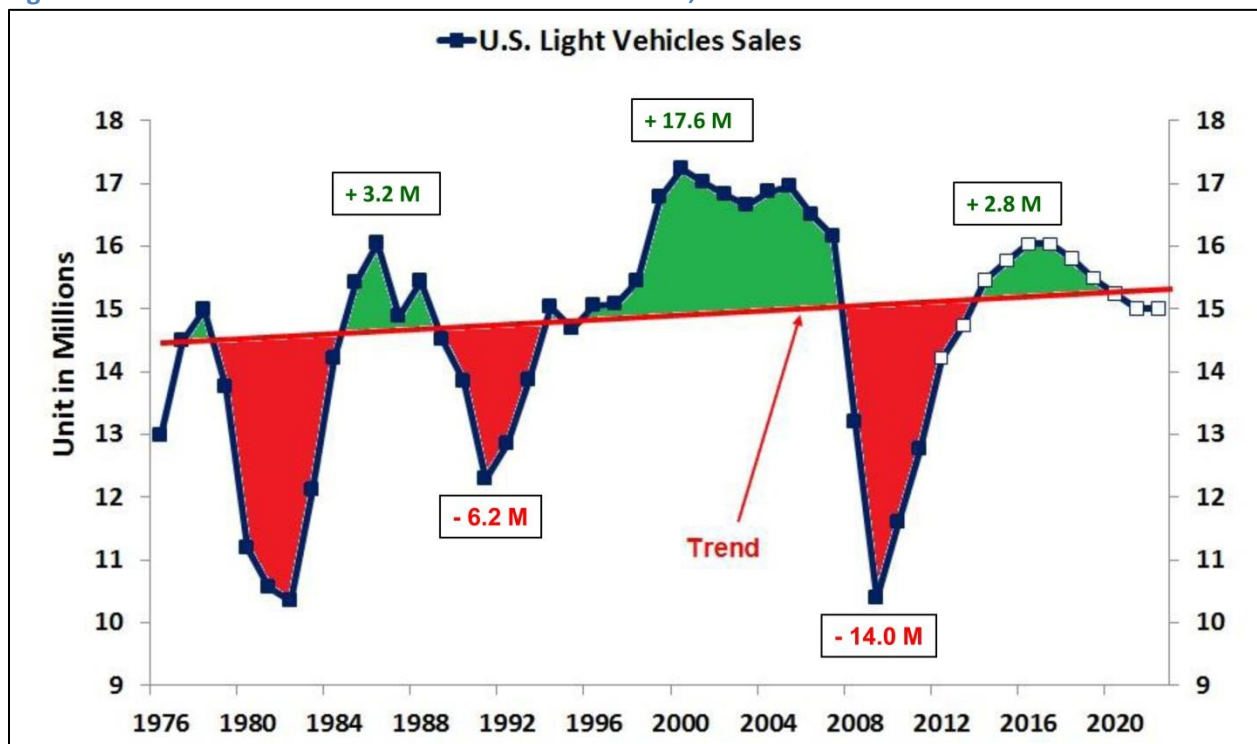
² CAR. (2012). "Book of Deals." Center for Automotive Research. June 2012.

Despite the downturn and lingering challenges to economic recovery, the automobile industry is slowly recovering. Many of the leading economic indicators continue to trend in the right direction for a recovery (Dow Jones Index, full time employment, and consumer price indices).³ Cumulative sales for the year as a whole have improved, with a 19.9 percent increase over last August's figures.⁴

Sales and Analysis

CAR has produced its own sales forecast based on an econometric analysis of many of these variables. The forecast suggests that automobile sales over the next several years will continue to steadily increase, reaching 14.9 million for 2013, and returning to the long-term trend at between 15 and 16 million in the subsequent years. Figure 1 displays historical and forecasted sales for the U.S. automotive industry. Regions of the graph highlighted in green are periods where sales were above trend, and regions that are highlighted in red are periods where sales were below trend.

Figure 1: Center for Automotive Research Sales Forecast, 2012



Source: Center for Automotive Research 2012

Employment

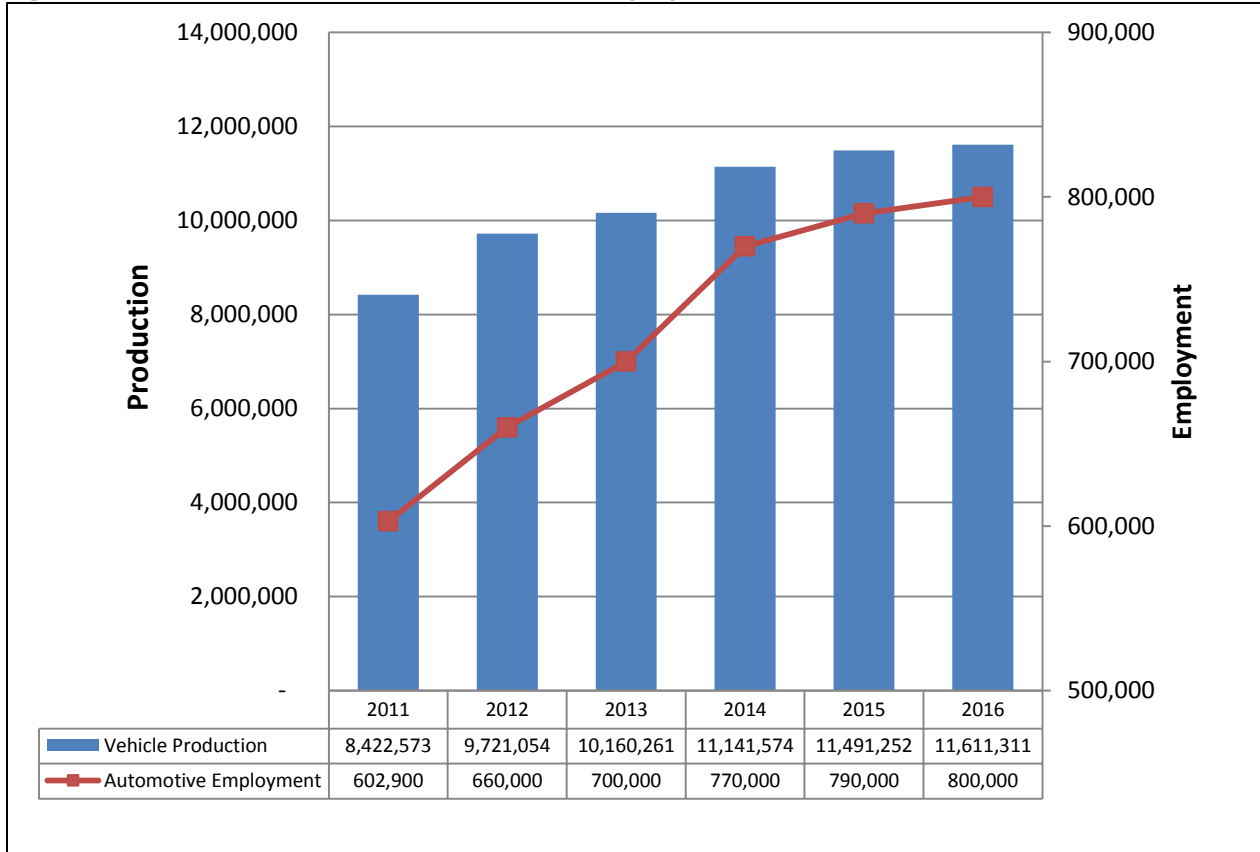
CAR's automotive employment forecast suggests that from 2011 to 2016 employment will increase by slightly more than a third, with a compound average growth rate of 6.1 percent. Production is forecast

³ Note: A consumer price index or CPI is a measure of the average change of consumer prices over time. FRED. (2012). "Federal Reserve Economic Data." Economic Research, Federal Reserve Bank of St. Louis. Accessed June 4, 2012. <<http://research.stlouisfed.org/>>.

⁴ Automotive News. (2012). "U.S. Total Vehicles Sales by Make, Aug. & YTD." Automotive News Data Center. September 4, 2012. <<http://www.autonews.com/section/datacenter>>.

to recover even more quickly, with a compound average growth rate of 6.2 percent, resulting in an increase of more than 35 percent in production from 2011 to 2016. These forecasted trends are displayed in Figure 2.

Figure 2: U.S. Vehicle Production & Automotive Employment Forecasts, 2011-2016



Source: LMC-Automotive 2012 and Center for Automotive Research 2012

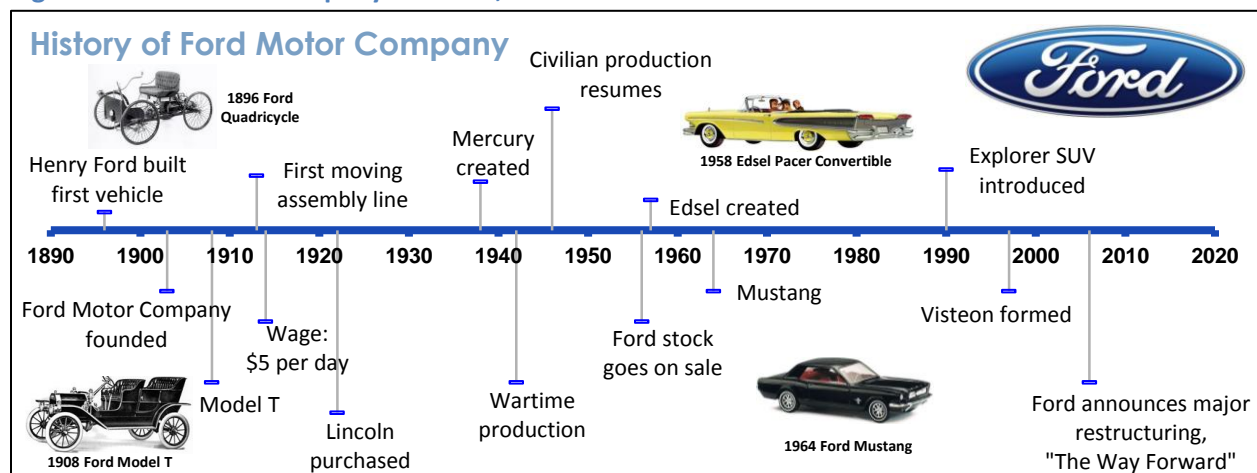
Section 2: Ford's Presence in North America

Company History

Ford Motor Company was founded in Michigan on June 16, 1903 by Henry Ford after previous attempts to manufacture cars had failed. Ford's early vehicles were chronologically named from Model A (1903) to Model K and Model S (1907). In 1908, Ford came out with the Model T, which was originally built in a Ford-owned factory, the Piquette Road Manufacturing Plant. The Model T was Ford's first truly mass-produced vehicle, with several dozen vehicles built daily. Production totaled 18,000 units in the first full production year. By 1911, Model T production was moved to the much larger Highland Park Plant to accommodate higher production rates, and in 1912, over 170,000 Model Ts were produced. By 1913, Ford had developed the moving assembly line. In 1914, Ford doubled the daily wage to \$5, which decreased turnover, improved morale, and increased productivity.

In 1922, Ford purchased Lincoln to expand its reach into the luxury vehicle market. In 1938, Ford established Mercury to provide mid-priced vehicles, bridging the gap between the company's Ford and Lincoln brands. Ford also created the Edsel brand in the 1950s, but discontinued the brand less than three years after its introduction. The company saw huge successes with its 1960 Ford Falcon and 1964 Ford Mustang vehicles. The following decades saw Ford make investments in Mazda and purchase the Aston Martin, Jaguar, Volvo and Land Rover brands. The company has since drastically reduced its stake in Mazda, and has sold all four brands to other automakers. Significant Ford milestones are summarized in Figure 3.

Figure 3: Ford Motor Company Timeline, 1896-2012



Source: Ford 2012 and Center for Automotive Research 2012

Recent Ford Investments

As one of the largest and oldest automakers in the North American automotive industry, Ford has made substantial investments in its U.S. manufacturing infrastructure. Since January 2010, Ford has announced almost \$9 billion in investment in the United States and Canada—nearly a third of the total announced automotive investment for that period. The investment was spread across 23 Ford sites. Some of the largest investments announced by Ford in the last few years were located at the company's Claycomo Plant (Kansas City, Missouri); Michigan Assembly Plant (Wayne, Michigan); Louisville Assembly Plant (Louisville, Kentucky); Chicago Manufacturing Campus (Chicago, Illinois); Kentucky Truck (Louisville, Kentucky); Flat Rock Assembly (Flat Rock, Michigan); and Sharonville Transmission Plant (Sharonville, Ohio), with each investment being over \$500 million. . In fact, two of the plants—Michigan Truck and Louisville Assembly—converted from frame-based vehicles to unibody vehicles, resulting in completely different products coming off the assembly lines. A list of recent Ford investments can be seen in Table 1.

Table 1: Investment by Ford in the U.S. and Canada, 2010-2012 YTD (May 2012)

Facility	City	State	Investment (Millions)
Chicago Manufacturing Campus	Chicago	IL	\$636
Kentucky Truck	Louisville	KY	\$621
Louisville Assembly Plant	Louisville	KY	\$639
Dearborn Engine	Dearborn	MI	\$130
Dearborn Stamping	Dearborn	MI	\$484
Dearborn Truck	Dearborn	MI	\$359
Headquarters	Dearborn	MI	\$18
Auto Alliance	Flat Rock	MI	\$555
Livonia Transmission	Livonia	MI	\$192
Rawsonville Components Plant	Rawsonville	MI	\$62
Romeo Engine	Romeo	MI	\$50
Sterling Axle	Sterling Heights	MI	\$141
Van Dyke Transmission Plant	Sterling Heights	MI	\$220
Michigan Assembly Plant	Wayne	MI	\$771
Wayne Stamping Plant	Wayne	MI	\$80
Woodhaven Forge	Woodhaven	MI	\$4
Claycomo Plant	Kansas City	MO	\$1,100
Buffalo Stamping	Buffalo	NY	\$136
Ohio Assembly	Avon Lake	OH	\$128
Cleveland Engine Plant #1	Brookpark	OH	\$328
Lima Engine Plant	Lima	OH	\$450
Sharonville Transmission Plant	Sharonville	OH	\$540
Ford Essex Engine Plant	Windsor	ONT	\$420
	TOTAL		\$8,914

Source: Center for Automotive Research, "Book of Deals" 2012

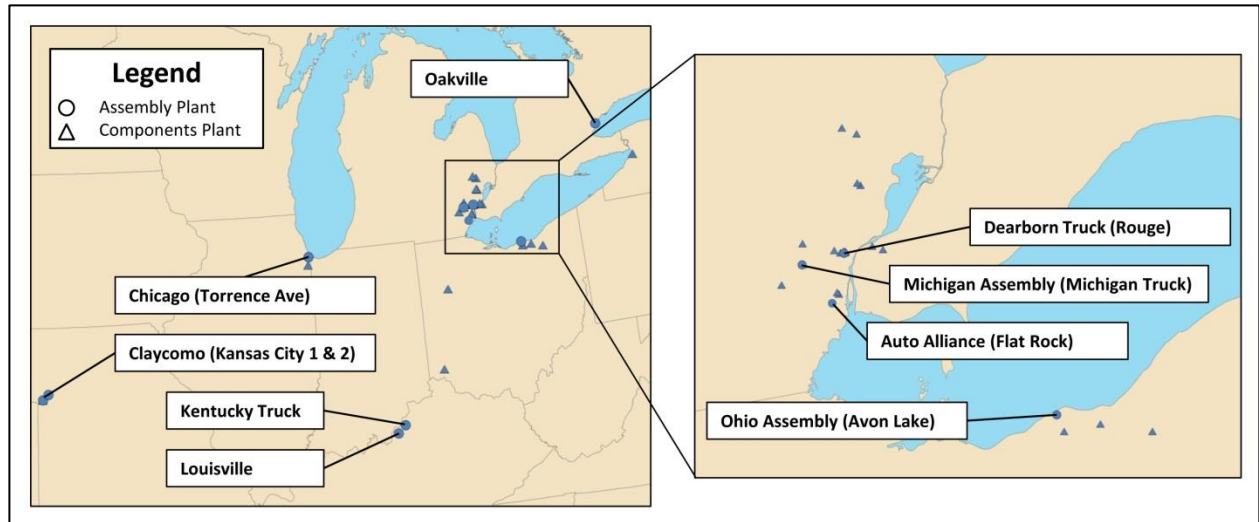
Note: In 2010, Ford announced investment in four facilities, Dearborn Truck, Sterling Heights Transmission/Van Dyke Transmission, Sterling Axle, and Livonia Transmission totaling \$850 million. The distribution of this investment is reflected in the total investment, but not in individual site investments.

Figure 4 details Ford's major facilities in the United States and Canada. Ford has three assembly sites in Michigan (Dearborn, Flat Rock, and Wayne); one in Ontario (Oakville); one in Ohio (Avon Lake); one in Illinois (Chicago); one in Missouri (Claycomo); and two in Kentucky (both in Louisville). These sites provide Ford with a total U.S. capacity to produce nearly 2.8 million motor vehicles annually.⁵

Ford's assembly plants produce a variety of products. Ford brand products produced in the United States and Canada include the C-Max, E-series (Econoline), Edge, Escape, Expedition, Explorer, F-series, Flex, Focus, Mustang, and Taurus. Lincoln brand products produced in the United States and Canada include the Mark LT, MKS, MKT, MKX, and Navigator. Of these, Ford's assembly plants in Michigan produce the Ford C-Max, Ford F-series, Ford Focus, Ford Mustang, and Lincoln Mark LT.

⁵ LMC Automotive. (2012). LMC Automotive Database.

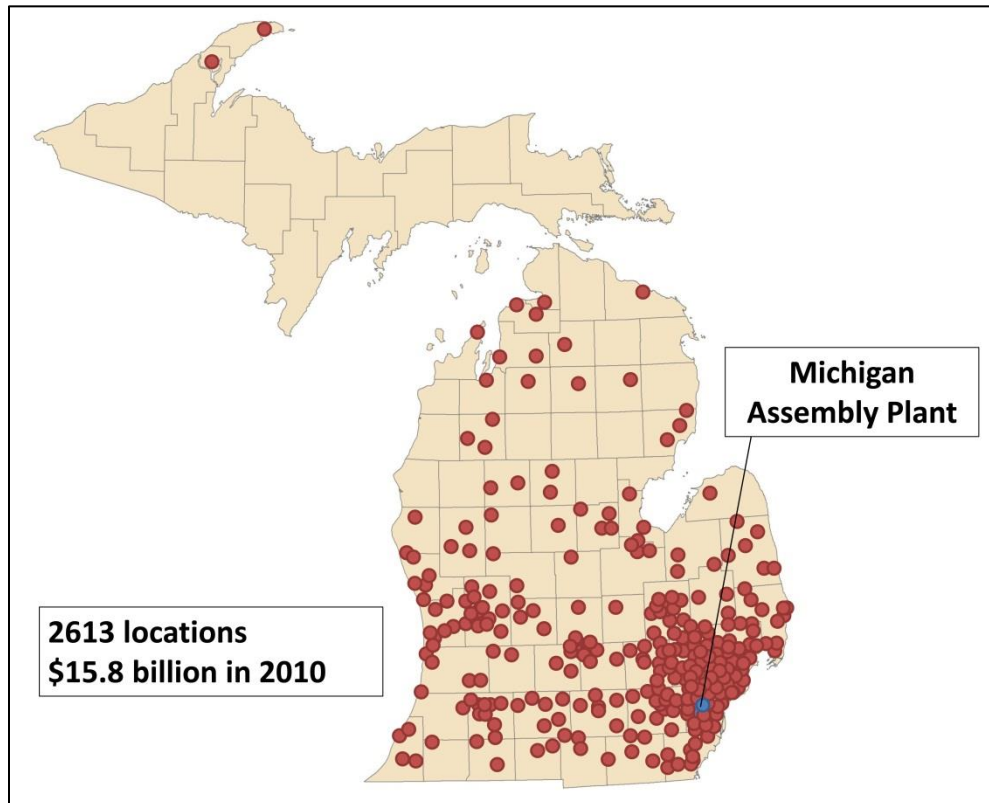
Figure 4: Map of Major Ford Facilities in the United States and Canada, 2012



Source: Center for Automotive Research 2012

The bulk of Ford’s assembly capacity is in Michigan as are three of its engine plants, a transmission plant, several stamping operations and several other components manufacturing facilities. Beyond Ford-owned manufacturing facilities, Michigan is home to more than 2,600 supplier facilities that produce parts for Ford. In 2010, Ford spent nearly \$16 billion on parts and components coming from Michigan supplier facilities. Ford’s suppliers in Michigan are displayed in Figure 5.

Figure 5: Map of Ford Supplier Facilities in Michigan, 2010



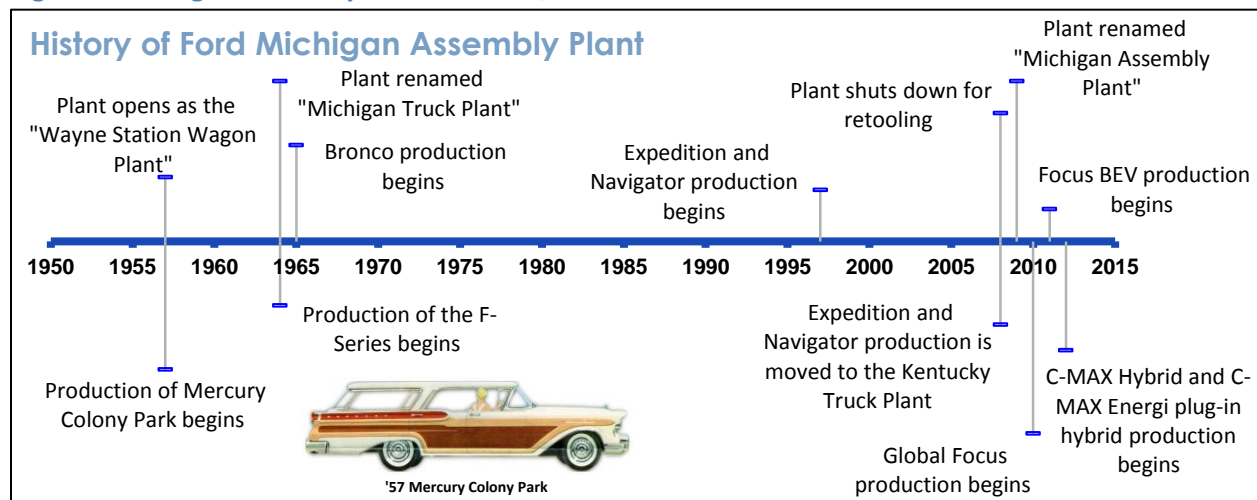
Source: Ford 2012 and Center for Automotive Research 2012

The Michigan Assembly Plant

One of the largest Ford investments in recent years has been in the Michigan Assembly Plant. Until 2008, the Michigan Assembly Plant was known as Michigan Truck Plant and produced sports utility vehicles. After closing, retooling, and reopening, the Michigan Assembly Plant began building the new global Ford Focus, Ford Focus Electric, and Ford C-Max. In 2012, the plant began building hybrid and plug-in hybrid vehicles. The plant is the first facility in the world capable of building such an array of vehicles (gas-powered, electric, hybrid, and plug-in hybrid) on the same production line.⁶

The Michigan Assembly Plant originally opened in 1957 as the Wayne Station Wagon Plant. An eight-fold increase in station wagon sales between 1947 and 1956 confirmed the decision to build the plant. It initially produced bodies for the Mercury Colony Park, a full-size station wagon. In 1964, after being briefly closed, the plant was reopened as the Michigan Truck Plant and began producing F-Series trucks. In 1965 the plant began producing the Ford Bronco. Due to high demand for the Bronco, the plant needed two expansions between 1966 and 1969. In 1974, the plant had an 18,000 square-foot expansion. In 1996 Bronco production ended, and in 1997 the plant began producing sports utility vehicles; its products included the Ford Expedition and the Lincoln Navigator. A new body shop was built in 2005. Truck production ended at the plant in 2008. After retooling, the plant reopened in 2010 as the Michigan Assembly Plant. These Michigan Assembly Plant milestones are summarized in Figure 6.

Figure 6: Michigan Assembly Plant Timeline, 1957-2012



Source: Ford 2012 and Center for Automotive Research 2012

The plant uses a flexible body-shop operation, allowing Ford to efficiently build multiple models in one plant. Michigan Assembly will be using that flexibility to produce several different models: the new global Ford Focus, the Ford Focus Electric, C-MAX Hybrid, and C-MAX Energi plug-in hybrid.

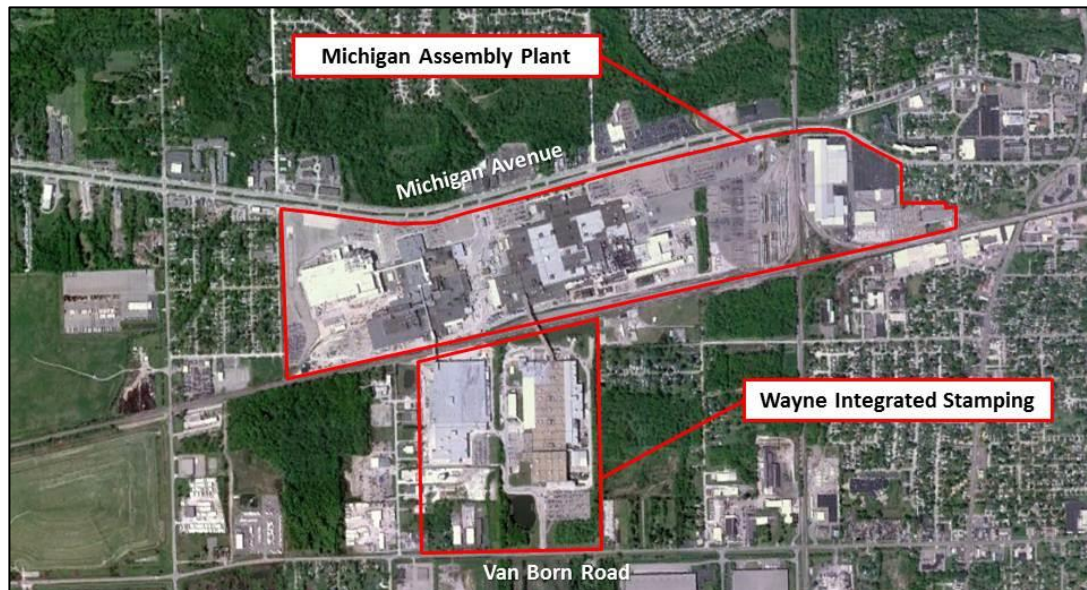
In order to adapt to the demand for vehicles without adding additional space, the Michigan Assembly Plant is using a unique shift arrangement. It is currently running three shifts, but rather than traditional

⁶ Ford. (2011). "Ford Opens Flexible, Green Michigan Assembly Plant with Production of All-New Ford Focus." Ford Media. March 17, 2011. <http://media.ford.com/article_display.cfm?article_id=34225>.

8-hour shifts five days a week, employees are working 10-hour shifts four days a week.⁷ There are three crews: the A crew, B crew, and C crew. The A crew works Monday through Thursday, and the B crew works Tuesday through Friday. The C crew works on Saturday and Sunday as well as Monday nights.⁸ This new work pattern allows the company to add jobs, reduce overtime, and increase the efficiency of the factory by running seven days a week instead of just five.

Figure 7 depicts the layout of the Michigan Assembly site. In addition to the assembly site itself, which is north of the railroad tracks at 38303 Michigan Avenue, there is a stamping facility to the south of the railroad tracks at 37500 Van Born Road. In total, the plant encompasses 2.9 million square feet and sits on 140 acres.⁹

Figure 7: Aerial Image of the Michigan Assembly Plant, 2012



Source: Google Earth 2012 and Center for Automotive Research 2012

The contemporary automotive supply chain is long and complex, given that the typical vehicle is composed of approximately 15,000 parts which can be sourced from thousands of companies all over the world.¹⁰ Generally automakers combine automotive systems to produce a vehicle. These systems can be manufactured by automakers themselves or sourced from Tier 1 suppliers who buy parts and components for the systems from Tier 2 suppliers, who purchase parts and components from Tier 3 suppliers and so on. The 2012 Ford Focus pictured in Figure 8 is an example of the diverse and complex nature of the supply chain.

⁷ Samilton, Tracy. (2012). "New Schedules Push Graveyard Shift Off The Clock." National Public Radio. June 14, 2012. <<http://www.npr.org/2012/06/14/154963293/new-schedules-push-graveyard-shift-off-the-clock>>.

⁸ Ford. (2013). Personal Communication.

⁹ Ford. (2012). "Fact Sheet: Michigan Assembly Plant." Ford Media. Accessed June 13, 2012. <http://media.ford.com/article_display.cfm?article_id=30317>.

¹⁰ Klier, Thomas and James Rubenstein. (2008). "The Parts of Your Vehicle." In *Who Really Made Your Car? Restructuring and Geographic Change in the Auto Industry*. W.E. Upjohn Institute for Employment Research. Pages 1-30. <http://research.upjohn.org/up_bookchapters/2>.

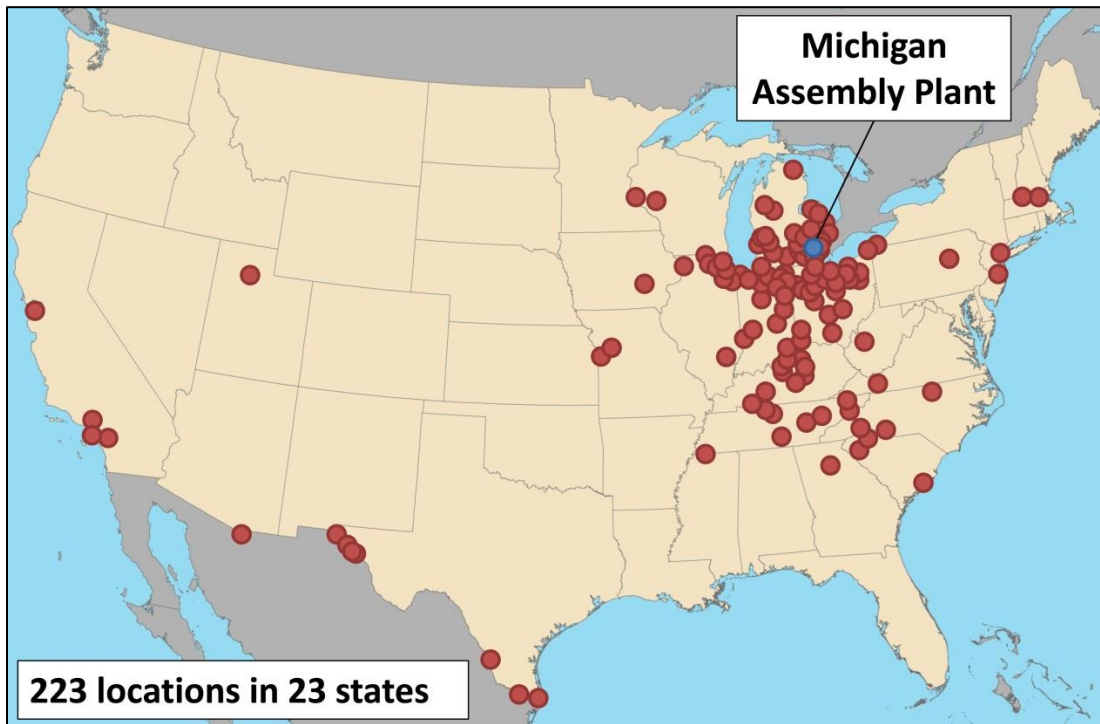
Because the Ford Focus is built on a global platform, Ford has indicated that Michigan is a globally competitive manufacturing location for both vehicles and vehicle components. Many of the global suppliers needed to assemble Ford vehicles are already located in Michigan, and even more global suppliers are locating in the state. The Ford Focus global platform also presents a great opportunity for suppliers already located in the region to export parts and components around the world to other Ford Focus production sites, which are located in Germany, Thailand, China, and Russia.

Figure 8: Parts and Components for the Ford Focus are Sourced from Many Suppliers, 2012



Source: Automotive News 2010

Figure 9: Michigan Assembly Plant HEV, PHEV, and BEV Component Suppliers in the U.S., 2012



Source: Ford 2012 and Center for Automotive Research 2012

As a further example of the extensive supply chain to the Michigan Assembly Plant, Figure 9 displays the locations of 223 suppliers of hybrid electric vehicle (HEV), plug-in hybrid electric vehicle (PHEV), and battery electric vehicle (BEV) components across the United States. Though these suppliers are concentrated in the Midwest, there are supplier facilities in 23 different states, stretching from the East Coast to the West Coast.

With such extensive supply chains, vehicles like the Ford Focus, which is produced in Wayne, Michigan, have global economic contributions. Investments made to produce the Focus affect not just jobs at the Michigan Assembly plant and its surrounding community, but also throughout Michigan, the United States, and other countries around the world.

Section 3: Global Suppliers to the Michigan Assembly Plant

Sourcing parts for Michigan Assembly

The parts sourcing operation for a plant the size of Michigan Assembly is quite complicated. Hundreds of suppliers deliver parts to the assembly plant, sometimes multiple times a day. Many of these suppliers are in-state, while some are on the opposite side of the globe. Logistics is a separate, yet vitally important, function within the company that tracks and coordinates suppliers' shipments to and from all of the assembly and major component plants within the Ford system. Coordinating the steady, dependable flow of parts globally requires constant, never-ending oversight of the entire supply chain.

The Michigan Assembly Plant is served by 379 Tier 1 suppliers¹¹ from across the globe, with 179 of these suppliers located within the United States, and 80 in Michigan. When Ohio and Indiana are included, 111 suppliers to the plant are from the immediate tri-state region.

In 2011, Michigan Assembly's total value of parts purchases from Tier 1 suppliers was \$3.1 billion. Of this total, \$1.8 billion, or 57 percent, was from suppliers located within the United States. The remaining purchases came from suppliers in Mexico (\$831 million; 27 percent); Canada (\$61 million; 2 percent); and the rest of the world (\$447 million; 14 percent).

Purchases made from suppliers located within the state of Michigan account for the single largest share of the total purchase value, \$1.1 billion – 34 percent of the total, and 60 percent of all U.S. purchases. Purchases from U.S. suppliers outside of Michigan amounted to \$711 million (23 percent of total; 40 percent of U.S. purchases).

As shown in Figure 10, purchases from the U.S. Central Automotive Region states of IL, IN, KY, MI, MO, and OH, accounted for \$1.5 billion or nearly half of all parts for the Michigan Assembly Plant in 2011 (47 percent of total; 83 percent of U.S. purchases). When Michigan is excluded, over \$400 million (13 percent of total; 23 percent of U.S. purchases) of the total parts purchased come from the other five states. Altogether, 141 of the Tier 1 suppliers to Michigan Assembly are in these six states. The maps in Figures 10, 11, and 12 show the location and dollar volumes of suppliers to the Michigan Assembly Plant.

¹¹ These are independent, non-affiliated Tier one suppliers only. Ford's captive suppliers, such as engine, transmission and stamping operations are not included in this analysis.

Major Subsystems

To gain another perspective on the assembly of an automobile, parts in an automobile are divided into major subsystems. For instance, the many parts necessary to manufacture engines and transmissions are categorized in the powertrain subsystem grouping. The major categories examined for this study are: body; interior; chassis and drivetrain; powertrain; wheels, tires and brakes; fasteners, liquids and small parts; and finally other, or miscellaneous.

When looking at the entire \$3 billion plus in purchases each year, it is helpful to know to which category the parts belong (see Table 2). Purchases of parts for the body, such as door handles, mirrors, and sun roofs amounted to \$563 million, or 18 percent of total purchases. Interior parts, including instrument panels and seats totaled \$784 million, 25 percent of the total. Parts for the chassis and drivetrain, which include axles, shocks, and struts accounted for \$351 million, 11 percent of the total. Powertrain parts purchases, including engines and transmissions, comprised \$849 million, 27 percent of total purchases. Purchases of wheels, tires, and brakes came to \$241 million, 8 percent of the total, while purchases of fasteners, liquids, and small parts used by multiple systems sum to \$58 million, 2 percent of the total. Parts that were hard to classify fall into the miscellaneous category totaled \$275 million, 9 percent.

Table 2: Purchases by Major Subsystem, 2011

Category	Spending	Percent of Total Spending
Body	\$562,530,733	18.0%
Interior	\$784,213,069	25.1%
Chassis & Drivetrain	\$350,985,823	11.3%
Powertrain	\$848,850,765	27.2%
Wheels, Tires, Brakes	\$240,759,700	7.7%
Fasteners; liquids; small parts used by multiple systems	\$57,636,930	1.9%
Miscellaneous	\$274,964,863	8.8%
Total	\$3,119,941,883	100%

Source: Ford 2012, CAR analysis

Top Ten Suppliers

The top ten suppliers, by volume of purchases, to the Michigan Assembly Plant accounted for \$1.3 billion of purchases in 2011 (see Table 3). Of the top ten, two powertrain suppliers are located in Mexico, accounting for \$425 million of purchases. These two companies supply Michigan Assembly with automatic transmissions and catalytic converters.

Seven of the top ten suppliers, by purchase amount, are in the United States, accounting for \$765 million in parts purchases. Of these, five are in Michigan (\$582 million), one in Illinois (\$72 million), and one in Virginia (\$111 million). The five top ten suppliers in Michigan send \$582 million in parts to Michigan Assembly. The components sourced from these Tier 1 suppliers include body parts; powertrain; interior; and miscellaneous parts.

This does not include engine purchases, which come from Dearborn engine—a captive Ford supplier. The top ten supplier in Illinois sends wheels, tires or brake components, while the top ten supplier in Virginia sends chassis and drivetrain components.

The remaining top ten suppliers was located in Honduras (\$117 million), which sends wiring looms and wiring harnesses to Michigan Assembly. It is believed the majority of the cost for these components is for labor to assemble the wiring harnesses—a very labor-intensive process.

Table 3: Top ten suppliers to Michigan Assembly, 2011

Country (State)	Number of Suppliers	Dollar Value of Purchases (Millions)	Types of Parts
Mexico	2	\$424.6	Powertrain
United States	7	\$765.3	
(Michigan)	5	\$582.2	Body, Interior, Powertrain, Misc.
(Illinois)	1	\$71.7	Wheels, Tires & Brakes
(Virginia)	1	\$111.4	Chassis & Drivetrain
Honduras	1	\$117.2	Powertrain

Source: Ford 2012, CAR analysis

Geographic Distribution of Suppliers and Sourcing

Looking at the geographic mix of the parts purchased by Michigan Assembly Plant in Figure 12, this study finds that 198 suppliers were located outside of the United States and Canada, sending a total purchase value of parts of \$1.3 billion. Of this, approximately \$830 million is sourced from Mexico, with the remaining \$448 million coming from the rest of the world. By far, the largest group of parts purchases—at nearly \$660 million—sourced from outside the U.S. and Canada are powertrain components, which include transmissions, and other engine componentry. As seen in Table 4, many auto companies have sourced major powertrain components from abroad. With roughly 12 percent of Tier 1 parts and many more Tier 2 and below parts coming from outside North America, there could be concern on Ford’s part about supply chain disruptions that may impede the smooth flow of parts to Michigan Assembly, which would stop the steady production of automobiles.

Table 4: Purchases by category outside of the U.S. and Canada, 2011

Parts Category	Number of Suppliers Outside U.S. and Canada	Dollar Value of Purchases (Millions)
Body	54	\$126.0
Chassis & Drivetrain	20	\$67.8
Fasteners, Fluids, Small Parts Used by Multiple Systems	24	\$15.4
Interior	42	\$251.8
Powertrain	25	\$657.9
Miscellaneous Parts	20	\$89.8
Wheels, Tire & Brakes	13	\$69.8

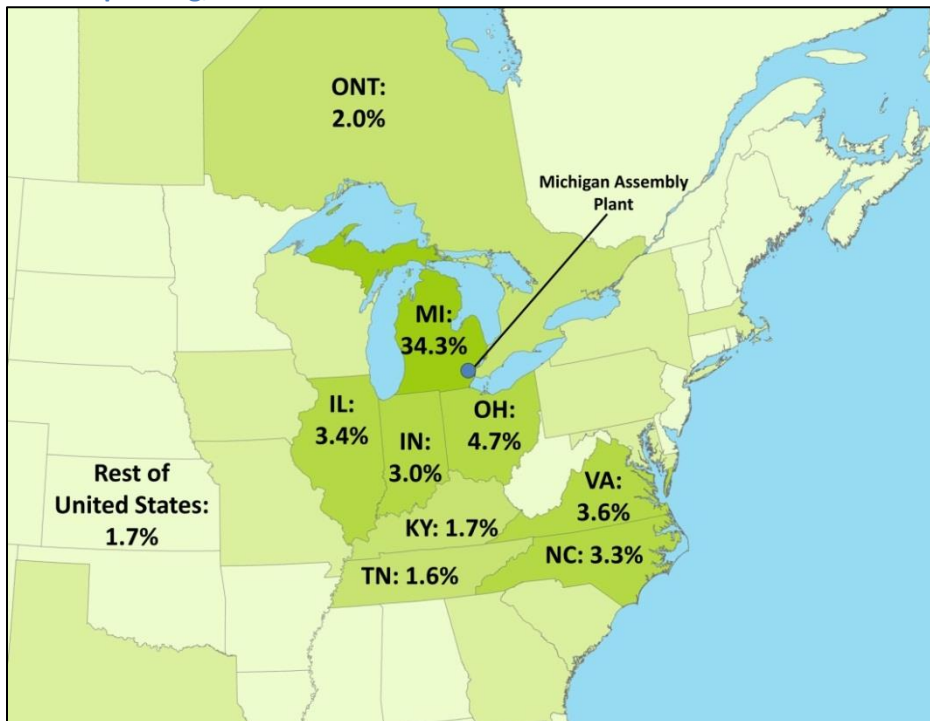
Source: Ford 2012, CAR analysis

Figure 10: Michigan Assembly Plant Independent Supplier Spending By State (Millions of Dollars), 2011



Source: Ford 2012, CAR analysis

Figure 11: Michigan Assembly Plant Independent Supplier Spending By State as a Percentage of Total Global Spending, 2011



Source: Ford 2012, CAR analysis

Figure 12: Michigan Assembly Plant Independent Supplier Spending by Country (Millions of Dollars), 2011



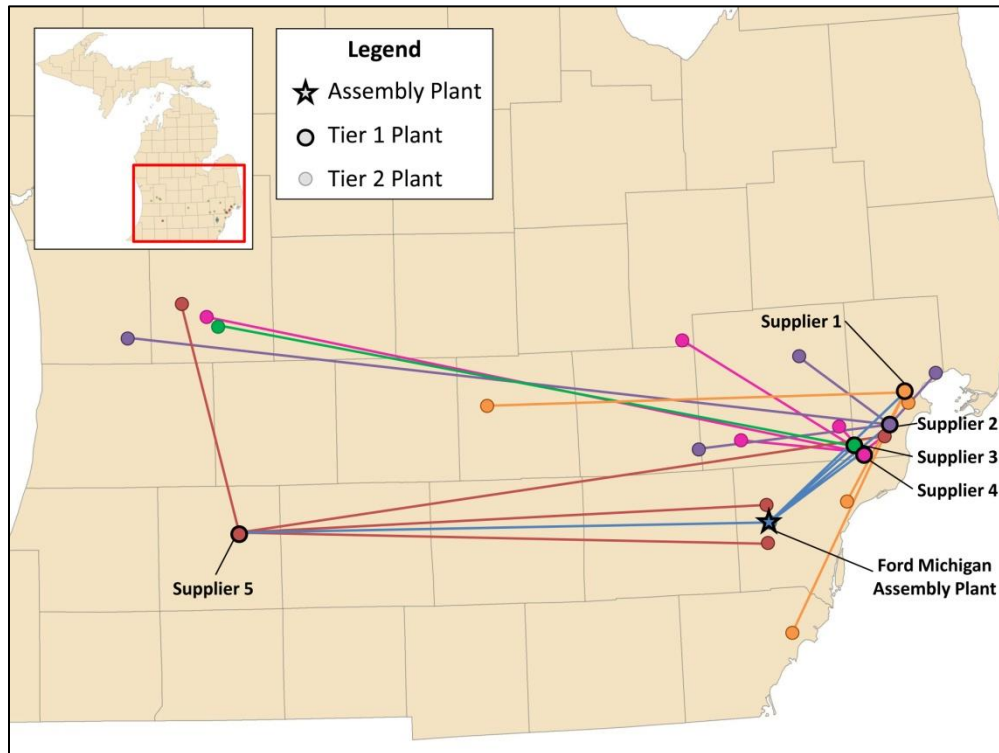
Source: Ford 2012, CAR analysis

Even this brief overview of purchasing data for Michigan Assembly illustrates the immense economic impact an automotive assembly plant has on the state economy. With so many parts being sourced from companies within Michigan, it is easy to see that the total employment impact in the state of this facility is substantially greater than just the direct employment at the Michigan Assembly Plant.

Illustration of Supplier Location Impact

In order to better understand and demonstrate the impact of the Michigan Assembly supply base on the State of Michigan, CAR collaborated with five of the plant's key Tier 1 suppliers to analyze the role their facilities play in the supply chain, as well as gaining an understanding of the chain of lower tier suppliers to these firms. This analysis revealed powerful examples of the benefits multiple supply chain tiers can bring to a region with as deep an automotive endowment as Michigan's.

Figure 13: Five Select Michigan Assembly Suppliers, Along with the Tier 2 Suppliers That Comprise Their Michigan Supply Chain



Source: Supplier Interviews

Figure 13 provides a map indicating the locations of the five Tier 1 suppliers featured in the study, along with the Michigan Tier 2 suppliers these firms identified as key to their sourcing components to Michigan Assembly. The strong concentration and diversity of automotive firms in Michigan, which is unrivaled anywhere in the world, makes it possible for these components to be locally sourced. In areas with a smaller automotive endowment, there is increased likelihood that a portion of these components would have to be sourced from distant locations. This phenomenon is responsible for Michigan’s high economic multiplier effect, which is discussed in detail in the following section.

The five Tier 1 suppliers analyzed identified 21 Michigan-based Tier 2 suppliers that are crucial to their supply of components to Michigan Assembly. Further analysis performed by CAR revealed that a majority of these firms are small, with only a single location and employment levels of under 100. The small size of these suppliers indicates a degree of vulnerability in automotive supply chains that require 100 percent of each vehicle’s components to be available at the time it is to be manufactured. With the automotive industry’s production volume recovery, these firms have come under increased pressure to keep up with rising volumes. This scenario makes them ideal candidates for the State of Michigan’s economic gardening strategy, particularly given that several indicated they were either planning to expand their operations or were considering expansion in the near future. Interestingly, many suppliers at Tier 3 and below can be large, global firms. In many cases, their scale is necessary to provide the sophisticated materials that enter the automotive supply chain in its lower tiers. This dynamic was

confirmed by the supplier analysis and is illustrated in the forthcoming Michigan Assembly supply chain example.

As stated earlier, a majority of the parts used by Michigan Assembly come from Michigan-based automotive suppliers. Still, many of the suppliers analyzed indicated further opportunities to localize even more of the Michigan Assembly supply chain in the state. Because the vehicles built at the plant share a global platform, some components continue to be sourced from overseas, particularly Germany. Several of the suppliers indicated that they receive subcomponents from Europe and see this as a vulnerability in their supply chain, with a higher risk of supply disruption than if the components were sourced more locally. Interestingly, the C1 platform, on which vehicles are built at Michigan Assembly, is also used at Ford's assembly plant in Louisville, Kentucky, which has recently begun producing the new generation of the Ford Escape. Now that the U.S. Midwest is seeing increased production based on this platform, these suppliers indicated an increased benefit to localizing production of some of the components still sourced from Europe.

When a program is awarded to a supplier, there is typically a concomitant tooling investment necessary in order to prepare the manufacturing facility to produce the part in question. In many cases, the tooling is owned by the automaker that awarded the business, though it is also common for suppliers to own their own tooling if it can be applied to multiple products for various customers. Tooling purchases present another opportunity for increased local economic benefit. Many of the suppliers indicated that the tooling they purchased as part of their supply to Michigan Assembly came either from Michigan or from other U.S. Midwest locations. Furthermore, even for particular tools imported from overseas, suppliers indicated that "end of arm" tooling and fixtures were sourced locally. The same is true for stamping operations, which allow dies to be sourced locally regardless of where a stamping press was produced, as well as molding operations, which can utilize locally produced molds regardless of where the rest of the tooling was produced. As mentioned previously, the benefits of such decisions are felt more strongly in an auto-intensive location like Michigan, as there is a greater likelihood that the capability to produce these products is available locally.

Supplier Location Impact Example: Polyurethane Foam Door Inners

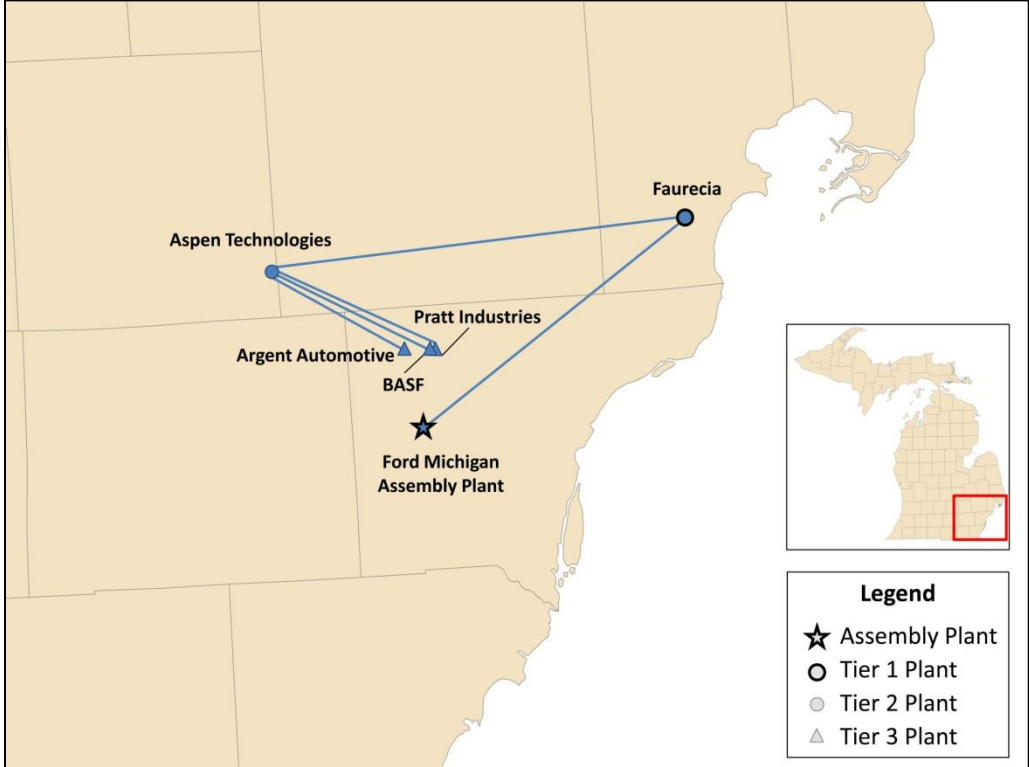
To provide an illustration of the positive role Michigan Assembly plays in Michigan's economy, as well as exemplify the local benefit possible in areas of high automotive concentration, this section will follow the supply chain of a single part through three tiers of the automotive supply chain and through shipping to Michigan Assembly.

The part analyzed is energy absorbing foam inserts which are installed in door panels. The inserts are produced by Aspen Technologies in Brighton, Michigan and then shipped to Faurecia's plant in Fraser. There, they are installed into door panels that are then shipped to Michigan Assembly on a just-in-time basis.

Figure 14 illustrates the path of the various components of the supply chain in question. The entire supply for these inserts is based in Michigan. The inputs at Tier 3 include chemicals from BASF Corporation in Livonia, double-sided adhesive tape (for mounting the insert inside the door panel) from

Argent Automotive in Plymouth, and packaging from Pratt Industries in Livonia. Aspen Technologies, serving as the Tier 2 provider in this instance, incorporates these products into the inserts provided to Faurecia’s Fraser plant, which serves as the Tier 1 provider of door panels to Michigan Assembly.

Figure 14: Polyurethane Foam Door Inner Supply Chain



Source: Supplier Interviews

This sample supply chain illustrates the benefits that can be obtained when a final assembly plant like Michigan Assembly is located in an area as dense in automotive investment as Michigan. Because all of the companies involved are located within about 50 miles of each other, the overall supply chain of this component is more efficient, responsive, and transparent. Shipping costs are minimized, as is the risk of production disruption caused by parts shipping delays. Likewise, in the event a problem occurs, a smaller amount of flawed inventory is in transit at any one time, limiting the financial impact of potential instances of quality control issues. These efficiencies are a key factor in competing with low-cost countries for automotive investment. Although the wages in such a location may be lower, increased shipping and inventory costs, as well as greater risk of supply chain disruptions, serve to detract from their attractiveness as manufacturing locations.

This supply chain also provides an example of the intense local investment that results even though a vehicle is based on a global platform, and many of the supply chain participants are global entities. Both Faurecia and BASF are large, global automotive suppliers based in Europe. Even though the C1 platform (on which the vehicles are built at Michigan Assembly) was developed in Europe and is used around the world, Ford, Faurecia, and BASF all use facilities located in Michigan to produce parts and vehicles based on this platform. Global platforms and supply bases therefore do not necessarily carry with them the

risk of parts and materials sourcing from low-cost overseas destinations at the expense of local investment.

Section 4: Economic Contribution Analysis

The motor vehicle industry is the largest manufacturing industry in the United States. No other single industry is linked as closely to the broader U.S. manufacturing sector or generates as much direct retail business and employment as the motor vehicle industry. Motor vehicle assembly operations and their support infrastructure generate significant jobs in the country, and individual assembly plants are substantial contributors to the host state's economy.

Because a motor vehicle assembly plant has many suppliers of goods and services that are necessary to manufacture the final product an assembly plant creates, or supports, jobs in many other companies throughout the state and country. Ford directly employs 4,900 at the Michigan Assembly Plant and supports over 19,000 additional indirect and spinoff jobs in Michigan. Indirect, or intermediate, jobs are workers who are employed at suppliers to the assembly plant and the suppliers' suppliers. Spinoff jobs are those at businesses that provide goods and services that are needed when the Ford and supplier employees spend their paychecks on goods and services.

Purpose of this Economic Impact Study

The goal of this economic impact study is to determine the additional economic opportunities that have been created by the operations of Ford Motor Company at the Michigan Assembly Plant. By choosing to invest in retooling the plant and produce the Ford Focus in Michigan, Ford has created jobs not only at the assembly plant, but also at other Ford facilities throughout Michigan and the United States as well as at manufacturing companies across the globe.

Ford's economic contribution resulting from the Michigan Assembly Plant was estimated using an economic model acquired from Regional Economic Modeling, Inc. (REMI). The data for this modeling effort were collected by CAR from Ford and a wide variety of publicly available sources, which are listed in the References section at the end of this paper.

Vehicle Manufacturer Activities

This section details the forecasted and estimated employment and income contributions by Ford's Michigan Assembly Plant automotive manufacturing and related operations to the private sector economy for Michigan, the region of Michigan, Ohio and Indiana, and finally, the United States as a whole. Employment estimates are reported by direct employment (people employed directly by Ford); intermediate employment (people employed by suppliers to Ford and the suppliers who supply them); and spin-off employment (expenditure-induced employment resulting from spending by direct and intermediate employees who earn an income as a result of Ford-related activities).

Direct employment data (including white- and blue-collar job classifications in all areas of plant operations) was provided by Ford; intermediate and spin-off employment effects were generated by the economic model. The employment of the supplier network does not include the production of engines and stamping components that are supplied by Ford owned operations.

At the time of the employment analysis, Ford employed 4,853 employees at the Michigan Assembly Plant (employment at the plant has since increased to 5,100). These employees are categorized as such:

- Hourly, non-skilled workers 4,049
- Hourly, skilled workers 571
- Salaried workers 233

Employment and payroll data for Ford was coded according to the North American Industry Classification System (NAICS) for input into the model—including motor vehicle manufacturing (category numbers: NAICS 3361-3363); management of companies (NAICS 551); professional, scientific and technical services (NAICS 541); warehousing and storage (NAICS 493); and administrative and support services (NAICS 561).

As can be seen in Table 5, there are 9,700 intermediate jobs in Michigan resulting from the plant’s direct employment. The spin-off jobs associated with spending (by the people who work in the direct and intermediate jobs) add another 9,400 jobs, bringing the total jobs associated with the plant (direct plus intermediate plus spin-off) to nearly 23,900 jobs.

Table 5: Estimate of the Contribution of Michigan Assembly Plant Operations to Michigan’s Economy, 2011

Economic Impact	Michigan
Employment	
Direct	4,853
Intermediate	9,681
Total (Direct plus Intermediate)	14,534
Spin-Off	9,336
Total (Direct plus Intermediate plus Spin-off)	23,870
Contribution to GSP (\$ Millions)	3,000
All Wages and Earnings (\$ Millions)	1,760
Personal State Income Taxes Paid (\$ Millions)	70

Source: Center for Automotive Research 2012

Private sector compensation associated with the total jobs amounts to nearly \$1.8 billion. The estimated personal taxes paid resulting from Ford’s automotive manufacturing operations at the Michigan Assembly Plant are \$70 million.

There are even greater contributions to the domestic economy when the intermediate and spin-off employment created beyond Michigan’s borders is considered. Ohio and Indiana are home to many auto suppliers as well. Table 6 shows the economic impacts for the tri-state region of Michigan, Indiana and Ohio, and for the U.S. economy as a whole.¹²

¹² Note that the regional results include the results for Michigan; the national results include the regional results.

Summing direct employment of 4,900, intermediate employment (nation-wide) of 19,100, and spin-off employment of 24,500 produces a private sector employment total of 48,500 employees. Comparing total employment to direct employment produces an overall employment multiplier of 10.0, meaning there are 9 additional jobs in the U.S. economy for every one job at the Michigan Assembly Plant.

Table 6: Estimate of the Michigan Assembly Plant Economic Impact, 2011

Michigan Assembly Plant Economic Impact	Michigan	Michigan, Indiana and Ohio	Total U.S.
Employment			
Direct	4,853	4,853	4,853
Intermediate	9,681	11,229	19,055
Total (Direct plus Intermediate)	14,534	16,082	23,908
Spin-Off	9,336	13,216	24,542
Total (Direct plus Intermediate plus Spin-off)	23,870	29,298	48,450
Multiplier: (Direct+Intermediate+Spin-off)/Direct			10.0
Contribution to GDP (\$ Millions)	3,000	3,467	5,719
All Wages and Earnings (\$ Millions)	1,761	2,106	3,562

Note: Due to rounding, columns or rows may not sum exactly.

Source: Center for Automotive Research 2012

Total compensation for all 48,500 private sector workers associated with Michigan Assembly Plant operations is nearly \$3.6 billion. The value added to the U.S. Gross Domestic Product (GDP) from all of these people working is nearly \$6 billion. Of this GDP contribution, \$3 billion remains in Michigan.

More vehicles, engines and transmissions are produced in Michigan than any other state. Supported by similarly auto-focused economies in Indiana and Ohio, this tri-state region dominates auto production in North America. The intensity of the industry in this region creates synergies that in turn allow for innovation, partnerships and entrepreneurial growth that support even more jobs in the industry. Comparison models were created to simulate the economic impacts of the Michigan Assembly Plant if it were instead located in other areas of the United States. For a similar plant located in Mississippi, the plant operations would result in just over 14,000 jobs created in the state, as opposed to plant operations in Michigan, which resulted in nearly 24,000 jobs. The difference of nearly 10,000 jobs indicates that there are not enough automotive support services or suppliers in Mississippi to support such a plant to the extent the Michigan economy is able to do. Likewise, a similar plant in the state of Texas, which has a longstanding auto industry and larger labor force, would result in a total employment contribution of approximately 15,000 jobs. Table 7 illustrates the comparison of automotive job contributions in Michigan, Mississippi, and Texas from an assembly plant employing 4,853 direct workers.

Table 7: Comparison of Employment for an Auto Assembly Plant in Selected States, 2011

Michigan Assembly Plant Economic Impact	Michigan	Texas	Mississippi
Employment			
Direct	4,853	4,853	4,853
Intermediate	9,681	5,430	4,561
Total (Direct plus Intermediate)	14,534	10,283	9,414
Spin-Off	9,336	4,761	4,763
Total (Direct plus Intermediate plus Spin-off)	23,870	15,044	14,177

Note: Due to rounding, columns or rows may not sum exactly.

Source: Center for Automotive Research 2012

Table 8 offers a more detailed look at the indirect (intermediate and spin-off) employment associated with Michigan Assembly Plant operations (for a breakdown of these jobs as a percentage of total indirect employment, see the tables in Appendix B). Total indirect employment was just over 19,000 jobs in the State of Michigan. In the intermediate employment category, nearly 9,700 jobs are spread across numerous manufacturing and non-manufacturing industries. The intermediate category represents the employment necessary to satisfy manufacturers' demands for the materials and services needed to design, produce and sell motor vehicles. This can be broadly considered the automotive supplier network. This supply network consists of the Tier 1 suppliers who supply parts and services directly to vehicle assemblers along with the lower tier suppliers who supply the basic materials and services to the Tier 1 companies. Some of these companies supply basic commodities and can be several steps removed from the vehicle design and manufacturing process.

Table 8: Distribution of Indirect Job Contributions by Industry Category, 2011

Industry Category	Intermediate	Spinoff	Total (Indirect)
Manufacturing	2,116	49	2,165
Professional and Technical Services	1,161	0	1,161
Administration and Services	290	4,289	4,579
Wholesale Trade	1,403	233	1,636
Retail Trade	174	1,501	1,675
Transportation and Warehousing	210	27	237
Finance and Insurance	255	178	433
Management of Companies	300	0	300
Other Non-Manufacturing	3,774	3,059	6,833
Total Employment	9,681	9,336	19,017

Source: Center for Automotive Research 2012

The Michigan Assembly Plant requires plastic and metallic parts, electronic components, and other materials to produce vehicles. It is these parts demands, satisfied by a vast array of specialized manufacturers, which generate intermediate employment. As shown in Table 9, intermediate jobs in the manufacturing sector are primarily in the industries necessary to produce automobiles—primary metals and fabricated metal products manufacturing, with nearly 800 jobs; machinery manufacturing, with nearly 200 jobs; auto parts manufacturing, with nearly 700 jobs (including many Tier 1 suppliers); and plastics and rubber products manufacturing, with over 200 jobs. There are nearly 300 more indirect jobs in other manufacturing subsectors. These employees are manufacturing the parts and components necessary to produce the services and material inputs at assembly operations. The numbers are in addition to any of the people directly employed by Michigan Assembly Plant.

Table 9: Intermediate Manufacturing Employment, 2011

Manufacturing Sub-Categories	Jobs
Primary metals	116
Fabricated metal products	666
Machinery	184
Motor vehicle parts	655
Plastics and rubber product	216
Other manufacturing	279
Total Intermediate Mfg. Employment	2,116

Source: Center for Automotive Research 2012

The bulk of employment in the intermediate category is in the non-manufacturing sector, totaling nearly 7,600 jobs. Industries within this category are not intuitively thought to be associated with automobile manufacturing in such high numbers. Industries of note in the non-manufacturing category are professional and technical services, just under 1,200 jobs; administration and services, nearly 300 jobs; wholesale trade, with 1,400 jobs; and management of companies, contributing 300 jobs.

Table 8 shows that more than 9,300 of the indirect jobs are spinoff jobs. These are expenditure-induced jobs, created as a result of spending by the people employed in the direct and intermediate categories. When employees use their paychecks to purchase goods (including electronics equipment, clothing, food, and even new automobiles), employment is created to supply their demands. As could be expected, a large portion of the spin-off jobs are in the non-manufacturing sector of retail trade, which is responsible for 1,500 of the indirect jobs.

The Macroeconomic Model

The basic approach in CAR's industry economic impact analyses is to use a specially constructed regional economic impact model using plant-specific data to generate estimates of the economic contribution associated with the Michigan Assembly Plant operations. For the estimation of employment and compensation associated with the Michigan Assembly Plant, CAR researchers used an economic model supplied and constructed for multi-state level analysis by REMI of Amherst, Massachusetts. CAR researchers made adjustments to the model to reflect the characteristics of the automobile industry, the other industries examined and Ford's specific employment and compensation data at the plant. The REMI model, which has been fully documented and peer-reviewed, was designed for the type of analysis employed in this current study and has been used by CAR and other organizations for over two decades.

The version of the model used in this study represents the economy of the United States and the economies of selected automotive states including Michigan, Indiana, Ohio, Texas, etc. This model permitted simulation of the interaction among these regional economies and the rest of the nation, providing for an accounting of interregional trade and migration. The model can simulate economic impacts that occur in any one region resulting from changing activities in any or all of the regions.

Conclusions

This study helps give a sense of the value of the Ford Motor Company's Michigan Assembly Plant in Wayne, Michigan to the economic vitality of Michigan. Additionally, it serves as a proxy for the impacts of most of the other assembly operations located in the state. This study, whether applied to the Michigan Assembly Plant or other automotive manufacturing facilities in the state, underlines how important it is that the state government of Michigan work with and support these assembly operations, not only for the benefit of workers at the plants, but for the workers at the goods and services supplier companies as well.

The Michigan Assembly Plant directly employs approximately 5,000 people and supports another 19,000 jobs in Michigan. Further, as can be seen in the study, this Michigan-based assembly plant supports workers and companies in the surrounding states within the Great Lakes region. Just as a plant in Michigan supports jobs in the surrounding states, so do assembly plants in surrounding states support jobs in Michigan.

The findings of this study should make clear that encouraging companies in surrounding states to relocate in Michigan will provide no real net increase in employment or economic activity in the region. Similarly, if companies are convinced to move from Michigan to a neighboring state, there will be no real regional gain. In fact the jobs already exist in the region.

What this study highlights is that many parts for the Michigan Assembly Plant are being sourced from outside the United States and Canada. These are the types of supplier companies that may realize benefits from moving closer to the final assembly operations. If the state is interested in working with automakers to identify key suppliers to bring to Michigan, their efforts should be focused on those companies located outside the region.

The key to the continued health and vitality of the state of Michigan and its large manufacturing companies is a continuing dialogue between these companies and the state. This study provides an example using one facility and how it impacts the state's economy and employment. Clearly, this study helps refine the vision of how the state should interact with its large employers in the auto sector. This study helps guide the conversation as to what the state can do to continue to support automakers. Additionally, this study serves as a template for ongoing interaction with the state. By continuing the efforts that have begun with this study, both parties can move closer to a mutually beneficial relationship.

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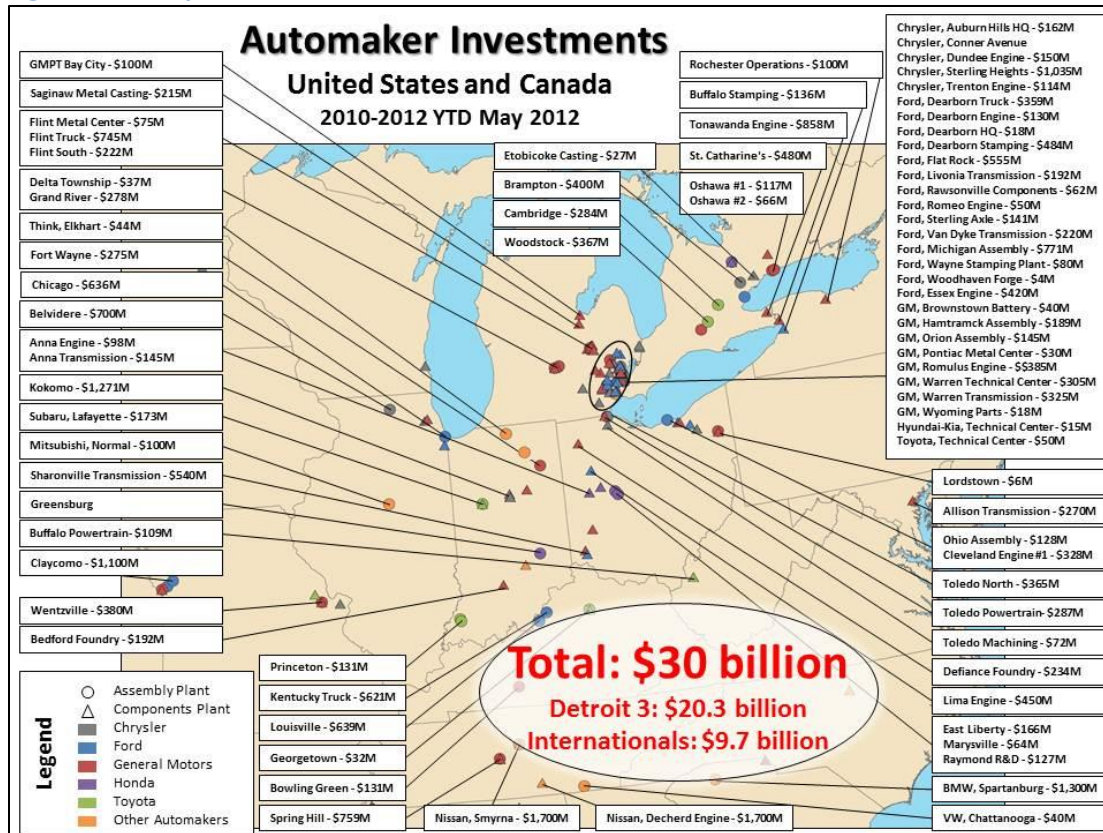
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Appendix A: Extended Overview of North American Industry

The North American Automobile Industry

For more than a century, the automotive industry has been a major contributor in shaping the identity of the U.S. economy by generating millions of jobs. Over the past two decades, the U.S. industry has been transformed by billions of dollars in new investments.¹³ While a significant amount of foreign direct investment has gone to non-traditional locations for automotive employment (often southern states such as Alabama, Georgia, Mississippi, and Tennessee), the bulk of automaker investment occurred in traditional automotive manufacturing communities (such as Indiana, Michigan, and Ohio). Though the 2007-2009 recession temporarily hampered new investments, over the subsequent years, companies have reinvested in U.S. facilities. Total announced automaker investments in the United States has totaled nearly \$30 billion from January 2010 through May 2012. A map documenting many of these investments is shown in Figure A-1.

Figure A-1: Map of Automaker Investments, 2010-2012 Year-to-Date



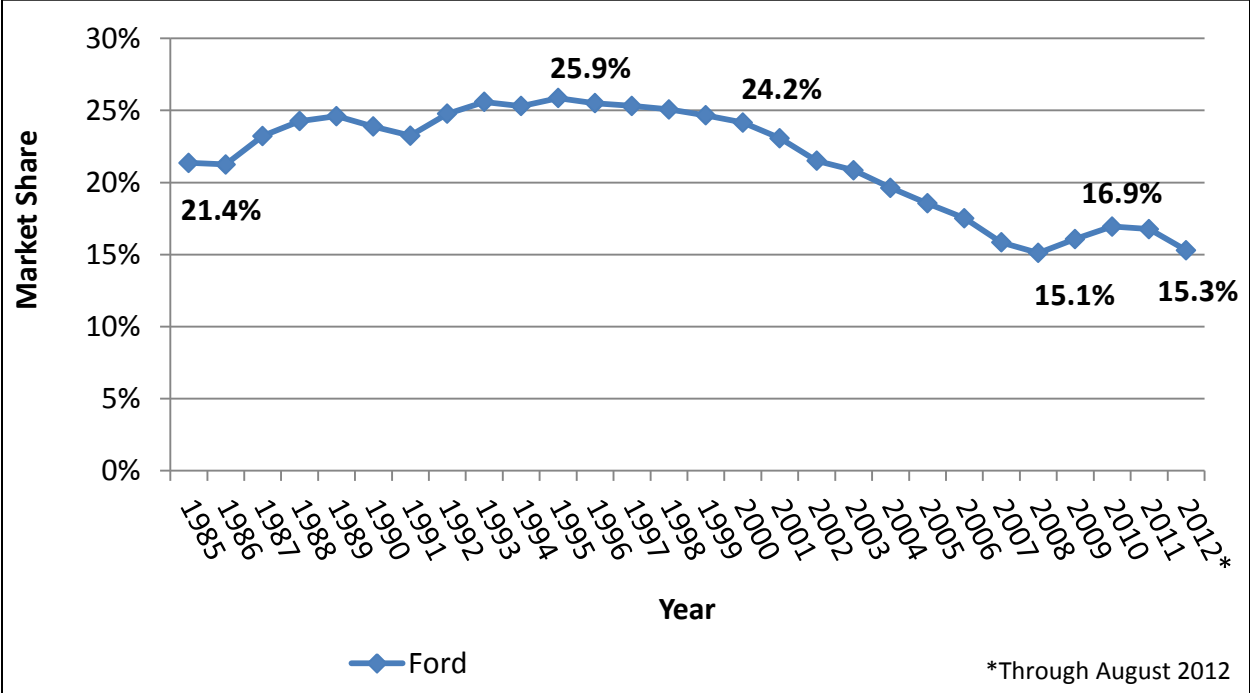
Source: Center for Automotive Research, "Book of Deals" 2012

The composition of the auto industry has transformed as domestic automotive assembly firms have slowly lost market share to imports as well as international firms operating in the United States. Ford ran counter to the market share trend between 1985 and 1993 by instead gaining share and maintaining

¹³ CAR. (2012). "Book of Deals." Center for Automotive Research. June 2012.

it through the 1990s. After 2000, however, Ford’s market share declined from nearly 25 percent of the U.S. market to just over 15 percent. Ford experienced market share growth after bottoming out in 2008. Having recovered from the effects of the tsunami, the Japanese automakers are recovering pent-up sales and as a result, Ford’s 2012 market share to date is only slightly above its 2008 level. A breakout of Ford’s market share from 1985 to present can be seen in Figure A-2 below.

Figure A-2: Ford U.S. Market Share, 1985-2012 (August 2012)

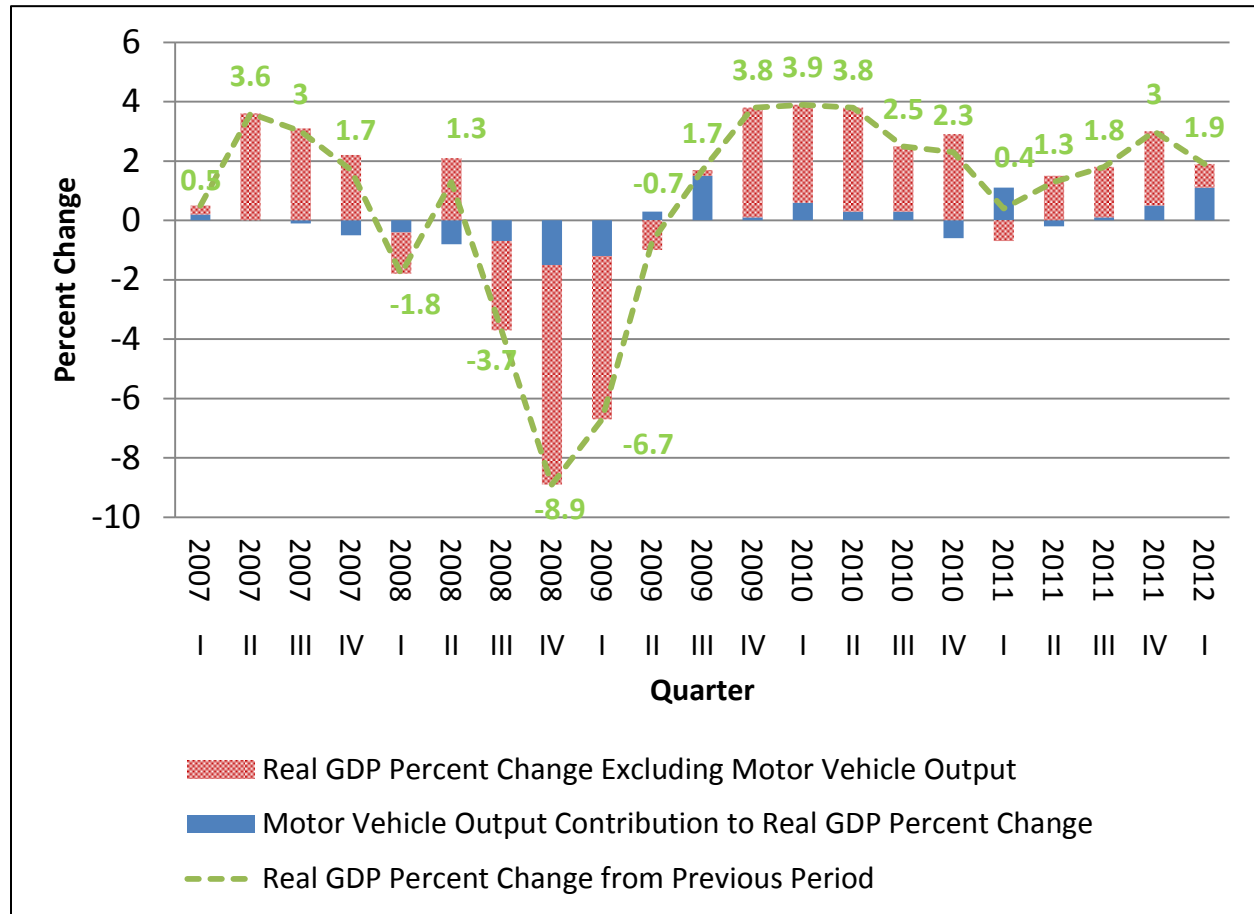


Source: Automotive News 2012, CAR analysis

The economic performance of the automotive sector, as well as manufacturing more broadly, is extremely important for the continued development and growth of national and regional economies. Trends in manufacturing, and the automotive sector in particular, are indicators of the state of the economy, with periods of growth in automotive manufacturing followed by periods of growth in the economy as a whole. While the automotive industry may add only a few percentage points to the total Gross Domestic Product (GDP), the effects of the sector’s activities extend beyond the direct impacts because the complex manufacturing process supply chain supports activities throughout many tiers of suppliers and jobs across a wide array of industries.

Figure A-3 illustrates how the growth or decline in automotive output often constitutes a significant portion of total change in GDP. In addition, due to the industry’s high multiplier, changes in motor vehicle output have cascading effects into other industries, also contributing to significant changes in overall U.S. GDP. This effect can also be seen in Figure A-3 which shows that periods of substantial growth and decline in GDP coincide with similar changes in motor vehicle output.

Figure A-3: Change in U.S. GDP and Automotive Output, 2007-2012 (Q1 2012)



Source: Bureau of Economic Analysis 2012, CAR analysis

Recent North American Developments

Sales and Analysis

At the beginning of the 2000s, annual U.S. light vehicle sales peaked at 17.4 million, and remained at over 16 million units through 2007. This unprecedented sales activity was largely supported by factors that included access to low-interest credit, housing development patterns necessitating increased vehicle ownership, a booming stock market, post-9/11 manufacturer incentives, and an enhanced sense of personal wealth.

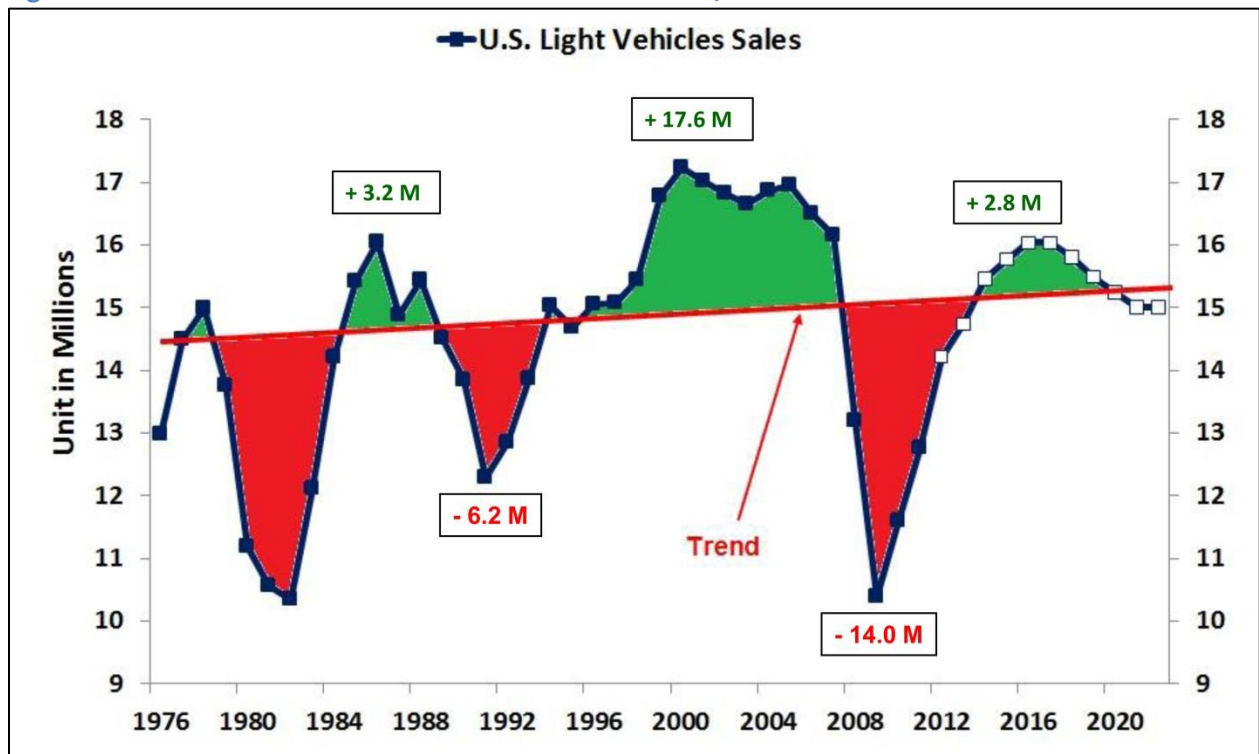
The surplus of vehicles produced in the early part of the 2000s decade, the ensuing credit crunch, and the recession are the central factors driving the recent contraction of the automotive industry. In 2008, the motor vehicle bubble burst, as did other bubbles associated with debt financing. Because suppliers, dealers, and assemblers expanded capacity during the early part of the decade, many were vulnerable when sales suddenly began to drop off.

As major consumer lending arms of large banks increased credit requirements and reduced lines of credit to all but the most qualified applicants, many consumers found they could no longer finance

motor vehicle purchases. High unemployment rates made the problem worse. With the current unemployment rate still hovering at 8.1 percent (August 2012), economic recovery and the rebound of the industry have been affected. Employment, income stability and consumer confidence are major determining factors in the purchase of durable goods, especially automobiles. Despite these conditions, the automobile industry is slowly recovering. Many of the leading economic indicators are trending in the right direction—with the Dow Jones Index, full time employment, and the consumer price indices for both new and used vehicles all increasing in recent years.¹⁴ Cumulative sales for the year as a whole have improved, with a 19.9 percent increase over last August’s figures.¹⁵

CAR has produced its own sales forecast based on an econometric analysis of many of these variables. The forecast suggests that automobile sales over the next several years will continue to steadily increase, reaching 14.9 million for 2013, and returning to the long-term trend at between 15 and 16 million in the subsequent years. Figure A-4 displays historical and forecasted sales for the U.S. automotive industry. Regions of the graph highlighted in green are periods where sales were above trend, and regions that are highlighted in red are periods where sales were below trend.

Figure A-4: Center for Automotive Research Sales Forecast, 2012



Source: Center for Automotive Research 2012

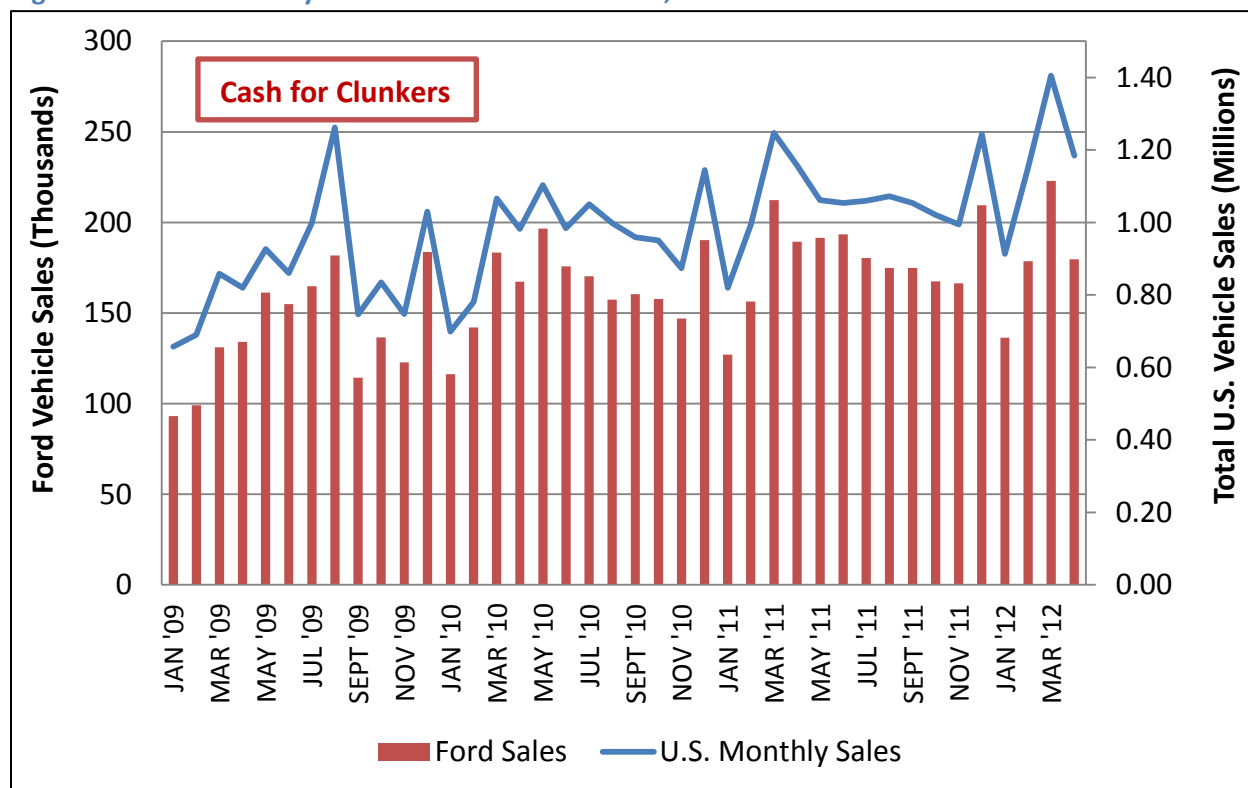
¹⁴ Note: A consumer price index or CPI is a measure of the average change of consumer prices over time. FRED. (2012). "Federal Reserve Economic Data." Economic Research, Federal Reserve Bank of St. Louis. Accessed June 4, 2012. <<http://research.stlouisfed.org/>>.

¹⁵ Automotive News. (2012). "U.S. Total Vehicles Sales by Make, Aug. & YTD." Automotive News Data Center. September 4, 2012. <<http://www.autonews.com/section/datacenter>>.

During July and August 2009, the U.S. Federal government intervened in the U.S. auto sales market by introducing the Car Allowance Rebate System (CARS), more commonly known as the “Cash for Clunkers” program. Congress originally appropriated \$1 billion for the program, but when that amount was quickly depleted, the amount was increased to \$3 billion. The impact on new vehicle sales was immediate and significant. Consumers turned in roughly 680,000 eligible vehicles in exchange for a \$3,500 or a \$4,500 voucher to be used for purchasing or leasing a new, more fuel-efficient vehicle.

The program helped boost new vehicle sales in the months of July and August 2009. CARS had a significant stimulating effect on the industry as dealers sold hundreds of thousands of additional vehicles beyond the norm for that time of year. The higher-than-anticipated volume of new vehicle sales created a tax revenue increase that boosted states’ finances. The effect of the program is clear in Figure A-5, which depicts Ford and U.S. monthly sales; the months of July and August 2009 show sharp increases in new vehicle sales.

Figure A-5: Ford Monthly U.S. Market Share and Sales, 2009-2012



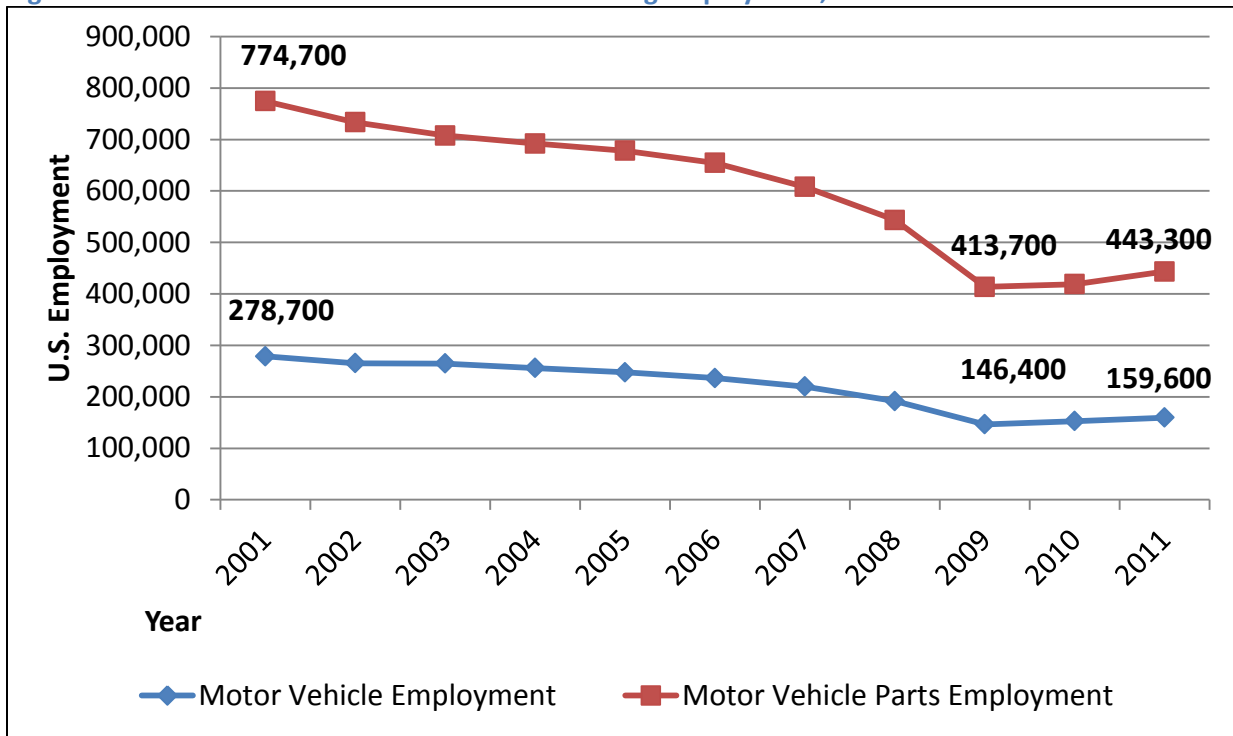
Source: Automotive News 2012, CAR analysis

In July and August 2009, Ford posted modest gains in sales as the CARS program stimulated sales of high fuel economy vehicles, such as the Ford Focus and Ford Escape, which were among the top 10 vehicle models sold via the CARS program. In 2009, Ford sold nearly 100,000 new vehicles as a result of the CARS program, which constituted nearly 15 percent of all vehicles sold through the program.

Employment

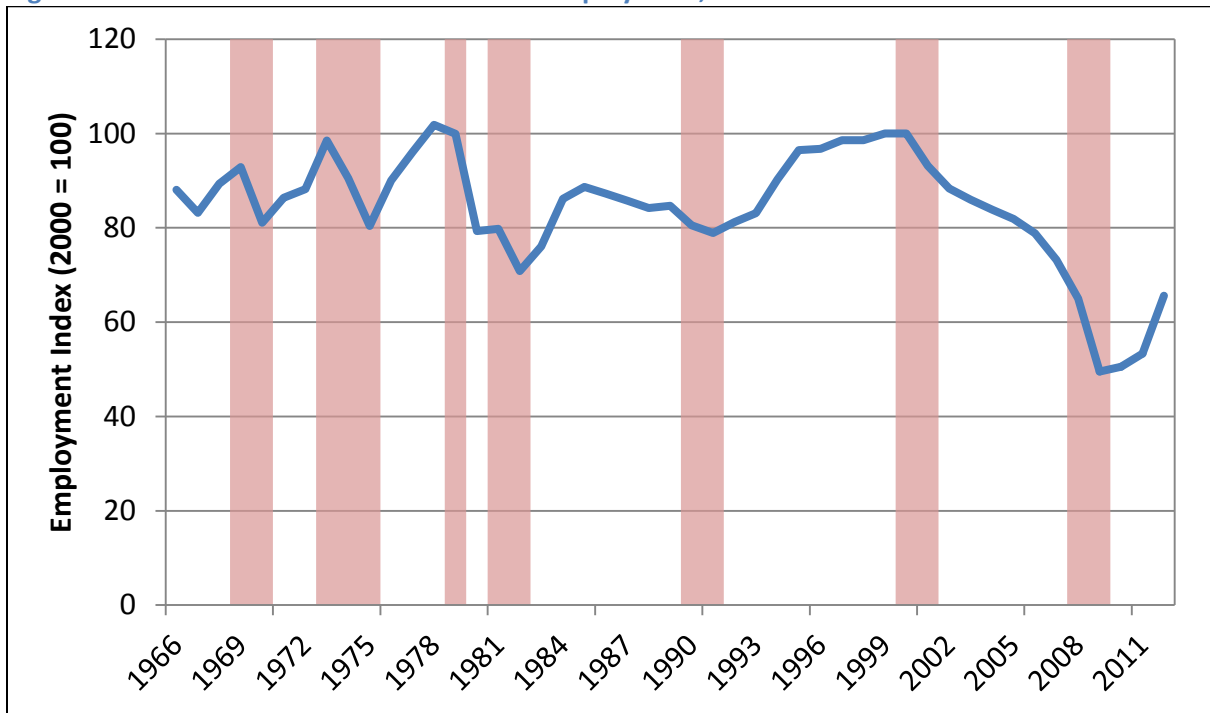
U.S. motor vehicle and parts manufacturing employment has been declining since 2001. Motor vehicle manufacturing employment dropped by nearly 120,000 (43 percent) between 2001 and 2011, as seen in Figure A-6. Over the same period, motor vehicle parts manufacturing employment declined by more than 330,000 (43 percent). The industry decline accelerated in the recession of 2007-2009, generating considerable job losses at automakers, and particularly at automotive parts suppliers. Recently, automakers and suppliers have rationalized capacity such that the industry is well positioned to be profitable even at much lower sales volumes. Industry employment should stabilize and grow in coming years as seen in Figure A-7, which shows that automotive employment frequently increases towards the end of and following recessions.

Figure A-6: U.S. Motor Vehicle & Parts Manufacturing Employment, 2001-2010



Source: Bureau of Labor Statistics 2012, CAR analysis

Figure A-7: Recessions and U.S. Automotive Employment, 1966-2012

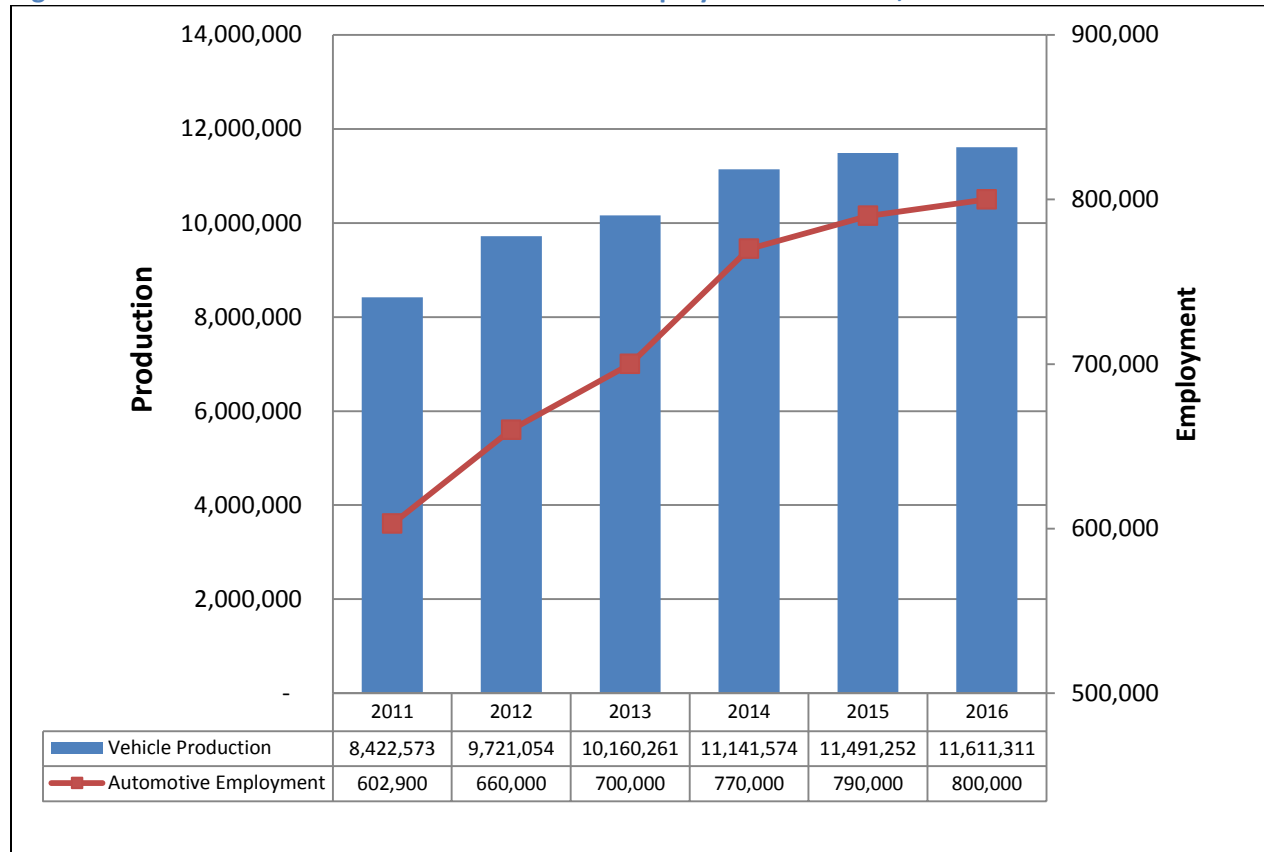


Source: Bureau of Labor Statistics 2012, CAR analysis

Note: Automotive Employment Index consists of SIC 3711/3714 and NAICS 3361/3363. 2000 is the base year.

CAR’s automotive employment forecast suggests that from 2011 to 2016 employment will increase by slightly more than a third, with a compound average growth rate of 6.1 percent. Production is forecast to recover even more quickly, with a compound average growth rate of 6.2 percent, resulting in an increase of more than 35 percent in production from 2011 to 2016. These forecasted trends are displayed in Figure A-8.

Figure A-8: U.S. Vehicle Production & Automotive Employment Forecasts, 2011-2016



Source: LMC-Automotive 2012 and Center for Automotive Research 2012

In the face of economic and regulatory uncertainty, there is an overall reluctance to invest in new capacity. Instead, most automotive companies have placed an emphasis on maximizing the utilization of existing “brick-and-mortar” capacity. Many automaker and supplier facilities are already running three shifts, or in the process of adding third shifts and overtime. Even after adding additional shifts in order to increase capacity utilization, automakers have been unable to keep up with increasing demand, which has spurred some new investment. Along with its fellow automakers, Ford has also been adding shifts. Its assembly plants in Chicago, Dearborn, and Wayne are running third shifts, and its plants in Cleveland and Louisville will be adding a third shift in the near future. The need for additional capacity, coupled with an anemic economic recovery, are leaving companies with a dilemma of whether to add new physical space, or squeeze more output from plants.

Appendix B: Additional Economic Contribution Tables

Table B-1: Distribution of Indirect Job Contributions by Industry Category, 2011

Industry Category	Intermediate	Spinoff	Total (Indirect)
Manufacturing	11%	0%	11%
Professional and Technical Services	6%	0%	6%
Administration and Services	2%	23%	24%
Wholesale Trade	7%	1%	9%
Retail Trade	1%	8%	9%
Transportation and Warehousing	1%	0%	1%
Finance and Insurance	1%	1%	2%
Management of Companies	2%	0%	2%
Other Non-Manufacturing	20%	16%	36%
Total Employment	51%	49%	100%

Source: Center for Automotive Research 2012

Table B-2: Intermediate Manufacturing Employment, 2011

Manufacturing Sub-Categories	MFG Jobs
Primary metals	5%
Fabricated metal products	31%
Machinery	9%
Motor vehicle parts	31%
Plastics and rubber product	10%
Other manufacturing	13%
Total Intermediate MFG Employment	100%

Source: Center for Automotive Research 2012