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The Ohio Polymers Industry:

Rubber and Plastic Resins and Products, and Related Machinery

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OVERVIEW AND FORECASTS

AN OVERVIEW OF THE INDUSTRY

Plastic and synthetic rubber resins (NAICS 32521) share some common chemical and production characteristics. 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.

Although plastics products (3261) are closely tied to national and international economic growth, the production of plastic resins typically has grown at a faster-than-average pace: 5 percent per year from 1991 through 2000 (O'Reilly, 2003). Overall production appears to have fallen in 2002, but this probably reflects only the absence of data for thermoplastic polyester production. Growth had definitely resumed by 2004, but production fell in 2005 due to post-hurricane plant outages as well as reduced consumer demand. Plastics production rebounded in 2006 and continued through 2007. The average annual increase in production from 2000 through 2007 was 2.38 percent per year. However, output fell almost 12 percent in 2008 during the recession (based on O'Reilly, 2002, 2010). Year-to-date production for the first nine months of 2009 was 3.7 percent lower than the corresponding period in 2008 (O'Reilly, 2010: 8).

Plastic resin production grew at a faster-than-average pace for many years because plastics replaced metal, glass, wood and paper in many 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 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). However, high prices for oil and natural gas (which are both fuel and raw materials), as well as technical innovations with competing materials, may reduce or eliminate the cost advantage of plastics and make other materials more appealing.

The widely varied uses of plastics mean that no one market is overwhelmingly important for the industry (like motor vehicles for the rubber products group). The three largest market segments for plastics are packaging (bags, bottles, food containers – 32 percent), consumer and institutional goods (kitchenware, toys, sporting goods, medical products – 21 percent), and building and construction materials (structures, pipes, conduits, fittings – 17 percent). Other notable segments are exports – 16 percent, transportation equipment – four percent, furniture and furnishings – four percent, electronic appliances and their components – two percent, adhesives, ink and coatings – one percent. All other uses comprise three percent. The dominance and steady demand of the packaging, consumer, and institutional segments – 53 percent – reduce business cycles fluctuations characteristic of the building, construction and transportation equipment segments (O'Reilly, 2010: 31).

The most commonly used thermoplastic resins include polyethylene (PE), polypropylene (PP), polyvinyl chloride (PVC), polystyrene (PS), polyesters – including polyethylene terephthalate (PET or PETE), and polyamide (nylon), and their uses vary by market segment. For example, the building and construction segment uses 70 percent of PVC and much of thermoset production. (Thermoplastics can be reheated; thermosets cannot.) The consumer and institutional segment uses 53 percent of PS production, while the packaging segment uses 45 percent of PE production. On the other hand, PP usage is not dedicated to any one segment. Having noted this, it also is true that 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 (O'Reilly, 2010: 31-32). These observations may be recast by industries within the plastic products group (NAICS 3261). The film, sheet, and bag industry (32611) is a notable user of PE and PP; the pipe, pipefittings and unsupported profile shapes industry (32612) uses PE and PVC; the plastic bottles industry (32616) uses PE, PET, PVC, and PS; and the fixtures, floor covering, and others industry (32619) uses PE, PP, PVC, and PS. (See the Industry Definition and Polymer 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. Indeed, O'Reilly notes that "[t]here are numerous plastics producers, with many focusing on just one or two product lines" (2010: 31). Yet, he also notes that only three to seven companies have significant positions in national production of any one of the five largest volume resins: PE, PP, PVC, PS, and polyesters. This is illustrated by the following list wherein names of major manufacturers found more than once have been *highlighted*.

PE: Chevron Phillips Chemical (the Chevron-ConocoPhillips joint venture), Dow Chemical, Equistar (a division of Access Industries), *ExxonMobil Chemical*, *Formosa Plastics*, the *INEOS Group*, and Westlake Chemical;
PP: *ExxonMobil Chemical*, *Formosa Plastics*, the *INEOS* Group, LyondellBasell (another division of Access Industries), Sunoco, and *Total SA*;
PVC: *Formosa Plastics*, Georgia Gulf, Occidental Petroleum, and Sintech;
PS: Americas Styrenics (the Dow Chemical-Chevron Phillips Chemical joint venture), the *INEOS*-NOVA[9] joint venture, and *Total SA*;
Polyesters: DAK Americas (the Alfa SAB de CV subsidiary), Eastman Chemical, Koch Industries' Invista BV, the Mossi & Ghisolfi Group, Nan Ya Plastics (a division of Formosa Plastics), and Wellman (LexisNexis, 2009; O'Reilly, 2010: 15, 31-32).

While thermoplastic resin production is not truly oligopolistic – 21 different names are listed above (not counting parent companies), with two appearing twice and two appearing thrice – the dominance of specific product lines by a relatively small number of large, vertically integrated, multi-national companies is apparent.[10]

This is partially explained by the characteristics of the industry: it is capital- and energy-intensive, and subject to extensive governmental regulation.[11] Large plant sizes are necessary for economies of scale in production, and the technology is complex. Long lead times usually are needed when establishing new facilities or upgrading or replacing old ones. After local authorities have been notified and zoning and environmental approval obtained, there is the time required for design, construction and start-up. Investments in utilities, storage, and distribution also are required, as are sophisticated safety and environmental equipment. Such long lead times make it difficult for companies to make short-term changes in capital spending to match significant changes in demand (O'Reilly, 2010: 23-25).

In addition to the characteristics mentioned above, companies considering entering the field may also be deterred by customer loyalty. Customers are often reluctant to change suppliers or raw materials because a new product must be tested, and testing may be expensive (O'Reilly, 2010: 25-26). In contrast to resin producers, the manufacture of specific plastic products is diffused among many companies of varying sizes.

The dominance of resin production by a relatively small number of companies is concomitant with two related industry trends: globalization and consolidation. Plastic resin production became a global industry as companies pursued opportunities in the high-growth emerging markets, often following the manufacturing companies that they supplied. Larger, geographically diversified customers want suppliers who can meet their needs on a global basis, and the largest resin companies now have operations in many countries (O'Reilly, 2010: 10-13). (Setting-up operations in a foreign country also is a way to circumvent trade barriers (O'Reilly, 1997a).) However, globalization leads to competition at home as well as abroad, as foreign-based companies invest in America. Resin producers have used a variety of strategies to reduce costs, grow, and remain competitive as the industry matures. They began reducing costs in the 1990s by closing plants and cutting jobs; then they improved production processes by refining how materials are handled at every step, working with customers from order-placement through shipment (O'Reilly, 1997a). They also have grown by acquiring facilities or product lines of others. O'Reilly (2010: 13) observes that

> "When companies merge, the surviving larger company can reduce costs in such areas as overhead, selling, and manufacturing. It can also achieve greater efficiencies in procurement and establish best practices for manufacturing and logistics. Most transactions are relatively small, involving individual product lines or plants. Companies seeking growth within maturing industry sectors may make acquisitions to achieve production or marketing efficiencies. Those that are divesting businesses usually do so because they're unwilling to make the investments needed to remain competitive, or because they want to focus on other businesses with better sales growth opportunities.[12]

Other factors driving industry consolidation include increasing capital requirements for technology, quality controls, meeting environmental standards, and the higher costs of research and development (O'Reilly, 2010: 26).[13]

Like plastics, "[s]ynthetic 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 surpassed natural rubber production by the early 1960s (Wikipedia, 2010).

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).

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 (Levy, 2009: 24). 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).

As judged by value-added, new tire production (NAICS 326211) was the largest single industry in the rubber group (U.S. Bureau of the Census, 2005c). In turn, 84.2 percent of tire production in 2002 was for use on motor vehicles (U.S. Bureau of the Census, 2005d). According to Modern Tire Dealer, a trade publication cited by Levy (2009: 23), nearly 45 million tires were shipped to motor vehicle assemblers as original equipment in 2008 for cars and light trucks, and another 229 million were delivered as replacements. Sales in 2009 were lower. Despite their low profit margins (when compared with per-unit replacement sales) and smaller percentage of total sales, sales to motor vehicle assemblers are important for several reasons. They help replacement sales because owners tend to replace tires with the same brand. This provides a larger market share than possible with replacements alone, and the greater economies of scale reduce per-unit operating costs. Sales to assemblers also incur lower distribution and advertising expenses (Levy, 2009: 24). Partial

Like the plastic resins industry, the tire industry is highly capital intensive; R & D, production technology, and operations are very expensive. Consequently, the industry is dominated by a small number of vertically integrated giants; Bridgestone/Firestone, Goodyear, and Michelin together account for about one-half of worldwide tire production (Levy, 2009: 10). (The vertical integration does not extend into distribution and retail sales. Other large companies dominate this part of the business.) Tire manufacturers in N. America face a number of challenges: overcapacity (which limits pricing power), competition from low cost manufacturers, and significant increases in the costs of raw materials: synthetic and natural rubber, chemicals, crude oil, reinforcement components, carbon black (Levy, 2009: 6). However, the bright spot in tire sales has been the increased demand for speed-rated radials. Such tires perform better than conventional radials, but their faster wear rate means replacements must be made more frequently (Levy, 2009: 24).

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. The non-tire part of the rubber industry is divided between large, diversified conglomerates and many small specialists. Carlisle, Cooper Tire & Rubber and Newell Rubbermaid are examples of the former with operations in Ohio.

Many resin and synthetic rubber producers have embraced the Internet as a way to improve the efficiency of procurement and distribution (O'Reilly, 2010: 25).

THE NEAR AND LONG TERM FORECASTS

A number of factors affect the outlook for the resin and synthetic rubber subgroup (NAICS 32521). These include trends in key end-use markets, the cost and availability of raw materials, foreign competition, technical advancements, and the competition of specific plastics with one another and alternative materials. These factors are somewhat interconnected.

The key end-use markets are packaging, building and construction, consumer and institutional products, and transportation equipment. These markets in turn are affected by trends in GDP, population growth, and consumer spending. Reflecting the consensus at Standard and Poor's, O'Reilly (2010: 4-6) expects the recovery of the chemical industry (including resin and synthetic rubber production) that began in the second half of 2009 to continue in 2010. However, the industry will still be operating at capacity rates below pre-recession levels. "[I]t may take several years for the industry to fully recover from the steep declines over the past two years" (O'Reilly, 2010: 5). This is due in particular to continuing weakness in the housing market (and the associated purchases of consumer durables such as appliances, carpeting, furniture, etc.) and motor vehicle sales. On the positive side, prices for oil and natural gas are well off their peaks in 2008, although they are still above their lows of earlier in the decade, and could rise slightly in 2010. Levy (2009: 24) predicts tire production will increase from 2009 levels with increased vehicle production and a likely increase in miles driven. Economic recovery also means that mergers and acquisitions probably will increase in 2010 (O'Reilly, 2010: 13).

At least some of the trends mentioned earlier are expected to continue into the foreseeable future. These include new resin production facilities in the Middle East and Asia, because natural gas is inexpensive in the former and rapidly growing markets are in the latter. Consequently, less capital will be invested stateside (O'Reilly, 2010: 19). The prices of oil and natural gas are volatile; when they are high, the competitiveness of producers in America is diminished. Under those circumstances, exports may be reduced, imports increased, and/or factories closed with associated jobs losses (O'Reilly, 2010: 18-19).

The long-term outlook for plastic and rubber products manufacturing (326) is for above average growth in output – about 3.6 percent annually. This incorporates the even faster-than-average rate of 4.1 percent forecast for plastic products (3261) and the below average rate of .3 percent of rubber products (3262) manufacturing (Figueroa and Woods, 2007).

The predicted output growth for the plastic and rubber products industry is not expected to lead to more jobs. Instead, a number of factors – including greater productivity – may lead to an overall net loss of jobs. Figueroa and Woods (2007) predicted national employment in the rubber group would fall 28.6 percent, from 159,300 in 2006 to 113,800 in 2016, more than offsetting the expected 2.0 percent gain from 637,600 to 650,500 in the plastics group. The Ohio Dept. of Job and Family Services' Labor Market Information division (ODJFS/BLMI, 2008) projected plastics group employment to fall 4.7 percent, from 49,300 to 47,000, rubber group employment to drop 37.8 percent, from 19,600 to 12,200, during the same time.[14]

See Table A14