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The Ohio Motor Vehicle Report

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THE OHIO MOTOR VEHICLE INDUSTRY

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B401 Don Larrick, Principal Analyst
Office of Research, Ohio Development Services Agency
PO Box 1001, Columbus, Oh. 43216-1001
Production Support:
Steven Kelley, Editor; Jim Kell, Contributor
Robert Schmidley, GIS Specialist

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EXECUTIVE SUMMARY

- 1,448,000-plus light vehicles were assembled in Ohio in 2013, an increase of 5.5 percent from 2012.

- 734,000-plus were assembled by Honda, 296,000 by Fiat Chrysler Automobiles, 285,000-plus by General Motors, and 132,000-plus by Ford.

- Ohio is at the center of the motor vehicle industry with 72.2 percent of N. American light vehicle production either in Ohio or within 500 miles (805 kilometers) of its borders.

- 10 different models currently are made in Ohio's six high-volume light vehicle plants. These included over 100,000 each of some of the nation's best-sellers in 2013: Honda Accords and CR-Vs, Chevrolet Cruzes, Jeep Wranglers, and Ford Econoline vans.

- Ohio ranked second in light vehicle output, reflecting its second and third ranks in car and light truck production in 2013 according to Automotive News; it ranked third in value-added for assembly, bodies, trailers and parts manufacturing operations combined according to the latest U.S. Census Bureau data.

- Honda is the largest motor vehicle industry employer in Ohio with about 13,500 employed in manufacturing operations, followed by General Motors with approximately 9,600, Ford with about 6,000, and 5,800 at Fiat Chrysler Automobiles (including its partners); 11 more companies each employ at least 1,000 people at their facilities in Ohio.

- Four companies supplying parts to the motor vehicle industry and on Fortune's U.S.-1,000 list maintain their world headquarters in Ohio: Cooper Tire & Rubber, Dana, Goodyear Tire & Rubber, and Parker-Hannifin.

- 22 more companies on Fortune's U.S.-1,000 or Global-500 lists have industry plants in Ohio.

- 562 active establishments in Ohio directly or indirectly supply motor vehicle assemblers – 8.7 percent of such in N. America – ranking the state second to Michigan among the surrounding states and provinces.

- 88,400 people were employed at assembly and parts plants (NAICS codes 3361 and 3363, respectively) in the first half of 2014. This is up from the 2009 average of 71,400, with 4,500 jobs added in assembly and 12,400 in parts operations according to the U.S. Bureau of Labor Statistics.

- 75 of Ohio's 88 counties have at least one motor vehicle industry establishment.
- Four of every seven jobs motor vehicle industry jobs were located in 13 counties: Cuyahoga, Defiance, Hamilton, Hancock, Logan, Lorain, Lucas, Montgomery, Ross, Shelby, Trumbull, Union and Wayne.
- Dozens of companies (or their subsidiaries) from 15 foreign nations employ more than 51,200 people in assembly and parts production in Ohio; 11 of them are on Fortune's Global 500 list.
- $4.68 billion in private investment for 161 projects in Ohio's motor vehicle industry was announced by 91 companies during the previous four years; 10,700 new jobs were anticipated upon completion.
- Motor vehicle industry wages/salaries in Ohio averaged more than $60,100 per year.

DESCRIPTION OF OHIO'S MOTOR VEHICLE INDUSTRY

THE AUTOMOTIVE INDUSTRY'S IMPACT ON OHIO'S ECONOMY

Cluster / Sector	Output (billions)	Value-Added (billions)	Employment (rounded)	Compensation (billions)
Direct				
Motor Vehicles	$32.7	$1.0	22,600	$2.2
Motor Vehicle Parts	$25.5	$3.4	57,130	$3.9
Motor Vehicle Related	$2.1	$0.6	6,280	$0.5
Motor Vehicle Cluster Direct Impact^	**$60.3**	**$5.0**	**86,010**	**$6.6**
Indirect: Supplier Network				
Other Manufacturing	$12.2	$2.7	29,060	$2.1
Other Goods Production	$0.5	$0.2	4,430	$0.2
Transportation, Information and Utilities	$2.2	$1.1	11,500	$0.7
Retail and Wholesale Trade	$3.3	$2.4	23,340	$1.4
Service	$7.7	$4.6	53,810	$3.2
Government	$0.2	$0.1	1,310	$0.1
Supplier Impact^	**$26.1**	**$11.1**	**123,450**	**$7.7**
Induced: Employee Spending				
Spending Across the Economy^	**$13.6**	**$7.9**	**107,270**	**$4.4**
Total Motor Vehicle Cluster Impact^	**$100.1**	**$23.9**	**316,730**	**$18.7**
State Total Economy	$972.5	$490.1	6,518,830	$317.2
Motor Vehicle Cluster as Percentage of Ohio's Economy^	**10.3%**	**4.8%**	**4.8%**	**5.8%**

Notes: * - Output, value-added and compensation are reported in 2014 dollars. Motor vehicle cluster numbers are the direct impact of the selected industries; the remaining six sector groups report the indirect impact across Ohio's economy, while induced spending is the summary of activity across all sectors of the state's economy.

^ - Components may not sum to higher levels due to rounding, which in turn may affect percentages.

Source: IMPLAN 3.0 by MIG, Inc. / Ohio Model (2011 data).

Prepared by: Office of Research, Ohio Development Services Agency (SK, 12/14).

The Minnesota IMPLAN Group (a private company specializing econometric analyses) offers this assessment of the motor vehicle industry's impact on Ohio's economy:

- The Ohio motor vehicle industry directly employed 86,010 workers in 2011.

- A broader view of the industry's role in the economy takes into account a cluster of industries supplying capital equipment, parts, materials and even facilities.

  - An estimated 29,060 workers in Ohio made goods incorporated into motor vehicles, bodies, trailers and parts, or that were used in the process. Examples of the former include windshields and windows, springs, nuts, bolts, bearings, valves, electronic parts, paints and metal coatings, adhesives, and sealing devices. These were often made of steel, aluminum, glass, rubber, plastics or other chemical products. Examples of the latter include capital equipment and paperboard products.

  - About 4,430 more non-manufacturing goods-producing jobs – notably in construction – depended on presence of the motor vehicle industry here.

- Additional service industries outside of goods production are integrated with or depend on the motor vehicle industry and employ 89,960. These bring total indirect employment to 123,450.

- Combining the impact of the goods-producing and service clusters with the 107,270 jobs added by induced employee spending across the economy means that a total of 4.8 percent of all Ohio workers (316,730/ 6,518,830) were directly or indirectly dependent on the motor vehicle industry cluster for their livelihoods. The corresponding net value-added of the goods and services amounted to 4.8 percent of the economy.

- The associated aggregate output of the $60.3 billion direct and $26.1 billion indirect impacts plus the $13.1 billion induced by employee spending – a total of $100.1 billion – was 10.3 percent of $972.5 billion in sales and revenues in Ohio (Minnesota IMPLAN Group, 2014).

Light Vehicle Assembly Plants in North America

Ohio Development Services Agency

CANADA

UNITED STATES

MEXICO

FCA Belvidere
Ford Chicago
GM Ft. Wayne
GM Lordstown
Honda East Liberty
Honda Marysville
Mitsubishi Normal
Subaru Lafayette
Honda Greensburg
Ford Kansas City
GM Fairfax
GM Wentzville
Toyota Princeton
Toyota Georgetown
Ford Kentucky Truck
Ford Louisville
GM Bowling Green
GM Spring Hill
Nissan Smyrna
VW Chattanooga
BMW Greer
Toyota Blue Springs
Honda Lincoln
Daimler Ladson
Daimler Vance
Kia West Point
Nissan Canton
Hyundai Montgomery
Tesla Fremont
Toyota Tijuana
GM Arlington
Ford Hermosillo
Toyota San Antonio
GM Ramos Arizpe
FCA Saltillo
Kia Monterrey
Nissan Aguascalientes (2 Plants)
GM San Luis Potosi
Honda El Salto
GM Silao
Honda Celaya
Mazda Salamanca
Ford Cuautitlan
FCA Toluca
Audi San Jose Chiapa
Nissan Jiutepec
VW Puebla

0 100 200 300 400 500 600 Miles

Honda Alliston
FCA Brampton
GM Oshawa Car
Toyota Cambridge
Ford Oakville
Toyota Woodstock
GM (CAMI) Ingersoll
GM Lansing Grand River Delta Township
GM Flint Assembly
GM Orion
FCA Sterling Heights
GM Detroit/ Hamtramck
FCA Warren Truck Conner Avenue
Ford Michigan Assembly Wayne
FCA Windsor
FCA Jefferson North
Ford Flat Rock
Ford Dearborn Truck
FCA Toledo North Toledo Supplier Park
Ford Avon Lake

0 20 40 60 80 Miles

Prepared by: Ohio Development Services Agency, Office of Research (October 2014)

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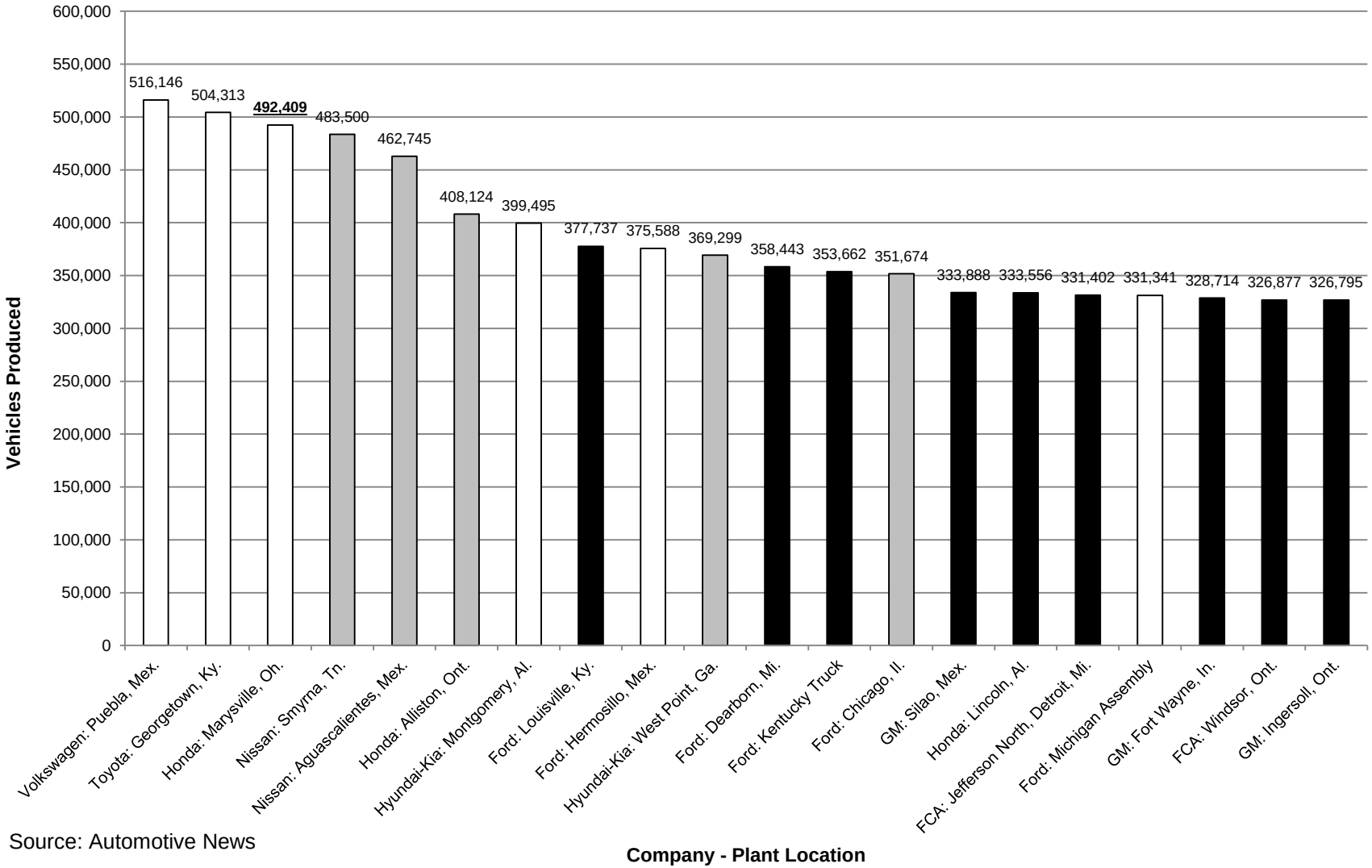
N. American Light Vehicle Production in 2013:

67-Plant Total -- 16,176,240

the 20 Highest-Volume Plants are Shown

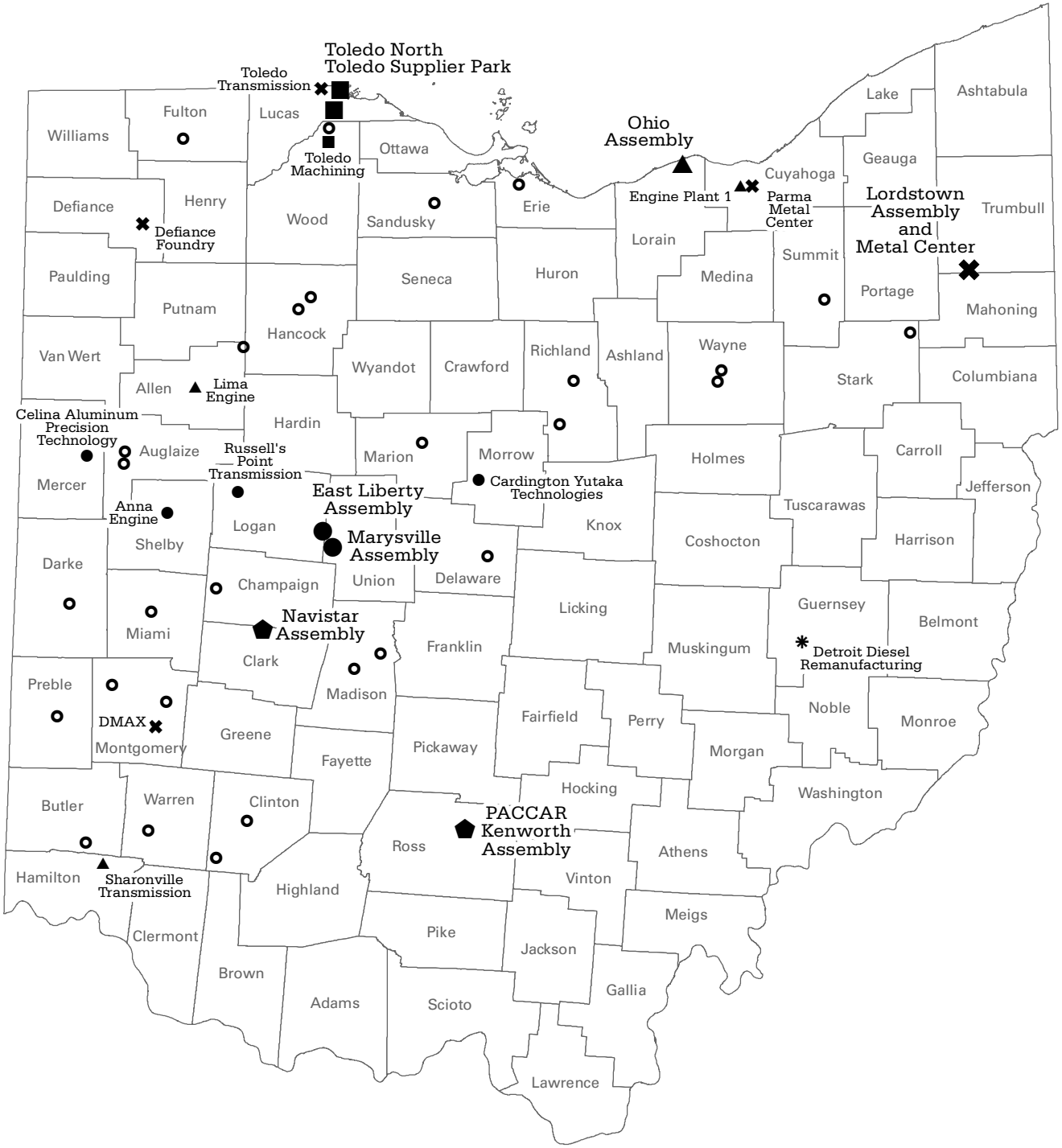
White: Cars Black: Light Trucks Gray: Both



Source: Automotive News

Ohio

Notable Establishments* in Ohio's Motor Vehicle Industry



Establishment Location

- ■ Fiat/Chrysler
- ✱ Daimler
- ▲ Ford
- ✖ General Motors
- ● Honda
- ⬟ Navistar, PACCAR
- ○ Other

*Establishments believed to employ 500 or more

Prepared by: Office of Research, Ohio Development Services Agency
September 2014

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NOTABLE MOTOR VEHICLE INDUSTRY MANUFACTURERS IN OHIO

Twenty-five companies on Fortune magazine's US-1,000 or Global-500 lists have motor vehicle industry establishments in Ohio; three of them maintain their world headquarters here: Cooper Tire & Rubber, Dana, Goodyear Tire & Rubber, and Parker-Hannifin. Honda is the largest industry employer with more than 13,500 in manufacturing operations (including subsidiaries). (Honda's total employment in Ohio is about 13,700 when other activities are included. An additional 4,700-plus are employed at companies Honda described as affiliates.) General Motors (GM) follows with approximately 9,600 (9,700 when non-manufacturing activities are included). Ford employs 6,000, and 5,800 work for Fiat Chrysler Automobiles (FCA), including its two partners at its Toledo Complex. Other companies employing at least 1,000 in Ohio include Cooper Tire & Rubber, Goodyear Tire & Rubber,[1] Johnson Controls, KTH Parts Industries, MAC Trailer, Magna International, Mahle Behr, Paccar's Kenworth division, Schaeffler Technologies, Showa, and Toledo Molding & Die.

Establishments with non-motor vehicle industry NAICS codes have been included when their specific products are used by the industry. Examples include GM's and Daimler's diesel engine plants (Daimler rebuilds engines on an assembly line), GM's foundry, the automotive glass operations of Asahi Glass, and Toledo Molding and Die's plastic products.

The map above shows the locations of the 49 manufacturing establishments with 500 or more employees. The list below includes the Fortune companies with at least 50 people at a site as well as other companies employing 500 or more in Ohio and having at least 50 people at a site.[2] It is organized by NAICS code and includes the city where the site is located. Parts operations may not be the primary businesses of some of the companies on the list, but their sites are included because their primary NAICS codes – or products their clients buy – make them as part of the industry.

Parent / Company / Division	Primary NAICS#	City	Jobs at Site~
Transportation equipment industry codes:			
33611: Automobiles and Light-Duty Motor Vehicles			
General Motors*[1] (includes workers at the integrated stamping facility)	336111/7	Lordstown	4,500
Honda*^ / Honda of America Mfg.	336111	Marysville	5,000
Hyundai M&D / Mobis NA (integrated with FCA's Toledo complex)[2]	336111	Toledo	420
FCA* (the Complex combines the North and South plants)^	336112	Toledo	4,110
Honda*^ / Honda of America Mfg.	336112	E. Liberty	2,650

Parent / Company / Division	Primary NAICS#	City	Jobs at Site~
33612: Medium- and Heavy-Duty Trucks			
Ford*[1] (its Ohio Assembly plant is transitioning to medium-duty trucks)	33612	Avon Lake	1,886
Navistar Intl. Corp.* (aka Intl. Truck & Engine)[3]	33612	Springfield	900
Paccar*/Kenworth Truck[4]	33612	Chillicothe	2,000
3362: Motor Vehicle Bodies and Trailers			
ARE[5]	336211	Massillon	475
ARE[5]	336211	Mt. Eaton	275
Kuka / Kuka Toledo Production Operations (integrated with FCA's complex)^	336211	Toledo	250
Berkshire Hathaway* / Scott Fetzer / Stahl[6]	336212	Wooster	94
MAC Trailer[7]	336212	Alliance	595
MAC Trailer[7]	336212	Kent	340
MAC Trailer[7]	336212	Salem	165
Thor Industries* / Airstream[8]	336213	Jackson Center	435
33631: Motor Vehicle Gasoline Engines and Engine Parts			
Dover* / Wiseco Piston	33631	Mentor	200
Ford*[1] (Engine Plant #1)	33631	Brookpark	970
Ford*[1, 25]	33631	Lima	969
Honda*^ / Honda of America Mfg.	33631	Anna	2,600
Mahle Behr / Mahle Dayton^	33631	Dayton	1,150
Mahle Behr / Mahle Engine Components USA^	33631	McConnelsville	115
33632: Motor Vehicle Electrical and Electronic Equipment			
Delphi Automotive / Delphi Automotive Systems^	33632	Warren	200
Delphi Automotive / Delphi Automotive Systems^	33632	Vandalia	350
Mitsubishi Electric* / Mitsubishi Electric Automotive America^	33632	Mason	400
Stanley Electric / Stanley Electric US^	33632	London	630
Stoneridge, Inc.[9]	33632	Lexington	500
Toyo Denso / Weastec (a Honda affiliate)^	33632	Hillsboro	145

Parent / Company / Division	Primary NAICS#	City	Jobs at Site~
33633: Motor Vehicle Steering and Suspension Components			
Showa / American Showa^	33633	Blanchester	575
Showa / American Showa^	33633	Sunbury	550
ThyssenKrupp* / Bilstein of America^	33633	Hamilton	185
Yamada Mfg. / Yamada N. America (a Honda affiliate)^	33633	S. Charleston	425
33634: Motor Vehicle Brake Systems			
Aisin Seiki* / Advics Mfg. ^	33634	Lebanon	670
Cooper-Standard* / Cooper-Standard Automotive	33634	New Lexington	352
Ernie Green Industries / Marion Industries[9]	33634	Marion	700
Nissin Kogyo / Nissin Brake Ohio (a Honda affiliate)^	33634	Findlay	750
TRW Automotive*[10]	33634	Fayette	210
33635: Motor Vehicle Transmissions and Parts			
FCA* (Machining Plant)^	33635	Perrysburg	1,050
Ford*[1]	33635	Sharonville	1,875
General Motors*[1]	33635	Toledo	1,890
Honda* / Honda Transmission Mfg. of America^	33635	Russells Point	1,135
Meritor, Inc.*[11]	33635	Heath	157
33636: Motor Vehicle Seating and Interior Trim			
Intl. Automotive Components Group, N. America	33636	Sidney	350
Johnson Controls* – Interiors Mfg.[12]	33636	Bryan	250
Magna Intl.* / Magna Seating of America	33636	Warren	250
Magna Intl.* / Magna Seating of America^	33636	Strongsville	60
Tachi-S / Setex^	33636	St. Marys	500
TS Tech / Trim Industries (a Honda affiliate)^	33636	Canal Winchester	440
TS Tech / TS Tech USA (a Honda affiliate)^	33636	Reynoldsburg	210

Parent / Company / Division	Primary NAICS#	City	Jobs at Site~
33637: Motor Vehicle Stampings			
ArcelorMittal* / ArcelMittal Tailored Blanks^	33637	Pioneer	85
Ernie Green Industries / Forida Production Engineering	33637	New Madison	90
Ford*[1]	33637	Walton Hills	316
General Motors*[1]	33637	Parma	1,367
G-TEKT / Jefferson Industries^	33637	W. Jefferson	700
Kasai Kogyo / M-Tek^	33637	Upper Sandusky	540
Magna Intl.* / Magna Cosma Intl. (aka Vehtek)^	33637	Bowling Green	300
Magna Intl.* / Norplas Industries (aka Magna Exteriors)^	33637	Northwood	1,100
Midway Products Group / Findlay Products	33637	Findlay	130
Midway Products Group / P & A Industries	33637	Findlay	200
Midway Products Group / Progressive Stamping[13]	33637	Ottoville	215
MTD Holdings / Shiloh Industries (aka Medina Blanking)	33637	Valley City	50
MTD Holdings / Shiloh Industries (aka Welded Blank or 3D Metals)	33637	Valley City	n.a.
MTD Holdings / Shiloh Industries (includes HQ)	33637	Valley City	n.a.
MTD Holdings / Shiloh Industries[14]	33637	Wellington	220
Tower International* / Tower Automotive Operations USA I	33637	Bluffton	283
Worthington Industries* / Artiflex Mfg.[15]	33637	Wooster	580-650
33639: Other Motor Vehicle Parts			
Cooper Standard* / Cooper-Standard Automotive	33639	Bowling Green	350
Dana* / Dana Driveshaft Mfg.[16]	33639	Lima	400
Flex-N-Gate (fka Ford's Automotive Components Holdings)[17]	33639	Sandusky	950
F-Tech / F&P America Mfg.^	33639	Troy	650
Hitachi* / AAP St. Marys^	33639	St. Marys	525
Honda* / AY Mfg.^	33639	Columbus	175
Honda* / Cardington Yutaka Technologies^	33639	Cardington	725
Honda* / Honda of America Mfg.^	33639	Marysville	200
Honda* / US Yachiyo^	33639	Marion	220

Parent / Company / Division	Primary NAICS#	City	Jobs at Site~
33639: Other Motor Vehicle Parts (continued)			
Intl. Automotive Components Group, N. America	33639	Wauseon	600
Johnson Controls* – Interiors[18]	33639	Northwood	345
Kasai Kogyo / M-Tek^	33639	Carey	100
KTH Parts Industries (a Honda affiliate)^	33639	St. Paris	1,040
KTH Parts Industries / Kalida Mfg. (a Honda affiliate)^	33639	Kalida	450
Magna Intl.* / Magna Modular Systems, Inc. (fka Decoma)	33639	Toledo	70
Moriroku Holdings / Greenville Technology^	33639	Greenville	735
Nihon Plast / Neaton Auto Parts Mfg. (a Honda affiliate)^	33639	Eaton	750
Pacific Industrial / Pacific Mfg. Ohio^	33639	Fairfield	500
Parker-Hannifin* / Hose Products	33639	Wickliffe	271
Peugeot* / Faurecia Exhaust Systems^	33639	Northwood	50
Peugeot* / Faurecia Exhaust Systems^	33639	Troy	300
Peugeot* / Faurecia Exhaust Systems^	33639	Toledo	130
Peugeot* / Faurecia Exhaust Systems[19]	33639	Franklin	390
Sankei Giken / Newman Technology^	33639	Mansfield	800
Sanoh Industrial / Sanoh America^	33639	Mt. Vernon	260
Schaeffler Technologies / LuK-Schaeffler Group USA^	33639	Wooster	1,175
Tanaka Seimitsu Kogyo / FT Precision (a Honda affiliate)^	33639	Fredericktown	365
Tenneco*[20]	33639	Napoleon	450
Tenneco*[21]	33639	Kettering	420
Tokai Kogyo / Green Tokai^	33639	Brookville	535
Tower Intl.* / Tower Automotive Operations USA I	33639	Bellevue	192
Related Industries:			
Toledo Molding and Die (including WEK)[22]	32619	Various	1,500
TS Tech / Tri-Mold (a Honda affiliate)^	32619	Circleville	170
Tokai Rubber Industries / DTR Industries^	32621	Bluffton	650
Cooper Tire & Rubber (may include HQ)*	326211	Findlay	1,060
Goodyear Tire & Rubber (includes HQ)*[23]	326211	Akron	3,500
Asahi Glass / AGC Automotive N. America^	3272	Bellefontaine	485

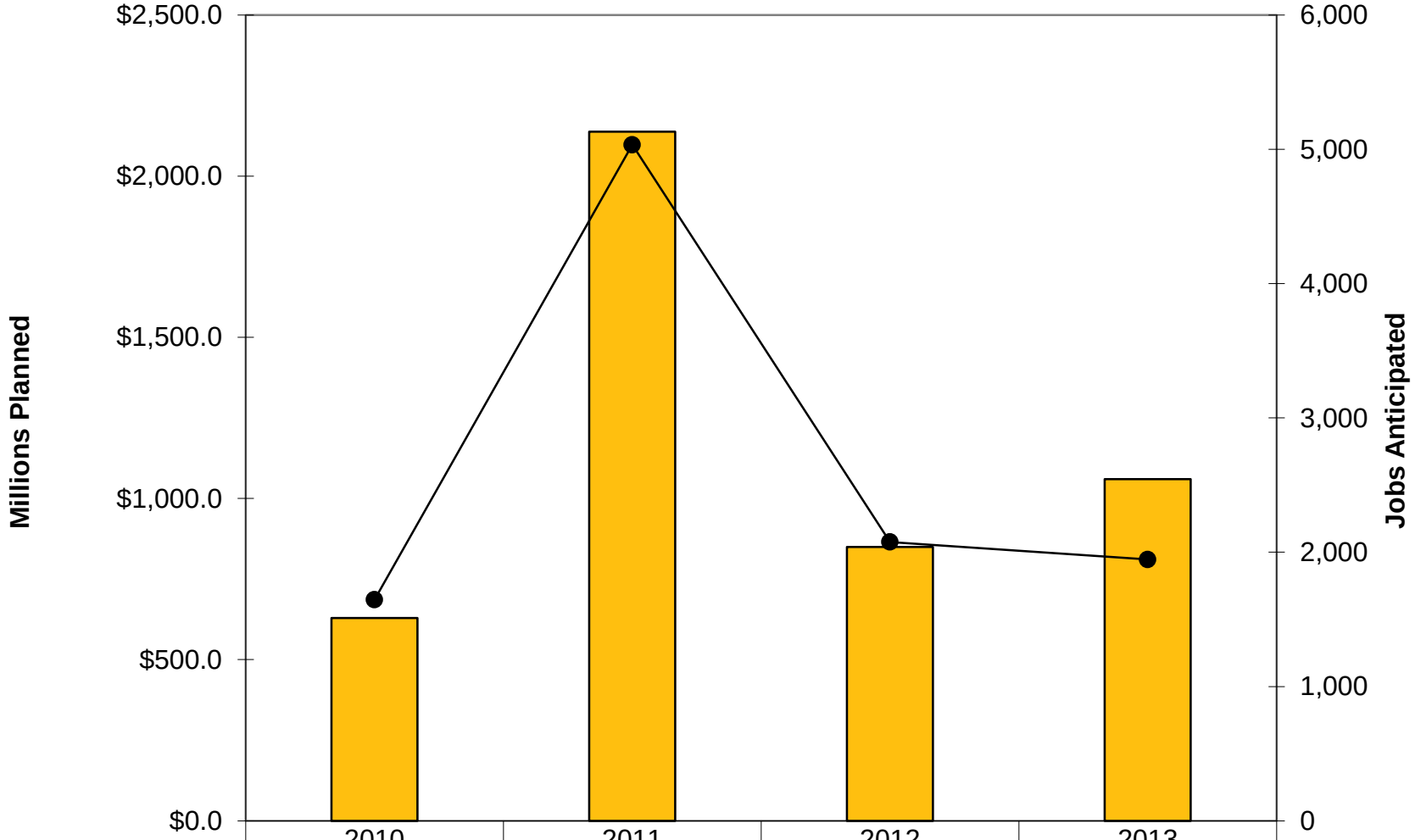
Parent / Company / Division	Primary NAICS#	City	Jobs at Site~
Related Industries (continued):			
Asahi Glass / Belletech^	3272	Bellefontaine	150
Ahresty / Ahresty Wilmington^	33152	Wilmington	650
General Motors*[1]	33152	Defiance	1,194
Honda* / Celina Aluminum Precision Technology^	331524	Celina	500
Sanoh Industrial / Sanoh America^	3329	Findlay	280
Sanoh Industrial / Sanoh America^	3329	Archbold	70
Honda* / Honda Engineering N. America	3335	Marysville	350
Daimler AG* / Detroit Diesel Remanufacturing East^	333618	Byesville	535
General Motors*[1] / DMAX (Isuzu owns 40 percent)	333618	Dayton	519
Crown Battery Mfg.[24]	335911	Fremont	548
Johnson Controls* – Battery Group	335911	Holland	456
Robert Bosch* / Robert Bosch Battery Systems	335911	Springboro	165

Abbreviations, notes and sources: aka – also known as; fka – formerly known as; HQ – headquarters; Intl. – International; Mfg. – Manufacturing; n.a. – not available; NAICS – N. American Industry Classification System; # – non-industry NAICS codes are included if production is principally for motor vehicles; ~ – unless otherwise noted, the jobs figure is from Hoover's (2014); * – a Fortune U.S.-1,000 or Global 500 company; ^ – jobs figure from International Corporate Investment in Ohio Operations (Office of Research, ODSA, 2014a); 1 – job figures from company website; 2 – jobs figure derived from Toledo News Now (2012) and Snavely (2013); 3 – estimate from Dayton Daily News (2013); 4 – based on Wartenburg (2012); 5 – jobs figure from Pritchard (2013); 6 – figure from OSHA (2012); 7 – the total is approximate and from Weber (2014), while the figure for Salem is from Shields (2011) and the figure for Kent is from McDonald (2014), which leaves the Alliance figure estimated by subtraction; 8 – 125 jobs may soon be added (Cogliano 2014a, b); 9 – jobs figure from automotive-oem.com (2014); 10 – jobs figure from Coehrs (2014) – the company may add 20 jobs in the near future; 11 – the plant may close in 2014 or 2015; 12 – minimal estimate from Manta (2014); 13 – jobs figure from the Better Business Bureau, Lima (2014); 14 – jobs figures from Muncey (2014); 15 – Wayne County Economic Development Council (2014); 16 – jobs figure is UAW employees only (Blade Staff, 2014); other non-mfg. sites excluded; 17 – jobs figure from Erie County Development (2014); 18 – estimate from Guyton (2012); 19 – the company plans to add 120 jobs at this site in the near future (Staff-Dispatch, 2014); 20 – jobs figure from CIC of Henry County (2014); 21 – jobs figure from Gnau (2013); 22 – total only from Lauzon (2014); 23 – jobs figure from Akron Ohio Economic Development (2013); 24 – jobs figure from Sandusky County Economic Development Corp. (2013); 300 jobs may be added soon (Linkhorn, 2014).

See Table A1

Investment Announcements in Ohio's Motor Vehicle Industry, 2010-2013

Four-Year Totals: $4,677.7 Million; 10,703 Jobs



	2010	2011	2012	2013
Millions Planned	$629.3	$2,138.4	$849.8	$1,060.2
New Jobs Anticipated	1,647	5,034	2,076	1,946

Source: Office of Research, ODSA

RECENT EXPANSION AND ATTRACTION ANNOUNCEMENTS

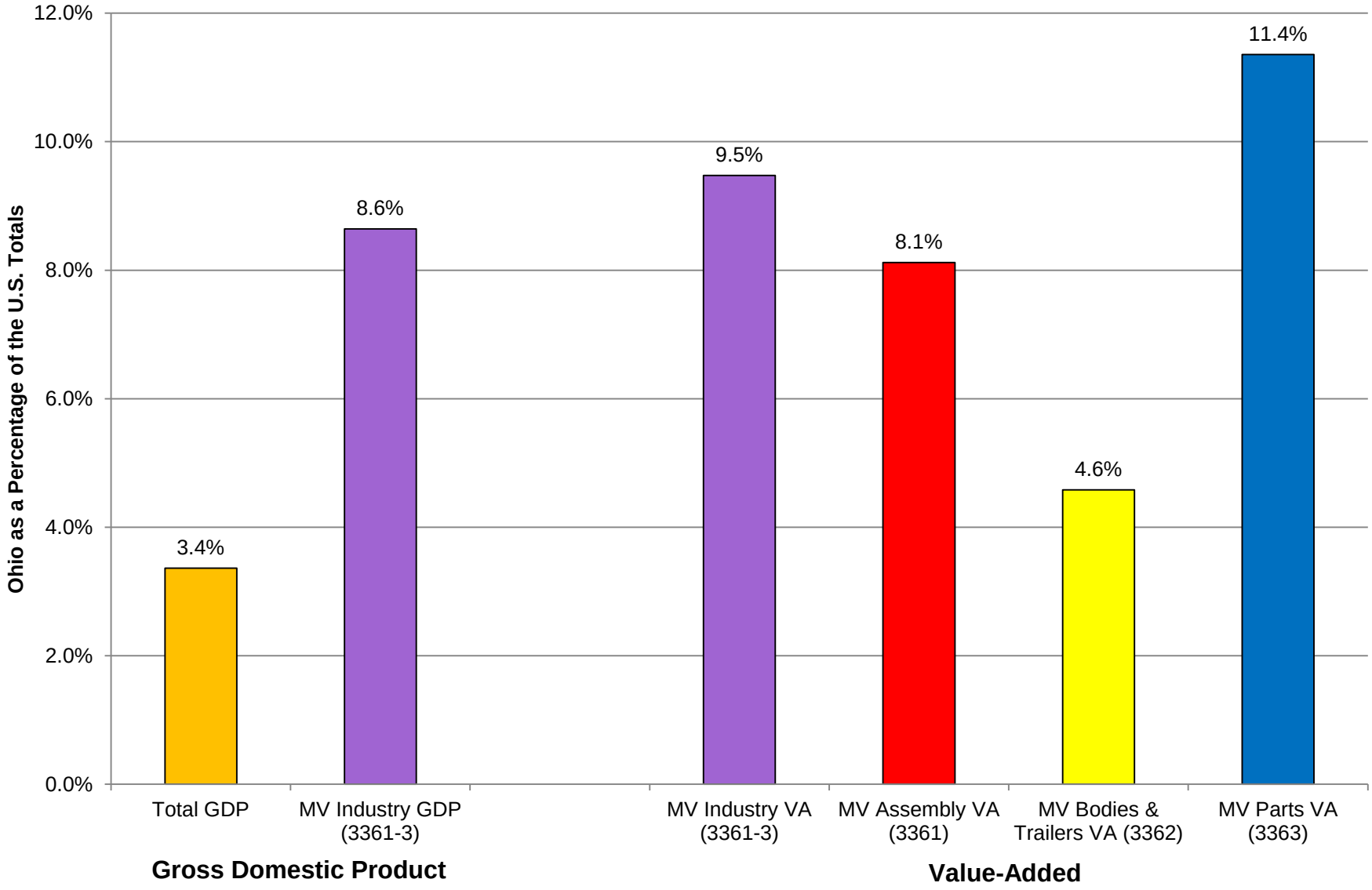
Ninety-one companies announced 161 major projects during the last four years with plans to invest almost $4.68 billion, creating 10,700 new jobs and adding 4.38 million square feet space for Ohio's motor vehicle industry upon completion. $3.48 billon, over 7,900 jobs and 3.89 million square feet – about three-fourth of the dollars and jobs and seven-eighths of the space – were planned for the parts group (NAICS 3363, plus products specifically for motor vehicles from non-transportation equipment industries). $1.18 billion was intended for assembly and chassis plants (NAICS 3361), with 2,000 new jobs anticipated. The remaining $17.3 million is for establishments making bodies, trailers, etc. (NAICS 3362); 764 new jobs could be added. 2011 was the biggest year in terms of planned investments and anticipated new jobs: almost $2.14 billion and 5,000-plus; those were 45.7 and 47.0 percent of the four-year totals, respectively.

Assemblers dominated the spending and hiring plans: FCA – $592.0 million and 1,100 jobs; Ford – $1.03 billion (including what was at the time its Automotive Components Holding plant) and 560 jobs; General Motors (GM) – $910.2 million (including it Defiance foundry) and 819 jobs; and Honda – $941.0 million and 630 jobs. PACCAR's Kenworth division did not disclose a dollar figure, but planned to add 511 new jobs. The five combined for $3.47 billion and 3,600-plus jobs – 74.1 and 33.8 percent of the dollars and jobs, respectively. In the cases of Ford, GM and Honda, though, most of the dollars invested and anticipated new jobs were for their parts operations – not their assembly plants. Johnson Controls and Magna International were the only two parts companies planning to invest more than $100 million. Bodies, trailers and parts companies planning to hire at least 200 people included Imasen Bucyrus Technology, International Automotive Components, Johnson Controls, KTH Parts, MAC Trailer, Magna International and Minth N. America.

These counts are part of the Ohio Private Investment Survey annually compiled by the Office of Research, Ohio Development Services Agency (2011-2014b). A major project must meet one of three criteria: at least 20,000 square feet of new space, $1 million to be spent for land, buildings, or equipment, or 50 new jobs. Many of the major investments are phased in over a two-to-three year cycle, with production and employee counts phased in after project completion.

See Table A2

The Concentration of the Motor Vehicle Industry in Ohio
by Group, and Based on 2011 Dollar Values



Sources: U.S. Bureau of the Census, U.S. Bureau of Economic Analysis

THE CONCENTRATION OF THE INDUSTRY IN OHIO: GROSS DOMESTIC PRODUCT AND VALUE-ADDED

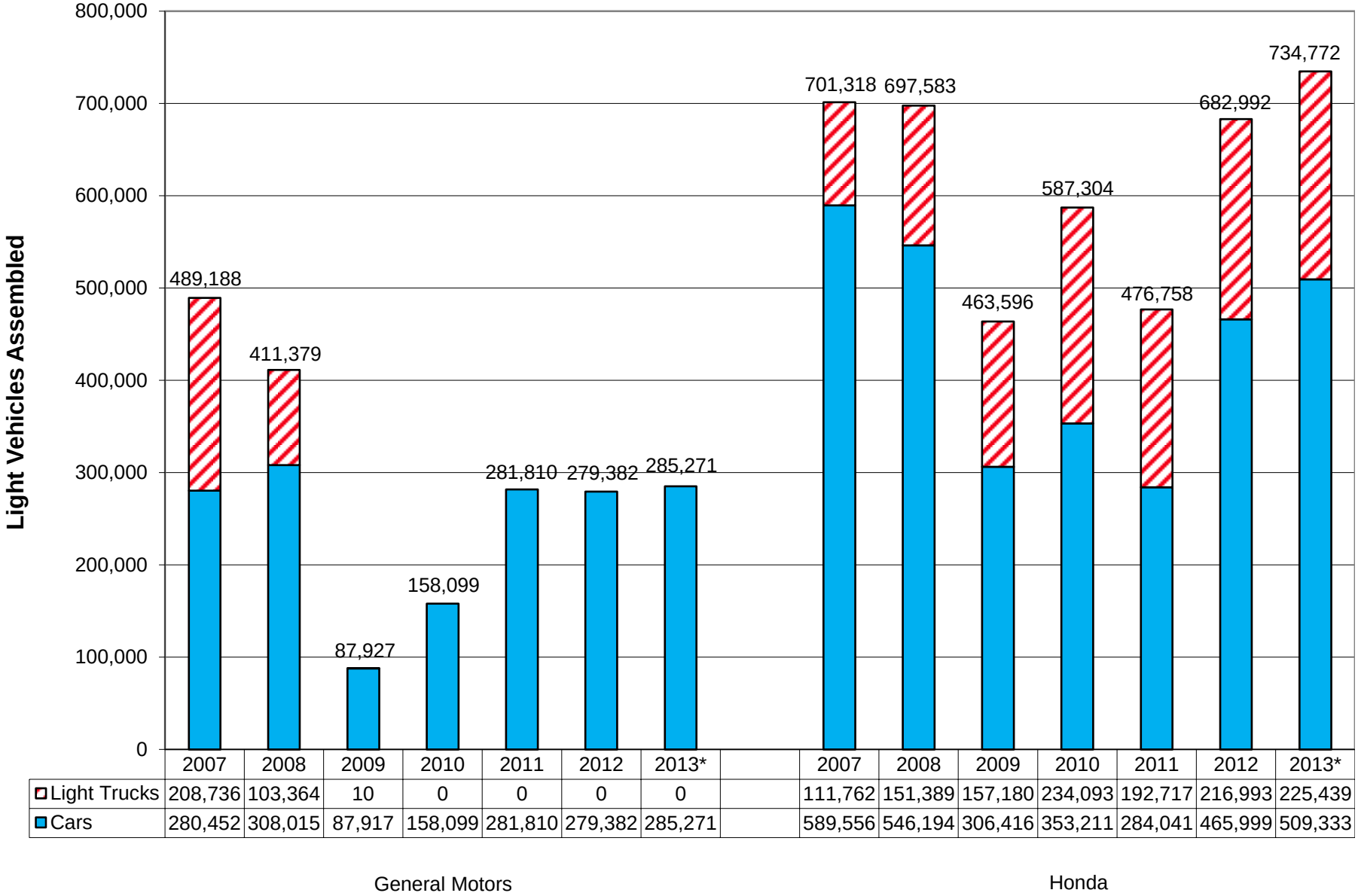
The chart above shows 8.6 percent of the U.S. motor vehicle industry's (NAICS 3361-3) net output in 2011 came from Ohio. By comparison, 3.4 percent of the net value of all goods and services produced and provided in America during 2011 originated in Ohio, according to the latest gross domestic product (GDP) figures from the U.S. Bureau of Economic Analysis (2014a). The greater portion of motor vehicle industry production here compared to total output indicates the concentration of the industry here. (Although 2012 data are available for GDP, using 2011 data facilitates comparison with the latest value-added data available from the Annual Survey of Manufactures; 2011 also is more typical of Ohio due to the temporary shutdown of the Toledo North assembly plant in 2012, and 2012 data from the Census of Manufactures will not be available until later in 2015. Sections of this report may be updated at that time.)

Value-added (VA) data from the Census Bureau (2013a), also shown in the chart above, illustrate how the industry's concentration varied by group in 2011. While the overall concentration of the industry (3361-3) was 9.5 percent,[3] parts production (3363) was notably concentrated with Ohio's plants producing 11.4 percent of the national total. It was followed by assembly operations (3361) and body-and-trailer production (3362) with 8.1 and 4.6 percent of the corresponding national totals. Data in table A10 show that Ohio's share of national assembly production averaged 14.8 percent, while parts production averaged 13.9 percent. The seemingly low VA portions of 2011 are at least partially explained by the permanent closure of GM's Moraine assembly plant in January, 2009, and resultant lower demand from nearby parts suppliers. Ohio's portion of body-and-trailer VA in 2011 was near its long term average.

Ohio ranked 3rd in the nation in assembly and parts VA, and 5th in bodies and trailers VA, during 2011. Its summary industry rank was 3rd (U.S. Bureau of the Census, 2013a).

See Tables A3 & A10

A Seven-Year Summary of Light Vehicle Production in Ohio:
General Motors and Honda



	General Motors								Honda						
	2007	2008	2009	2010	2011	2012	2013*		2007	2008	2009	2010	2011	2012	2013*
Light Trucks	208,736	103,364	10	0	0	0	0		111,762	151,389	157,180	234,093	192,717	216,993	225,439
Cars	280,452	308,015	87,917	158,099	281,810	279,382	285,271		589,556	546,194	306,416	353,211	284,041	465,999	509,333

Note: * - Initial, subject to revision. Sources: Automotive News & Ward's.

COMPANY SUMMARIES OF LIGHT VEHICLE PRODUCTION IN OHIO

The charts on the preceding and following pages illustrate light vehicle production in Ohio during the last seven years for the four high-volume light vehicle assemblers. Each had one or two assembly plants here in this time period. A summary of data on the charts indicates the severity of the recession: collective production of light vehicles in Ohio fell 55 percent from 1,748,000 in 2007 to 783,000 in 2009. Car and light truck production fell at nearly the same rate over the two years, although light trucks dropped first with the high gasoline prices of 2008, and cars followed in 2009. All four assemblers shared more or less in this production plunge. Production grew to 1,448,000 in 2013, an 84.9 percent improvement from 2009, but still below the early recession level of 2008. Car output improved more rapidly than light truck output: 101.5 vs. 68.0 percent, but both were still less than their pre-recession peaks.

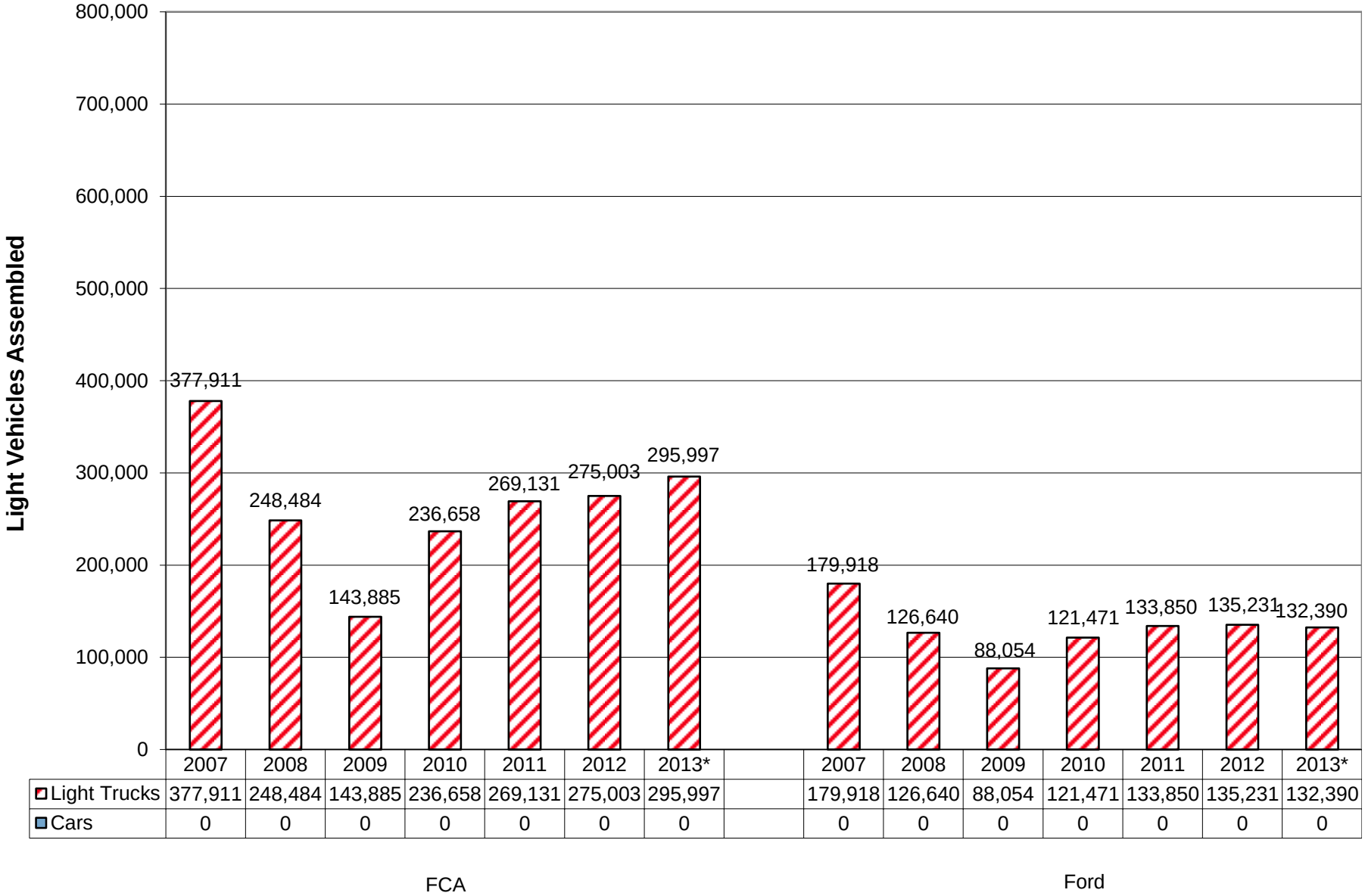
Honda, the highest-volume assembler in Ohio, saw combined production from its two plants fall by one-third – the least of the four – from 701,000 in 2007 to less than 464,000 in 2009. 2010 production rose 26.7 percent from 2009 to 587,000. However, 2011 output fell to less than 477,000 due to natural disasters in Japan and Thailand disrupting parts production. The principal constraints of the disasters were on Accord, followed by the CR-V and the Crosstour, falling by a combined 95,000 units. With the recoveries from the disasters as well as continuing economic expansion, production rebounded to well over 734,000 in 2013.

The summary car and light truck production figures mask more complex changes at Honda's plants. The E. Liberty plant now focuses on light truck assemblies with the expansion of CR-V production and the transfer of Acura RDX production from Marysville. Production increases of both models more than compensated for the end of Element production in 2011. The only car currently assembled in E. Liberty is the Crosstour, which was launched in 2009 after Civic production was transferred out of state. The Marysville plant has assembled only cars since early 2012 – mostly Accords with some near-luxury Acura TLs added.

In contrast to Honda, GM's production fell 82 percent, from 489,000 to less than 88,000, but has recovered to 285,000-plus. The recession and high gasoline prices in 2008 – and the subsequent drop in demand for mid-size SUVs – were factors in the decision to officially close the Moraine plant in December. (It appears 10 vehicles were assembled in January, 2009, before it was permanently closed.) As with Honda, though, there is more to GM's drastic output drop than the impact of the recession. Car production in Lordstown increased by 27,000-plus to 308,000 in 2008 before plummeting to less than 88,000 in 2009. At least part of the drop could be due to the termination of the Pontiac G5 in preparation for the Cruze, which replaced the Cobalt in 2010. By 2011, production in Lordstown had returned to its pre-recession level.

Also see Tables A4a and A11

A Seven-Year Summary of Light Vehicle Production in Ohio:
FCA and Ford



	2007	2008	2009	2010	2011	2012	2013*		2007	2008	2009	2010	2011	2012	2013*
Light Trucks	377,911	248,484	143,885	236,658	269,131	275,003	295,997		179,918	126,640	88,054	121,471	133,850	135,231	132,390
Cars	0	0	0	0	0	0	0		0	0	0	0	0	0	0

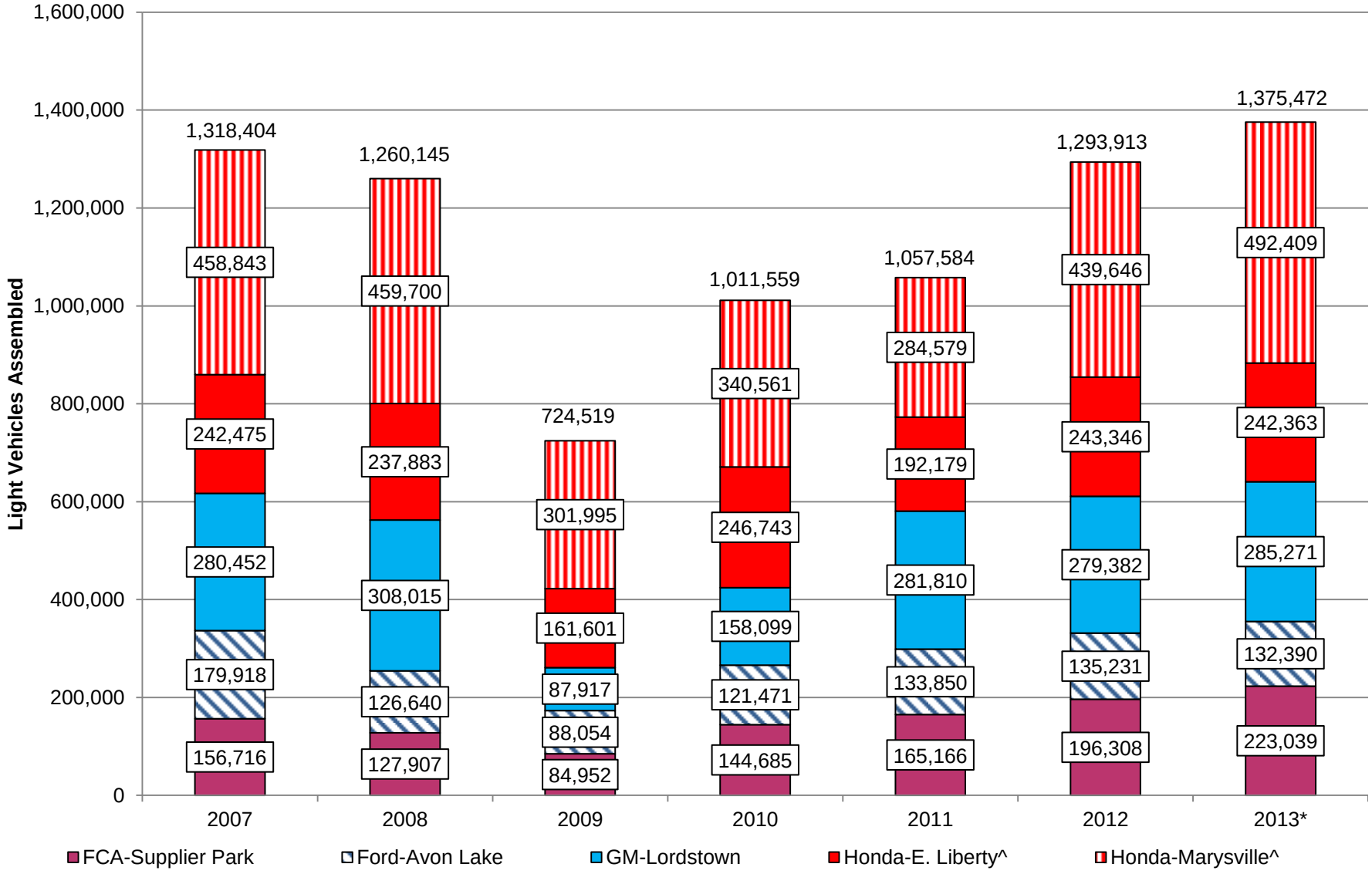
Note: * - Initial, subject to revision. Sources: Automotive News & Ward's.

Fiat Chrysler Automobiles (FCA) and Ford made only light trucks in Ohio. FCA's production of sport-utility vehicles (SUVs) fell 61.9 percent from almost 378,000 in 2007 to less than 144,000 in 2009. Production recovered to 275,000 in 2012, an increase of 91.1 percent from 2009, but still less than the pre-recession level of 2007. As with Honda, the summary figures do not convey the complicated changes at FCA's plants. Output from Supplier Park, which assembles Jeep Wranglers, surpassed the 2007 pre-recession mark by 2011 and continued growing to 223,000 in 2013. This contrasts with production at Toledo North, which made the Dodge Nitro and the Jeep Liberty. Assemblies of Nitros and Liberties rose out of the 2009 recession trough, but Chrysler terminated Nitro production in December, 2011, and Liberty production in August, 2012, to retool the plant for a new Jeep in 2013. These changes more than offset the growing output from Supplier Park. Production at Toledo North resumed in June, 2013,[4] with nearly 73,000 Cherokees produced by the end of the year. FCA's total output in Ohio during 2013 was almost 296,000.

Ford assembled Econoline vans at its Ohio Assembly plant in Avon Lake. Production fell 51 percent from nearly 180,000 in 2007 to 88,000 in 2009. Output rose in 2010, but plateaued in the 132,000-136,000 range for 2011-2013. Figures for the last three years are about three-quarters of 2007's production.

Also see Table A4a

Light Vehicles Assembled in Ohio
at Plants Operating Throughout 2007-2013



Note: * - Initial, subject to revision; ^ - production constrained by floods in East Asia during 2011 and 2012. Sources: Automotive News, Wards

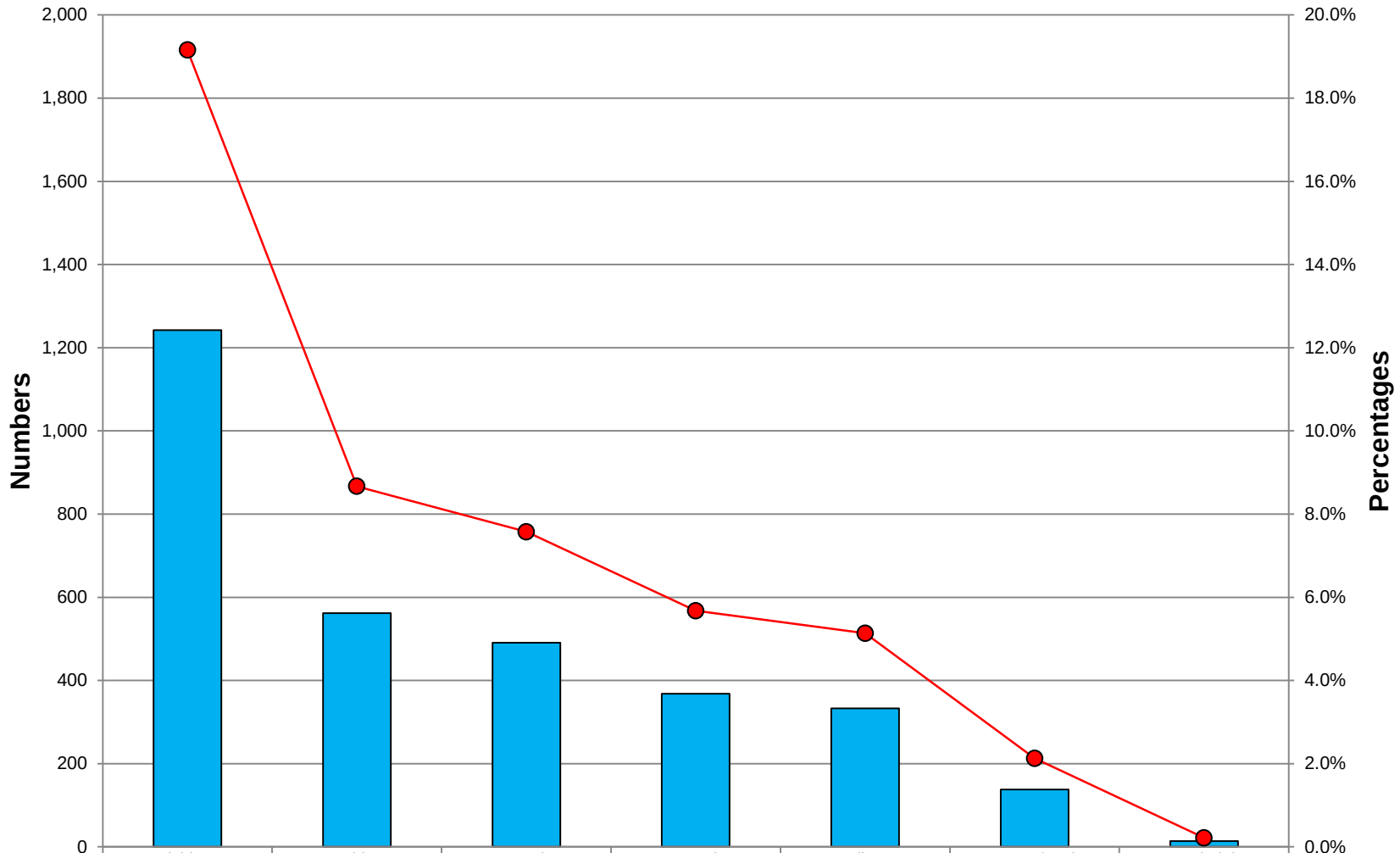
LIGHT VEHICLE ASSEMBLIES AT CONTINUOUSLY OPERATING PLANTS: 2007-2013

In one sense, the aggregate production figures in the preceding section lead to an overly negative conclusion regarding the recovery of the motor vehicle industry in Ohio. It is true that total output in 2013 was 82.8 percent of output in 2007 (1,448,000-plus vs. 1,748,000-plus), and the wind-down and closure of GM's Moraine plant in 2008 undoubtedly had a substantial negative impact on the state's economy. However, a different picture of the industry and its recovery emerges when the focus is limited to those plants continuously operating from January, 2007, through December, 2013.

The chart above shows the annual light vehicle production in Ohio for each of the five high-volume assembly plants in continuous operation from 2007 through 2013 (i.e., excluding Moraine and Toledo North). The effect of the recession is still evident as aggregate output fell 45.0 percent from 1,318,000-plus in 2007 to less than 725,000 in 2009. However, aggregate output in 2013 was greater than that of 2007. In this sense, light vehicle production in Ohio has completely recovered from the recession of 2008-2009 as well as the impact of the 2011 East-Asian floods (which affected Honda's production; output growth from Supplier Park, Avon Lake and Lordstown more than made up for the reductions at E. Liberty and Marysville during 2011).

See Tables A4b and A11

Estimated Numbers and Percentages of Supply Plants
in Selected States/Provinces, 2014
N. American Total = 6,484



	Michigan	Ohio	Ontario	Kentucky	Indiana	Pennsylvania	W. Virginia
Number	1,242	562	491	368	333	138	14
Pct. of N.A.	19.2%	8.7%	7.6%	5.7%	5.1%	2.1%	0.2%

Source: ELM Analytics

PARTS SUPPLIERS

All assemblers either have their own parts plants (notably for power train and large-size stamped components) or deal with independent parts suppliers. ELM Analytics has information on nearly 6,500 such plants in N. America. They include tier-1 plants directly supplying assemblers as well as indirect suppliers (tier-2 plants making sub-assemblies; and tier-3 plants supplying raw materials). The chart illustrates the numbers and percentages of such plants in Ohio and bordering states plus Ontario. The seven collectively form a contiguous area with 48.6 percent of all suppliers in N. America. The estimated 562 establishments in Ohio – 8.7 percent of those in N. America – rank the state second in this group.[5]

Some companies concentrate on supplying original equipment (OE) to assemblers. The larger include Delphi Automotive, Goodyear Tire & Rubber, Johnson Controls, Magna International, Superior Industries, Tenneco, TRW (some of whose establishments were sold to form the Blackstone Group), and Visteon. Other OE companies, such as Allied Signal, Eaton, General Electric, 3M, PPG Industries, Textron, and United Technologies, have significant motor vehicle operations, but receive most of their revenue from outside of the motor vehicle industry. Still other companies make parts that are more likely to be sold in the aftermarket (AM) as replacements; the larger include Cooper Tire & Rubber, Federal-Mogul and Meritor. Some, like Dana Holdings, participate in both (Levy, 2014: 12). The distinction between OE and AM companies is somewhat arbitrary as many OE manufacturers also produce goods for the AM (Levy, 2014:27). Many of these OE and AM companies have establishments in Ohio and are found in the “Notable” section. The same diversity may characterize many of the smaller companies in ELM’s database.

Parts companies survive by making a few specialized items requiring a high degree of skill, and doing so more efficiently than assemblers. Their ability to spread research, development, and equipment expenditures over several contracts – as well as selling their expertise to a number of assemblers – gives them a cost advantage over assemblers. They also are less likely to have a unionized labor force. Tier-1 companies try to maintain a diversified tier-2 and -3 supply base to ensure a steady flow of parts at competitive prices. However, assemblers and tier-1 companies have been occasionally willing to provide financial and managerial assistance to the latter to maintain timely parts production (Levy, 2014: 26-27).

OE sales tend to be cyclical because they follow the sales of new vehicles. AM sales have been affected by two countervailing trends: the improved durability of OE has depressed demand more than the in-recession tendency of owners to keep and repair vehicles instead of purchasing new ones (Levy, 2014: 27).

The role of tire makers in the industry is often discussed separately from other parts makers. Levy, (2014: 7, 12) cites *Modern Tire Dealer* statistics showing OE and AM sales growing in 2013 from 2012 levels for both cars and trucks. AM sales constitute the vast majority of tires sales and are the more profitable segment on a per-unit basis. (They have been

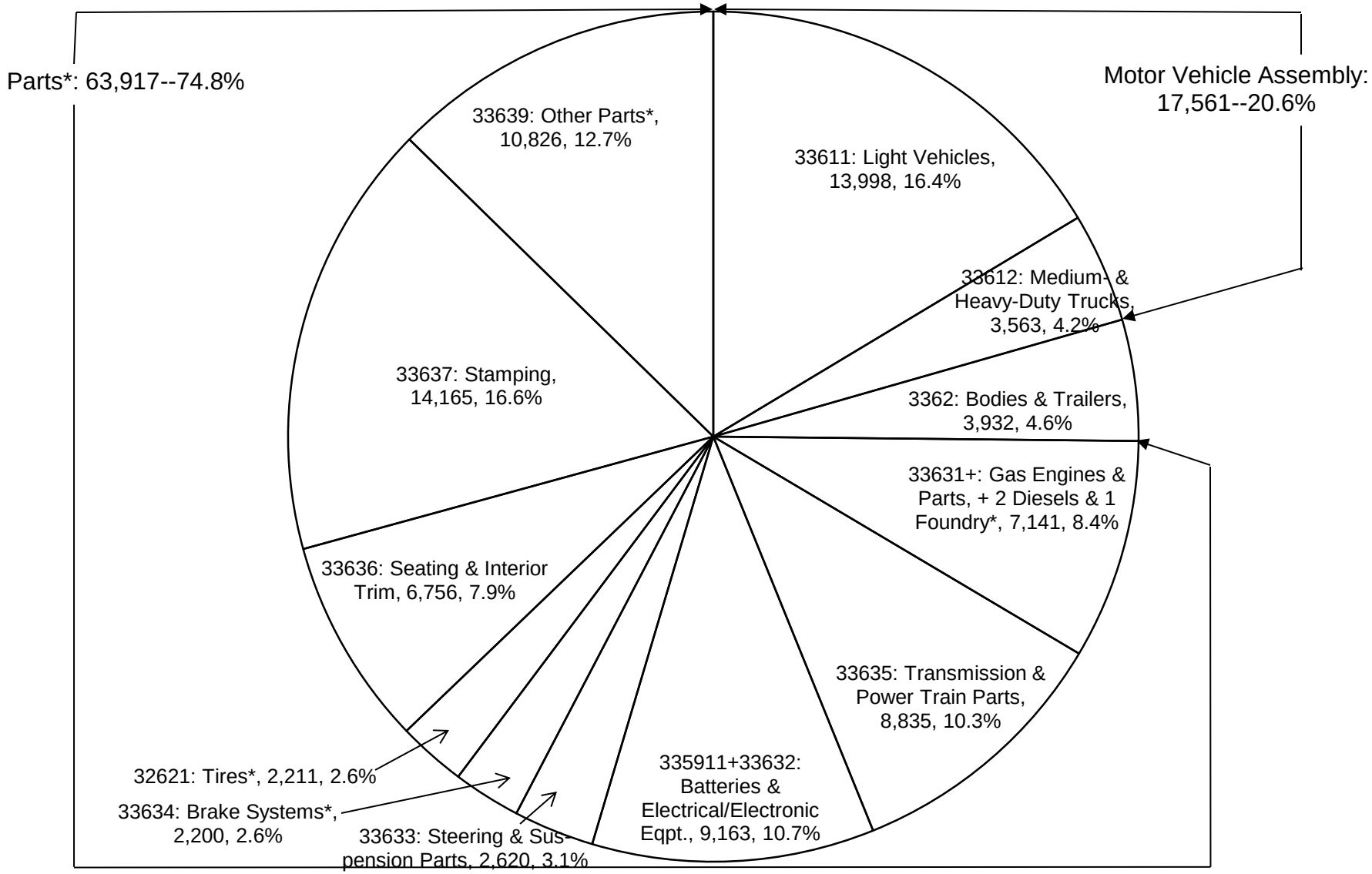
boosted by the increasing popularity of high-performance speed-rated radials, which wear out faster than conventional radials.) Despite the lower profit margins of OE sales, though, they are important for several reasons. OE sales help AM sales because owners tend to replace tires with the same brand. In turn, this means a larger market share than could be attained in the AM alone, and greater economies of scale reduce per-unit operating costs, distribution and advertising expenses (Levy, 2014: 28).

The tire industry is highly capital intensive. Research and development efforts, production technology, and operations are very expensive. Consequently, the industry is dominated by a small number of vertically integrated giants; Bridgestone, Goodyear, and Michelin together account for about one-half of worldwide tire production (Levy, 2012: 10; 2014: 12). (The vertical integration does not extend into distribution and retail sales. Other large companies dominate this part of the business.) The tire industry consolidated long ago to become a global industry. Foreign–based manufacturers now own a substantial portion of U.S. domestic capacity. Goodyear and Cooper are the only two publically-traded tire companies with U.S. headquarters (Levy 2014: 12).

Cost pressures and the increased number of niche markets compelled the giants to adopt flexible manufacturing techniques. These more sophisticated processes allow producers to economically meet customers' specifications. Global tire makers also pursue technical improvements in their products as a means of drawing attention in a competitive market (Prat, 1998). Tires have indeed become better at resisting wear according to the National Highway Traffic Safety Administration. Consumers can search the Administration's website starting at http://www.safercar.gov/.

The remainder of the motor vehicle-related rubber industry includes belts, hoses, motor mounts, bushings, window and door moldings, seals, etc., and their circumstances and fortunes are quite like other parts makers (Levy, 2014: 28).

Employment in Ohio's Motor Vehicle Industry
Estimated Total: 85,410--100%



Sources: ODSA, & U.S. Census Bureau

* - Estimated

THE COMPOSITION OF OHIO'S MOTOR VEHICLE INDUSTRY – EMPLOYMENT AT THE PLANTS

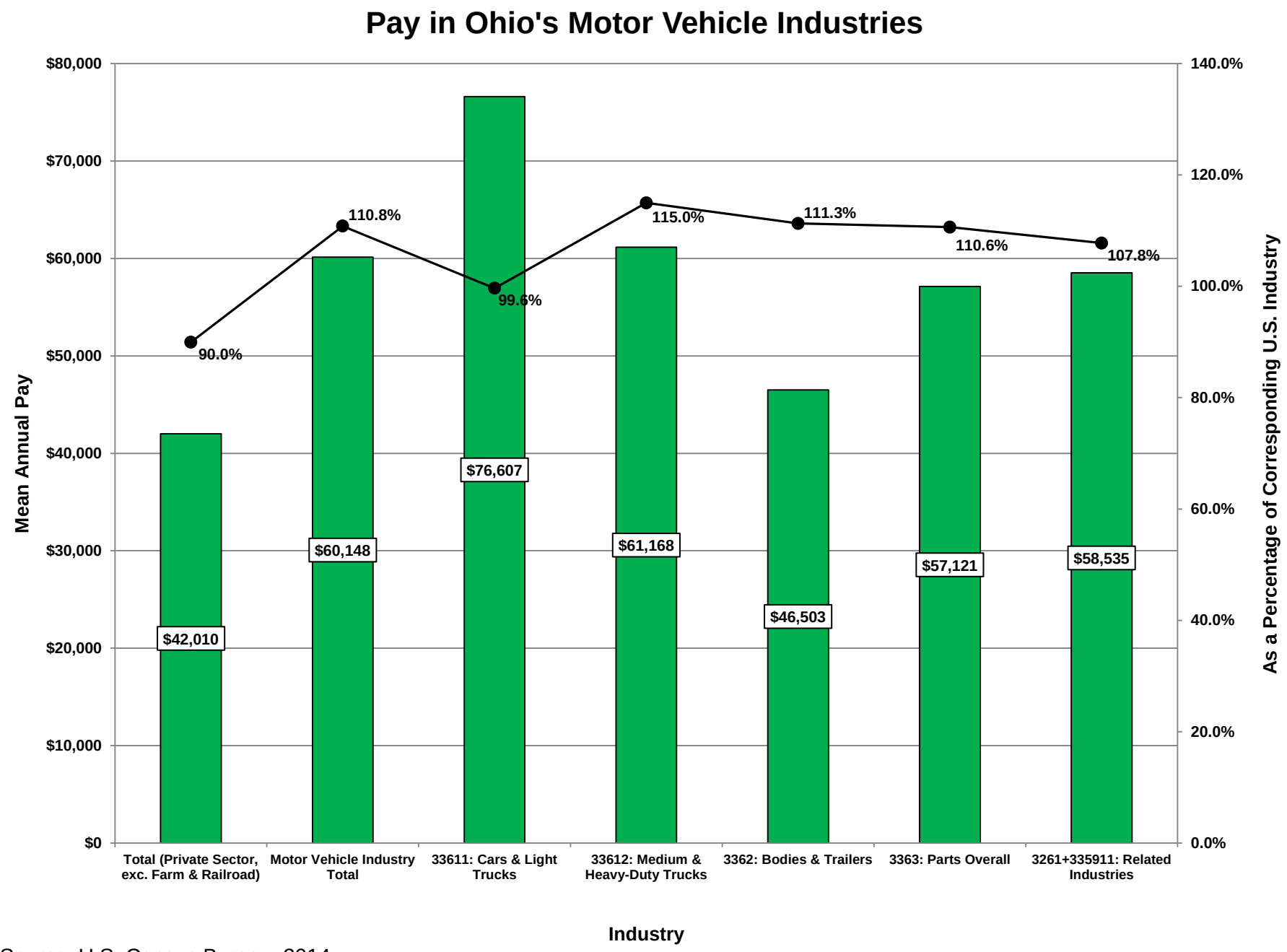
The latest detailed data from the Census Bureau and other sources show that 85,400-plus people worked in Ohio's motor vehicle industry. The chart above illustrates the distribution of employment within the industry. 17,500-plus, or 20.6 percent, worked at assembly plants (NAICS 3361), with about 14,000 – 16.4 percent – in the light vehicle subgroup (33611) and 3,500-plus – 4.2 percent – at establishments assembling buses and medium-to-heavy-duty trucks (33612). The 3,900-plus producing bodies and bodies and trailers (3362) were 4.6 percent of the industry total.

63,900, or 74.8 percent, worked in parts industries including tires, storage batteries, and those employed at a foundry and two diesel engine plants (3363, 32621, 335911, 33152 and 333618, respectively).[6] Stamping (33637) was the largest industry within the parts group: well over 14,100 jobs, or 16.6 percent of the motor vehicle industry total. It was followed by the combination of electrical and electronic equipment with storage batteries, well over 9,100 – 12.2 percent, and other motor vehicle parts, 10,800-plus – 12.8 percent. The only other subgroups employing at least 6,000 people were transmission and power train parts – 10.3 percent, engines (including the foundry and two diesel plants) and parts – 8.4 percent, and seating and interior trim – 7.9 percent. The remaining parts industries each employed less than 3,000, and ranged from 2.6 to 3.1 percent of the industry total.

Light vehicle assembly plants are the largest in the industry, averaging close to 1,100 employees each, followed by medium- and heavy-duty truck plants at about 400. These averages incorporate the dichotomies between the high-volume plants, all but one of which employ at least 2,000 people in Ohio, and the much smaller, specialized operations serving niche markets. A similar dichotomy may characterize new-tire plants (326211). The smallest plants in the industry typically are those making bodies and trailers (3362) and retreading tires (326212), while battery and parts plants (335911 and 3363) frequently employ one- to a few-hundred. However, parts plants owned by high-volume assemblers often employ more than 1,000.

Comparisons with national figures (based solely on the Census Bureau's County Business Patterns) point to specific industry concentration here. Overall motor vehicle industry employment is concentrated in Ohio, with 10.4 percent of the national industry's workers here. By comparison, 3.9 percent of all employees in the nation (excluding those on farms, at railroad companies, and in government) worked in Ohio. The overall concentration is driven by specific industries especially concentrated here: vehicle assembly – 11.7 percent, electrical and electronic equipment – 16.1 percent, and parts for steering, suspension, brakes, transmissions and power trains, seating and interior trim, and stampings – all at least 14 percent of the corresponding national totals.

See Table A5



Source: U.S. Census Bureau, 2014

INDUSTRY WAGES

Census Bureau data charted above show that employees in Ohio's motor vehicle industry were estimated to have averaged more than $60,100 in wages and salaries for the latest year available. This figure is 110.2 percent of the corresponding national average, and over $18,100 above the average for all private sector employees in Ohio (excluding the agricultural sector and railroad transportation industry). There is considerable variation within the industry: work at light vehicle assembly plants (33611) paid $76,600 per year, while work in medium- and heavy-truck plants (33612) averaged $61,100-plus. Bodies and trailers (3362) paid $46,500, and parts (3363) averaged $57,100-plus. People working in the related tires and batteries cluster averaged more than $58,500. All of these specific averages equaled or surpassed the corresponding national averages.

Data in Appendix table A6 show there was substantial variation between the individual industries within the parts group. On one hand, electrical/electronic equipment paid approximately $75,600, followed by transmissions and power train parts with $70,900. On the other hand, employees in seating and interior trim were paid less than $39,500. (Data for gasoline engines, engine parts and brake systems were suppressed to maintain confidentiality.) One possible explanation for the higher wages in transmission and power train plants is that a large portion of employment is at subdivisions of high-volume assemblers, while those in other groups are less likely to work for assemblers. The relatively high pay in the related industries segment may reflect the fact that Ohio is world headquarters for two mass-market tire makers.

See Table A6

Ohio

Number of Establishments in Ohio's Motor Vehicle Industry

Statewide: 566

Establishments in County

- None
- 1 - 4
- 5 - 9
- 10 - 19
- 20 - 60

Sources:
2012 County Business Patterns,
U.S. Census Bureau and various
private sector publications

Prepared by: Office of Research,
Ohio Development Services Agency
September 2014

R081314A

THE DISTRIBUTION OF INDUSTRY ESTABLISHMENTS ACROSS OHIO

The motor vehicle industry is widely distributed across Ohio. The latest available data, mapped above, show 566 establishments[7] in 75 counties. However, the majority of establishments could be found in 15 counties: Cuyahoga – 60, Franklin and Montgomery – 30 each, Lucas – 24, Summit – 21, Lorain – 17, Hancock – 16, Stark – 15, Hamilton, Wayne and Williams – 14 each, Richland – 13, and Medina – 12, and Clarke and Trumbull – 11 each. Three more counties had 10 each: Butler, Lake and Wood. Twenty-six counties had from five to nine establishments, and 31 had from one to four.

It is interesting to note that the seven counties with the eight high-volume assembly plants – Clark, Logan, Lorain, Lucas, Ross, Trumbull, and Union – had a total of 75 industry establishments. This is a larger-than-proportional count, and 13.3 percent of the state total, but far from the majority.

See Table A7

Ohio

Total Employment in Ohio's Motor Vehicle Industry
Statewide: 85,410

Employment in County

- None
- 1 - 499
- 500 - 1,249
- 1,250 - 3,999
- 4,000 - 8,696

Sources:
2012 County Business Patterns,
U.S. Census Bureau and various
private sector publications

Prepared by: Office of Research,
Ohio Development Services Agency
September 2014

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THE DISTRIBUTION OF INDUSTRY EMPLOYMENT ACROSS OHIO

The map above shows the distribution of motor vehicle industry employment by county. The seven counties with high-volume assembly plants – Clark, Logan, Lorain, Lucas, Ross, Trumbull, and Union – had 75 industry establishments (13.3 percent of the total), but almost 28,400 industry jobs (33.2 percent of the total). High-volume assembly plants are large employers and may support a number of parts jobs close by. Counties that fit this pattern included Lucas (about 5,000 jobs, with around 1,500 at the assembly plants at the time), and Trumbull (8,700, with about 4,500 at the assembly plant).

The other assembly-plant counties have fewer industry jobs, but border counties that have large numbers of parts employees. Almost all of the nearly 5,000 jobs in Union were at the plant, with close to 2,000 parts jobs in Franklin and 1,400-plus in Madison. In Logan, the substantial majority of the jobs were at the assembly plant, with almost 2,900-plus parts jobs in Shelby. In Lorain, around 1,800 of the 2,800 jobs were at the assembly plant, with 5,000 parts jobs in Cuyahoga. Eight-hundred-fifty of the 1,400-plus jobs in Clark were at the assembly plant, with close to 3,700 parts jobs in Montgomery. It should be noted Lucas also fits this pattern with well over 1,000-plus and 1,400-plus parts jobs in Fulton and Wood. Ross is the exception to the pattern. Although more than 2,000 of its 2,700-plus total are at the plant, no bordering county had at least 1,000 parts jobs.

Other counties which had large numbers of parts jobs included Allen – 1,100-plus (including a Ford engine plant), Butler – 1,000-plus, Champaign – well over 1,000; Defiance – nearly 2,200 (including a GM foundry), Erie – 1,400 (including Flex-N-Gate), Hamilton – 2,200-plus (including a Ford transmission plant), Hancock – nearly 4,200 (including Cooper Tire & Rubber), Licking – well over 1,200, Richland – 1,400-plus, Warren – 1,600, and Wayne – 1,500-plus.

Trumbull had the largest number of industry jobs – about 8,700, followed by Cuyahoga with about 5,200. Five counties had between 3,000 and 5,000: Hancock, Lucas, Montgomery, Shelby and Union. Six counties had between 2,000 and 3,000: Defiance, Hamilton, Logan, Lorain, Ross and Wayne. These 13 counties combined for 58.5 percent of the industry jobs in Ohio. Twelve counties had between 1,000 and 2000, 16 counties had between 500 and1,000 jobs, and 34 counties had between 1 and 500.

See Table A7

FOREIGN INVESTMENT IN OHIO

Dozens of foreign-based companies have subsidiaries and/or joint ventures in Ohio's motor vehicle industry; 11 of them are on Fortune's Global 500 list. The following list identifies them, the countries where the home offices are located, their subsidiaries in Ohio, and the total number of employees in the state. Sometimes the arrangements are complex, as evidenced by Honda's subsidiaries and affiliates in Ohio. The affiliates may be partially owned by the Honda Motor Co., a joint venture between it and other companies, or they may be independent but have Honda as their principal customer.

Foreign Parents	Country	Ohio Subsidiaries ^	Total Jobs~
Ahresty Corp.	Japan	Ahresty Wilmington Corp.	650
Aisin Seiki Co., Ltd.*	Japan	Advics Mfg. Ohio, Inc.	670
Amtek Auto Ltd.	India	Tekfor, Inc.	265
Aoki Holdings, Inc.	Japan	Aoki Mfg. Columbus, Inc.	50
ArcelorMittal*	Luxembourg	ArcelorMittal Tailored Blanks	85
Asahi Glass Co., Ltd.	Japan	(total)	635
		AGC Automotive N. America, Inc.	485
		Belletech Corp.	150
Autoneum Holding AG	Switzerland	Autoneum N. America, Inc.	450
Beijing Wanxiang Industrial Corp.	China	Powers & Sons LLC	230
Daimler AG*	Germany	Detroit Diesel Remanufacturing East	535
Delphi Automotive PLC	United Kingdom	Delphi Automotive Systems LLC	550
Dia Seiko Co., Ltd.	Japan-Canada	ABC-Inoac Exterior Systems LLC[1]	265
FCA, Inc.*	Italy	FCA, Inc. (Toledo complex and Perrysburg machining)	5,160
Feintool Intl. Holding AG	Switzerland	Feintool Cincinnati, Inc.	230
Fine Sinter Co., Ltd.	Japan	American Fine Sinter Co., Ltd.	125
F-Tech, Inc.	Japan	F&P America Mfg., Inc.	650
Fusherashi Co., Ltd.	Japan	Fuserashi International Technology, Inc.	35
GS Electech, Inc.	Japan	GSW Mfg., Inc.	190
Gebr. Röchling KG	Germany	Rochling Automotive Corp. USA LLP	110
G-TEKT Corp.	Japan	Jefferson Industries Corp.	700
Hirschvogel Holding GmbH	Germany	Hirschvogel, Inc.	150
Hitachi, Ltd.*	Japan	AAP St. Marys Corp.	525
Hoerbiger Tectum Holding AG	Switzerland	Altronic LLC	150
Honda Motor Co., Ltd.*	Japan	(total)	13,555
		AY Mfg., Ltd.	175
		Cardington Yutaka Technologies, Inc.	725
		Celina Aluminum Precision Technology, Inc.	500
		Honda of America Mfg., Inc.	10,450
		Honda Engineering N. America, Inc.	350
		Honda Transmission Mfg. of America, Inc.	1,135
		US Yachiyo, Inc.	220

Foreign Parents	Country	Ohio Subsidiaries ^	Total Jobs~
Honda affiliates:		(total)	4,745
KTH Parts Industries, Inc.	Japan	(subtotal)	1,490
		Kalida Mfg., Inc.	450
		KTH Parts Industries, Inc.	1,040
Nihon Plast Co., Ltd.	Japan	Neaton Auto Parts Mfg., Inc.	750
Nissin Kogyo Co., Ltd.	Japan	Nissin Brake Ohio, Inc.	750
Tanaka Seimitsu Kogyo Co., Ltd.	Japan	FT Precision, Inc.	365
Toyo Denso Co., Ltd.	Japan	Weastec, Inc.	145
TS Tech Co., Ltd.	Japan	(subtotal)	820
		Trim Industries, Inc.	440
		Tri-Mold LLC	170
		TS Tech USA Corp.	210
Yamada Mfg. Co., Ltd.	Japan	Yamada N. America, Inc.	425
Howa Textile Industry Co., Ltd.	Japan	American Howa Kentucky, Inc.	135
Hyundai M&D Co., Ltd.	S. Korea	Mobis NA LLC (integrated with FCA's Toledo complex)[2]	420
Ikeda Mfg. Co., Ltd.	Japan	Sunfield, Inc.	100
Imasen Electric Industrial Co., Ltd.	Japan	Imasen Bucyrus Technology, Inc.	220
Intl. Automotive Components Group SA	Luxembourg	Intl. Automotive Components Group N. America, Inc.	950
Isuzu Motors Ltd.	Japan	DMAX (General Motors Co. owns 60 percent)	519
Kaneta Kogyo Co., Ltd.	Japan	Bucyrus Precision Tech, Inc.	190
Kasai Kogyo Co.	Japan	M-Tek, Inc.	640
Keihin Corp.	Japan	Keihin Thermal Technology of America, Inc.	425
Knorr-Bremse AG	Germany	Bendix Commercial Vehicle Systems LLC	350
Kongsberg Automotive Holding ASA	Norway	Kongsberg Automotive	60
Kuka AG	Germany	Kuka Toledo Production Operations LLC (part of FCA's complex)	250
Magna Intl., Inc.*	Canada	(total)	1,810
	Canada-Germany	Gramag Truck Interior Systems LLC (a joint venture with Grammar AG)	30
		Magna Cosma International (aka Vehtek)	300
		Magna Modular Systems, Inc. (aka Magna Exteriors & Interiors)	70
		Magna Seating of America, Inc.	310
		Norplas Industries, Inc. (aka Magna Exteriors)	1,100
Mahle Behr GmbH & Co. KG	Germany	(total)	1,265
		Mahle Dayton LLC	1,150
		Mahle Engine Components USA, Inc.	115
Mancor Automotive	Canada	(total)	220
		Mancor Ohio Inc.	100
		Matsu Ohio, Inc.	120
Meteor Gummiwerke KH Badje GmbH & Co. KG	Germany	Meteor Sealing Systems LLC	155
Miba AG[3]	Austria	(total)	420
		Miba Bearings US LLC	310
		Miba Sinter US LLC	110
Mitec Automotive AG	Germany	Mitec Powertrain, Inc.	35
Mitsubishi Electric Corp.*	Japan	Mitsubishi Electric Automotive America, Inc.	400

Foreign Parents	Country	Ohio Subsidiaries ^	Total Jobs~
Molten Corp.	Japan	Molten N. America Corp.	90
Moriroku Holdings Co.	Japan	Greenville Technology, Inc.	735
Muro Corp.	Japan	Murotech Ohio Corp.	75
Nippon Seiki Co., Ltd.	Japan	New Sabina Industries, Inc.	400
Nippon Sheet Glass Co., Ltd.	Japan	Pilkington, N. America, Inc.	300
Nissen Chemitec Corp.	Japan	Nissen Chemitec American, Inc.	210
Nitto Denko Corp.	Japan	Nitto Denko Automotive Ohio, Inc.	160
Pacific Industrial Co., Ltd.	Japan	(total)	512
		Pacific Industries USA, Inc.	12
		Pacific Mfg. Ohio, Inc.	500
Peugeot SA*	France	Faurecia Exhaust Systems, Inc.[4]	870
Pioneer Corp.	Japan	Pioneer Automotive Technologies, Inc.	175
Rank Group Ltd.	New Zealand	Fram Group Operations LLC	415
Robert Bosch Stiftung GmbH*	Germany	Robert Bosch Battery Systems LLC	165
Roki Holdings Co., Ltd.	Japan	Roki America Co., Ltd.	360
S & T Motic Co., Ltd.	S. Korea	S & T Automotive America	80
Sankei Giken Co., Ltd.	Japan	Newman Technology, Inc.	800
Sankyo Kogyo Co., Ltd.	Japan	SK Tech, Inc.	75
Sanoh Industrial Co., Ltd.	Japan	Sanoh America, Inc.	610
Schaeffler Technologies GmbH & Co. KG	Germany	LuK-Schaeffler Group USA, Inc.	1,175
Showa Corp.	Japan	American Showa, Inc.	1,125
Stanley Electric Co., Inc.	Japan	Stanley Electric US Co., Inc.	630
Sulzer Ltd.	Switzerland	Sulzer Friction Systems, Inc.	20
Tachi-S Co., Ltd.	Japan	Setex, Inc.	500
Taiho Kogyo Co., Ltd.	Japan	Taiho Corp. of America	120
Temasek Holdings Ltd.	Singapore	Kidron, Inc.	200
ThyssenKrupp AG*	Germany	Bilstein of America, Inc.	185
Toboyo Co., Ltd.	Japan	Toyobo Kureha America Ltd.	40
Tokai Kogyo Co., Ltd.	Japan	Green Tokai Co., Ltd.	535
Tokai Rubber Industries Ltd.	Japan	DTR Industries, Inc.	650
Tremcar, Inc.	Canada	Tremcar USA, Inc.	145
USUI Kokusai Sangyo Kaisha Ltd.	Japan	USUI Intl. Corp.	190
Valeo SA	France	Valeo Thermal Systems	300
Windsor Mold, Inc.	Canada	Precision Automotive Plastics	200
Yanagawa Seiki Co., Ltd.	Japan	YSK Corp.	240

Abbreviations, notes and sources: aka – also known as; Intl. – International; Mgf. – Manufacturing; ^ – some manufacturing subsidiaries are classified outside of the industry by their NAICS codes, but are included because a significant portion of their out-put is used by parts makers or assemblers; ~ – unless otherwise noted, job figures are from International Corporate Investment in Ohio Operations (Office of Research, ODSA, 2014a); * – a Fortune Global 500 company; 1 - ABC-Inouc is itself a Canadian-Japanese joint venture, with Dia Seiko as the Japanese parent of Inoac, while the ABC Group is a Canadian company; 2 – jobs figure based on Toledo News Now (2012) and Snavely (2013); 3 - jobs figures are from the company website; 4 – the company plans to add 120 jobs in the new future (Staff-Dispatch, 2014).

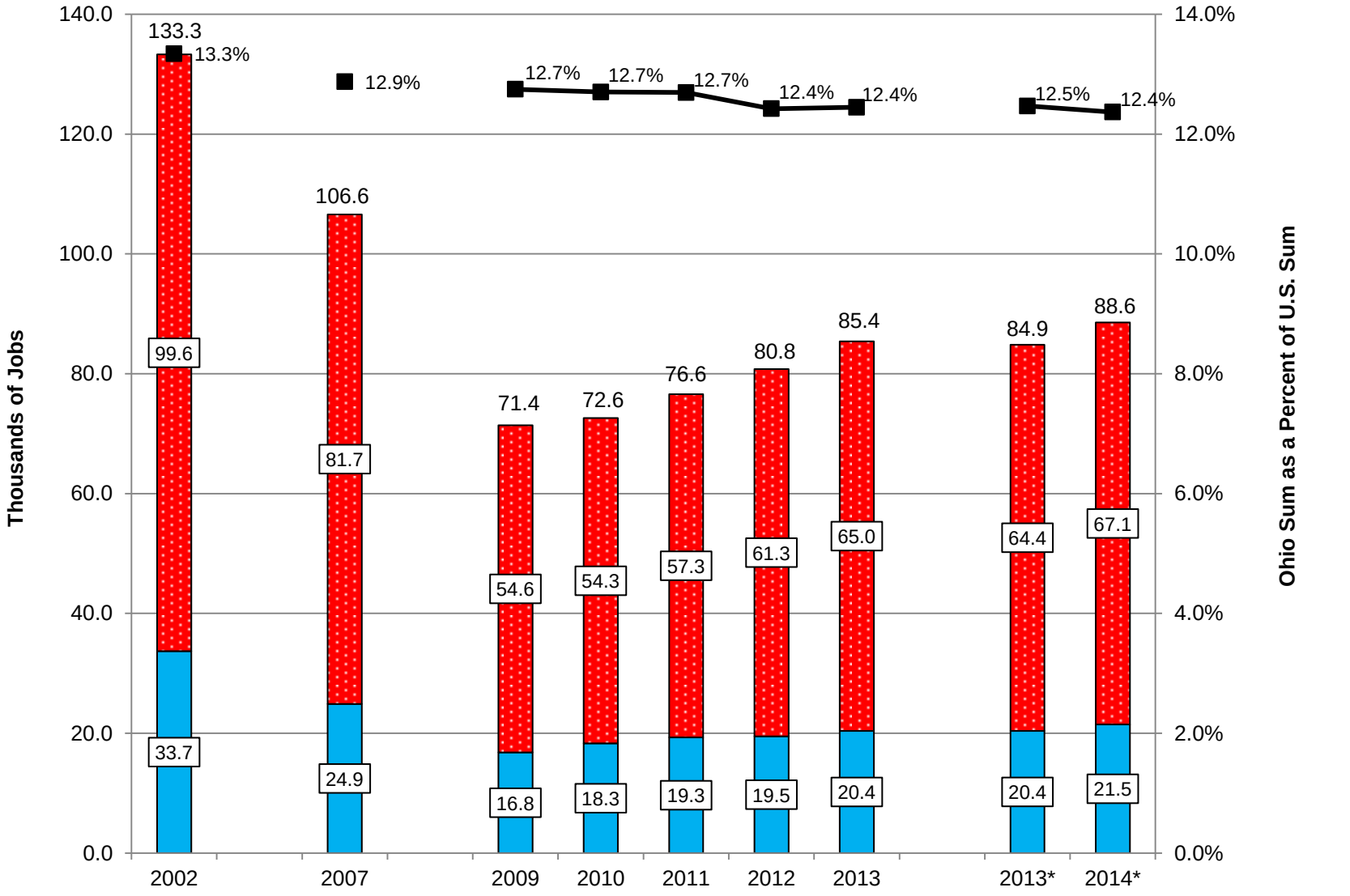
The companies listed above combine to employ over 51,200 people in Ohio. Honda is the largest foreign-based company in the state's motor vehicle industry with more than 13,500 at its manufacturing facilities and an additional 4,700-plus at its affiliates. (Additional people are employed at Honda's non-manufacturing facilities.) FCA is the second largest foreign-based employer with well over 5,100 at its Toledo complex and its Perrysburg machining facility combined. Other foreign-based companies with at least 1,000 workers in Ohio include Magna International, Mahle Behr, Schaeffler Technologies and Showa. Except for Honda and FCA, the companies listed above are exclusively parts manufacturers. None manufactures trailers or batteries, but one, a Pacific Industrial subsidiary, makes tire values.

The dozens of foreign parent companies have headquarters in 15 nations. Twelve are located in Germany, five in Canada, four in Switzerland, two each in France, Luxembourg and South Korea, and one each in Austria, China, India, Italy, New Zealand, Norway, Singapore and the United Kingdom. The remaining 49 are Japanese. Although exact numbers are difficult to ascertain[8], it appears that Japanese-based companies account for about 33,500 jobs – 65.4 percent of all foreign-based company employment related to Ohio's motor vehicle industry. German companies account for almost 4,400, or 8.6 percent, and Canadian companies account for more than 2,500, or 4.9 percent. The Italian FCA has 10.1 percent.[9]

TRENDS

Jobs in the Assembly (3361) and Parts (3363) Groups

BLS/CES Figures for Ohio: 2002-2014



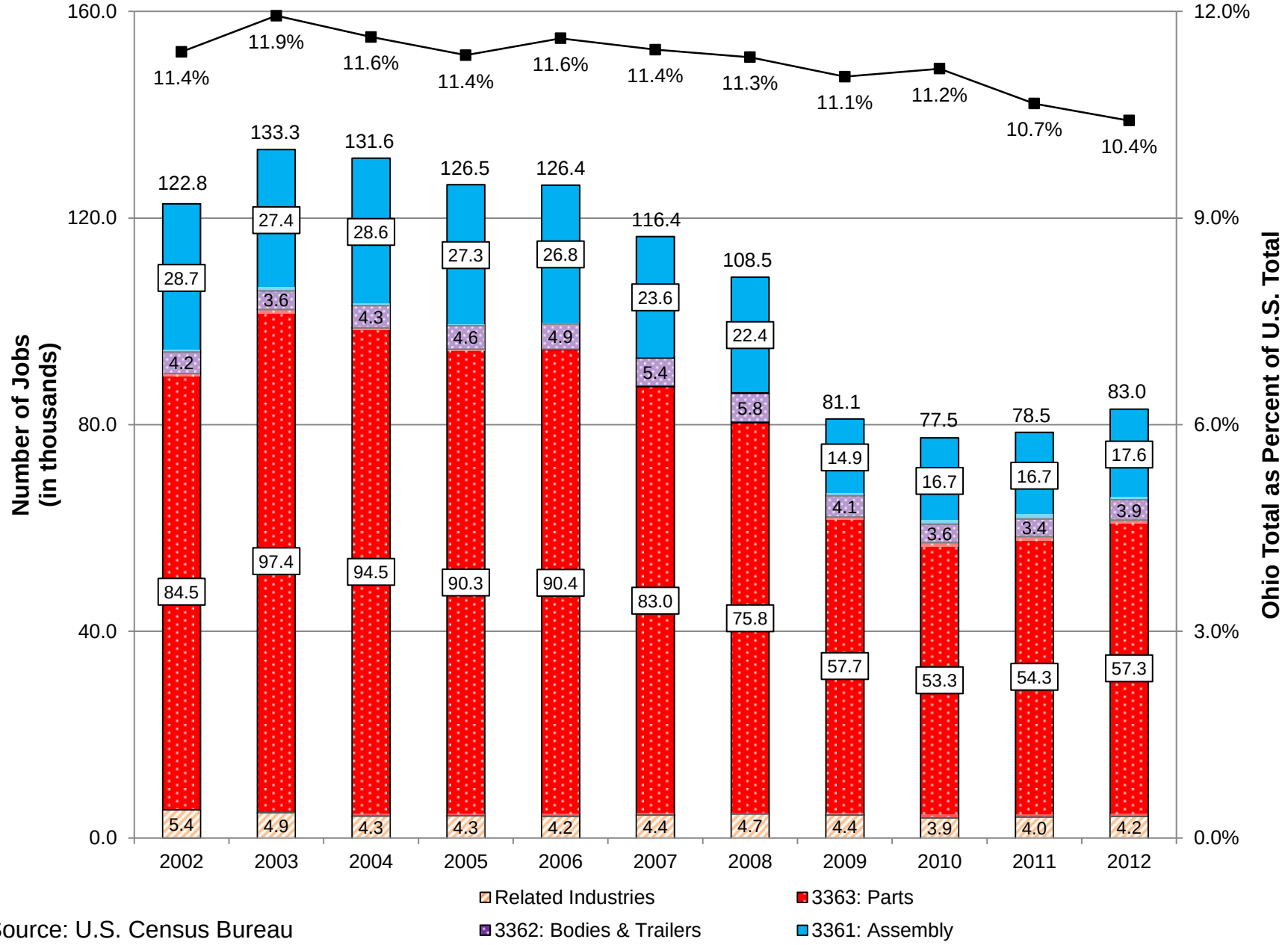
Source: U.S. BLS/Current Employment Statistics
* January through September

THE MOST CURRENT EMPLOYMENT DATA FOR THE TWO LARGEST GROUPS

Understanding the extraordinary changes in the motor vehicle industry during the last decade-plus is aided by the most current data available. The chart above shows the history for selected years and the current levels of employment in the two largest motor vehicle industry groups: assembly and parts (NAICS 3361 and 3363). Combined employment fell 20.0 percent from 133,300 in 2002 to 106,600 in 2007, according to the U.S. Bureau of Labor Statistics (BLS, 2014) – despite real economic growth here (see Appendix table A9.) The greater share of job losses occurred in the larger parts group (red) – from 99,600 to 81,700, but the smaller assembly group (blue) showed a slightly greater percentage decline: 26.1. The latter includes the effect Ford's Lorain plant closure in 2005. The losses accelerated during the 2007-2009 recession as parts and assembly employment fell in near equal proportions from 81,700 to 54,600 and 24,900 to 16,800, respectively. Employment in both groups has recovered somewhat since 2009 with the parts group growing to 65,500 and the assembly group rising to 20,400 in 2013. The chart above shows employment continuing to grow in 2014 with the first nine months sum of the two groups averaging 88,600 compared with 84,900 during the first nine months of 2013. As welcome as this news is, employment levels in both groups are still substantially below those of 2007, due at least in part to permanent closure of GM's Moraine assembly plant in January, 2009.

The chart above also shows the sum of jobs in assembly and parts plants in Ohio as a percentage of the corresponding national sum. The fact that Ohio's share of the national sum slipped by less than a point from 2002 through the first nine months of 2014 – 13.3 to 12.4 – means that its experience was largely just part of what happened throughout the country.

Employment Trends in Ohio's Motor Vehicle Industry: 2002-2012



Source: U.S. Census Bureau

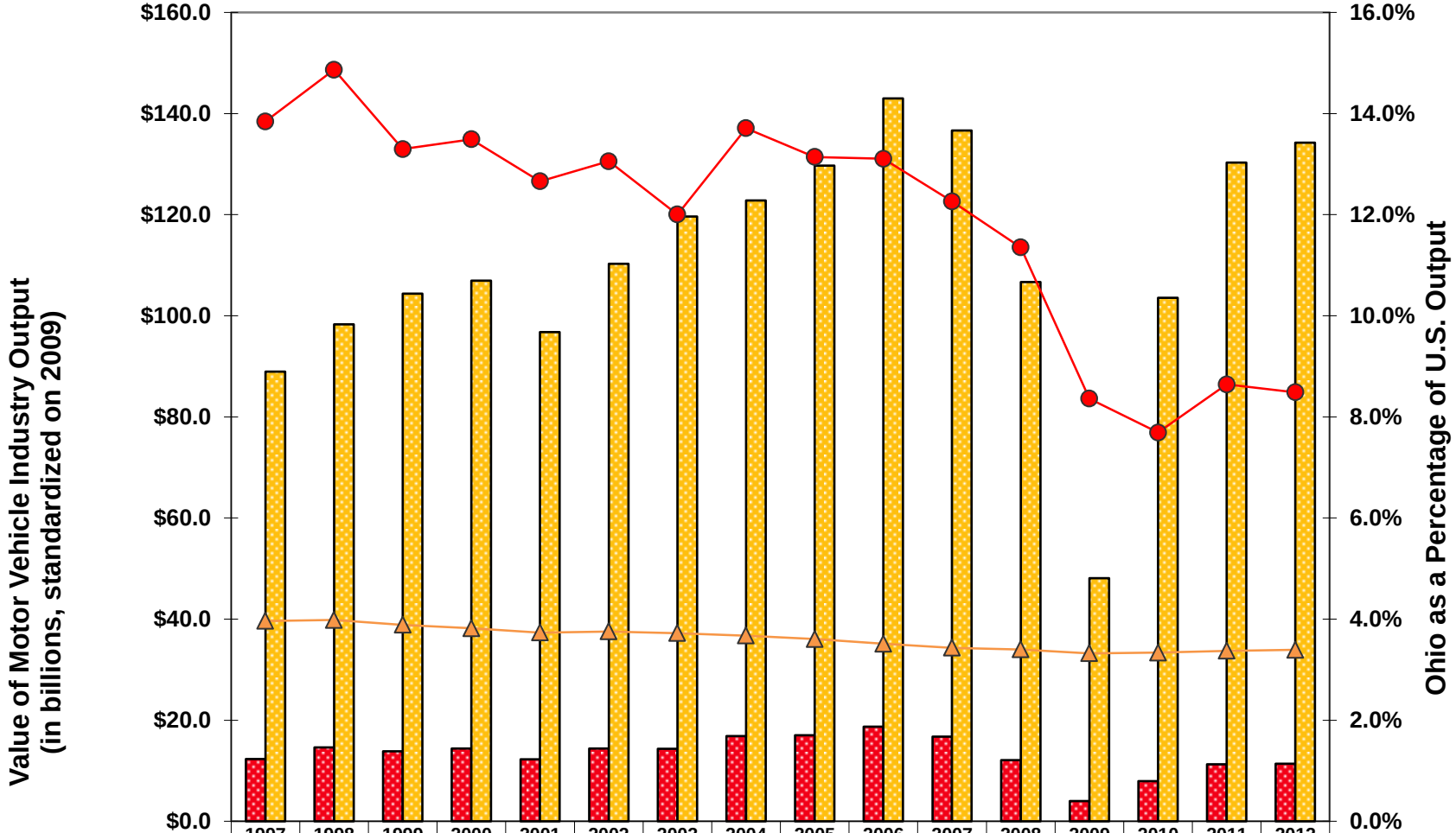
EMPLOYMENT DATA FOR THE BROADER INDUSTRY

The data from County Business Patterns, while time-delayed, permit a more inclusive and detailed description of industry employment changes.[10] The chart above shows employment in Ohio's motor vehicle industry first rose from 122,800 in 2002 to 133,300 in 2003 before falling to 77,500 in 2010. The biggest drop occurred from 2008 to 2009 when 27,400 jobs were lost. Employment has since risen to 83,000. The net loss of 39,800 jobs in 10 years is a 32.4 percent decline. The job losses were almost entirely in the two groups mentioned in the preceding section: 27,100 in parts and 11,100 in assemblies – declines of close to 40 percent each.[11] This contrasts with the related industries of tire and battery production, which collectively lost 1,300 jobs, a 23.4 percent decline, and the bodies and trailers group, which lost 200, a 5.7 percent decline. Detailed data in Appendix table A8 show that job losses were seen in most of the individual industries spread within these four clusters. The few notable exceptions with net growth were in trailers, motor homes and campers (NAICS 336212-4), electrical and electronic equipment (33632 – growth has been driven by the demand for communications and entertainment devices (Levy, 2014: 13)) and seating and interior trim (33636).[12]

The chart above also illustrates Ohio's broader industry summary employment figures as percentages of the corresponding national totals. The 122,800 employees in 2002 were 11.4 percent of the U.S. total, and the 77,500 in 2010 were 11.2 percent. The nearly constant percentages while employment changed so dramatically mean that what happened in Ohio was generally part of what happened across the country. Appendix table A8 shows variations for specific industries, but the overall trend is quite similar. Meanwhile, Ohio's lower percentages in 2011 and 2012 might reflect the effects of East Asian floods on Honda's Ohio plants in 2011 and the wind-down of production at FCA's Toledo North plant in 2012.

See Table A8

Motor Vehicle Industry (NAICS 3361-3363) Output and Its Concentration in Ohio, 1997-2012



	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Ohio MV Output	$12.3	$14.6	$13.9	$14.4	$12.3	$14.4	$14.4	$16.8	$17.0	$18.7	$16.8	$12.1	$4.0	$8.0	$11.3	$11.4
U.S. MV Output	$88.9	$98.3	$104.4	$106.9	$96.8	$110.3	$119.7	$122.8	$129.7	$143.0	$136.7	$106.7	$48.1	$103.6	$130.3	$134.3
Ohio MV as Pct. of U.S.	13.8%	14.9%	13.3%	13.5%	12.7%	13.1%	12.0%	13.7%	13.1%	13.1%	12.3%	11.4%	8.4%	7.7%	8.6%	8.5%
Ohio Total as Pct. of U.S.	4.0%	4.0%	3.9%	3.8%	3.7%	3.8%	3.7%	3.7%	3.6%	3.5%	3.4%	3.4%	3.3%	3.3%	3.4%	3.4%

Source: U.S. Bureau of Economic Analysis

GROSS DOMESTIC PRODUCT

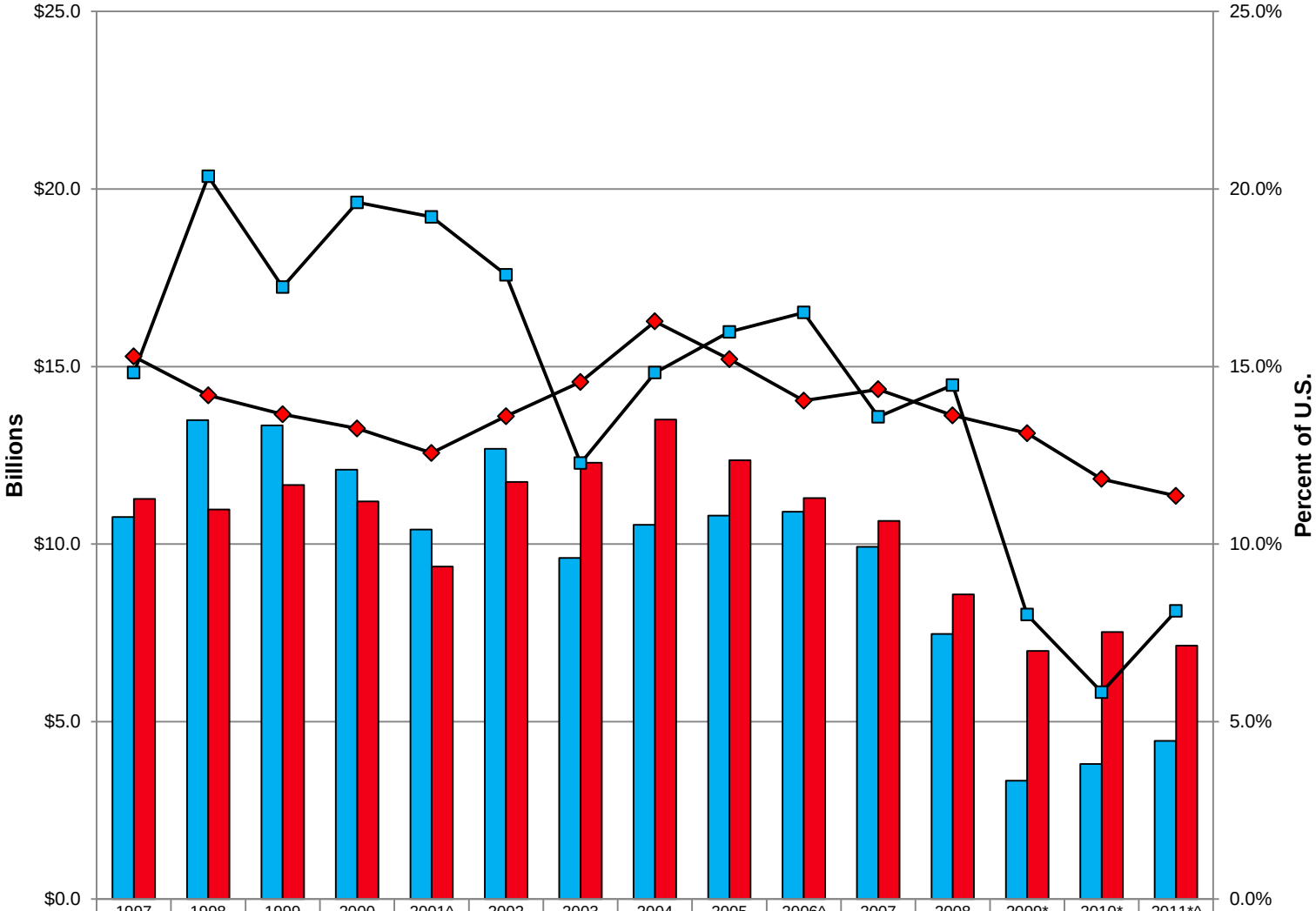
Gross Domestic Product (GDP) data are summary figures for the final values of goods and services added by people working during a year. Values are calculated for each industry in every state, including, of course, the motor vehicle industry (NAICS 3361-3) in Ohio. The cyclical nature of motor vehicle industry output is evident after adjusting for inflation. It is easier to see in the chart above where national output (indicated by the yellow columns) rose 20.2 percent from 1997 through 2000 before falling in 2001. Output more-than-recovered in 2002, and continued growing through 2006 – an increase of 47.7 percent – and was still very high in 2007 before plummeting 66.4 percent by 2009. Output jumped 179.2 percent as production returned to pre-recession levels in 2011 and 2012, the latest years for which data are available. Output from Ohio (the red columns) corresponds closely with the national trends: 17.1 percent growth in 1997-2000, 52.0 percent growth in 2001-2006, a 78.6 percent plunge in 2006-2009, and a 185.0 percent leap in 2009-2012. In short, production trends in Ohio's motor vehicle industry largely reflect what has happened throughout the nation.

Normally such swings in output are principally due to consumers' desires to feel comfortable before spending so much money. Sales and production typically rise during periods of sustained economic growth because jobs are plentiful and customers feel sufficiently confident making large expenditures. Conversely, sales and production fall when the economy contracts and the unemployment rate is high. Sales and production also are affected by secondary factors such as the cost of operation (insurance, gasoline, etc.), engineering and style changes, safety and other qualitative improvements (which make older models obsolete) and low interest rates (Levy, 2014: 26). The severe downturn of the 2008-2009 recession may have been exacerbated by the near collapse of the financial system and the initial constriction of credit for businesses as well as consumers.

The chart above also illustrates the concentration of the industry in the state. While economic activity in Ohio ranged between 3.3 and 4.0 percent of total domestic output (indicated by the orange triangles), typically 12 to 14 percent of U.S. motor vehicle industry goods (the red dots) originated here. Only with the onset of the recession in late-2007 does the industry concentration in Ohio start to fall. The drop in concentration incorporates the permanent closure of GM's Moraine plant in January, 2009, its closure of the Mansfield stamping plant and Ford's closure of a Cleveland engine plant. Ohio was second only to Michigan in motor vehicles industry output from 1997 through 2008, slipping to third – after Indiana – thereafter (U.S. Bureau of Economic Analysis, 2014a).

See Table A9

Value-Added in Ohio's Motor Vehicle Industry
(NAICS 3361 & 3363) 1997-2011



	1997	1998	1999	2000	2001^	2002	2003	2004	2005	2006^	2007	2008	2009*	2010*	2011*^
3361: Assembly Value	$10.8	$13.5	$13.3	$12.1	$10.4	$12.7	$9.6	$10.5	$10.8	$10.9	$9.9	$7.5	$3.3	$3.8	$4.5
3363: Parts Value	$11.3	$11.0	$11.7	$11.2	$9.4	$11.8	$12.3	$13.5	$12.4	$11.3	$10.6	$8.6	$7.0	$7.5	$7.1
3361: Assembly Pct. of U.S.	14.8%	20.4%	17.2%	19.6%	19.2%	17.6%	12.3%	14.8%	16.0%	16.5%	13.6%	14.5%	8.0%	5.8%	8.1%
3363: Parts Pct. of U.S.	15.3%	14.2%	13.7%	13.3%	12.6%	13.6%	14.6%	16.3%	15.2%	14.0%	14.4%	13.6%	13.1%	11.8%	11.4%

Source: U.S. Census Bureau

* - Less reliable data; ^ - Unrevised estimate

VALUE-ADDED BY OHIO'S MOTOR VEHICLE INDUSTRY

Value-added data provide additional insight because they are available at the group level.[13] The chart and data table above illustrate a number of characteristics of the industry:

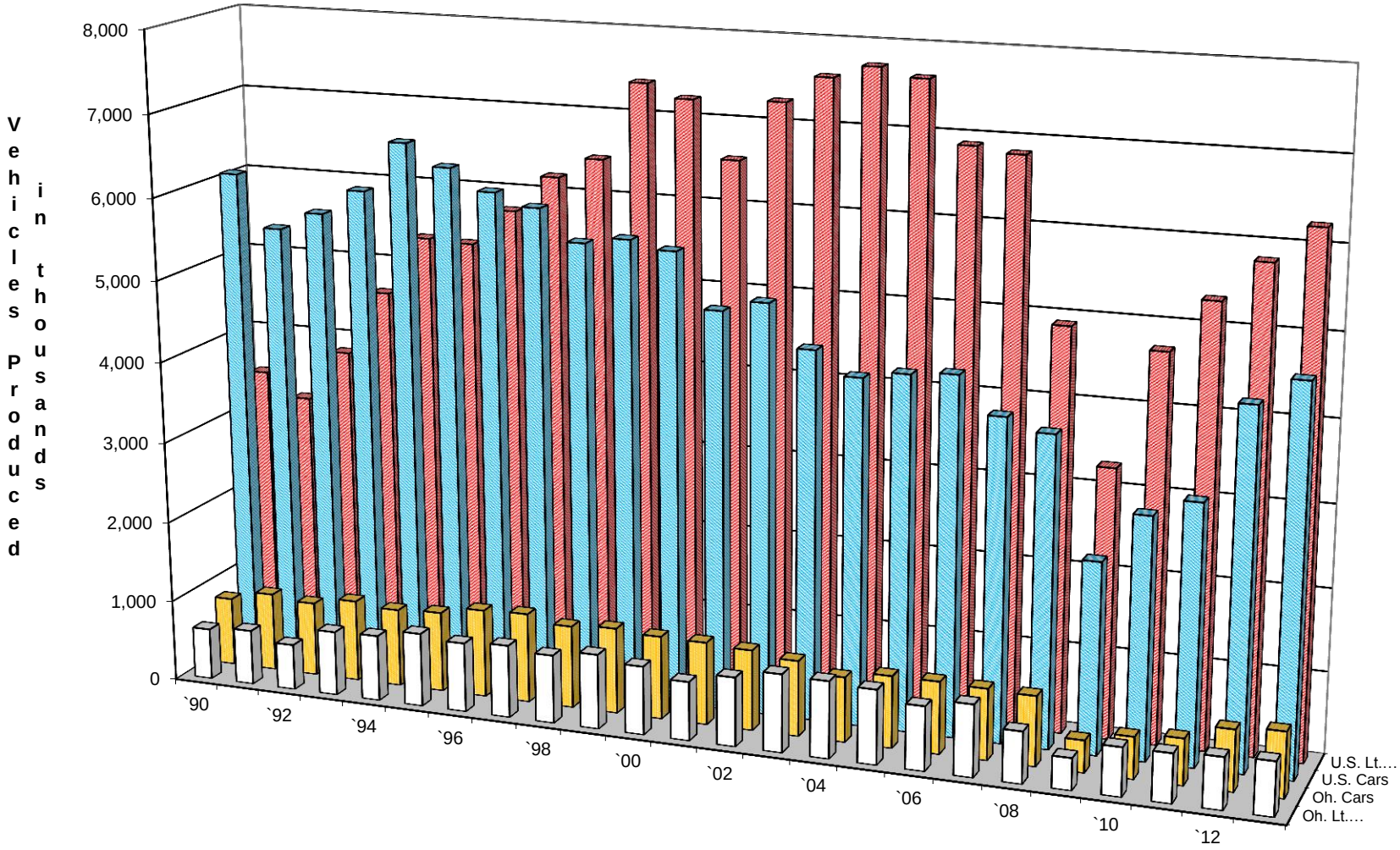
- The industry in Ohio is overwhelmingly comprised motor vehicle assembly and parts operations; both are multi-billion-dollar industries. Values-added in assembly and parts operations (indicated by the blue and red columns) were $4.5 and $7.1 billion, respectively, in 2011, close to the lowest in the time covered. (There is no adjustment for inflation.) These amounts contrast with the smaller industrial role of the bodies and trailers group, where value-added is usually less than $.5 billion in any year here.[14] During the 15-year period shown, value-added by assembly plants contributed an average of 46.8 percent of industry output from Ohio, parts plants added 51.0 percent, and bodies and trailers plants chipped in 2.2 percent. However, value-added by the parts group has been greater than value-added by the assembly group since 2003.

- Assembly and parts operations are directly dependent on one another, but they do not necessarily change in the same direction from one year to the next. This reflects the facts that parts made here are used in vehicles assembled here and elsewhere, and parts made outside of Ohio may be used by assembly plants here. Parts also are made for the replacement (i.e., repair) market as well as new vehicles.

- The overall concentration of the motor vehicle industry in Ohio reflects the concentration of the two largest groups, assembly and parts operations (the blue squares and red diamonds, respectively), much more than the bodies and trailers group. From 1997 through 2011, the percentage of value-added by assembly operations in Ohio ranged from 5.8 to 20.4 percent of the national total, while parts operations ranged from 11.4 to 15.3 percent of the corresponding total. The steeper plunge from 2006 to 2009 in value-added at assembly plants – nearly $7.6 billion, or 69.4 percent – reduced Ohio's portion of the corresponding national value-added to the single digits. This reflects the closure of GM's Moraine plant by 2009 as well as the impact of the recession. While value-added by the parts group also fell, the drop was not as severe – $4.3 billion, or 38.1 percent – and the portion of such value-added from Ohio remained in the range of 1997-2011.[15] This comparatively milder drop in value-added for parts may be the aggregative result of two countervailing tendencies: on one hand, people tend to postpone large expenditures in hard times; on the other hand, they are more likely to repair than to replace vehicles in hard times. Values-added in both the assembly and parts groups have risen in the current economic expansion, but their portions of the national totals have been below their long-term averages.

See Tables A9 & A10

Light Vehicle Production in Ohio and the U.S., 1990-2013



	`90	`91	`92	`93	`94	`95	`96	`97	`98	`99	`00	`01	`02	`03	`04	`05	`06	`07	`08	`09	`10	`11	`12	`13^
Oh. Lt. Trucks	631	678	565	796	813	907	855	893	840	918	842	723	848	957	944	912	785	878	630	389	592	596	627	654
Oh. Cars	843	967	915	1,006	960	989	1,085	1,105	1,016	1,056	1,022	1,016	990	928	797	882	885	870	854	394	511	566	745	795
U.S. Cars	6,078	5,440	5,667	5,982	6,601	6,340	6,083	5,934	5,554	5,638	5,542	4,879	5,019	4,510	4,230	4,321	4,367	3,924	3,777	2,331	2,934	3,149	4,326	4,649
U.S. Lt. Trucks	3,464	3,177	3,808	4,608	5,332	5,306	5,749	6,197	6,448	7,387	7,228	6,546	7,261	7,577	7,731	7,625	6,893	6,828	4,896	3,280	4,695	5,322	5,804	6,238

Sources: Automotive News & Ward's.

^ - Initial estimate, subject to revision

LIGHT VEHICLE PRODUCTION IN OHIO AND THE U.S.

Light vehicle production is the core of the motor vehicle industry, comprising the vast majority of all motor vehicles made. The chart above illustrates the ups and downs of production in Ohio and the U.S. from 1990 through 2012. These fluctuations reflect various influences, including economic expansion and contraction, the opening and closing of plants, and changes in companies' product-mixes. In Ohio, the majority of production shifted from light trucks to cars during the mid-1980s as Honda increased production in first Marysville and then in E. Liberty. Cars were the majority of light vehicles produced in Ohio from 1990 through 2002. 2003 was the first year since 1988 in which more light trucks than cars rolled off assembly lines in Ohio. Neither car nor light truck production has consistently dominated since then, although light truck production has dropped with the closure of Ford's Lorain plant in 2005 and GM's Moraine plant in 2008-9. However, it rebounded in 2010 as Honda's E. Liberty plant changed to emphasize sport-utility vehicles. Car assemblies were again the majority in 2012 and 2013 after Honda recovered from the effects of floods in E. Asia.

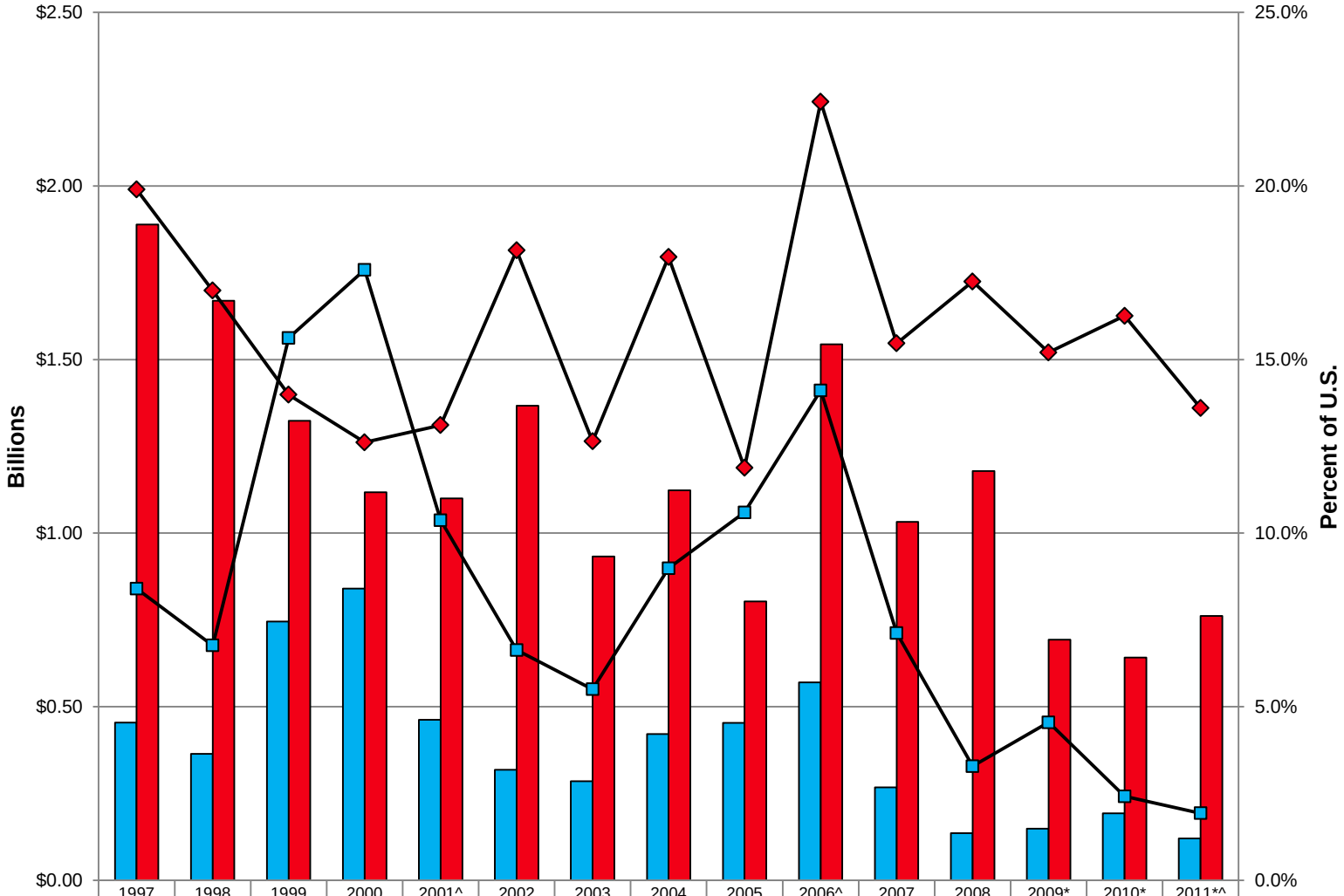
This differs from the national trend. Data in table A11, as well as the chart above, show production shifting from cars to light trucks. Car production still comprised 63.7 percent of U.S. light vehicle production in 1990. By 1997, car production was 48.9 percent of the same, and fell to 35.4 percent in 2004. It rose above 40 percent during the recession years of 2008-9, but dropped below that level as recovery took hold in 2010.[16] It rose again to 42.7 percent in 2012-13. Several explanations have been offered for these shifts: 1) using car platforms and adding car-like amenities and handling characteristics made light trucks substitutes for large cars and station wagons over the long term (Levy, 2010: 9); 2) higher profit margins and the lower corporate average fuel economy (CAFE) requirements of the time assemblers to emphasize light truck production (Gott, et.al., 1999); nevertheless 3) light truck sales (and hence production) drop when fuel prices rise and/or the economy falters (Levy, 2014: 4, 8, 13).[17]

These contrasting shifts of production-mixes mean that Ohio has become a relatively more important source for cars, rising from 13.9 percent of U.S. output in 1990 to a peak of 22.6 percent in 2008; it has been about 17 percent for the last few years. At the same time, the state became a relatively less important source for light trucks. Factories in Ohio produced 21.3 percent of the nation's light trucks in 1991, but less than 13 percent since 1999. Ohio moved up from third to second rank in car production (after Michigan), but fell from first and second rankings in light truck production to second and third (after Michigan and occasionally Missouri).

Throughout this transition, Ohio has typically been the source of one-seventh to one-sixth of light vehicles made in the U.S. The combined high numbers of cars and light trucks almost always make Ohio the second-ranked source for light vehicles.

See Table A11

Capital Expenditures in Ohio's Motor Vehicle Industry
(NAICS 3361 & 3363) 1997-2011



	1997	1998	1999	2000	2001^	2002	2003	2004	2005	2006^	2007	2008	2009*	2010*	2011*^
3361: Assembly Expndtrs.	$0.45	$0.36	$0.75	$0.84	$0.46	$0.32	$0.29	$0.42	$0.45	$0.57	$0.27	$0.14	$0.15	$0.19	$0.12
3363: Parts Expndtrs.	$1.89	$1.67	$1.32	$1.12	$1.10	$1.37	$0.93	$1.12	$0.80	$1.54	$1.03	$1.18	$0.69	$0.64	$0.76
3361: Assembly Pct. of U.S.	8.4%	6.8%	15.6%	17.6%	10.4%	6.6%	5.5%	9.0%	10.6%	14.1%	7.1%	3.3%	4.5%	2.4%	1.9%
3363: Parts Pct. of U.S.	19.9%	17.0%	14.0%	12.6%	13.1%	18.1%	12.6%	18.0%	11.9%	22.4%	15.5%	17.2%	15.2%	16.3%	13.6%

Source: U.S. Census Bureau

* - Less reliable data; ^ Unrevised estimate

CAPITAL EXPENDITURES FOR OHIO'S MOTOR VEHICLE INDUSTRY

The chart above shows how much money companies have spent purchasing land, buildings, and equipment for production in Ohio, both in dollars (columns) and as a percentage of all such industry expenditures in the nation (squares and diamonds). It focuses on expenditures at assembly plants (blue) and parts plants (red). It is evident that annual capital expenditures at parts plants typically ranged between $1-2 billion – although the latest three years were less than $1 billion per year – and amounted to 11.9 to 22.4 percent of the U.S. totals, averaging 15.8 percent. Expenditures at assembly plants usually were less than $500 million and were 1.9 to 17.6 percent of national totals, averaging 7.9 percent. Capital expenditures for body and trailer production in Ohio also vary widely, but seldom exceeded $20 million a year and averaged 3.0 percent the national total. Total expenditures fluctuated during the years shown, ranging between $842 million and $2.37 billion (2010 and 1997). Figures within this range were 7.0 to 18.8 percent of the industry's annual investments (2010 and 2006). The 15-year average was 12.3 percent.

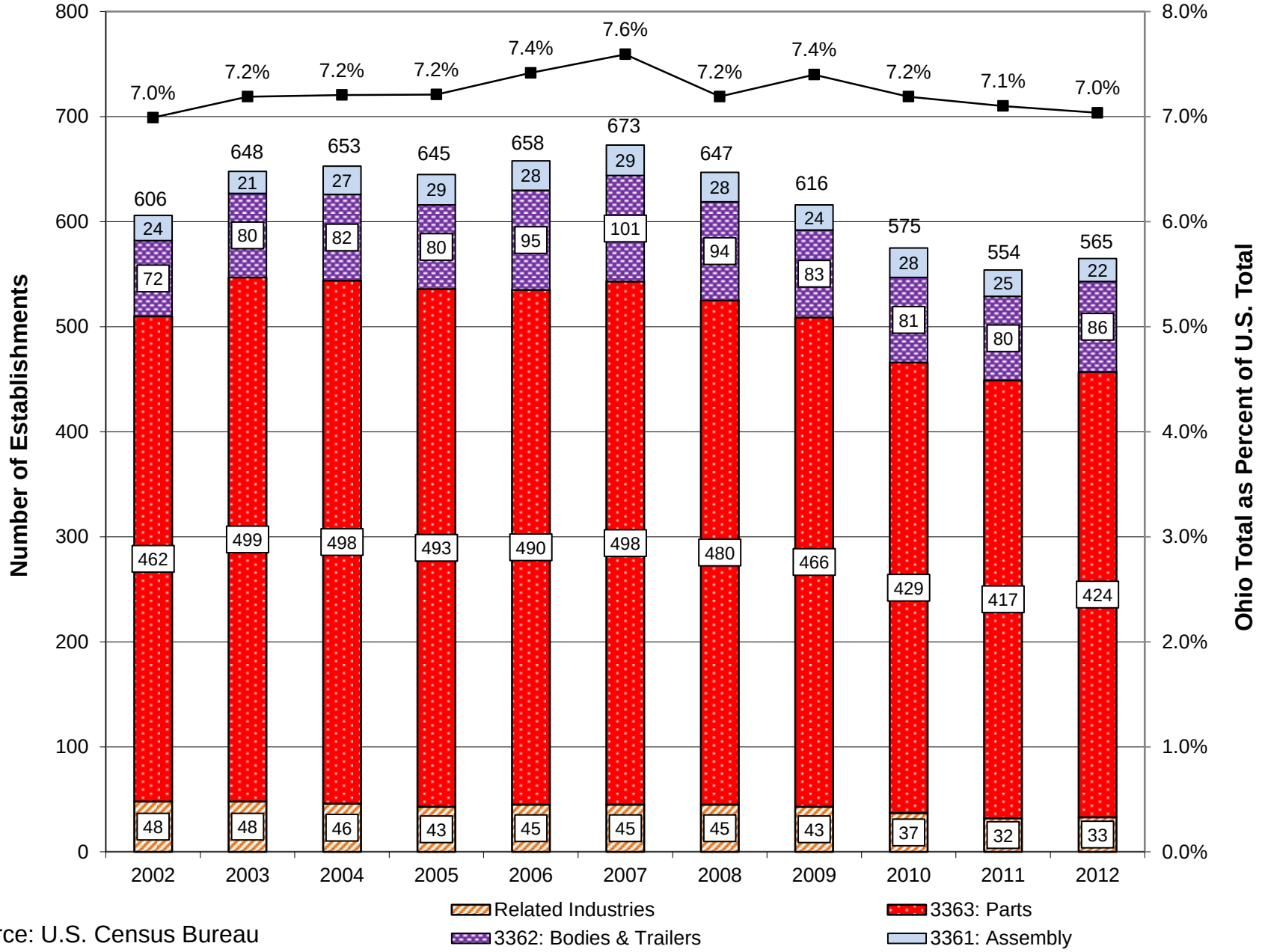
Levy (2004) offers an explanation of the up-and-down character of industry investment at the local level. He notes that large capital expenditures are required for product development and launching new models. While companies do this all the time, individual models typically are made at just one plant, with the consequence that capital expenditures at the local level may be highly variable over the course of the years, and a major changeover could require extensive changes costing billions (Levy, 2014: 31). This also may be true of engine, transmission and the larger stamping plants. Based on the chart above, this certainly appears true for Ohio.[18]

Most capital expenditures in Ohio are made for parts production: the average over the latest 15 years is $742 of every $1,000 spent. An additional $250 went into assembly operations, with the remaining $8 for bodies and trailers. These proportions vary widely from year to year.

Despite some notable exceptions, it is hard to argue that companies are abandoning their facilities in Ohio – at least in a relative sense. Short time periods make it difficult to distinguish fluctuations and volatility from genuine trends. Consequently, longer-term averages may be more useful. In this regard, the figures are fairly close. On average, 13.6 percent of the industry's value-added from 1997-2011 originated in Ohio, while industry establishments in Ohio absorbed a comparable 12.3 percent of capital expenditures, and had 11.2 percent of comparable employment in 2011. These varied by group: the figures for assembly plants were 14.8 percent of value-added, 7.9 percent of capital expenditures, and 12.2 percent of jobs, but the corresponding figures for parts plants were 13.9 percent, 15.8 percent, and 12.7 percent.

See Tables A5, A10 & A12

Establishments Trends in Ohio's Motor Vehicle Industry: 2002-2012



Source: U.S. Census Bureau

ESTABLISHMENTS

Further evidence that the motor vehicle industry has not abandoned production in Ohio is seen in above chart showing the number of establishments by industry group from 2002 to 2012. The total number of industry establishments appears to rise and fall with the industry expansion and contraction, although the recent the rise in establishments appears to lag the start of recovery by two years. Despite the number of industry establishment varying between 554 and 673 (the latter is 121.5 percent of the former), Ohio's portion of the national total varied between 7.0 and 7.6 percent. This little-varying portion is consistent with the idea that what has happened in Ohio is more or less part of what was happening in the national industry.

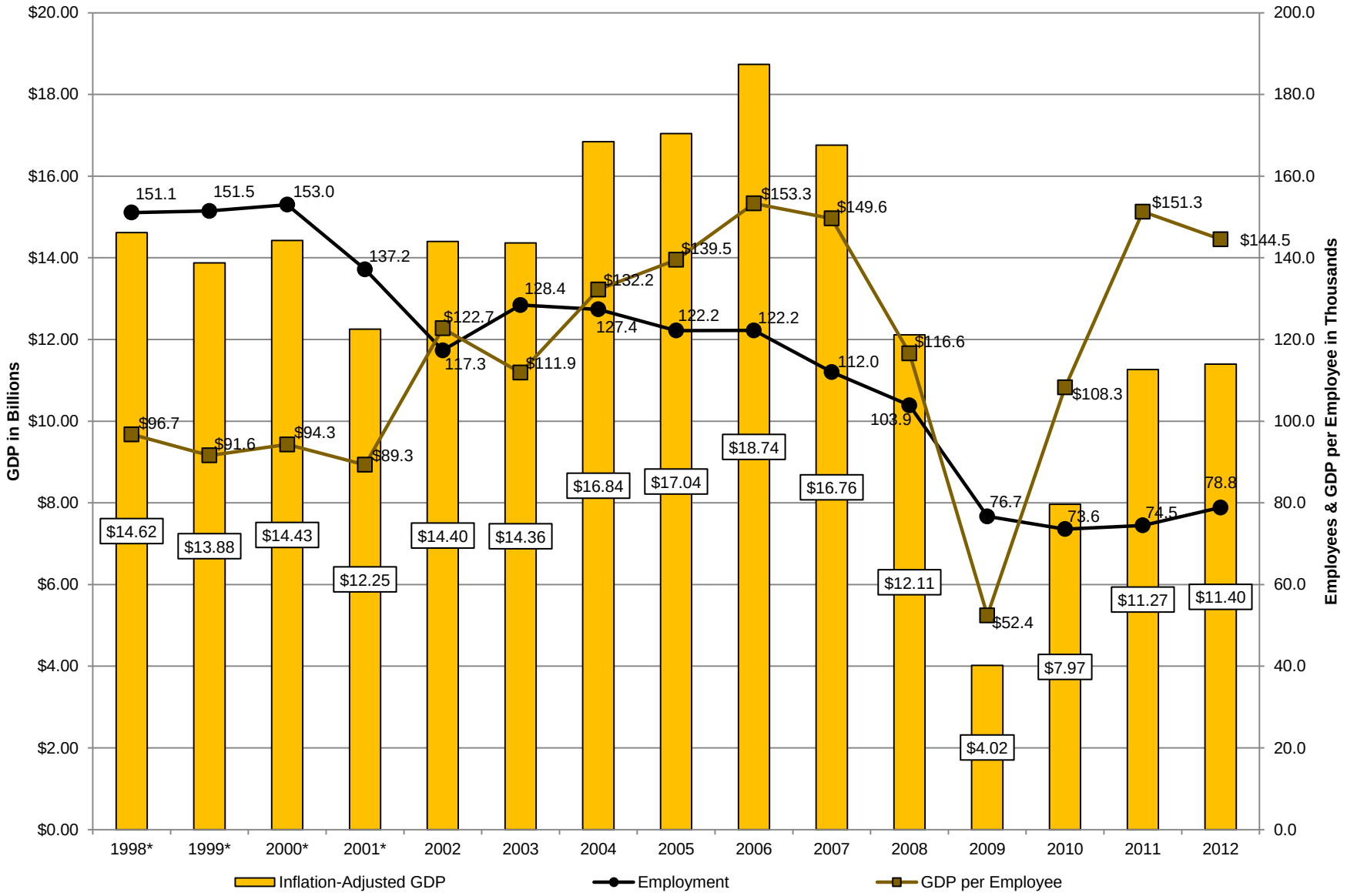
These fluctuations are the aggregate result of all the changes in the constituent industries, but most of the changes are seen primarily in the parts group (NAICS 3363), which ranged between 417 and 498, and secondarily in the bodies and trailers group (3362), which varied from 72 to 101. The variations in the assembly group (3361), from 21 to 29, seem less noticeable because of the relatively small number of such plants. This is misleading because the closure of GM's Moraine plant and Ford's Lorain plant had much larger – and negative – impacts on Ohio's economy than any fluctuating numbers of a few much smaller light vehicle plants (33611) could. The up-and-down variations of these three groups contrast with the trend in related industries toward fewer establishments. Detailed figures in Appendix table A13 specify most of the reduction to the tire industry (32621) as well as showing variations in other specific industries.

There are number of possible explanations for these changes. Analysts such as Levy (2014) have noted the consolidation of parts manufacturers as well as the desires of assemblers to deal with fewer suppliers, either of which could result in plant closures or repurposing for another industry. Some suppliers could have gone out of business with the recession while others opened new plants. It also is possible that some suppliers were reclassified one or more times during this time. In good years for the motor vehicle industry, a supply plant may be classified as part of the industry because that is where it makes the plurality of its revenue. In bad years for the motor vehicle industry, the same plant may be classified outside of the industry because the plurality of its revenue is made outside of the industry.

See Table A13

Selected Trends in Ohio's Motor Vehicle Industry, 1998-2012

(Gross Domestic Product, Employment and Productivity in NAICS 3361-3)



Sources: U.S. Bureaus of the Census and Economic Analysis

* - Employees and GDP per Employee are estimated

OUTPUT, EMPLOYMENT AND PRODUCTIVITY

The chart above juxtaposes three trends in Ohio's motor vehicle industry (NAICS 3361-3): inflation-adjusted gross domestic product (GDP, gold columns), aggregate employment (black dots) and GDP per employee (brown squares). The most striking comparison is GDP with employment. Changes in GDP illustrate the changing volume of industry goods originating here, rising and falling – though not always in lock-step – with the economy's overall expansions (1998-2000, 2002-2007, and 2010-2012) and contractions (2001 and 2008-2009). Industry employment fell with reduced output volumes in 2001 and 2008-2009, and continued falling even as output grow in the corresponding following years of 2002 and 2010. However, employment grew in the subsequent years of 2003 and 2011. These patterns of change indicate employment lags output at least early in expansions. This is understandable, as employers add hours for existing employees before adding new employees to reduce overtime and associated expenses.

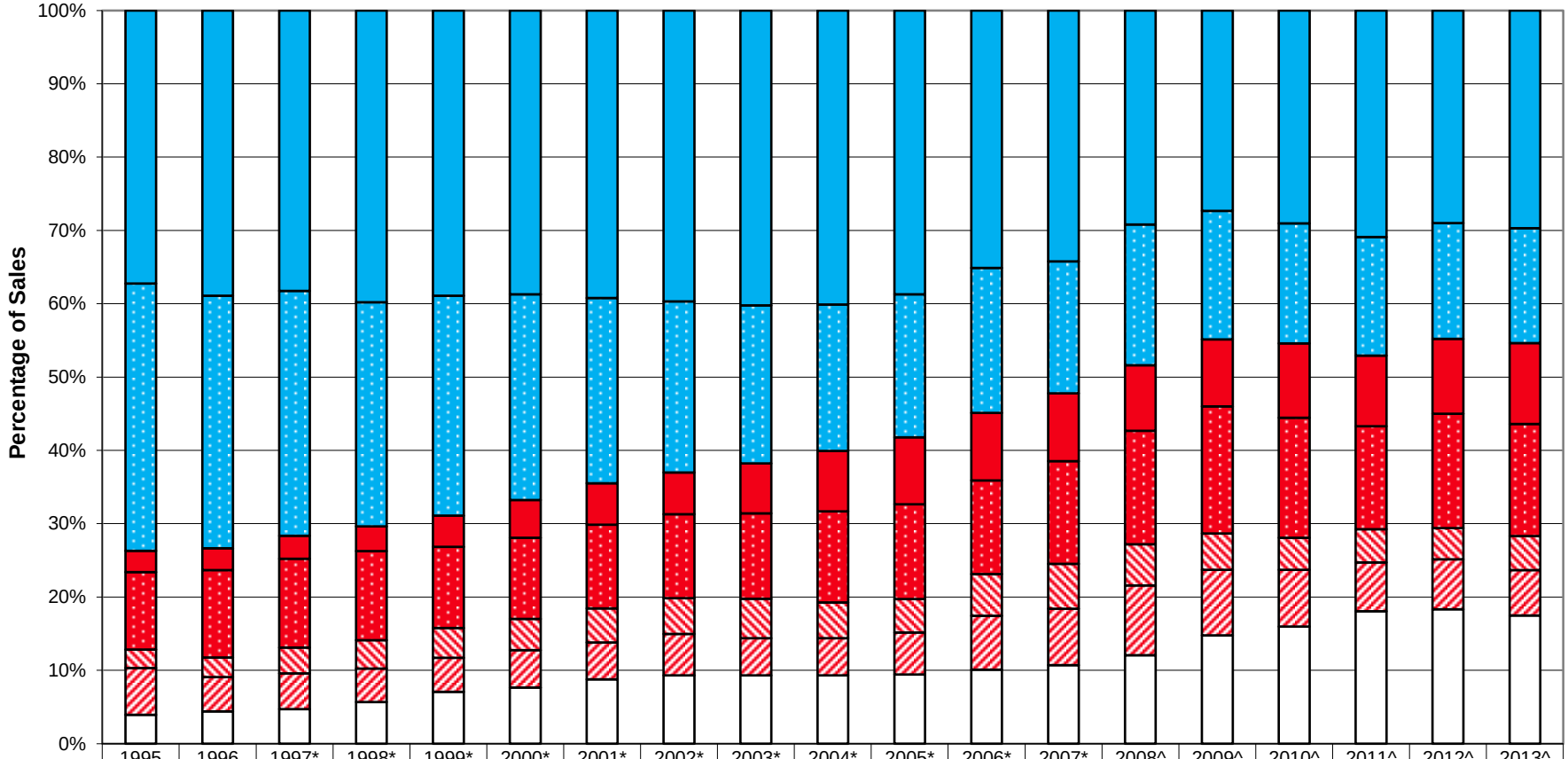
However, the most significant industry change during this time may be the increasing output per employee. In the first three years shown above, GDP and employment were fairly steady, with the former around $14 billion per year (give or take a few hundred million), and the latter ranging between 151,000 and 153,000. This means output per employee averaged $91-$97,000 per year after adjusting for inflation. Even in the recessionary year of 2001, with aggregate output and employment both declining, output per employee was barely dented at $89,300. (This seems consistent with economists' conclusion that that recession was short and relatively mild.) Increases in productivity appear in 2002 with output per employee rising to $122,700. Even as aggregate employment rose and output was nearly unchanged in 2003, output per employee remained greater than seen in the first four years. Output per employee continued to grow from 2003 through 2006, peaking at $153,300 – all the more impressive as aggregate employment fell. It was only during the depths of the last recession – 2009 – that output per employee fell substantially below the levels of about a decade earlier. By 2011, output per employee rivaled that of 2006. Initial estimates for 2012 – industry GDP at $11.4 billion and County Business Patterns employment at 78,800 – show output per employee at $144,500. The slight decrease is similar to that seen in 2002-2003.

Data show in Appendix tables A8, A9 and A14 document a similar – albeit smoother – transition to greater output per employee across the nation. Industry GDP-per-employee rose from $84,300 in 1998 to $145,100 in 2007. Productivity plummeted to $72,600 in 2009 and rose to $195,200 in 2011. The initial estimate for 2012 was $184,700. The long-term net rise in productivity was facilitated at least in part by capital expenditures, which among other things, increased automation.

See Tables A8, A9 & A14

U.S. INDUSTRY ANALYSIS AND OUTLOOK

U.S. Market Share Sales Trends in Light Vehicles by Brand & Import Status: 1995 - 2013



	1995	1996	1997*	1998*	1999*	2000*	2001*	2002*	2003*	2004*	2005*	2006*	2007*	2008^	2009^	2010^	2011^	2012^	2013^
U.S.B.T.	37.2%	38.9%	38.2%	39.8%	38.9%	38.7%	39.2%	39.7%	40.2%	40.1%	38.7%	35.1%	34.2%	29.2%	27.3%	29.1%	30.9%	29.0%	29.7%
U.S.B.C.	36.4%	34.5%	33.4%	30.6%	30.0%	28.1%	25.3%	23.3%	21.5%	20.0%	19.5%	19.8%	18.0%	19.2%	17.5%	16.3%	16.2%	15.8%	15.7%
J.B.D.T.	2.9%	3.0%	3.1%	3.3%	4.2%	5.2%	5.7%	5.7%	6.8%	8.2%	9.1%	9.2%	9.2%	8.9%	9.1%	10.2%	9.6%	10.2%	11.0%
J.B.D.C.	10.5%	11.9%	12.1%	12.2%	11.1%	11.1%	11.4%	11.5%	11.7%	12.4%	12.9%	12.8%	14.0%	15.5%	17.3%	16.3%	14.0%	15.6%	15.3%
J.B.I.T.	2.5%	2.7%	3.5%	3.9%	4.1%	4.3%	4.6%	4.9%	5.4%	4.9%	4.6%	5.7%	6.1%	5.6%	4.9%	4.4%	4.5%	4.3%	4.7%
J.B.I.C.	6.4%	4.7%	4.9%	4.5%	4.6%	5.1%	5.1%	5.7%	5.1%	5.1%	5.7%	7.3%	7.7%	9.5%	8.9%	7.7%	6.7%	6.8%	6.2%
Others	3.9%	4.4%	4.7%	5.7%	7.1%	7.6%	8.8%	9.3%	9.3%	9.3%	9.4%	10.1%	10.7%	12.1%	14.8%	16.0%	18.0%	18.3%	17.5%

Sources: Automotive News, Ward's. Note: * - 1997 and later years not entirely comparable with earlier years; ^ - Automotive News data. Abbreviations used: B - Brand; C - Car; D - Domestic; I - Import; J - Japanese; T - Light Truck; U.S. - United States. Chrysler is treated as U.S.B. for the sake of continuity even though Fiat gained control of it in July, 2011.

MARKET SHARE TRENDS

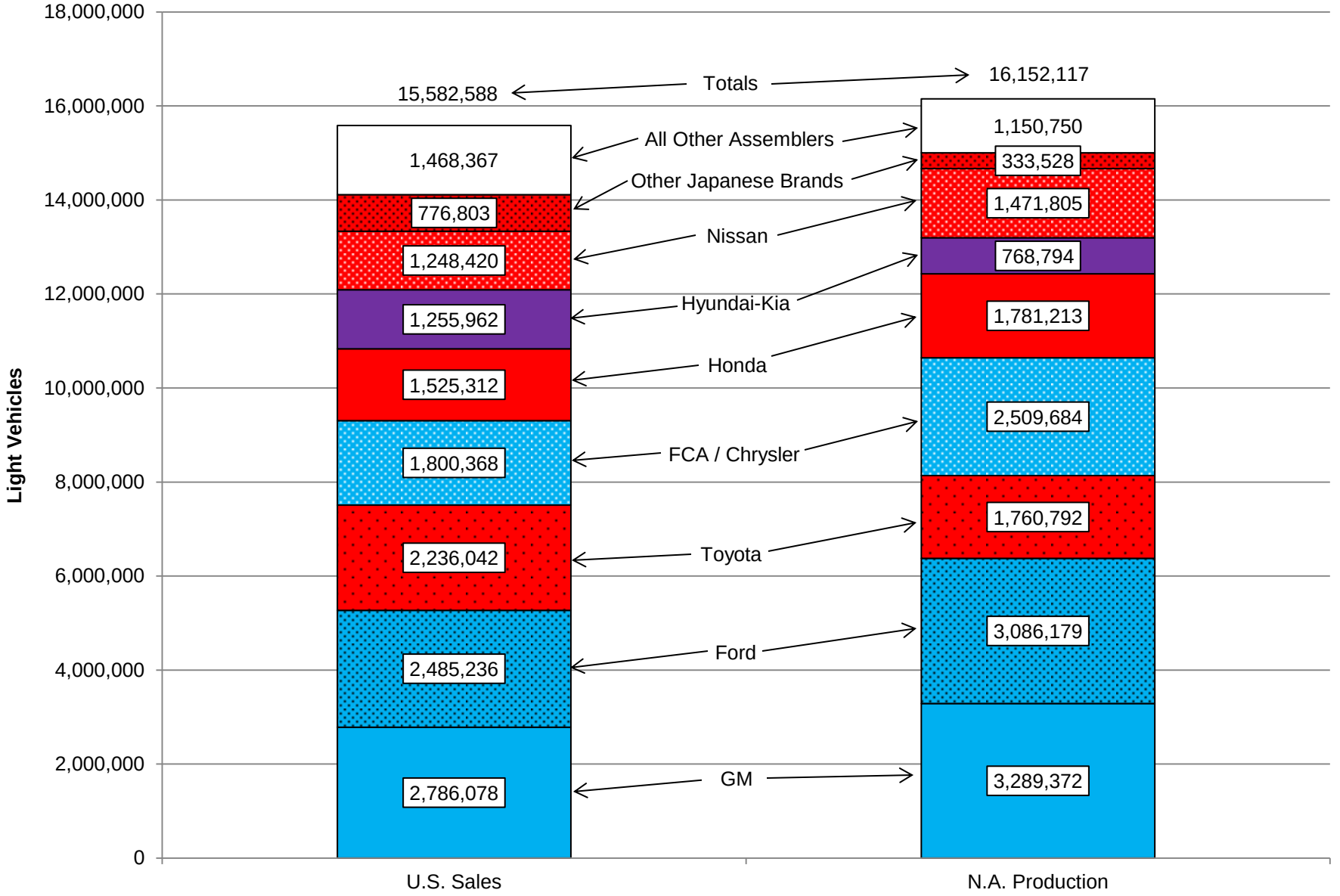
Market share trends are important because sooner or later "capacity [i.e., the number of plants and their workers] follows market share" (Harbour Consulting, 2006: 11). Beginning in the early 1970s, the U.S. light vehicle market was transformed from a stable oligopoly dominated by the Detroit Three (GM, Ford and Chrysler) since the 1950s into the most competitive market in the world. Foreign-based assemblers – those from Japan were first and have been the most successful – captured significant market shares by offering higher quality products better matching consumer demand. More followed. Competition compelled the Detroit Three to address both quality and organizational problems in the 1990s. They (and their suppliers) restructured their organizations and re-engineered their vehicles (and parts), improving design and quality while reducing costs. Design and quality issues are now much less distinguishing (Levy, 2014: 25), but the share-shift has continued.[19]

The chart above illustrates a number of market share trends in U.S. light vehicle sales from 1995 through 2013. After a relatively stable period in the early and mid-1990s, the combined share of U.S. brand cars and light trucks (USBC and USBT, blue, from the Detroit Three) fell below 70 percent of all sales in 1999, and continued to fall each year through 2009, when it was 44.9 percent. The net loss of market share for U.S. brands is the combination of two trends. Most notably, sales of USBC fell from 36.4 to 17.5 percent. While USBTs sales usually ranged between 38 and 40 percent for most of 1995 through 2005, they fell to 27.3 percent in 2009. Most of the market share lost by USBs was gained by Japanese brands (JBs, red), which collectively rose from 22.4 percent in 1995 to peak at 40.3 percent in 2009; all Other companies (white) saw their collective share rise from 3.9 to 14.8 percent. The Detroit Three reduced their capacity because of their long-term slide in market share. This was felt in Ohio with the closure of GM's Moraine assembly plant and its Mansfield stamping plant during the last recession. Similarly, Ford closed its Cleveland foundry and one of its engine plants; its Lorain assembly plant was closed in 2005 after a co-production agreement with Nissan ended.

Since 2009, USBs collective market share has remained around 45 percent as USBTs have recovered a few points, offsetting the continued decline of USBCs. JBs reduced market share in the last few years may be partially explained by the 2011 floods in East Asia constraining parts production, with US and Other brands picking up a few points as a consequence. As JB suppliers recovered in 2012, though, JBs have regained market share – from 34.9 to 37.1 percent by 2013 – at the expense of USBs and Others. (Levy, (2014: 20-21) comes to the same conclusion.) The collective light vehicle market share of the Detroit Three may have slipped a bit in the first half of 2014 compared with the first half or 2013 (Levy, 2014: 4).

The chart also illustrates the shift to N. American production for JB sales: from 13.5 percent in 1995 to 26.5 percent in 2009 and 2010 – a 13 point gain – and 26.3 in 2013. By comparison, JB imports rose 6.2 points from 8.9 to 15.1 percent

2013 U.S. Sales and N.A. Production
of Light Vehicles by Company*



Source: Automotive News

Note: * - Tesla excluded due to incomplete data

in 2008, but have since dropped to 10.8 percent. Shifting production from Japan to N. America achieved intended goals: circumvent the import quotas seen in the 1980s, insulate sales from the effects of changing currency values (higher yen values make imported Japanese vehicles relatively more expensive when compared with vehicles produced in N. America), and facilitate adaptation to local tastes.[20]

Finally, it should be noted that the long term growth in market share of Others – 17.5 percent in 2013 – largely reflects the success of Hyundai-Kia, now at 8.1 percent. (Levy (2014: 22) confirms this.) Hyundai-Kia has followed the Japanese strategy and derives most of its U.S. sales from domestically produced vehicles. By comparison, the remaining nine Other companies are mostly reliant on imports (Automotive News, 2014).

The chart above illustrates current market shares by company, singling-out those whose U.S. sales exceeded 1,000,000. GM tops the list with almost 2.79 million, followed by Ford with more than 2.48 million and Toyota with nearly 2.37 million. FCA's Chrysler division, Honda, Hyundai-Kia and Nissan each had sales ranging from about 1.80 to 1.25 million. These seven companies held 85.6 percent of the market, individually ranging from 17.9 to 8.0 percent (GM to Nissan). Four other Japanese assemblers combined for 776,800, amounting to almost 5.0 percent of the market. The remaining nine – all European brands – sold almost 1.47 million light vehicles for a 9.4 percent share.[21] U.S. brands (blue, a.k.a. the Detroit 3) held the plurality of sales at 45.4percent; the three largest Japanese brands had 32.2 percent, and Korean Hyundai-Kia had 8.1 percent (Automotive News, 2014).

The chart above has a second column showing the 2013 N. American production of the same seven companies and summaries for other assemblers.[22] These seven companies made 90.8 percent of the light vehicles, with the Detroit 3 producing 55.0 percent. If Japanese and Other brands accounted for 54.6 percent of U.S. sales but only 45 percent of production, then they still substantially rely on imports for their U.S. market shares even when the majority of what they sell in the U.S. is made in N. America (Automotive News, 2014).[23]

The U.S. heavy-duty truck market is a different story for two reasons. First, few heavy-duty trucks are manufactured outside of N. America because distances travelled are shorter and few roads could accommodate them. Second, the few foreign-based assemblers in the U.S. market have preferred to buy U.S.-based assets rather than establish their own manufacturing facilities.[24] However, some foreign medium-duty truck makers have made some inroads into the U.S. market with their exports (Corridore, 2014: 17).

See Tables A15a & A15b

INDUSTRY OPERATIONS AND RECENT TRENDS

Companies making light vehicles (NAICS 33611) and companies assembling medium- and heavy-duty trucks (33612) have a number of characteristics in common despite serving different markets. (The former serve mostly families and individuals, the latter supply capital goods to organizations and individual operators.) Both produce some of their vehicle components as well as purchasing other parts from independent suppliers. The modules and parts – mostly comprised of metals, plastics, rubber or glass – are shipped to plants where workers assemble them into vehicles. Both engage in the more-profitable-but-riskier activities of leasing and financing.[25] Medium- and heavy-duty truck makers also offer logistical, maintenance and repair services (Levy, 2014; Corridore, 2014: 11).

Price competition in both industries is intense and continuous regardless of how well the economy is doing, but for different reasons. Light vehicle companies are competing in a market that has not been an oligopoly for decades, which limits their pricing power (Levy, 2010: 22). On the other hand, heavy-duty truck buyers have the size, financial-soundness and knowledge of market choices to counter-balance the oligopoly of Daimler, Navistar, Paccar and Volvo (Corridore, 2014: 17). Companies in both industries have used rebates and discounts as a competitive strategy more or less frequently.[26] In the same vein, sales in both industries also are affected by the availability of credit and the costs of ownership (Corridore, 2014: 7-8; Levy, 2014: 26); in addition, sales of medium- and heavy-duty trucks will spike higher ahead of new government regulations aimed at reducing pollution *if* buyers believe the new vehicles will be more expensive to own and/or operate, and, given such behavior, sales will drop in the year following the implementation (Corridore, 2014: 7-8). As mentioned before, engineering, safety and quality improvements as well as changes in style affect light vehicle sales (Levy, 2014: 26).

Both industries are cyclical,[27] but for different reasons. Purchasing a new light vehicle usually is the second largest expenditure a person or family makes, and people need to feel confident that they can afford it. As previously noted, new light vehicle sales take-off when the economy is expanding and people feel secure in their employment prospects, but can plunge when the economy contracts, jobs are scarce and people are less secure (Levy, 2014: 26). Medium- and heavy-duty trucks are capital goods, and as such, purchases may lag the economy; fleet operators order new trucks only after considering their financial strength and the outlook for their services. Purchases are made to add capacity as well as to replace aging equipment. During times of economic weakness, orders fall, or may be cancelled or deferred. Owners may choose to repair trucks, and fleet operators have even cannibalized idle trucks for spare parts (Corridore, 2014: 18).[28]

In other ways, the two industries differ. Heavy-duty trucks usually are customized to suit buyers' needs. Buyers select engines, transmissions, axles, suspensions, wheels, tires, brake systems, seating and other features based on considerations such as distance per trip, geography, and cargo type. More recent optional features that improve safety and efficien-

cy include GPS-based tracking and communications systems, antilock brakes, and crash-avoidance warning systems. Because trucks are so customized, assemblers concentrate on the design of platforms and rely on suppliers to design the various mechanical and electrical systems that they assemble into a complete vehicle. This lets assemblers maintain the lowest possible fixed-cost base and maximizes flexibility for customers. Basic vehicle redesigns may not be made for 10 years. New designs result from breakthroughs such as improved aerodynamics or weight reductions. Suppliers may make interim improvements – notably in engines, transmissions and axles, and they work with assemblers to meet safety and emissions regulations (Corridore, 2014: 17).[29]

By contrast, light vehicle makers have sought to shorten model life times to five years. They can move from sketch to prototype in less than a year and, if well-received in test marketing and cost-effective to make, to actual production in about two more years. (Prototypes failing either of those criteria are terminated.) The accelerated pace may be due in part to changing consumer tastes and regulatory requirements, but the practice also keeps a company's line-up fresh. The shorter time required to bring a new model to production is facilitated by product designers and engineers collaborating to minimize redesign work in later development stages (Levy, 2010: 20; 2014: 23); subsequent work with industrial process designers minimizes assembly time (Harbour Consulting, 2004).

The industrial process has changed over the years as companies responded to competitive pressures – either from imports or from rivals setting up operations in national markets around the world. Companies had to improve quality and cut costs wherever possible. (Better quality means, among other things, that products last longer, and that less time is needed for routine maintenance.) A number of organizational and technical changes have been made pursuing these goals. The assembly process has been simplified in a number of ways. Vehicles today contain fewer parts than in the past, and fewer parts mean lower production costs as well as less chance of assembly errors. Similarly, the number of stampings required for sheet metal parts such as hoods, trunks, fenders and doors has been reduced (Levy, 2014: 23; also see Corridore, 2014: 12).

Perhaps the most far-reaching organizational change has been the shift of some work from assemblers to tier-1 suppliers. Two examples illustrate these changes. In the past, seats were made at the assembly plant from the inventory of components. Now, assemblers order seats from an off-site facility, and have them delivered just-in-time for installation. (Suppliers delivering goods in reusable containers reduce waste and pollution costs.) Meeting these demands is easier if suppliers locate close to their customers, as orders are placed daily or for specific amounts (Levy, 2014: 23). Similarly, the pistons, cylinder liners, connecting rods, and related bearings were made by different companies at different locations and shipped to a plant for assembly. Now, a single company has combined the operations, delivering a tested, more reliable system at less cost than before (Gaines, 1999; Levy, 1999).

These examples represent more than shifting vehicle assembly work off-site. They are part of the broader reorganization of the supplier base and its relationship with assemblers. Suppliers now work with assemblers in designing, developing, and engineering components. They frequently assemble the components into modules, and do quality control testing. There are advantages and risks for both with this approach. Pooling organizational resources facilitated and shortened R&D cycles as well as actual production. Shifting these activities to suppliers reduces some investment risks and costs for assemblers while drawing both closer. Under these circumstances, contracts are no longer done annually, but for the life of the model. The contracts stipulate supplier targets for quality, costs and timeliness. In turn, assemblers agree to share profits and savings with suppliers. Tier-1 suppliers are left to decide how to meet the goals, and they can choose their own tier-2 and tier-3 suppliers (Levy, 2014: 23, 27). Failure to meet expectations can cost suppliers business. For example, Chrysler withdrew from a deal with Collins & Aikman over price and quality concerns regarding a bumper for its Ohio-made Jeep Liberty (Levy, 2004).

Another far-reaching consequence of suppliers assuming subassembly work has been the standardization of final assembly procedures for different model vehicles. In other words, when the same modules are used in different models, it is easier if those modules are assembled in the same order regardless of what model is being assembled. Given the tight schedules and close coordination between assemblers and tier-1 and tier-2 suppliers that just-in-time manufacturing requires, standardizing the process saves money (Harbour Consulting, 2004). Conversely, the commonality of parts and the standardization of assembly processes enable companies to assemble more models on one line. The key for an assembler's efficient operation then is rapidly and inexpensively making the necessary changes for different models. (An example might be re-programming welding machines instead of swapping one type for another.)

Harbour Consulting (2004) believes that this results in the more efficient use of facilities. For example, greater demand for one model produced by one plant and little demand for another made at a second plant could lead to overtime at the former and underutilization of labor and equipment at the latter. If the second plant could quickly and easily switch between production setups for the two models, then overtime could be reduced at the first plant and the second plant's facilities would be better utilized. (This also means it is easier to fill niche markets – Durbin, 2006). This can only happen if there is a just-in-time supply system, sufficient commonalities between the two vehicles' components, the assembly sequences are standardized, and the same equipment can be used for either model with little or no change.

While relationships among assemblers and suppliers may be closer and more extensive, they are not cozy. Assemblers want lower prices from tier-1 suppliers regardless of their own demand levels (and the subsequent impact on per-unit costs of suppliers) and any increased costs faced by suppliers (Levy, 2012: 20).[30] Furthermore, assemblers want to continue reducing the number of suppliers with whom they deal to trim further their own costs and increase efficiency.[31] Indeed, the number of supplier *companies* has fallen as companies merge or leave the business. (Mergers and acqui-

sitions among and by suppliers are done for a number of reasons. A larger size enables the new company to offer more products and/or integrate components into a module, thereby spreading overhead costs and reducing per unit costs. Larger companies also are better able to follow and service their clients around the world, making themselves more valuable to clients and more likely to get contracts. The most recent example of this is ZF Friedrichshafen's purchase of TRW (Associated Press, 2014). TRW has operations in Ohio.) Tier-1 suppliers, in turn, are trying to reduce the number of their suppliers in order to reduce their own costs and improve efficiency (Levy, 2004; 2014: 14).

Yet, with more invested in suppliers, assemblers and even tier-1 companies have been known to aid their crucial suppliers with staff or loans to avoid costly delays in production.[32] The recession's impact on suppliers was not as bad it could have been precisely for those reasons (Levy, 2012: 25), despite the plant closures, visits to bankruptcy courts, and/or sales of unprofitable divisions. Ironically, some of the remaining suppliers are in a better bargaining position vis-a-vis assemblers because there are fewer of them producing fewer products, and they are stretched to the limit despite lots of overtime, the addition of third shifts, and/or increasing capacity to meet demands (Levy, 2014: 14; also Sedgwick, 2012b).

TECHNOLOGIES FOR PRODUCTION PROCESSES AND VEHICLES

Innovative technologies have been an important part of improving productivity at the plant. Past examples include computer-aided design, engineering and manufacturing (CAD/CAE/CAM), the adoption of progressive die presses ("progs") at stamping plants, and the use of the Internet. It used to take 12 workers 12 weeks to produce a clay model of a proposed new vehicle. Today, one designer with CAD equipment and software can produce an animated video in three weeks, and a part may be designed in as little as one hour (Levy, 2010: 20). Progs are faster, form multiple parts with one stroke, use less space, and cost less (Harbour & Associates, 2001). Assemblers and suppliers can use the Internet to communicate more quickly and easily, while consolidating supply chain transactions and logistics to a single location can reduce companies' costs. A recent, highly publicized innovation is 3D printing, a process using CAD software that adds material layer by layer at various areas within a spatial frame to create almost any shape in a matter of minutes. It further reduces the time, cost and tools required by the industry to create prototypes (Levy, 2014: 25). Other innovations, such as the increasing use of alternative materials to make vehicles lighter – aluminum, plastics, magnesium, carbon-fiber composites, and the adhesives to bond them – have attracted less attention (Hagerty and Ramsey, 2014).

However, production process innovations may come with tradeoffs, limitations and even unforeseen or undesired consequences. For example, aluminum wheels weight less and work better with rubber than steel wheels, but aluminum costs more per pound than steel. Similarly, progs work better with coiled steel than with steel blanks, and are less effective with aluminum. Prog die changes may take longer than die changes in the tandem presses they replace, and require more training for workers. The Internet website Covisint, started by GM, Ford and Daimler-Chrysler as a one-stop bidding shop for suppliers, was sold to Compuware because it did not work as well as envisioned,[33] and, to the dismay of parts makers, the transparency of on-line procurement put downward pressure on parts prices (more so on commodity items, less so on high value-added items) (Levy, 2014: 26; also Corridore, 2014: 13).

Various technical innovations also have benefitted consumers by improving fuel economy. Gasoline and diesel engines have become cleaner and more fuel efficient, with the former extracting nearly twice as much power from a gallon of gas as they did in the mid-1980s (Eisenstein, 2012a; Whoriskey, 2011).[34] The addition of turbochargers is the most publicized technology incorporated to meet the new corporate average fuel economy (CAFE) standards.[35] Also noteworthy is the use of transmissions with more forward gears than the conventional four- and five-speeds. They have fewer parts, weigh less and perform better when accelerating or maneuvering in traffic (Harbour Consulting, 2006: 170-171). More recently, continuously variable transmissions (CVTs) have been reintroduced in pursuit of the same goals.[36]

Innovative technologies have made vehicles safer. Recent examples include tire pressure monitors, inflatable curtains, knee and side air-bags, rear view mirrors with expanded fields of vision, rear view cameras linked to dashboard monitors,

and the integration of electronic stability controls with anti-lock brakes (Levy, 2010: 19; Levy 2012: 17). Adding such safety features is credited with saving thousands of lives (Levy, 2014: 13, 18).[37]

As with production process innovations, these and other improvements have come at a price. Complying with pollution, safety and CAFE standards impacts vehicle performance. For example, the easiest way to improve fuel economy is to reduce vehicle weight, but *ceteris paribus*, that reduces safety in a collision, while adding pollution control equipment adds weight to a vehicle. Achieving these goals forced manufacturers to adopt complex solutions that increased vehicles' costs (Levy, 2014: 18).[38]

Efforts to improve fuel economy and meet emissions requirements have gone beyond improving components to include alternative power sources. People and organizations inside and outside of the industry have been investigating natural gas,[39] diesel, ethanol and electricity as supplements to, or replacements of, gasoline for years. As with other innovations, each has its advantages and drawbacks. Engines using natural gas emit fewer pollutants than gasoline, but such vehicles have limited ranges, and there is no distribution network comparable to that for gasoline or even diesel fuel. Diesel engines are more fuel efficient than gasoline engines, able to go 25-30 percent farther per gallon because they run on a leaner mixture of fuel and air. That also means, *ceteris paribus*, they emit less CO_2 than gasoline engines and accelerate faster. Clean-burning diesel engines also have been a cheaper option than engines running on natural gas (Heywood, 2006: 62). However, diesels cost more for a number of reasons: they have to be sturdier and heavier because they operate at higher pressures, and their fuel injection system is more complex. Diesel fuel is more expensive, and the number of fuel stations is limited. Both engines and fuel must also meet stricter emission standards in America.[40] Biological (and, therefore, renewable) sources of diesel fuel have been developed and are being used, although some restrictions or engine modifications may be required (Wikipedia, 2014).

The use of ethanol (a.k.a. grain alcohol) as a fuel has a long history, even though it becomes a viable supplement-to or replacement-for gasoline on an industrial scale only when the price of oil is sufficiently high.[41] Ethanol has a higher octane content than gasoline (Green, 2006),[42] and is a renewable energy source (Rohter, 2006; Wikipedia, 2014).[43] Unlike diesels, engines using ethanol are not substantially different from those using gasoline (Green, 2006). In fact, millions of so-called flexible fuel engines, which run on either gasoline or ethanol, have been made (Wikipedia, 2014), and the gasohol used in gasoline engines is 10 percent ethanol (Fischetti, 2006). The only technical disadvantages of ethanol are that it is more corrosive than gasoline – which is easily remedied, and that engines running on ethanol are hard to start when cold – which is why it is blended with gasoline. E85 fuel is 85 percent ethanol and 15 percent gasoline.[44] The EPA raised the limit on the amount of ethanol that may be blended into gasoline from 10 to 15 percent, but only for light vehicles made after 2006. This was not a mandate, and the decision whether to offer it was left to fuel suppliers and retailers (Bartash, 2010).

More systemic issues surround alternative fuels exist. Choi (2006) cited a University of Minnesota study comparing energy gains and environmental impacts of ethanol and biodiesel that concluded that biodiesel was the better choice. Soybean-based biodiesel fuel returned more energy and produced less greenhouse gases when compared with corn-based ethanol production. It also entailed less nitrogen, phosphorus and pesticide pollution. However, Choi noted one limitation found by the scientists: "Dedicating all current U.S. corn and soybean production to biofuels, however, would meet only 12 percent of gasoline demand and 6 percent of diesel demand. Prairie grass may provide larger biofuel supplies with greater environmental benefits" (2006: 38). This statistic was roughly consistent with fact that 20 percent of corn production in 2006 was converted to ethanol (Corridore, 2014: 8), and that ethanol comprised about 2 percent of U.S. transportation fuel (Heywood, 2006: 62). Heywood adds that ethanol made from residues and waste of plants seldom used as food could be more efficient and produce fewer greenhouse gases. Kammen (2006) came to a similar conclusion. Corn production grew from less than 11 billion bushels in 2006 to nearly 14 billion in 2013, and the portion used for fuel had risen to about 35 percent (Corridore, 2014: 8).

Concern also has been expressed that so much corn is being used for ethanol that there's less available for people and animals to eat, and that prices of other corn-based products rose as a consequence (Mercer, 2008). *Ceteris paribus*, increasing demand for corn-based ethanol increases prices for corn and other corn-based products, including food. However, the relationship may not be so simple because other factors come into play. People may substitute other products to replace corn, more farmers may choose to plant more corn in response to higher corn prices, and the variations in weather will always play a role (Koff, 2010).

Battery-powered vehicles date to the early 20th century. Their initial advantage of fewer moving parts – and, therefore, fewer breakdowns – was out-weighed by their bulk, limited range, lengthy recharge times and slower acceleration rates. In addition, gasoline was cheap, readily available, and easy to transport (Vellequette, 2008). The disadvantages remained significant for years even as batteries improved, gasoline prices would spike, and concerns about pollution grew (battery-powered vehicles emit no pollutants).

Recent technical advances have companies seriously pursuing battery power. Neil (2006) described the changes by comparing GM's EV1, the most advanced battery-powered car from the mid-1990s, with the Tesla Roadster. The EV1 used nickel metal hydride batteries that, under ideal conditions, would last about 150 miles, with a full charge taking eight hours. The Roadster uses lithium-ion batteries that last for 250 miles, with a full charge taking 3.5 hours; and it comes with a portable charging pack so that it does not exclusively rely on its home charging station. The company also claimed the Roadster can accelerate from 0 to 60 miles per hour in four seconds, and has a top speed of 130 mile per hour. The sporty Roadster is relatively expensive, but a sedan is available for less than $50,000. Other small companies also are focused exclusively on manufacturing battery-powered cars. Meanwhile, many high-volume light vehicle makers followed

the trailblazing Toyota Prius[45] and developed electric vehicles (EVs) – either as hybrids[46] or solely battery-powered. They included BMW, Daimler (using Tesla's technology – Tschampa, 2014), FCA (a prototype Jeep – Chavez, 2008), Ford (the the C-Max), GM (the Volt), Honda (the CR-Z and the Insight), Mazda, Mitsubishi, Nissan (the Leaf) and VW, all of whom had plans or goals of sales in the 100,000s (Eisenstein, 2012a; Automotive News, 2014). (Not all of these efforts resulted in models brought to market.) Navistar, a medium- and heavy-duty truck maker, now produces a hybrid (Navistar, 2014).

Hybrid light vehicles are very fuel efficient, currently coming close to or even exceeding the CAFE goals for 2025 of 54.5 miles per gallon. Yet, like purely battery-powered EVs, hybrids remain relatively expensive even after factoring-in any federal tax credit. Incorporating hybrid technologies can add thousands of dollars to a vehicle's cost, and batteries are significant part of the extra cost.[47] (Executives complain that prices do not cover production costs (Tschampa, 2014), with the Prius a notable exception (Chang, 2014); nevertheless, some assemblers have priced their hybrid premium models the same as the non-hybrid versions (Schoenberger, 2010).[48]) Owners usually must operate their vehicles for years before recouping the extra cost in lower fuel ex-penditures.[49] The fact that only 35 percent of hybrid owners in one survey bought another hybrid in 2011 was interpreted as indicating they have been unable to recoup the higher prices of comparable non-hybrid models with savings on fuel. Hybrids also face competition from fuel-efficient non-hybrid compact and sub-compact models. Fleming (2014) declared market share stalled at "about 3 percent of all cars sold." Similarly, Automotive News (2014: 17) recorded sales of models "sold exclusively with electrified powertrains" totaled 340,635 in 2013, up from 312,230 in 2012. Those figures represented 4.4 and 4.2 percent of car sales those years, and excluded sales of models where electrified power-trains were an option.

As with alternative fuels, systemic issues need to be resolved before EVs are widely adopted. The U.S. lacked the manufacturing capacity for batteries, drive motors and electronic control as recently as 2008 according to one industry insider cited by Schoenberger (2008). Manufacturers and utilities need to address issues of electric grid capacity,[50] standardizing plugs, safety measures, and locations for recharging stations – public garages, curbside meters, and workplace parking lots. Private sector and public policy supports for electric vehicles are also needed (Business Courier of Cincinnati, 2008). Some progress on these issues is evident. General Electric has developed a charging station, but retreated from its 2010 pledge to purchase 25,000 electric vehicles by 2015 as its leasing customers wanted more options (Catts, 2013; Hirsch, 2010). Delphi, among others, was developing a wireless charging system for hybrid and electric vehicles in which drivers park their vehicles over pads that can transfer 3,300-plus watts to a receiver on the vehicle as fast as most residential plug-in chargers (Colias, 2010). The U.S. government has purchased thousands of hybrid vehicles, supporting about 10 percent of that market (Keane and Green, 2010).

Fuel cells are the other power source for EVs. They produce electricity as a result of a chemical reaction. Although they are not as efficient as batteries, they have three advantages: they can be adapted to any size vehicle without loss of ef-

ficiency, range 300 miles, and be refueled in three minutes (Chang, 2014; Webb, 2012). Those using hydrogen emit only heat and water vapor as by products, while those using other fuels produce few emissions. Hydrogen storage is less of a problem because tanks have been designed to diffuse hydrogen into the air in non-flammable concentrations if punctured or leaking (Thomas, 2008). Given equivalent units of fuel, hydrogen-based fuel cell vehicles are about twice as efficient as those powered by internal combustion engines (Harbour & Associates, 2001; Wald, 2004). An earlier model from GM delivered the gasoline equivalent of 43 mpg with a range of 200 miles (Thomas, 2008) while a Honda model got the equivalent of 68 mpg (Business First, 2008) with a range of 270 (Thomas, 2008) or 280 miles (Jones, 2008a). The cost of fuel cells also has fallen by 95 percent (Chang, 2014).

Favorable reactions have been reported. One driver of Honda's model commented that there was no sacrifice – he did not feel he was "puttering around in an underpowered, cramped little soapbox" (Thomas, 2008). Indeed, Honda's most recent model can go from 0 to 60 mph in 10 seconds (Jones, 2008a), has a top speed of 99 mph, and seats four people. Its 148-pound fuel cell stack is 30 percent lighter than the previous model, and one-third the size of the 1999 model (Kageyama, 2008).

Fuel cells are appealing, but systemic obstacles to widespread use remain. Fuel cells are heavy, difficult to make and not completely reliable in freezing weather (Jones, 2008a). Hydrogen does not freely exist on Earth, and producing it depends on current energy sources. The sources are either expensive or the technology for using them is not widely available – and that includes electrolysis powered by water, wind and the sun. The current practice of extracting hydrogen from natural gas (coal is another source of hydrogen) produces about one-half of the greenhouse gases that a gasoline engine does, but costs the equivalent of $3 per gallon (Thomas, 2008; *ceteris paribus*, the price could be greater after adjusting for inflation). Once produced, hydrogen must be moved to a point where it is stored is stored before being distributed to vehicles. Webb (2012) noted there are very few hydrogen filling stations in the country (California aims to have 50 fueling stations by the end of 2015 (Chang, 2014)), and the few hydrogen vehicles in use were leased. Building a distribution system may take decades (Ogden, 2006). Nevertheless, hydrogen vehicles are headed to showrooms (Chang, 2014).

Heywood (2006: 62) estimated that it will take years – even decades – before any of the fuel efficiency technologies discussed is competitive and widely diffused in motor vehicles.

History and Projections: 2000-2020

U.S. Motor Vehicle Industry Output
Plus Industry Jobs

	2000	2010	2020
U.S. MV GDO	100.0	77.6	109.3
U.S. MV Jobs	100.0	51.3	51.4
Ohio MV Jobs	100.0	47.7	50.1

Sources: Henderson, ODJFS/LMI

THE NEAR AND LONGER TERM OUTLOOKS

Many of the trends identified earlier are expected to continue into the foreseeable future, but analysts may differ on the details, and new developments will emerge. Trends about which they prognosticate include employment, sales volumes, industry growth, exports, fuel prices and the possibilities for new technology.

The chart above indexes the history and projections for three industry subjects: the U.S. motor vehicle industry gross duplicated output (GDO for NAICS 3361-3, green circles) and employment (green squares), plus industry employment for Ohio (red triangles). The chart shows U.S. motor vehicle industry GDO fell 22.4 percent (100 minus 77.6) from 2000 to 2010. Henderson (2012) predicts industry output will increase 40.9 percent from 2010 to 2020. However, the net change in output by 2020 is expected to be 9.3 percent (109.3 minus 100) greater than what it was in 2000. By comparison, data in Appendix table A16 project total U.S. GDO to be 47.2 percent larger in 2020 than in 2000. In essence, the motor vehicle industry is expected continue its cyclical, slower-than-average long-term growth, and may become a smaller part of the economy. Figures in Appendix table A16 show most of the industry growth is expected at assembly plants (3361).

The chart above also illustrates the comparative changes in industry employment seen in the past and forecast for the future. U.S. industry employment fell a net 48.7 percent from 2000 to 2010 (100 minus 51.3), and Henderson (2012) projects it will be virtually unchanged for the following decade (the index equals 51.4 in 2020). More detailed figures in Appendix table A16 present a similar history for each industry group: jobs in assembly and parts operations (3361 and 3363) fell 48.1 and 50.6 percent, respectively, from 2000 to 2010, while bodies and trailers jobs (3362) fell 41.1 percent. Assembly and bodies and trailers jobs are projected to increase 9.8 and 6.5 percent from 2010, but an off-setting and continuing decline of 20.2 percent more parts jobs during the 2010-20 decade. In short, industry employment is not expected to recover as output, with continuing losses of parts jobs a notable factor.

Similarly, data from the Ohio Dept. of Job and Family Service's Labor Market Information division (ODFJS/LMI, 2013) show industry employment in Ohio (red triangles) fell 52.3 percent from 2000 to 2010 (100 minus 47.7); LMI projects only a slight increase by 2020 (from 47.7 to 50.1). Figures in Appendix table A16 show group job losses ranging from 51.2 to 58.6 percent during the 2000-2010 decade. Only slight gains for each group are expected in recovery during the following decade, with the net 2000-2020 decline in sum and for all groups remaining around 50 percent.

These industry employment records and forecasts contrast with the overall history and expectations. Figures in Appendix table A16 show net changes of -2.2 and -1.0 percent, respectively, in overall U.S. and Ohio employment between 2000 and 2010, with corresponding gains of 14.3 and 9.3 percent expected in the 2010-2020 decade. The net 2000-2020 changes for the U.S. and Ohio may be gains of 11.8 and 8.1 percent.

The near-term prospects for the industry are rosier. Analysts are forecasting light vehicle sales in the range of 16.1 to 16.4 million for 2014, up at least 3.4 percent from 2013 (see Beene, 2014, and Levy, 2014: 8), and 16.7 to 16.9 million in 2015 (Beene, 2014, and O'Leary, 2014). By comparison, sales were 16.1 million in 2007 – the last year before the 2008-2009 recession. Currently – and more specifically – "economic growth and steady gasoline prices will support expansion in the highly profitable light truck segment," which also is supported by increasing construction activities (Levy, 2014: 4) and general economic growth (Levy, 2014: 8). The growth in light vehicle sales could extend for a few more years (Levy, 2014: 31). This is due in part to real overall economic growth which has occurred and is expected to continue. Near-term medium- and heavy-duty truck sales also are forecast to rise because the real economic growth and labor market improvement expected through 2015 will support purchase to replace an aging fleet (Corridore, 2014: 1-2, 6). The outlook for parts suppliers, including tires, in 2014 also is positive – not just because new vehicle sales are expected to rise, but also due to the increasing number of vehicles on the road, improved longevity (i.e., greater reliability) and thrifty customers repairing their aging vehicles and replacing tires (Levy 2014: 7-9). Although some of these actions reflect the aftermath of the recession, the cost of new vehicles is not a deterrent (Levy, 2014: 19).

The above-mentioned 3.4 percent sales growth is a driving factor in the 2.5 percent growth forecast for the economy overall (Levy, 2014: 8), but may only reflect the relative cyclicality of the industry. The chart above also indexes the history of the net changes in industry and overall economic output after adjusting for inflation, respectively indicated by the red and blue circles. The total gross domestic output[51] (GDO) grew 10.4 percent (110.4 minus 100) from 2000 to 2010 while the motor vehicle industry GDO fell 22.4 percent (100 minus 77.6). Total GDO is forecast to increase at a high rate for the 2010-20 decade, rising 33.3 percent, while industry GDO may rise at even faster – 40.9 percent. Yet the overall net change for industry GDO by 2020 is expected to be just 9.3 percent above 2000 (109.3 minus 100), far less than total GDO change of 47.2 percent (147.2 minus 100) (Henderson, 2012). This is consistent with Levy's (2004) description of the N. American and Western European light vehicle markets as mature and saturated, with long-term sales growth therein being relatively slow and cyclical.

The longer-term potential for higher growth rates exists – despite current turmoil or malaise – in the developing markets of Latin America, Eastern Europe, and Asia – particularly Brazil, China and India. In fact, the Chinese market became the world's largest for new vehicles in 2009, and will remain so (Levy, 2014: 4, 13, 17). However, exports of motor vehicles are unlikely to grow significantly[52] for several reasons. Some Asian countries are developing their own industries or restrict the access of U.S. manufacturers. Others are subject to risks such as currency crises. Even if trade barriers did not exist, the typical U.S.-made product is over-equipped and far too expensive for emerging markets. Production costs (labor, energy, regulatory requirements, etc.) make this so. To a limited extent, this is true even of Canada. Canadians are much wealthier than typical consumers in emerging markets, but they generally are not as wealthy as Americans, and Canada's population is one-ninth that of the U.S. Consequently, the best-selling American-made models are the less ex-

pensive ones (Levy, 1999). Instead of trying to export to areas outside of N. America, U.S.-based assemblers may circumvent trade barriers by doing what they have done in the past: (1) set up operations in the markets in which they want to sell, even if the governments require using some locally produced parts, (2) buy a significant stake in a local company, and/or (3) form a joint venture with a local company (Gaines, 1999; Gott, et.al., 1999; Nielsen, 2000). Conversely, Levy (2014: 9) expects foreign-based assemblers to establish more assembly plants in the U.S., although he expects some U.S.-based parts makers will supply them.

The long term outlook for suppliers is mixed. The number of suppliers may continue to shrink even though, as a group, they survived the recession better than expected. Reduced business from the Detroit Three, cost pressures, and divestitures could result in smaller numbers (Levy, 2012: 19-20). More assembler alliances may shrink the number of platforms, with a subsequent reduction in suppliers (Sedgwick, 2010). On the other hand, the remaining suppliers, like assemblers, may have growth opportunities in emerging markets. Analysts disagree about the extent to which merger and acquisitions will occur (Colis, 2010b; Levy, 2012: 19-20; Staff, 2010).

Within the overall sales forecast are a number of trends. The high oil prices of 2008 hurt consumers in many parts of the world (Charlton, 2008). While the recession sharply reduced oil prices from that peak, medium- and long-term oil prices are expected to trend higher, principally because of strong growth and increased demand in Asian countries. Consequently, more new small vehicles could be launched in the next few years, and consumers everywhere are predicted to purchase vehicles that are more fuel efficient, regardless of whether they are cars or light trucks (Durbin, 2014; Levy, 2012: 3, 7, 15).[53] A belief that any dip in oil prices is temporary, the new CAFE standards, efforts to reduce U.S. dependence on foreign oil and the negative effects of fossil fuels (Levy, 2014: 13) add further impetuous to this trend.[54]

CAFE standards, currently 35.5 miles per gallon for light vehicles in model years 2012-2016, are set to rise to 54.5 miles per gallon by 2025. Along with stricter emission standards, it is believed that these qualities will add about $2,000 to the price of a light vehicle, but result in substantial fuel cost reductions. Similar programs to increase fuel efficiency and reduce greenhouse gas emissions (CO_2, HFCs, N_2O and CH_4) from medium- and heavy-duty trucks and buses during 2014-2018 are in place. Regarding the latter, increased costs of $6,220 should be more than offset by fuel savings of $73,000 over the life of the vehicle. Payback occurs over one or two years for normal operations, and four to five years in low mileage conditions (Levy, 2012: 17-18).

High gasoline prices make alternative fuels more practical. The use of compressed natural gas may increase (Vellequette, 2012), given the recent plunge in natural gas prices and the boom in shale drilling. Meanwhile, only slow growth in ethanol production is expected in the near future due to only moderate growth in gasoline consumption (Corridore, 2014: 8). A number of motor vehicle company officials and industry analysts argued that ethanol usage by light vehicles could

increase if the federal government acted to encourage its use beyond simply mandating that renewable fuel usage increase.[55] They suggested incentives for service stations to install more pumps offering E85 (a mixture of up to 85 percent ethanol and as little as 15 percent gasoline) and/or subsidies to lower its costs (Thomas, 2006). It's also noteworthy that, as he forecast, the number of vehicles sold with flexible fuel engines increased and has surpassed 2.4 million in 2012 (Wikipedia, 2014).

Assemblers anticipate making engines smaller and more efficient with applications of new techniques and the wider use of current technology. Vellequette (2012) mentions direct fuel injection, reducing the number of cylinders in engines, adding turbochargers – and liquid cooling exhaust gases to protect them from overheating, using engine heat to warm lubricants faster to reduce friction, improvements in transmissions and axle ratios to increase the torque delivered to wheels, and using more hybrid technologies. Romm and Frank (2006) expected more sophisticated systems will recapture more of the braking energy used to recharge hybrid batteries.

Increased use of safety equipment and electronics (for navigation, communications and entertainment) is expected. Both may diffuse from high-end to mass-market vehicles (Eisenstein, 2012b; Levy, 2012: 11). Adaptive cruise control, automatic braking, and collision-avoidance technologies may be mandated for all future vehicles (Nelson, 2012). However, self-driving cars remain problematic due to technical limitations (White, 2014).

Sales of hybrids are expected to increase, as more companies offer more models with the option of hybrid drives (see Romm and Frank, 2006), but analysts disagree about much of the market hybrids (and all-electric vehicles) may take in the future. Hybrids accounted for 3.4 percent of sales in 2012 (all-electric vehicles may have had 0.1 percent), and may rise to 7.4 percent by 2017 (see Gearino, 2012). Further gains in market share probably will depend on higher fuel prices, lower battery costs (perhaps 68 percent, via improved technology and manufacturing efficiencies – Bond, 2012), and persuading the public that these are reliable vehicles (Pooley, et.al., 2011). On a related note, Daimler, GM, Honda, Hyundai and Toyota plan to launch hydrogen fuel cell vehicles in the next few years, as the technology is nearly ready, and despite the fact that the infrastructure is not (Webb, 2012).

See Table A16

ASSEMBLER PROFILES

There are six high-volume motor vehicle assemblers with at least one such establishment in Ohio. They are Fiat Chrysler Automobiles (FCA), Ford, General Motors (GM), Honda, Navistar and Paccar. All share a number of characteristics:

- they are publicly held companies;
- they have more than one brand;
- they have multi-continental operations;
- they are researching and/or developing alternative and supplemental power sources for their vehicles;
- they make some of their own parts;
- they have subsidiaries; often these are secondary businesses (with NAICS codes outside of the motor vehicle industry) supporting their principal business, but also offering goods and/or services that may be unrelated to the industry.

Furthermore, the four light vehicle assemblers – FCA, Ford, GM and Honda – have revenues and employment outside the state of Ohio.[56] Consequently, the individual profiles in this report focus on company operations in Ohio, highlighting recent and planned changes here.

Ohio

Fiat Chrysler Automobiles in Ohio

FCA
FIAT CHRYSLER AUTOMOBILES

Prepared by: Office of Research
Ohio Development Services Agency
October 2014

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Fiat Chrysler Automobiles NV

Website: www.fcagroup.com
2013 Revenue: €86,816,900,000 (an estimated $115,311,000,000, which would have ranked about 49th overall in the world if included in Fortune's Global 500).
Profit: €1,951,000,000 (an estimated $2,591,000,000) – 2.2 percent of revenue (Wikipedia, 2014; X-Rates.com, 2014).
2013 Light Vehicle Production for its Chrysler Group:
in N. America: 2,509,684 – ranked 3rd with 15.5 percent of all N. American light vehicle production;
in Ohio: 295,997 – ranked 2nd in the state, with 11.8 percent of its N. American light vehicle production here (Automotive News, 2014).

Fiat Chrysler Automobiles (FCA) is moving its headquarters from Turin, Italy, to London, UK (its new tax domicile), although it is incorporated under Dutch law. Its estimated 2013 revenues would make it the 7th-ranked motor vehicle manufacturer in the world when compared with other Fortune Global-500 companies. Sergio Marchionne is the CEO, and John Elkann is Chairman of the Board. Additional car brands currently in the Fiat Group are Abarth, Alfa Romeo, Lancia and Maserati (Ferrari is being spun-off), while Dodge, Jeep and Ram are light vehicle brands in the Chrysler Group. Other marques are Mopar, Magneti Marelli, Automotive Lighting (all components), VM Motori (engines), Comau (automation) and Teksid (its foundry). Michael Manley is President and CEO of the Jeep brand. FCA's latest world-wide employment figure is 225,587 (Fleming, 2014; Wikipedia, 2014).

Chrysler was the top-ranked light truck assembler in Ohio during 2013 (and 2nd-ranked in overall light vehicle output), but has the lightest footprint of all high-volume light vehicle assemblers. Its three manufacturing plants here – two assembly plants in Toledo and a power train operation in Perrysburg – combined currently employ about 5,800, including those directly em-ployed by other companies but working under its aegis at Supplier Park. This is an increase of more than 3,300 from two years ago (Automotive News, 2014; Office of Research, 2014a; Snavely, 2013; Toledo News Now, 2012).

Jeep Cherokee production started in June, 2013, at the retooled Toledo North, while the Jeeps Wrangler and Wrangler Unlimited continue to be made at Supplier Park. The Perrysburg plant makes steering columns and torque converters. The new Wrangler production currently scheduled for 2017 *probably* will remain in Toledo since FCA decided on a body-on-frame assembly (as opposed to a unibody assembly, which would militate against production remaining here) (Automotive News, 2014; FCA, 2014; Vellequette, 2014).

Ohio

Ford Motor Company in Ohio

Prepared by: Office of Research
Ohio Development Services Agency
October 2014

R081314A

Ford Motor Co.

Website: www.ford.com
2013 Revenue: $146,917,000,000 – ranked 8th overall in the U.S. and 26th overall in the world;
Profit: $7,155,000,000 – 4.9 percent of revenue (Fortune, 2014).
2013 Light Vehicle Production:
in N. America: 3,086,179 – ranked 2nd with 19.1 percent of all N. American light vehicle production;
in Ohio: 132,390 – ranked 4th in the state, with 4.3 percent of its N. American light vehicle production here (Automotive News, 2014).

Ford was the 5th-ranked motor vehicle manufacturer in the world, as judged by 2013 revenue, and the only one of the Detroit Three not to file bankruptcy in 2009.[57] The company's world headquarters is in Dearborn, Michigan, where William Clay Ford Jr. is Executive Chairman, Mark Fields is President and CEO, and Bruce Hettle is Executive Vice President for N. America Manufacturing. Its other current brands are Lincoln and Motorcraft (the latter sells AM parts). Ford has manufacturing operations on every continent as well as interests in or joint ventures with other motor vehicle companies. The company's principal business is manufacturing cars and trucks of all sizes and some components thereof. (Other parts production was spun off to Visteon years ago.) It also owns Ford Credit, which principally finances sales of motor vehicles. The latest worldwide employment figure is 181,000 (Ford, 2014; Fortune, 2014; Wikipedia, 2014).

Avon Lake continues making Econoline vans as it prepares for medium-duty trucks and/or chassis. While the Ohio Assembly plant employs the largest number of Ford workers at any one site in the state – close to 1,900, the company's footprint extends to four other manufacturing facilities here. The Walton Hills stamping plant makes Econoline side panels as well as deck lids, doors, fenders and floor pans, and employs 300-plus people. Engine Plant No. 1 at Brook Park makes the 3.5L EcoBoost and 3.7L Duratech engines, while the Lima plant makes the V-6 versions of the same; all are gasoline engines, and each plant employs about 970 people. 1,875 people work at the Sharonville plant, which makes five- and six-speed transmissions (Ford, 2014). Ford's total employment in Ohio is about 6,000, and has increased by 450 during the last two years. In 2013, it announced plans to invest $420 million at the Lima engine plant (Office of Research, ODSA, 2014b). In 2014, it announced a $500 million investment at the Lima plant to add 300 people to make the new 2.7L EcoBoost engine (Linkhorn, 2014).

Ohio

General Motors in Ohio

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Ohio Development Services Agency
October 2014

R081314A

General Motors Co.

Websites: www.gm.com
2013 Revenue: $155,427,000,000 – ranked 7th overall in the U.S. and 21st overall in the world;
Profit: $5,346,000,000 – 3.4 percent of revenue (Fortune, 2014).
2013 Light Vehicle Production:
in N. America: 3,289,372 – ranked 1st with 20.3 percent of all N. American light vehicle production;
in Ohio: 285,271 – ranked 3rd in the state, with 8.7 percent of its N. American light vehicle production here (Automotive News, 2014).

General Motors (GM) is the 4th-ranked motor vehicle company in the world, as judged by revenue. The company's world headquarters is in Detroit, Michigan, where Theodore (Tim) Solso is Chairman of the Board, Mary Barra is the CEO, Dan Ammann is President, and Alan Batey is Executive Vice President and President of N. America. The principal business of the company in N. America is manufacturing light vehicles, medium-duty trucks and some components thereof. (Other parts operations were spun off to Delphi Automotive, and non-motor vehicle subsidiaries were divested – all years ago.) In addition to its own facilities, GM has joint ventures with a number of foreign motor vehicle manufacturers and ownership stakes in two more, giving it operations on every continent. The associated brands currently include Alpheon, Baojun, Buick, Cadillac, Chevrolet, GMC, Holden, HSV, Jiefang, Opel, UzDaewoo, Vauxhall, and Wuling. It also owns GM Financial, which has loan and lease programs for customers and dealers. Its latest worldwide employment figure is 219,000 (Fortune, 2014; GM, 2014; Wikipedia, 2014).

GM's Cruze is the second most popular model to come out of Ohio in recent history; the current model was named "fleet car of the year." A turbo-charged diesel version debuted in 2013. The 4,500 workers at the Lordstown assembly, metal center (an adjacent stamping plant) and paint shop where Cruzes are made comprise the plurality of GM's 9,400-plus manufacturing employees in Ohio. Similar to Ford, GM's footprint extends to four more manufacturing establishments. Close to 1,900 make six- and eight-speed rear wheel drive transmissions in Toledo, well over 1,300 work at the Parma stamping plant, and about 1,200 work at the Defiance foundry casting aluminum and iron engine blocks. Its DMAX plant in Dayton, a joint venture with Isuzu employing 500-plus, makes the 6.6L V-8 diesel engine used in several pickups and vans. It also has a parts distribution center in Cincinnati (GM, 2014; Wikipedia, 2014).

In addition to the $85.7 million GM planned to invest at its Toledo plant beginning in 2013 (Office of Research, 2014b), it is noteworthy that both the Toledo and Lordstown facilities have installed roof-top solar power arrays to help meet their electricity requirements and reduce their carbon dioxide emissions. The Toledo plant also has reduced its waste water pre-treatment discharges and sends no waste to a landfill (GM, 2014).

Ohio

Honda Motor Company in Ohio

Prepared by: Office of Research
Ohio Development Services Agency
October 2014

R081314A

Honda Motor Co.

Websites: world.honda.com and ohio.honda.com
2013 Revenue: $118,210,500,000 – ranked 45th overall in the world;
Profit: $5,730,700,000 – 4.8 percent of revenue (Fortune, 2014).
2013 Light Vehicle Production:
in N. America: 1,781,213 – ranked 4th with 11.0 percent of all N. American light vehicle production;
in Ohio: 734,772 – ranked 1st in the state, with 41.3 percent of its N. American light vehicle production here (Automotive News, 2014).

Honda was the 6th-ranked motor vehicle manufacturer in the world, as judged by 2013 revenue.[58] The company's world headquarters is in Tokyo, Japan, where Fumihiko Ike is Chairman of the Board and Takanobu Ito is President and CEO. Takuji Yamada is President and CEO of American Honda Motor Co. (Torrance, Ca.), and Tomomi Kosaka is President and CEO of Honda of America Manufacturing (Marysville, Oh.). The company's principal business is manufacturing light vehicles and some components thereof. Its only other brand is Acura. Although headquartered in Japan and with operations on every continent, the plurality of revenue comes from N. America. The latest worldwide employment figure is 190,338 (Fortune, 2014; Honda, 2014; Wikipedia, 2014).

Honda assembles three car and two SUV models at its Marysville and E. Liberty plants, which make it the top car producer, the 2nd-ranked light truck maker, and overall leader in light vehicle production in Ohio. Its Accord and CR-V (the latter was named *Motor Trend's* 2015 SUV of the Year), are respectively, the single highest-volume car and light truck models made here. The new TLX incorporates a number of technological innovations mentioned earlier: a stop-start function, cylinder deactivation, 8- and 9-speed transmissions, advanced electronics, pre-collision braking and 7 air bags (Undercoffler, 2014). 13,500-plus work in its manufacturing facilities. Of that number, 5,550 are at the Marysville complex, 2,650 at E. Liberty, 2,600 at the Anna engine plant, over 1,100 at the Russells Point transmission plant, and 500 at the Celina foundry. At least 1,100 more make parts at subsidiaries not bearing the Honda name. An additional 1,300-plus Honda employees are engaged in research, development and other professional and technical services at various locations in Union and Franklin Counties. Honda's *keiretsu* partners collectively employ over 4,700 making parts. Honda's manufacturing employment has grown by about 1,000 over the last two years, while its *keiretsu* partners have added about 800 (Automotive News, 2014; Honda, 2014; Office of Research, 2014a).

Honda planned to invest $273 million at its Marysville and Anna plants beginning in 2013, with 150 new jobs anticipated in Marysville. These may be related to the starts of Acura NSX and ILX production in 2015; both are hybrid drive cars. Current plans call for a new V-6 engine for the CR-V (Automotive News, 2014; Honda, 2014; Office of Research, 2014b).

Ohio

Navistar International and PACCAR/Kenworth in Ohio

Prepared by: Office of Research
Ohio Development Services Agency
October 2014

R081314A

Navistar International Corp.

Website: www.navistar.com
2013 Revenue: $10,848,000,000 – ranked 259rd overall in the U.S., not in the top 500 in the world;
Profits: -$898,000,000 – -8.3 percent of revenue (Fortune, 2014).

Navistar is the fourth largest medium- and heavy-duty truck maker in the world. Technically a holding company, its world headquarters is in Lisle, Illinois, where Troy Clarke is President and CEO, and James H. Keyes is Chairman of the Board. It has manufacturing establishments in N. and S. America, Europe and Asia, with additional facilities elsewhere. The company's principal business is assembling medium- and heavy-duty trucks and buses. It also manufactures military vehicles, truck and bus bodies and chassis, diesel engines (including non-motor vehicle machinery) and other OE and AM parts – either under its own name or under another with a partner (e.g., Ford's Blue Diamond medium-duty trucks). It offers financing and insurance, and maintains a sales and service network. Its most prominent brands are IC (buses), International (trucks and defense vehicles) and Maxx-Force (diesel and natural gas engines) (Navistar, 2014; Wikipedia, 2014). Worldwide employment is listed as 16,500 (Wikipedia, 2014). About 900 people are employed at the Springfield plant (Dayton Daily News, 2013), which makes International ProStar, WorkStar, DuraStarr (a hybrid), TerraStar, and Tran-Star medium- and heavy-duty trucks (Navistar, 2014; Wikipedia, 2014). The TranStar's engine uses compressed natural gas (Fleet & Fuels, 2013).

Paccar, Inc.

Website: www.paccar.com
2013 Revenue: $17,124,000,000 – ranked 169th overall in the U.S., not in the top 500 in the world;
Profits: $1,171,000,000 – 6.8 percent of revenue (Fortune, 2014).

Paccar is the third largest medium- and heavy-duty truck maker in the world, with plants in N. and S. America, Europe and Australia, and additional facilities elsewhere. Its world headquarters is in Bellevue, Washington, where Mark C. Pigott is Executive Chairman and Ronald E. Armstrong is the CEO. Its other truck brands are DAF, Kenworth (which it describes as premium) and Peterbilt. It also makes engines and other parts (including Dynacraft batteries), off-road trucks, winches and hoists, and has related sales, leasing, financing and repair operations. It is pursuing hybrid technology for its medium-duty trucks. 22,800 were employed worldwide in 2012 (Paccar, 2014; Wikipedia, 2014). About 2,000 (based on Wartenberg, 2012) assemble the class-8 T680 and T880 trucks at its Kenworth plant in Chillicothe. The plant has the capacity to produce 150 trucks per day (Kenworth, 2014).

APPENDICES

NAICS CODES: INDUSTRY DEFINITION AND EXAMPLES

Beginning with the 1997 Economic Censuses, the nation's industry statistics have been collected under the North American Industry Classification System (NAICS) (Office of Management and Budget, 1998). Establishments producing goods or providing services sufficiently alike are classified in the same *industry*. A six-digit NAICS code is assigned to each industry. Closely related industries formed an *industry group*. The first four digits of the code indicate the group to which the industries belong. (A five-digit code defines a subgroup when it subsumes more than one six-digit code; otherwise, it serves as an industry code.) Industry groups with common elements and shared characteristics comprise a *major industry* or *sub-sector*, and are indicated by the first three digits of the code. Most of the data from government sources used in this report have been collected under that system.

Three groups from the *transportation equipment* sub-sector (NAICS 336) combine to form the core of the motor vehicle industry in this report. They are *motor vehicles* (3361, also referred to as assembly operations), *motor vehicle bodies and trailers* (3362), and *motor vehicle parts* (3363). The *tires* subgroup (32621) and *storage batteries* (335911) are included – when information is available – because most of the goods produced in those industries are original equipment or replacement parts for motor vehicles. Industries wherein most of the goods produced are not used in motor vehicles are excluded from this report, although some exceptions may be made for establishments at least mostly dedicated to motor vehicle parts. Diesel engine and automotive glass production (333618 and 327215, respectively) are examples of this.

The defining concept for the motor vehicle industry is manufacturing equipment for transporting people and goods over a network of roads. This definition excludes establishments producing ships, boats, railroad and aerospace vehicles and equipment. Also excluded for various reasons are establishments producing motorcycles, bicycles, military armored vehicles and tanks, all-terrain vehicles, go-carts, golf carts, racecars, snowmobiles, animal-drawn vehicles, children's vehicles and components thereof. After the discussion of the industry's impact on Ohio's economy, industries dependent on motor vehicles – suppliers of materials to the industry, makers of equipment used to manufacture motor vehicles-bodies-trailers-and-parts, wholesalers, retailers, gas stations, and repair services – are not included.

Motor vehicle establishments use production processes similar to machinery manufacturers (333): bending, forming, welding, machining and assembling metal, glass, rubber and/or plastic parts into components and finished products. However, most machinery is used to produce other goods, and the goods-moving machinery – agricultural, construction, and material-handling equipment – is not intended for highway use. Other people-moving machinery – elevators, escalators, moving sidewalks, etc. – is also classified in the machinery industry.

Examples of products made in various motor vehicle industries follow the NAICS codes and industry titles below.

The transportation equipment industries:

3361	Motor Vehicles.
33611	Automobiles and Light Duty Motor Vehicles.
336111	Automobiles. Establishments assemble complete automobiles (unibody or body-and-chassis) or produce chassis alone. The manufacture of car bodies or assembling vehicles on a purchased chassis is classified in 336211.
336112	Light Trucks and Utility Vehicles. Establishments assemble complete light trucks (body and chassis) or produce light truck chassis alone. Light duty trucks include minivans, pick-ups, and sport-utility vehicles. The manufacture of truck and bus bodies or assembling vehicles on a purchased chassis is classified in 336211.
33612	Heavy Duty Trucks. Heavy-duty trucks also include buses, heavy-duty motor homes, and other special purpose heavy-duty motor vehicles for highway use. Establishments assemble complete trucks (body and chassis) or chassis alone. Medium-duty trucks (as defined by Ward's) are also included in this industry.
3362	Motor Vehicle Bodies and Trailers.
336211	Motor Vehicle Bodies. Establishments produce truck cabs as well as car, truck and bus bodies. These may be sold separately or assembled on a purchased chassis and sold as complete vehicles. Dump truck lifting mechanisms and fifth wheels are included.
336212	Truck Trailers. Examples also include truck trailer chassis, cargo container chassis, detachable trailer bodies, and detachable trailer chassis sold separately.
336213	Motor Homes. The defining element is the integration of the motor and the living quarters in the same unit. Whether or not the chassis is purchased is irrelevant. Car and van conversion is included if the work is done on an assembly line. Mobile homes are classified in 321991, and customized cars and trailers are classified in 811121.
336214	Travel Trailers and Campers. Examples include transport trailers for cars, camping trailers, horse trailers, and utility trailers.
3363	Motor Vehicle Parts.
33631	Motor Vehicle Gasoline Engines and Engine Parts.[59]
336311	Carburetors, Pistons, Rings, and Valves. Both original and rebuilt equipment is included.
336312	Gasoline Engines and Engine Parts. Examples include crankshafts, flywheels, ring gears, fuel injection systems and parts, manifolds, positive crankcase ventilation (PCV) valves, mechanical pumps, and timing gears and chains. Both original and rebuilt equipment is included. Other gasoline engine equipment – car-

buretors, pistons, piston rings, valves, wiring harnesses, electrical and electronic equipment, transmissions, radiators, steering and suspension components, rubber and plastic belts and hoses without fittings – is classified elsewhere in 3363. Stationary gasoline engines and parts of the same nature but not for use in motor vehicles are classified outside of the motor vehicle industry. All diesel engines, including those used in motor vehicles, are classified in 333618.

33632 Motor Vehicle Electrical and Electronic Equipment.[59]

336321 Vehicular Lighting Equipment. Vehicular lighting fixtures are included, but bulbs are classified elsewhere.

336322 Other Motor Vehicle Electrical and Electronic Equipment. Examples include alternators, generators, coils, distributors, ignition cable sets, wiring harnesses, instrument control panels, spark plugs, block and battery heaters, and windshield washer pumps. Equipment of the same nature but not for use with motor vehicles is classified elsewhere. Electric motors (even for electric vehicles), railway traffic control signals and passenger car alarms, and car stereos are classified elsewhere.

33633 Motor Vehicle Steering and Suspension Components. Examples include steering wheels and columns, rack and pinion steering assemblies, struts, and shock absorbers. Spring manufacturers are classified in fabricated metal products (332).

33634 Motor Vehicle Brake Systems. Examples include cylinders, drums, hose assemblies, calipers, pads, linings and shoes. Rubber and plastic hose and belting without fittings are classified in 326.

33635 Motor Vehicle Transmissions and Parts. Examples include automatic and manual transmissions, axle bearings, differentials and axle assemblies, torque converters, and universal joints. Both original and rebuilt equipment is included. Mechanical power transmission equipment not for use in motor vehicles is classified elsewhere.

33636 Motor Vehicle Seating and Interior Trim. Seat belts, and seat and tire covers are included.

33637 Motor Vehicle Metal Stampings. Examples include fenders, hard tops, body parts, moldings, and exterior trim. Tops for convertibles are classified in 336399.

33639 Other Motor Vehicle Parts.[59]

336391 Motor Vehicle Air Conditioning. This industry produces air conditioning compressors and systems for cars, trucks and buses. It also produces them for vehicles that are not part of the motor vehicle industry: aircraft (NAICS 336411), farm machinery (NAICS 333111), construction machinery (NAICS 33312), and related vehicles. The reason equipment for such other vehicles is included is probably because it is highly similar to that used in motor vehicles and the greatest portion of it is used in motor vehicles. Establishments producing air-conditioning compressors and systems not used in vehicles are classified in NAICS 333415.

336399 All Other Motor Vehicle Parts. Examples include air bags, catalytic converters, intake filters, luggage and utility racks, mufflers, resonators, radiators (including those for stationary engines), trailer hitches, and wheel rims. Both original and rebuilt equipment is included.

The related industries:

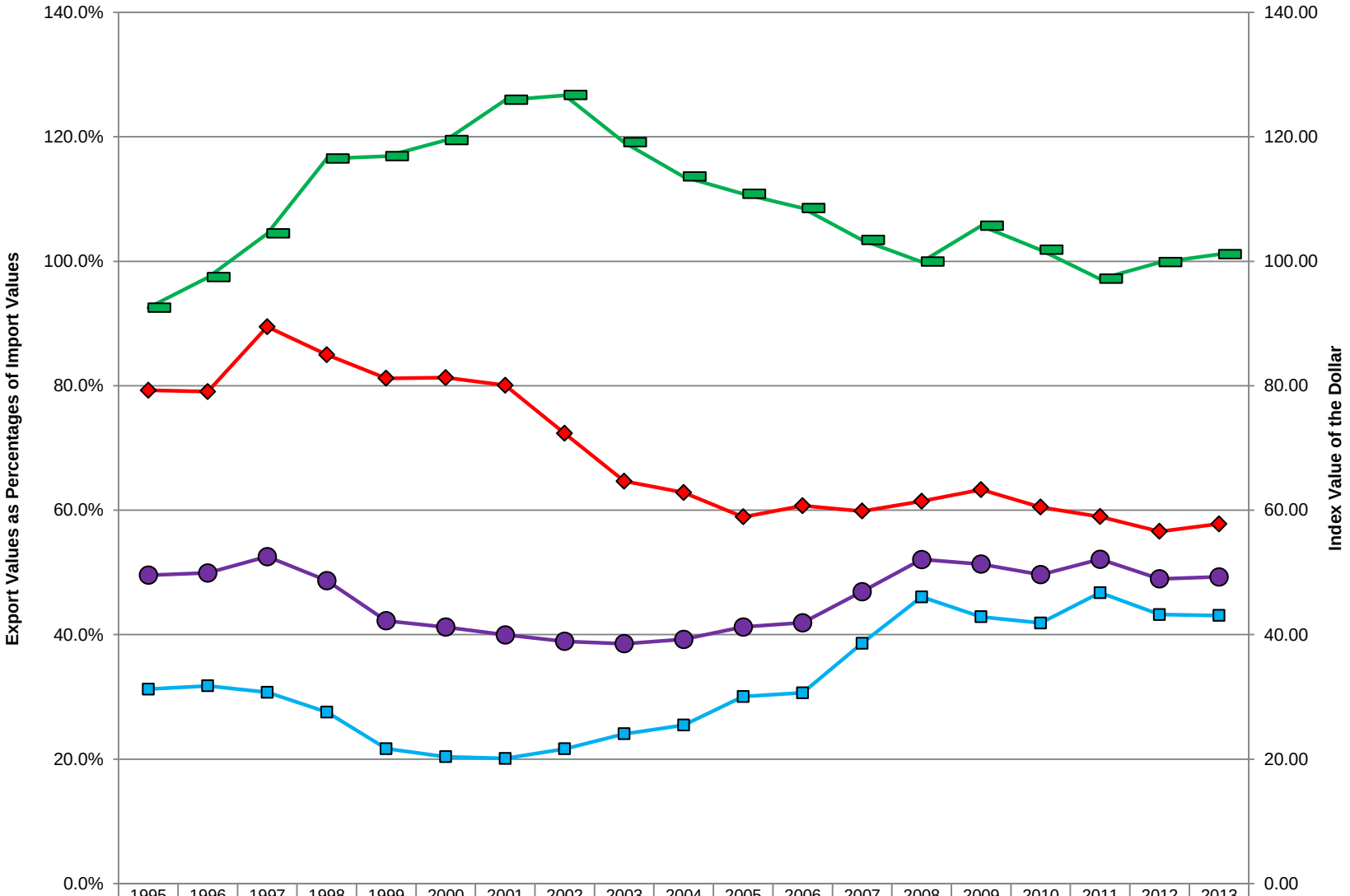
32621	Tires.
326211	Tire Manufacturing, except retreading. Includes pneumatic, semi-pneumatic and solid tires, inner tubes, and repair materials. Most new tires are produced for motor vehicles.
326212	Tire retreading. The feature distinguishing this industry from tire repair service is the reliance on assembly line operations. Retreads are used by school buses and commercial trucks (Rubber Manufacturers Association, 2006). These markets are much smaller than the markets for passenger cars and non-commercial light trucks.
335911	Storage Batteries. In particular, lead-acid batteries smaller than 1.5 cubic feet.

GLOSSARY

A number of terms used in this report have more or less specific meanings. The term *motor vehicles* includes a variety of products: cars, vans, sport-utility vehicles (SUVs), crossover utility vehicles (CUVs), buses, trucks (including pickups) and motor homes. The basic industry division is between cars and light trucks, which are mass-market *light vehicles* overwhelmingly purchased by families and individuals (Levy's focus), and heavy-duty trucks, etc., which are capital equipment mostly for organizations (Corridore's focus). This follows Census Bureau's NAICS codes: 33611 and 33612, respectively. Detailed discussions of the industry, though, divide trucks (which include buses) into eight classes based on *gross vehicle weight* (GVW - the combined weight of the vehicle and its maximum payload), and then regroup the classes into *light-*, *medium-* and *heavy-duty* for higher-level presentations. Ward's (1991-2009) treats class 1-3 trucks, with GVWs of 14,000 lbs. or less, as light-duty. These include small and family vans, SUVs, pickups and perhaps a few CUVs. Classes 4-7, with GVWs ranging from 14,001 to 33,000 lbs., are medium-duty. Class 8 trucks, with GVWs over 33,000 lbs., are heavy-duty. These groupings are somewhat arbitrary. For example, Levy's (2014: 10) discussion of light duty trucks focuses on classes 1 and 2 (GVWs of 10,000 lbs. or less). Annual sales of the two are in the millions and comprised 92.3 percent of all truck sales in 2013, while class 3 sales have ranged from 112,000 to 254,000 in the last five years – much closer to medium-duty production levels. Similar to Levy, Corridore (2014: 6, 17) limits his discussion of medium-duty trucks to classes 5-7 (GVWs of 16,001-33,000 lbs.). Ford (2014) treats class 7 and 8 trucks as heavy duty. Sales class 8 trucks exceeded medium-duty trucks (classes 4-7) in three of the latest five years for which data are readily available (2009-13) (Levy, 2014: 10).

Assembler distinguishes motor vehicle manufacturers such as Ford, GM, Honda, or Kenworth from other companies making only the parts and modules comprising a vehicle. The latter are *parts manufacturers* or *suppliers*. Suppliers produce goods and modules for use either as *original equipment (OE)* or to be sold as *replacement parts* in the *aftermarket (AM)*. Many do both to varying degrees. Parts makers also are grouped depending on their position in the supply chain. *Tier-1* refers to those selling parts and sub-assemblies directly to assemblers. *Tier-2* companies make parts for tier-1 companies, and *tier-3* companies supply the raw materials to tier-1 and -2 companies. *Power train* is a generic term grouping engines and transmissions. *Accessories* may be added to vehicles but are not necessary for operating vehicles.

Motor Vehicle Imports, Exports and the Value of the Dollar, 1995-2013



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Industry Total	49.6%	49.9%	52.5%	48.7%	42.2%	41.2%	40.0%	38.9%	38.5%	39.2%	41.2%	41.9%	46.9%	52.1%	51.3%	49.6%	52.1%	49.0%	49.3%
Motor Vehicles	31.2%	31.8%	30.7%	27.5%	21.7%	20.4%	20.1%	21.6%	24.1%	25.5%	30.1%	30.7%	38.6%	46.1%	42.9%	41.9%	46.7%	43.2%	43.1%
Parts & Accessories	79.3%	79.0%	89.5%	85.0%	81.2%	81.3%	80.1%	72.3%	64.7%	62.8%	58.9%	60.7%	59.8%	61.4%	63.3%	60.5%	59.0%	56.6%	57.8%
Dollar Value Index	92.52	97.40	104.44	116.48	116.87	119.45	125.91	126.66	119.09	113.59	110.81	108.52	103.40	99.90	105.69	101.82	97.15	99.82	101.12

Sources: U.S. Bureau of Economic Analysis, Federal Reserve Board

TRADE BALANCES

The broadest measure of motor vehicle industry trade includes new and used vehicles and parts and accessories, and the common base for comparing and summarizing is their dollar values. The chart above illustrates changes in the balance of trade by calculating export values as a percent of import values. (This also removes the effects of inflation.) The fact that all of the export::import ratios – Motor Vehicles (blue squares), Parts and Accessories (red diamonds) and the Industry Total combination of the two (purple circles) – are less than 100 percent (the left vertical axis) indicates a U.S. trade deficit for each part and the industry as a whole during the 1995-2013 period.[60]

A partial explanation for the changes in the ratios is the changing Index Value of the Dollar (green rectangles, the right vertical axis).[61] A lower value of the dollar makes American-made goods relatively less expensive for foreigners to buy and foreign goods more expensive for people and companies in American to buy. A higher value has the opposite effects. Consequently, as the Index Value rose from 1995 through 2002, American exports became more expensive, and the Motor Vehicle export::import ratio fell, and as the Index fell from 2002 through 2008, American exports became more affordable and the Motor Vehicle ratio rose. Even the slightly elevated Index values in 2009-2010 and 2012-2013 were accompanied by slightly lower Motor Vehicle ratios. The relationship between the Index Value and the Total ratio largely reflects the incorporated Index Value--Motor Vehicle ratio relationship.

On the other hand, changes in the Parts and Accessories ratio appear to have a different relationship with changes in Index values; they have not moved in opposite directions as the aforementioned Motor Vehicles. Possible explanations for this may be the lower costs of parts, their use in specific models, and the ties of parts suppliers with assemblers. Parts suppliers often are tied to a few assemblers (or one for power train and stamping plants associated with light vehicles). Consequently, when foreign-based assemblers first establish plants here, they may have to import parts (more initially, fewer eventually as either their parts suppliers open facilities here or relationships are established with indigenous suppliers)[62] despite unfavorable currency exchange ratios, instead relying on the greater value-added at assembly plants to compensate for the added expense.

A deeper (albeit narrower) understanding of the impact of currency fluctuations on trade would focus on specific currencies instead of the Index Value, and would note effects on U.S.-based companies can be complex. For example, the devaluation of Asian currencies aided U.S.-based tire manufacturers by making natural rubber, their principal raw material, less expensive (Prat, 1998). One of them even increased production at its Asian plants because the devaluation of Asian currencies made its own products inexpensive imports, thereby decreasing its costs. Similarly, an under-valued yuan and rapid industrialization may explain why tire imports from China grew 57.5 percent from 2012 to reach 51.2 million units in 2013. The encompassing overall growth of tire imports and increased competition from low-cost Asian manu-

facturers may have contributed to over-capacity in N. America. This led domestic companies to increase their production of commodity tires in low-cost countries while shifting domestic production to higher-margin premium brands (Levy, 2014: 8).

Trade agreements can affect levels of trade independently of the dollar's value. The N. American Free Trade Agreement (NAFTA) boosted motor vehicle trade among the member countries. Manufacturers rationalized production, improved productivity and reduced expenses. NAFTA's effect on U.S.-Canadian trade has been less dramatic than on U.S.-Mexican trade because Canada and the U.S. already had small or no tariffs (Gott, et.al., 1999). However, Mexico's NAFTA and MERCOSUR memberships link the N. and S. American trade blocks, and its lower costs make it an attractive location for exports to other Latin America nations, not just to the U.S. and Canada (Levy, 1999).

Government policy may have unintended consequences on trade. U.S.-based companies shifted the assembly of some larger (and more expensive) cars to Canada in order to meet the Corporate Average Fuel Economy (CAFE) requirements for vehicles assembled in the U.S. (Adams, 1998). This shows up in the U.S.-Canadian trade statistics. Most of the bilateral industry trade with Canada consists of intra-company shipments (Gott, et.al., 1999). The U.S. exports more engines and other parts to Canada than it imports from Canada (which may be another reason why the Parts export:: import ratio is not inversely related to the dollar Index Value). However, many of those engines and parts come back to the U.S. in vehicles; the U.S. trade deficit with Canada in vehicles (in recent years this has been specified to cars) has more than off-set the surplus in engines, parts and accessories (U.S. Bureau of Economic Analysis, 2014b).

See Table A17

DETAILED TABLES

Table A1: Leading and Notable Motor Vehicle Industry Employers in Ohio, 2014

Parent/Co. Name/Division	NAICS#	City	Jobs~ Total	Jobs~ At Site
ARE, Inc.[1]			750	
ARE, Inc.	336211	Massillon		475
ARE, Inc.	336211	Mt. Eaton		275
Ahresty Corp./Ahresty Wilmington Corp.^	33152	Wilmington		650
Aisin Seiki Co., Ltd.*/Advics Mfg. Ohio, Inc.^	33634	Lebanon		670
ArcelorMittal*/ArcelorMittal Tailored Blanks^	33637	Pioneer		85
Asahi Glass Co., Ltd.^			635	
AGC Automotive N. America, Inc.	3272	Bellefontaine		485
Belletech Corp.	3272	Bellefontaine		150
Berkshire Hathaway, Inc.*/Scott Fetzer Co./Stahl Co.[2]	336212	Wooster		94
Cooper Tire & Rubber Co. (also HQ)*	326211	Findlay		1,000
Cooper-Standard Holdings, Inc.*			702	
Cooper-Standard Automotive, Inc.	33634	New Lexington		352
Cooper-Standard Automotive, Inc.	33639	Bowling Green		350
Crown Battery Mfg. Co.[3]	335911	Fremont		548
Daimler AG*/Detroit Diesel Remanufacturing East^	333618	Byesville		535
Dana Holding Corp.*/Dana Driveshaft Mfg., LLC[4]	33639	Lima		400
Delphi Automotive PLC^			550	
Delphi Automotive Systems, LLC	3363	Warren		200
Delphi Automotive Systems, LLC	3363	Vandalia		350
Dover Corp.*/Wiseco Piston Co., Inc.	33631	Mentor		200
Ernie Green Industries, Inc.			790	
Forida Production Engineering, Inc.	33637	New Madison		90
Marion Industries, Inc.[5]	33634	Marion		700
FCA, Inc.*			5,830	
Hyundai M&D Co., Ltd./Mobis NA LLC (integrated with the complex)[6]	336111	Toledo		420
FCA, Inc. (Toledo Assembly Complex)^	336112	Toledo		4,110
Kuka AG/Kuka Toledo Production Operations, LLC (integrated with the complex)^	336211	Toledo		250
FCA, Inc.^	33635	Perrysburg		1,050
Flex-N-Gate (fka Ford's Automotive Components Holdings LLC)[7]	33639	Sandusky		950
Ford Motor Co.*[8]			6,016	
Ford Motor Co. (this is becoming a medium-duty truck plant)	336112	Avon Lake		1,886
Ford Motor Co. (Engine Plant #1)	336312	Brookpark		970
Ford Motor Co.[25]	336312	Lima		969

Table A1: Leading and Notable Motor Vehicle Industry Employers in Ohio, 2014

Parent/Co. Name/Division	NAICS#	City	Jobs~ Total	Jobs~ At Site
Ford Motor Co. (continued)*[8]				
Ford Motor Co.	33635	Sharonville		1,875
Ford Motor Co.	33637	Walton Hills		316
F-Tech, Inc./F&P America Mfg., Inc.^	3363	Troy		650
General Motors Co.*[8]			9,585	
General Motors Co.	33152	Defiance		1,309
DMAX (Isuzu Motors Ltd. owns 40 percent)	333618	Dayton		519
General Motors Co. (jobs include a small adjacent stamping plant)	336111/7	Lordstown		4,500
General Motors Co.	33635	Toledo		1,890
General Motors Co.	33637	Parma		1,367
Goodyear Tire & Rubber Co. (includes HQ)*[9]	326211	Akron		3,500
G-TEKT Corp./Jefferson Industries Corp.^	33637	W Jefferson		700
Hitachi, Ltd.*/AAP St. Marys Corp.^	33639	Saint Marys		525
Honda Motor Co., Ltd.*^			13,555	
AY Mfg., Ltd.	3363	Columbus		175
Cardington Yutaka Technologies Inc.	33639	Cardington		725
Celina Aluminum Precision Technology, Inc.	331524	Celina		500
Honda of America Mfg., Inc.	3363	Marysville		200
Honda of America Mfg., Inc.	336112	East Liberty		2,650
Honda of America Mfg., Inc.	33631	Anna		2,600
Honda of America Mfg., Inc.	336111	Marysville		5,000
Honda Engineering N. America, Inc.	3335	Marysville		350
Honda Transmission Mfg. of America, Inc.	33635	Russells Point		1,135
US Yachiyo, Inc.	33639	Marion		220
Honda affiliates:^			4,745	
KTH Parts Industries, Inc.			1,490	
Kalida Mfg. Inc.	33639	Kalida		450
KTH Parts Industries, Inc.	33639	Saint Paris		1,040
Nihon Plast Co., Ltd./Neaton Auto Parts Mfg., Inc.		Eaton		750
Nissin Kogyo Co., Ltd./Nissin Brake Ohio, Inc.	33634	Findlay		750
Tanaka Seimitsu Kogyo Co., Ltd./FT Precision, Inc.	33639	Fredericktown		365
Toyo Denso Co., Ltd./Weastec, Inc.	33632	Hillsboro		145
TS Tech Co., Ltd.			820	
Trim Industries, Inc.	33636	Canal Winchester		440

Table A1: Leading and Notable Motor Vehicle Industry Employers in Ohio, 2014

Parent/Co. Name/Division	NAICS#	City	Jobs~ Total	Jobs~ At Site
Honda affiliates (continued):^				
Tri-Mold LLC	32619	Circleville		170
TS Tech USA Corp.	33636	Reynoldsburg		210
Yamada Mfg. Co., Ltd./Yamada N. America, Inc.	33633	South Charleston		425
International Automotive Components (IAC) Group SA			950	
IAC Group N. America, Inc.	33636	Sidney		350
IAC Group N. America, Inc.	33639	Wauseon		600
Johnson Controls, Inc.*			1,051	
Johnson Controls Battery Group, Inc.	335911	Holland		456
Johnson Controls Interiors Mfg.[10]	33636	Bryan		250
Johnson Controls Interiors LLC[11]	33639	Northwood		345
Kasai Kogyo Co.^			640	
M-Tek, Inc.	3363	Carey		100
M-Tek, Inc.	33637	Upper Sandusky		540
MAC Trailer, Inc.[12]			1,100	
MAC Trailer, Inc.	336212	Alliance		595
MAC Trailer, Inc.	336212	Kent		340
MAC Trailer, Inc.	336212	Salem		165
Magna International Inc.*			1,810	
Magna Modular Systems, Inc. (aka Magna exteriors & interiors, fka Decoma)	33639	Toledo		70
Norplas Industries, Inc.^ (aka Magna exteriors)	33637	Northwood		1,100
Magna Cosma International aka - Vehtek^	33637	Bowling Green		300
Gramag Truck Interior Systems LLC^ (joint venture with Grammar AG)	33636	London		30
Magna Seating of America, Inc.	33636	Warren		250
Magna Seating of America, Inc.^	33636	Strongsville		60
Mahle Behr GmbH & Co. KG^			1,265	
Mahle Dayton LLC	33631	Dayton		1,150
Mahle Engine Components USA, Inc.	33631	Mcconnelsville		115
Meritor, Inc.*[13]	33635	Heath		157
Midway Products Group Inc.			545	
Findlay Products Corp.	33637	Findlay		130
P & A Industries, Inc.	33637	Findlay		200
Progressive Stamping, Inc.[14]	33637	Ottoville		215
Mitsubishi Electric Corp.*/Mitsubishi Electric Automotive America, Inc.^	33632	Mason		400

Table A1: Leading and Notable Motor Vehicle Industry Employers in Ohio, 2014

Parent/Co. Name/Division	NAICS#	City	Jobs~ Total	Jobs~ At Site
Moriroku Holdings Co./Greenville Technology, Inc.^	33639	Greenville		735
MTD Holdings, Inc.			799	
Shiloh Industries, Inc.[15]	33637	Wellington		220
Shiloh Industries, Inc. (aka Welded Blank or 3D Metals)	33637	Valley City		n.a.
Shiloh Industries, Inc. (aka Medina Blanking)	33637	Valley City		50
Shiloh Industries, Inc. (includes HQ)	33637	Valley City		n.a.
Navistar International Corp.* (aka International Truck & Engine)[16]	33612	Springfield		900
Nihon Plast Co., Ltd./Neaton Auto Parts Mfg., Inc.^		Eaton		750
Nissin Kogyo Co., Ltd./Nissin Brake Ohio, Inc.^	33634	Findlay		750
Paccar, Inc.*/Kenworth Truck Co.[17]	33612	Chillicothe		2,000
Pacific Industrial Co., Ltd./Pacific Mfg. Ohio, Inc.^	33639	Fairfield		500
Parker-Hannifin Corp.*/Hose Products Division	33639	Wickliffe		271
Peugeot SA*^			870	
Faurecia Exhaust Systems, Inc.	3363	Northwood		50
Faurecia Exhaust Systems, Inc.[18]	33639	Franklin		390
Faurecia Exhaust Systems, Inc.	33639	Troy		300
Faurecia Exhaust Systems, Inc.	33639	Toledo		130
Robert Bosch Stiftung GmbH*/Robert Bosch Battery Systems LLC	335911	Springboro		165
Sankei Giken Co., Ltd./Newman Technology, Inc.^	33639	Mansfield		800
Sanoh Industrial Co., Ltd.^			610	
Sanoh America, Inc.	3329	Findlay		280
Sanoh America, Inc.	3363	Mt. Vernon		260
Sanoh America, Inc.	3329	Archbold		70
Schaeffler Technologies GmbH & Co. KG/LuK-Schaeffler Group USA, Inc.^	33639	Wooster		1,175
Showa Corp.^			1,125	
American Showa, Inc.	3363	Sunbury		550
American Showa, Inc.	33633	Blanchester		575
Stanley Electric Co., Inc./Stanley Electric US Co Inc.^	33632	London		630
Stoneridge, Inc.[5]	33632	Lexington		500
Tachi-S Co., Ltd./Setex, Inc.^	33636	Saint Marys		500
Tenneco, Inc.*			870	
Tenneco, Inc.[19]	33639	Napoleon		450
Tenneco, Inc.[20]	33639	Kettering		420
Thor Industries, Inc.*/Airstream, Inc.[21]	336213	Jackson Center		435

Table A1: Leading and Notable Motor Vehicle Industry Employers in Ohio, 2014

Parent/Co. Name/Division	NAICS#	City	Jobs~ Total	Jobs~ At Site
ThyssenKrupp AG*/Bilstein of America, Inc.^	33633	Hamilton		185
Tokai Kogyo Co., Ltd./Green Tokai Co., Ltd.^	33639	Brookville		535
Tokai Rubber Industries Ltd./DTR Industries, Inc.^	32621	Bluffton		650
Toledo Molding and Die, Inc.[22]	32619		1,500	
Toledo Molding and Die, Inc. (HQ and Test Lab)		Toledo		n.a.
Toledo Molding and Die, Inc.		Bowling Green		n.a.
Toledo Molding and Die, Inc.		Delphos		n.a.
Toledo Molding and Die, Inc.		Tiffin		n.a.
Toledo Molding and Die, Inc.		Toledo		n.a.
WEK		Jefferson		n.a.
Tower International, Inc.*			475	
Tower Automotive Operations USA I LLC	33637	Bluffton		283
Tower Automotive Operations USA I LLC	33639	Bellevue		192
TRW Automotive Holdings Corp.*[23]	33634	Fayette		210
Worthington Industries, Inc.*/Artiflex Mfg., LLC[24]	33637	Wooster		580

Abbreviations, notes and sources: aka - also know as; fka - formerly known as; HQ - headquarters; Intl. - International; Mfg. - Manufacturing; n.a. - not available; NAICS - N. American Industry Classification System; # - non-industry NAICS codes are included if production is principally for motor vehicles; ~ - unless otherwise noted, the jobs figure is from Hoover's (2014); * - a Fortune U.S.-1,000 or Global 500 company; ^ - jobs figure from International Corporate Investment in Ohio Operations (Office of Research, ODSA, 2014a); 1 - jobs figure from Pritchard (2013); 2 - figure from OSHA (2012); 3 - jobs figures from Sandusky Co. Economic Development Corp. (2013); 4 - jobs figure is UAW employees only (Blade Staff, 2014); other non-mfg. sites excluded; 5 - jobs figure from automotiveoem.com (2014); 6 - jobs figure derived from Toledo News Now (2012) and Snavely (2013); 7 - jobs figure from Erie County Development (2014); 8 - job figures from company website; 9 - jobs figure from Akron Ohio Economic Development (2013); 10 - minimal estimate from Manta (2014); 11 - estimate from Guyton (2012); 12 - total is approximate and from Weber (2014); Salem figure from Shields (2011); Kent figure McDonald (2014); Alliance figure by subtraction; 13 - the plant may close in 2014 or 2015; 14 - jobs figure from the Better Business Bureau, Lima (2014); 15 - jobs figure from Muncey (2014); 16 - estimate from the Dayton Daily News (2013); 17 - based on Wartenburg (2012); 18 - the company plans to add 120 jobs at this site in the near future (Staff-Dispatch, 2014); 19 - jobs figure from CIC of Henry County (2014); 20 - jobs figure from Gnau (2013); 21 - 125 jobs may soon be added (Cogliano 2014a, b); 22 - jobs figure from Lauzon (2014); 23 - jobs figure from Coehrs (2014) - the company may add 20 jobs in the near future; ZF Friedrichshafen is buying TRW (AP, 2014); 24 - Wayne County Economic Development Council (2014); 300 jobs may soon be added (Linkhorn, 2014).

Table A2: Expansion and Attraction Announcements in Ohio's Motor Vehicle Industry, 2010-2013

Year	Parent/Company/Division	County	NAICS Code*	Product	Total Invested	Jobs	Space (Sq. Ft.)
2010	American Cold Forge	Wood	332111	Steel auto parts	$2,000,000	22	11,000
2010	Behr GmbH & Co. KG/Behr Dayton Thermal Products	Montgomery	336391	Air-conditioning	$12,300,000		
2010	Bridgestone Corp./Bridgestone APM Co.	Wyandot	326291	Motor vehicle seat parts	$2,800,000	50	23,600
2010	Delphi Automotive plc/Delphi Automotive LLP	Montgomery	336391	Air-conditioning parts	$7,000,000	100	
2010	Fehrer Enterprise Corp./NC Works, Inc.	Warren	31323	Automotive fabrics	$4,200,000	30	80,000
2010	Ford Motor Co.	Cuyahoga	336312	Engines, related activity	$121,000,000	60	
2010	Ford Motor Co.	Allen	336312	Engines, related activity	$59,000,000	300	
2010	Ford Motor Co.	Cuyahoga	336312	Engines, related activity	$50,000,000		
2010	FT Precision, Inc.	Knox	336399	Miscellaneous parts	$82,600,000	62	
2010	General Motors Co.	Defiance	331524	Aluminum engine blocks	$176,000,000	189	
2010	General Motors Co.	Lucas	33635	Transmissions	$20,000,000		
2010	Honda Motor Co., Ltd./Honda of America Mfg.	Logan	33635	Transmissions	$20,000,000	100	200,000
2010	Honda Motor Co., Ltd./Honda of America Mfg.	Union	336111	Cars, related assembly activity	$4,926,000		
2010	Honda Motor Co., Ltd./Honda of America Mfg.	Logan	336112	SUVs, related assembly activity	$3,000,000		40,000
2010	Inteva Products	Montgomery	336399	Miscellaneous parts	$1,200,000	20	63,000
2010	Magna International, Inc./Norplas Industries, Inc.	Wood	33637	Stampings	$6,500,000	300	30,000
2010	Moriroku Holdings Co./Greenville Technology, Inc.	Darke	326199	Plastic auto parts	$5,000,000		72,000
2010	Nissin Kogyo Co., Ltd./Nissin Brake Ohio, Inc.	Hancock	33634	Brakes	$36,000,000	37	
2010	Ohio Stamping & Machine LLC	Clark	33637	Stampings	$1,900,000		
2010	Sanoh Industrial Co., Ltd./Sanoh America, Inc.	Fulton	33634	Brake parts	$4,200,000	28	
2010	Schaeffler Technologies GmbH & Co. KG/LuK Schaeffler Group USA, Inc.	Wayne	336399	Miscellaneous parts		50	
2010	September Ends	Clark	33636	Interior trim	$1,000,000		
2010	Structure Mfg. Group	Huron	33612	Trucks	$2,200,000	150	
2010	Thor Industries, Inc./Airstream, Inc.	Shelby	336213	Recreational vehicles	$2,000,000	99	
2010	VR Waverly	Pike	33637	Stampings	$2,500,000	50	
2010	Walther Engineering & Mfg. Co.	Warren	336399	Truck parts	$2,000,000		30,000
2010 Subtotals					$629,326,000	1,647	549,600
2011	American Trailer Works, Inc.	Brown	336212	Trailers	$5,200,000	110	
2011	AMP Electric Vehicles, Inc.	Hamilton	336111	Cars, related assembly activity	$1,100,000		45,000
2011	Behr GmbH & Co. KG/Behr Dayton Thermal Products	Montgomery	336391	Air-conditioning	$12,300,000		
2011	Bridgestone Corp./Bridgestone APM Co.	Hancock	336399	Miscellaneous parts	$2,300,000		22,000
2011	Engineered Mobile Solutions, Inc.	Clermont	336212	Trailers		20	58,000
2011	FCA, Inc.	Lucas	336112	SUVs, related assembly activity	$500,000,000	1,100	260,000
2011	FCA, Inc.	Wood	336399	Miscellaneous parts	$72,000,000		
2011	FCA, Inc.	Lucas	336112	SUVs, related assembly activity			26,000
2011	Feintool International Holding AG/Feintool Cincinnati, Inc.	Hamilton	33637	Stampings	$2,000,000		
2011	Ford Motor Co.	Cuyahoga	336312	Engines, related activity	$250,000,000	200	
2011	Ford Motor Co.	Lorain	336112	Vans, related assembly activity	$128,000,000		
2011	Ford Motor Co./Automotive Components Holding	Erie	336399	Miscellaneous parts	$1,700,000		
2011	Formed Fiber Technologies LLC	Shelby	33636	Seats		57	
2011	Gebr. Rochling KG/Roechling Automotive Corp. USA LLP	Summit	326199	Plastic auto parts	$28,000,000	123	75,000
2011	General Motors Co.	Lucas	33635	Transmissions	$260,000,000	400	
2011	General Motors Co.	Lucas	33635	Transmissions	$83,000,000	30	
2011	General Motors Co.	Cuyahoga	33637	Stampings	$60,000,000	200	
2011	General Motors Co.	Trumbull	336111	Cars, related assembly activity	$5,500,000		
2011	Honda Motor Co., Ltd./Honda of America Mfg.	Logan	336112	SUVs, related assembly activity	$69,000,000		
2011	Honda Motor Co., Ltd./Honda of America Mfg.	Union	336111	Cars, related assembly activity	$64,000,000		
2011	Honda Motor Co., Ltd./Honda of America Mfg.	Logan	336112	SUVs, related assembly activity	$44,000,000		
2011	Honda Motor Co., Ltd./Honda of America Mfg.	Logan	33635	Transmissions	$40,000,000		75,000

Table A2: Expansion and Attraction Announcements in Ohio's Motor Vehicle Industry, 2010-2013

Year	Parent/Company/Division	County	NAICS Code*	Product	Total Invested	Jobs	Space (Sq. Ft.)
2011	Honda Motor Co., Ltd./Honda of America Mfg.	Shelby	336312	Engines, related activity	$30,000,000		
2011	Honda Motor Co., Ltd./Honda of America Mfg.	Logan	336112	SUVs, related assembly activity	$16,000,000		
2011	Honda Motor Co., Ltd./Honda of America Mfg.	Logan	33635	Transmissions	$10,000,000		
2011	Honda Motor Co., Ltd./Honda of America Mfg.	Logan	336112	SUVs, related assembly activity	$6,000,000		
2011	Howa Textile Industry Co., Ltd./American Howa Kentucky, Inc.	Delaware	336399	Auto sun shades	$6,000,000	85	
2011	International Automotive Components Group	Fulton	336399	Miscellaneous parts	$18,000,000	105	
2011	International Automotive Components Group	Shelby	33636	Seats		56	
2011	JM Consolidated Industries LLC	Clark	336399	Truck parts	$1,500,000	50	
2011	Johnson Controls, Inc.	Lucas	335911	Batteries	$138,500,000	50	220,000
2011	Johnson Controls, Inc.	Highland	33636	Seats	$6,700,000	96	
2011	K. William Beach Mfg. Co.	Clark	33633	Steering/suspension subassemblies	$2,100,000	13	
2011	KTH Parts Industries, Inc./Kalida Mfg. Inc	Putnam	33637	Stampings	$8,200,000	3	15,000
2011	MAC Trailer	Stark	336212	Trailers		125	
2011	MAC Trailer/MAC LTT, LCC	Portage	336212	Tank trailers	$6,100,000	250	
2011	Magna International, Inc./Vehtek Systems, Inc.	Wood	33637	Stampings	$109,000,000	250	309,000
2011	Mancor Canada, Inc./Mancor Ohio, Inc.	Montgomery	336399	Truck parts	$947,000	50	11,300
2011	Midway Products Group, Inc.	Hancock	33637	Stampings		60	50,000
2011	Millat Industries	Montgomery	336399	Miscellaneous parts	$1,500,000		
2011	Mitec Automotive AG/Mitec Powertrain, Inc.	Hancock	336399	Miscellaneous parts	$32,000,000	88	100,000
2011	Nissen Chemitec Corp./Nissen Chemitec America, Inc.	Madison	326199	Plastic auto parts		25	30,000
2011	Optimum Plastics, Inc.	Delaware	326199	Plastic auto parts	$6,300,000	8	30,000
2011	Paccar, Inc./Kenworth Truck Co.	Ross	33612	Heavy duty trucks		511	
2011	Reiter Automotive/Autonuem	Lucas	336399	Auto acoustics products	$20,000,000	150	107,000
2011	Riffle Machine Works	Ross	336399	Truck parts	$1,200,000	125	50,000
2011	Shougang Corp./BWI Group	Montgomery	336111	Car chassis	$20,200,000	100	160,000
2011	ThyssenKrupp AG/Bilstein of America	Butler	33633	Shock absorbers	$7,300,000	60	
2011	Tremcar, Inc./Tremcar USA, Inc.	Tuscarawas	336211	Aluminum tanks	$2,500,000	145	
2011	TRW (fka Kelsey-Hayes Co.)	Fulton	33634	Brake parts	$4,000,000	24	
2011	UCI-Fram Group Operations	Darke	336399	Oil filters	$9,900,000	73	
2011	UCI-Fram Group Operations	Wood	336322	Spark plugs	$800,000	62	
2011	USUI Kokusai Sangyo Kaisha Ltd./USUI International Corp.	Hamilton	336399	Miscellaneous parts	$15,900,000	130	125,000
2011	Windsor Mold, Inc./Autoplas, Inc.	Huron	326199	Plastic auto parts	$9,700,000	40	27,500
2011	Yamada Mfg. Co., Ltd./Yamada N. America, Inc.	Clark	33633	Steering systems	$20,000,000	60	
2011 Subtotals					$2,138,447,000	5,034	1,795,800
2012	Ada Technologies, Inc.	Hardin	336399	Miscellaneous parts	$5,200,000	52	
2012	ArcelorMittal/Powerlasers	Williams	33637	Metal blanks	$5,000,000	30	
2012	Creative Extruded Products, Inc.	Montgomery	326199	Plastic auto parts			65,000
2012	Dia Seiko Co., Ltd./ABC INOAC Exterior Systems LLC	Sandusky	326121	Plastic auto parts	$14,000,000	100	
2012	Ernie Green Industries, Inc./Florida Production Engineering, Inc.	Pickaway	336399	Miscellaneous parts	$2,500,000	32	41,000
2012	Fehrer Enterprise Corp./NC Works, Inc.	Warren	31323	Automotive fabrics	$3,800,000	16	60,000
2012	Findlay Products Corp.	Hancock	33637	Stampings	$1,000,000		
2012	Fuserashi Co., Ltd./Fuserashi International Technology, Inc.	Medina	33637	Forged auto parts	$4,400,000	17	60,000
2012	Gebr. Rochling KG/Roechling Automotive Corp. USA LLP	Summit	326199	Plastic auto parts	$4,000,000		
2012	General Motors Co.	Trumbull	336111	Cars, related assembly activity	$200,000,000		
2012	General Motors Co.	Cuyahoga	33637	Stampings	$20,000,000		
2012	Honda Motor Co., Ltd./Honda of America Mfg.	Shelby	336312	Engines, related activity	$170,000,000	200	
2012	Honda Motor Co., Ltd./Honda of America Mfg.	Shelby	336312	CVT pulley parts	$98,000,000	20	
2012	Honda Motor Co., Ltd./Honda of America Mfg.	Logan	33635	Transmissions	$50,000,000	120	
2012	Honda Motor Co., Ltd./Honda of America Mfg.	Logan	336112	SUVs, related assembly activity	$16,000,000		

Table A2: Expansion and Attraction Announcements in Ohio's Motor Vehicle Industry, 2010-2013

Year	Parent/Company/Division	County	NAICS Code*	Product	Total Invested	Jobs	Space (Sq. Ft.)
2012	Honda Motor Co., Ltd./Honda of America Mfg.	Union	336111	Cars, related assembly activity	$7,100,000		
2012	Honda Motor Co., Ltd./US Yachiyo, Inc.	Marion	336399	Fuel tanks	$20,000,000	40	51,000
2012	Imasen Electric Industrial Co., Ltd./Imasen Bucyrus Technology, Inc.	Crawford	336399	Motor vehicle parts		250	
2012	Industry Products Co.	Miami	336399	Auto trunk floors	$3,400,000	50	124,000
2012	International Automotive Components Group/Huron LLC	Erie	33636	Interior trim	$5,000,000	143	
2012	Johnson Controls, Inc./Hoover Universal	Wood	336399	Miscellaneous parts	$10,000,000	86	
2012	KTH Parts Industries, Inc. (Honda affiliate)	Champaign	336399	Miscellaneous parts	$4,700,000	100	
2012	KTH Parts Industries, Inc./Kalida Mfg. Inc	Putnam	336399	Miscellaneous parts		41	120,000
2012	L&W Cleveland	Lorain	33637	Stampings	$16,500,000	60	
2012	Marengo Fabricated Steel Ltd.	Morrow	336211	Tank truck bodies	$1,500,000	15	
2012	Molten Corp.	Hancock	326199	Plastic auto parts	$1,200,000	60	
2012	Nissin Kogyo Co., Ltd./Nissin Brake Ohio, Inc.	Hancock	33634	Brakes	$20,000,000	125	320,000
2012	Oerlikon/Sulzer Friction Systems	Montgomery	33635	Transmission parts	$4,000,000		
2012	Ohashi Technica, Inc./Ohashi Technica USA, Inc.	Delaware	336399	Miscellaneous parts	$2,000,000		28,000
2012	Piston Automotive LLC	Lucas	336399	Miscellaneous parts	$6,900,000	84	
2012	Sanoh Industrial Co., Ltd./Sanoh America, Inc.	Fulton	33634	Brake parts	$7,000,000	40	
2012	Schaeffler Technologies GmbH & Co. KG/LuK Schaeffler Group USA, Inc.	Wayne	336399	Miscellaneous parts	$46,500,000	100	
2012	Stanley Electric Co., Inc./Stanley Electric US Co.	Madison	336321	Motor vehicle lighting	$56,700,000		
2012	Stripmatic Products	Cuyahoga	33637	Stampings	$1,600,000		
2012	Taiho Kogyo Co., Ltd./Taiho Corp. of America	Seneca	336399	Miscellaneous parts	$13,000,000	35	
2012	Toledo Molding & Die, Inc.	Seneca	336399	Miscellaneous parts	$8,400,000	64	
2012	Toledo Molding & Die, Inc.	Van Wert	336399	Miscellaneous parts	$5,400,000	45	
2012	Toledo Molding & Die, Inc.	Lucas	336399	Miscellaneous parts	$3,000,000	41	50,000
2012	TS Tech Co., Ltd./TS Trim Industries, Inc.	Franklin	33637	Stamped trim parts	$7,000,000		85,000
2012	Westport Axle Corp.	Lorain	336399	Axles	$3,500,000	10	100,000
2012	Wiseco Piston Company, Inc.	Lake	336311	Forged aluminum pistons	$1,500,000	100	
2012 Subtotals					$849,800,000	2,076	1,104,000
2013	Ada Technologies, Inc.	Hardin	336399	Miscellaneous parts	$1,000,000		
2013	Ahresty Corp./Ahresty Wilmington Corp.	Clinton	331523	Die-cast aluminum auto parts		107	25,000
2013	AMG Industries, Inc.	Knox	33637	Stampings	$100,000	10	200,000
2013	Behr GmbH & Co. KG/Behr Dayton Thermal Products	Montgomery	336391	Air-conditioning parts	$4,000,000		
2013	Bridgestone Corp./Bridgestone APM Co.	Wyandot	326291	Motor vehicle rubber products	$3,200,000	25	
2013	Clark Fixture Technology Mexico S. de RL de CV/Clark Fixture Technologies	Wood	336399	Exhaust system	$1,000,000	5	8,600
2013	Eberhard Mfg. Co.	Cuyahoga	336399	Miscellaneous parts	$1,200,000		20,000
2013	FCA, Inc.	Wood	336399	Miscellaneous parts	$20,000,000		
2013	Ford Motor Co.	Allen	336312	Engines, related activity	$420,000,000		
2013	General Motors Co.	Lucas	33635	Transmissions	$55,700,000		
2013	General Motors Co.	Lucas	33635	Transmissions	$30,000,000		
2013	G-Tekt Ltd./G-Tekt N. America Corp.	Madison	33637	Stampings	$28,000,000	23	173,000
2013	Hendrickson USA LLC	Stark	33633	Truck suspensions	$2,000,000	30	
2013	Hitachi, Ltd./AAP St. Marys Corp.	Auglaize	336399	Auto wheels			93,000
2013	Honda Motor Co., Ltd./Honda of America Mfg.	Shelby	336312	Engine parts	$180,000,000		
2013	Honda Motor Co., Ltd./Honda of America Mfg.	Union	336111	Cars, related assembly activity	$70,000,000	100	
2013	Honda Motor Co., Ltd./Honda of America Mfg.	Union	336111	Cars, related assembly activity	$23,000,000	50	
2013	Howa Textile Industry Co., Ltd./American Howa Kentucky, Inc.	Delaware	336399	Miscellaneous parts	$4,300,000	60	
2013	Ikeda Mfg. Co., Ltd./Sunfield, Inc.	Licking	336399	Miscellaneous parts			64,000
2013	International Automotive Components Group	Shelby	336399	Miscellaneous parts	$1,200,000	42	
2013	ISS America, Inc.	Logan	336311	Auto engine parts	$3,000,000	20	20,000
2013	KTH Parts Industries, Inc. (Honda affiliate)	Champaign	336399	Miscellaneous parts	$28,000,000	60	60,000

Table A2: Expansion and Attraction Announcements in Ohio's Motor Vehicle Industry, 2010-2013

Year	Parent/Company/Division	County	NAICS Code*	Product	Total Invested	Jobs	Space (Sq. Ft.)
2013	Matcor Automotive, Inc./Matsu Ohio, Inc.	Williams	33637	Stampings	$4,000,000	46	
2013	Miba AG/Miba Sinter USA LLC	Morgan	336399	Sintered auto parts	$34,000,000	110	
2013	Millat Industries	Montgomery	336399	Motor vehicle parts	$2,800,000	13	
2013	Minth N. America, Inc.	Warren	336399	Miscellaneous parts	$86,000,000	418	
2013	Mitec Automotive AG/Mitec Powertrain, Inc.	Hancock	336399	Miscellaneous parts	$1,500,000		
2013	Muro corp./Murotech Ohio Corp.	Auglaize	33637	Stampings	$1,300,000		12,000
2013	Nippon Sheet Glass Co., Ltd./Pilkington N. America, Inc.	Wood	327211	Motor vehicle glass	$250,000	100	
2013	Ohio Valley Mfg.	Richland	33637	Stampings	$4,500,000	30	35,000
2013	Proform Industries Ltd.	Franklin	336399	Fuel tanks	$1,200,000	120	
2013	Riffle Machine Works	Ross	336399	Truck part subassemblies	$3,000,000	40	100,000
2013	Stanley Electric Co., Inc./Stanley Electric US Co.	Madison	336321	Motor vehicle lighting	$15,000,000	150	
2013	Tachi-S Co., Ltd./Setex, Inc.	Auglaize	33636	Seats		85	44,000
2013	Takagi Mfg. Co., Ltd./Takumi Stamping, Inc.	Butler	33637	Stampings	$3,600,000	13	46,000
2013	ThyssenKrupp AG/Bilstein of America	Butler	33633	Suspension components	$5,400,000	100	
2013	Trilogy Engineered Solutions LLC	Summit	336312	Engine parts for CNG	$1,100,000	25	
2013	Valeo SA/Valeo Climate Control Corp.	Butler	336391	Air-conditioning parts	$14,400,000	105	
2013	Xperion E & E USA LLC	Licking	336312	Cylinders for natural gas	$6,400,000	59	50,000
2013 Subtotals					$1,060,150,000	1,946	950,600
Grand Totals 2010-2013:					$4,677,723,000	10,703	4,400,000

Notes: * - Establishments with NAICS codes outside of the industry definition are included here when their products are made for motor vehicles.
Abbreviations Used: Mfg. - manufacturing.

Source: Office of Research, ODSA (2011-2014b).

Prepared by: Office of Research, Ohio Development Services Agency (ODSA) (DL, JK, 8/14).

Table A3: Motor Vehicle Industry Concentration in Ohio

Year, Subject & NAICS Codes	Industry Title[1]	From Ohio: Amount (millions)	From Ohio: Distribu-tion in Ohio	U.S. Totals (millions)	Ohio as a Percentage of the U.S.
2011 GDP[2]:	Total	$519,082		$15,431,583	3.4%
3361-3	Motor Vehicle Industry (part)[3]	$9,836		$113,793	8.6%
2011 Value-Added:					
3361-3	Motor Vehicle Industry (part)[3]	$12,009	100.0%	$126,751	9.5%
3361	MV Assembly	$4,459	37.1%	$54,917	8.1%
3362	MV Bodies & Trailers	$412	3.4%	$8,980	4.6%
3363	MV Parts	$7,139	59.4%	$62,855	11.4%
2007 Value-Added:	Motor Vehicle Industry (summary)	$21,467	100.0%	$168,943	12.7%
3361-3	Motor Vehicle Industry (part)	$21,040	98.0%	$159,024	13.2%
3361	MV Assembly	$9,920	46.2%	$73,382	13.5%
33611	Automobile & Light Duty MV	$9,294	43.3%	$68,785	13.5%
336111	Automobiles	D	D	$22,036	D
336112	Light Truck & Utility Vehicles	D	D	$46,750	D
33612	Heavy Duty Trucks	$626	2.9%	$4,597	13.6%
3362	MV Bodies & Trailers	$470	2.2%	$12,783	3.7%
336211	MV Bodies	$269	1.3%	$4,364	6.2%
336212	Truck Trailers	$85	0.4%	$2,595	3.3%
336213&4	Motor Homes, Travel Trailers, & Campers	$117	0.5%	$5,824	2.0%
3363	MV Parts	$10,649	49.6%	$72,859	14.6%
33631	MV Gas Engines & Engine Parts	$2,340	10.9%	$9,877	23.7%
336311	Carburetors, Pistons, Rings, & Valves	$77	0.4%	$1,023	7.6%
336312	Gasoline Engines & Engine Parts	$2,262	10.5%	$8,855	25.5%
33632	MV Electrical & Electronic Eqpt.	$478	2.2%	$7,648	6.3%
336321	Vehicular Lighting Eqpt.	$269	1.3%	$1,597	16.8%
336322	Other MV Electrical & Electronic Eqpt.	$210	1.0%	$6,052	3.5%
33633	MV Steering & Suspension Parts	$526	2.4%	$4,026	13.1%
33634	MV Brake Systems	$488	2.3%	$3,822	12.8%
33635	MV Transmission & Power Train Parts	$1,674	7.8%	$12,202	13.7%
33636	MV Seating & Interior Trim	$828	3.9%	$5,249	15.8%
33637	MV Metal Stamping	$2,897	13.5%	$12,710	22.8%

Table A3: Motor Vehicle Industry Concentration in Ohio

Year, Subject & NAICS Codes	Industry Title[1]	From Ohio: Amount (millions)	From Ohio: Distribu-tion in Ohio	U.S. Totals (millions)	Ohio as a Percentage of the U.S.
33639	Other MV Parts	$1,418	6.6%	$16,712	8.5%
336391	MV Air-Conditioning	$109	0.5%	$2,134	5.1%
336399	All Other MV Parts	$1,310	6.1%	$14,578	9.0%
3261 & 335911	Related Non-transportation Industries	$427	2.0%	$9,919	4.3%
32621	Tires	$403	1.9%	$7,666	5.3%
326211	Tire Mfg. (Exc. Retreading)	$366	1.7%	$6,672	5.5%
326212	Tire Retreading	$37	0.2%	$611	6.0%
335911	Storage Batteries[4]	$24	0.1%	$2,253	1.1%

Notes: 1 - Abbreviations and symbols: D - suppressed to maintain confidentiality; Eqpt. - equipment; Exc. - except; GDP - gross domestic product; Mfg. - manufacturing; MV -motor vehicle(s).

2 - State GDP is analogous to national GDP, but not identical with it due to minor technical differences.

3 - The value-added figure for Motor Vehicle Industry (part) is greater than the GDP figure because the former includes costs not included in the latter. The GDP figures for 2011 may be revised at a later date.

4 - The value-added figure for Ohio was suppressed, and the encompassing figure for batteries (NAICS 33591) was used instead. Given that the only non-storage battery plant (NAICS 335912) in Ohio employed less than 20 people out of a total of 875 for all battery production, the $24.3 million figure may be only a slight over-statement.

Source: U.S. Bureau of the Census (2010c, 2013a), U.S. Bureau of Economic Analysis (2014a).

Prepared by: Office of Research, Ohio Development Services Agency (ODSA) (DL, JK, SK, 8/14).

Table A4a: Detailed Light Vehicle Production in Ohio, 2010-2014

Company: Assembly Type City Nameplate and Model	2014 (YTD)* Vehicles Produced	2014 (YTD)* Percent of Production	2013 (YTD) Vehicles Produced	2013 (YTD) Percent of Production	2013* Vehicles Produced	2013* Percent of Production	2012 Vehicles Produced	2012 Percent of Production	2011 Vehicles Produced	2011 Percent of Production	2010 Vehicles Produced	2010 Percent of Production	Notes
Total Light Vehicles	836,465	100.0%	721,884	100.0%	1,448,430	100.0%	1,372,608	100.0%	1,161,549	100.0%	1,103,532	100.0%	H1
Total Cars	388,626	46.5%	416,148	57.6%	794,604	54.9%	745,381	54.3%	565,851	48.7%	511,310	46.3%	
Total Light Trucks	447,839	53.5%	305,736	42.4%	653,826	45.1%	627,227	45.7%	595,698	51.3%	592,222	53.7%	FCA1
FCA: Light Trucks	256,165	30.6%	112,811	15.6%	295,997	20.4%	275,003	20.0%	269,131	23.2%	236,658	21.4%	Two adjacent SUV plants.
Toledo North:	139,167	16.6%	882	0.1%	72,958	5.0%	78,695	5.7%	103,965	9.0%	91,973	8.3%	FCA1
Dodge Nitro	0	0.0%	0	0.0%	0	0.0%	0	0.0%	26,042	2.2%	27,562	2.5%	Production ended in December, 2011.
Jeep Cherokee	139,167	16.6%	882	0.1%	72,958	5.0%	0	0.0%	0	0.0%	0	0.0%	FCA2
Jeep Liberty	0	0.0%	0	0.0%	0	0.0%	78,695	5.7%	77,923	6.7%	64,411	5.8%	Production ended in August, 2012.
Toledo Supplier Park:	116,998	14.0%	111,929	15.5%	223,039	15.4%	196,308	14.3%	165,166	14.2%	144,685	13.1%	FCA3
Jeep Wrangler	29,565	3.5%	37,313	5.2%	67,431	4.7%	72,472	5.3%	62,798	5.4%	59,181	5.4%	
Jeep Wrangler Unlimited	87,433	10.5%	74,616	10.3%	155,608	10.7%	123,836	9.0%	102,368	8.8%	85,504	7.7%	
Ford: Light Trucks	85,394	10.2%	79,339	11.0%	132,390	9.1%	135,231	9.9%	133,850	11.5%	121,471	11.0%	F1
Avon Lake (aka Ohio Assembly):	85,394	10.2%	79,339	11.0%	132,390	9.1%	135,231	9.9%	133,850	11.5%	121,471	11.0%	
Econoline	85,394	10.2%	79,339	11.0%	132,390	9.1%	135,231	9.9%	133,850	11.5%	121,471	11.0%	
GM: Cars	155,370	18.6%	150,427	20.8%	285,271	19.7%	279,382	20.4%	281,810	24.3%	158,099	14.3%	
Lordstown:	155,370	18.6%	150,427	20.8%	285,271	19.7%	279,382	20.4%	281,810	24.3%	158,099	14.3%	Sub-compacts.
Chevrolet Cobalt	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	91,796	8.3%	Replaced by the Cruze mid-2010.
Chevrolet Cruze	155,370	18.6%	150,427	20.8%	285,271	19.7%	279,382	20.4%	281,810	24.3%	66,303	6.0%	
Honda: Light Vehicles	339,536	40.6%	379,307	52.5%	734,772	50.7%	682,992	49.8%	476,758	41.0%	587,304	53.2%	H1
Car Subtotal	233,256	27.9%	265,721	36.8%	509,333	35.2%	465,999	33.9%	284,041	24.5%	353,211	32.0%	
Light Truck Subtotal	106,280	12.7%	113,586	15.7%	225,439	15.6%	216,993	15.8%	192,717	16.6%	234,093	21.2%	
E. Liberty--Light Vehicles:	114,264	13.7%	126,011	17.5%	242,363	16.7%	243,346	17.7%	192,179	16.5%	246,743	22.4%	
Acura RDX--Light Truck	27,431	3.3%	30,363	4.2%	57,007	3.9%	37,504	2.7%	0	0.0%	0	0.0%	A CUV; moved from Marysville, March, 2012.
Crosstour--Car	7,984	1.0%	12,425	1.7%	16,924	1.2%	26,435	1.9%	18,839	1.6%	33,200	3.0%	H2
CR-V--Light Truck	78,849	9.4%	83,223	11.5%	168,432	11.6%	179,407	13.1%	165,840	14.3%	196,743	17.8%	Will get a new V6 engine soon.
Element--Light Truck	0	0.0%	0	0.0%	0	0.0%	0	0.0%	7,500	0.6%	16,800	1.5%	Production ended in mid-2011.
Marysville--Light Vehicles:	225,272	26.9%	253,296	35.1%	492,409	34.0%	439,646	32.0%	284,579	24.5%	340,561	30.9%	H3
Accord--Car	221,507	26.5%	238,709	33.1%	466,695	32.2%	400,143	29.2%	229,439	19.8%	284,717	25.8%	
Acura RDX--Light Truck	0	0.0%	0	0.0%	0	0.0%	82	0.0%	19,377	1.7%	20,550	1.9%	
Acura TL--Car	3,765	0.5%	14,587	2.0%	25,714	1.8%	39,421	2.9%	35,763	3.1%	35,294	3.2%	

Notes and abbreviations: * - Initial, subject to revision; aka - also known as; CUV - crossover utility vehicle; SUV - sport utility vehicle; YTD - year to date (through June).
FCA1 - The plant closed in August, 2012, to retool for the new Cherokee; it re-opened in June, 2013.
FCA2 - The Liberty was replaced by the Cherokee, which uses a Fiat platform and a smaller V6 engine.
FCA3 - The next generation, due in 2017, will be lighter and have more power train options for greater fuel efficiency.
F1 - The plant may retool later 2014 for medium-duty trucks or chassis, but a few stripped and cut-away E series vans will still be made; perhaps 100-plus workers will not be recalled after the plant reopens.
GM1 - A turbo-charged diesel version is in production; the model will be refreshed for 2015.
H1 - East Asian floods beginning in March, 2011, disrupted parts production and constrained assemblies for the rest of the year and into the first few months of 2012.
H2 - I4-&-5-speed or V6-&-6-speed versions started in 2013 models.
H3 - The Acura NSX will be assembled near Marysville, and ILX assembly will be transferred from Indiana - both by 2015; the TLX replaced the TL beginning July, 2014.

Source: Automotive News (2011-2014).

Prepared by: Office of Research, Ohio Development Services Agency (ODSA) (DL, 8/14).

Table A4b: Light Vehicle Production at Continuously Operating Plants in Ohio, 2007-2013

	Annual Production							Percentage Changes		
Company and Plant	2007	2008	2009	2010	2011	2012	2013'	2007-2009	2009-2013	2007-2013
Total Light Vehicles*	1,318,404	1,260,145	724,519	1,011,559	1,057,584	1,293,913	1,375,472	-45.0%	89.8%	4.3%
FCA: Supplier Park	156,716	127,907	84,952	144,685	165,166	196,308	223,039	-45.8%	162.5%	42.3%
Ford: Avon Lake	179,918	126,640	88,054	121,471	133,850	135,231	132,390	-51.1%	50.4%	-26.4%
GM: Lordstown	280,452	308,015	87,917	158,099	281,810	279,382	285,271	-68.7%	224.5%	1.7%
Honda*:	701,318	697,583	463,596	587,304	476,758	682,992	734,772	-33.9%	58.5%	4.8%
E. Liberty*:	242,475	237,883	161,601	246,743	192,179	243,346	242,363	-33.4%	50.0%	0.0%
Marysville*:	458,843	459,700	301,995	340,561	284,579	439,646	492,409	-34.2%	63.1%	7.3%

Notes: * - production constrained by floods in Asia for most of 2011 and the first few months of 2012; i - initial, subject to revision.

Sources: Automotive News (2010-2014), Ward's (2009).

Prepared by: Office of Research, Ohio Development Services Agency (DL, 9/14).

Table A5: Motor Vehicle Industry Establishments and Employment, Ohio and the U.S., 2012

		Ohio			U.S.			Ohio as a Percentage of the U.S.	
2012 NAICS Codes	Shorter Industry Title	Establishments	Employment	Mean	Establishments	Employment	Mean	Establishments	Employment
11-81	Total (Private Sector, exc. Farm & Railroad)	250,842	4,548,143	18.1	7,431,808	115,938,468	15.6	3.4%	3.9%
32621-3363	Motor Vehicle (MV) Industry	565	83,006	146.9	8,029	796,871	99.2	7.0%	10.4%
3361-3	Transportation Eqpt. Subtotal	532	78,842	148.2	7,372	727,084	98.6	7.2%	10.8%
3361	MV Assembly	22	17,561	798.2	336	149,966	446.3	6.5%	11.7%
33611	Cars & Light Trucks	13	13,998	1,076.8	251	119,210	474.9	5.2%	11.7%
33612	Medium- & Heavy-Duty Trucks	9	3,563	395.9	85	30,756	361.8	10.6%	11.6%
3362	MV Bodies & Trailers	86	3,932	45.7	1,887	115,510	61.2	4.6%	3.4%
336211	MV Bodies	39	1,566	40.2	741	40,544	54.7	5.3%	3.9%
336212	Truck Trailers	24	1,035	43.1	421	28,304	67.2	5.7%	3.7%
336213-4	Motor Homes, Trailers & Campers^	23	1,331	57.9	725	46,662	64.4	3.2%	2.9%
3363	MV Parts	424	57,349	135.3	5,149	461,608	89.7	8.2%	12.4%
33631	MV Gas Engines & Engine Parts*	49	4,900	100.0	849	52,752	62.1	5.8%	9.3%
33632	MV Electrical & Electronic Eqpt.	28	8,047	287.4	678	50,017	73.8	4.1%	16.1%
33633	MV Steering & Suspension Parts	19	2,620	137.9	245	28,663	117.0	7.8%	9.1%
33634	MV Brake Systems*	23	2,200	95.7	195	21,859	112.1	11.8%	10.1%
33635	MV Transmission & Power Train Parts	31	8,835	285.0	503	58,248	115.8	6.2%	15.2%
33636	MV Seating & Interior Trim	31	6,756	217.9	398	47,010	118.1	7.8%	14.4%
33637	MV Metal Stamping	140	14,165	101.2	773	81,018	104.8	18.1%	17.5%
33639	Other MV Parts	103	9,826	95.4	1,508	122,041	80.9	6.8%	8.1%
32621-335911	Related Industries Subtotal	33	4,164	126.2	657	69,787	106.2	5.0%	6.0%
32621	Tires	28	3,048	108.9	529	50,480	95.4	5.3%	6.0%
326211	Tire Mfg. (Exc. Retreading)*	7	2,621	374.4	111	43,806	394.6	6.3%	6.0%
326212	Tire Retreading*	21	427	20.3	418	6,674	16.0	5.0%	6.4%
335911	Storage Batteries	5	1,116	223.2	128	19,307	150.8	3.9%	5.8%

Notes: * - The Ohio employment figure is estimated. Abbreviations: Eqpt. - equipment; Exc. - except; Mfg. - manufacturing; MV - motor vehicle. General Motor's (GM's) iron foundry in Defiance and its diesel engine plant in Dayton, as well as Daimler's diesel engine plant in Byesville, are excluded because their NAICS codes (331511 and 333618) are not part of the industry definition, and there is no ready comparison to the national summary. Conversely, a few non-motor vehicle tire and/or battery manufacturers are included to facilitate comparison. ^ - The overwhelming majority of establishments and employment are in the 336214 - Trailers and Campers.

Sources: ODSA (2012); U.S. Bureau of the Census (2014b).

Prepared by: Office of Research, Ohio Development Services Agency (ODSA) (DL, 8/14).

Table A6: Motor Vehicle Industry Employment and Pay, Ohio and the U.S., 2012

2012 NAICS Codes	Shorter Industry Title	Ohio Employ-ment	Ohio Payroll in millions	Ohio Mean	U.S. Employ-ment	U.S. Payroll in millions	U.S. Mean	Ohio Means as a Percent of U.S. Means
11-81	Total (Private Sector, exc. Farm & Railroad)	4,548,143	$191,069.5	$42,010	115,938,468	$5,414,256.0	$46,699	90.0%
32621-3363	Motor Vehicle (MV) Industry	83,006	$4,992.7	$60,148	796,871	$43,255.2	$54,281	110.8%
3361-3	Transportation Eqpt. Subtotal	78,842	$4,748.9	$60,234	727,084	$39,464.5	$54,278	111.0%
3361	MV Assembly	17,561	$1,290.3	$73,474	149,966	$10,801.1	$72,023	102.0%
33611	Cars & Light Trucks	13,998	$1,072.3	$76,607	119,210	$9,164.8	$76,879	99.6%
33612	Medium- & Heavy-Duty Trucks	3,563	$217.9	$61,168	30,756	$1,636.3	$53,202	115.0%
3362	MV Bodies & Trailers	3,932	$182.8	$46,503	115,510	$4,826.5	$41,785	111.3%
336211	MV Bodies	1,566	$81.0	$51,701	40,544	$1,786.3	$44,058	117.3%
336212	Truck Trailers	1,035	$48.8	$47,194	28,304	$1,144.9	$40,451	116.7%
336213-4	Motor Homes, Trailers & Campers	1,331	$53.0	$39,850	46,662	$1,895.4	$40,619	98.1%
3363	MV Parts	57,349	$3,275.8	$57,121	461,608	$23,836.9	$51,639	110.6%
33631	MV Gas Engines & Engine Parts*	4,900	D	n.a.	52,752	$3,050.9	$57,834	n.a.
33632	MV Electrical & Electronic Eqpt.	8,047	$608.3	$75,589	50,017	$2,621.3	$52,408	144.2%
33633	MV Steering & Suspension Parts	2,620	$119.2	$45,511	28,663	$1,440.4	$50,254	90.6%
33634	MV Brake Systems*	2,200	D	n.a.	21,859	$1,008.3	$46,127	n.a.
33635	MV Transmission & Power Train Parts	8,835	$626.5	$70,908	58,248	$3,555.4	$61,039	116.2%
33636	MV Seating & Interior Trim	6,756	$266.7	$39,479	47,010	$2,170.1	$46,162	85.5%
33637	MV Metal Stamping	14,165	$734.0	$51,819	81,018	$4,380.2	$54,064	95.8%
33639	Other MV Parts	9,826	$484.8	$49,334	122,041	$5,610.3	$45,970	107.3%
32621-335911	Related Industries Subtotal	4,164	$243.7	$58,535	69,787	$3,790.8	$54,319	107.8%
32621	Tires	3,048	$181.7	$59,601	50,480	$2,775.5	$54,982	108.4%
326211	Tire Mfg. (Exc. Retreading)*	2,621	D	n.a.	43,806	$2,530.5	$57,765	n.a.
326212	Tire Retreading*	427	D	n.a.	6,674	$245.1	$36,718	n.a.
335911	Storage Batteries	1,116	$62.1	$55,625	19,307	$1,015.3	$52,585	105.8%

Notes: * - The Ohio employment figure is estimated. Abbreviations: Eqpt. - equipment; Exc. - except; Mfg. - manufacturing; MV - motor vehicle. General Motor's (GM's) iron foundry in Defiance and its diesel engine plant in Dayton, as well as Daimler's diesel engine plant in Byesville, are excluded because their NAICS codes (331511 and 333618) are not part of the industry definition, and there is no ready comparison to the national summary. Conversely, a few non-motor vehicle tire and/or battery manufacturers are included to facilitate comparison. ^ - The overwhelming majority of employment and pay are in the 336214 - Trailers and Campers. D - suppressed to maintain confidentiality; n.a. - not available.

Sources: ODSA (2012); U.S. Bureau of the Census (2014b).

Prepared by: Office of Research, Ohio Development Services Agency (ODSA) (DL, 8/14).

Table A7: Establishments and Estimated Employment in Ohio's Motor Vehicle Industry by County, 2012

Area Name	Establishments	Employment*	Area Name	Establishments	Employment*	Area Name	Establishments	Employment*
Ohio	566	85,410	Greene	0	0	Morrow	2	695
			Guernsey^	2	403	Muskingum	0	0
Adams	0	0	Hamilton	14	2,280	Noble	0	0
Allen	7	1,304	Hancock	16	4,192	Ottawa	2	30
Ashland	1	15	Hardin	2	400	Paulding	3	173
Ashtabula	7	78	Harrison	0	0	Perry	0	0
Athens	0	0	Henry	3	657	Pickaway	1	143
Auglaize	5	556	Highland	2	35	Pike	1	333
Belmont	2	145	Hocking	0	0	Portage	5	369
Brown	2	145	Holmes	4	104	Preble	4	409
Butler	10	1,024	Huron	3	205	Putnam	5	882
Carroll	1	3	Jackson	0	0	Richland	13	1,479
Champaign	5	1,088	Jefferson	2	22	Ross	4	2,743
Clark	11	1,467	Knox	4	581	Sandusky	8	904
Clermont	6	313	Lake	10	291	Scioto	1	3
Clinton	1	666	Lawrence	0	0	Seneca	8	626
Columbiana	7	245	Licking	7	1,272	Shelby	9	3,367
Coshocton	1	3	Logan	6	2,734	Stark	15	566
Crawford	5	794	Lorain	17	2,814	Summit	21	923
Cuyahoga	60	5,213	Lucas	24	4,987	Trumbull	11	8,696
Darke	4	473	Madison	6	1,501	Tuscarawas	7	365
Defiance^	5	2,192	Mahoning	7	90	Union	2	4,953
Delaware	6	618	Marion	8	667	Van Wert	3	314
Erie^	5	1,417	Medina	12	528	Vinton	0	0
Fairfield	5	165	Meigs	0	0	Warren	9	1,673
Fayette	1	143	Mercer	3	330	Washington	1	3
Franklin	30	1,987	Miami	7	852	Wayne	14	2,040
Fulton	7	1,076	Monroe	0	0	Williams~	14	909
Gallia	1	143	Montgomery^	30	3,740	Wood	10	1,512
Geauga	2	31	Morgan	2	476	Wyandot	5	420

Notes: * - Employment figures are estimates or incorporate estimates; some later-in-year figures from other sources were used in place of County Business Pattern's mid-march estimates, with the consequence that county totals shown here sum to less than the state total; therefore county totals tend to be a little low; ^ - Figures include GM's Defiance foundry, Flex-N-Gate's Erie parts plant, Daimler's Guernsey diesel plant, and GM-Isuzu's D-MAX Montgomery diesel plant; ~ - Titan's construction equipment tire plant is excluded.

Sources: Harris (2012), ODSA (2012), and U.S. Bureau of the Census (2014b).

Prepared by: Office of Research, Ohio Development Services Agency (ODSA) (DL, 8/14).

Table A8: Motor Vehicle Industry Employment Trends, 2002-2012 (in thousands, except percentages)

NAICS Code	Shorter Industry Title	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Changes: 2002-12 Number	Changes: 2002-12 Percent
32621-3363	***Ohio*** Motor Vehicle (MV) Industry	122.8	133.3	131.6	126.5	126.4	116.4	108.5	81.1	77.5	78.5	83.0	-39.8	-32.4%
3361-3	Transportation Eqpt. Subtotal	117.3	128.4	127.4	122.2	122.2	112.0	103.9	76.7	73.6	74.5	78.8	-38.5	-32.8%
3361	MV Assembly	28.7	27.4	28.6	27.3	26.8	23.6	22.4	14.9	16.7	16.7	17.6	-11.1	-38.8%
33611	Cars & Light Trucks	24.8	24.0	25.2	23.6	23.2	20.4	19.8	12.7	14.5	13.9	14.0	-10.8	-43.5%
33612	Medium- & Heavy-Duty Trucks	3.9	3.3	3.4	3.7	3.7	3.1	2.6	2.2	2.2	2.9	3.6	-0.4	-9.1%
3362	MV Bodies & Trailers	4.2	3.6	4.3	4.6	4.9	5.4	5.8	4.1	3.6	3.4	3.9	-0.2	-5.7%
336211	MV Bodies	2.6	2.0	2.1	2.3	2.5	3.2	3.4	2.2	1.8	1.7	1.6	-1.0	-39.9%
336212	Truck Trailers	0.7	0.8	1.2	1.2	1.5	1.3	1.1	0.9	0.8	0.7	1.0	0.3	44.6%
336213-4	Motor Homes, Trailers & Campers^	0.8	0.9	0.9	1.0	1.0	0.9	1.3	1.0	0.9	1.0	1.3	0.5	56.8%
3363	MV Parts*	84.5	97.4	94.5	90.3	90.4	83.0	75.8	57.7	53.3	54.3	57.3	-27.1	-32.1%
33631	MV Gas Engines & Engine Parts	8.5	10.1	9.5	8.6	8.5	8.1	7.2	6.5	3.2	4.6	4.9	-3.6	-42.1%
33632	MV Electrical & Electronic Eqpt.	5.8	9.9	9.1	8.5	9.7	9.1	8.2	6.8	8.5	8.0	8.0	2.2	38.4%
33633	MV Steering & Suspension Parts	6.3	6.2	5.6	4.9	4.9	5.1	5.4	4.2	3.5	3.2	2.6	-3.6	-58.1%
33634	MV Brake Systems	5.6	8.1	7.3	6.4	6.2	5.0	3.4	2.7	2.4	2.4	2.2	-3.4	-60.4%
33635	MV Transmission & Power Train Parts	11.5	13.4	13.8	13.3	13.1	11.6	11.4	7.5	7.1	7.3	8.8	-2.6	-22.9%
33636	MV Seating & Interior Trim	5.5	7.3	7.2	7.3	7.3	7.3	6.4	5.3	5.2	5.8	6.8	1.3	22.8%
33637	MV Metal Stamping	25.6	26.4	25.1	24.0	24.3	21.7	20.3	14.4	13.9	13.4	14.2	-11.4	-44.6%
33639	Other MV Parts	15.8	16.1	17.0	17.2	16.6	15.1	13.5	10.4	9.5	9.6	9.8	-6.0	-37.9%
32621-335911	Related Industries Subtotal*	5.4	4.9	4.3	4.3	4.2	4.4	4.7	4.4	3.9	4.0	4.2	-1.3	-23.4%
32621	Tires	4.5	3.7	3.2	3.3	3.1	3.3	3.5	3.3	2.7	2.9	3.0	-1.4	-31.6%
326211	Tire Mfg. (Exc. Retreading)	4.0	3.2	2.7	2.7	2.7	2.9	3.0	2.9	2.4	2.5	2.6	-1.4	-34.4%
326212	Tire Retreading	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.3	0.4	0.4	0.4	0.0	-7.2%
335911	Storage Batteries	1.0	1.2	1.1	1.0	1.0	1.1	1.2	1.2	1.2	1.1	1.1	0.1	13.6%
32621-3363	***U.S.*** Motor Vehicle (MV) Industry	1,075.6	1,116.5	1,131.8	1,112.9	1,088.7	1,017.3	957.5	733.7	693.5	736.2	796.9	-278.7	-25.9%
3361-3	Transportation Eqpt. Subtotal	988.4	1,032.5	1,049.7	1,033.2	1,007.9	941.7	879.4	662.1	627.6	667.3	727.1	-261.3	-26.4%
3361	MV Assembly	216.9	211.5	216.8	214.5	211.2	196.5	182.1	134.4	130.4	136.7	150.0	-66.9	-30.9%
33611	Cars & Light Trucks	196.2	183.4	187.2	182.2	179.0	165.9	153.4	111.7	109.5	109.1	119.2	-77.0	-39.2%
33612	Medium- & Heavy-Duty Trucks	20.7	28.1	29.6	32.3	32.1	30.6	28.6	22.7	20.9	27.5	30.8	10.1	48.7%
3362	MV Bodies & Trailers	114.4	132.6	143.9	147.6	155.6	151.6	136.4	96.0	94.2	102.8	115.5	1.1	1.0%
336211	MV Bodies	39.3	43.7	45.0	46.2	47.6	50.4	47.5	39.5	38.6	38.3	40.5	1.3	3.2%
336212	Truck Trailers	22.0	23.7	25.7	29.0	32.3	32.9	25.9	18.8	17.9	23.1	28.3	6.3	28.6%
336213-4	Motor Homes, Trailers & Campers^	53.1	65.2	73.2	72.4	75.8	68.3	63.0	37.7	37.7	41.4	46.7	-6.5	-12.2%
3363	MV Parts	657.1	688.4	689.1	671.0	641.1	593.6	560.9	431.8	402.9	427.9	461.6	-195.5	-29.8%
33631	MV Gas Engines & Engine Parts	80.5	92.3	91.8	80.9	76.6	71.9	60.6	48.3	44.3	51.4	52.8	-27.8	-34.5%
33632	MV Electrical & Electronic Eqpt.	83.4	89.3	87.0	85.3	77.6	69.3	66.1	52.4	47.7	45.7	50.0	-33.4	-40.1%
33633	MV Steering & Suspension Parts	36.1	39.1	37.3	37.8	39.4	36.0	37.4	31.7	26.1	27.2	28.7	-7.4	-20.6%
33634	MV Brake Systems	36.5	41.4	40.9	39.4	33.8	30.9	27.4	21.7	20.2	21.7	21.9	-14.6	-40.1%
33635	MV Transmission & Power Train Parts	92.4	93.7	94.6	90.8	83.8	78.0	75.3	52.1	51.2	53.4	58.2	-34.1	-37.0%
33636	MV Seating & Interior Trim	47.9	54.9	56.9	57.4	52.8	52.2	50.0	40.9	39.8	41.8	47.0	-0.9	-1.9%
33637	MV Metal Stamping	111.9	115.5	114.7	111.2	110.6	100.0	94.3	66.9	67.0	72.1	81.0	-30.9	-27.6%
33639	Other MV Parts	168.3	162.2	165.9	168.3	166.5	155.4	150.0	117.7	106.6	114.6	122.0	-46.3	-27.5%
32621-335911	Related Industries Subtotal	87.2	84.0	82.0	79.7	80.8	75.6	78.1	71.6	66.0	68.9	69.8	-17.4	-20.0%
32621	Tires	68.9	66.6	64.0	62.6	62.5	58.0	58.2	53.4	48.1	50.0	50.5	-18.4	-26.7%
326211	Tire Mfg. (Exc. Retreading)	60.9	58.2	55.1	54.3	54.0	49.8	50.2	46.4	41.8	43.8	43.8	-17.1	-28.1%
326212	Tire Retreading	8.0	8.4	8.9	8.3	8.5	8.2	8.0	7.0	6.3	6.2	6.7	-1.3	-16.1%
335911	Storage Batteries	18.3	17.4	18.0	17.1	18.3	17.7	19.8	18.1	17.8	18.9	19.3	1.0	5.3%

Notes: ^ - The vast majority are Trailers and Campers (336214); * - some constituent Ohio figures may be estimates; abbreviations used: Eqpt. - equipment; Exc. - except; Mfg. - manufacturing; MV - motor vehicle.
Sources: U.S. Bureau of the Census (2004b-2014b).
Prepared by: Office of Research, Ohio Development Services Agency (ODSA) (DL, 8/14).

Table A9: Total and Motor Vehicle Industry Gross Domestic Product for Ohio and the U.S., 1997-2012
(in billions of chained dollars, except percentages, and standardized on 2009)

	Motor Vehicles, Bodies, Trailers & Parts (NAICS 3361-3363) GDP						Total GDP						
	Ohio			U.S.			Ohio		U.S.		Ohio as a Percent of the U.S.		
Year	Dollar Value (billions)	Percent Change from Prior Yr.	As Percent of Total	Dollar Value (billions)	Percent Change from Prior Yr.	As Percent of Total	Dollar Value (billions)	Percent Change from Prior Yr.	Dollar Value (billions)	Percent Change from Prior Yr.	NAICS 3361-3363	Total	Ohio::U.S. Concentration Ratio
1997	$12.3		2.8%	$88.9		0.8%	$441.5		$11,140.6		13.8%	4.0%	3.49
1998	$14.6	18.7%	3.2%	$98.3	10.5%	0.8%	$462.2	4.7%	$11,609.6	4.2%	14.9%	4.0%	3.73
1999	$13.9	-5.1%	2.9%	$104.4	6.2%	0.9%	$472.8	2.3%	$12,164.0	4.8%	13.3%	3.9%	3.42
2000	$14.4	4.0%	3.0%	$106.9	2.4%	0.8%	$482.7	2.1%	$12,643.0	3.9%	13.5%	3.8%	3.53
2001	$12.3	-15.1%	2.6%	$96.8	-9.5%	0.8%	$476.5	-1.3%	$12,760.6	0.9%	12.7%	3.7%	3.39
2002	$14.4	17.5%	3.0%	$110.3	13.9%	0.8%	$487.8	2.4%	$12,990.1	1.8%	13.1%	3.8%	3.48
2003	$14.4	-0.2%	2.9%	$119.7	8.5%	0.9%	$495.8	1.6%	$13,322.1	2.6%	12.0%	3.7%	3.23
2004	$16.8	17.2%	3.3%	$122.8	2.6%	0.9%	$506.2	2.1%	$13,779.9	3.4%	13.7%	3.7%	3.73
2005	$17.0	1.2%	3.3%	$129.7	5.6%	0.9%	$512.7	1.3%	$14,226.8	3.2%	13.1%	3.6%	3.65
2006	$18.7	9.9%	3.7%	$143.0	10.2%	1.0%	$513.0	0.1%	$14,612.6	2.7%	13.1%	3.5%	3.73
2007	$16.8	-10.6%	3.3%	$136.7	-4.4%	0.9%	$508.7	-0.8%	$14,824.6	1.5%	12.3%	3.4%	3.57
2008	$12.1	-27.7%	2.4%	$106.7	-21.9%	0.7%	$500.9	-1.5%	$14,728.9	-0.6%	11.4%	3.4%	3.34
2009	$4.0	-66.8%	0.8%	$48.1	-54.9%	0.3%	$476.2	-4.9%	$14,328.0	-2.7%	8.4%	3.3%	2.52
2010	$8.0	98.1%	1.6%	$103.6	115.4%	0.7%	$488.6	2.6%	$14,639.7	2.2%	7.7%	3.3%	2.30
2011	$11.3	41.4%	2.2%	$130.3	25.8%	0.9%	$501.3	2.6%	$14,868.8	1.6%	8.6%	3.4%	2.56
2012	$11.4	1.2%	2.2%	$134.3	3.0%	0.9%	$517.1	3.1%	$15,245.9	2.5%	8.5%	3.4%	2.50
Net Changes, 1997-2012													
Numeric	-$0.9		-0.6%	$45.3		0.1%	$75.5		$4,105.3		-5.4%	-0.6%	-0.99
Percent	-7.5%			50.9%			17.1%		36.8%				

Notes: State GDP is analogous to national GDP, but not identical with it due to minor technical differences. Chained dollars adjusts for inflation, allowing comparisons of the volume of goods produced from year to year.

Source: U.S. Bureau of Economic Analysis (2014a).

Prepared by: Office of Research, Ohio Development Services Agency (DL, 8/14).

Table A10: Trends in Value-Added by Group for Ohio and the U.S., 1997-2011
(in millions of dollars)

	Ohio				U.S.				Ohio as a Percentage of the U.S.			
Year	3361: Assembly	3362: Bodies & Trailers	3363: Parts	Summary	3361: Assembly	3362: Bodies & Trailers	3363: Parts	Summary	3361: As-sembly	3362: Bodies & Trailers	3363: Parts	Sum-mary
1997	$10,760.0	$281.9	$11,275.6	$22,317.5	$72,575.0	$7,693.7	$73,797.9	$154,066.6	14.8%	3.7%	15.3%	14.5%
1998	$13,493.2	$331.0	$10,977.3	$24,801.4	$66,288.7	$8,474.4	$77,370.5	$152,133.6	20.4%	3.9%	14.2%	16.3%
1999	$13,344.9	$331.2	$11,665.1	$25,341.2	$77,424.7	$10,158.9	$85,426.3	$173,009.9	17.2%	3.3%	13.7%	14.6%
2000	$12,092.3	$339.9	$11,197.9	$23,630.2	$61,627.7	$9,871.3	$84,481.3	$155,980.3	19.6%	3.4%	13.3%	15.1%
2001^	$10,408.9	$273.1	$9,362.9	$20,044.9	$54,172.8	$8,417.3	$74,532.3	$137,122.4	19.2%	3.2%	12.6%	14.6%
2002	$12,686.7	$244.0	$11,753.1	$24,683.9	$72,157.1	$8,741.7	$86,428.2	$167,327.0	17.6%	2.8%	13.6%	14.8%
2003	$9,606.0	$272.5	$12,292.3	$22,170.8	$78,239.9	$9,475.8	$84,401.2	$172,117.0	12.3%	2.9%	14.6%	12.9%
2004	$10,541.7	$703.1	$13,504.4	$24,749.2	$71,100.6	$11,186.5	$83,006.0	$165,293.2	14.8%	6.3%	16.3%	15.0%
2005	$10,800.6	$945.8	$12,361.1	$24,107.5	$67,605.8	$12,292.5	$81,289.8	$161,188.0	16.0%	7.7%	15.2%	15.0%
2006^	$10,908.5	$1,122.4	$11,298.8	$23,329.8	$66,035.3	$13,482.8	$80,497.4	$160,015.6	16.5%	8.3%	14.0%	14.6%
2007	$9,920.1	$470.4	$10,649.2	$21,039.7	$73,039.6	$12,806.0	$74,178.3	$160,023.9	13.6%	3.7%	14.4%	13.1%
2008	$7,469.2	$253.7	$8,581.8	$16,304.8	$51,590.4	$10,021.2	$63,002.7	$124,614.3	14.5%	2.5%	13.6%	13.1%
2009*	$3,337.8	$307.2	$6,994.3	$10,639.2	$41,665.0	$7,012.0	$53,305.1	$101,982.1	8.0%	4.4%	13.1%	10.4%
2010*	$3,805.3	$362.6	$7,522.4	$11,690.3	$65,275.0	$8,200.8	$63,575.7	$137,051.5	5.8%	4.4%	11.8%	8.5%
2011*^	$4,458.9	$411.5	$7,138.5	$12,009.0	$54,916.5	$8,980.1	$62,854.6	$126,751.2	8.1%	4.6%	11.4%	9.5%
Average percentages for the 15-year period:									14.8%	4.5%	13.9%	13.6%

Notes: * - Some data for Ohio are less reliable, as indicated by the relatively large standard errors of the estimates (not shown).
^ - Initial figures, but not subject to revision because they precede an Economic Census year.

Sources: U.S. Bureau of the Census (2000c, 2001a-2003a, 2005c, 2006a-2008a, 2010c, 2011a-2013a).

Prepared by: Office of Research, Ohio Development Services Agency (DL, 8/14).

Table A11: Light Vehicle Production in Ohio and the U.S., 1990-2013

	Ohio				U.S.				Ohio as Percent of U.S.		
Year	Cars	Light Trucks	Light Vehicles	Cars % of Light Vehicles	Cars	Light Trucks	Light Vehicles	Cars % of Light Vehicles	Cars	Light Trucks	Light Vehicles
1990	843,476 *	631,178	1,474,654	57.2%	6,077,885	3,463,527	9,541,412	63.7%	13.9%	18.2%	15.5%
1991	966,663 *	677,811 *	1,644,474	58.8%	5,439,864	3,176,719	8,616,583	63.1%	17.8%	21.3%	19.1%
1992	914,951 *	564,887 *	1,479,838	61.8%	5,666,891	3,808,159	9,475,050	59.8%	16.1%	14.8%	15.6%
1993	1,005,870	795,541	1,801,411	55.8%	5,982,120	4,608,017	10,590,137	56.5%	16.8%	17.3%	17.0%
1994	959,856	812,660	1,772,516	54.2%	6,601,223	5,332,048	11,933,271	55.3%	14.5%	15.2%	14.9%
1995	988,869	907,288	1,896,157	52.2%	6,339,892	5,306,197	11,646,089	54.4%	15.6%	17.1%	16.3%
1996	1,084,599	855,430	1,940,029	55.9%	6,082,835	5,749,418	11,832,253	51.4%	17.8%	14.9%	16.4%
1997	1,105,007	893,447	1,998,454	55.3%	5,933,921	6,196,565	12,130,486	48.9%	18.6%	14.4%	16.5%
1998	1,016,129	840,416	1,856,545	54.7%	5,554,373	6,448,290	12,002,663	46.3%	18.3%	13.0%	15.5%
1999	1,055,762	918,210	1,973,972	53.5%	5,637,949	7,387,029	13,024,978	43.3%	18.7%	12.4%	15.2%
2000	1,022,393	841,636	1,864,029	54.8%	5,542,217	7,228,497	12,770,714	43.4%	18.4%	11.6%	14.6%
2001	1,016,218	722,869	1,739,087	58.4%	4,879,119	6,545,570	11,424,689	42.7%	20.8%	11.0%	15.2%
2002	989,509	847,787	1,837,296	53.9%	5,018,777	7,260,805	12,279,582	40.9%	19.7%	11.7%	15.0%
2003	927,925	956,952	1,884,877	49.2%	4,510,469	7,576,559	12,087,028	37.3%	20.6%	12.6%	15.6%
2004	797,009	943,622	1,740,631	45.8%	4,229,625	7,730,729	11,960,354	35.4%	18.8%	12.2%	14.6%
2005	882,222	912,367	1,794,589	49.2%	4,321,272	7,625,381	11,946,653	36.2%	20.4%	12.0%	15.0%
2006	884,734	785,007	1,669,741	53.0%	4,366,996	6,893,281	11,260,277	38.8%	20.3%	11.4%	14.8%
2007	870,008	878,327	1,748,335	49.8%	3,924,268	6,828,042	10,752,310	36.5%	22.2%	12.9%	16.3%
2008	854,209	629,877	1,484,086	57.6%	3,776,641	4,896,450	8,673,091	43.5%	22.6%	12.9%	17.1%
2009	394,333	389,129	783,462	50.3%	2,331,435	3,280,365	5,611,800	41.5%	16.9%	11.9%	14.0%
2010	511,310	592,222	1,103,532	46.3%	2,934,267	4,694,826	7,629,093	38.5%	17.4%	12.6%	14.5%
2011	565,851	595,698	1,161,549	48.7%	3,148,601	5,322,261	8,470,862	37.2%	18.0%	11.2%	13.7%
2012	745,381	627,227	1,372,608	54.3%	4,325,546	5,803,973	10,129,519	42.7%	17.2%	10.8%	13.6%
2013^	794,604	653,826	1,448,430	54.9%	4,648,593	6,238,442	10,887,035	42.7%	17.1%	10.5%	13.3%

Notes: * - Model year production, which does not coincide with the calendar year. Research for a prior report showed that combining and comparing model and calendar year data introduces only minimal distortions. Therefore, comparisons of Ohio with the U.S. for these years are useful, but not entirely valid; ^ - Initial, subject to revision.

Sources: Automotive News (2010-2014), Ward's (1991-2009).

Prepared by: Office of Research, Ohio Development Services Agency (DL, 8/14).

Table A12: Trends in Capital Expenditures by Group for Ohio and the U.S., 1997-2011
(in millions of dollars)

	Ohio				U.S.				Ohio as a Percentage of the U.S.			
Year	3361: Assembly	3362: Bodies & Trailers	3363: Parts	Summary	3361: Assembly	3362: Bodies & Trailers	3363: Parts	Summary	3361: As-sembly	3362: Bodies & Trailers	3363: Parts	Sum-mary
1997	$454.1	$26.6	$1,888.5	$2,369.3	$5,406.6	$441.1	$9,489.4	$15,337.1	8.4%	6.0%	19.9%	15.4%
1998	$364.1	$12.6	$1,669.7	$2,046.4	$5,383.8	$377.8	$9,830.8	$15,592.3	6.8%	3.3%	17.0%	13.1%
1999	$745.7	$16.6	$1,323.6	$2,086.0	$4,773.5	$463.7	$9,464.3	$14,701.4	15.6%	3.6%	14.0%	14.2%
2000	$840.2	$13.6	$1,118.0	$1,971.8	$4,777.8	$588.1	$8,863.0	$14,229.0	17.6%	2.3%	12.6%	13.9%
2001^	$462.6	$6.7	$1,099.9	$1,569.2	$4,461.3	$503.3	$8,390.4	$13,355.0	10.4%	1.3%	13.1%	11.8%
2002	$318.6	$8.3	$1,366.9	$1,693.8	$4,802.2	$328.0	$7,534.3	$12,664.5	6.6%	2.5%	18.1%	13.4%
2003	$285.3	$4.6	$932.7	$1,222.6	$5,186.7	$386.8	$7,377.3	$12,950.7	5.5%	1.2%	12.6%	9.4%
2004	$421.3	$14.6	$1,123.6	$1,559.5	$4,686.8	$441.5	$6,259.2	$11,387.5	9.0%	3.3%	18.0%	13.7%
2005	$453.8	$22.7	$803.2	$1,279.7	$4,283.1	$391.2	$6,759.4	$11,433.6	10.6%	5.8%	11.9%	11.2%
2006^	$570.5	$11.1	$1,543.9	$2,125.4	$4,042.8	$393.5	$6,884.3	$11,320.6	14.1%	2.8%	22.4%	18.8%
2007	$268.2	$14.0	$1,032.4	$1,314.6	$3,765.1	$413.9	$6,675.5	$10,854.5	7.1%	3.4%	15.5%	12.1%
2008	$135.8	$12.0	$1,179.2	$1,327.0	$4,129.9	$332.2	$6,836.7	$11,298.7	3.3%	3.6%	17.2%	11.7%
2009*	$148.5	$4.2	$693.2	$845.9	$3,264.0	$431.9	$4,559.5	$8,255.4	4.5%	1.0%	15.2%	10.2%
2010*	$192.8	$8.0	$641.6	$842.5	$7,976.9	$187.6	$3,946.4	$12,110.8	2.4%	4.3%	16.3%	7.0%
2011*^	$120.3	$5.1	$761.2	$886.6	$6,221.4	$350.1	$5,595.5	$12,167.1	1.9%	1.5%	13.6%	7.3%
Average percentages for the 15-year period:									7.9%	3.0%	15.8%	12.3%

Notes: * - Some data for Ohio are less reliable, as indicated by the relatively large standard errors of the estimates (not shown).
^ - Initial figures, but not subject to revision because they precede an Economic Census year.

Sources: U.S. Bureau of the Census (2000c, 2001a-2003a, 2005c, 2006a-2008a, 2010c, 2011a-2013a).

Prepared by: Office of Research, Ohio Development Services Agency (DL, 8/14).

Table A13: Motor Vehicle Industry Establishment Trends, 2002-2012

NAICS Codes	Shorter Industry Title	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Changes: 2002-12 Number	Changes: 2002-12 Percent
32621-3363	***Ohio*** Motor Vehicle (MV) Industry	606	648	653	645	658	673	647	616	575	554	565	-41	-6.8%
3361-3	Transportation Eqpt. Subtotal	558	600	607	602	613	628	602	573	538	522	532	-26	-4.7%
3361	MV Assembly	24	21	27	29	28	29	28	24	28	25	22	-2	-8.3%
33611	Cars & Light Trucks	16	14	18	19	19	19	17	14	18	15	13	-3	-18.8%
33612	Medium- & Heavy-Duty Trucks	8	7	9	10	9	10	11	10	10	10	9	1	12.5%
3362	MV Bodies & Trailers	72	80	82	80	95	101	94	83	81	80	86	14	19.4%
336211	MV Bodies	38	42	38	35	43	46	41	37	36	36	39	1	2.6%
336212	Truck Trailers	14	16	20	18	24	22	25	22	22	19	24	10	71.4%
336213-4	Motor Homes, Trailers & Campers^	20	22	24	27	28	33	28	24	23	25	23	3	15.0%
3363	MV Parts	462	499	498	493	490	498	480	466	429	417	424	-38	-8.2%
33631	MV Gas Engines & Engine Parts	46	49	55	49	54	61	58	58	48	49	49	3	6.5%
33632	MV Electrical & Electronic Eqpt.	50	44	41	38	39	38	37	33	31	30	28	-22	-44.0%
33633	MV Steering & Suspension Parts	24	23	22	23	24	26	23	22	22	20	19	-5	-20.8%
33634	MV Brake Systems	26	33	33	29	29	27	28	31	26	24	23	-3	-11.5%
33635	MV Transmission & Power Train Parts	34	40	38	35	35	35	27	27	28	27	31	-3	-8.8%
33636	MV Seating & Interior Trim	24	31	32	34	37	37	36	31	31	29	31	7	29.2%
33637	MV Metal Stamping	130	154	156	159	152	149	154	155	139	137	140	10	7.7%
33639	Other MV Parts	128	125	121	126	120	125	117	109	104	101	103	-25	-19.5%
32621-335911	Related Industries Subtotal	48	48	46	43	45	45	45	43	37	32	33	-15	-31.3%
32621	Tires	41	42	40	37	38	39	38	36	30	25	28	-13	-31.7%
326211	Tire Mfg. (Exc. Retreading)	10	11	12	10	9	9	9	9	7	6	7	-3	-30.0%
326212	Tire Retreading	31	31	28	27	29	30	29	27	23	19	21	-10	-32.3%
335911	Storage Batteries	7	6	6	6	7	6	7	7	7	7	5	-2	-28.6%
32621-3363	***U.S.*** Motor Vehicle (MV) Industry	8,668	9,012	9,061	8,945	8,871	8,862	8,996	8,324	7,997	7,801	8,029	-639	-7.4%
3361-3	Transportation Eqpt. Subtotal	7,833	8,160	8,240	8,168	8,083	8,091	8,237	7,632	7,339	7,161	7,372	-461	-5.9%
3361	MV Assembly	395	367	377	380	370	378	377	355	371	341	336	-59	-14.9%
33611	Cars & Light Trucks	308	273	275	281	275	280	277	265	277	250	251	-57	-18.5%
33612	Medium- & Heavy-Duty Trucks	87	94	102	99	95	98	100	90	94	91	85	-2	-2.3%
3362	MV Bodies & Trailers	2,001	2,142	2,195	2,164	2,157	2,187	2,156	2,007	1,898	1,835	1,887	-114	-5.7%
336211	MV Bodies	753	837	826	814	820	845	839	787	742	705	741	-12	-1.6%
336212	Truck Trailers	388	394	408	391	394	394	429	407	402	401	421	33	8.5%
336213-4	Motor Homes, Trailers & Campers^	860	911	961	959	943	948	888	813	754	729	725	-135	-15.7%
3363	MV Parts	5,437	5,651	5,668	5,624	5,556	5,526	5,704	5,270	5,070	4,985	5,149	-288	-5.3%
33631	MV Gas Engines & Engine Parts	971	1,042	1,021	1,005	992	1,010	949	890	851	851	849	-122	-12.6%
33632	MV Electrical & Electronic Eqpt.	922	880	854	828	799	800	792	754	729	712	678	-244	-26.5%
33633	MV Steering & Suspension Parts	221	233	229	246	257	253	261	258	246	248	245	24	10.9%
33634	MV Brake Systems	253	262	262	251	241	238	233	204	199	191	195	-58	-22.9%
33635	MV Transmission & Power Train Parts	513	536	534	533	535	526	524	490	476	466	503	-10	-1.9%
33636	MV Seating & Interior Trim	332	392	407	399	421	407	409	409	403	395	398	66	19.9%
33637	MV Metal Stamping	719	790	788	792	781	758	788	769	736	717	773	54	7.5%
33639	Other MV Parts	1,506	1,516	1,573	1,570	1,530	1,534	1,748	1,496	1,430	1,405	1,508	2	0.1%
32621-335911	Related Industries Subtotal	835	852	821	777	788	771	759	692	658	640	657	-178	-21.3%
32621	Tires	707	722	692	656	663	649	643	580	535	514	529	-178	-25.2%
326211	Tire Mfg. (Exc. Retreading)	149	153	145	138	138	129	134	120	115	111	111	-38	-25.5%
326212	Tire Retreading	558	569	547	518	525	520	509	460	420	403	418	-140	-25.1%
335911	Storage Batteries	128	130	129	121	125	122	116	112	123	126	128	0	0.0%

Notes: ^ - The vast majority are Trailers and Campers (336214); abbreviations used: Eqpt. - equipment; Exc. - except; Mfg. - manufacturing; MV - motor vehicle.
Sources: U.S. Bureau of the Census (2004b-2014b).
Prepared by: Office of Research, Ohio Development Services Agency (ODSA) (DL, 8/14).

Table A14: Selected Motor Vehicle Industry* Statistics for Ohio and the U.S., 1998-2012

	Ohio				U.S.			
Year	Gross Domestic Product (millions)	Employ-ment (thousands)	Gross Domestic Product per Employee	Capital Expend-itures (millions)	Gross Domestic Product (millions)	Employ-ment (thousands)	Gross Domestic Product per Employee	Capital Expend-itures (millions)
1998^	$14,617	151.1	$96,748	$2,046	$98,313	1,165.6	$84,343	$15,592
1999^	$13,878	151.5	$91,616	$2,086	$104,375	1,170.1	$89,206	$14,701
2000^	$14,427	153.0	$94,293	$1,972	$106,928	1,198.1	$89,251	$14,229
2001^	$12,253	137.2	$89,326	$1,569	$96,783	1,060.1	$91,292	$13,355
2002	$14,399	117.3	$122,724	$1,694	$110,276	988.4	$111,570	$12,665
2003	$14,364	128.4	$111,860	$1,223	$119,664	1,032.5	$115,902	$12,951
2004	$16,840	127.4	$132,226	$1,560	$122,822	1,049.7	$117,002	$11,387
2005	$17,044	122.2	$139,484	$1,280	$129,699	1,033.2	$125,531	$11,434
2006	$18,739	122.2	$153,319	$2,125	$142,989	1,007.9	$141,863	$11,321
2007	$16,760	112.0	$149,634	$1,315	$136,668	941.7	$145,127	$10,854
2008	$12,112	103.9	$116,589	$1,327	$106,698	879.4	$121,331	$11,299
2009	$4,020	76.7	$52,429	$846	$48,075	662.1	$72,606	$8,255
2010	$7,965	73.6	$108,251	$842	$103,577	627.6	$165,042	$12,111
2011	$11,265	74.5	$151,289	$887	$130,325	667.3	$195,294	$12,167
2012	$11,265	74.5	$151,289	n.a.	$130,325	667.3	$195,294	n.a.

Notes: * - NAICS codes 3361-3 combined; ^ - Employment and GDP per employees estimated; n.a. - not available.

Sources: U.S. Bureaus of the Census (2001a-2003a, 2006a-2008a, 2011a-2013a, 2000b-2014b, 2005c, 2010c) and Economic Analysis (2014a).

Prepared by: Office of Research, Ohio Development Services Agency (DL, 9/14).

Table A15a: U.S. Sales of Imported and Domestic Light Vehicles, 1995-2013

	Domestic Built				Imports				Totals			
Year & type	U.S. Brand	Japanese Brand	All Others	Total	U.S. Brand	Japanese Brand	All Others	Total	U.S. Brand	Japanese Brand	All Others	Total
1995: Cars	5,433,959	1,594,725	100,023	7,128,707	74,065	967,906	464,286	1,506,257	5,508,024	2,562,631	564,309	8,634,964
Trucks	5,622,090	441,007	0	6,063,097	7,840	380,923	29,501	418,264	5,629,930	821,930	29,501	6,481,361
Total	11,056,049	2,035,732	100,023	13,191,804	81,905	1,348,829	493,787	1,924,521	11,137,954	3,384,561	593,810	15,116,325
1996: Cars	5,283,829	1,840,015	129,738	7,253,582	43,727	722,403	506,042	1,272,172	5,327,556	2,562,418	635,780	8,525,754
Trucks	6,004,180	459,689	10,165	6,474,034	6,525	414,715	34,085	455,325	6,010,705	874,404	44,250	6,929,359
Total	11,288,009	2,299,704	139,903	13,727,616	50,252	1,137,118	540,127	1,727,497	11,338,261	3,436,822	680,030	15,455,113
1997*: Cars	4,947,704	1,827,257	141,808	6,916,769	106,608	737,506	511,191	1,355,305	5,054,312	2,564,763	652,999	8,272,074
Trucks	5,778,757	473,971	14,712	6,267,440	2,949	533,953	45,305	582,207	5,781,706	1,007,924	60,017	6,849,647
Total	10,726,461	2,301,228	156,520	13,184,209	109,557	1,271,459	556,496	1,937,512	10,836,018	3,572,687	713,016	15,121,721
1998*: Cars	4,671,055	1,891,048	199,278	6,761,381	83,370	706,939	587,789	1,378,098	4,754,425	2,597,987	787,067	8,139,479
Trucks	6,181,040	518,411	43,804	6,743,255	3,207	603,078	51,746	658,031	6,184,247	1,121,489	95,550	7,401,286
Total	10,852,095	2,409,459	243,082	13,504,636	86,577	1,310,017	639,535	2,036,129	10,938,672	3,719,476	882,617	15,540,765
1999*: Cars	4,863,463	1,870,805	245,089	6,979,357	206,340	783,597	728,990	1,718,927	5,069,803	2,654,402	974,079	8,698,284
Trucks	6,567,196	715,372	137,463	7,420,031	4,109	685,956	85,158	775,223	6,571,305	1,401,328	222,621	8,195,254
Total	11,430,659	2,586,177	382,552	14,399,388	210,449	1,469,553	814,148	2,494,150	11,641,108	4,055,730	1,196,700	16,893,538
2000*: Cars	4,651,346	1,922,657	256,502	6,830,505	216,786	885,094	914,240	2,016,120	4,868,132	2,807,751	1,170,742	8,846,625
Trucks	6,675,664	895,081	80,060	7,650,805	38,306	737,590	76,429	852,325	6,713,970	1,632,671	156,489	8,503,130
Total	11,327,010	2,817,738	336,562	14,481,310	255,092	1,622,684	990,669	2,868,445	11,582,102	4,440,422	1,327,231	17,349,755
2001*: Cars	4,132,495	1,953,838	238,663	6,324,996	193,241	865,424	1,038,964	2,097,629	4,325,736	2,819,262	1,277,627	8,422,625
Trucks	6,664,127	967,980	86,357	7,718,464	51,799	793,396	136,085	981,280	6,715,926	1,761,376	222,442	8,699,744
Total	10,796,622	2,921,818	325,020	14,043,460	245,040	1,658,820	1,175,049	3,078,909	11,041,662	4,580,638	1,500,069	17,122,369
2002*: Cars	3,736,251	1,927,076	214,318	5,877,645	185,726	952,315	1,087,543	2,225,584	3,921,977	2,879,391	1,301,861	8,103,229
Trucks	6,609,603	954,593	82,568	7,646,764	66,032	819,295	181,048	1,066,375	6,675,635	1,773,888	263,616	8,713,139
Total	10,345,854	2,881,669	296,886	13,524,409	251,758	1,771,610	1,268,591	3,291,959	10,597,612	4,653,279	1,565,477	16,816,368
2003*: Cars	3,391,080	1,941,147	195,203	5,527,430	194,047	844,482	1,044,522	2,083,051	3,585,127	2,785,629	1,239,725	7,610,481
Trucks	6,600,737	1,129,552	71,103	7,801,392	94,839	892,164	240,177	1,227,180	6,695,576	2,021,716	311,280	9,028,572
Total	9,991,817	3,070,699	266,306	13,328,822	288,886	1,736,646	1,284,699	3,310,231	10,280,703	4,807,345	1,551,005	16,639,053
2004*: Cars	3,114,964	2,094,307	147,602	5,356,873	253,039	852,346	1,043,674	2,149,059	3,368,003	2,946,653	1,191,276	7,505,932
Trucks	6,664,465	1,389,089	61,176	8,114,730	102,052	824,785	319,421	1,246,258	6,766,517	2,213,874	380,597	9,360,988
Total	9,779,429	3,483,396	208,778	13,471,603	355,091	1,677,131	1,363,095	3,395,317	10,134,520	5,160,527	1,571,873	16,866,920
2005*: Cars	3,075,058	2,189,281	216,194	5,480,533	234,455	969,341	982,737	2,186,533	3,309,513	3,158,622	1,198,931	7,667,066
Trucks	6,441,730	1,546,113	77,530	8,065,373	117,187	773,429	324,699	1,215,315	6,558,917	2,319,542	402,229	9,280,688
Total	9,516,788	3,735,394	293,724	13,545,906	351,642	1,742,770	1,307,436	3,401,848	9,868,430	5,478,164	1,601,160	16,947,754

Table A15a: U.S. Sales of Imported and Domestic Light Vehicles, 1995-2013

	Domestic Built				Imports				Totals			
Year & type	U.S. Brand	Japanese Brand	All Others	Total	U.S. Brand	Japanese Brand	All Others	Total	U.S. Brand	Japanese Brand	All Others	Total
2006*: Cars	3,068,116	2,107,786	300,188	5,476,090	198,446	1,207,354	938,964	2,344,764	3,266,562	3,315,140	1,239,152	7,820,854
Trucks	5,675,676	1,522,237	138,883	7,336,796	117,425	938,955	290,370	1,346,750	5,793,101	2,461,192	429,253	8,683,546
Total	8,743,792	3,630,023	439,071	12,812,886	315,871	2,146,309	1,229,334	3,691,514	9,059,663	5,776,332	1,668,405	16,504,400
2007*: Cars	2,708,404	2,259,309	285,637	5,253,350	185,388	1,240,663	939,012	2,365,063	2,893,792	3,499,972	1,224,649	7,618,413
Trucks	5,397,480	1,484,315	200,929	7,082,724	111,103	982,240	294,742	1,388,085	5,508,583	2,466,555	495,671	8,470,809
Total	8,105,884	3,743,624	486,566	12,336,074	296,491	2,222,903	1,233,754	3,753,148	8,402,375	5,966,527	1,720,320	16,089,222
2008^: Cars	2,379,316	2,049,953	247,174	4,676,443	163,254	1,258,793	943,619	2,365,666	2,542,570	3,308,746	1,190,793	7,042,109
Trucks	3,834,378	1,183,528	176,168	5,194,074	33,272	744,026	232,206	1,009,504	3,867,650	1,927,554	408,374	6,203,578
Total	6,213,694	3,233,481	423,342	9,870,517	196,526	2,002,819	1,175,825	3,375,170	6,410,220	5,236,300	1,599,167	13,245,687
2009^: Cars	1,706,252	1,809,047	242,665	3,757,964	122,571	932,504	879,388	1,934,463	1,828,823	2,741,551	1,122,053	5,692,427
Trucks	2,822,709	953,758	170,518	3,946,985	28,853	512,984	250,255	792,092	2,851,562	1,466,742	420,773	4,739,077
Total	4,528,961	2,762,805	413,183	7,704,949	151,424	1,445,488	1,129,643	2,726,555	4,680,385	4,208,293	1,542,826	10,431,504
2010^: Cars	1,811,256	1,893,685	336,373	4,041,314	82,475	895,404	968,338	1,946,217	1,893,731	2,789,089	1,304,711	5,987,531
Trucks	3,327,937	1,178,962	304,091	4,810,990	39,301	507,657	244,365	791,323	3,367,238	1,686,619	548,456	5,602,313
Total	5,139,193	3,072,647	640,464	8,852,304	121,776	1,403,061	1,212,703	2,737,540	5,260,969	4,475,708	1,853,167	11,589,844
2011^: Cars	2,019,659	1,795,074	617,268	4,432,001	47,936	854,619	1,004,333	1,906,888	2,067,595	2,649,693	1,621,601	6,338,889
Trucks	3,916,503	1,229,777	371,567	5,517,847	31,914	578,062	312,864	922,840	3,948,417	1,807,839	684,431	6,440,687
Total	5,936,162	3,024,851	988,835	9,949,848	79,850	1,432,681	1,317,197	2,829,728	6,016,012	4,457,532	2,306,032	12,779,576
2012^: Cars	2,273,434	2,259,331	901,659	5,434,424	16,186	984,396	1,038,898	2,039,480	2,289,620	3,243,727	1,940,557	7,473,904
Trucks	4,165,677	1,483,343	374,008	6,023,028	35,216	616,507	344,571	996,294	4,200,893	2,099,850	718,579	7,019,322
Total	6,439,111	3,742,674	1,275,667	11,457,452	51,402	1,600,903	1,383,469	3,035,774	6,490,513	5,343,577	2,659,136	14,493,226
2013^: Cars	2,408,623	2,381,156	924,032	5,713,811	38,449	962,635	1,074,530	2,075,614	2,447,072	3,343,791	1,998,562	7,789,425
Trucks	4,545,549	1,715,025	365,676	6,626,250	79,061	727,761	360,091	1,166,913	4,624,610	2,442,786	725,767	7,793,163
Total	6,954,172	4,096,181	1,289,708	12,340,061	117,510	1,690,396	1,434,621	3,242,527	7,071,682	5,786,577	2,724,329	15,582,588

Note: * - Wards changed how data are presented; therefore, figures for 1997 and after are not entirely comparable with earlier years; ^ - Automotive News data, which are not entirely comparable with Wards.

Sources: Automotive News (2009-2014), Ward's (1995-2008).

Prepared by: Office of Research, Ohio Development Services Agency. Telephone 614/466-2116 (DL, 10/14).

Table A15b: Percentages of U.S. Sales of Imported and Domestic Light Vehicles, 1995-2013

	Domestic Built				Imports				Totals			
Year & type	U.S. Brand	Japanese Brand	All Others	Total	U.S. Brand	Japanese Brand	All Others	Total	U.S. Brand	Japanese Brand	All Others	Total
1995: Cars	35.9%	10.5%	0.7%	47.2%	0.5%	6.4%	3.1%	10.0%	36.4%	17.0%	3.7%	57.1%
Trucks	37.2%	2.9%	0.0%	40.1%	0.1%	2.5%	0.2%	2.8%	37.2%	5.4%	0.2%	42.9%
Total	73.1%	13.5%	0.7%	87.3%	0.5%	8.9%	3.3%	12.7%	73.7%	22.4%	3.9%	100.0%
1996: Cars	34.2%	11.9%	0.8%	46.9%	0.3%	4.7%	3.3%	8.2%	34.5%	16.6%	4.1%	55.2%
Trucks	38.8%	3.0%	0.1%	41.9%	0.0%	2.7%	0.2%	2.9%	38.9%	5.7%	0.3%	44.8%
Total	73.0%	14.9%	0.9%	88.8%	0.3%	7.4%	3.5%	11.2%	73.4%	22.2%	4.4%	100.0%
1997*: Cars	32.7%	12.1%	0.9%	45.7%	0.7%	4.9%	3.4%	9.0%	33.4%	17.0%	4.3%	54.7%
Trucks	38.2%	3.1%	0.1%	41.4%	0.0%	3.5%	0.3%	3.9%	38.2%	6.7%	0.4%	45.3%
Total	70.9%	15.2%	1.0%	87.2%	0.7%	8.4%	3.7%	12.8%	71.7%	23.6%	4.7%	100.0%
1998*: Cars	30.1%	12.2%	1.3%	43.5%	0.5%	4.5%	3.8%	8.9%	30.6%	16.7%	5.1%	52.4%
Trucks	39.8%	3.3%	0.3%	43.4%	0.0%	3.9%	0.3%	4.2%	39.8%	7.2%	0.6%	47.6%
Total	69.8%	15.5%	1.6%	86.9%	0.6%	8.4%	4.1%	13.1%	70.4%	23.9%	5.7%	100.0%
1999*: Cars	28.8%	11.1%	1.5%	41.3%	1.2%	4.6%	4.3%	10.2%	30.0%	15.7%	5.8%	51.5%
Trucks	38.9%	4.2%	0.8%	43.9%	0.0%	4.1%	0.5%	4.6%	38.9%	8.3%	1.3%	48.5%
Total	67.7%	15.3%	2.3%	85.2%	1.2%	8.7%	4.8%	14.8%	68.9%	24.0%	7.1%	100.0%
2000*: Cars	26.8%	11.1%	1.5%	39.4%	1.2%	5.1%	5.3%	11.6%	28.1%	16.2%	6.7%	51.0%
Trucks	38.5%	5.2%	0.5%	44.1%	0.2%	4.3%	0.4%	4.9%	38.7%	9.4%	0.9%	49.0%
Total	65.3%	16.2%	1.9%	83.5%	1.5%	9.4%	5.7%	16.5%	66.8%	25.6%	7.6%	100.0%
2001*: Cars	24.1%	11.4%	1.4%	36.9%	1.1%	5.1%	6.1%	12.3%	25.3%	16.5%	7.5%	49.2%
Trucks	38.9%	5.7%	0.5%	45.1%	0.3%	4.6%	0.8%	5.7%	39.2%	10.3%	1.3%	50.8%
Total	63.1%	17.1%	1.9%	82.0%	1.4%	9.7%	6.9%	18.0%	64.5%	26.8%	8.8%	100.0%
2002*: Cars	22.2%	11.5%	1.3%	35.0%	1.1%	5.7%	6.5%	13.2%	23.3%	17.1%	7.7%	48.2%
Trucks	39.3%	5.7%	0.5%	45.5%	0.4%	4.9%	1.1%	6.3%	39.7%	10.5%	1.6%	51.8%
Total	61.5%	17.1%	1.8%	80.4%	1.5%	10.5%	7.5%	19.6%	63.0%	27.7%	9.3%	100.0%
2003*: Cars	20.4%	11.7%	1.2%	33.2%	1.2%	5.1%	6.3%	12.5%	21.5%	16.7%	7.5%	45.7%
Trucks	39.7%	6.8%	0.4%	46.9%	0.6%	5.4%	1.4%	7.4%	40.2%	12.2%	1.9%	54.3%
Total	60.1%	18.5%	1.6%	80.1%	1.7%	10.4%	7.7%	19.9%	61.8%	28.9%	9.3%	100.0%
2004*: Cars	18.5%	12.4%	0.9%	31.8%	1.5%	5.1%	6.2%	12.7%	20.0%	17.5%	7.1%	44.5%
Trucks	39.5%	8.2%	0.4%	48.1%	0.6%	4.9%	1.9%	7.4%	40.1%	13.1%	2.3%	55.5%
Total	58.0%	20.7%	1.2%	79.9%	2.1%	9.9%	8.1%	20.1%	60.1%	30.6%	9.3%	100.0%
2005*: Cars	18.1%	12.9%	1.3%	32.3%	1.4%	5.7%	5.8%	12.9%	19.5%	18.6%	7.1%	45.2%
Trucks	38.0%	9.1%	0.5%	47.6%	0.7%	4.6%	1.9%	7.2%	38.7%	13.7%	2.4%	54.8%
Total	56.2%	22.0%	1.7%	79.9%	2.1%	10.3%	7.7%	20.1%	58.2%	32.3%	9.4%	100.0%

Table A15b: Percentages of U.S. Sales of Imported and Domestic Light Vehicles, 1995-2013

	Domestic Built				Imports				Totals			
Year & type	U.S. Brand	Japanese Brand	All Others	Total	U.S. Brand	Japanese Brand	All Others	Total	U.S. Brand	Japanese Brand	All Others	Total
2006*: Cars	18.6%	12.8%	1.8%	33.2%	1.2%	7.3%	5.7%	14.2%	19.8%	20.1%	7.5%	47.4%
Trucks	34.4%	9.2%	0.8%	44.5%	0.7%	5.7%	1.8%	8.2%	35.1%	14.9%	2.6%	52.6%
Total	53.0%	22.0%	2.7%	77.6%	1.9%	13.0%	7.4%	22.4%	54.9%	35.0%	10.1%	100.0%
2007*: Cars	16.8%	14.0%	1.8%	32.7%	1.2%	7.7%	5.8%	14.7%	18.0%	21.8%	7.6%	47.4%
Trucks	33.5%	9.2%	1.2%	44.0%	0.7%	6.1%	1.8%	8.6%	34.2%	15.3%	3.1%	52.6%
Total	50.4%	23.3%	3.0%	76.7%	1.8%	13.8%	7.7%	23.3%	52.2%	37.1%	10.7%	100.0%
2008^: Cars	18.0%	15.5%	1.9%	35.3%	1.2%	9.5%	7.1%	17.9%	19.2%	25.0%	9.0%	53.2%
Trucks	28.9%	8.9%	1.3%	39.2%	0.3%	5.6%	1.8%	7.6%	29.2%	14.6%	3.1%	46.8%
Total	46.9%	24.4%	3.2%	74.5%	1.5%	15.1%	8.9%	25.5%	48.4%	39.5%	12.1%	100.0%
2009^: Cars	16.4%	17.3%	2.3%	36.0%	1.2%	8.9%	8.4%	18.5%	17.5%	26.3%	10.8%	54.6%
Trucks	27.1%	9.1%	1.6%	37.8%	0.3%	4.9%	2.4%	7.6%	27.3%	14.1%	4.0%	45.4%
Total	43.4%	26.5%	4.0%	73.9%	1.5%	13.9%	10.8%	26.1%	44.9%	40.3%	14.8%	100.0%
2010^: Cars	15.6%	16.3%	2.9%	34.9%	0.7%	7.7%	8.4%	16.8%	16.3%	24.1%	11.3%	51.7%
Trucks	28.7%	10.2%	2.6%	41.5%	0.3%	4.4%	2.1%	6.8%	29.1%	14.6%	4.7%	48.3%
Total	44.3%	26.5%	5.5%	76.4%	1.1%	12.1%	10.5%	23.6%	45.4%	38.6%	16.0%	100.0%
2011^: Cars	15.8%	14.0%	4.8%	34.7%	0.4%	6.7%	7.9%	14.9%	16.2%	20.7%	12.7%	49.6%
Trucks	30.6%	9.6%	2.9%	43.2%	0.2%	4.5%	2.4%	7.2%	30.9%	14.1%	5.4%	50.4%
Total	46.5%	23.7%	7.7%	77.9%	0.6%	11.2%	10.3%	22.1%	47.1%	34.9%	18.0%	100.0%
2012^: Cars	15.7%	15.6%	6.2%	37.5%	0.1%	6.8%	7.2%	14.1%	15.8%	22.4%	13.4%	51.6%
Trucks	28.7%	10.2%	2.6%	41.6%	0.2%	4.3%	2.4%	6.9%	29.0%	14.5%	5.0%	48.4%
Total	44.4%	25.8%	8.8%	79.1%	0.4%	11.0%	9.5%	20.9%	44.8%	36.9%	18.3%	100.0%
2013^: Cars	15.5%	15.3%	5.9%	36.7%	0.2%	6.2%	6.9%	13.3%	15.7%	21.5%	12.8%	50.0%
Trucks	29.2%	11.0%	2.3%	42.5%	0.5%	4.7%	2.3%	7.5%	29.7%	15.7%	4.7%	50.0%
Total	44.6%	26.3%	8.3%	79.2%	0.8%	10.8%	9.2%	20.8%	45.4%	37.1%	17.5%	100.0%

Note: * - Wards changed how data are presented; therefore, figures for 1997 and after are not entirely comparable with earlier years; ^ - Automotive News data, which are not entirely comparable with Wards.

Sources: Automotive News (2009-2014), Ward's (1995-2008).

Prepared by: Office of Research, Ohio Development Services Agency. Telephone 614/466-2116 (DL, 10/14).

Table A16: History and Projections* for the U.S. Motor Vehicle Industry, 2000-2020

NAICS Code	Shorter Industry Title	Actual 2000	Actual 2010	Projected for 2020	Changes 2000-2010 Number	Changes 2000-2010 Percent	Changes 2010-2020 Number	Changes 2010-2020 Percent	Changes 2000-2020 Number	Changes 2000-2020 Percent
U.S. Gross Duplicated Output^ (in billions, standardized on 2005)										
	Total	$20,979	$23,171	$30,876	$2,192	10.4%	$7,705	33.3%	$9,897	47.2%
31-33	Manufacturing	$4,585	$4,363	$5,723	-$222	-4.8%	$1,360	31.2%	$1,138	24.8%
3361-3	Transportation Eqpt. (part)	$460	$357	$503	-$103	-22.4%	$146	40.9%	$43	9.3%
3361	Assembly	$233	$186	$267	-$47	-20.2%	$81	43.5%	$34	14.6%
3362	Bodies & Trailers	$28	$20	$29	-$8	-28.6%	$9	45.0%	$1	3.6%
3363	Parts	$199	$151	$207	-$48	-24.1%	$56	37.1%	$8	4.0%
Jobs (in thousands)										
U.S.	Total	146,236.3	143,068.1	163,536.1	-3,168.2	-2.2%	20,468.0	14.3%	17,299.8	11.8%
31-33	Manufacturing	17,262.9	11,524.0	11,450.9	-5,738.9	-33.2%	-73.1	-0.6%	-5,812.0	-33.7%
3361-3	Transportation Eqpt. (part)	1,313.6	674.0	675.6	-639.6	-48.7%	1.6	0.2%	-638.0	-48.6%
3361	Assembly	291.4	151.3	166.1	-140.1	-48.1%	14.8	9.8%	-125.3	-43.0%
3362	Bodies & Trailers	182.7	107.6	114.6	-75.1	-41.1%	7.0	6.5%	-68.1	-37.3%
3363	Parts	839.5	415.1	394.9	-424.4	-50.6%	-20.2	-4.9%	-444.6	-53.0%
Ohio	Total	5,425.0	5,368.9	5,867.0	-56.1	-1.0%	498.1	9.3%	442.0	8.1%
31-33	Manufacturing	1,023.4	620.5	617.6	-403.0	-39.4%	-2.8	-0.5%	-405.8	-39.7%
3361-3	Transportation Eqpt. (part)	163.9	78.1	82.2	-85.8	-52.3%	4.0	5.2%	-81.7	-49.9%
3361	Assembly	39.2	18.3	19.7	-21.0	-53.5%	1.4	7.7%	-19.6	-49.9%
3362	Bodies & Trailers	12.8	5.3	5.6	-7.5	-58.6%	0.2	4.3%	-7.3	-56.8%
3363	Parts	111.8	54.6	57.0	-57.3	-51.2%	2.4	4.4%	-54.9	-49.1%

Notes: * - Projections have not been made for tires (NAICS 32621) or storage batteries (335911).
^ - Gross Duplicated Output is greater than Gross Domestic Product because the latter is the final value of goods and services only, while the former also includes the value of intermediate goods and services.

Sources: Henderson (2012); ODJFS/LMI (2013).

Prepared by: Office of Research, Ohio Development Services Agency (DL, 2/13).

Table A17: Imports and Exports of Motor Vehicles, Parts and Accessories, and the Value of the Dollar, 1995-2013 (in millions of dollars, except index values)

		Exports			Imports			Balances of Trade		
Year	Index Value of the Dollar	Total	Motor Vehicles*	Parts & Accessories	Total	Motor Vehicles*	Parts & Accessories	Total	Motor Vehicles*	Parts & Accessories
1995	92.52	$61,261	$23,896	$37,365	$123,632	$76,488	$47,144	-$62,371	-$52,592	-$9,779
1996	97.40	$64,238	$25,192	$39,046	$128,691	$79,292	$49,399	-$64,453	-$54,100	-$10,353
1997	104.44	$73,302	$26,940	$46,362	$139,492	$87,669	$51,823	-$66,190	-$60,729	-$5,461
1998	116.48	$72,386	$25,884	$46,502	$148,680	$93,954	$54,726	-$76,294	-$68,070	-$8,224
1999	116.87	$75,256	$25,289	$49,967	$178,241	$116,696	$61,545	-$102,985	-$91,407	-$11,578
2000	119.45	$80,357	$26,126	$54,231	$194,952	$128,241	$66,711	-$114,595	-$102,115	-$12,480
2001	125.91	$75,437	$25,387	$50,050	$188,747	$126,234	$62,513	-$113,310	-$100,847	-$12,463
2002	126.66	$78,941	$28,915	$50,026	$202,777	$133,631	$69,146	-$123,836	-$104,716	-$19,120
2003	119.09	$80,633	$32,347	$48,286	$209,171	$134,484	$74,687	-$128,538	-$102,137	-$26,401
2004	113.59	$89,213	$36,538	$52,675	$227,331	$143,482	$83,849	-$138,118	-$106,944	-$31,174
2005	110.81	$98,408	$43,971	$54,437	$238,714	$146,312	$92,402	-$140,306	-$102,341	-$37,965
2006	108.52	$107,264	$49,083	$58,181	$255,962	$160,135	$95,827	-$148,698	-$111,052	-$37,646
2007	103.40	$121,264	$60,777	$60,487	$258,498	$157,410	$101,088	-$137,234	-$96,633	-$40,601
2008	99.90	$121,453	$65,323	$56,130	$233,204	$141,825	$91,379	-$111,751	-$76,502	-$35,249
2009	105.69	$81,715	$39,974	$41,741	$159,188	$93,236	$65,952	-$77,473	-$53,262	-$24,211
2010	101.82	$112,007	$54,981	$57,026	$225,641	$131,344	$94,297	-$113,634	-$76,363	-$37,271
2011	97.15	$133,037	$66,772	$66,265	$255,226	$142,831	$112,395	-$122,189	-$76,059	-$46,130
2012	99.82	$146,151	$73,573	$72,578	$298,505	$170,254	$128,251	-$152,354	-$96,681	-$55,673
2013	101.12	$152,556	$77,083	$75,473	$309,571	$178,962	$130,609	-$157,015	-$101,879	-$55,136

Notes and abbreviations: * - new and used.

Sources: Federal Reserve Board (1996, 1999, 2004, 2006, 2008, 2010, 2014); U.S. Bureau of Economic Analysis (2014b).

Prepared by: Office of Research, Ohio Development Services Agency (DL, 10/14).

NOTES

1 Including corporate headquarters.

2 Total company employment figures for the motor vehicle industry exclude sites employing less than 50 people.

3 The differing portions of industry GDP and VA from Ohio may be partially explained by the fact that GDP excludes the cost of purchased services included in VA, costs which may not be proportional from one state to another, as well as the fact that 2011 GDP figures are revised, while 2011 VA figures are not.

4 Model changeovers usually don't cause severe disruption to assemblers because they're normally done in two to four week in the summer. However, a major changeover may require extensive changes at the plant, new equipment must be de-bugged and proven, and glitches in production processes resolved (Levy, 2014: 31). Assemblers also have been disrupted by material shortages, troubled suppliers and quality issues (Levy, 2014: 14). Any one or combination of these issues could have been a factor in the delayed launch of the Cherokee.

5 There are a number of caveats that must be noted. Parts plants include assemblers' parts plants and independent tier-1, -2, and -3 supplier plants – the latter regardless of their NAICS code. Only active suppliers are included; plants that are opening, closing or inactive are excluded. Also excluded are administrative and support establishments for sales, research and development, and other internal non-production services, as well as tooling companies (i.e., those selling machinery used by assemblers and suppliers to produce their goods), freight forwarders (i.e., independent transportation services), and trainers (i.e., educators). Finally, the ELM database is continually updated and revised, which means exact numbers may not be reproducible after awhile, and the information therein is volunteered by participating companies. For these reasons, there is no guarantee of accuracy beyond the aforementioned criteria.

6 Specifically, GM's Defiance foundry and its diesel engine plant in Dayton, plus Daimler's Detroit Diesel in Byesville. On the other hand, larger non-motor vehicle suppliers in the tires subgroup have been excluded.

7 Daimler's and GM's diesel engine plants, as well as the latter's foundry (NAICS code 3315) dedicated to the motor vehicle industry were excluded in the previous section so that consistent comparisons could be made with the U.S. industry. They are included in this section, and their employment is included in the next section. Conversely, larger non-motor vehicle industry tire establishments and employment are excluded.

8 The difficulty arises in allocating the jobs of joint ventures to home country of the partners.

9 FCA, the result of the Fiat-Chrysler merger, is relocating key headquarters functions to both the Netherlands and the United Kingdom at this writing – but until the transition is completed, it is assigned to Italy, the home country of the acquiring Fiat.

10 County Business Patterns data also are highly consistent with the county level statistics cited other sections of this report.

11 Numbers from the U.S. BLS CES program and the Census Bureau are different because the two use different data collection techniques with different time frames (monthly, which can be aggregated to longer intervals, vs. mid-March alone), and occasionally classify plants differently. Unlike the Census Bureau, state-level BLS CES data for smaller industries are not available.

12 Net changes are dependent on the beginning and ending points. The pattern of changes seen year to year could alter the interpretation of the overall change. Therefore, net changes are not necessarily indicative of long term trends.

13 Value-added and GDP figures are closely related. GDP computations begin with value-added (which is largely the difference between the value of shipments and the costs of labor and materials) and proceed by subtracting additional costs such as services purchased by the manufacturing establishment. This explains why GDP figures are less than value-added figures.

14 The percentage of value-added for bodies and trailers in Ohio during 2004-2006 are greater than the percent of U.S. GDP originating in Ohio, leading one to believe that the former is concentrated here. However, the percentages for value-added in bodies and trailers – and the totals on which they are based – are not reliable because the relative standard errors of the bodies and trailers estimates are way too high (see U.S. Census Bureau, 2008a). Caution also is warranted for the assembly and parts value-added figures for 2009 and 2010 due to relatively high standard errors (U.S. Bureau of the Census, 2012a).

15 Using value-added in Ohio as a percentage of the nation removes the effects of inflation, making comparisons of one year with any other more meaningful. It should also be noted that the decline in value added from 2002 to 2003 is inconsistent with the increases of GDP and light vehicle production for the same period (U.S. Bureau of the Census, 2005a; U.S. Bureau of Economic Analysis, 2014a; Ward's, 2005).

16 Levy (2012: 23) gives partial credit to the “cash-for-clunkers” program for increasing light vehicle production in the first half of 2010.

17 These changes are evident to dealers and assemblers in as little as 60 days (Reuters, 2011).

18 Capital expenditures also vary with the size and degree of vertical integration of the company. GM and Ford generally spend more than the smaller and less vertically integrated Chrysler group (Levy, 2014: 25).

19 The Detroit Three have made substantial progress in matching the initial-quality and frequency-of-repair records of Japanese-brand assemblers. At the same time, though, assemblers’ recalls have risen; Levy (2014: 1) recounts a litany of recent ones. This probably is due to the increased use of electronics, tougher standards, and better reporting (Harbour Consulting, 2004).

20 See the appendix section on the balance of trade for an illustration of the inverse relationship between the index value of the dollar and the ratio of export-to-import values in motor vehicles.

21 The four other Japanese brands *sold* here are Mazda, Mitsubishi, Subaru and Suzuki. The nine other foreign brands sold here have European nameplates: BMW, Daimler, Volkswagen and Volvo (the car division is now Chinese-owned) are mass-market companies; Aston Martin, Ferrari, Jaguar-Land Rover (now Indian-owned), Lotus and Maserati are sports cars, with the exception of the SUV Land Rover. The former four combined for 8.9 percent of the market; the latter five collectively totaled less than .5 percent.

22 Automotive News lists only two other Japanese companies *assembling* light vehicles in N. America besides the three named on the chart: Mitsubishi and Subaru, who collectively produced less than 2.1 percent of the total. The only European companies assembling light vehicles in N. America are BMW, Daimler and Volkswagen; their combined production was 7.1 percent of the total – and most of that came from Volkswagen’s Mexican plant. Tesla is the only exclusively-electric car manufacturer with production data published by Automotive News: 24,123. However, sales data for Tesla were not published in the annual report. Consequently, Tesla is excluded from calculations in this section.

23 79.2 percent of the light vehicles sold in the U.S. during 2013 were assembled in N. America, while 20.8 were imported. 29.2 percent of Japanese brand sales were imports, 36.1 percent of Hyundai-Kia’s sales were imports, and 66.8 percent of European brand sales were imports. By contrast, only 1.7 percent of the Detroit 3’s U.S. sales were not assembled in N. America (Automotive News, 2014).

24 Daimler's principal N. American subsidiary is Freightliner, but it also owns White Star and Sterling. Volvo bought Mack from Renault in 2001 (Levy, 2014: 11) when the Renault needed cash to take a veto-stake in Nissan.

25 The manufacturers or their subsidiaries are making loans as well as taking a chance on the price they can get for a used vehicle once a lease has expired (Corridore, 2014: 11-12).

26 Rebates, discounts, etc. are intended to stimulate demand; their use is less likely with models already in high demand. Maintaining high demand reduces *per-unit* costs for assemblers and may lead to increased market share, but failure to lower overall costs at the same time simply reduces profit. In the latter instance, incentives can be counterproductive. Usage of rebates and discounts by light vehicle assemblers and their associated dealers was greatest in 1997-2008, but abated with the recession as the Detroit Three reduced capacity (Levy, 2012: 24). However, they have returned with the intense competition in the largest market segment: mid-size cars (Levy, 2014: 5-6). Corridore (2014: 12) tells a similar tale of overproduction and using residual value guarantees at lease's end – an incentive – in the late 1990s, all in an attempt to increase market share. These actions had the unintended consequence of flooding the market with used trucks a few years later, reducing their prices, and forcing lessors to take substantial write-downs. This was an exception to truck-makers usual practice of using incentives to stimulate sales only when necessary (Jaffe, 2010: 17).

27 Medium- and heavy-duty truck production is the more highly cyclical of the two (Corridore, 2014:11). Production during 2003-2013 ranged from 462,000 (2006) to 132,000 (2009), with the latter just 28.6 percent of the former. The production numbers in this range represented between 1.9 and 4.1 percent (2010 and 2006, respectively) of all motor vehicle production in the U.S., according to Ward's statistics cited by Levy (2014: 10).

28 The market for recreational vehicles (RVs – essentially NAICS 336213-4) resembles that for light vehicles in that RVs are largely purchased by individuals for non-commercial use. It resembles the market for medium- and heavy-duty trucks in its extreme cyclicality as well as production and sales numbers. Show-room prices for RVs range from less than economy cars to those of heavy-duty trucks (Schreiner, 2012).

29 Assemblers also establish and support a network of independent dealers with wholesale financing, marketing strategies and materials, etc. Dealers, in turn, sell to independent truck operators – persons who typically buy just one vehicle from inventory (Corridore, 2014: 18).

30 Assemblers have faced challenges in dealing with higher costs for raw materials such as steel, copper, rubber and

plastics due to increased demand for commodities. For both assemblers and suppliers, rapid growth in developing countries – particularly China – has been a significant factor in such demand.

31 On the other hand, the reliance on one source for a component risks slow-downs or even stoppages at assembly plants when production slows down or stops at the plant where the component is made. For example, operations at seven Chrysler and three GM assembly plants slowed for lack of a single part because of hurricane-induced floods at the supplier in North Carolina (Associated Press, 1999). Similarly, Japanese assembly operations in N. America also were curtailed by floods in Japan and Thailand during 2011, allowing the Detroit Three to briefly regain some U.S. market share.

32 For example, Delphi received help from GM when the former was in bankruptcy from 2005 to 2009 (Karush, 2006), and, after emerging from bankruptcy, in turn helped companies with purchasing and manufacturing shortly thereafter (Levy, 2012: 25). Delphi in 2010 differed from the Delphi that entered bankruptcy in 2005. In 2005 it had 119 product lines, and derived at least one-half of its revenue from GM; 70 percent of its revenue came from N. America, 25 percent from Europe, and five percent from Asia. By 2010, it had 35 product lines and derived 18 percent of its revenue from GM, with a geographic distribution of 27 percent from N. America, 43 percent from Europe, and 18 percent from Asia (Colias, 2010).

33 Compuware kept the name and tried to improve on the company's successes as well as expand its customer base into unrelated industries – all the while competing with other electronic commerce exchanges for business (Wikipedia, 2014).

34 During much of that time, though, some of the fuel efficiency gains went to meet consumers' preferences for more powerful engines instead of increasing miles per gallon (Levy, 2012: 16-17; Whoriskey, 2011). Recently "[h]igher oil prices, as well as expectations that any lull in these prices is only temporary, are spurring demand for smaller, more fuel-efficient gasoline-powered vehicles, and encouraging investment in alternative fuel technologies. In addition, efforts to reduce US energy dependence and the negative impact of fossil fuels are forces driving regulatory demands for higher fuel efficiency" (Levy, 2014: 13). Consequently, consumers have been shifting from larger to smaller vehicles within categories such as SUVs, or switching categories such as moving from light trucks to sedans. There also have been overall shifts from V8s to V6s and from V6s to I4s (Levy, 2012: 11, 15).

35 Turbochargers are a moderately-priced, off-the-shelf technology that has been around for years, but only recently have they become sufficiently reliable for widespread use in gasoline engines. Turbochargers work by using ex-

haust gases to turn a rotor that drives a compressor pumping more air into the combustion chamber, thus increasing power. Consequently, turbocharged engines may be made smaller, thereby improving fuel economy without sacrificing power; a modern turbocharged V-6 performs about like a V-8 without one. About eight percent of the vehicles sold in America during 2010 were so equipped. The Lordstown-made Cruze, the Cleveland-made engine for Ford's F-150, and any vehicle with a clean-diesel engine are examples of turbocharger use (Gearino, 010; Levy, 2012: 15; Sedgwick and Roy, 2010). Other possibilities for improving fuel efficiency include automatically turning off the engine at stop lights (some hybrids do this), using booster batteries during acceleration to supplement engines designed for maintaining speed, getting gasoline engines to diesel, improving vehicular aerodynamics – even for the underbody, and operating on three or four cylinders in a fuel-saving mode – a V6 engine made in Anna could do just that (Phelan, 2008).

36 CVTs were introduced to the U.S. mass market in 1987, but reliability problems lead to their discontinuation. Re-engineered CVTs have been reintroduced by Japanese-based companies as standard equipment on some high volume models. For example, Honda's recent additions at its Russells Point and Anna plants make CVTs and related items as standard equipment for Accords with I4 engines (Chappell, 2012; Rechtin, 2012).

37 In the U.S., new safety features usually are incorporated by regulation; in Europe, they typically originate with customer demand. Consequently, European parts makers are leaders in this field (Levy, 2010: 19).

38 The fuel efficiency of vehicles is increasing and greenhouse gas (GHG) emissions per driver are declining. This at least partially due to actions taken by the EPA as well as new CAFE requirements, which require 35.5 mpg by 2016 and 54.5 mpg by 2025 (Levy, 2014: 16).

39 Natural gas is a generic term for methane and ethane – the two most common types – as well as propane, butane and other paraffin hydrocarbons. All are subject to processing before use. Gasoline consists of liquid hydrocarbons derived from crude petroleum by a variety of processes (Parker, 1984). Honda's Anna plant has made engines that use natural gas (Harbour Consulting, 2004), but Honda limited sales of vehicles with such engines to fleet operations.

40 The shift to low-sulfur fuel and Honda's recently-patented method of reducing N_2O have helped meet these standards (Harbour Consulting, 2006: 144-145; Kiley, 2008). Federal officials believe the increased costs of trucks incurred in meeting requirements to improve efficiency and reduce GHG emissions by 23 percent by the end of 2018 will be more than offset by savings on fuels over the life of the vehicle (Levy, 2014: 19).

41 Decades ago, farmers produced ethanol for use in their own engines (Wikipedia, 2014); the price of ethanol also varies with the price of its feed stocks, but cost-cutting and technical improvements in the production process may further reduce the break-even price of ethanol (Rohter, 2006).

42 Octane ratings of gasoline are based on the ratio of 2,2,4-trimethylpentane, which has eight carbon atoms, to heptane's seven carbon atoms. Gasoline rated at 87 octane has a ratio of the former to the latter of 87 to 13. The more complex the molecular chain, the more it can be compressed before spontaneously igniting, allowing the engine to operate at a higher compression ratio and producing greater power. The octane rating of ethanol is typically 108-110 (Fischetti, 2006).

43 Ethanol can be fermented from a variety of plants; sugarcane is a better source than corn. Brazilian officials claimed U.S. import duties of $.54 per gallon prevented the industry from developing even faster (Rohter, 2006; Wikipedia, 2014).

44 The reason cold engines are harder to start with ethanol is that it is less volatile than gasoline.

45 Toyota had the most advanced hybrid system and the majority of such sales in America in the middle of the first decade of this century. It had more than 650 patents, and licensed the technology to other companies (Harbour Consulting, 2006: 144).

46 Hybrid vehicles combine battery-powered electric motors with internal combustion (IC) engines to turn the wheels while reducing fuel consumption in the latter. Some hybrids turn the wheels only with battery-powered motors and use the IC engine to recharge the battery. Others use both power sources to turn the wheels. It needs to be emphasized that battery-powered electric motors can be combined with *any* type of IC engine using *any* type of fuel to create a hybrid system (Levy, 2010: 18). Various technological changes and innovations are used in hybrid vehicles. These include:

- using thermocouples to convert heat from IC engines and exhaust systems into electricity (Mayhood, 2008);
- running the vehicle's electrical components from the batteries instead of the engine;
- shutting off the IC engine when the vehicles is not moving;
- reducing engine size which, *ceteris paribus*, reduces fuel consumption;
- replacing the familiar four-stroke cycle IC engine with the less powerful but more fuel efficient two-stroke cycle engine; and
- capturing via regenerative braking energy that would otherwise be lost: "Just as a motor can transform electrical energy stored in a battery into torque (the force that produces wheel rotation and hauling power), the process

can run in reverse so that the torque created by slowing a moving car generates electricity that can be accumulated in the battery" (Romm and Frank, 2006: 74-75).

Simply shutting off the IC engine during stops improves fuel economy about 10 percent; using all may improve fuel economy by up to 60 percent.

47 The choice is between incorporating more techniques, with the attendant complexity achieving greater fuel efficiency at higher cost, vs. fewer techniques with less complexity, achieving some fuel saving at a lower cost. Japanese-based companies have tended to choose the former and U.S.-based companies the latter (Jones, 2008b).

48 Eisenstein (2012a) states that high-volume assemblers continue to make money-losing EVs because they do not want to be shut out of the California market, and the California Air Resources Board mandates a percentage of zero emissions vehicles. California is often believed to set trends for other states and even the nation.

49 The specific length of time varies from model to model, and also depends on how many miles are driven per year as well as the price of fuel (Romm and Frank, 2006). Edmunds estimates it takes an average of six years to recoup the greater initial cost of a hybrid, assuming gasoline costs $4.00 per gallon (cited by Levy, 2012:13).

50 The rise of electric vehicles, whether all-electric or hybrid, would require a power grid capable of handling the increased load. This could include people charging vehicles in anticipation of power loss in a storm. A grid often takes days to completely recover from a disaster, while gas stations can quickly reopen if they have generators to power their pumps (Schnably, 2010).

51 Gross domestic output is greater than gross domestic product because the latter is the final value of goods and services only, while the former also includes the value of intermediate goods and services.

52 Honda exported more vehicles from the U.S. than it imported from Japan for the first time in 2013 (more and less than 100,000, respectively), continuing the trend of the last few years of decreasing imports and increasing exports (Gearino, 2014). However, these numbers are dwarfed by total imports by all companies that still number in the millions. Both Honda and FCA would like to export more cars from the U.S. (Levy, 2014:14).

53 The U.S. Energy Information Administration forecasts worldwide demand for oil to rise from 84 to 111 million barrels per day in 2035. Prices per barrel are expected to average $125, but could go as high as $200 (standardized on 2009) (cited in Funk, 2010). Experts debate just exactly when world oil production will plateau or peak, followed

by an inevitable decline. Some have concluded that it could occur in the next decade, while others think it is decades away. "Many industry experts… argue that today's high prices are temporary, the result of technical bottleneck, sharply rising demand from Asia, and a plummeting dollar" (Roberts, 2008: 88). Others argue that speculation by large investors is the primary reason. Whatever the reason, though, high prices have not generated the output that prior price jumps have. Some industry experts counter this last point by noting that political and economic impediments above ground have prevented extracting more of what is below ground. Even if these problems are resolved and output increased, worldwide demand is expected to grow due to continued population growth as well as economic development, eventually outstripping supply. Extracting what remains will be much more difficult and costly. Furthermore, the amount of oil discovered each year since the early 1960s has trended downward. World oil production from existing fields has been falling by as much as eight percent per year, meaning that the oil companies must develop an average of up to seven million barrels in additional capacity *every day* to maintain current total output levels – let alone additional output to meet growing demand. Biofuels and more efficient motor vehicles may compensate to a degree – for a while, but sooner or later more fundamental and extensive changes to our currently energy-hungry lifestyle and economy must be made (Roberts, 2008).

Under these circumstances, it is ironic that U.S. gasoline consumption has declined a bit from its 2006 peak. Gasoline consumption here is predicted to continue declining for several reasons: the growing demand for gasoline in rapidly developing Asian economies – with the concomitant higher prices, higher fuel economy standards for light vehicles starting in 2012, mandated increases in ethanol use, the growing use of vehicles at least partially powered by electricity, and less driving by aging baby boomers (Fahey, 2010).

54 The CAFE mandates are not out of the question. A study by Lotus Engineering concluded that a gasoline-powered car could get 127 miles per gallon on the highway. The car would be a 1,150 pound three-seater, have an aluminum frame, use composite body panels, and place a 600 cc motorbike engine under the rear seats. It would be crashworthy and cost about $10,000. It would also incorporate the latest electronic technology such as voice command and a heads-up display (Sedgwick, 2012a).

55 The Energy Independence and Security Act of 2007 required the blending of 36 billion gallons of ethanol and other fuels with gasoline, diesel and jet fuel by 2022. As of 2012, U.S. ethanol production had risen to 13.3 billion gallons, using an estimated 42 percent of U.S. corn production (Corridore, 2014: 8). If 42 percent of the corn crop was used to produce 13.3 billion gallons of ethanol, then 100 percent of the corn crop, which was approximately 11 billion bushels, would have produced 31.67 billion gallons of ethanol – still short of the mandated 36 billion gallons. This also means that not one kernel of corn would have been used for food or anything else. If 11 billion bushels would have produced 31.67 billion gallons of ethanol, then about 12.5 billion bushels would be required to make 36

billion gallons of ethanol. However, if an average of 8 billion bushels per year is used for food and everything else besides ethanol, then total corn production would have to reach 20.5 billion bushels per year to accommodate both. The current forecast is that corn production for 2022 may be about 15 billion bushels. Clearly, something somewhere has to give.

56 Net state collections for Ohio totaled just over $26.5 billion in fiscal year 2013 (Ohio Dept. of Taxation, 2014). There were 108,469 full-time and 76,720 part-time employees, which, when combined, amounted to the equivalent of 135,594 full-time jobs for Ohio's state government in March, 2012 (U.S. Bureau of the Census, 2014d).

57 Alan Mulally, Ford's president and CEO at the time, and one analyst believed that Ford would have failed along with GM and Chrysler without the governmental assistance provided to the latter two because it would not have been able to get parts. The analyst argued that the parts industry was in worse shape than the assemblers (Keane, 2012).

58 The total includes significant amounts from its other products: motorcycles, scooters, all-terrain vehicles, outboard motors, portable generators, lawn mowers, power tillers, snow blowers and general purpose engines. Honda has recently ventured in robotics and aircraft production.

59 The two 6-digit industries in this subgroup are no longer distinguished under the 2012 NAICS.

60 In the Trade Balances section, vehicles, parts, and accessories from Canada and Mexico are imports. In the Market Share Trends section, which considers only new light vehicles, Canadian and Mexican production is part of domestic output.

61 The G5a index from the Federal Reserve Board summarizes the value of the dollar against the currencies of major trading partners; it is a broadly based general measure.

62 Levy has similar sentiments (2014: 9).

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