Ohio | Development Services Agency

Research Office
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Ohio's Polymers Industry

Rubber and Plastic Resins and Products, and Related Machinery

May, 2015

OHIO'S POLYMERS INDUSTRY:
Plastic Resins, Synthetic Rubber and Products

MAY 2015

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EXECUTIVE SUMMARY

- $5.49 billion worth of plastic and rubber products (NAICS code 326) were made in Ohio, the largest volume of such goods among all of the states as judged by Gross Domestic Product data from the U.S. Bureau of Economic Analysis (2014).

- Factories in Ohio ranked first in manufacturing both plastic products (3261) and rubber products (3262) based on the latest Annual Survey of Manufactures value-added figures (U.S. Bureau of the Census, 2015a).

- Exports are an increasingly important market for plastic and rubber products makers, rising from less than $1.1 billion 2002 to more than $2.3 billion in 2014. NAFTA partners Canada and Mexico are the largest foreign market, combining for $1.62 billion of purchases that year (International Trade Administration, 2015).

- 28 companies on Fortune magazine's U.S.-1,000 or Global-500 lists have polymers industry operations in Ohio; six of them have their world headquarters here: A. Schulman, Cooper Tire & Rubber, Goodyear Tire & Rubber, Momentive Performance Materials, Parker-Hannifin and PolyOne [sic].

- 68,700 people worked in Ohio's polymers industry (32521, 325991 and 326 combined) according to the latest County Business Patterns data; 32,400, or 47 percent, were employed making other plastic products (32619) (U.S. Bureau of the Census, 2015b).

- 75 counties have at least one of Ohio's 1,038 polymers industry establishment; 12 counties account for the majority: Summit, Cuyahoga, Franklin, Portage, Stark, Hamilton, Lake, Montgomery, Geauga, Butler, Lorain and Ashtabula; the majority of jobs are found in an overlapping group of 13 counties: Summit, Hancock, Portage, Franklin, Geauga, Wood, Sandusky, Williams, Ashtabula, Cuyahoga, Medina, Butler and Darke (U.S. Bureau of the Census, 2015b).

- Goodyear is the largest polymers industry employer in Ohio with 3,000 people; other companies employing at least 1,000 include Continental, Cooper Tire & Rubber, Eaton, International Automotive Components, PolyOne, and Toledo Molding & Die.

- International investment is increasingly important; 70 companies from 18 foreign nations employ close to 15,100 in manufacturing operations making plastic resins, synthetic rubber and a variety of products; eight of them were on Fortune's Global-500 list; Eaton is the largest employer with more than 1,300, followed by Continental and International Automotive Components with about 1,000 each.

- 97 companies announced 104 major polymers industry investments in Ohio from 2011 through 2014; planned expenditures totaled $663 million with 4,600 new jobs anticipated upon completion.

- The advantages of locating in Ohio include proximity to customers and suppliers (of both raw materials and production machinery), a well-developed, multi-modal transportation network, and a knowledgeable work force. In addition, the State of Ohio's Third Frontier program helps in a variety of ways to link the research capabilities of universities with entrepreneurial efforts in the development of new materials and technologies.

- People working in Ohio's polymers industry averaged over $46,300 in pay according to the latest County Business Patterns data (the national average was $1,700 more). This is the aggregate result of the higher wages paid in resin and synthetic rubber production and compounding (32521, 991) and rubber products manufacturing (3262) – particularly new tire production (326211) – offsetting the lower wages in all other plastic products (326199) (U.S. Bureau of the Census, 2015b).

- The portion of U.S. capital expenditures in Ohio from 2002 through 2012 for manufacturing plastic and rubber products (326) essentially equals the corresponding portion of value-added from Ohio, indicating companies' continuing commitment to manufacturing here (U.S. Bureau of the Census, 2005a-2014a, 2005c, 2010c, 2015c).

- While plastic and rubber products (326) continue to grow with the economy – as well as by substituting for other materials, major resin and synthetic rubber manufacturers (32521) are consolidating and globalizing their operations.

- Polymers industry growth is expected in the near term as two key markets for its products – the cyclical housing and motor vehicle industries – continue to expand. Growth in the steadier consumer and institutional products markets moderates the cyclicality of the former. Exports may continue to grow if the currently low prices of natural gas are maintained. However, a significant increase in prices for oil and natural gas (which are both raw materials and fuels for the industry) would be a challenge for the industries.

- Long-term growth rates in the volume of goods produced are forecast to be highest in the resins and synthetic rubber sub-group (32521), followed by the rubber products group (3262) and the plastics group (3261) (U.S. Bureau of Labor Statistics, 2013); only the resins and synthetic rubber sub-group may see employment gains in Ohio (ODJFS-LMI, 2014).

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DESCRIPTION OF OHIO'S POLYMERS INDUSTRY

Ohio

Ohio Polymers Industry

Notable Establishments*

KEY

- Notable Establishment*
- Interstate Route
- Other Highway
- Ohio County

*Establishment believed to employ 500 or more

Sources:
See Table A1

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NOTABLE POLYMERS INDUSTRY MANUFACTURERS

Twenty-eight companies on Fortune magazine's U.S.-1,000 or Global-500 lists have polymers industry establishments in Ohio. Six of them maintain their world headquarters in Ohio: A. Schulman, Cooper Tire & Rubber, Goodyear Tire & Rubber, Momentive Performance Materials, Parker-Hannifin and PolyOne. Goodyear is the largest industry employer in Ohio with 3,000 people. Other companies employing at least 1,000 include Continental, Cooper Tire & Rubber, Eaton, International Automotive Components, PolyOne and Toledo Molding & Die. Thirteen more companies, including four in the Fortune U.S.-1,000 or Global-500, employ between 500 and 1,000.[1]

The map above shows the locations of 13 establishments thought to employ at least 500 people. The list below includes the Fortune companies with at least 50 people at a site as well as other companies employing 500 or more people in Ohio and having at least 50 people at a site. It is organized by N. American Industry Classification System (NAICS) code and includes the city where the site is located. Producing plastic and rubber resins and/or products may not be the principal business of some companies on the list, but those company sites are included because of their primary NAICS codes. See Appendix table A1 for the list organized by company.

Industry Group/Company/Subsidiary or Division	Primary NAICS	City	Jobs at Site~
32521, 325991			
A Schulman, Inc. (HQ)	325211	Fairlawn	77
A Schulman, Inc. (fka Diamond Polymers)	325211	Akron	124
Dow Chemical Co.*/Multibase, Inc. (a joint venture with Corning, Inc.*)	325211	Copley	85
Dow Chemical Co.*/Rohm & Haas Co.	325211	W. Alexandria	110
Dow Chemical Co.*/Rohm & Haas Co.	325211	Cincinnati	180
E I du Pont de Nemours & Co.*[6]	325211	Circleville	790
E I du Pont de Nemours & Co.*/Electronic Polymers	325211	Dayton	65
Illinois Tool Works, Inc.* (aka Evercoat)	325211	Blue Ash	130
Mitsubishi Chemical…*/Mitsubishi Chemical Performance Polymers, Inc.[2]	325211	Bellevue	115
Momentive Performance Materials LLC*/Hexion LLC (HQ)	325211	Columbus	100
PolyOne Corp.*[14]	325211	Greenville	255
PolyOne Corp.*	325211	N. Baltimore	80
Bayer AG*/Bayer MaterialScience LLC (sic)	325212	Hebron	150
E I du Pont de Nemours & Co.*/Performance Elastomers LLC	325212	Stow	130

Industry Group/Company/Subsidiary or Division	Primary NAICS	City	Jobs at Site~
PolyOne Corp.* (HQ, and adjacent to Lubrizol)[15]	325991	Avon Lake	650
3261			
Berry Plastics Corp.*/Filmco, Inc.	326113	Aurora	100
Dow Chemical Co.*	326113	Hebron	105
PolyOne Corp.*/Designed Structures & Solutions LLC (fka Spartech)[16]	326113	Paulding	95
Mitsui*/Mitsui…/Advanced Composites, Inc. (joint venture with Marubeni, Inc.)	326121	Sidney	220
Mitsubishi Corp.*/Cantex, Inc.	326122	Aurora	60
Parker-Hannifin Corp.*/Parflex[12]	32613	Ravenna	315
Transdigm Group, Inc.*/Schneller LLC	32613	Kent	75
Dow Chemical Co.*	32615	Ironton	175
Plastipak Packaging, Inc.	32616	Jackson Center	500
Plastipak Packaging, Inc. (aka Constar)	32616	Hebron	125
Plastipak Packaging, Inc.	32616	Medina	200
Silgan Holdings, Inc.*/Silgan Plastics LLC	32616	Ottawa	200
3M Co.*	326199	Elyria	170
A Schulman, Inc. (fka Graco)	326199	N. Canton	50
Axiall Corp.*/Exterior Portfolio LLC (fka Crane)	326199	Columbus	250
Berry Plastics Corp.*[1]	326199	Streetsboro	100
Berry Plastics Corp.*/BPRex Healthcare Brookville, Inc.	326199	Perrysburg	135
Berry Plastics Corp.*/Venture Packaging, Inc.	326199	Monroeville	360
Compagnie de Saint Gobain*[2]/St. Gobain Performance Plastics Corp.	326199	Aurora	200
Compagnie de Saint Gobain*[2]/St. Gobain Performance Plastics Corp.	326199	Ravenna	100
Continental Structural Plastics, Inc.	326199	N. Baltimore	234
Continental Structural Plastics, Inc.[3]	326199	Van Wert	82
Continental Structural Plastics, Inc.	326199	Carey	390

Industry Group/Company/Subsidiary or Division	Primary NAICS	City	Jobs at Site~
3261 (continued)			
Continental Structural Plastics, Inc.[4]	326199	Conneaut	277
Core Molding, Inc.[5]	326199	Columbus	500
Crown Cork & Seal, Inc.*	326199	Lancaster	90
Eaton plc/Cooper Lighting LLC[2]	326199	Aurora	140
Illinois Tool Works, Inc.*	326199	Troy	92
Illinois Tool Works, Inc.* (aka Tomco)[9]	326199	Bryan	150
International Automotive Components Group SA/IAC N. America, Inc.[10]	326199	Huron	736
International Automotive Components Group SA/IAC N. America, Inc.	326199	Fremont	273
Johnson Controls, Inc.*/JCIM LLC[1]	326199	Bryan	250
Moriroku Co. Ltd./Greenville Technology, Inc.[2]	326199	Greenville	735
Newell-Rubbermaid, Inc.*/Rubbermaid, Inc.[11]	326199	Mogadore	840
Owens Corning*/Fibreboard Corp. (HQ)	326199	Toledo	200
Ply Gem, Inc./Great Lakes Window, Inc.[6]	326199	Walbridge	450
Ply Gem, Inc./Mastic Home Exteriors, Inc.[13]	326199	Sidney	160
Sonoco Products Co.*/Createc Corp. (aka Protective Solutions)	326199	Findlay	100
Step2 Co. LLC[17]	326199	Streetsboro	n.a.
Step2 Co. LLC[17]	326199	Perrysville	n.a.
Toledo Molding & Die, Inc. (HQ and Test Lab)	326199	Toledo	n.a.
Toledo Molding & Die, Inc.	326199	Bowling Green	n.a.
Toledo Molding & Die, Inc.	326199	Delphos	n.a.
Toledo Molding & Die, Inc.	326199	Tiffin	n.a.
Toledo Molding & Die, Inc.	326199	Toledo	n.a.
Toledo Molding & Die, Inc./WI, Inc. (fka WEK industries)	326199	Jefferson	n.a.
3262			
Cooper Tire & Rubber Co.* (HQ)	326211	Findlay	1,000
Goodyear Tire & Rubber Co.* (HQ)[8]	326211	Akron	3,000
Titan International, Inc.*/Titan Tire Corp.	326211	Bryan	400
Continental AG*[2]/Veyance Technologies, Inc.	32622	St. Marys	430

Industry Group/Company/Subsidiary or Division	Primary NAICS	City	Jobs at Site~
3262 (continued)			
Continental AG*[2]/Veyance Technologies, Inc.	32622	Marysville	400
Cooper-Standard, Inc.*/Cooper-Standard Automotive, Inc.	32622	Bowling Green	350
Eaton plc/Eaton Corp.[7]	32622	Van Wert	1,200
Continental AG*[2]/Veyance Technologies, Inc.	32629	Fairlawn	170
Bridgestone Corp.*/Bridgestone APM Co.[2]	326291	Upper Sandusky	515
Tokai Rubber Industries Ltd./DTR Industries, Inc.[2]	326291	Bluffton	650
Bridgestone Corp.*/Firestone Polymers LLC[1]	326299	Akron	100
Compagnie de Saint Gobain*[2]/St. Gobain Performance Plastics Corp.	326299	Akron	140
Yamashita Rubber Co. Ltd./YUSA Corp.[2]	326299	Washington CH	540

Notes: aka - also known as; fka - formerly known as; HQ - employment figure is-or-includes headquarters administration; n.a. - not available; ~ - jobs figures from Hoover's (2015) unless otherwise noted; jobs figures are thought to be the best available, but accuracy cannot be guaranteed; * - a Fortune U.S.-1,000 or Global-500 company; 1 - jobs figure from Manta (2015); 2 - jobs figure(s) from Office of Research (2014); 3 - jobs figure from Van Wert City Economic Development (2014); 4 - jobs figure from Growth Partnership for Ashtabula Co. (2014); jobs figure from Gearino (2015); 6 - jobs figure from company website; 7 - jobs figure from Cearns (2013); 8 - jobs figure from Akron City (2015); 9 - jobs figure from ELM Analytics (2015); 10 - jobs figure from Erie Co. Development (2012); 11 – jobs figure from Plastics News (2012); 12 - jobs figure from Rubber News (2014); 13 - jobs figure from I-75 Newspaper Group (2012); 14 - jobs figure from Carpe (2013); 15 - jobs figure for adjacent facilities at two addresses from Fogarty (2011); PolyOne has additional plants producing color-ants and additives and/or providing engineering services, often nearby; 16 - jobs figure from LexisNexis (2015); 17 - jobs figure from Gaetjens (2015); 18 - jobs figure from Lauzon (2014).

Sources: Akron City (2015), Carpe (2013), Cearns (2013), du Pont (2012), ELM Analytics (2015), Erie Co. Development (2012), Fogarty (2011), Fortune (2014), Gaetjens (2015), Gearino (2015), Great Lakes Window (2015), Growth Partnership for Ashtabula Co. (2014), Hoover's (2015), I-75 Newspaper Group (2012), Lauzon (2014), LexisNexis (2015), Manta (2015), Office of Research (2014), Plastics News (2012), PolyOne (2015), Rubber News (2014), Van Wert City Economic Development (2014), and Various company websites (2015).

Prepared by: Office of Research, Ohio Development Services Agency. Telephone 800/848-1300, or 614/466-2116 (DL, 4/15).

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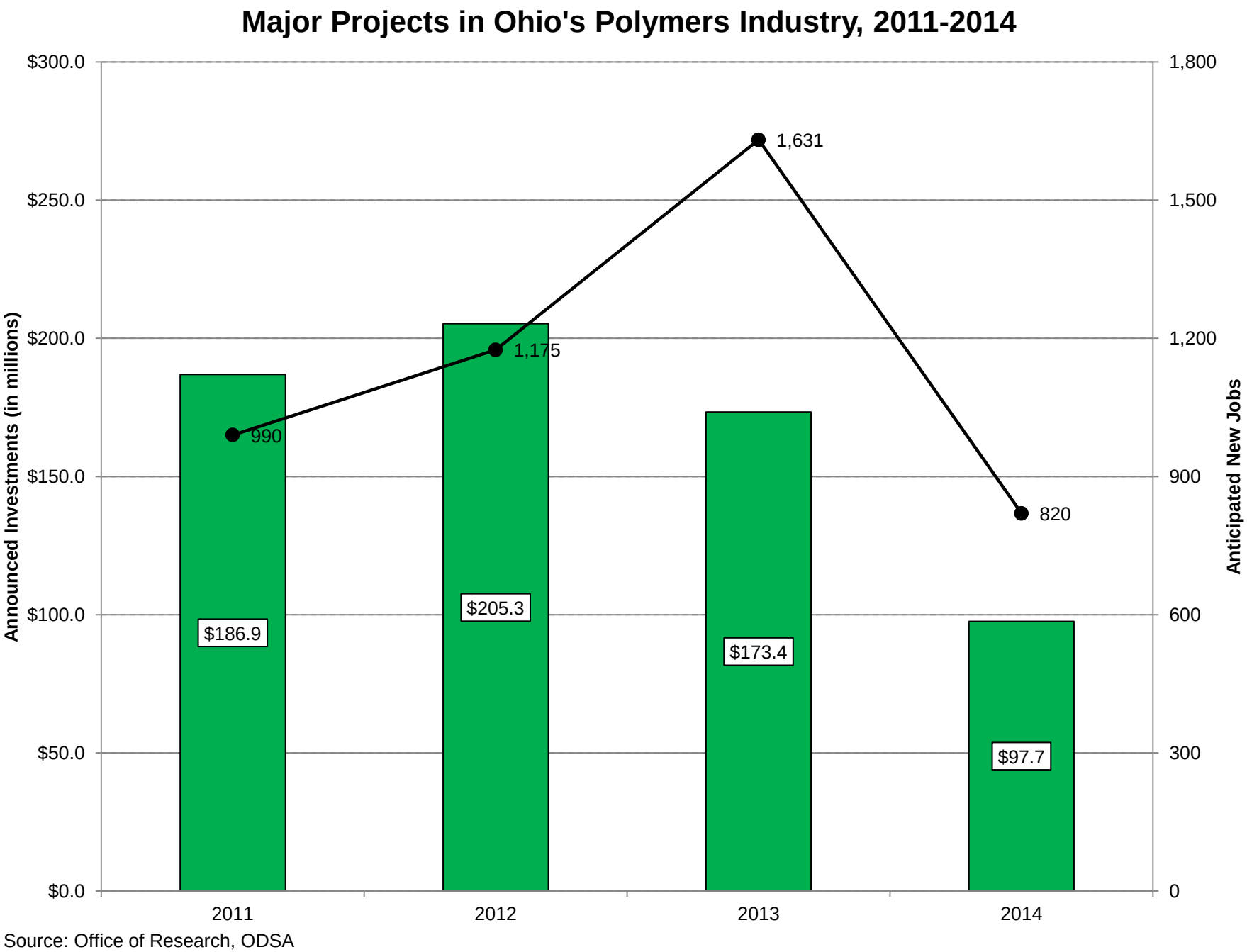

Source: Office of Research, ODSA

RECENT EXPANSION AND ATTRACTION ANNOUNCEMENTS

97 companies announced 104 major investments in Ohio's polymers industry from 2011 through 2014. The companies intended to invest a total of $663 million and planned 4,600 new jobs upon completion. The chart above shows the greatest aggregate investment declarations were recorded in 2012, while the largest numbers of new jobs were anticipated in 2013.

81 of the projects were planned for plastic products (NAICS 3261) and totaled $544 million, with well over 4,100 new jobs anticipated. Those figures were 82.0 percent of the announced investments and 89.7 percent of all new industry jobs. The 17 projects for producing and/or compounding plastic resins and synthetic rubber (32521 and 325991) intended to invest $98 million and pledged to hire nearly 400 people – 8.6 and 14.8 percent of the corresponding totals, while six rubber products (3262) projects drew $21 million with nearly 80 new jobs – 1.7 and 3.2 percent, respectively.

Huhtamaki, iMFLUX [sic] and Kraton Polymers planned the largest investments – each at least $50 million. Other companies planning to spend $20 to $49 million included Continental Structural Plastics, Newell-Rubbermaid and Octal Extrusions. ArmorSource [sic] and Moriroku's Greenville Technology joined Huhtamaki and iMFLUX as each anticipated hiring at least 200 people when announcing their projects. Other companies anticipating at least 100 new jobs included ABC Inouc, All Service Plastic Molding, Axium Plastics, Centrex Plastics, Continental Structural Plastics, Edgetech, Jeld-Wen, Newell-Rubbermaid, Next Generation Films, Sonoco Plastics and TH Plastics.

These counts are derived from a list of major investments compiled by the Office of Research (2015). To be included, a major investment must meet one of the following minimums: at least

- $1,000,000 for land, buildings or equipment for facilities; or
- 50 new jobs; or
- 20,000 square feet of new or added space.

Many of the major investments are phased-in over two or three years with employee counts following after project completion. Investment figures are not comparable with Census Bureau data on capital expenditures.

See Table A2

FOREIGN INVESTMENT IN OHIO

Foreign investment in Ohio is part of the globalization about which industry analysts write, and it has become increasingly important to the industry (see Larkin, 2012; Muir, 2014). Seventy foreign-based companies have subsidiaries in Ohio's polymers industry; eight are on Fortune's Global-500 list. All of the companies are listed below, along with the countries where the home office is located, their Ohio subsidiaries, and the estimated number of employees here. Sometimes a parent company will have more than one subsidiary here, or have more than one establishment with the same name. In either instance, only the total employment by the parent is shown. Eaton is the largest employer with more than 1,300, followed by Continental and International Automotive Components with about 1,000 each. Altogether, the 70 companies employ close to 15,100 in manufacturing plants in Ohio.

Ultimate Foreign Parent (s)	Parent Country	Ohio Subsidiar(y/ies)	Industry Side	Total Jobs~
Amcor Ltd.	Australia	Amcor Rigid Plastics USA, Inc.	Plastics	90
Axium Plastics, Inc.	Canada	Axium Plastics, Inc.	Plastics	165
Bayer AG*	Germany	Bayer MaterialScience (sic) LLC	Rubber	150
Bridgestone Corp.*	Japan	Bridgestone APM Co.	Rubber	515
Compagnie de St.-Gobain*	France	St.-Gobain Performance Plastics Corp.	Plastics	470
Continental AG*	Germany	Veyance Technologies, Inc.	Rubber	1,000
De Ruijter International BV	Netherlands	De Ruijter International USA, Inc.	Rubber	10
Deceuninck Group	Belgium	Deceuninck N. America LLC	Plastics	110
Eaton Corp.	Ireland	Eaton Corp. & Cooper Lighting, LLC	Both	1,340
Fenner plc	United Kingdom	Fenner Dunlop, Inc.	Rubber	230
Fletcher Building Ltd.	New Zealand	Formica Corp.	Plastics	450
Freudenberg & Co. KG (jv)	Germany	Freudenberg-NOK Sealing Technologies	Plastics	65
Frostbite Holding Guernsey II Ltd.	United Kingdom	Dometic Corp.	Plastics	100
Fujikura Rubber Group	Japan	IER Fujikura, Inc.	Rubber	175
Fukuvi Chemical Industry Co., Ltd.	Japan	Fukuvi USA, Inc.	Plastics	40
Gebr. Rochling KG	Germany	Roeching Glastic Composites	Plastics	170
Emirate of Abu Dhabi/Intl. Petroleum Investment Co.	United Arab Emirates	Nova Chemicals, Inc.	Rubber	40
Fujikura Rubber Group	Japan	IER Fujikura, Inc.	Rubber	175
Groupe Emballage Spécialisé SEC	Canada	iVex (sic) Protective Packaging, Inc.	Plastics	40
Grupo Empresarial Kaluz, SA de CV	Mexico	Dura-Line Corp.	Plastics	49
Hexpol AB	Sweden	Gold Key Processing, Inc. & Hexpol Compounding LLC	Plastics	360
Huhtamäki Oyj	Finland	Huhtamaki, Inc.	Plastics	350
Hunter Douglas NV	Netherlands	Astra Products Ltd. (aka Eclipse Blind Systems, Inc.)	Plastics	165

Ultimate Foreign Parent (s)	Parent Country	Ohio Subsidiar(y/ies)	Industry Side	Total Jobs~
IKO Industries Ltd.	Canada	Blair Rubber Co.	Rubber	25
Ineos AG	Switzerland	Ineos ABS Corp.	Rubber	270
Intl. Automotive Components Group, SA	Luxembourg	IAC N. America, Inc.	Plastics	1,009
KN Rubber LLC	Canada	Koneta, Inc.	Rubber	150
Kumi Kasei Co., Ltd.	Japan	Kamco Industries, Inc.	Plastics	475
Laird plc	United Kingdom	Laird Technologies, Inc.	Plastics	100
Lanxess AG	Germany	Rhein Chemie Corp.	Plastics	100
Melrose Industries plc	United Kingdom	Elster Perfection Corp. & H & H Engineered Molded Products, Inc.	Plastics	255
Meteor Gummiwerke KH Bädje GmbH & Co. KG (jv)	Germany	LMI Custom Mixing LLC	Plastics	50
Meteor Gummiwerke KH Bädje GmbH & Co. KG	Germany	Meteor Sealing Systems LLC	Rubber	155
Mitsubishi Chemical Holdings Corp.*	Japan	Mitsubishi Chemical Performance Polymers	Rubber	115
Mitsubishi Corp.*	Japan	Cantex, Inc.	Plastics	60
Mitsui*-Hexa Chemical (jv)	Japan	Hexa Americas, Inc.	Plastics	40
Mitsui*/Mitsui Chemicals, Inc.	Japan	Advanced Composites, Inc.	Plastics	220
Molten Corp.	Japan	Molten (N. America) Corp.	Rubber	90
Moriroku Holdings Co., Ltd.	Japan	Greenville Technology, Inc.	Plastics	735
Nifco, Inc.	Japan	Nifco America Corp.	Plastics	300
Nissen Chemitec Corp.	Japan	Nissen Chemitec America, Inc.	Plastics	210
Novatex GmbH	Germany	Novatex N. America, Inc.	Rubber	85
Okamoto Industries	Japan	Okamoto Sandusky Mfg. LLC	Rubber	15
Radici Partecipazioni SpA	Italy	Radici Plastics USA	Plastics	150
Ravago SA	Luxembourg	Goldsmith & Eggleton, Inc. & Trinity Specialty Compounding, Inc.	Both	105
Rank Group/Packaging Holdings Ltd.	New Zealand	Pactiv Corp.	Plastics	150
Rank Group/Reynolds Holdings	New Zealand	Graham Packaging PET Technologies, Inc. & Graham Packaging Plastic Products, Inc.	Plastics	293
Rexam plc	United Kingdom	Rexam Healthcare	Plastics	100
Ritrama SpA	Italy	Ritrama, Inc.	Plastics	67
RTS Companies, Inc.	Canada	RTS Companies US, Inc.	Plastics	80
Schutz GmbH & Co.	Germany	Schutz Container Systems, Inc.	Plastics	90
Scott Bader Commonwealth Ltd.	United Kingdom	Scott Bader, Inc.	Plastics	6
Shin-Etsu Chemical Co., Ltd.	Japan	Shin-Etsu Silicones of America	Rubber	150
Siemag Weiss GmbH & Co. KG	Germany	Hycomp LLC	Plastics	80
Sigma Industries, Inc.	Canada	RMC USA & Sigma Oh Industries	Plastics	130
Solvay SA	Belgium	Solvay Specialty USA LLC & Solvay USA, Inc.	Plastics	280
Soprema Holding	France	Soprema USA, Inc.	Rubber	80
Storopack Deutschland GmbH & Co. KG	Germany	Storopack, Inc.	Plastics	80

Ultimate Foreign Parent (s)	Parent Country	Ohio Subsidiar(y/ies)	Industry Side	Total Jobs~
Sumitomo Bakelite Co., Ltd.	Japan	Sumitomo Bakelite N. America, Inc.	Plastics	80
Survitec Group Ltd.	United Kingdom	Survitec Group	Rubber	120
Tarkett SA	France	Johnsonite, Inc.	Plastics	185
Tembec, Inc.	Canada	Tembec BTLSR, Inc.	Plastics	50
Tigers Polymer Corp.	Japan	Tigerpoly Mfg., Inc.	Plastics	260
Tokai Rubber Industries Ltd.	Japan	DTR Industries, Inc.	Rubber	650
Total SA*	France	CCP (Cook Composites & Polymers) US LLC	Plastics	28
TS Tech Co., Ltd.	Japan	Tri-Mold LLC	Plastics	170
Valfilm	Brazil	Valfilm (fka Dow Chemical Co. plant 70)	Plastics	150
Wacker Chemie AG	Germany	Wacker Chemical Corp.	Rubber	30
Windsor Mold Group	Canada	Autoplas & Precision Automotive Plastics	Plastics	250
Yama SpA	Italy	Speed N. America, Inc.	Plastics	35
Yamashita Rubber Co., Ltd.	Japan	YUSA Corp.	Rubber	540
Yokohama Rubber Co., Ltd.	Japan	Yokohama Industries Americas, Inc.	Rubber	110

Notes: ~ – Almost all jobs figures are from the Office of Research (2014); jobs figures are thought to be the best available, but accuracy cannot be guaranteed; * – a Fortune Global-500 company; Intl. – International; (jv) – a joint venture with another company that may or may not be listed.

Sources: Various company websites (2015), Fortune (2014), Hoover's (2015), LexisNexis (2015), Office of Research (2014).

The foreign parent companies are headquartered in 18 nations. Twenty-one are Japanese, 11 are German, eight are Canadian, seven are British, four are French, three are Italian, and two each are Belgian, Dutch, Luxembourgian or New Zealanders. Australia, Brazil, Finland, Ireland, Mexico, Sweden, Switzerland and the United Arab Emirates are home to one each. The vast majority of companies focus on the plastics side of the industry, but some with more than one establishment here may have operations on both the plastics and rubber sides. A few produce resins or synthetic rubber.

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THE ADVANTAGES OF LOCATING IN OHIO

The polymers industry is concentrated in Ohio for a number of reasons beyond the origin of the modern rubber industry in its Northeast (Prat, 1998), notably:

- The suppliers are close. A substantial portion oil and natural gas refinery output – the principal raw materials for resin and synthetic rubber production – occurs in the region from New Jersey through Illinois (O'Reilly, 2002; also U.S. Bureau of the Census, 2015b); in particular, natural gas production and processing are growing in Ohio with the development of the Utica shale (Schneider, 2013); coal and coal-products, secondary sources for resin and synthetic rubber production, also are produced in the region stretching from Virginia and Pennsylvania through Illinois (U.S. Energy Information Administration, 2015).

- Ohio has been the largest supplier of plastics- and rubber-working machinery in the nation based on the number of such establishments, their employment and their collective value-added (U.S. Bureau of the Census, 2010c, 2013b).[2]

- The polymers industry in Ohio is close to its major customers, which often are other manufacturers. Manufacturing is a relatively large part of Ohio's economy, and industries that are larger consumers of rubber products – motor vehicles, food processing, printing, and industrial machinery (Prat, 1990) – are concentrated in Ohio (U.S. Bureau of Economic Analysis, 2014).

- Ohio's central location, concentration of rail and major highways, and borders on major waterways make it well suited for distributing raw materials and intermediate and final polymeric products to customers, whether by truck, rail, water, pipeline and even rail-truck intermodal and air cargo – all as appropriate for the product form (see Muir, 2014: 29).

- Innovations from research and development (R&D) activities drive the expanding markets for rubber and plastic products. Regions in which industrial R&D activities are concentrated have a comparative advantage over other regions for future technological change, new products, and new industries (Malecki, 1981). Considerable R&D is done near corporate headquarters, in particular research that is basic and not related to product lines (Shanahan, et.al., 1985). As earlier noted, Ohio is corporate headquarters for many polymers industry companies. Furthermore, the concentration of R&D activity in a small geographic area also provides an environment for entrepreneurial ventures. "Many of the small to medium-size polymer manufacturing firms in the [Akron] region were established by people previously employed in polymer-related… industries" (Shanahan, et.al., 1985: 168).

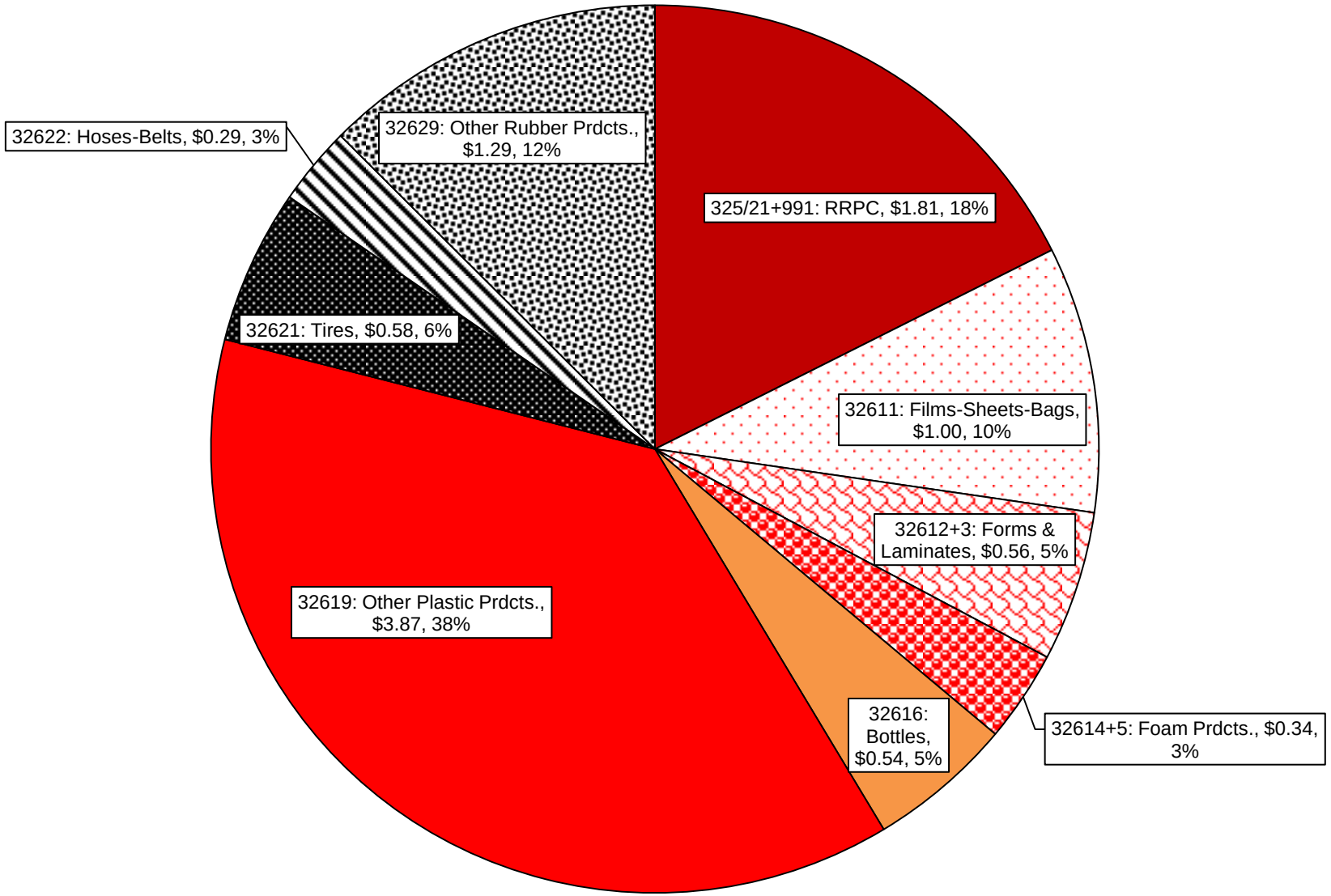
- R & D at universities may focus on industrial applications as well as basic research. This is evident from the many programs at over a dozen universities covering all aspects of polymer-related expertise from basic science through industrial applications and process engineering to technical training and quality control. Training in these fields extends from universities to community colleges, vocational centers, and even some secondary schools.

- The State of Ohio's Third Frontier program helps link the research capabilities and activities at universities with private sector entrepreneurs interested in commercial development of new materials and technologies. Support may take the form of grants, loans or tax incentives. The new companies may initially be located at a number of local centers.

The Variety of Polymers Industry Production in Ohio, 2012

in Billions of Dollars of Value-Added

Total: $10.29



Source: U.S. Bureau of the Census

THE VARIETY OF PRODUCTION IN OHIO

The chart above illustrates the variety and distribution of polymers industry production in Ohio. (The 19 specific constituent industries are grouped for easier presentation.) Overall, $10.29 billion of value was added during 2012 by establishments producing or compounding plastic resins or synthetic rubber, or making products from those materials. The value-added by resin and rubber production and compounding (RRPC, NAICS 32521 plus 325991) was $1.81 billion, or 17.6 percent of the industry total. Plastic materials and resins (325211) comprised the overwhelming majority of this production at $1.45 billion – 14.5 percent of the industry total.

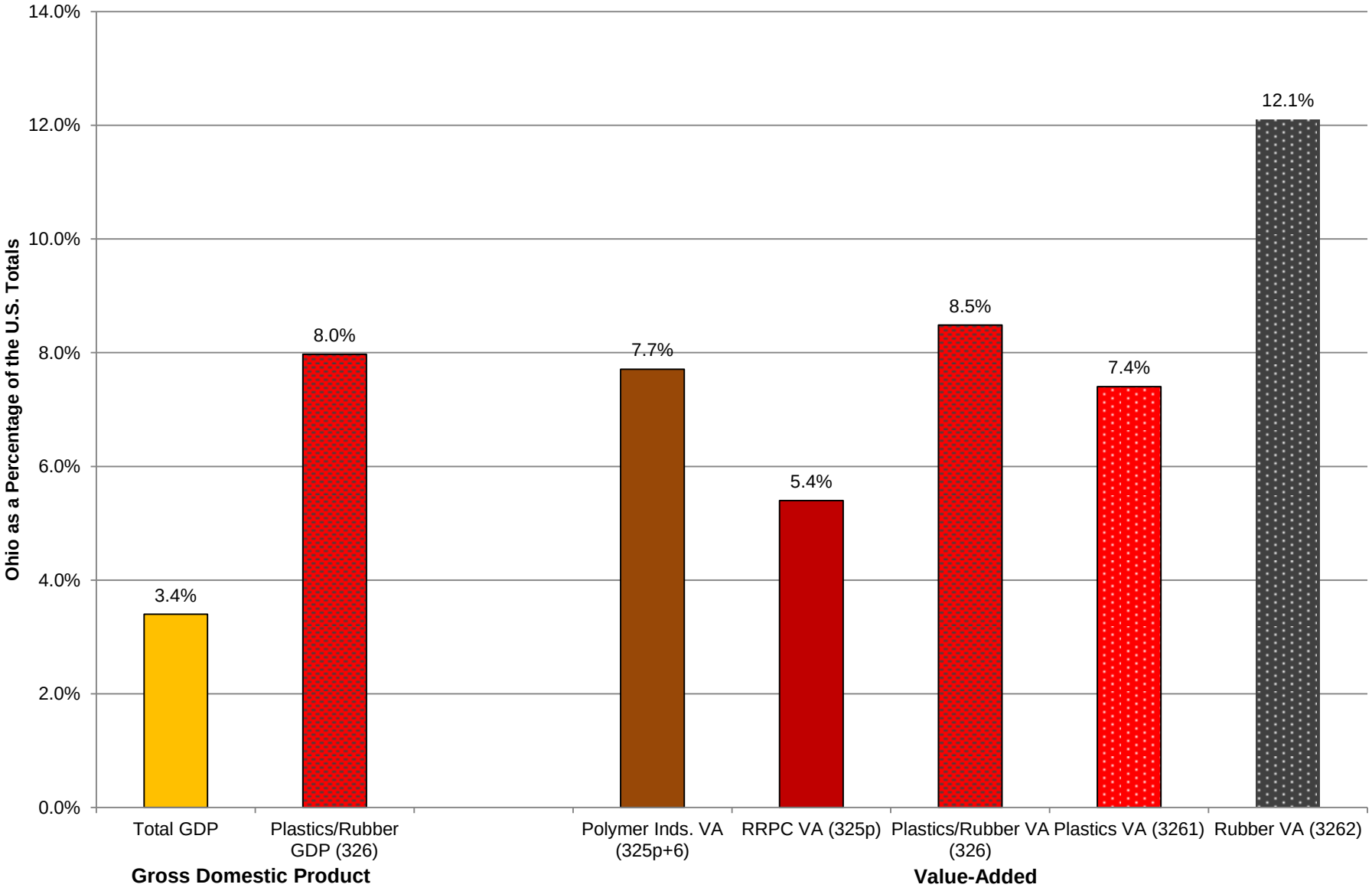
The other 82.4 percent – $8.48 billion – was value-added by making products from those materials (326). The larger portion of output – $6.32 billion, or 61.4 percent – was plastic products (3261, bright reds and orange in the pie chart). In turn, plastic products manufacturing is largely comprised of other plastic products (32619), specifically the myriad *all other plastic products* (326199) not named in other industries (326111-326191). At $3.83 billion, this specific industry contributed 60.7 percent of plastic products (3261) value-added and 37.2 percent of the polymers industry total.

Rubber products (3262, charcoal patterns in the chart) made up the smaller portion of the products industry (326) at $2.16 billion, which, in the big picture, was 21.0 percent of Ohio's polymers industry total. While other rubber products (32629) is the largest of the three rubber subgroups, rubber products for mechanical use (326291) was the third largest specific polymers industry in Ohio (after all-other-plastic-products and plastic-materials-and-resins) with $803 million in value-added – 7.8 percent of the total.

See Table A3

Polymers Industry Concentrations in Ohio

Based on 2012 Dollar Values



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

POLYMERS INDUSTRY CONCENTRATION IN OHIO

Figures on the left in the chart above show 8.0 percent of the U.S. plastic and rubber products industry's gross domestic product (GDP for NAICS 326) came from Ohio during 2012. This contrasts with 3.4 percent of the net value of all goods and service originating in Ohio (U.S. Bureau of Economic Analysis (BEA), 2014). The greater portion of national plastic-and-rubber-products output compared to total output indicates the industry's concentration here.

Value-added (VA) data (from which GDP figures are derived), shown on the right in the chart, illustrate how the industry's concentration varied by group that same year. While the overall VA concentration (326) was 8.5 percent, rubber products output (3262) was notably concentrated with Ohio's plants producing 12.1 percent of the U.S. total, while plastic products output (3261) was less concentrated at 7.4 percent.[3] The chart above also shows resin and synthetic rubber production and compounding (RRPC, 325p) is moderately concentrated in Ohio with 5.4 percent of U.S. value-added here. When combined with the portion of plastic and rubber products output from Ohio, the overall portion of polymers industry (325p +6) value-added here was 7.7 percent.

Data taken from Appendix table A3 – shown on the right half of this page – indicate these summary concentration figures are broadly based with output from 17 of the 19 specific constituent industries more or less concentrated in Ohio. Ohio ranked first in five industries, second in three industries, and third in six industries.

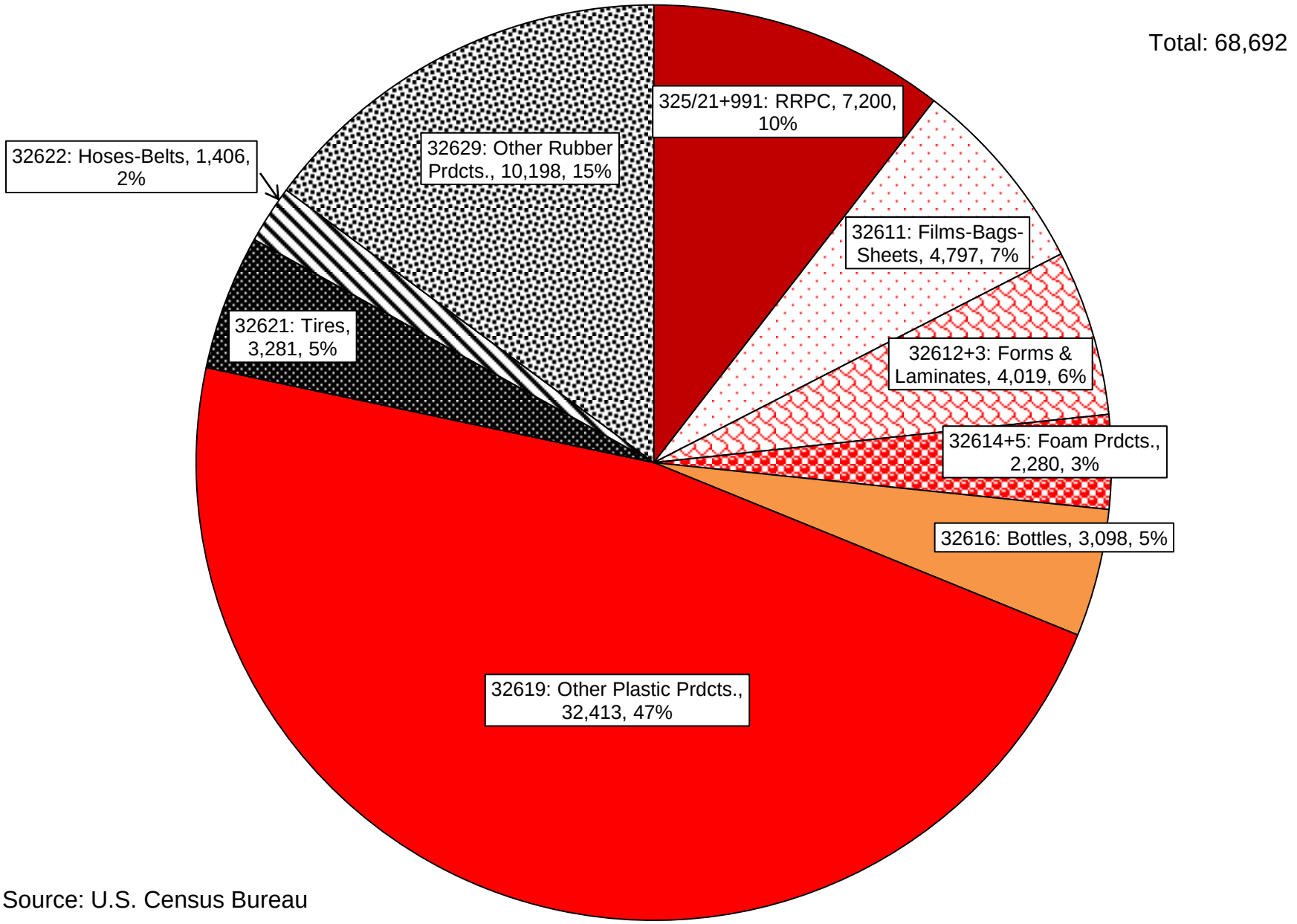
2012 U.S. Industry Value-Added Originating in Ohio

NAICS: Title	Percent	Rank
326291: Rubber Prdcts. Mech. Use	23.4%	1st
32622: Rubber & Plastic Hose & Belts	12.8%	1st
32616: Plastic Bottles	11.2%	1st
326299: All Other Rubber Prdcts.	11.1%	2nd
32613: Laminates	10.9%	2nd
326199: All Other Plastic Prdcts.	9.2%	1st
326113: Uns. Plastics (Exc. Packaging)	7.5%	2nd
326211: Tires (Exc. Retreading)	7.5%	3rd
325911: Custom Compounding	7.1%	3rd
32615: Urethane & Foam (Exc. PS)	5.7%	6th
326212: Tire Retreading	5.6%	1st
326112: Uns. Plastic Packaging Etc.	5.6%	3rd
325211: Plastic Materials & Resins	5.3%	3rd
326121: Uns. Plastic Profiles	4.9%	3rd
326122: Plastic Pipes & Fittings	4.9%	5th
325212: Synthetic Rubber	4.3%	3rd
326111: Uns. Plastic Bags	3.5%	6th
Ohio's Total GDP	*3.4%*	*7th*
32614: Polystyrene Foam Prdcts.	3.1%	9th
326191: Plastic Plumbing Fixtures	0.4%	9th

Abbreviations: Exc. – Except; Mech. – Mechanical; Prdcts. – Products; PS – Polystyrene; Uns. – Unsupported.

See Table A3 for all of the details

Distribution of Employment in Ohio's Polymers Industry, 2013



Source: U.S. Census Bureau

EMPLOYMENT IN OHIO'S POLYMERS INDUSTRY

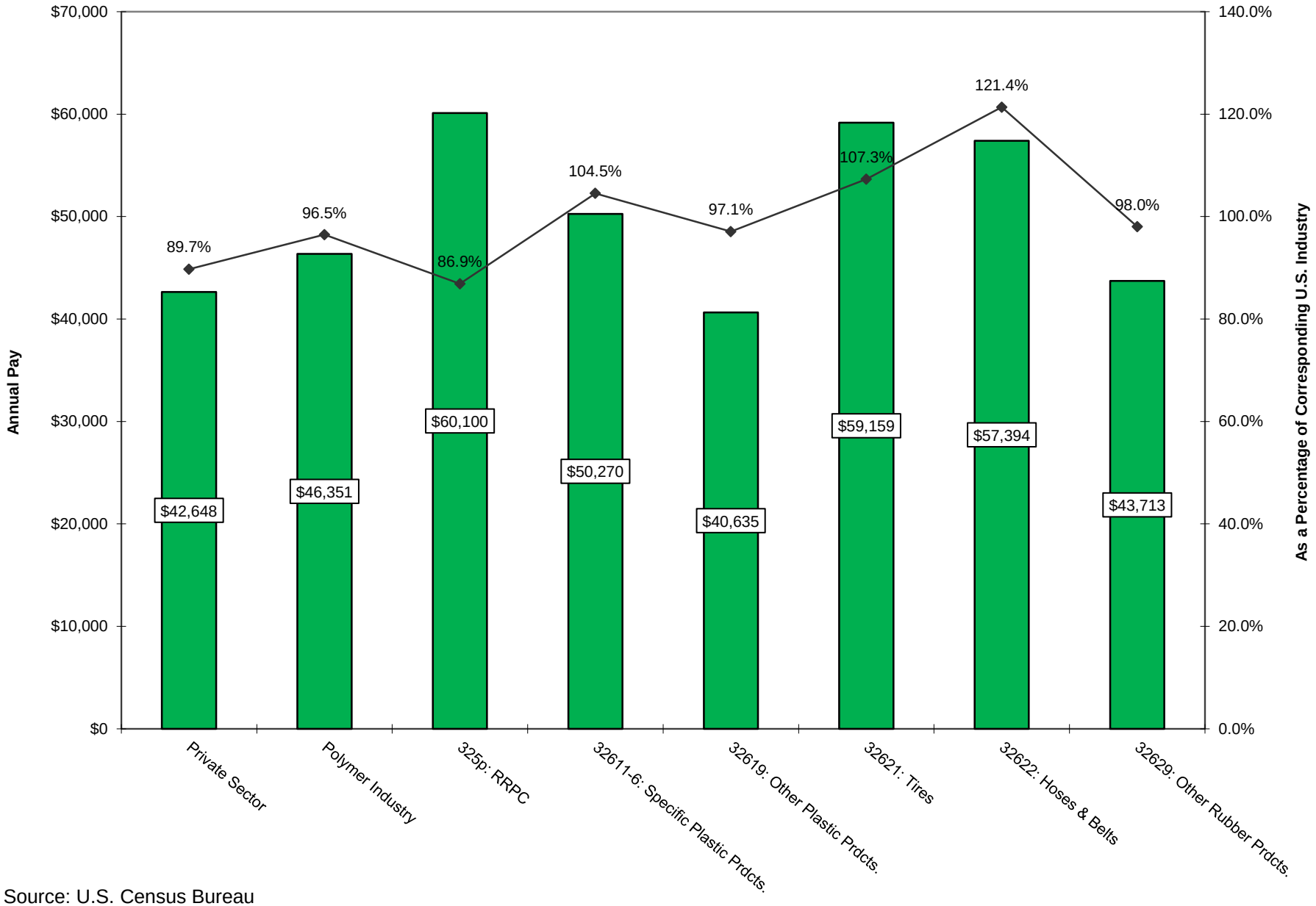
1,038 establishments employed nearly 68,700 people in Ohio's polymers industry according to the latest comprehensive data from the U.S. Bureau of the Census (2015b). 46,600, or 67.8 percent of industry employees, worked in the plastic products group (NAICS 3261). That group is, in turn, largely comprised of the other plastic products industry (32619) with 32,400 people – 47.2 percent – at 444 establishments. All but about 300 worked in the all other plastic products industry (326199, 46.7 percent). The size of this one industry dwarfs all other constituent industries.

Close to 14,900 people, or 21.7 percent of industry employees, worked at 203 establishments in the rubber products group (3262). The largest industry in this group (and exceeded only by other plastic products) is other rubber products (32629) with 10,200 employees. Nearly 6,500 of them made rubber products for mechanical use (326291) such as in machinery or transportation equipment. (Both machinery and transportation equipment production and employment are concentrated in Ohio (U.S. Bureau of Economic Analysis, 2014; U.S. Bureau of the Census, 2015b).) The production and customized compounding of plastic resins and synthetic rubber (32521 plus 325991) occupied 7,200 workers, or 10.5 percent of industry employment here, with well over 4,800 producing plastic resins (325211).

Consistent with production statistics, 7.3 and 8.6 percent of industry establishments and jobs are located in Ohio. (Ohio's portions of all private non-farm, non-railroad establishments and employment are 3.3 percent and 3.9 percent, respectively.) While the rubber products group (3262) is the second largest portion of industry employment, it is the most-concentrated portion of the industry workforce with 10.8 and 11.6 percent of national industry establishments and employment. Rubber products for mechanical use (326291) is the most-concentrated specific industry with 18.0 and 22.6 percent of U.S. establishments and employment. While plastic products employment (3261) is concentrated in Ohio with 8.0 percent of the U.S. total, some specific industries are more concentrated than others: notably laminates (32613), bottles (32616) and all other pro-ducts (326199) at 13.8, 9.7 and 9.6 percent of the corresponding national totals. Among resin and rubber producers and compounders, custom compounders of purchased resins are the most-concentrated at 8.9 percent of the U.S. total.

See Table A4 for all of the details

Pay in Ohio's Polymers Industries, 2013



Source: U.S. Census Bureau

INDUSTRY PAY

The chart above shows that annual pay in Ohio for private sector employees (excluding those in the farming and railroad industries) averaged $42,648. People employed in the polymers industry averaged $46,351, but there is much variation within this summary figure. Pay was greatest in the resin and rubber production and compounding cluster (RRPC, NAICS 325p, $60,100). Overall pay in the rubber products group (3262) was higher than overall pay in the plastic products group (3261): $48,410 vs. $43,570. The higher average of the former reflects the higher pay in tires (32621, $59,159) and rubber and plastic hose and belt production (32622, $57,394).

Pay varies by specific industry within the plastic products group, ranging from $36,393 in plumbing fixtures (326191) to $64,781 in unsupported film and sheet production (326113). Generally, though, pay in the specific subgroups (32611-6) averaged more than pay in residual-but-huge other plastic products (32619): $50,270 vs. $40,635. Appendix table A5 shows more detail as well as any exception(s) to this generalization.

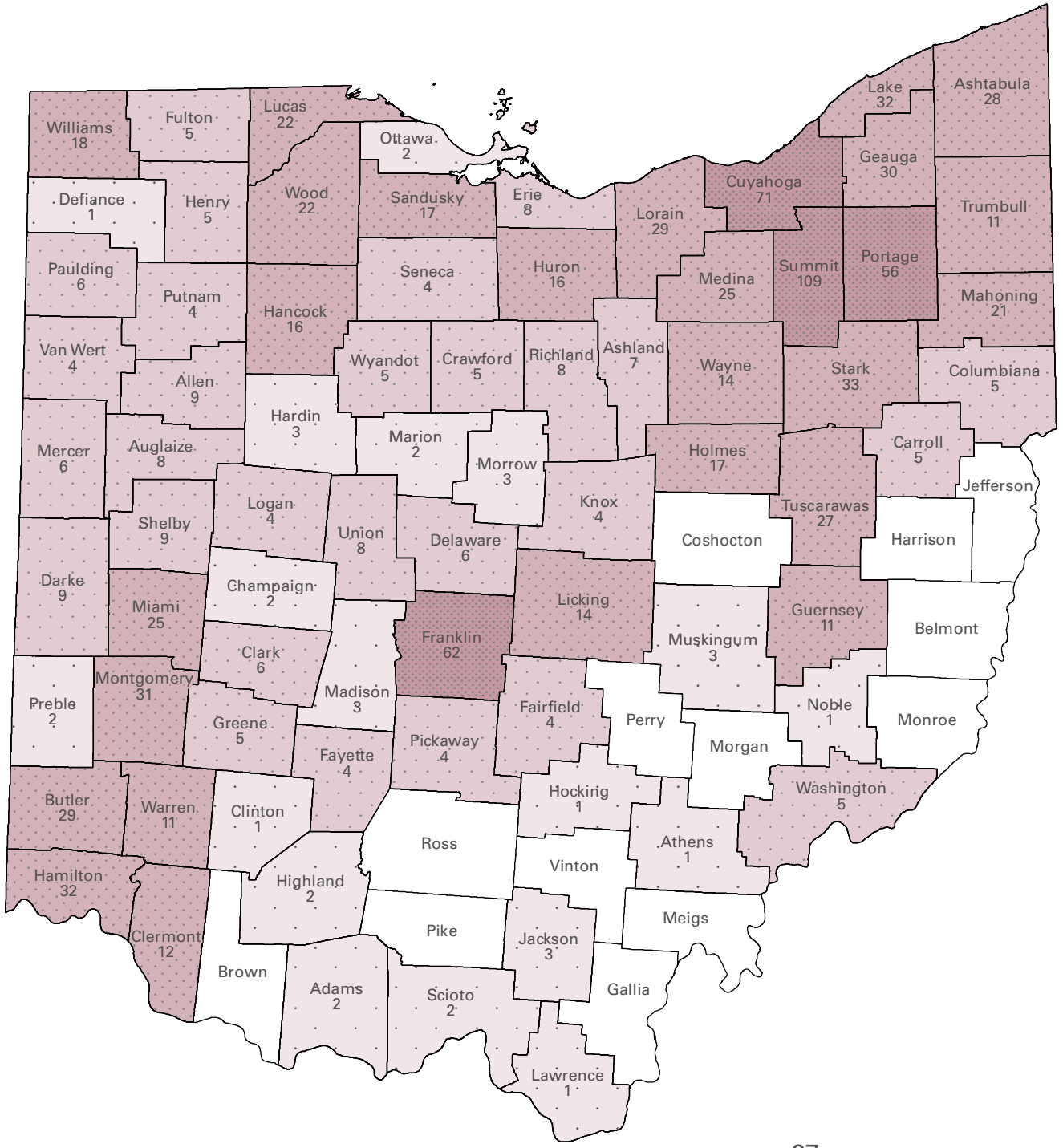
Mean polymers industry pay in Ohio was 96.5 percent of the national average. This largely reflects comparable pay in the two largest subgroups: other plastic products (32619) and other rubber products (32629) at 97.1 and 98.0 percent of the respective national averages. Nevertheless, there was considerable variation across specific industries. While the chart above shows specific plastic industries (32611-6) averaged 104.5 percent of the national aggregate, individual industries within the cluster ranged from 87.7 percent (326112, unsupported plastic film and sheet) to 119.4 percent (32614, polystyrene foam products) of the corresponding national averages. Pay in Ohio's rubber and plastic hose and belt establishments also was 121.4 percent of the national average. On the other hand, the high pay in resin and rubber production and compounding was just 86.9 percent of the national average. Again, Appendix table A5 shows details of variability for all of the industries.

See Table A5

Ohio

Ohio Polymers Industry

Establishments County
Statewide: 1,038



Number of Establishments in County

- 51 - 109
- 11 - 50
- 4 - 10
- 1 - 3
- None

Source:
2013 County Business Patterns,
U.S. Census Bureau

Prepared by:
Office of Research
Ohio Development Services Agency
May 2015

R040815A

THE DISTRIBUTION OF INDUSTRY ESTABLISHMENTS ACROSS OHIO

The map above illustrates the distribution of the 1,038 polymers industry establishments across Ohio according to the latest County Business Patterns data. Seventy-five counties had at least one industry establishment. However, the 18 counties with more than 20 establishments – Summit, Cuyahoga, Franklin, Portage, Stark, Hamilton and Lake, Montgomery, Geauga, Butler, Lorain, Ashtabula, Tuscarawas, Medina and Miami, Lucas and Wood, and Mahoning (listed in descending order and with some ties) – accounted for 65.9 percent of the state total. The top 12 counties accounted for the majority of establishments. Eleven counties ranged from 11 to 18 establishments, 20 counties counted five to nine establishments, and 26 had from one to four.

Counties with an establishment making plastic or rubber products did not necessarily have a resin- or rubber- producing or compounding plant, but counties with at least one resin- or rubber-producing or compounding establishment (NAICS 32521 or 325991) almost always had at least one establishment making plastic or rubber products (326). Defiance and Lawrence are the exceptions to the latter.

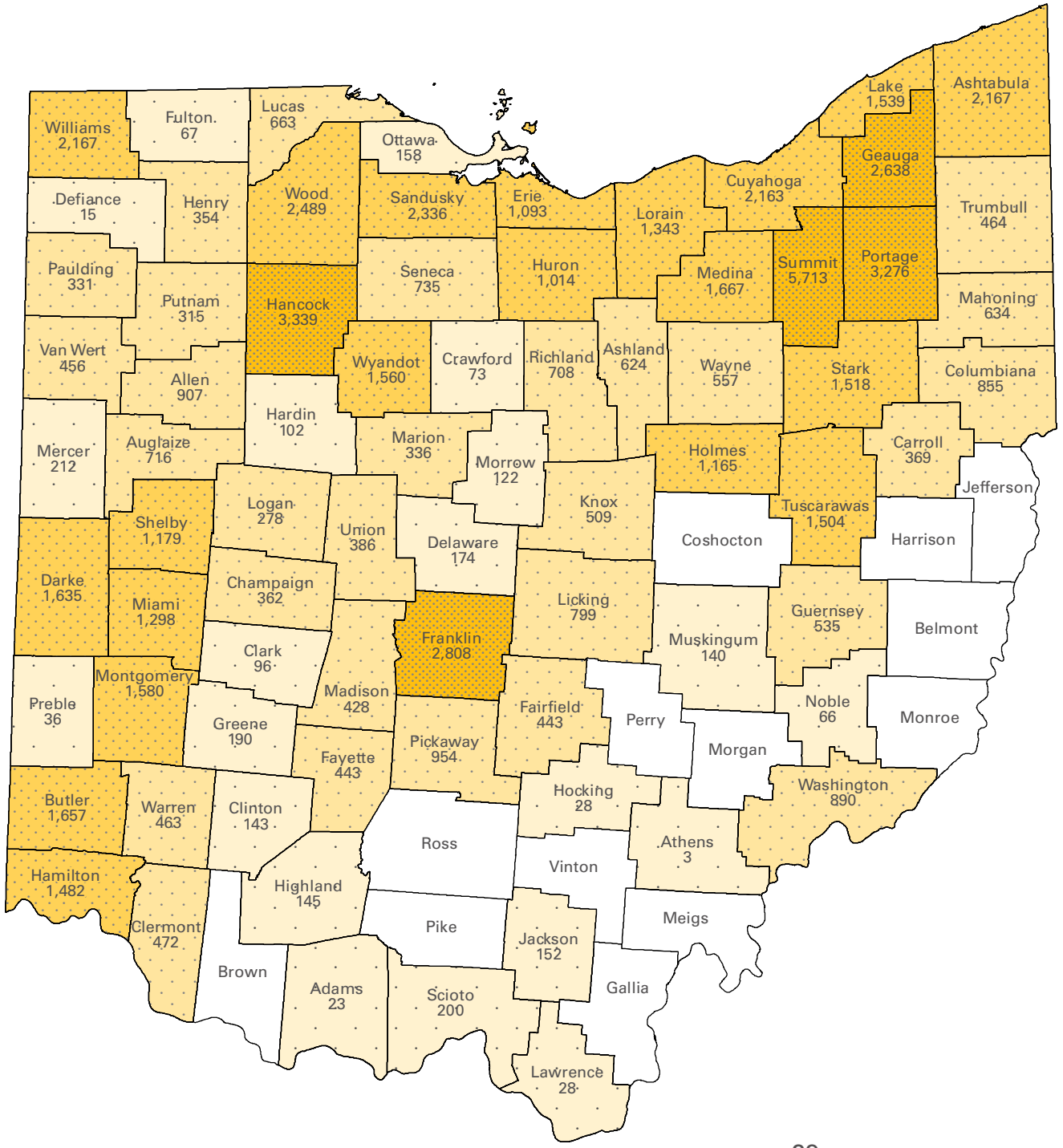
Another way to look at the map is to focus on Summit and the surrounding counties: Cuyahoga, Geauga, Medina, Portage, Stark and Wayne. These seven combine to form an area with 338 establishments, or 32.6percent of all polymers industry establishments in Ohio. More specifically, the seven counties have 33.6 percent of the state's 131 resin or rubber production or custom-compounding establishments. While polymers industry establishments are widely diffused across the state, this concentration lends credence to the Akron region's Polymer Valley moniker.

See Table A6

Ohio

Ohio Polymers Industry

Employment by County*
Statewide: 68,692



Number of Employees in County*

- 2,501 - 5,713
- 1,001 - 2,500
- 251 - 1,000
- 1 - 250
- None

*Most employment figures are, or incorporate, estimates

Source:
2013 County Business Patterns,
U.S. Census Bureau

Prepared by:
Office of Research
Ohio Development Services Agency
May 2015

R040815A

THE DISTRIBUTION OF INDUSTRY EMPLOYMENT ACROSS OHIO

Fourteen counties accounted for the majority of the industry employment in Ohio. Summit topped the list with 5,700-plus (this excludes employment at Bridgestone's research facility and Goodyear's headquarters), followed by Hancock (home to Cooper Tire and Rubber) with 3,300-plus and Portage with well over 3,200. Ashtabula, Cuyahoga, Franklin, Geauga, Sandusky, Williams and Wood each had between 2,000 and 3,000 employees; Butler, Darke, Erie, Hamilton, Holmes, Huron, Lake, Lorain, Medina, Miami, Montgomery, Shelby, Stark, Tuscarawas and Wyandot ranged between 1,000 and 2,000 each. Fourteen counties had between 500 and 1,000, and 36 counties had from 1 to 499.[4]

Similar to the preceding section, Summit and the surrounding counties are estimated to have had 17,500-plus jobs, or 25.6 percent of industry employment in the state.

See Table A6

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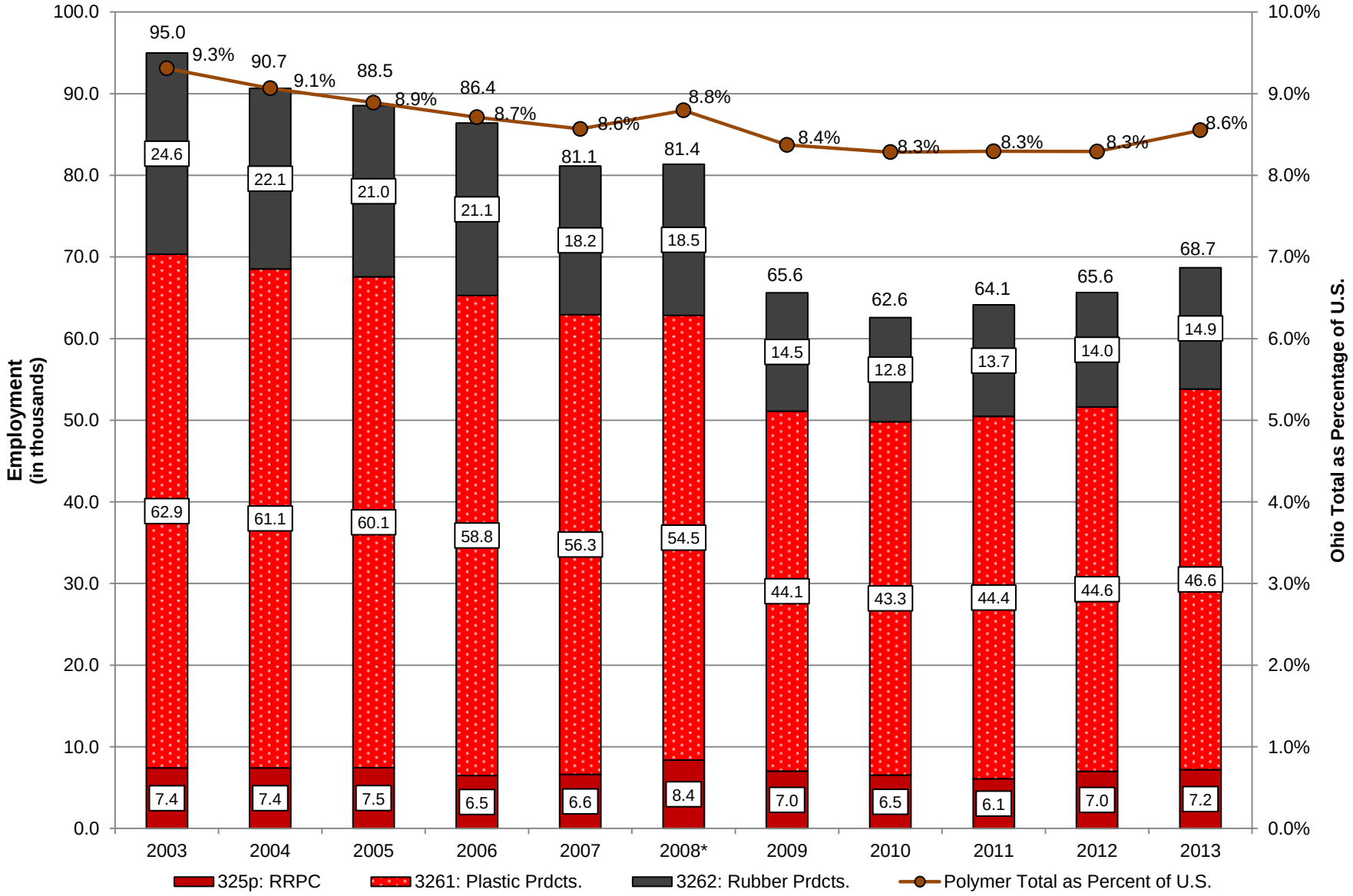
TRENDS

Employment in Ohio's Polymers Industry, 2003-2013
in thousands, except percentages



Source: U.S. Census Bureau

* - 2007 NAICS implemented; 325p figures not entirely comparable with earlier years.

EMPLOYMENT

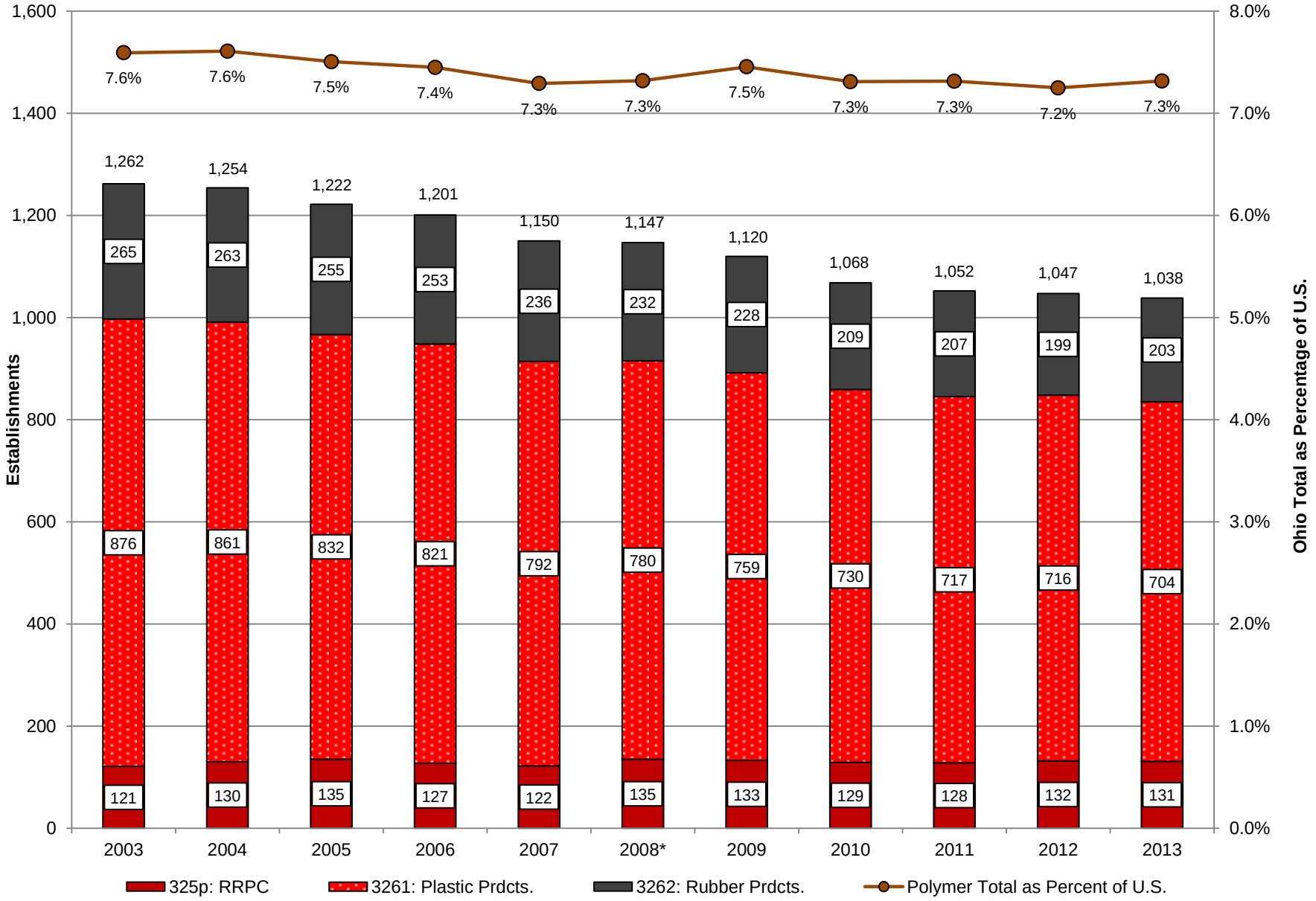
The chart above illustrates the latest comprehensive polymers industry employment changes over the last decade. Employment rose to approximately 95,000 with the recovery from the 2001 recession, but gradually declined to 81,400 in early 2008. Employment dropped by nearly 18,800 with the recession, bottoming-out at less than 62,600 in 2010; 6,100-plus jobs have since been added.[5] The net drop in industry employment in Ohio – down 34.1 percent from 2003 to 2010 – was worse than the corresponding national decline change of 24.2 percent. However, the industry in Ohio has regained jobs at a faster rate than the nation: 9.8 vs. 6.3 percent over three years. Nevertheless, the portion of U.S. polymers industry employment in Ohio fell from 9.3 to 8.6 percent over the decade.

The chart above shows the 2003-2013 employment changes occurred principally in the plastic products group (NAICS 3261, red pattern) and secondarily in the rubber products group (3262, charcoal). The magnitude of the 2003-2010 drop in the former was larger than in the latter – 19,600 vs. 11,900 – but the percentage decline was greater in the latter than in the former – 48.3 vs. 31.2. Beginning in 2010, 1,200 more jobs were gained in the plastics group than in the rubber group – 3,300 vs. 2,100, but the percentage improvement was greater in the latter than in the former – 16.7 vs. 7.7 percent. The net changes were 25.9 and 39.6 percent drops in Ohio's plastic and rubber products employment levels. These were greater than the corresponding national drops. While changing employment levels in the resin-rubber-production-compounding cluster (325p: RRPC) appear largely consistent with the recent recession and recovery, the longer-term record beginning in 2003 shows no definitive trend. Specific industry figures in Appendix table A7 show net gains in plastic resin production (325211) were offset by losses in custom compounding (325991) both in Ohio and across the country.[6] Synthetic rubber (325212) jobs declined for the nation as a whole, but fluctuated with no discernable trend in Ohio.

Preliminary data from the U.S. Bureau of Labor Statistics (2015) indicate the plastic and rubber products industry (326) in Ohio expanded by 900 jobs, or 1.7 percent, during the first three quarters 2014 when compared with the first three quarters of 2013. The corresponding growth rate for the U.S. industry was 2.5 percent.[7]

See Table A7

Establishments in Ohio's Polymers Industry, 2003-2013



Source: U.S. Census Bureau

* - 2007 NAICS implemented; 325p figures not entirely comparable with earlier years.

ESTABLISHMENTS

The chart above shows the number polymers industry establishments in Ohio fell 17.7 percent from 1,262 in 2003 to 1,038 in 2013. Unlike employment, *the summary number* of establishments has not increased during the current recovery. This change in Ohio is part of a national trend that saw a 14.6 percent decline. The slightly greater rate decline in Ohio than in the U.S. means that the portion of industry establishments here has drifted down from 7.6 to 7.3 percent.

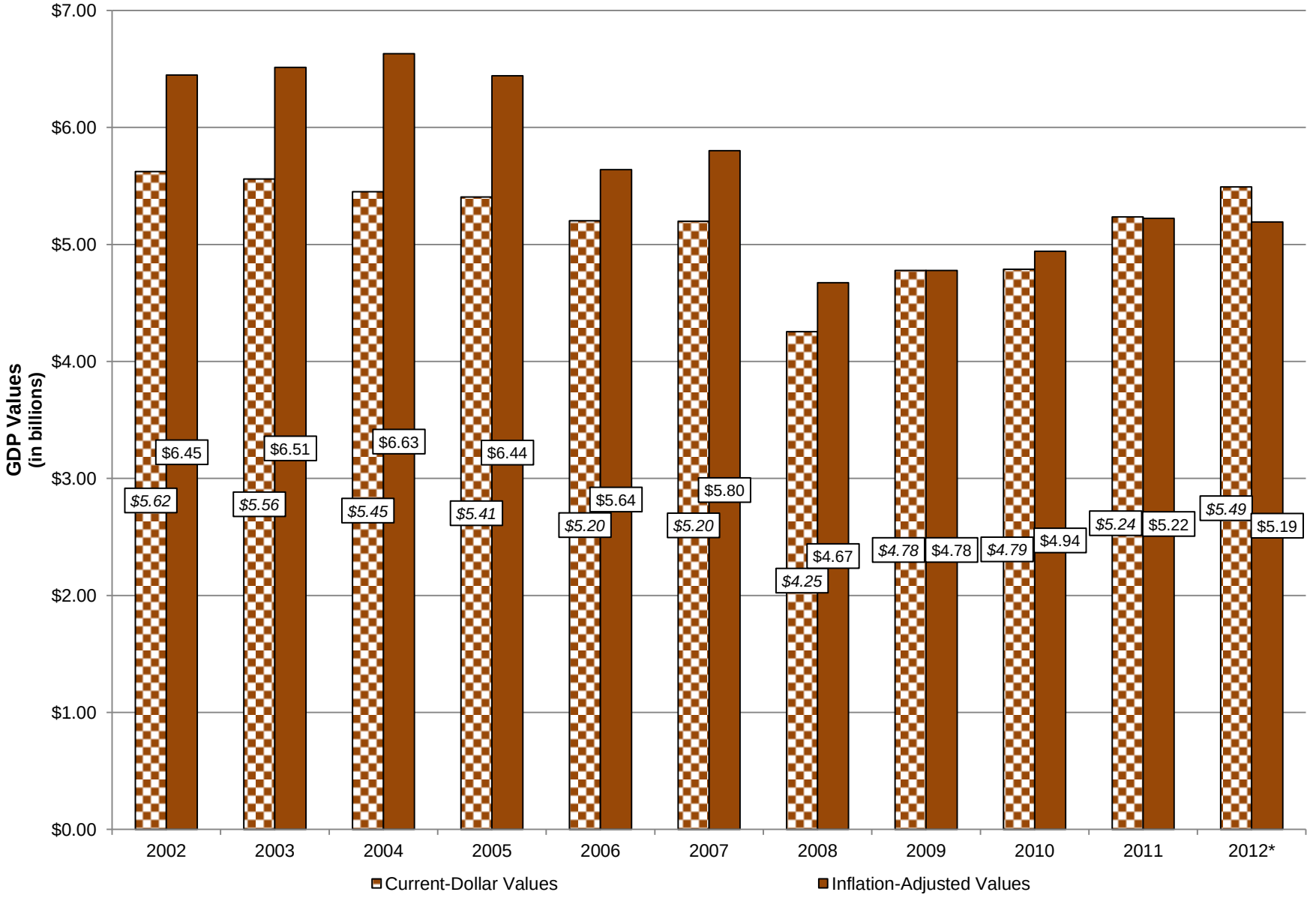
The chart above shows declines in both the plastic and rubber products groups (3261 and 3262). The plastics group saw more establishments leave or close than did the rubber group – 172 vs. 62, but the proportional decline was greater in the latter than in the former – 23.4 vs. 19.6 percent. Data in Appendix table A8 show most of most of the decline occurring in the other plastic products subgroup (32619), and significant declines were seen in pipes and polystyrene products (32612 and 32614). On the other hand, little or no change was seen in the films-sheets-bags, laminates, urethane and bottles sub-groups (32611, 3, 5 & 6). Declines in the rubber group were seen in all three subgroups.

Recent trends in the resin and rubber production and compounding cluster (325p, RRPC) notably contrast with the industry's products side (326). The chart above shows the number of RRPC establishments rising from 121 to 135, a 11.6 percent increase. Undoubtedly part of the increase is due to the adoption of the 2007 NAICS beginning in 2008 when a number of establishments were reclassified into the plastic resins industry (325211). However, a careful look at the figures in Appendix table A8 shows such establishments fluctuating in Ohio from 2003 through 2007 and recovering after the dip in the recession. This growth more than offset the declining number of custom-compounding establishments (325991).[8]

The specificity of all these industry changes in Ohio is remarkably similar to the national picture evident in Appendix table A8.

See Table A8

Nominal and Inflation-Adjusted Plastic and Rubber Products GDP from Ohio, 2002-2012
(Inflation-Adjusted Figures Standardized on 2009)



Source: U.S. Bureau of Economic Analysis.

* - Preliminary

GROSS DOMESTIC PRODUCT

The gross domestic product (GDP) is the net value of goods and services produced and provided by people using capital in the United States. The U.S. Bureau of Economic Analysis (BEA) publishes estimates of each state's contribution to the national total by industry. The chart above illustrates the plastic and rubber products industry's output from Ohio beginning in 2002. The nominal, current-dollar values (the checkered columns) gradually declined from $5.62 billion in 2002 to $5.20 billion in 2006 and 2007. At $5.49 billion in 2012, the industry appears to have returned to its pre-recession production range.

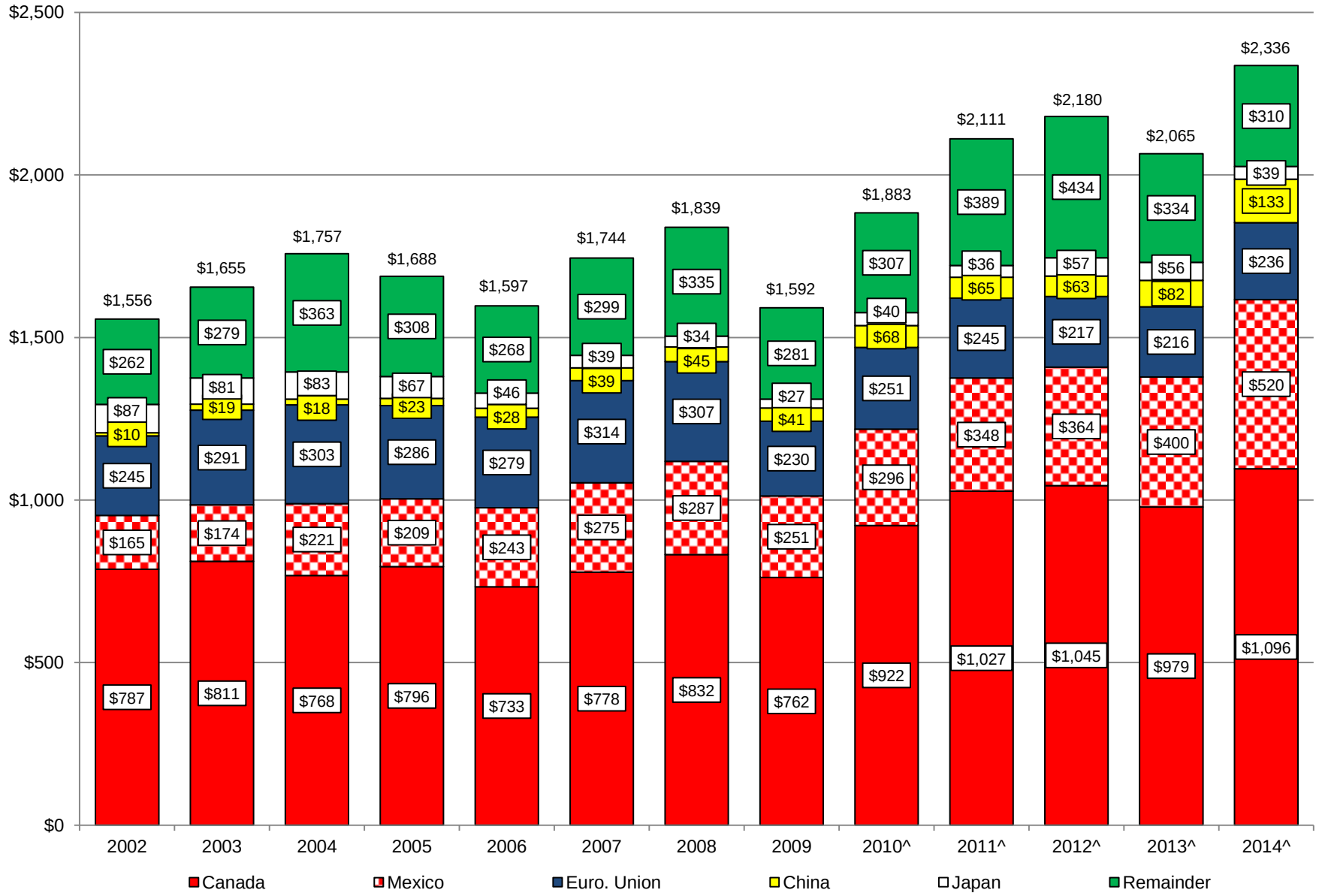
However, real changes in economic output – i.e., the *volumes* of goods produced – are known only after accounting for inflation (and, less commonly, deflation). The solid columns in the chart above illustrate these changes. Real industry output from Ohio fell almost without interruption from the $6.63 billion peak in 2004 to the recession low of $4.67 in 2008. The industry gradually has been recovering since, but output volume in 2012 still remained below pre-recession levels. This pattern of growth and contraction roughly in-sync with the encompassing overall economy is characteristic of a maturing industry.[9] (Output was constrained during parts of 2005 and 2006 after hurricanes damaged oil and gas production and processing facilities in and around the Gulf of Mexico (Muir, 2014)).

Data in Appendix table A9 show what happened in Ohio is very similar to what happened in the industry across the U.S. Consequently, the portion of industry output coming from Ohio varied little, fluctuating in the range of 7.5 to 8.9 percent regardless of nominal or real dollar valuations. The slightly smaller portions of more recent years may simply reflect the relatively more rapid growth elsewhere in the country concomitant with more rapid population growth.

See Table A9

Exports of Plastic & Rubber Products (NAICS 326) from Ohio

in millions, standardized on 2014



Sources: International Trade Administration, U.S. Bureau of Labor Statistics

^ - Subject to revision

EXPORTS

Export markets for plastic and rubber products (NAICS 326) have become more important to such manufacturers in Ohio. The chart above illustrates their inflation-adjusted overall growth from $1.556 to $2.336 billion, a 50.1 percent increase from 2002.[10] Many factors may have contributed to this growth; most notably, the value of the dollar generally has trended lower after peaking in 2002 (Federal Reserve Board, 2015), but reduced trade barriers, economic development and real growth in various areas of the world as well as technological advances – among others – probably played important roles. The greater decline in U.S. natural gas prices vis-a-vis global crude oil prices indirectly helped U.S. producers compete on costs (Muir, 2014: 4). (Natural gas and oil are key resources for manufacturing plastic resins and synthetic rubber.)

The chart also illustrates where exports are going as well as they have grown and waned. The near-majority of exports from Ohio goes to Canada, followed by Mexico. While exports to both have trended higher, those to Mexico have grown more rapidly (especially in recent years): 39.3 vs. 214.6 percent. Collectively, these two NAFTA partners account for 69.2 percent of industry exports in 2014 – up from 61.2 percent in 2002.

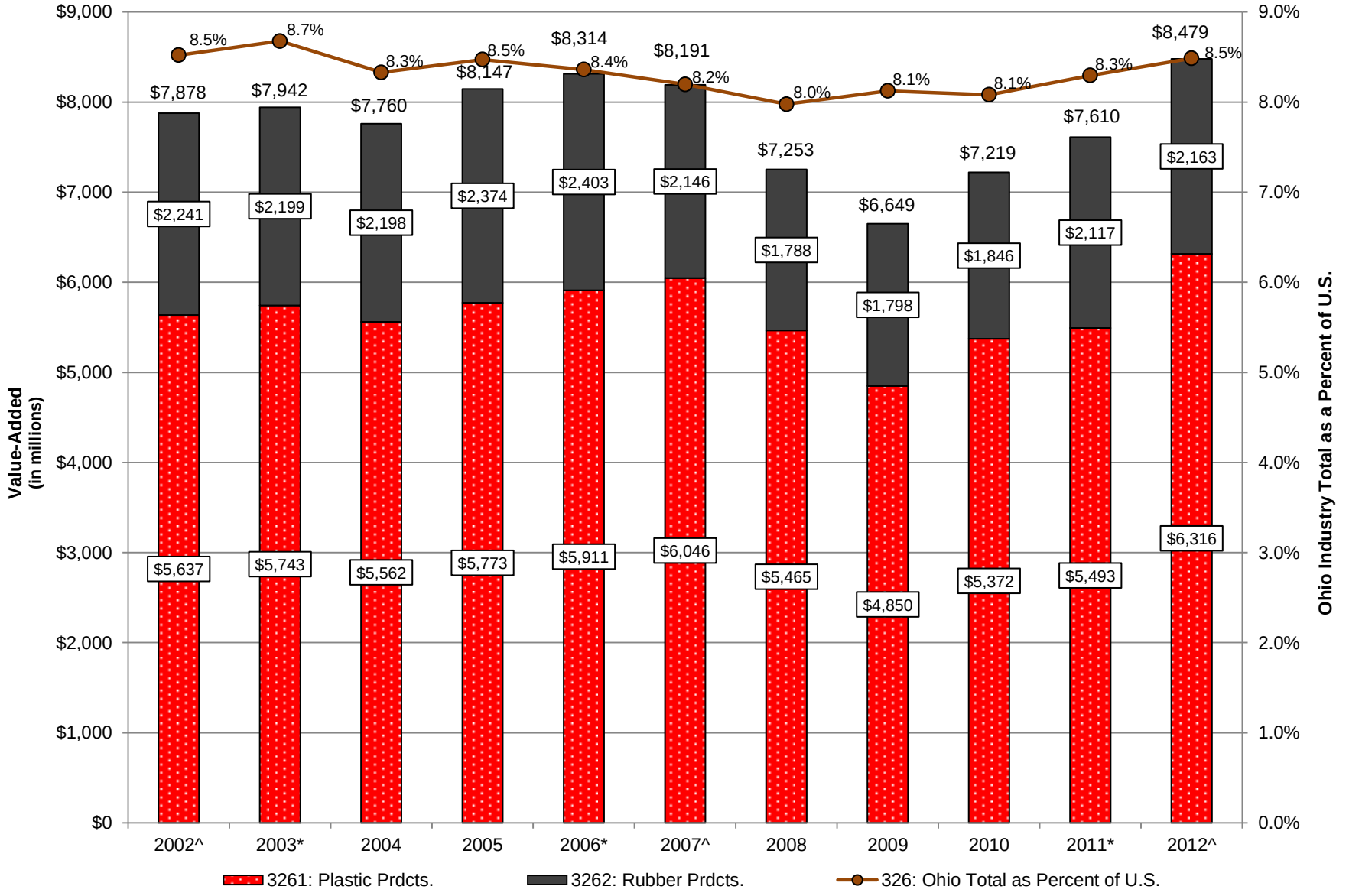
While the greatest absolute increase in exports has been to our NAFTA partners (an inflation-adjusted $665 million), high rates of growth can be found outside of NAFTA. The most notable example is China, with exports rising 1,232.5 percent *after adjusting for inflation*. At $133 million in 2014, China imported more plastic and rubber products from Ohio than any other single country outside of NAFTA. Less dramatically, collective exports to the Remainder of the World (Hong Kong, Macau, Taiwan and 167 other areas) have risen a net 18.5 percent from $262 to $310 million. Collectively, China and the Remainder of the World account for 19.0 percent of industry exports from Ohio – up from 17.4 percent in 2002.

These contrast with the trends in the larger economies of the 28-nation European Union (EU) trade block and Japan. Annual exports to the EU were greater than those to Mexico during the first seven years shown above, indicating its importance as an export market. However, its imports from Ohio show no long-term trend, with little net change between 2002 and 2014 after adjusting for inflation. Exports to Japan, though, have fallen 55.1 percent after adjusting for inflation; they amounted to $39 million in 2014. Collectively, the EU and Japan now account for 11.8 percent of industry exports from Ohio – down from 20.3 percent in 2002.

Finally, the chart above shows the impact of the last recession. Exports to all areas declined, with the total falling 13.4 percent from 2008 to 2009. Growth rebounded 18.3 percent in 2010 and has continued largely uninterrupted.

See Table A10

Value-Added by Ohio's Plastic and Rubber Products Industry
(NAICS 326) by Group, 2002-2012



Source: U.S. Census Bureau

Notes: ^ - Census of Manufactures data; * - Unrevised Annual Survey data

VALUE-ADDED BY GROUP

Value-added (VA) data provide additional insights not available with gross domestic product (GDP) data for plastic and rubber products by focusing on contributions of the two industry groups: plastic products (NAICS 3261) and rubber products (3262). The chart above illustrates how output from the two appears to rise and fall almost in lock-step: the rise to about mid-decade, the fall with the recession and subsequent recovery growth. The far-larger plastics group grew from $5.6 billion in 2002 to $6.0 billion in 2007 before dropping below $4.9 at the trough of the recession in 2009; a nominal decline of 19.8 percent in two years. VA has grown since, surpassing $6.3 billion in 2012, an increase of 30.2 percent. Similarly, VA in rubber products rose from about $2.2 billion in earlier years of the decade to $2.4 in 2006 before falling below $1.8 billion during 2008; a nominal decline of 25.6 percent in two years. Like the plastics group, VA in rubber products has grown and was well over $2.1 billion in 2012, an increase of nearly 21 percent. (These figures have not been adjusted for inflation.)

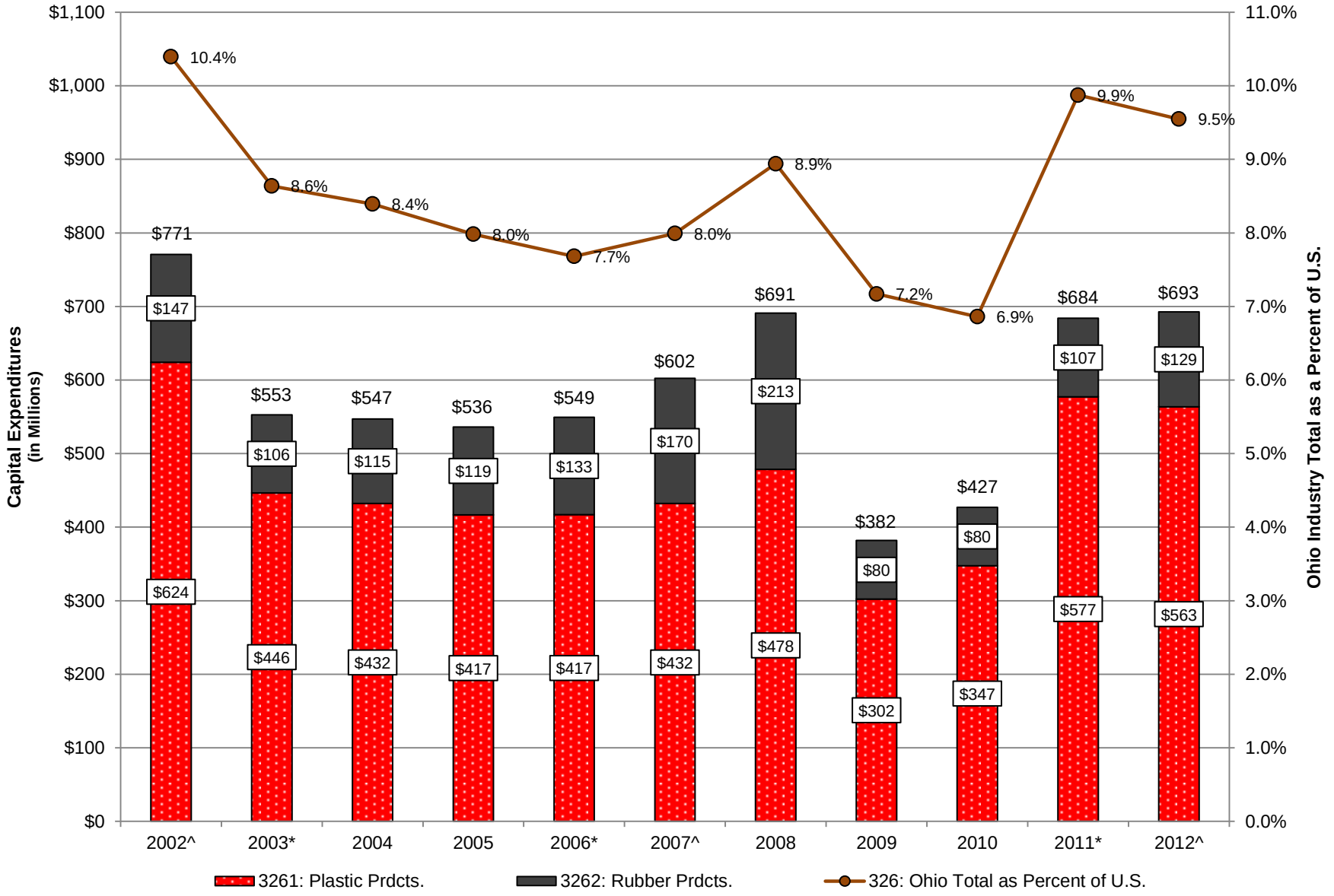
These patterns of apparent growth, recession and recovery in Ohio are very similar to the patterns seen for the nation as a whole. Consequently, the U.S. portion of plastic and rubber products VA in Ohio remained relatively stable; the chart above shows the portions ranging from 8.0 to 8.7 percent.

Figures in Appendix table A11 show the plastics group averaged 72.8 percent of total industry VA, but the portions were slightly above average for most of the 2007-2012 period. While rubber products are the smaller portion of total VA added in Ohio, figures in Appendix table A11 show their manufacture consistently has been the more-concentrated in Ohio. On average, 12.5 percent of the nation's VA in the rubber products group originated in Ohio compared with 7.4 percent of its VA in plastic products. The percentages fluctuated during this time period, with Ohio's portion of rubber products VA ranging between 11 and 12.4 percent during the 2007-2012 period.

Preliminary data from the 2013 Annual Survey of Manufactures show valued-added increases over 2012 in both groups. Once again Ohio ranked first in the nation in both groups with 7.6 and 12.3 percent of U.S. value-added in plastic and rubber products (U.S. Bureau of the Census, 2015a).

See Table A11

Capital Expenditures in Ohio's Plastic and Rubber Products Industry
(NAICS 326) by Group, 2002-2012



Source: U.S. Census Bureau

Notes: ^ - Census of Manufactures data; * - Unrevised Annual Survey data

CAPITAL EXPENDITURES BY GROUP

Capital expenditures (CE) are funds spent for land, buildings and equipment used in manufacturing. The chart above shows that they can vary widely over the years. Annual CE in Ohio by plastics products manufacturers (NAICS 3261) ranged from $302 to $624 million (the latter is 206.6 percent of the former), while those by rubber products manufacturers (3262) ranged from $80 to $213 million (the latter is 266.3 percent of the former). Combined CE ranged from $382 to $771 million. (No adjustments have been made for inflation.) On average, 78.3 percent of industry CE in Ohio were made in the plastics group, although that portion varied between 69.2 to 84.4 percent.

The wide ranges of absolute CE in Ohio convert into wide-ranging portions of industry CE here. Data in Appendix table A12 show those portions ranging from 6.8 to 10.3 percent in the plastic products group and from 5.8 to 14.3 percent in the rubber products group. The respective group averages were 8.1 and 10.5 percent of national totals. The graph above shows the combined portions fluctuating between 6.9 and 10.4 percent around the average of 8.6 percent. This variability seems to indicate that CE are more episodic at the state level because major investments made once in a while.

Comparing the national portions of value-added (VA) and CE in Ohio yields further insights into the industry here. On average 7.4 percent of national plastic products VA came from Ohio, while Ohio received 8.1 percent of the corresponding CE – a ratio of .91::1.00. Such a ratio may be one indicator of companies' continuing intentions to make plastic products in Ohio. This contrasts with corresponding ratio of 1.19::1.00 for the rubber products, suggesting that such companies have been emphasizing production. The summary combining the two groups is .97::1.00.

See Tables A11 & A12

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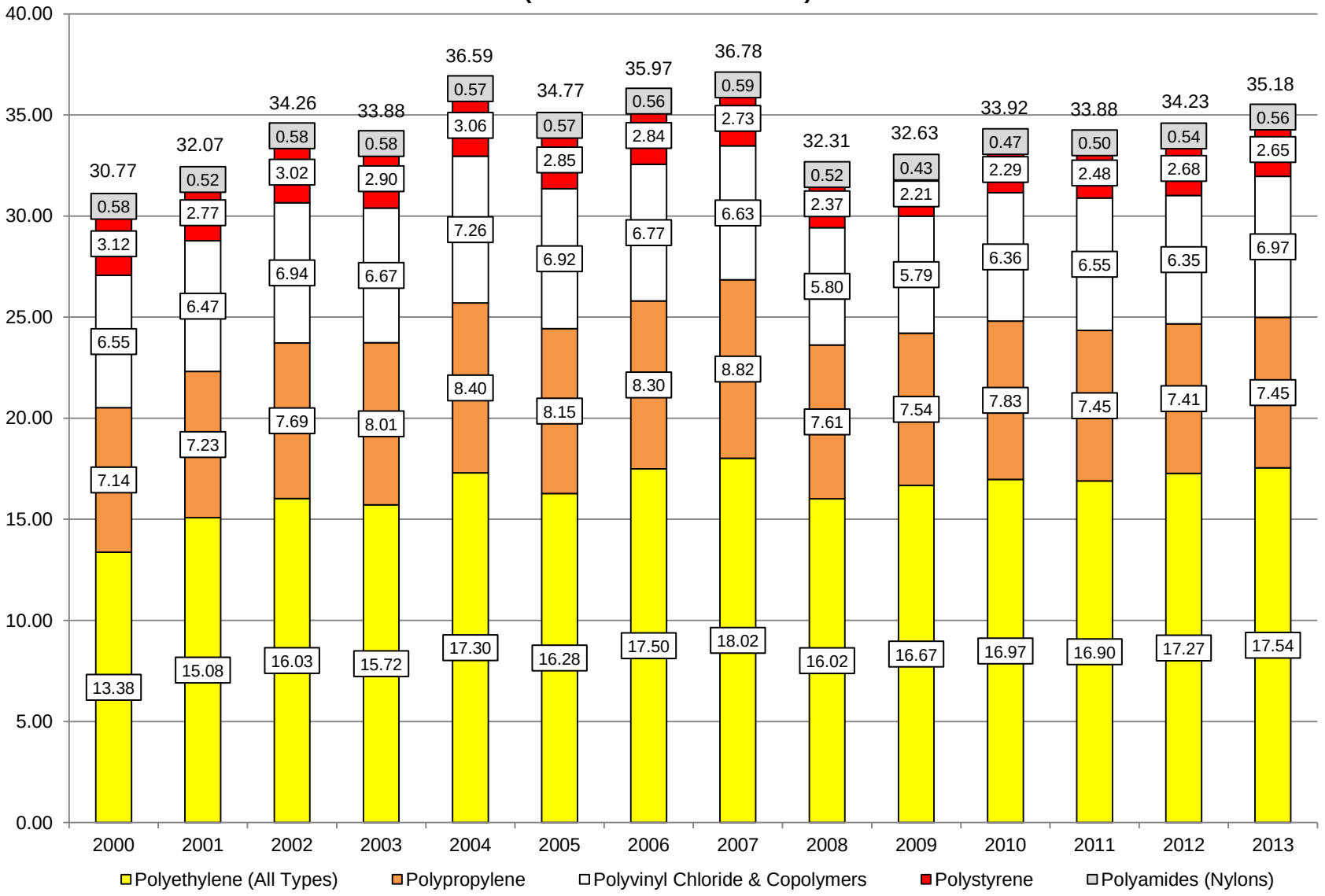
OVERVIEW AND FORECASTS

U.S. Prodution of Major Thermoplastic Resins, 2000-2013
(in millions of metric tons)



Source: Standard & Poors

Note: no polyester data available

AN OVERVIEW OF THE INDUSTRIES

Plastic and synthetic rubber resins (NAICS 32521) share some chemical and production characteristics. (See A Polymers Primer.) However, companies creating and using those resins have had somewhat different experiences over the years due, at least in part, to differences in the markets that they serve.

Output of plastic products (3261) is closely tied to the cycles of national and international economic growth. Consequently, commodity resin production is somewhat cyclical due to the highly cyclical nature of some markets ultimately served – notably motor vehicle production and housing construction. Nevertheless, plastic resins production rose at an average annual rate of five percent from 1991 through 2000 (O'Reilly, 2003). Smaller-volume specialty resins are niche products less subject to cyclical changes (Muir: 2014: 27-28).

The chart above shows the growth rate for *major commodity thermoplastics* cooling only slightly to an average of 4.4 percent per year from 30.77 million metric tons in 2000 to 35.59 million in 2004. (*Thermoplastics*, which comprise at least 90 percent of all plastic resins produced, can be recycled by re-heating; *thermosets* cannot.) Output has fluctuated since due to the 2005 hurricane damage in Gulf Coast areas producing and processing natural gas and oil – which are raw materials and fuel, as well as the recession and the extraordinarily high prices of natural gas and oil in 2008 (Larkin, 2012: 3, 29). This is certainly true of the highest volume resins shown: polyethylene, polypropylene, and polyvinyl chloride; it is less characteristic of polystyrene and the polyamides. (Data for polyesters are not readily available.)

Resins output grew at a faster-than-average pace for many years as plastics replaced metal, glass, wood and paper in myriad products due to superior performance characteristics such as moisture, corrosion, fracture, and, within limits, temperature resistance. Other advantages include a high strength-to-weight ratio, ease of design and fabrication, and parts consolidation. These characteristics have meant reduced costs – either for producers or consumers – of one kind or another: capital requirements, material and energy consumption, longer service life, and greater flexibility in production set-ups (National Bureau of Standards and Battelle Columbus Laboratories, 1983; Office of Technology Assessment, 1988; Shea, 1990; Weizer and Hayes, 1998). High natural gas and oil prices (as well as technical innovations with competing materials) can reduce or eliminate the cost advantage of plastics. Consequently, resin-producing companies try to reduce their exposure to these spot market fluctuations by purchasing materials on long-term contracts (Muir, 2014: 28).

The widely varied uses of plastics mean that no one market is overwhelmingly important for the plastics group (unlike motor vehicles for the rubber products group). The four largest market segments for plastics are packaging (bags, bottles, food containers – 34 percent), consumer and institutional goods (kitchenware, toys, sporting goods, medical products – 20 percent), exports (19 percent), and building and construction materials (structures, pipes, conduits, fittings – 16 percent).

Other notable segments are transportation equipment (four percent), and furniture and furnishings (two percent), electronics (two percent) and adhesives, inks, coatings, etc. (three percent). The steady demand of the packaging, consumer and institutional segments – 54 percent – counters variations in demand from the building and construction, transportation equipment, export and furniture and furnishings segments – 41 percent, making aggregate demand less cyclical (Muir, 2014: 34-35; Larkin, 2012: 7; O'Reilly, 2010: 31).

Uses of commodity resins vary by market segment, with some segments core users for particular resins. For example, the building and construction segment uses about 70 percent of polyvinyl chloride (PVC) and about two-thirds of thermoset production. The consumer and institutional segment uses about one-half of polystyrene (PS) production, while packaging uses more polyethylene (PE) than anything else. On the other hand, polypropylene (PP) usage is not dedicated to any one segment. The converse also is true: market segments use more than one type of resin. For example, the packaging, consumer and institutional segments use PE, PP, and PS, and construction uses PS as well as PVCs and thermosets (Larkin, 2012: 29-30).

These observations may be recast by industries within the plastic products group. The film, sheet, and bag sub-group (32611) is a notable user of PE and PP; the pipe, pipefittings and unsupported profile shapes sub-group (32612) uses PE and PVC; the plastic bottles industry (32616) uses PE, PVC, PS and the polyesters polyethylene terephthalate (PET and PETE); and the fixtures and floor coverings industry (now part of 326199) uses PE, PP, PVC, and PS. See the Industry Definition and Polymers Primer sections in the Appendices for more details and examples.

With a number of resins made to serve diverse markets, it seems that the resin industry is fragmented. Larkin noted that "There are numerous plastics producers, with many focusing on just one or two product lines" (2012: 29). However, Muir (2014: 35-36) lists only three to six companies as significant producers for anyone of the five largest volume resins – PE, PP, PVC, PS, and polyesters. The combination of these two observations appears in the following list, highlighting the names of major manufacturers found more than once.

- PE: Chevron Phillips Chemical (the Chevron-Phillips 66 joint venture), Dow Chemical, ExxonMobil's ExxonMobil Chemical, the INEOS Group, LyondellBasell and Westlake Chemical – a total of six;
- PP: Odebrecht's Braskem SA, ExxonMobil Chemical, Formosa Plastics, the INEOS Group, LyondellBasell and Total SA – a total of six;
- PVC: Formosa Plastics, Axiall's Georgia Gulf, Occidental Petroleum, and Shin-Etsu Chemical's Shintech – a total of four;
- PS: the INEOS-NOVA Chemical joint venture (the latter is a subsidiary of International Petroleum Investment), Bain Capital's Styron, and Total SA – a total of three;

Polyesters: DAK Americas (the Alfa SAB de CV subsidiary), Formosa Plastics' Nan Ya Plastics division, Koch Industries' Invista, the Mossi & Ghisolfi Group, and Wellman – a total of five (also see LexisNexis, 2015).[11]

Overall thermoplastic resin production is not truly oligopolistic, with about 18 different direct producers listed (depending on how Nan Ya is treated). Nevertheless, the dominance of specific product lines by a relatively small number of large, vertically integrated, multinational companies is apparent, and some companies are prominent producers of more than one resin. ExxonMobil Chemical, LyondellBasell and Total each appear twice, and INEOS and Formosa Plastics appear three times. (Recall from the "Notables" and "Foreign Investment" sections that Axiall, INEOS, International Petroleum Investment, LyondellBasell and Shin-Etsu have operations in Ohio, either directly or through their subsidiaries.)

The tendency towards oligopoly in resin production is due in part to production requirements: it is capital- and energy-intensive, the technology is complex, and large plant sizes are necessary for economies of scale in production. Investments in utilities, storage, and distribution also are required, as are sophisticated safety and environmental equipment given the hazardous nature of the raw materials and unwanted byproducts. Long lead times usually are needed when establishing new facilities or upgrading or replacing old ones, and production is subject to extensive governmental regulation.[12] After local authorities have been notified and zoning and environmental approval obtained, there is the time required for design, construction and start-up. (Long lead times make it difficult for companies to make short-term capital spending changes to match significant changes in demand). Furthermore, customer loyalty may deter even established producers considering entering a new field. Customers often are reluctant to change suppliers or raw materials because a new product must be tested, and testing may be expensive (Larkin, 2012: 22-24; Muir, 2014: 29-30). All of these factors comprise a set of high barriers to entry by any would-be competitor.

Producers of specialty resins face the same requirements as commodity producers regarding regulations and long lead times for plant design and construction. They also may be on the forefront of technical sophistication, but their capital requirements are lower due to smaller plant sizes and ultimately lower production volumes. However, specialty companies making a variety of products may have many plants (Muir, 2014: 28-29).

High entry barriers have not made for a lack of competition within the industry. Commodity resin producers have taken a number of steps to reduce costs, grow, and remain competitive as the industry matured. Initial cost reduction efforts in the 1990s focused on closing plants, cutting jobs, improving production processes by refining how materials are handled at every step, and working with customers from order-placement through shipment (O'Reilly, 1997a). More recently, companies have grown by acquiring facilities or product lines of others. Such moves can reduce administrative and manufacturing costs, lead to increased efficiency in procurement [and greater bargaining power], and establish better practices for manufacturing and logistics. The divesting companies sell because they may be unwilling or unable to make investments

needed to remain competitive, want to exit a geographic area, or want to focus on other businesses where opportunities are thought to be greater (Larkin, 2012: 13).[13] "Most transactions have been relatively small, involving individual product lines or plants" (Muir, 2014: 17). It should be noted that any one company may make both divestitures and acquisitions. Other factors driving industry consolidation include increasing capital requirements for technology, quality controls, meeting environmental standards, and the higher research and development costs (O'Reilly, 2010: 26).

Resin production also became a global industry as companies pursued opportunities in rapidly growing emerging markets, often following the companies they supplied. Consolidation facilitated such moves because large, geographically diversified suppliers were better able to meet their customers' global needs. The largest resin companies now have operations in many countries (O'Reilly, 2010: 10-13; Muir, 2014: 30). Establishing operations in foreign countries also circumvented trade barriers (O'Reilly, 1997a). However, globalization led to competition at home as well as abroad, as foreign-based companies invest in America. Under these circumstances, the consolidation via mergers and acquisitions engendered by competition has pushed commodity resin production towards oligopoly. In contrast to resin producers, the manufacture of specific plastic products is diffused among many companies of varying sizes.

Like plastics, "Synthetic rubber has become ubiquitous. People rely on synthetic rubber products for safety in areas ranging from the highway to the doctor's office. As a result of the great resistance to corrosion, poor electrical conductivity, and ability to flex and regain shape, synthetic rubber uses continue to grow as technology advances" (Yoder, 2000: 12.1). Synthetic rubber production now comprises two-thirds of all rubber production, in part due to its advantages over natural rubber in thermal stability and compatibility with petroleum products (Wikipedia, 2015).

Synthetic rubber is a mature industry. Industrial advances from the 1980s onward have involved existing polymers more often than new ones. Like the plastic resins industry, it also is characterized by high entry costs and low profit margins, and is dominated by large firms. The pressure to increase quality and efficiency while reducing costs motivated some mergers and acquisitions (Yoder, 2000). Many resin and synthetic rubber producers have embraced the Internet as a way to improve efficiency in procurement and distribution (Larkin, 2012: 23).

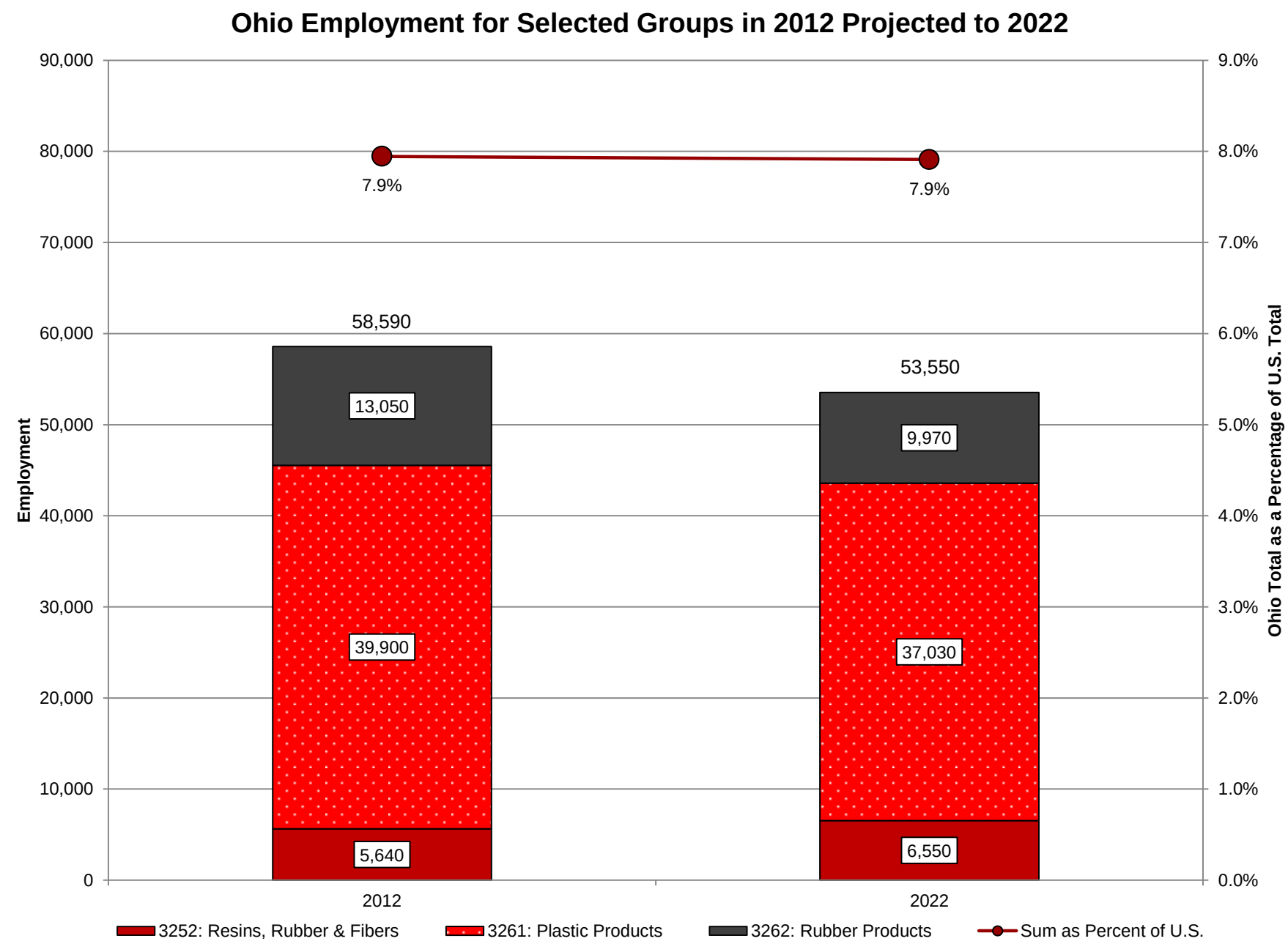
Unlike the plastic side of the industry, the rubber side (NAICS 325212 and most of 3262) is largely dependent on one industry: motor vehicles. Historically, 62 percent of synthetic rubber production was for tires, and another eight was used for automotive mechanical goods (Yoder, 2000) such as belts, bushings, gaskets, hoses, motor mounts, and window and door moldings and seals. Of the remaining 30 percent, eight was incorporated into plastics, six was used for non-automotive mechanical goods, and five for building and construction. All other applications – notably healthcare – accounted for the remaining 11 percent (Yoder, 2000).[14]

Judging by value-added, new tire production (NAICS 326211) was the largest single industry in the rubber group (see the U.S. figures in Appendix table A3). In turn, 83.8 percent of new tire production in 2012 was for use on motor vehicles either as original equipment or as replacements (U.S. Bureau of the Census, 2015c). In 2013, 53.4 million tires were delivered to assemblers for new cars and light trucks (e.g., pick-ups, minivans, sport-utility vehicles), with another 245.6 million shipped as replacements according Modern Tire Dealer, an industry publication cited by Levy (2014: 28). The sum of the two figures represents a 4.4 percent increase in light vehicle tire shipments from 2012. Despite their low profit margins (when compared with per unit replacement sales) and smaller percentage of total sales, sales to assemblers are important for several reasons. Such sales help replacement 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 replacement market alone, and greater economies of scale reduce per-unit operating costs. Original equipment sales also reduce distribution and advertising expenses (Levy, 2014: 28).

Like the plastic resins industry, 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, 2014: 12). (The vertical integration does not extend into distribution and retail sales. Other large companies dominate these businesses.) 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); the most recent example is Goodyear's new tire that can make electricity and adjust air pressure (Akron Beacon Journal, 2015).[15] Also like the plastic resins industry, foreign investment plays a significant role in U.S. tire production; Goodyear and Cooper are the only publicly-held tire companies based in America (Levy, 2014: 12).

Tire manufacturers in N. America have faced the challenges of overcapacity, competition from low cost manufacturers and, until recently, high prices for raw materials (natural and synthetic rubber, carbon black, oil and reinforcements). In response, they moved commodity production to low cost areas and shifted domestic production to premium products. Growing new vehicle sales and demand for replacements bode well for the industry (Levy, 2014).

Manufacturers of belts, hoses, motor mounts, bushings, window and door moldings and seals, and other rubber parts (NAICS 32622, 32629) for the motor vehicle industry closely resemble other parts manufacturers in their market participation and fortunes. Original equipment manufacturers are tied more to the fluctuations of new vehicle sales (Levy, 2014: 28). The non-tire part of the rubber industry is divided between large, diversified conglomerates and many small specialists. Continental, Eaton, Newell-Rubbermaid and Saint-Gobain are examples of the former with operations in Ohio.



Sources: ODJFS-LMI & U.S. BLS

THE NEAR AND LONG TERM FORECASTS

A number of interrelated factors affect the outlook for the production of plastic and rubber products (NAICS 326) and the materials that comprise them (32521 and 325991). These include trends in the costs and availability of raw materials, key end-use markets, foreign competition, and technical advancements – particularly as the last affect the competition of plastic and rubber products with alternative materials – and even between resins.

Near-term growth is expected to continue if: 1) the key end-use markets of packaging, building and construction, consumer and institutional products, exports and transportation equipment – the demand side – continue to expand, and 2) the cost of raw materials and fuel – the supply side – do not significantly increase. There are reasons for optimism on both counts. On the demand side, the more-cyclical housing [along with associated consumer durables such as appliances, carpeting, furniture, etc.] and the motor vehicle industries continue to expand, and the export market is reviving (Muir, 2014: 9-10). The predicted growth in motor vehicle sales and the increasing number of miles driven also mean that tire sales are expected to rise (Levy, 2014: 12). On the supply side, natural gas and oil prices will fluctuate, but are forecast to remain generally favorable, especially as gases become increasingly available with the developing shale sources. However, most of the major expansions of plants producing plastic resins are going into the Gulf Coast area (Muir, 2014: 5-6, 14). Overall, polymers industry growth is expected to match real growth in the gross domestic product (drawn from Larkin, 2012; O'Reilly, 2010).

The lower prices of raw materials – again, particularly natural gas – also favor continued growth in exports of plastic resins and products. It is possible that exports to Asia, the Middle East and Latin America will continue to grow rapidly (as contrasted with Europe) due to the industrialization, improving living standards and higher birth rates in these areas. However, export growth could be restrained if economic growth in China slows, the European recession deepens, and/or feedstock prices rise significantly (Muir, 2014: 14; Larkin, 2012; O'Reilly, 2010: 18-19).

Over the longer term (i.e., from 2012 to 2022), output from most parts of the polymers industry (NAICS 3252 and 326) are predicted to grow at a slower-than-average rate. The U.S. economy is expected to expand at an average annual rate of 2.6 percent compared with forecasts of 2.4 for the resins, synthetic rubber and artificial fibers group (3252) and 2.1 percent for the plastic and rubber products industry (326).[16] Within the latter industry, output from the plastic products group (3261) is predicted to grow at a 1.8 percent annual rate. However, output from the smaller rubber products group is forecast to grow at a 2.9 percent annual rate (U.S. Bureau of Labor Statistics, 2013).

Characterizing the aggregate varies by group. Output from the resins-rubber-fibers group in 2012 was greater than in 2002, and is expected to rise an additional 26.9 percent by 2022. Rubber products output in 2012 was less than 2002,

but output in 2022 may exceed the 2002 level by 18.4 percent, while plastics products output in 2022 might remain 2.2 percent below its 2002 level despite gains from 2012 (U.S. Bureau of Labor Statistics, 2013).

The recovery and expansion to higher output levels generally are not expected to bring more jobs over the longer term despite the modest gains seen during 2010-2014. The preceding chart shows employment in Ohio's plastic products group is expected to decline 7.2 percent from 39,900 in 2012 to 37,030 in 2022; employment in its rubber products group may fall 23.6 percent from 13,050 to 9,970. Employment in resins-rubber-fibers could be the exception, possibly growing 16.1 percent from 5,640 to 6,550. Summary employment for the three groups is predicted to decline 8.6 percent from 58,590 to 53,550. All industry group employment figures at the national level are expected to decline. Despite differences in percentage changes, the percentage of summary employment in Ohio may remain virtually unchanged at 7.9 percent (ODJFS-LMI, 2014; U.S. Bureau of Labor Statistics, 2013).

See Table A13

APPENDICES

DETAILED TABLES

Table A1: Notable Company Operations in Ohio, 2015

Parent, Company and/or Subdivision(s)	NAICS	City	Jobs Total	Jobs at Site~
3M Co.*	326199	Elyria		170
A Schulman, Inc.*			251	
A Schulman, Inc. (HQ)	325211	Fairlawn		77
A Schulman, Inc. (fka Diamond Polymers)	325211	Akron		124
A Schulman, Inc. (fka Graco)	326199	North Canton		50
Axiall Corp.*/Exterior Portfolio LLC (fka Crane)	326199	Columbus		250
Bayer AG*/Bayer MaterialScience LLC	325212	Hebron		150
Berry Plastics Corp.*			695	
Berry[1]	326199	Streetsboro		100
Berry Plastics Filmco, Inc.	326113	Aurora		100
BPRex Healthcare Brookville, Inc.	326199	Perrysburg		135
Venture Packaging, Inc.	326199	Monroeville		360
Bridgestone Corp.*			615	
Bridgestone APM Co.[2]	326291	Upper Sandusky		515
Firestone Polymers LLC[1]	326299	Akron		100
Compagnie de Saint Gobain*[2]			440	
Saint-Gobain Performance Plastics Corp.	326199	Aurora		200
Saint-Gobain Performance Plastics Corp.	326299	Akron		140
Saint-Gobain Performance Plastics Corp.	326199	Ravenna		100
Continental AG*[2]			1,000	
Veyance Technologies, Inc.	32622	St. Marys		430
Veyance Technologies, Inc.	32622	Marysville		400
Veyance Technologies, Inc.	32629	Fairlawn		170
Continental Structural Plastics Holdings Corp.			983	
Continental Structural Plastics, Inc.	326199	North Baltimore		234
Continental Structural Plastics, Inc.[3]	326199	Van Wert		82
Continental Structural Plastics, Inc.	326199	Carey		390
Continental Structural Plastics, Inc.[4]	326199	Conneaut		277
Cooper Tire & Rubber Co.*	326211	Findlay		1,000
Cooper-Standard Holdings, Inc.*/Cooper-Standard Automotive, Inc.	326220	Bowling Green		350
Core Molding, Inc.[5]	326199	Columbus		500
Crown Cork & Seal, Inc.*	326199	Lancaster		90

Table A1: Notable Company Operations in Ohio, 2015

Parent, Company and/or Subdivision(s)	NAICS	City	Jobs Total	Jobs at Site~
Dow Chemical Co.*			655	
Dow Chemical Co.	326113	Hebron		105
Dow Chemical Co.	326150	Ironton		175
Rohm & Haas Co.	325211	West Alexandria		110
Rohm & Haas Co.	325211	Cincinnati		180
Multibase, Inc. (a joint venture with Corning, Inc.*)	325211	Copley		85
EI du Pont de Nemours & Co.*			985	
Du Pont[6]	325211	Circleville		790
Du Pont Electronic Polymers	325211	Dayton		65
Du Pont Performance Elastomers LLC	325212	Stow		130
Eaton plc			1,340	
Cooper Lighting LLC[2]	326199	Aurora		140
Eaton Corp.[7]	326220	Van Wert		1,200
Goodyear Tire & Rubber Co.* (HQ)[8]	326211	Akron		3,000
Illinois Tool Works, Inc.*			372	
Illinois Tool Works, Inc.	326199	Troy		92
Illinois Tool Works, Inc. (aka Evercoat)	325211	Blue Ash		130
Illinois Tool Works, Inc. (aka Tomco)[9]	326199	Bryan		150
International Automotive Components Group SA			1,009	
International Automotive Components Group N. America, Inc.[10]	326199	Huron		736
International Automotive Components Group N. America, Inc.	326199	Fremont		273
Johnson Controls, Inc.*/JCIM LLC[1]	326199	Bryan		250
Mitsubishi Chemical Holdings Corp.*/Mitsubishi Chemical Performance Polymers, Inc.[2]	325211	Bellevue		115
Mitsubishi Corp.*/Cantex, Inc.	326122	Aurora		60
Mitsui*/Mitsui Chemicals, Inc./Advanced Composites, Inc. (a joint venture with Marubeni, Inc.)	326121	Sidney		220
Momentive Performance Materials Holding LLC*/Hexion LLC (HQ)	325211	Columbus		100
Moriroku Holdings Co. Ltd./Greenville Technology, Inc.[2]	326199	Greenville		735
Newell-Rubbermaid, Inc.*/Rubbermaid, Inc.[11]	326199	Mogadore		840
Owens Corning*/Fibreboard Corp. (HQ)	326199	Toledo		200
Parker-Hannifin Corp.*/Parflex[12]	326130	Ravenna		315
Plastipak Holdings, Inc.			825	
Plastipak Packaging, Inc.	326160	Jackson Center		500

Table A1: Notable Company Operations in Ohio, 2015

Parent, Company and/or Subdivision(s)	NAICS	City	Jobs Total	Jobs at Site~
Plastipak Holdings, Inc. (continued)				
Plastipak Packaging, Inc. (aka Constar)	326160	Hebron		125
Plastipak Packaging, Inc.	326160	Medina		200
Ply Gem Holdings, Inc.			610	
Great Lakes Window, Inc.[6]	326199	Walbridge		450
Mastic Home Exteriors, Inc.[13]	326199	Sidney		160
PolyOne Corp.*			1,080	
PolyOne Corp.[14]	325211	Greenville		255
PolyOne Corp. (HQ, and adjacent to Lubrizol)[15]	325991	Avon Lake		650
PolyOne Corp.	325211	North Baltimore		80
PolyOne Designed Structures & Solutions LLC (fka Spartech)[16]	326113	Paulding		95
Silgan Holdings, Inc.*/Silgan Plastics LLC	326160	Ottawa		200
Sonoco Products Co.*/Createc Corp. (aka Protective Solutions)	326199	Findlay		100
Step2 Holdings LLC[17]			650	
Step2 Co. LLC	326199	Streetsboro		n.a.
Step2 Co. LLC	326199	Perrysville		n.a.
Titan International, Inc.*/Titan Tire Corp.	326211	Bryan		400
Tokai Rubber Industries Ltd./DTR Industries, Inc.[2]		Bluffton		650
Toledo Molding & Die, Inc.[18]	32619		1,500	
Toledo Molding & Die, Inc. (HQ and Test Lab)		Toledo		n.a.
Toledo Molding & Die, Inc.		Bowling Green		n.a.
Toledo Molding & Die, Inc.		Delphos		n.a.
Toledo Molding & Die, Inc.		Tiffin		n.a.
Toledo Molding & Die, Inc.		Toledo		n.a.
WI, Inc. (fka WEK industries)		Jefferson		n.a.
Transdigm Group, Inc.*/Schneller LLC	326130	Kent		75
Yamashita Rubber Co. Ltd./YUSA Corp.[2]	326299	Washington CH		540

Notes: aka - also known as; fka - formerly known as; HQ - employment figure is-or-includes headquarters administration; n.a. - not available; ~ - jobs figures from Hoover's (2015) unless otherwise noted; jobs figures are thought to be the best available, but accuracy cannot be guaranteed; * - a Fortune U.S.-1,000 or Global-500 company; 1 - jobs figure from Manta (2015); 2 - jobs figure(s) from Office of Research (2014); 3 - jobs figure from Van Wert City Economic Development (2014); 4 - jobs figure from Growth Partnership for Ash-

Table A1: Notable Company Operations in Ohio, 2015

Parent, Company and/or Subdivision(s)	NAICS	City	Jobs Total	Jobs at Site~

tabula Co. (2014); jobs figure from Gearino (2015); 6 - jobs figure from company website; 7 - jobs figure from Cearns (2013); 8 - jobs figure from Akron City (2015); 9 jobs figure from ELM Analytics (2015); 10 - jobs figure from Erie Co. Development (2012); 11 - jobs figure from Plastics News (2012); 12 - jobs figure from Rubber News (2014); 13 - jobs figure from I-75 Newspaper Group (2012); 14 - jobs figure from Carpe (2013); 15 - jobs figure for adjacent facilities at two addresses from Fogarty (2011); PolyOne has additional plants producing colorants and additives and/or providing engineering services, often nearby; 16 - jobs figure from LexisNexis (2015); 17 - jobs figure from Gaetjens (2015); 18 - jobs figure from Lauzon (2014).

Sources: Akron City (2015), Carpe (2013), Cearns (2013), du Pont (2012), ELM Analytics (2015), Erie Co. Development (2012), Fogarty (2011), Fortune (2014), Gaetjens (2015), Gearino (2015), Great Lakes Window (2015), Growth Partnership for Ashtabula Co. (2014), Hoover's (2015), I-75 Newspaper Group (2012), Lauzon (2014), LexisNexis (2015), Manta (2015), Office of Research (2014), Plastics News (2012), PolyOne (2015), Rubber News(2014), Van Wert City Economic Development (2014).

Prepared by: Office of Research, Ohio Development Services Agency. Telephone 800/848-1300, or 614/466-2116 (DL, 4/15).

Table A2: Expansion and Attraction Announcements in Ohio's Polymers Industry, 2011-2014

Year	Company	Area	NAICS Code	Product	Anticipated New Jobs	Announced Investment
2011	A Schulman Inc	Akron	325991	Resin compounding	20	$7,000,000
2011	All Service Plastic Molding Inc	Vandalia	326199	Plastic products	101	$9,000,000
2011	Armstrong World Industries	Hilliard	326192	Ceiling tiles	15	$10,000,000
2011	Axium Plastics LLC	New Albany	326199	Plastic products	165	$17,200,000
2011	Centrex Plastics LLC	Tiffin	326199	Plastic shelving	60	$8,000,000
2011	CK Technologies LLC	Montpelier	326199	Plastic products	8	$1,300,000
2011	Edgetech I.G. Inc	Cambridge	326199	Window insulation	100	$7,000,000
2011	Evergreen Plastics/Polychem	Clyde	326199	Plastic products	4	$7,700,000
2011	Future PolyTech	Coldwater	326199	Plastic products	15	$1,500,000
2011	GenPak LLC	Hilliard	326199	Food containers	25	$6,700,000
2011	Hadlock Plastics LLC	Geneva	326199	Plastic products	50	$1,000,000
2011	Iten Industries Inc	Ashtabula	32613	Plastic parts		$1,000,000
2011	Kraton Polymers US LLC - conversion project	Belpre	325212	Polymers - polyisoprene		$30,000,000
2011	Kraton Polymers US LLC - energy controls	Belpre	325212	Polymers		$30,000,000
2011	Mar-Bal Inc	Chagrin Falls	326199	Polymer molding		$1,500,000
2011	Momentive Performance Materials Holdings LLC	Columbus	325211	Plastic resins	89	$1,360,000
2011	Nissen Chemitec America Inc	London	326199	Plastic auto parts	25	
2011	Optimum Plastics Inc	Delaware	326199	Plastic auto parts	8	$6,300,000
2011	Polymera Inc	Union Twp	326199	Wood polymer composites	25	$5,500,000
2011	Portage Precision Polymers Inc	Ravenna	326191	Rubber products	15	$1,800,000
2011	Simonton Building Products	Columbus	326199	Vinyl windows	85	$1,100,000
2011	Sonoco Plastics	New Albany	32616	Plastic bottles	100	$17,000,000
2011	Tech ll	Springfield	326199	Plastic food containers		$2,750,000
2011	Trans-Foam Inc	Akron	32615	Foam products	40	$2,500,000
2011	Windsor Mold/Autoplas	Bellevue	326199	Auto plastics	40	$9,700,000
2011 Totals					990	$186,910,000
2012	ABC INOAC Exterior Systems	Fremont	326121	Plastic auto parts	100	$14,000,000
2012	All Service Plastic Molding - phase 2	Vandalia	326199	Plastic products		$1,500,000
2012	Continental Structural Plastics	Conneaut	326199	Plastic products	25	$1,000,000
2012	Crayex Corp	Piqua	32612	Plastic film	20	$3,600,000
2012	Creative Extruded Products Inc	Harrison Twp	326199	Plastic auto parts		
2012	Geo-Tech Polymers LLC	Waverly	325211	Plastics recycling	50	$2,800,000
2012	Graham Packaging	Findlay	326199	Packaging products		$2,500,000
2012	Grand River Rubber Plastics Co	Ashtabula	326199	Gaskets		$1,400,000
2012	Greenville Technology Inc	Greenville	326199	Plastic products	250	$3,500,000
2012	Hadsell Chemical Processing LLC	Waverly	325211	Chemical processing	35	$1,350,000
2012	Hexa Americas Inc	Sidney	325211	Plastic pellets		$1,300,000
2012	Huhtamaki Inc	Batavia Twp	326199	Drinking cups	208	$64,600,000
2012	Johnsonite Inc	Chagrin Falls	326199	Flooring		$15,000,000
2012	McHenry Industries	Austintown Twp	32613	Signs		

Table A2: Expansion and Attraction Announcements in Ohio's Polymers Industry, 2011-2014

Year	Company	Area	NAICS Code	Product	Anticipated New Jobs	Announced Investment
2012	MJS Plastics Inc	Greenville	325211	Plastic resins	5	$1,100,000
2012	Molten Corp	Findlay	326199	Plastic auto parts	60	$1,200,000
2012	New Wave Plastics	Cleveland	325211	Plastic materials		$1,000,000
2012	Newell Rubbermaid	Mogadore	326199	Consumer products	143	$49,100,000
2012	Patrick Products Inc	Leipsic	32616	Plastic bottles	30	$6,200,000
2012	Premix Inc	North Kingsville	326199	Plastic products	20	$1,900,000
2012	Salem Republic Rubber Co	Sebring	32622	Rubber hose	10	$1,600,000
2012	Soft-Lite LLC	Streetsboro	326199	Windows	50	$500,000
2012	Standridge Color Corp	Defiance	32521	Polymer processing	6	$1,300,000
2012	Survitec Group Inc	Sharon Twp	326299	Survival suites		$10,000,000
2012	Technical Rubber Co	Johnstown	326211	Tire repair products	29	$5,000,000
2012	TH Plastics	Findlay	326199	Plastic products	50	$7,000,000
2012	Thogus Products Co	Avon Lake	326199	Plastic products	30	$3,000,000
2012	Trinity Specialty Compounding Inc	West Unity	326199	Polymers	54	$3,800,000
2012 Totals					1,175	$205,250,000
2013	Amcor Rigid Plastics USA Inc	Bellevue	32616	Plastic bottles		$1,800,000
2013	ArmorSource LLC	Hebron	326199	Combat helmets	250	
2013	Bio100 Technologies	Mansfield	326199	Polymers	20	$2,600,000
2013	Blair Rubber Co	Seville	326299	Rubber products	3	$1,500,000
2013	Bridgestone APM Company	Upper Sandusky	326291	Automotive rubber products	25	$3,200,000
2013	Capital Resin Corp	Columbus	325211	Resins		$1,250,000
2013	Centrex Plastics LLC	Findlay	326199	Plastic products	55	$4,500,000
2013	Continental Structural Plastics	Carey	326199	Plastic products	50	$18,300,000
2013	Core Molding Technologies Inc	Columbus	32619	Plastic truck parts	85	$5,000,000
2013	Custom Molded Products/Allen Ltd	Wilmington	326199	Molded plastics	40	$3,850,000
2013	DCI Plastics	Fayette	326199	Plastic products	14	
2013	Durez Corp	Kenton	325211	Phenolic resins		$1,000,000
2013	iMFLUX Inc	Hamilton	326199	Plastic products	221	$50,000,000
2013	JELD-WEN Inc	Mt Vernon	326199	Vinyl windows	135	$150,000
2013	Mitsubishi Chemical Performance Polymers Inc	Bellevue	325211	Plastic resins	25	$14,000,000
2013	Molded Fiber Glass Companies	Ashtabula	325211	Auto composites	50	
2013	Molten North America	Findlay	326199	Injection molding	25	$1,200,000
2013	Myers Industries Inc	Middlefield	326199	Plastic products	65	$6,000,000
2013	Next Generation Films Inc	Lexington	326112	Plastic packaging	100	$15,000,000
2013	Poly Concepts LLC	St Henry	326199	Plastic chairs		$2,500,000
2013	PolyOne Corporation	Greenville	326113	Plastic film and sheet	130	$12,000,000
2013	Rage Corporation	Hilliard	326199	Plastic products	110	$4,300,000
2013	Ridge Corp	Etna Twp	326199	Truck wall liners	40	$5,000,000
2013	Southeastern Container Inc	Bowling Green	32616	Plastic bottles	10	$1,200,000
2013	Special Design Products	Columbus	32615	Foam packaging		

Table A2: Expansion and Attraction Announcements in Ohio's Polymers Industry, 2011-2014

Year	Company	Area	NAICS Code	Product	Anticipated New Jobs	Announced Investment
2013	SpringSeal Inc	Ravenna	326199	Plastic products	11	$2,000,000
2013	TH Plastics Inc	Bowling Green	326199	Plastic products	82	$5,000,000
2013	Timbertech Limited	Wilmington	326199	Plastic decking	85	$12,000,000
2013 Totals					1,631	$173,350,000
2014	Alpha Inc	Lima	3261	Plastic bottles	30	$16,000,000
2014	Cast Nylons Co. Ltd.	Willoughby	3252	Plastic resins	20	$2,000,000
2014	Continental Structural Plastics, Inc	North Baltimore	3261	Plastic products for trucks	56	$2,900,000
2014	Creative Foam Corporation	Dayton	3261	Foam products	80	$1,150,000
2014	Custom Poly Bag Inc	Marlboro Twp	3261	Plastic bags		$4,400,000
2014	Dayton Molded Urethanes LLC	Dayton	3261	Auto products	80	$1,500,000
2014	Deceuninck North America, LLC	Monroe	3261	Vinyl windows	80	$10,000,000
2014	Deimling/Jeliho Plastics Inc	Amelia	3261	Molded plastic products		
2014	Eaton Corporation	Aurora	3261	Plastic hoses	43	$1,700,000
2014	Future Molding/Hedstrom	Ashland	3261	Plastic products	20	
2014	Hedstrom Plastics	Ashland	3261	Plastic balls	30	
2014	Key Resin Company	Batavia	325991	Chemicals	23	$2,600,000
2014	KLW Plastics, Inc	Monroe	3261	Plastic products		$3,000,000
2014	Liqui-Box Corporation	Ashland	3261	Juice boxes	24	
2014	Lubrizol Advanced Materials Inc	Brecksville	3252	Plastic materials	73	
2014	Octal Extrusions	West Chester Twp	3261	Plastic sheet	52	$20,000,000
2014	Rowmark LLC	Findlay	3261	Plastic products	20	$11,000,000
2014	Storopack, Inc	West Chester Twp	3261	Plastic packaging		
2014	Tarkett USA/Johnsonite	Solon	3261	Flooring	35	$6,800,000
2014	Toledo Molding & Die	Bowling Green	3261	Auto parts	28	$8,000,000
2014	Universal Polymer & Rubber Ltd	Middlefield	3262	Molded rubber products	11	
2014	Venture Packaging Midwest, Inc	Monroeville	3261	Plastic products	45	
2014	Wilbert Plastic Services	Bellevue	3261	Auto plastic parts	70	$6,600,000
2014 Totals					820	$97,650,000
Grand Totals					4,616	$663,160,000

Source: Office of Research, ODSA (2015).

Prepared by: Office of Research, Ohio Development Services Agency. Telephone 800/848-1300, or 614/466-2116 (DL, 3/15).

Table A3: Distribution and Concentration of the Polymers Industry in Ohio, 2012

NAICS Codes	Industry Title[1]	From Ohio: Amount (millions)	From Ohio: Distribution in Ohio	U.S. Totals (millions)	Ohio as a Percent of the U.S.	Ohio's Rank in the U.S.
GDP:[2]	Total	$548,526	100.0%	$16,141,152	3.4%	7th
326	Plastic & Rubber Products	$5,492	1.0%	$68,895	8.0%	1st
Value-Added:	Polymer Industries Total	$10,290	100.0%	$133,473	7.7%	2nd
32521+325991	Resins & Rubber Production & Compounding	$1,811	17.6%	$33,554	5.4%	4th
32521	Resins & Synthetic Rubber	$1,557	15.1%	$29,996	5.2%	4th
325211	Plastic Materials & Resins	$1,449	14.1%	$27,497	5.3%	3rd
325212	Synthetic Rubber	$108	1.1%	$2,499	4.3%	3rd
325991	Custom Compounding of Purchased Resins	$254	2.5%	$3,557	7.1%	3rd
326	Plastic & Rubber Products[3]	$8,479	82.4%	$99,920	8.5%	1st
3261	Plastic Products	$6,316	61.4%	$82,043	7.7%	1st
32611	Uns. Plastic Films, Sheets & Bags	$997	9.7%	$16,643	6.0%	4th
326111	Uns. Plastic Bags	$138	1.3%	$3,914	3.5%	6th
326112	Uns. Plastic Packaging Film & Sheet	$283	2.8%	$5,018	5.6%	3rd
326113	Uns. Plastic Film & Sheet (Exc. Packaging)	$576	5.6%	$7,711	7.5%	2nd
32612	Plastic Pipe, Pipe Fitting & Uns. Profile Shapes	$367	3.6%	$7,476	4.9%	4th
326121	Uns. Plastic Profile Shapes	$175	1.7%	$3,577	4.9%	3rd
326122	Plastic Pipes & Pipe Fittings	$193	1.9%	$3,899	4.9%	5th
32613	Laminated Plastic Plate, Sheet & Shapes	$196	1.9%	$1,795	10.9%	2nd
32614	Polystyrene Foam Products	$119	1.2%	$3,890	3.1%	9th
32615	Urethane & Foam Products (Exc. Polystyrene)	$224	2.2%	$3,933	5.7%	6th
32616	Plastic Bottles	$544	5.3%	$4,864	11.2%	1st
32619	Other Plastic Products	$3,868	37.6%	$43,441	8.9%	1st
326191	Plastic Plumbing Fixtures	$37	0.4%	$1,705	2.2%	9th
326199	All Other Plastic Products	$3,831	37.2%	$41,737	9.2%	1st

Table A3: Distribution and Concentration of the Polymers Industry in Ohio, 2012

NAICS Codes	Industry Title[1]	From Ohio: Amount (millions)	From Ohio: Distribution in Ohio	U.S. Totals (millions)	Ohio as a Percent of the U.S.	Ohio's Rank in the U.S.
3262	Rubber Products	$2,163	21.0%	$17,876	12.1%	2nd
32621	Tires	$579	5.6%	$7,748	7.5%	3rd
326211	Tires (Exc. Retreading)	$552	5.4%	$7,265	7.6%	2nd
326212	Tire Retreading	$27	0.3%	$484	5.6%	1st
32622	Rubber & Plastic Hoses & Belts	$295	2.9%	$2,309	12.8%	1st
32629	Other Rubber Products	$1,289	12.5%	$7,819	16.5%	1st
326291	Rubber Products for Mechanical Use	$803	7.8%	$3,438	23.4%	1st
326299	All Other Rubber Products	$486	4.7%	$4,381	11.1%	2nd

Notes: 1 - Abbreviations: Exc. - Except; GDP - Gross Domestic Product; Uns. - Unsupported. 2 - State GDP is analogous to national GDP, but not identical with it due to minor techical differences. 3 - The Value-Added figure for Plastic & Rubber Products is greater than the GDP figure because the former includes costs not included in the latter; the GDP figure is subject to revision.

Sources: U.S. Bureau of the Census (2015c); U.S. Bureau of Economic Analysis (2014).

Prepared by: Office of Research, Ohio Development Services Agency. Telephone 800/848-1300 or 614/466-2116 (DL, 3/15).

Table A4: Establishments and Employment in Polymers Industries, Ohio and U.S., 2013

NAICS Codes	Short Title	Ohio			U.S.			Ohio as a Percent of the U.S.	
		Establishments	Employment*	Mean per Establishment	Establishments	Employment*	Mean per Establishment	Establishments	Employment
	Total Covered Employment	250,117	4,587,136	18.3	7,488,353	118,266,253	15.8	3.3%	3.9%
	Polymers Industry	1,038	68,692	66.2	14,187	803,332	56.6	7.3%	8.6%
32521+325991	Resin & Rubber Production & Compounding	131	7,200	55.0	1,719	95,968	55.8	7.6%	7.5%
32521	Resin & Synthetic Rubber	96	5,609	58.4	1,283	78,166	60.9	7.5%	7.2%
325211	Plastic Materials & Resins	81	4,870	60.1	1,131	69,660	61.6	7.2%	7.0%
325212	Synthetic Rubber	15	739	49.3	152	8,506	56.0	9.9%	8.7%
325991	Custom Compounding of Purchased Resins	35	1,591	45.5	436	17,802	40.8	8.0%	8.9%
326	Plastic & Rubber Products	907	61,492	67.8	12,468	707,364	56.7	7.3%	8.7%
3261	Plastic Products	704	46,607	66.2	10,583	579,593	54.8	6.7%	8.0%
32611	Uns. Plastic Films, Sheets & Bags	87	4,797	55.1	1,329	95,864	72.1	6.5%	5.0%
326111	Uns. Plastic Bags	18	852	47.3	342	26,637	77.9	5.3%	3.2%
326112	Uns. Plastic Packaging Film & Sheet	26	1,650	63.5	407	31,049	76.3	6.4%	5.3%
326113	Uns. Plastic Film & Sheet (Exc. Packaging)	43	2,295	53.4	580	38,178	65.8	7.4%	6.0%
32612	Plastic Pipe, Pipe Fitting & Uns. Profile Shapes	61	2,590	42.5	881	39,678	45.0	6.9%	6.5%
326121	Uns. Plastic Profile Shapes	33	1,470	44.5	401	18,347	45.8	8.2%	8.0%
326122	Plastic Pipes & Pipe Fittings	28	1,120	40.0	480	21,331	44.4	5.8%	5.3%
32613	Laminated Plastic Plate, Sheet & Shapes	26	1,429	55.0	225	10,343	46.0	11.6%	13.8%
32614	Polystyrene Foam Products	23	615	26.7	478	24,151	50.5	4.8%	2.5%
32615	Urethane & Foam Products (Exc. Polystyrene)	34	1,665	49.0	631	28,437	45.1	5.4%	5.9%
32616	Plastic Bottles	29	3,098	106.8	456	31,899	70.0	6.4%	9.7%
32619	Other Plastic Products	444	32,413	73.0	6,583	349,221	53.0	6.7%	9.3%
326191	Plastic Plumbing Fixtures	18	308	17.1	400	15,241	38.1	4.5%	2.0%
326199	All Other Plastic Products	426	32,105	75.4	6,183	333,980	54.0	6.9%	9.6%
3262	Rubber Products	203	14,885	73.3	1,885	127,771	67.8	10.8%	11.6%
32621	Tires	29	3,281	113.1	500	49,078	98.2	5.8%	6.7%
326211	Tires (Exc. Retreading)	9	2,914	323.8	108	42,804	396.3	8.3%	6.8%
326212	Tire Retreading	20	367	18.4	392	6,274	16.0	5.1%	5.8%
32622	Rubber & Plastic Hoses & Belts	19	1,406	74.0	254	18,140	71.4	7.5%	7.8%
32629	Other Rubber Products	155	10,198	65.8	1,131	60,553	53.5	13.7%	16.8%
326291	Rubber Products for Mechanical Use	81	6,499	80.2	449	28,718	64.0	18.0%	22.6%
326299	All Other Rubber Products	74	3,699	50.0	682	31,835	46.7	10.9%	11.6%

Notes: * - Employment figures may not be exact due to confidentiality requirements; Exc. - excluding; Uns. - unsupported.

Source: U.S. Bureau of the Census (2015b).

Prepared by: Office of Research, Ohio Development Services Agency. Telephone 800/848-1300, or 614/466-2116 (DL, 5/15).

Table A5: Employment and Pay in Polymers Industries, Ohio and U.S., 2013

NAICS Codes	Short Title	Ohio Employ-ment*	Ohio Annual Payroll (000)	Ohio Mean Pay per Worker	U.S. Employ-ment*	U.S. Annual Payroll (000)	U.S. Mean Pay per Worker	Ohio Means as Percentages of U.S. Means
	Total Covered Employment	4,587,136	$195,630,962	$42,648	118,266,253	$5,621,697,325	$47,534	89.7%
	Polymers Industry	68,692	$3,183,945	$46,351	803,332	$38,600,596	$48,051	96.5%
32521+325991	Resin & Rubber Production & Compounding	7,200	$432,720	$60,100	95,968	$6,638,844	$69,178	86.9%
32521	Resin & Synthetic Rubber	5,609	$341,720	$60,924	78,166	$5,640,929	$72,166	84.4%
325211	Plastic Materials & Resins	4,870	$297,105	$61,007	69,660	$5,046,663	$72,447	84.2%
325212	Synthetic Rubber	739	$44,615	$60,372	8,506	$594,266	$69,864	86.4%
325991	Custom Compounding of Purchased Resins	1,591	$91,000	$57,197	17,802	$997,915	$56,056	102.0%
326	Plastic & Rubber Products	61,492	$2,751,225	$44,741	707,364	$31,961,752	$45,184	99.0%
3261	Plastic Products	46,607	$2,030,645	$43,570	579,593	$25,697,767	$44,338	98.3%
32611	Uns. Plastic Films, Sheets & Bags	4,797	$266,415	$55,538	95,864	$5,071,123	$52,899	105.0%
326111	Uns. Plastic Bags	852	$38,429	$45,104	26,637	$1,181,558	$44,358	101.7%
326112	Uns. Plastic Packaging Film & Sheet	1,650	$79,314	$48,069	31,049	$1,700,893	$54,781	87.7%
326113	Uns. Plastic Film & Sheet (Exc. Packaging)	2,295	$148,672	$64,781	38,178	$2,188,672	$57,328	113.0%
32612	Plastic Pipe, Pipe Fitting & Uns. Profile Shapes	2,590	$118,456	$45,736	39,678	$1,848,804	$46,595	98.2%
326121	Uns. Plastic Profile Shapes	1,470	$67,833	$46,145	18,347	$905,860	$49,374	93.5%
326122	Plastic Pipes & Pipe Fittings	1,120	$50,623	$45,199	21,331	$942,994	$44,208	102.2%
32613	Laminated Plastic Plate, Sheet & Shapes	1,429	$84,220	$58,936	10,343	$511,388	$49,443	119.2%
32614	Polystyrene Foam Products	615	$30,802	$50,085	24,151	$1,012,760	$41,934	119.4%
32615	Urethane & Foam Products (Exc. Polystyrene)	1,665	$65,279	$39,207	28,437	$1,227,550	$43,167	90.8%
32616	Plastic Bottles	3,098	$148,355	$47,887	31,899	$1,407,398	$44,120	108.5%
32619	Other Plastic Products	32,413	$1,317,118	$40,635	349,221	$14,618,744	$41,861	97.1%
326191	Plastic Plumbing Fixtures	308	$11,209	$36,393	15,241	$576,930	$37,854	96.1%
326199	All Other Plastic Products	32,105	$1,305,909	$40,676	333,980	$14,041,814	$42,044	96.7%
3262	Rubber Products	14,885	$720,580	$48,410	127,771	$6,263,985	$49,025	98.7%
32621	Tires	3,281	$194,100	$59,159	49,078	$2,705,655	$55,130	107.3%
326211	Tires (Exc. Retreading)	2,914	$180,885	$62,074	42,804	$2,467,314	$57,642	107.7%
326212	Tire Retreading	367	$13,215	$36,008	6,274	$238,341	$37,989	94.8%
32622	Rubber & Plastic Hoses & Belts	1,406	$80,696	$57,394	18,140	$857,947	$47,296	121.4%
32629	Other Rubber Products	10,198	$445,784	$43,713	60,553	$2,700,383	$44,595	98.0%
326291	Rubber Products for Mechanical Use	6,499	$281,130	$43,257	28,718	$1,229,977	$42,829	101.0%
326299	All Other Rubber Products	3,699	$164,654	$44,513	31,835	$1,470,406	$46,188	96.4%

Notes: * - Employment figures may not be exact due to confidentiality requirements; Exc. - excluding; Uns. - unsupported.

Source: U.S. Bureau of the Census (2015b).

Prepared by: Office of Research, Ohio Development Services Agency. Telephone 800/848-1300, or 614/466-2116 (DL, 5/15).

Table A6: Establishments and Employment in Ohio's Polymers Industry, by County, 2013

Area Name	Establishments	Employment*	Area Name	Establishments	Employment*	Area Name	Establishments	Employment*
Ohio	1,038	68,692	Greene	5	190	Morrow	3	122
			Guernsey	11	535	Muskingum	3	140
Adams	2	23	Hamilton	32	1,482	Noble	1	66
Allen	9	907	Hancock	16	3,339	Ottawa	2	158
Ashland	7	624	Hardin	3	102	Paulding	6	331
Ashtabula	28	2,167	Harrison	0	0	Perry	0	0
Athens	1	3	Henry	5	354	Pickaway	4	954
Auglaize	8	716	Highland	2	145	Pike	0	0
Belmont	0	0	Hocking	1	28	Portage	56	3,276
Brown	0	0	Holmes	17	1,165	Preble	2	36
Butler	29	1,657	Huron	16	1,014	Putnam	4	315
Carroll	5	369	Jackson	3	152	Richland	8	708
Champaign	2	362	Jefferson	0	0	Ross	0	0
Clark	6	96	Knox	4	509	Sandusky	17	2,336
Clermont	12	472	Lake	32	1,539	Scioto	2	200
Clinton	1	143	Lawrence	1	28	Seneca	4	735
Columbiana	5	855	Licking	14	799	Shelby	9	1,179
Coshocton	0	0	Logan	4	278	Stark	33	1,518
Crawford	5	73	Lorain	29	1,343	Summit	109	5,713
Cuyahoga	71	2,163	Lucas	22	663	Trumbull	11	464
Darke	9	1,635	Madison	3	428	Tuscarawas	27	1,504
Defiance	1	15	Mahoning	21	634	Union	8	386
Delaware	6	174	Marion	2	336	Van Wert	4	456
Erie	8	1,093	Medina	25	1,667	Vinton	0	0
Fairfield	4	443	Meigs	0	0	Warren	11	463
Fayette	4	443	Mercer	6	212	Washington	5	890
Franklin	62	2,808	Miami	25	1,298	Wayne	14	557
Fulton	5	67	Monroe	0	0	Williams	18	2,167
Gallia	0	0	Montgomery	31	1,580	Wood	22	2,489
Geauga	30	2,638	Morgan	0	0	Wyandot	5	1,560

Note: * - All county employment figures should be considered estimates. The fact that the sum of county employment figures - 68,488 - is 99.7 percent of the state total - 68,692 - means that the county estimates tend to be very slightly low.

Source: U.S. Bureau of the Census (2015b).

Prepared by: Office of Research, Ohio Development Services Agency. Telephone 800/848-1300, or 614/466-2116 (DL, 5/15).

Table A7: Ohio and U.S. Polymers Industry Employment Trends, 2003-2013^

NAICS Code	Shorter Industry Title	2003	2004	2005	2006	2007	2008*	2009	2010	2011	2012	2013	Changes: 2003-2013 Number	Changes: 2003-2013 Percent
Ohio:	Polymer Industry Total	94,972	90,666	88,539	86,394	81,144	81,353	65,626	62,579	64,126	65,643	68,692	-26,280	-27.7%
32521+991	Resin & Rubber Production & Compounding	7,418	7,427	7,452	6,490	6,627	8,389	7,011	6,538	6,093	6,995	7,200	-218	-2.9%
325211	Plastic Materials & Resins	3,995	4,063	4,498	3,507	3,676	5,310	4,526	4,263	4,127	5,044	4,870	875	21.9%
325212	Synthetic Rubber	666	666	572	580	494	649	724	633	697	772	739	73	10.9%
325991	Custom Compounding of Purchased Resins	2,757	2,697	2,382	2,403	2,457	2,430	1,761	1,642	1,269	1,179	1,591	-1,166	-42.3%
326	Plastic & Rubber Products	87,554	83,239	81,087	79,904	74,517	72,964	58,615	56,041	58,033	58,648	61,492	-26,062	-29.8%
3261	Plastic Products	62,912	61,093	60,109	58,792	56,310	54,459	44,096	43,290	44,370	44,632	46,607	-16,305	-25.9%
32611	Uns. Plastic Films, Sheets, & Bags	5,378	5,262	5,022	4,910	4,937	5,068	4,620	5,005	4,835	4,917	4,797	-581	-10.8%
32612	Plastic Pipe, Pipe Fitting, & Uns. Profile Shapes	3,518	3,822	4,135	4,198	3,835	3,204	2,661	2,277	2,596	2,446	2,590	-928	-26.4%
32613	Laminated Plastic Plate, Sheet, & Shapes	1,043	866	807	886	1,011	1,239	1,076	984	1,067	1,428	1,429	386	37.0%
32614	Polystyrene Foam Products	1,106	1,083	995	1,070	1,073	1,154	983	723	708	548	615	-491	-44.4%
32615	Urethane & Foam Products (Exc. Polystyrene)	2,527	2,370	2,485	2,402	2,231	1,708	1,533	1,472	1,543	1,746	1,665	-862	-34.1%
32616	Plastic Bottles	4,291	3,930	3,888	3,899	3,886	3,635	3,598	3,453	3,050	3,180	3,098	-1,193	-27.8%
32619	Other Plastic Products	45,049	43,760	42,777	41,427	39,337	38,451	29,625	29,376	30,571	30,367	32,413	-12,636	-28.0%
3262	Rubber Products	24,642	22,146	20,978	21,112	18,207	18,500	14,519	12,751	13,663	14,016	14,885	-9,757	-39.6%
32621	Tires	3,718	3,179	3,261	3,138	3,335	3,452	3,268	2,715	2,895	3,048	3,281	-437	-11.8%
32622	Rubber & Plastic Hoses & Belts	2,373	2,488	2,355	2,376	2,066	1,802	1,521	1,285	1,522	1,424	1,406	-967	-40.8%
32629	Other Rubber Products	18,551	16,479	15,362	15,598	12,806	13,251	9,730	8,751	9,246	9,544	10,198	-8,353	-45.0%
U.S.:	Polymer Industry Total	1,020,132	1,000,078	995,995	991,856	947,079	925,058	783,812	755,532	773,230	791,729	803,332	-216,800	-21.3%
32521+991	Resin & Rubber Production & Compounding	98,740	91,978	93,886	91,014	91,596	102,932	90,331	87,917	89,193	93,931	95,968	-2,772	-2.8%
325211	Plastic Materials & Resins	65,514	61,135	63,993	60,912	61,199	72,878	64,017	62,035	62,629	69,352	69,660	4,146	6.3%
325212	Synthetic Rubber	10,532	9,036	8,760	8,549	8,455	9,638	8,841	8,573	9,329	8,316	8,506	-2,026	-19.2%
325991	Custom Compounding of Purchased Resins	22,694	21,807	21,133	21,553	21,942	20,416	17,473	17,309	17,235	16,263	17,802	-4,892	-21.6%
326	Plastic & Rubber Products	921,392	908,100	902,109	900,842	855,483	822,126	693,481	667,615	684,037	697,798	707,364	-214,028	-23.2%
3261	Plastic Products	746,211	739,197	739,862	740,254	707,972	675,817	566,862	549,026	559,991	572,165	579,593	-166,618	-22.3%
32611	Uns. Plastic Films, Sheets, & Bags	105,208	102,710	100,952	101,725	97,545	98,090	91,423	91,259	91,380	96,046	95,864	-9,344	-8.9%
32612	Plastic Pipe, Pipe Fitting, & Uns. Profile Shapes	49,263	50,219	51,198	50,957	49,680	44,420	38,983	36,363	37,578	39,212	39,678	-9,585	-19.5%
32613	Laminated Plastic Plate, Sheet, & Shapes	10,764	11,515	10,622	11,063	10,718	12,853	10,770	10,374	10,682	10,555	10,343	-421	-3.9%
32614	Polystyrene Foam Products	31,631	31,646	30,711	32,756	32,229	28,026	25,330	25,047	24,947	23,492	24,151	-7,480	-23.6%
32615	Urethane & Foam Products (Exc. Polystyrene)	31,834	33,682	36,609	36,765	34,825	33,283	26,985	25,977	27,086	28,814	28,437	-3,397	-10.7%
32616	Plastic Bottles	33,901	33,281	32,507	32,773	32,863	36,028	33,746	32,717	31,054	32,347	31,899	-2,002	-5.9%
32619	Other Plastic Products	483,610	476,144	477,263	474,215	450,112	423,117	339,625	327,289	337,264	341,699	349,221	-134,389	-27.8%
3262	Rubber Products	175,181	168,903	162,247	160,588	147,511	146,309	126,619	118,589	124,046	125,633	127,771	-47,410	-27.1%
32621	Tires	66,587	64,007	62,621	62,478	57,964	58,207	53,415	48,148	50,044	50,480	49,078	-17,509	-26.3%
32622	Rubber & Plastic Hoses & Belts	22,101	22,148	21,713	21,307	19,781	19,898	16,578	15,606	16,433	17,494	18,140	-3,961	-17.9%
32629	Other Rubber Products	86,493	82,748	77,913	76,803	69,766	68,204	56,626	54,835	57,569	57,659	60,553	-25,940	-30.0%

Notes: ^ - Employment figures may not be exact due to confidentiality requirements; * - Implementation of the 2007 N. American Industry Classification System (NAICS) added establishments and employees to industry 325211; consequently, earlier figures are not entirely comparable with this and later figures; Exc. - Except; Uns. - Unsupported.

Source: U.S. Bureau of the Census (2005b-2015b).

Prepared by: Office of Research, Ohio Development Services Agency. Telephone 800/848-1300, or 614/466-2116 (DL, 5/15).

Table A8: Ohio and U.S. Polymers Industry Establishment Trends, 2003-2013

NAICS Code	Shorter Industry Title	2003	2004	2005	2006	2007	2008*	2009	2010	2011	2012	2013	Changes: 2003-2013 Number	Percent
Ohio:	Polymer Industry Total	1,262	1,254	1,222	1,201	1,150	1,147	1,120	1,068	1,052	1,047	1,038	-224	-17.7%
32521+991	Resin & Rubber Production & Compounding	121	130	135	127	122	135	133	129	128	132	131	10	8.3%
325211	Plastic Materials & Resins	58	66	73	65	63	84	79	76	78	86	81	23	39.7%
325212	Synthetic Rubber	9	9	11	9	6	6	9	10	12	13	15	6	66.7%
325991	Custom Compounding of Purchased Resins	54	55	51	53	53	45	45	43	38	33	35	-19	-35.2%
326	Plastic & Rubber Products	1,141	1,124	1,087	1,074	1,028	1,012	987	939	924	915	907	-234	-20.5%
3261	Plastic Products	876	861	832	821	792	780	759	730	717	716	704	-172	-19.6%
32611	Uns. Plastic Films, Sheets, & Bags	94	88	84	89	82	81	81	83	86	89	87	-7	-7.4%
32612	Plastic Pipe, Pipe Fitting, & Uns. Profile Shapes	78	84	83	80	77	73	63	64	61	63	61	-17	-21.8%
32613	Laminated Plastic Plate, Sheet, & Shapes	25	27	25	23	24	21	23	23	22	27	26	1	4.0%
32614	Polystyrene Foam Products	34	30	24	25	24	27	27	25	24	22	23	-11	-32.4%
32615	Urethane & Foam Products (Exc. Polystyrene)	40	37	36	37	38	40	41	36	37	37	34	-6	-15.0%
32616	Plastic Bottles	27	25	24	23	23	27	28	27	24	28	29	2	7.4%
32619	Other Plastic Products	578	570	556	544	524	511	496	472	463	450	444	-134	-23.2%
3262	Rubber Products	265	263	255	253	236	232	228	209	207	199	203	-62	-23.4%
32621	Tires	42	40	37	38	39	38	36	30	25	28	29	-13	-31.0%
32622	Rubber & Plastic Hoses & Belts	26	27	26	24	21	22	23	22	23	19	19	-7	-26.9%
32629	Other Rubber Products	197	196	192	191	176	172	169	157	159	152	155	-42	-21.3%
U.S.:	Polymer Industry Total	16,621	16,484	16,282	16,123	15,770	15,673	15,024	14,611	14,383	14,444	14,187	-2,434	-14.6%
32521+991	Resin & Rubber Production & Compounding	1,602	1,598	1,575	1,531	1,537	1,740	1,673	1,642	1,639	1,756	1,719	117	7.3%
325211	Plastic Materials & Resins	802	791	817	791	799	1,070	1,036	1,014	1,024	1,161	1,131	329	41.0%
325212	Synthetic Rubber	152	153	159	153	150	147	140	142	147	149	152	0	0.0%
325991	Custom Compounding of Purchased Resins	648	654	599	587	588	523	497	486	468	446	436	-212	-32.7%
326	Plastic & Rubber Products	15,019	14,886	14,707	14,592	14,233	13,933	13,351	12,969	12,744	12,688	12,468	-2,551	-17.0%
3261	Plastic Products	12,652	12,571	12,455	12,341	12,054	11,779	11,296	10,986	10,803	10,758	10,583	-2,069	-16.4%
32611	Uns. Plastic Films, Sheets, & Bags	1,472	1,471	1,411	1,402	1,363	1,368	1,319	1,300	1,310	1,340	1,329	-143	-9.7%
32612	Plastic Pipe, Pipe Fitting, & Uns. Profile Shapes	1,068	1,067	1,048	1,027	1,031	1,024	894	892	878	883	881	-187	-17.5%
32613	Laminated Plastic Plate, Sheet, & Shapes	284	281	284	279	284	246	243	240	238	238	225	-59	-20.8%
32614	Polystyrene Foam Products	538	523	522	543	554	524	478	457	460	436	478	-60	-11.2%
32615	Urethane & Foam Products (Exc. Polystyrene)	595	596	628	653	648	671	655	622	636	637	631	36	6.1%
32616	Plastic Bottles	416	409	407	407	394	458	450	445	443	458	456	40	9.6%
32619	Other Plastic Products	8,279	8,224	8,155	8,030	7,780	7,488	7,257	7,030	6,838	6,766	6,583	-1,696	-20.5%
3262	Rubber Products	2,367	2,315	2,252	2,251	2,179	2,154	2,055	1,983	1,941	1,930	1,885	-482	-20.4%
32621	Tires	722	692	656	663	649	643	580	535	514	529	500	-222	-30.7%
32622	Rubber & Plastic Hoses & Belts	270	276	277	260	256	263	266	261	262	253	254	-16	-5.9%
32629	Other Rubber Products	1,375	1,347	1,319	1,328	1,274	1,248	1,209	1,187	1,165	1,148	1,131	-244	-17.7%

Notes: * - Implementation of the 2007 N. American Industry Classification System (NAICS) added establishments and employees to industy 325211; consequently, earlier figures are not entirely comparable with this and later figures; Exc. - Except; Uns. - Unsupported.

Source: U.S. Bureau of the Census (2005b-2015b).

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Table A9: Total and Industry Gross Domestic Product for Ohio and the U.S.: 2002-2012 (in billions, except percentages)

Industry Titles	Gross Domestic Product											Percent Change/ Difference 2002-2012
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012*	
Current Dollar Figures:												
Ohio: Total	$412.29	$426.46	$447.96	$466.61	$480.38	$489.94	$491.71	$476.17	$494.70	$519.08	$548.53	33.0%
NAICS 326: Plastic & Rubber Products	$5.62	$5.56	$5.45	$5.41	$5.20	$5.20	$4.25	$4.78	$4.79	$5.24	$5.49	-2.3%
NAICS 326 as a Percentage of Total	1.36%	1.30%	1.22%	1.16%	1.08%	1.06%	0.87%	1.00%	0.97%	1.01%	1.00%	-0.36%
U.S.: Total	$10,919	$11,447	$12,209	$13,024	$13,782	$14,401	$14,636	$14,328	$14,863	$15,432	$16,141	47.8%
NAICS 326: Plastic & Rubber Products	$63.5	$63.3	$64.4	$63.6	$64.4	$63.7	$56.3	$61.5	$63.7	$65.9	$68.9	8.5%
NAICS 326 as a Percentage of Total	0.58%	0.55%	0.53%	0.49%	0.47%	0.44%	0.38%	0.43%	0.43%	0.43%	0.43%	-0.15%
Ohio as a Percentage of U.S.:												
Total	3.8%	3.7%	3.7%	3.6%	3.5%	3.4%	3.4%	3.3%	3.3%	3.4%	3.4%	-0.4%
NAICS 326: Plastic & Rubber Products	8.9%	8.8%	8.5%	8.5%	8.1%	8.2%	7.6%	7.8%	7.5%	7.9%	8.0%	-0.9%
Industry Concentration Ratio - Ohio::U.S.	2.35	2.36	2.31	2.37	2.32	2.40	2.25	2.34	2.26	2.36	2.35	0.00
Inflation-Adjusted Figures, Standardized on 2009												
Ohio: Total	$487.79	$495.81	$506.24	$512.66	$512.97	$508.67	$500.87	$476.17	$488.56	$501.34	$517.06	6.0%
NAICS 326: Plastic & Rubber Products	$6.45	$6.51	$6.63	$6.44	$5.64	$5.80	$4.67	$4.78	$4.94	$5.22	$5.19	-19.5%
NAICS 326 as a Percentage of Total	1.32%	1.31%	1.31%	1.26%	1.10%	1.14%	0.93%	1.00%	1.01%	1.04%	1.00%	-0.32%
U.S.: Total	$12,990	$13,322	$13,780	$14,227	$14,613	$14,825	$14,729	$14,328	$14,640	$14,869	$15,246	17.4%
NAICS 326: Plastic & Rubber Products	$72.8	$74.1	$78.3	$75.7	$69.8	$71.1	$61.9	$61.5	$65.7	$65.8	$65.1	-10.5%
NAICS 326 as a Percentage of Total	0.56%	0.56%	0.57%	0.53%	0.48%	0.48%	0.42%	0.43%	0.45%	0.44%	0.43%	-0.13%
Ohio as a Percentage of U.S.:												
Total	3.8%	3.7%	3.7%	3.6%	3.5%	3.4%	3.4%	3.3%	3.3%	3.4%	3.4%	-0.4%
NAICS 326: Plastic & Rubber Products	8.9%	8.8%	8.5%	8.5%	8.1%	8.2%	7.6%	7.8%	7.5%	7.9%	8.0%	-0.9%
Industry Concentration Ratio - Ohio::U.S.	2.36	2.36	2.30	2.36	2.30	2.38	2.22	2.34	2.25	2.35	2.35	-0.01

Notes: * - preliminary and subject to revision.

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

Prepared by: Office of Research, Ohio Development Services Agency. Telephone 800/848-1300, or 614/466-2116 (DL, 3/15).

Table A10: Exports of Plastic and Rubber Products (NAICS 326) from Ohio, 2002-2014 (in millions of dollars, except percentages)

Area	2002	2003	2004	2005	2006	2007	2008	2009	2010^	2011^	2012^	2013^	2014^	Inflation-Adjusted Growth^ 2002-2014
Current Dollars:														
World Total	$1,047	$1,140	$1,242	$1,279	$1,283	$1,410	$1,591	$1,377	$1,677	$1,996	$2,111	$2,043	$2,336	
NAFTA	$641	$678	$699	$761	$784	$851	$968	$876	$1,085	$1,300	$1,364	$1,364	$1,617	
Canada	$530	$559	$543	$603	$589	$629	$720	$659	$821	$971	$1,012	$968	$1,096	
Mexico	$111	$120	$156	$158	$195	$222	$249	$217	$264	$329	$353	$395	$520	
European Union (28 nations*)	$165	$200	$214	$217	$224	$254	$265	$199	$224	$232	$211	$213	$236	
China*	$7	$13	$13	$17	$22	$31	$39	$35	$60	$61	$61	$81	$133	
Japan	$59	$56	$59	$51	$37	$31	$29	$24	$35	$34	$55	$55	$39	
Remainder of World (170 areas*)	$176	$192	$257	$233	$215	$242	$290	$243	$273	$368	$421	$330	$310	
Percent Distribution:														
NAFTA	61.2%	59.5%	56.3%	59.5%	61.1%	60.4%	60.9%	63.6%	64.7%	65.1%	64.6%	66.7%	69.2%	
Canada	50.6%	49.0%	43.7%	47.1%	45.9%	44.6%	45.2%	47.9%	49.0%	48.7%	47.9%	47.4%	46.9%	
Mexico	10.6%	10.5%	12.6%	12.4%	15.2%	15.8%	15.6%	15.8%	15.7%	16.5%	16.7%	19.4%	22.3%	
European Union (28 nations*)	15.7%	17.6%	17.3%	17.0%	17.4%	18.0%	16.7%	14.4%	13.3%	11.6%	10.0%	10.4%	10.1%	
China*	0.6%	1.1%	1.0%	1.3%	1.7%	2.2%	2.4%	2.6%	3.6%	3.1%	2.9%	3.9%	5.7%	
Japan	5.6%	4.9%	4.7%	4.0%	2.9%	2.2%	1.8%	1.7%	2.1%	1.7%	2.6%	2.7%	1.7%	
Remainder of World (170 areas*)	16.8%	16.9%	20.7%	18.3%	16.8%	17.2%	18.2%	17.7%	16.3%	18.4%	19.9%	16.2%	13.3%	
Real Dollars, Standardized on 2014:														
World Total	$1,556	$1,655	$1,757	$1,688	$1,597	$1,744	$1,839	$1,592	$1,883	$2,111	$2,180	$2,065	$2,336	50.1%
NAFTA	$952	$985	$989	$1,004	$976	$1,053	$1,119	$1,013	$1,218	$1,375	$1,409	$1,378	$1,617	69.7%
Canada	$787	$811	$768	$796	$733	$778	$832	$762	$922	$1,027	$1,045	$979	$1,096	39.3%
Mexico	$165	$174	$221	$209	$243	$275	$287	$251	$296	$348	$364	$400	$520	214.6%
European Union (28 nations*)	$245	$291	$303	$286	$279	$314	$307	$230	$251	$245	$217	$216	$236	-3.3%
China*	$10	$19	$18	$23	$28	$39	$45	$41	$68	$65	$63	$82	$133	1232.5%
Japan	$87	$81	$83	$67	$46	$39	$34	$27	$40	$36	$57	$56	$39	-55.1%
Remainder of World (170 areas*)	$262	$279	$363	$308	$268	$299	$335	$281	$307	$389	$434	$334	$310	18.5%

Notes: * - European Union nations include Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom (European Union, 2015). Overseas territories may be included with the national totals or listed with the Remainder of the World. The Remainder of the World includes Hong Kong, Macau, Taiwan and 167 other areas (Samoa is among the last); exports do not go to every Remainder area every year (International Trade Administration, 2015).
^ - Trade and/or Producer Price Index figures may be revised later.

Sources: European Union (2015); International Trade Administration (2015); U.S. Bureau of Labor Statistics (2015).

Prepared by: Office of Research, Ohio Development Services Agency. Telephone 614/466-2116 (DL, 4/15).

Table A11: Value-Added in Ohio and the U.S.: 2002-2012 (in millions of current dollars)

Area Name / NAICS: Title	2002^	2003*	2004	2005	2006*	2007^	2008	2009	2010	2011*	2012^	`02-`12 Averages
Ohio:												
326: Plastic & Rubber Products	$7,878	$7,942	$7,760	$8,147	$8,314	$8,191	$7,253	$6,649	$7,219	$7,610	$8,479	$7,767
3261: Plastic Products	$5,637	$5,743	$5,562	$5,773	$5,911	$6,046	$5,465	$4,850	$5,372	$5,493	$6,316	$5,652
Percentage of Industry	71.6%	72.3%	71.7%	70.9%	71.1%	73.8%	75.3%	73.0%	74.4%	72.2%	74.5%	72.8%
3262: Rubber Products	$2,241	$2,199	$2,198	$2,374	$2,403	$2,146	$1,788	$1,798	$1,846	$2,117	$2,163	$2,116
Percentage of Industry	28.4%	27.7%	28.3%	29.1%	28.9%	26.2%	24.7%	27.0%	25.6%	27.8%	25.5%	27.2%
U.S.:												
326: Plastic & Rubber Products	$92,462	$91,536	$93,151	$96,162	$99,451	$99,940	$90,923	$81,829	$89,332	$91,723	$99,920	$93,312
3261: Plastic Products	$75,189	$73,988	$75,853	$78,877	$82,762	$82,651	$75,997	$66,892	$72,575	$73,601	$82,043	$76,403
Percentage of Industry	81.3%	80.8%	81.4%	82.0%	83.2%	82.7%	83.6%	81.7%	81.2%	80.2%	82.1%	81.9%
3262: Rubber Products	$17,273	$17,547	$17,297	$17,284	$16,689	$17,289	$14,926	$14,938	$16,757	$18,123	$17,876	$16,909
Percentage of Industry	18.7%	19.2%	18.6%	18.0%	16.8%	17.3%	16.4%	18.3%	18.8%	19.8%	17.9%	18.1%
Ohio as a Percentage of the U.S.:												
326: Plastic & Rubber Products	8.5%	8.7%	8.3%	8.5%	8.4%	8.2%	8.0%	8.1%	8.1%	8.3%	8.5%	8.3%
3261: Plastic Products	7.5%	7.8%	7.3%	7.3%	7.1%	7.3%	7.2%	7.3%	7.4%	7.5%	7.7%	7.4%
3262: Rubber Products	13.0%	12.5%	12.7%	13.7%	14.4%	12.4%	12.0%	12.0%	11.0%	11.7%	12.1%	12.5%

Note: ^ - Census of Manufactures data; * - Unrevised Annual Survey of Manufacturers data.

Sources: U.S. Bureau of the Census (2005a-2014a, 2005c, 2010c, 2015c).

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Table A12: Capital Expenditures in Ohio and the U.S.: 2002-2012 (in millions of current dollars)

Area Name / NAICS: Title	2002^	2003*	2004	2005	2006*	2007^	2008	2009	2010	2011*	2012^	`02-`12 Averages
Ohio:												
326: Plastic & Rubber Products	$771	$553	$547	$536	$549	$602	$691	$382	$427	$684	$693	$585
3261: Plastic Products	$624	$446	$432	$417	$417	$432	$478	$302	$347	$577	$563	$458
Percentage of Industry	81.0%	80.8%	79.0%	77.7%	75.9%	71.8%	69.2%	79.1%	81.4%	84.4%	81.3%	78.3%
3262: Rubber Products	$147	$106	$115	$119	$133	$170	$213	$80	$80	$107	$129	$127
Percentage of Industry	19.0%	19.2%	21.0%	22.3%	24.1%	28.2%	30.8%	20.9%	18.6%	15.6%	18.7%	21.7%
U.S.:												
326: Plastic & Rubber Products	$7,415	$6,399	$6,518	$6,716	$7,152	$7,534	$7,730	$5,324	$6,225	$6,926	$7,255	$6,836
3261: Plastic Products	$6,311	$5,497	$5,368	$5,620	$6,014	$6,210	$6,248	$4,464	$4,851	$5,579	$5,771	$5,630
Percentage of Industry	85.1%	85.9%	82.4%	83.7%	84.1%	82.4%	80.8%	83.8%	77.9%	80.6%	79.6%	82.4%
3262: Rubber Products	$1,104	$902	$1,149	$1,096	$1,138	$1,324	$1,482	$861	$1,374	$1,347	$1,483	$1,205
Percentage of Industry	14.9%	14.1%	17.6%	16.3%	15.9%	17.6%	19.2%	16.2%	22.1%	19.4%	20.4%	17.6%
Ohio as a Percentage of the U.S.:												
326: Plastic & Rubber Products	10.4%	8.6%	8.4%	8.0%	7.7%	8.0%	8.9%	7.2%	6.9%	9.9%	9.5%	8.6%
3261: Plastic Products	9.9%	8.1%	8.1%	7.4%	6.9%	7.0%	7.7%	6.8%	7.2%	10.3%	9.8%	8.1%
3262: Rubber Products	13.3%	11.8%	10.0%	10.9%	11.6%	12.8%	14.3%	9.3%	5.8%	7.9%	8.7%	10.5%

Note: ^ - Census of Manufactures data; * - Unrevised Annual Survey of Manufacturers data.

Sources: U.S. Bureau of the Census (2005a-2014a, 2005c, 2010c, 2015c).

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Table A13: Projections for Industry Group Employment*, Ohio and the U.S.: 2012-22

NAICS Code	Shorter Industry Title	Jobs		Changes: 2012-2022	
		Actual 2012	Projected 2022	Number	Percent
Ohio	Total	5,502,100	5,957,100	455,000	8.3%
31-33	Manufacturing	656,040	635,360	-20,680	-3.2%
3252	Resin, Synthetic Rubber and Artificial Fibers	5,640	6,550	910	16.1%
326	Plastic and Rubber Products	52,950	47,000	-5,950	-11.2%
3261	Plastic Products	39,900	37,030	-2,870	-7.2%
3262	Rubber Products	13,050	9,970	-3,080	-23.6%
U.S.	Total	145,355,800	160,983,700	15,627,900	10.8%
31-33	Manufacturing	11,918,900	11,369,400	-549,500	-4.6%
3252	Resin, Synthetic Rubber and Artificial Fibers	92,300	83,300	-9,000	-9.8%
326	Plastic and Rubber Products	645,100	593,700	-51,400	-8.0%
3261	Plastic Products	515,900	476,600	-39,300	-7.6%
3262	Rubber Products	129,200	117,100	-12,100	-9.4%

Note: * - Projections have not been made for resin and synthetic rubber production (NAICS 32521), nor for custom compounding of purchased resins (325991). However, resin and synthetic rubber employees comprised 97 percent of the encompassing resin, synthetic rubber and artificial fiber group (3252) in Ohio in 2012 according to County Business Patterns. The corresponding figure for the U.S. was 84.8 percent. In this sense, projections for the group serve as proxies for the sub-group. The same cannot be said for the other chemical products group (3259) and custom compounding (U.S. Bureau of the Census, 2014b).

Sources: ODJFS-LMI (2015), U.S. Bureau of the Census (2014b) and U.S. BLS (2013).

Prepared by: Office of Research, Ohio Development Services Agency. Telephone 800/848-1300, or 614/466-2116 (DL, 3/15).

Industry Definition and Examples of Products

The nation's industry statistics have been collected under the North American Industry Classification System (NAICS) starting in 1997 (Office of Management and Budget, 1998; minor revision were made for 2002, 2007 and 2012). Establishments producing goods or services sufficiently alike are classified in the same *industry*, and assigned a six-digit code number. Closely related industries form an *industry group*. The first four digits of the industry 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 defines an industry.) In turn, the first three digits indicate the major industry of which the groups are a part. In this report the *Polymers Industry* is defined as the combination of one subgroup, one specific industry, and one major industry: *resin and synthetic rubber manufacturing* (NAICS 32521), *custom compounding of purchased resins* (325991), and *plastic and rubber products manufacturing* (326). Definitions and examples of specific industry products follow.

32521 Resin and Synthetic Rubber.

325211 Plastic Materials and Resins. Examples include nonvulcanizable elastomers. Plants may also mix or blend their own resins on a customized or standard basis.

325212 Synthetic Rubber. Examples include vulcanizable elastomers. Rubber adhesives are excluded from the Industry.

325991 Custom Compounding of Purchased Resins. Resins made elsewhere are mixed or blended. Reformulated resins from recycled plastic products also are included.

326 Plastic and Rubber Products. Establishments in this sub-sector make goods from plastic resins and raw and synthetic rubber. Plastic and rubber products are included in this sub-sector because both are elastomers manipulated with similar technologies. (Individual products are classified as one or the other based on their blended proportions; see A Polymers Primer.) Goods combining plastic and rubber products with other material(s) are classified outside of the Industry because different technologies are used to produce them. Examples of the latter include rubber and plastic footwear, furniture, and cloth or paper laminated with plastics.

3261 Plastic Products. These are intermediate and final goods made from new and/or recycled resins. Common technologies in this group include casting and various types of molding: blowing, compressing, extruding, and injecting.

32611 Unsupported Plastic Films, Sheets, and Bags.

326111 Unsupported Plastic Bags. Resins are processed into bags and/or coat or laminate film and sheet into bags. Manufacturers also may print on the bags.

326112 Unsupported Plastic Packaging Film and Sheet.

326113 Unsupported Plastic Film and Sheet (Except Packaging). This industry produces films and unlaminated sheets for purposes other than packaging.

32612 Plastic Pipe, Pipe Fitting, and Unsupported Profile Shapes.

326121 Unsupported Plastic Profile Shapes. Non-rigid profile shapes such as rods, tubes, and sausage casings are examples.

326122 Plastic Pipes and Pipe Fittings. The pipes and fittings are rigid.

32613 Laminated Plastic Plate, Sheet, and Shapes. Laminating generally involves bonding or impregnating the material with resins and compressing them under heat. Laminating packaging material is classified elsewhere in the Industry. Coating or laminating non-plastic materials such as paper or cloth is classified outside of the Industry.

32614 Polystyrene Foam Products. The food containers used by many restaurants for take-out orders are just one example of this industry's products.

32615 Foam Products (Except Polystyrene). Urethane is the principal resin used in industry products.

32616 Plastic Bottles. Other containers are classified elsewhere in the Industry.

32619 Other Plastic Products.

326191 Plastic Plumbing Fixtures. Examples include bathtubs, hot tubs, portable toilets, shower stalls, and urinals. Fiberglass may be incorporated. Plastic pipes and fittings are classified elsewhere in the Industry. Assembling plastic components into plumbing fixtures such as faucets is classified outside of the Industry.

326199 All Other Plastic Products. Examples include air mattresses, inflatable boats, bowls and their lids, clothes hangers, gloves, hardware, siding, trash containers, and non-foam cups and dinnerware. Resilient floor coverings (formerly 326192) were added in 2012 as part of the revisions to the 2007 system.

3262 Rubber Products. Products may be intermediate or final, and come from natural, synthetic, or reclaimed rubber. Common technologies used in this group include vulcanization, cementing, molding, extruding, and lathe cutting.

32621 Tires.

326211 Tires (Except Retreading). New tires and inner tubes of all shapes and sizes are included. Most tires are produced for the motor vehicle industry.

326212 Tire Retreading. The feature distinguishing this industry from tire repair service is the reliance on assembly line operations. Retreads are used by commercial trucks and aviation, school buses, and off-road vehicles included in agricultural, industrial, and mining equipment. These markets are much smaller than the market for passenger cars and non-commercial light trucks.

32622 Rubber and Plastic Hoses and Belts. Plants making garden hoses from purchased hose are included.

32629 Other Rubber Products.

326291 Rubber Products for Mechanical Use. Products are typically used in transportation equipment, machinery, and other equipment. Tubes are classified elsewhere in the Industry.

326299 All Other Rubber Products. Examples include balloons, bath and doormats, birth control devices, combs, inflatable life rafts, latex foam rubber, reclaimed rubber, rubber bands, and tubes (except extruded, lathe-cut, and molded). Rubberized fabrics, and rubber clothing accessories (e.g., bathing caps), gloves, toys, and gaskets, packing, and sealing devices are classified outside of the Industry.

A Polymers Primer

In the general manufacturing processes for plastics and synthetic rubbers (SRs), the raw materials – natural gas, petroleum, and coal tar – are refined, distilled and/or fractionated to produce gases, light oils, middle fractions, and heavy oils. These materials may be mixed with substances such as ammonia or formaldehyde, or further chemically decomposed to yield intermediates that are, in turn, catalyzed into *monomers*. Specifically, natural gas olefins – ethane (C_2H_6), propane (C_3H_8) and butane (C_4H_{10}) – are separated and steam-cracked to yield ethylene $(C_2H_4)_n$, propylene $(C_3H_6)_n$ and butadiene $(C_4H_6)_n$. (These three are the most important because they are the building blocks for most plastics and SRs.) Aromatics, particularly benzene and xylenes, are derived primarily from petroleum, but may also be produced from coal tar or olefin operations using steam cracking. Styrene $(C_8H_8)_n$ and phenol (i.e., carbolic acid, C_6H_5OH) are the two most common benzene derivatives; it also is used to make epoxy, polycarbonate, polyurethanes ($C_{25}H_{42}N_2O_6$), polyamides (i.e., nylons, $C_{12}H_{26}N_2O_4$), unsaturated polyesters and SR's. Xylenes are used in producing esters (compounds formed by eliminating water and bonding an alcohol with an organic acid). The monomers are finally catalyzed into *polymers*. Polymers are strings of petrochemical monomers. Polyethylene (PE), polypropylene (PP), polystyrene (PS), and polyester are chains of ethylene, propylene, styrene and ester monomers (Muir, 2014: 33-34; O'Reilly, 2010: 23, 29-32; Prat, 1993; Standard & Poor's, 1994; Wikipedia, 2015).

The production of plastic resins and SRs is more complex than described above. Examples abound, but a few illustrate the point. About three-fourths of ethylene output is used to make PE, PS, and polyvinyl chloride (PVC, $(C_2H_3Cl)_n$, or ethylene with Cl substituting for one H atom), with an additional portion used in SR production. About one-half of propylene output is used to produce PP; it also is used to make intermediate chemicals subsequently used to make acrylonitrile-butadiene-styrene (ABS) $(C_8H_8{\cdot}C_4H_6{\cdot}C_3H_3N)_n$ and unsaturated polyesters (all thermoplastics resins) as well as phenolics and urea (CH_4NO_2) (both thermosetting resins). About two-thirds of butadiene production is used to make SRs, which, in turn, are used in tires and other fabricated rubber products; butadiene also is used in manufacturing nylon and ABS resins. Xylenes also are used to make vinyl resins (-CH=CH_2, or ethylene minus one H atom). (Muir, 2014: 34; O'Reilly, 2010: 29-32; Wikipedia, 2015).[17]

Plastics and SRs use some of the same molecules, but they may be classified as one or the other based of the amounts of polymers comprising them. For example, a compounded resin with at least 50 percent butadiene is classified as a SR, but one with less than 50 percent butadiene is classified as a plastic. However, the key distinction between plastics and SRs is that the latter are vulcanized elastomers. Adding sulfur and "cooking" the mixture cross-links the polymers, increasing their resiliency and strength, and giving them elastic and yield properties similar to natural rubber. This converts the rubber hydrocarbon from a thermoplastic into a thermoset. (Natural rubber is mostly latex, or isoprene (C_5H_8), with some impurities. Its properties also are improved by further processing, including vulcanization.) Plastics are non-vul-

canizable elastomers (Parker, 1984; Standard & Poor's, 1989; Wikipedia, 2015). The most common SRs are butadiene and styrene-butadiene rubber (BR and SBR), chloroprene, isobutylene-isoprene, and ethylene-propylene (co- and ter-polymers). Historically, the tire industry used about 76 percent of SBR production (Yoder, 2000). SRs also are used in inner tubes, laboratory tubes, hoses, plumbing fixtures, gaskets, mechanical belts and seals, gloves, footwear, scuba diving equipment, inflatable boats, mouse pads, orthopedic braces, adhesives, solid rocket propellant and radar absorbent material (Wikipedia, 2015).

Plastics and SRs may be classified by their production characteristics. Commodity resins are produced in high volumes at low cost with little differentiation between manufacturers. PEs, PVCs, PPs, PSs, and SRs incorporating butadiene and propylene are examples. Their primary cost determinant is the price of the feedstock. These contrast with low-volume specialty resins custom designed to meet specific requirements. The latter often are critical components of end products, and are sold on performance characteristics. Research and development (R&D) and related engineering services are a large part of their higher cost. R&D for high-volume resins is limited, emphasizing reducing feedstock, energy and labor costs (Muir, 2014: 27; O'Reilly, 2010: 23). Other R&D efforts are geared toward improving the performance of existing resins by alloying and blending resins, or incorporating non-plastic materials in plastic resins to create composites. New uses of plastics are mentioned in the industry or popular media such as Plastics News, Rubber News or Scientific American's website – <http://www.scientificamerican.com> (search on keywords "plastic" and "rubber").

Plastics may be grouped by a variety of characteristics, but the most basic and familiar division is between thermoplastics and thermosets. Thermoplastics can be re-softened by reheating, and therefore can be recycled into new products; thermosets cannot. Thermosets are heat resistant to a point, but reheating them to higher temperatures destroys the cross-linked polymers at their cores. However, some thermosets may be ground up and reused as filler.

Major thermoplastics, ranked in descending order of production volume and with their common uses, include:

PE – including *high* and *low density* varieties: HDPE – detergent bottles and milk jugs; LDPE and LLDPE – dry-cleaning and produce bags, trash can liners, and food storage containers;
PP: drinking straws, bottle caps and food containers; also parts in appliances and motor vehicles;
PVC and copolymers (polymers made by alternating two different monomers in sequence): plumbing pipes and guttering, flooring, outdoor furniture, shower curtains, window frames, shrink-wrap, water bottles, and containers for salad dressings and liquid detergents; poly-vinylidene chloride (PVDC) is a related plastic used for food packaging (e.g., Saran wrap);
PS – straight and rubber-modified: *in foam form* – packaging pellets, cups, meat trays, and clamshell take-away food containers; *in non-foam form* – tableware and cutlery;

Polyesters, including polyethylene terephthalate (PET or PETE) $(C_{10}H_8O_4)_n$: films, jars, synthetic fibers such as Dacron, and bottles for carbonated drinks, microwavable packaging and cooking oils; teflon is a closely related plastic used for low friction and heat resistant applications such as water slides and frying pans;
Polyamides (nylons): in fiber form – fabrics, toothbrush bristles and fishing lines; in block form – gears, bearings, bushings, and other mechanical parts.

Other notable thermoplastics include ABS and polycarbonate (PC) $(C_{15}H_{16}O_2)$. ABS is light and rigid, yet is good for shock absorbance. It is used in pipes, golf club heads, motor vehicle body parts, protective head-gear, electronic equipment cases such as monitors, printers and keyboards, and toys (e.g., Lego bricks). PCs are used in CDs, DVDs, riot shields, security windows, aircraft canopies, traffic lights, lenses and eyeglasses. Bayblend mixes ABS and PC, creating a stronger plastic used in cars. Thermoplastics have accounted for at least 90 percent of the total weight of plastics production for years, and continue to have the more-promising growth prospects (Muir, 2014: 34; Wikipedia, 2015).

Common thermosets, ranked descending order of production volume, include:

Phenolic (Bakelite): phenolics have been largely replaced by cheaper and less brittle plastics, but they are still used in applications requiring heat-resistant and insulating properties such as electronic circuit boards;
Urea, as part of blown polyureathane: mattresses, furniture padding, and thermal insulation; as part of non-blown polyureathane: coatings, printing rollers, and a component of spandex;
Epoxies: used in coatings, adhesives and composite materials such as fiberglass and carbon fiber; and
Melamine: produced from urea, it is used in kitchen utensils and plates; it is the main ingredient in Formica.

Thermosets are relatively mature products, with at least two-thirds of demand tied to construction and consumer durables (Muir, 2014: 36).

Initial outputs may be in the form of pellets, flakes, granules, powders, liquid resins, sheeting and films. These, in turn, may be molded or shaped under heat and pressure (Muir, 2014: 34) to make final products (NAICS 326). Finished plastic products typically include a combination of additives. Processing-aids improve the compounding and molding of resins. They include lubricants, which enhance resin flow and mold release, and compensate for imperfections in the machinery and resins, and anti-blocking agents, which prevent layers of film from sticking together. Modifiers increase the materials' flexibility or (if rubber-based) stress resistance. Extenders are a broad class of materials used to ensure the stability of resins during processing or prolong the useful life of the product. Extenders include antioxidants, antistatic agents, biocides, flame-retardants, and heat and light stabilizers. Colorants may be used. Additives are sold mostly to resin producers and compounders. PVCs use the greatest portion of these additives; PEs, PSs, and PPs use significant amounts of antioxidants (O'Reilly, 1997b, 1999, 2003).

NOTES:

1 The list in this section of the text and Appendix table A1 are not comprehensive because company sites employing less than 50 people are excluded.

2 Statistics for the plastic- and rubber-working machinery industry from the Census Bureau were last published in the 2011 County Business Patterns and the 2007 Census of Manufactures data files. Such machinery was subsumed under “other industrial machinery” beginning in 2012.

3 Value-added (VA) is considered the best available measure for comparing the relative economic performance of manufacturing among industries and geographic areas. The BEA starts with the Census Bureau’s VA figures when estimating GDP, and subtracts additional costs such as purchased services in deriving the net contribution of the industry’s GDP. The VA and GDP percentages for Ohio may differ due in part to the variability of such costs between the states. VA figures are available for industry groups from the Annual Survey of Manufactures, and for subgroups and specific industries from the quinquennial Census of Manufactures; GDP figures are not.

4 Employment figures for all of the counties with industry establishments should be regarded as estimates because the Census Bureau does not disclose precise figures if doing so would violate the confidentiality of respondents. Instead, the Bureau provides a range encompassing the jobs figure. Techniques thought to be fairly accurate on average can generate plausible estimates in these instances. Even when a specific figure is provided by the Bureau, a note describing how it may vary from the true number usually is attached.

5 County Business Pattern employment figures are for the week including March 15, which, in 2008, was in the early stages of the recession. Changes in employment levels often lag the start of economic expansions and contractions by about a year; that could be why March 2010 employment was less than a year earlier, even though the recovery started in the summer of 2009.

6 Beginning with publication of the 2008 data, use of the 2007 NAICS for County Business Patterns resulted in establishments and their employees being added to the plastic resins industry (325211) from elsewhere; this made comparisons with earlier years difficult.

7 Most of the statistics used in this report come from the Census Bureau or are derived from its data bases. The use of one source takes advantage of an underlying consistency and uniformity of definitions and coverage across a variety of subjects and geographic levels as well as providing a high degree of accuracy. While Bureau of Labor

Statistics data have the advantage of timeliness, they do not always have the specific industry and geographic detail characteristic of Census Bureau datasets. Statistics from the two bureaus may also differ due to differences in how they may classify the same establishments as well as collection methodologies.

8 Fluctuations in plant numbers may be more than establishments (re)opening and closing temporarily or permanently. While some establishments may have gone out of business or been closed as part of a company consolidation, others may have been reclassified when production changed to make or emphasize a different product. Such production shifts are particularly possible with resin and synthetic rubber production and compounding plants due to the similarity of raw materials and handling processes (Larkin, 2012), but there is no way of knowing for sure exactly what has happened.

9 Net growth or contraction in industries showing cyclical changes in output may be a function of the starting and ending times chosen. Therefore, caution is warranted when trying to discern trends.

10 The current-dollar figures in Appendix table A10 were adjusted for inflation by using the U.S. Bureau of Labor Statistics' (2015) producer price index values for the industry. Figures show in the chart and Appendix table A10 are not comparable with Gross Domestic Product or Value-Added figures shown elsewhere. Export sales of plastic resins (325211) have been an increasing share of total industry sales, but producers still derive 81 percent their revenue streams from domestic sales (Muir, 2014).

11 Many of these companies have overseas headquarters, underscoring the importance of foreign investment in the plastic resins industry. Alfa is Mexican, Braskem is Brazilian, Formosa is Taiwanese, Mossi & Ghisolfi is Italian, Shin-Etsu is Japanese, and Total is French. International Petroleum Investment is owned by the Emirate of Abu Dhabi, part of the United Arab Emirates. INEOS is based in Switzerland, but is registered in the United Kingdom. Similarly, LyondellBasell is incorporated in the Netherlands while its parent is American.

12 The regulation of resin producers stems from their frequent work with hazardous materials. The rules contribute to worker safety, public health, and environmental protection. Companies developed techniques to reduce, treat, handle and dispose of hazardous waste largely in response to tighter restrictions on emissions of harmful compounds. They also have developed a voluntary, self-regulatory program to improve health, safety and environmental performance – in part to avoid more onerous regulations as well as to improve their public images (Larkin, 2012: 18-19). Major laws affecting the industry include the Clean Air Act, the Clean Water Act, the Resource Conservation and Recovery Act, the Toxic Substance and Control Act, and the Comprehensive Environmental Re-

sponse Compensation and Liability Act (a.k.a., the Superfund program) (Muir, 2014: 29).

13 Two examples illustrating some of these motives have been seen in Ohio. One was Dow Chemical's purchase of Rohm and Haas. The other is Momentive Performance Materials Holdings. Initially incarnated as Hexion Specialty Chemicals by the 2005 merger of Borden Chemical, Resolution Specialty Materials, and Resolution Performance Products, it made subsequent acquisitions and renamed itself. It is now a Fortune U.S.-1,000 company. Specialty chemical production is more resilient in downturns and less energy- and capital-intensive than commodity production (Muir, 2014: 28).

14 2012 Census of Manufactures data show that 60.4 percent of SR production was used for new tires, as judged by the dollar values of production (U.S. Bureau of the Census, 2015c).

15 According to the National Highway Traffic Safety Administration, tires have become better at resisting wear. Consumers can search the Administration's website; start with http://www.safercar.gov/.

16 Projections have not been made for resin and synthetic rubber production (NAICS 32521), nor for custom compounding purchased resins (325991). However, resin and synthetic rubber employees comprised 97.0 percent of the encompassing resin, synthetic rubber and artificial fiber group (3252) in Ohio in 2012 according to County Business Patterns. The corresponding figure for the U.S. was 84.8 percent. In this sense, projections for the group serve as proxies for the sub-group. The same cannot be said for the other chemical products group (3259) and custom compounding (U.S. Bureau of the Census, 2014b).

17 Although complex molecules such as nylons and polyurethanes may have fixed numbers of carbon and other atoms, the chemical formulas shown do not convey the varying spatial arrangement of the atoms in the molecules. Similarly, ABS resins may vary in the portions of their constituent molecules. The same may be said for other complex polymers and their mixtures – and there is no one formula for polyesters.

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