

Manufacturing and Marketing: Vertical Integration in the U.S. Tire Manufacturing Industry, 1890-1980s

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Forward integration has been explained both as a method of achieving monopoly power and as a source of greater efficiency [6, 16]. An efficiency perspective underpins the work of Chandler and Williamson who regard vertical integration, particularly into distribution, as a crucial step in the creation and success of large firms. While their views have moved closer, Chandler and Williamson emphasize different motives for forward integration [4, 13]. Technology provides the fundamental dynamic in Chandler's account while Williamson concentrates on responses to the uncertainties of contracts.

Four propositions are advanced about motives for integrating manufacturing and distribution. First, Chandler identifies a phase in which new capital-intensive technology and mass production promote large firms in certain industries. Thus, "... the initial step in the creation of the modern industrial enterprise was the investment in production facilities large enough to achieve the cost advantages of scale and scope" [13, pp. 489-90]. The result is a technical imperative to maintain volume in manufacturing by integrating forward into distribution. Williamson assigns less importance to production and considers that a given technology may be consistent with differing degrees of integration. Second, Williamson [16] emphasizes transaction costs and asset specificity. Manufacturers are assumed to possess limited knowledge while independent distributors seek personal advantage at the producer's expense in any contract. The basic motive for forward integration is to improve the manufacturer's information and decision-making while reducing opportunism. Third, Chandler and Williamson agree that the threshold for forward integration is reduced where products require specialist marketing or after-sale services because these diminish the independent distributor's advantage (economy of scope) in selling the item within a broad product range [4, pp. 67-69; 17, pp. 111-14]. Thus, Chandler asserts that: "When a manufacturer's volume attained a scale that would reduce the cost of transporting, storing, and distributing his products to the level of that achieved by the wholesaler through volume economies, the intermediary lost his cost advantage" [13, p. 487]. Forward integration ensues but conceivably lags behind the initial achievement of mass production. Fourth, Chandler and Williamson rely on a survivors' test: the strategy which emerges or persists in the long term is assumed to be efficient or at least more efficient than any existing alternative. In this context Chandler stresses the importance of creating a management structure whose effectiveness in coordinating product flows crucially affects overall performance and responsiveness to technical pressures and incentives. Sound strategy and solid structure still require

correct implementation and remain vulnerable to old-fashioned entrepreneurial failure, albeit with a tinge of collective responsibility. In this fashion Chandler's dynamic forces of scale and scope are highly qualified. This paper examines the motives for forward integration in the tire industry, where manufacturers entered wholesaling by 1912 and moved into retailing from 1925. Backward integration, which varied by firm and function, is not examined here.

First, was mass production the "initial step" which triggered forward integration? As in other industries the precise timing of mass production is blurred. Its beginnings may be dated variously from the introduction of tire-building machines in 1909, the managerial hierarchies developed from 1912, the 1913 Akron strike over piece-rates and time study, or the construction of new factories specializing on the principal tire sizes around 1916. Such major innovations as Banbury mixers and conveyor systems for materials and tires were not adopted until the early 1920s. Broadly, mass production may be regarded as beginning around 1912, being well advanced by 1919, and firmly in place by 1926. An indirect influence was technical change in the automobile industry [8]. The results were impressive: capital-output ratios increased, labor productivity growth surpassed all other industries from 1909 to 1919, and new factories signaled greater asset specificity. The pace of change also created problems. Even new plants became congested, persistently high labor turnover inhibited efficiency, and tire assembly was only semi-automated.

Technical imperatives to forward integration presumably arose after 1912. Yet entry into wholesaling was well advanced by then and was initiated by firms of varying sizes. B.F. Goodrich, a mechanical goods and tire producer, opened a wholesale outlet in Chicago in 1890, moved decisively into wholesaling in 1898 as part of a managerial reorganization, and possessed 15 branches which handled 57% of sales by 1910. The firm also established tire depots. U.S. Rubber's branches were centralized in 1911 and the firm even owned retail stores. B.F. Goodrich and U.S. Rubber were the leading producers to 1909, but smaller firms also began wholesaling. Goodyear bought out four agencies in 1902 and had 55 branches which handled virtually all wholesaling by 1912. Firestone began as a carriage tire jobbing business, integrated back into manufacturing in 1903, and had absorbed wholesaling before adopting tire building machines, a key innovation, in 1912. Chandler's end result is apparent: manufacturers combined mass production and mass distribution, and the pioneers prospered. However, his sequence was reversed: entry into wholesaling preceded the achievement of mass production, and the primacy of volume or "throughput" in explaining forward integration is correspondingly diminished. Williamson's emphasis on asset specificity similarly fares poorly since forward integration preceded greater specialization of plants and machinery.

The key influence was the nature of demand. Tires were both an intermediate good sold to car makers and a consumer good sold to motorists. This division of the market reduced the threshold for forward integration. Original equipment (OE) sales to automobile producers accounted for around 30% of demand and provided known quantities of business in return for lower

profits. In this sense contracts met manufacturers' desire for volume. They also promoted forward integration via transaction costs. Goodyear sold OE tires through an agency before 1906 but solicited business direct after the agent switched suppliers. More significant, car firms demanded effective distribution by OE suppliers in order to service car owners. Firestone used a new tire and low prices to circumvent a patent pool and obtain the Ford Model N contract in 1906, but inability to guarantee national distribution forced Firestone to revert to a tire interchangeable with other makes [12]. The problem was tackled by standardization of tire sizes around 1909, but it illustrates the incentive for forward integration and explains Firestone's swift move into wholesaling. OE suppliers also faced financial and marketing pressures to maximize renewal business in order to offset lower OE earnings, to establish brand loyalty, and to benefit from association with particular cars.

Wholesaling, thus, was an essential support to OE contracting and volume whilst maximizing profits. The visible and invisible hands acted in concert. Expanding tire demand accelerated the trend, but mass production, Chandler's first step, was not the trigger. Market structure lowered the threshold for integration, but transaction costs and the establishment of brand loyalty were the key influences. Like sewing machines and agricultural machinery, mass marketing rather than mass production triggered the growth of large firms [9]. Tires might be treated as a case of specialist marketing reducing volume so far that forward integration was viable below the level of mass production or asset specificity set in very early. More simply OE contracts, wholesaling, and later mass production were responses to the surging derived demand and profits available.

A further option was backward integration by vehicle manufacturers. In the 1890s the Pope cycle interests acquired the neighboring Hartford Rubber Works to supply tires. Ford invested (disastrously) in a rubber plantation in the 1920s and produced some tires at River Rouge in the late 1930s before selling the equipment to the Soviet Union. General Motors contemplated such investment in 1930 but concluded that tires could be obtained below the cost of production. Automobile firms generally maintained long-term relationships with a few suppliers, set technical specifications, and offered contracts for specific percentages of their business on the basis of the lowest bid received. Firms at times added new suppliers or threatened to enter tire production. Such arrangements ensured continuity of supply, product quality, and low prices. At the same time tires were more complex and the renewal market was larger than for other components which automobile firms produced.

The second stage of forward integration was entry into retailing in the 1920s, a rare occurrence in U.S. industry since forward integration was generally confined to wholesaling. Retailing previously was the province of independent tire dealers and franchises; in the latter case manufacturers determined sales territories, provided marketing support, and gave discounts for large accounts, early orders, and prompt payment. Between 1926 and 1937 the dealers' share of retail sales declined from 91% to 53% and the gap was filled by a mix of private brand contracts and manufacturers entering retailing (Table 1). Private brands were sold to mass distributors and resembled OE

orders in trading off volume for lower prices and profits. Again volume could be pursued via contracts. By 1937 mail-order firms, by then direct retailers, accounted for 19% and oil companies for 17% of renewal sales. This development interestingly represented a partial retreat by manufacturers since mail-order firms fulfilled wholesale and retail functions for their business. Chain store and mail-order firms sold only their own brands, but oil company business was divided evenly between manufacturers' brands and private brands. Oil company sales, thus, were more open to brand loyalties.

TABLE 1
DISTRIBUTION OF RENEWAL TIRE SALES, 1926-1987 (%)

	Independent Dealers	Oil Companies	Mail-Order Chain Stores	Manufacturers' Stores
1926	91.2	0	8.8	0
1929	76.2	1.1	18.3	4.4
1933	65.9	8.4	14.7	11.0
1937	53.0	17.0	19.0	11.0
1947	51.7	23.1	19.3	5.8
1955	45.2	25.7	21.0	8.1
1960	41.5	25.8	24.3	8.4
1964	38.8	23.5	27.4	10.3
1972	56.0	15.0	19.0	10.0
1978	60.0	5.5	23.0	11.5
1987	68.0	2.0	17.0	13.0

Sources: [5, 7, 8, and *Modern Tire Dealer*, January 1988]

Small producers led private brand sales but were squeezed out by Goodyear, B.F. Goodrich and U.S. Rubber from the mid-1920s. Volume was important. When Goodyear obtained all Sears' business in 1926 the sales manager emphasized the "substantial guaranteed daily production." However he signaled a strategic aim, adding: "what is more important, it is one more move to definitely clinch for Goodyear the unquestioned leadership in the tire business." U.S. Rubber and B.F. Goodrich contracted with other mass distributors in the early 1930s.

Private brand contracts had transaction cost aspects. The largest were on a "cost-plus" basis which allowed for fluctuating rubber prices. Long-term deals with one or two suppliers simplified monitoring and encouraged investment. Asset specificity was created, though at the expense of volume in existing plants, when Goodyear established a southern factory following Sears' urgings. Goodyear also transferred common stock and cash to Sears in 1931 in return for a higher profit margin and to avert the threat of losing the

contract. U.S. Rubber purchased Montgomery Ward's earlier suppliers to ensure a regional spread of factories.

The mass distributors' emergence was accompanied by manufacturers establishing their own retail stores, which accounted for 11% of renewal sales by 1937. Did this entry into retailing reflect technology, asset specificity, transaction costs, or the equalization of economies of scope between producer and retailer? It certainly followed the realization of mass production, so ideas of throughput and asset specificity should be applicable. Yet there are indications that technical pressures had diminished. Reynolds suggests that maximum economies of scale accrued with a daily output of 1,000 casings in 1933, far below the scale of the largest plants [16]. Such conditions are consistent with a general desire for volume but imply that the leading firms' superiority was not simply a product of technical advantages. Bain claims that this situation persisted into the 1950s [5]. The marketing of cheaper second and third line tires to meet mass distributors' prices added to production costs.

Both independent dealers and mass distributors sold tires as part of general automotive businesses, which implies economies of scope. Dealers undertook servicing, retreading, or even sold electrical goods and furniture; Sears' tires retailed in its type C automotive stores. Tire manufacturers could then anticipate similar economies, but clearly the mass distributors were not failing, as Chandler assumes, to supply specialist distribution or precise scheduling of product flows [3, pp. 364, 486]. Sears may have revealed the potential of retailing to the manufacturers. It also seems improbable that mass distributors' economies of scope were exhausted almost instantly. Firestone's retail stores lost \$7 million between 1928 and 1933; indeed the firm began manufacturing batteries and brake linings for its stores, which suggests that entry into retailing occurred despite continuing economies of scope rather than because such savings could be realized solely from tires. Mass distributors and company stores conceivably obtained equal economies, but the mass distributors' combined sales in 1937 were three times those of all company stores. This hardly suggests equality of internal and market costs.

Developments in retailing were rooted in changing markets. As new car sales became more volatile, renewal demand assumed greater significance at a time when improving tire life was sharply reducing the frequency of tire purchases. The dynamic element was not volume, throughput, asset specificity, or opportunism per se, but strategic and price competition in shifting markets. When mass distributors used only one or two suppliers there was insufficient business for all leading firms and Sears' lower prices disrupted existing competition. Firestone lacked private brand contracts and responded to Sears' growth by developing a network of 423 company stores by 1934. Manufacturers had supported dealers with advertising and sales advice. Firestone began to increase financial support to existing dealers, but initial partnerships developed into full control as the depression sapped dealers' finances [12, pp. 186-87, 204]. Other leading firms reacted strategically by opening outlets in urban areas, and stores became a means of promoting brand loyalty and, in turn, higher profits.

While volume and strategic rivalry were the primary motives, transaction cost elements can be discerned. Stores provided a defense against

sudden termination of private brand contracts. When the Sears-Goodyear contract ended in 1936, following an FTC order and the Robinson-Patman Act, the manufacturer relied more on its stores. Sears established a long-term relationship including stock ownership with Armstrong Rubber, previously a minor firm. Company stores provided greater control over discounts to commercial account and individual customers in the competitive markets of the 1930s. This may have countered opportunistic price-cutting by dealers. Yet producers were sanctioning discounting at the time, so direct control simply gave formal recognition to such practices. There was little immediate stability. Company stores operated at a loss in the early 1930s, Goodyear's stores applied maximum discounts regardless of turnover, and private brands ensured vigorous price and warranty competition.

After 1945 manufacturers employed a mix of contracts and forward integration. Company stores lost market share as manufacturers relied on buoyant OE and private brand sales to 1955, but stores were more profitable than in the 1930s. FTC decisions restricting "override" contracts effectively compelled oil companies rather than manufacturers to handle sales to franchised service stations. Then OE demand slackened and manufacturers opened more stores during intense price competition around 1959 [5]. Medium-sized firms, such as General and Mansfield, captured the initial rise in market share until Goodyear and Firestone acquired several retail chains in the early 1960s and substituted their brands for distributors' labels. At the same time Firestone entered the private brand field and was less reliant on company stores for volume.

From 1973 the industry encountered depressed demand, the swift adoption of more durable radial tires, and a rising quantity of imported vehicles. The impact was dramatic. Radials required more materials, new machinery, and improved quality control; production became more capital-intensive though more labor was involved in tire assembly [5, 10]. Technical imperatives to maximize volume increased, but radial design and quality were the critical factors. In the late 1960s U.S. manufacturers shied away from radials in favor of bias-belted tires which involved less new investment. Radials were thought likely to encounter consumer resistance by ending the soft ride characteristic of American cars. Recession and rising oil prices, however, prompted Detroit to adopt the fuel-efficient radials rapidly from 1973. Radials' durability, rising fuel costs, and lower speed limits dampened renewal demand. The division of the tire market accelerated product innovation which in turn forced changes in production and substantial new investment. OE suppliers were forced to lead the product innovation, but the earlier hesitation had conceded leadership in radial technology to Europe. Emphasis on the product was increased by the introduction of federal grades for traction, treadwear, and temperature resistance. There also was closer regulation of tire advertising. The industry resisted federal standards on the grounds that uniform testing was impractical, but marketed "performance" tires for fast cars using grades for traction and other characteristics.

Since 1970 company stores have steadily gained market share with a widening gap between the large networks of Goodyear and Firestone and those of other firms. B.F. Goodrich and Uniroyal (formerly U.S. Rubber)

reduced their stores and then combined their tire divisions in a separate firm. Store ownership may have given some protection via brand loyalty as Goodyear and Firestone struggled to produce radial tires. In the 1980s, as half a century earlier, Firestone's stores re-emphasized the supply of full automotive services at a time of weak OE sales. Franchising again provided a means of partial integration. As in the 1930s depressed demand and improved tire life initiated a new round of warranty competition. Yet oil companies contracted tire retailing by moving away from full-service stations to focus on their core business, and tire dealers regained ground. There were more multiple outlets in the dealers' sector so economies of scope remained, but dealers also benefited from handling increasing imports and the closure of B.F. Goodrich and Uniroyal stores. Michelin recently has acquired retail outlets and Bridgestone and Continental have purchased Firestone and General Tire respectively and thus obtained established networks.

Did forward integration determine performance? A general survivors' test offers considerable support for Chandler's link between integration and performance. Tire manufacture has become the province of large, vertically-integrated firms through a recurring shake-out of small and medium-sized producers. The four largest firms accounted for 50% of sales in 1921, 75% in 1937, and 75% in 1978. Volume has increased, the industry is more capital-intensive, and Goodyear, the dominant firm since 1916, possesses most retail stores. Small firms are less integrated. The last significant domestic entrant was General Tire in 1916 which integrated forward despite lacking OE business until the 1950s. Multinational investment has come from Dunlop (since 1923), Michelin (1906-1930 and from 1968), and more recently Bridgestone, Continental, and Pirelli.

Yet the motives and value of forward integration have varied. Between 1900 and 1912 wholesaling was a vital support to growth through OE contracts. Retail stores in the 1920s were a means of promoting brand loyalty in increasingly competitive markets and became a method of exerting financial strength through discounting in the 1930s. In the post-war era stores still encouraged brand loyalty, but since 1970 have been less significant than expertise in radial design and manufacture. Firestone's successful marketing of its "500" steel radial tire became a liability due to product failures, and federal pressure led to the recall of 14 million tires in 1978.

OE and private brand contracts have been of major importance. The successful challenge of Goodyear and Firestone to the industry leaders between 1910 and 1916 was triggered by their OE contracts with Ford and General Motors. The most successful firm in the 1930s was U.S. Rubber, whose renewal market share increased from its 1920s average of 6.8% to 15.4% in 1932 and 31% in 1940 [2, p. 309]. However, U.S. Rubber closed its stores in the 1930s, so involvement in retailing made no contribution, to the marketing department's dismay. OE and private brand contracts explain U.S. Rubber's resurgence. In 1929 U.S. Rubber captured half of General Motors' business, a firm controlled, like U.S. Rubber, by the DuPonts. GM sought to take advantage of depressed raw material prices through a contract in which raw materials in its tires were charged at current market rates; after negotiations with other firms a contract was signed with U.S. Rubber in 1931.

U.S. Rubber also increased sales to Ford and contracted with Montgomery Ward and oil companies. The firm used the advantages of association with GM cars and the mass distributors' private brand business to expand sales. U.S. Rubber's links to GM survived the DuPont's enforced divestiture of its GM stock in 1962, but U.S. Rubber had resumed a stores program in 1959 as the anti-trust suit proceeded. Reasonable growth was possible without retail stores if private brand business could be retained. Armstrong has become a significant firm through being Sears' principal supplier since 1945. Product quality and OE contracts have underpinned Michelin's recent success in a similar fashion to Goodyear and Firestone, 1909-1916, or U.S. Rubber in the 1930s. Michelin's initial inroads came from contracts with Sears and Ford for top-quality radial tires, and the firm's technical advantage offset reliance on dealers, especially as the radial's longer life delayed renewal demand. The entry of Bridgestone and its acquisition of Firestone followed in the wake of the Japanese automobile firms' penetration of the U.S. market.

Chandler's stress on the relative efficiency of administrative coordination has some applicability. The emergence of Goodyear and Firestone after 1910 probably included superior organization or management. Goodyear and Firestone's management structures proliferated after 1910 and the tire specialists performed better than the more diversified B.F. Goodrich and U.S. Rubber who possessed similar technology. Equally, institutional impressions of control often were undermined by the staggering pace of growth. At Goodyear, as in many large corporations, the 1920-21 recession revealed evidence of imprecise control over finance, purchasing, and credit provisions, and forced a reorganization. New management, clearly self interested, criticized Goodyear's sales and production departments. Firestone lambasted his own organization for its faults. Both firms owed more to the entrepreneurial style of their respective founders, Frank A. Seiberling and Harvey S. Firestone, in seizing OE business than to coherent organization. The latter, like mass production, became more evident in the 1920s. Organizational influences also were evident in U.S. Rubber's revival around 1930, which included managerial and factory reorganizations by F.B. Davis, a former DuPont executive [2].¹ Yet success still depended on contracts not integration. Michelin's challenge rests on its radial technology in the context of higher oil prices in the 1970s.

Forward integration has been a supportive rather than a dynamic element in company performance. A mix of private brand contracts and company stores rather than integration per se determined performance. The counterbalance to volume via private brand and OE contracts was low earnings. The value of company stores lay in their strategic role in depressed markets. Ironically, OE and private brand contracts contributed to forward integration but ensured intense competition and modest returns so that an oligopolistic market structure has not yielded monopoly profits.

¹The DuPont's envisaged selling the tire division, retaining U.S. Rubber's plantations, and acquiring Goodyear's plantations. The idea proved impractical.

Manufacturers also employed other strategies. New work practices and longer shifts have been obtained by locating radial capacity in the South [10]. A tension exists between volume production and the marketing of a range of sizes and designs which could improve profitability. Leading firms absorbed other manufacturers in the 1920s, 1930s, and 1960s in order to produce and market cheaper tires and private brands without debasing their major brand names. The variety of tires has been reduced periodically and then proliferated again. Since 1970 "all-season" tires, marketed as alternatives to specialist snow tires have increased their share of renewal sales from 1.4% in 1977 to 55.1% a decade later. Yet profits from specialist markets favor such product differentiation as "performance" tires.

Conclusion

Chandler and Williamson provide powerful and persuasive models of corporate development, and elements of the technology and transaction cost approaches to forward integration can be applied in tire manufacture. Yet neither provides a full explanation. There are dangers of understating the persistence of contractual relations and the importance of market sub-divisions in affecting marketing strategy and profitability. In tire manufacturing forward integration preceded mass production, thereby undermining Chandler's emphasis on volume and technology. If the primacy of mass production is abandoned then Chandler's linking of production, distribution, and organization is useful, provided the role of contracts is emphasized. In the 1920s forward integration went further, but did so in conjunction with the rise of mass distributors rather than because their services were deficient or their economies of scope had been exhausted. Far from failing, the mass distributors triggered change. Transaction costs give a partial explanation, but are a rather static concept. Williamson's view of opportunism as ever present requires the introduction of further influences to account for the timing of forward integration. Price and strategic competition require emphasis. Opportunism is rather all-embracing and understates other obstacles to fulfilling contracts, such as financial resources. From the 1970s forward integration took second place to product innovation as technology altered fundamentally. Tires are perhaps a curious case, but the industry's history indicates that the role and value of forward integration are not fixed.

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