Pluralistic Competition:
with an illustrative case study of
the rubber tire industry

by

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Dissertation

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Aug 1940

[Signature]
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PART THREE: AN ILLUSTRATIVE CASE

PLURALISTIC COMPETITION IN THE PRODUCTION AND DISTRIBUTION
OF RUBBER TIRES

1. Introduction

The economic activities of what is commonly called "the rubber tire industry" have been discussed many times before now, but never with the orientation of the student of pluralistic competition.

With sharp variations in the comprehensiveness of their study, in the particular aspects which they have chosen to emphasize, and in the purposes for which their analyses have been designed, economists, government officials, lawyers, journalists, and business men have devoted much attention to the problems of this industry. Various-ly they have described and analysed, criticized, praised, and lamented, and some have even predicted with respect to the competitive policies of the congeries of allied and conflicting business units concerned with the production

1 Cf. subsequent citations in this chapter.
and distribution of rubber tires.

General agreement has been reached on some points, and many of the facts which have been unearthed in these investigations are well known. For instance, on the supply side it is generally accepted that the tire industry is particularly sensitive to changes in the price of its principal raw material, an import which has been controlled by successive alliances of foreign rubber producers. On the demand side, where the market for tires is primarily a function of the production and use of automobiles, it is recognized that tire producers are obliged to face the competitive policies of many different kinds of customers. These range all the way from the monopsonistic (or oligopsonistic) automobile manufacturers who constitute the "original equipment market," through varying types of large scale automobile users such as government agencies, major industrial corporations, and taxi, trucking and bus companies, the sales to which are usually handled by tire producers or their subsidiaries as "national and commercial accounts," to the individual automobile users whose purchases provide the "renewal" (or "replacement") market." And this market is served directly by tire manufacturers' owned retail stores or indirectly by independent tire dealers, and by such mass distributors as mail-order houses, automotive supply chains, and oil companies. It is well known that
concentration has proceeded apace in the industry with production coming to be dominated by a small number of corporations, especially the so-called "Big 4", and with the mass-distributors tending to displace the independent dealers. The most spectacular aspect of the industry, however, and the problem which has singled it out for special study is the widely recognized claim that even while the products of the industry have been vastly improved in quality and lowered in cost of production and price, this service to the ultimate consumer has not been rewarded by large profits to the business units involved. This low profitability has been attributed to the violence of "competition" in the industry, especially during the decade following 1926.


These facts and interpretations, and many more, can easily be discovered by any student who is willing to search through the scattered writings on the subject. Nowhere, however, can he find a systematic treatment of the nature of this allegedly violent competition. There are no comprehensive studies that carefully identify the various business units concerned, and the areas in which they conflict and ally, that examine their tactics in these areas, nor that try to gauge the relative importance of the areas of conflict, and the relative intensity of the competition in these areas.

The following pages propose to attempt such a treatment, to integrate the existing data regarding the rubber tire industry and its ramifications by focusing attention on the principal policy-forming units concerned with tires, and by piecing together the fragmentary information on their competitive policies. By describing these units and their tactics as manifestations of pluralistic competition, an illustrative case, and, it is hoped, a test will be provided of the methodological hypothesis advanced in the preceding chapter. In an effort to indicate the relative strength of the various policy-forming units, the relative importance of the major areas of conflict and alliance, and the relative intensity of competition, at present and as they have changed over time, such quantitative data as
are available will be included. It must be recognized, of course, that at best these are crude yardsticks, and that the analyst of reality cannot isolate his data and measure the effectiveness of a single policy at a time, but can only gauge the net effect of a number of simultaneous tactics.

The writer hopes, however, that his analysis will serve two important purposes:

(1) To describe the inter-related competitive policies of business units concerned with the production and distribution of tires in a more comprehensive and intelligible fashion than has been done previously, and to bring the earlier studies up to date.

(2) To suggest areas where further data must be gathered if our understanding of the consequences of these policies is ever to be clarified.

2. Identification of the Policy-forming Unit

As a point of departure for the study of the almost endless network of competitive inter-relations

Wherever possible, quantitative measures will be carried up through the calendar year 1936. In some instances, however, this is not feasible. For instance, data from the Census of Manufactures are available only through 1937. In addition, much significant material can be found in studies completed in 1933, 1934, and 1935, such as the publications of the NRA Division of Review, and the Federal Trade Commission Docket No. 2116.
among units involved in the manufacture and sale of tires, we shall center our study on a single set of quasi-homo-
geneous business units and examine other units only in so
far as their policies have direct relevance to the com-
petitive adjustments of these central units. The conflict
and avoidance of conflict among these heterogeneous units
themselves will receive only incidental mention.

As our central units, from which all subsequent
analysis will stem, we shall select the manufacturers of
tires. There are several advantages to this selection.
The actual units concerned with tire manufacture most
nearly approximate the "firms" in the tire "industry" as
conceived in imperfect competition theory, and thus
would commend themselves to the attention of the economic
theorist. They are the units which, at least until 1927,
dominated the industry; hence they would appeal to the
institutionalist as a legitimate starting point for his
investigations. Finally, they are suitable to the analyst
of pluralistic competition for, as we shall see, they
not only compete and cooperate among themselves directly,
but also do so indirectly through their competitive rela-
tions with more heterogeneous units even while these
other units are competing and cooperating among them-
selves.

At first glance the identification of the
central policy-forming units engaged in the manufacture
of tires seems an easy task, but any exact definition of these units presents considerable difficulties. Integration and diversification within the industry, the complications of modern corporate structure, differences in the size, strength, organization, and control of the producing units all are factors which must be taken into account before we can properly speak of tire manufacturers as meaningful units in pluralistic competition.

The following pages will attempt to draw some of the most essential distinctions.

3. Rubber Manufacturing and the Tire Industry

First of all, it must be recognized that the manufacturing of tires is only a part, albeit a major part, of the rubber manufacturing industry. This industry, which has grown from small beginnings one hundred years ago, has been dominated by its tire output only for the past three decades.

Although rubber was sold commercially in England as early as 1770, when it allegedly gained its name by Dr. John Priestley's discovery that the substance was excellently adapted to the purpose of wiping from paper

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5 See Table 1, next page.
<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Establishments</th>
<th>Average Number of Earners (000's)</th>
<th>Value of Products (millions of dollars)</th>
<th>Rubber Consumption (000's of Long Tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1849</td>
<td>36</td>
<td>2.6</td>
<td>3.0</td>
<td>1.0</td>
</tr>
<tr>
<td>1859</td>
<td>37</td>
<td>3.0</td>
<td>5.9</td>
<td>1.5</td>
</tr>
<tr>
<td>1869</td>
<td>56</td>
<td>6.0</td>
<td>14.6</td>
<td>3.8</td>
</tr>
<tr>
<td>1879</td>
<td>104</td>
<td>11.8</td>
<td>25.5</td>
<td>7.5</td>
</tr>
<tr>
<td>1889</td>
<td>167</td>
<td>20.2</td>
<td>42.9</td>
<td>15.0</td>
</tr>
<tr>
<td>1899</td>
<td>301</td>
<td>36.6</td>
<td>99.9</td>
<td>20.3</td>
</tr>
<tr>
<td>1904</td>
<td>265</td>
<td>43.9</td>
<td>148.0</td>
<td>26.1</td>
</tr>
<tr>
<td>1909</td>
<td>267</td>
<td>49.3</td>
<td>197.4</td>
<td>39.8</td>
</tr>
<tr>
<td>1914</td>
<td>342</td>
<td>74.0</td>
<td>301.0</td>
<td>62.3</td>
</tr>
<tr>
<td>1919</td>
<td>477</td>
<td>158.5</td>
<td>1138.2</td>
<td>215.0</td>
</tr>
<tr>
<td>1921</td>
<td>496</td>
<td>103.3</td>
<td>709.9</td>
<td>177.8</td>
</tr>
<tr>
<td>1923</td>
<td>529</td>
<td>137.9</td>
<td>958.5</td>
<td>319.4</td>
</tr>
<tr>
<td>1925</td>
<td>530</td>
<td>141.9</td>
<td>1260.8</td>
<td>388.5</td>
</tr>
<tr>
<td>1927</td>
<td>516</td>
<td>142.0</td>
<td>1225.1</td>
<td>373.0</td>
</tr>
<tr>
<td>1929</td>
<td>525</td>
<td>149.1</td>
<td>1117.5</td>
<td>467.4</td>
</tr>
<tr>
<td>1931</td>
<td>453</td>
<td>99.3</td>
<td>614.3</td>
<td>355.2</td>
</tr>
<tr>
<td>1933</td>
<td>408</td>
<td>106.3</td>
<td>472.7</td>
<td>412.4</td>
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<tr>
<td>1935</td>
<td>466</td>
<td>114.7</td>
<td>677.6</td>
<td>491.5</td>
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<tr>
<td>1927</td>
<td>477</td>
<td>129.6</td>
<td>882.5</td>
<td>543.6</td>
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(a) Adapted from P.W. Barker, Rubber Industry of the United States, 1839-1939 (Washington, D.C.: Government Printing Office, 1939), p.13, Table 2. Barker's table was followed by the following caution: "All data are not exactly comparable, owing to changing schedules of the Bureau of the Census and to changes in the industry, but it is believed that general trends are accurate. Cf. Fourteenth Census of the United States, Vol. 10, Manufactures, 1919, Reports for Selected Industries, pp.993-1003."
the marks of a black lead pencil," it was first used in manufacture in 1823 when Charles McIntosh of Glassgow waterproofed garments by applying to them a solution of rubber in coal-tar naptha. A similar enterprise marked the entrance of rubber manufacturing in the United States when in 1832 a Mr. Chaffee organized the Roxbury India Rubber Company. After a short success this industry collapsed when it was discovered that its products could not withstand changes in temperature, becoming sticky in heat and cracking in cold weather.

In 1839 this difficulty was overcome by Charles Goodyear's discovery of the vulcanization process, by which the compounding of sulphur with crude rubber, followed by the application of heat, created a product which would retain its shape even while being flexible. Thereafter a number of rubber manufacturing

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7 Ibid., p.24.


9 Ibid., p.500.
companies were established, centered chiefly in Springfield, Watertown, Chicopee Falls, and Boston, Massachusetts, and Passaic, New Jersey.

The principal products of the early industry included rubberized clothing, footwear, life-preservers, and such small articles as balls and erasers. Of these, rubber footwear was the product of leading importance in manufacture until about 1909. The development of several other products, however, contributed significantly to the expansion of rubber manufacturing. Hose, belting and mechanical rubber goods occupied a prominent place in the industry after 1870. By 1890, carriage and bicycle tires began to constitute a large proportion by value of rubber goods produced, and at the turn of the century automobile tires came to play an important role in the industry, achieving first rank within a decade, and continuing to grow with the automobile industry until reaching its peak in 1925 when more than 65% of the value of all rubber manufactures was concentrated in tires.

13 See Table 2, next page.
Table 2

Growth of the United States Rubber Tire Manufacturing Industry, 1909-1937 (a)

<table>
<thead>
<tr>
<th>Year</th>
<th>(A) Number of Establishments (000's)</th>
<th>(B) Average Number of Earners ($ millions)</th>
<th>(C) Value of Tires and Tubes Produced ($ millions)</th>
<th>(D) Value of Tires and Tube Output as a Percentage of Value of Products of Rubber Tire Manufacturing Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>1909</td>
<td>227</td>
<td>26.5</td>
<td>128.4</td>
<td>.....</td>
</tr>
<tr>
<td>1914</td>
<td>301</td>
<td>50.2</td>
<td>223.6</td>
<td>.....</td>
</tr>
<tr>
<td>1919</td>
<td>437</td>
<td>119.8</td>
<td>987.1</td>
<td>.....</td>
</tr>
<tr>
<td>1921</td>
<td>178</td>
<td>55.5</td>
<td>496.1</td>
<td>450.3</td>
</tr>
<tr>
<td>1923</td>
<td>160</td>
<td>74.0</td>
<td>644.2</td>
<td>569.1</td>
</tr>
<tr>
<td>1925</td>
<td>126</td>
<td>61.6</td>
<td>925.0</td>
<td>824.5</td>
</tr>
<tr>
<td>1927</td>
<td>109(c)</td>
<td>78.3</td>
<td>869.7</td>
<td>779.5</td>
</tr>
<tr>
<td>1929</td>
<td>91(c)</td>
<td>83.3</td>
<td>770.2</td>
<td>676.9</td>
</tr>
<tr>
<td>1931</td>
<td>48(c)</td>
<td>49.2</td>
<td>406.3</td>
<td>366.9</td>
</tr>
<tr>
<td>1933</td>
<td>44(c)</td>
<td>53.0</td>
<td>299.3</td>
<td>256.5</td>
</tr>
<tr>
<td>1935</td>
<td>42</td>
<td>57.1</td>
<td>446.1</td>
<td>374.3</td>
</tr>
<tr>
<td>1937</td>
<td>48</td>
<td>63.3</td>
<td>575.9</td>
<td>478.8</td>
</tr>
</tbody>
</table>

(a) Adapted from Biennial Census of Manufactures, 1921, p.1172; 1927, pp.780,782; 1933, pp.372, 375; 1937, pp.776, 786.

(b) The Census classification for these dates included mechanical rubber goods with tires and tubes, hence data are not strictly comparable before and after 1921 when the classification was revised. Cf. Biennial Census of Manufactures, 1921, p.1167.

(c) According to Leigh, op. cit., p.181, A.L. Kress, Deputy NRA Administrator of the Rubber Tire Industry, in an unpublished study entitled A Forecast of Rubber Tires - 1940, claims that of the establishments tabulated by the Bureau of the Census only the following were active: 1927 - 92, 1929 - 62, 1931 - 32, 1933 - 32.
A complicating element for the analyst trying to identify the tire manufacturers arises from the way in which this industry has grown. As we shall see, some of the major tire manufacturers were rubber goods manufacturers long before they produced tires, others entered the industry as producers of carriage and bicycle tires and expanded into automobile tires with the development of the automobile industry, and still others entered later to make automobile tires only to branch out into other rubber products once they were established.

Table 2 offers a crude quantitative measure of the recent extent of this diversification of production among the business units occupied with tire manufacture. Columns (A) and (B), showing the changes in the number of establishments and in the number of individuals employed in the industry, may be disregarded for the moment, since later discussions will point to the decline in numbers as a sign of the intensity of competition and to the increase in the productivity of labor as a mitigating structural adjustment. Columns (C), (D), (E) and (F), however, give a rough indication of the relative importance to rubber manufacturers of their tire and tube output. Column (C) shows the "selling values, f.o.b. factory" output. Column (C) shows the "selling values, f.o.b. factory"

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of all the products manufactured by the establishments
classified by the Census Bureau as members of the Rubber
Tire Industry. Column (D) presents similar values for
all tires and tubes produced in the United States by
these or any other establishments. The excess of (C)
over (D) represents for each date the value of production
of goods other than tires by the units which are primarily
tire manufacturing plants, and suggests the existence of
areas which demand other competitive policies than those
connected with tires. The declining relative importance
of tires to these units is expressed by Column (E), while
Column (F) indicates the changing proportional signifi-
cance of tires and tubes to the total value output of all
units classified as members of the rubber industry.

It must be remembered that these figures are
aggregates, and, as such, contain all the false simplicity
of an arithmetic average if they are interpreted as repre-
sentative of all units. The relative interest of independ-
dent rubber manufacturing units in the tire market and the
intensity of their competition with respect to tires can

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15 *Ibid.*, pp.5, 7. Plants are generally counted separately
unless there are two or more under common ownership in
the same locality. Each plant is classified in its "in-
dustry" according to its product or group of products of
chief value.

16 Secondary production of all rubber goods is about .5% of
the total produced within the industry as classified by
the Census, so it is safe to assume that the secondary
production in tires is negligible.
only be ascertained when these aggregate data are broken down in much more detail.

In addition, not too much significance must be attached to the absolute figures of dollar values, except as possible indications of potential money income to the aggregate of tire producing units. As indications of the growth or decline of the industry they tend to be misleading unless they are qualified by reference to changes in prices and the volume of production. The 1919 peak in value of products, for instance, is largely attributable to the high prices of the immediate postwar period, while the decline from 1925 through 1928 is conditioned by the fact that prices fell relatively more than production increased during that period.

Table 3 on the following page indicates the changes in production and prices of tires and tubes since 1921. The production data are believed to be reasonably accurate, but the price index is of doubtful significance.

And to the inclusion of mechanical rubber goods with tires and tubes in the Census data for that year. Cf. supra, p.75, Table 2, note (b).

The Bureau of Labor Statistics receives fifty-six quotations from three tire manufacturers, twenty-one quotations for inner tubes, and fourteen for truck and bus tires. These quotations are weighted in accordance with the production statistics of the Bureau of the Census. Since 1935, these weights have been as follows: Balloon tires - 53,984,000, Inner tubes - 61,605,000, Truck and bus tires - 5,477,000. Cf. P.W. Barker, "Rubber Industry in the United States," op. cit., p.28.
### Table 3

**Production and Prices, Automobile Tires and Tubes, 1921-1938**

<table>
<thead>
<tr>
<th>Year</th>
<th>Production (000's)</th>
<th>Price Index (1926-100)</th>
<th>Index of Production</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Pneumatic Casings</td>
<td>Inner Tubes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Monthly Average</td>
<td>Monthly Average</td>
<td></td>
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<tr>
<td></td>
<td>(000's)</td>
<td>(000's)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1921</td>
<td>2424</td>
<td>3011</td>
<td>47.2</td>
</tr>
<tr>
<td>1922</td>
<td>2411</td>
<td>4237</td>
<td>66.6</td>
</tr>
<tr>
<td>1923</td>
<td>3772</td>
<td>5010</td>
<td>73.5</td>
</tr>
<tr>
<td>1924</td>
<td>4303</td>
<td>5832</td>
<td>83.8</td>
</tr>
<tr>
<td>1925</td>
<td>5071</td>
<td>6885</td>
<td>99.0</td>
</tr>
<tr>
<td>1926</td>
<td>5134</td>
<td>5844</td>
<td>100.0</td>
</tr>
<tr>
<td>1927</td>
<td>5370</td>
<td>6686</td>
<td>104.6</td>
</tr>
<tr>
<td>1928</td>
<td>6435</td>
<td>5736</td>
<td>126.5</td>
</tr>
<tr>
<td>1929</td>
<td>5727</td>
<td>4568</td>
<td>111.6</td>
</tr>
<tr>
<td>1930</td>
<td>4247</td>
<td>4028</td>
<td>82.7</td>
</tr>
<tr>
<td>1931</td>
<td>4062</td>
<td>3074</td>
<td>79.1</td>
</tr>
<tr>
<td>1932</td>
<td>3340</td>
<td>3546</td>
<td>65.0</td>
</tr>
<tr>
<td>1933</td>
<td>3775</td>
<td>3856</td>
<td>73.5</td>
</tr>
<tr>
<td>1934</td>
<td>3726</td>
<td>3920</td>
<td>72.8</td>
</tr>
<tr>
<td>1935</td>
<td>4113</td>
<td>4753</td>
<td>80.1</td>
</tr>
<tr>
<td>1936</td>
<td>4670</td>
<td>4854</td>
<td>91.0</td>
</tr>
<tr>
<td>1937</td>
<td>4442</td>
<td>4088</td>
<td>86.5</td>
</tr>
<tr>
<td>1938</td>
<td>3349</td>
<td>3154</td>
<td>65.0</td>
</tr>
</tbody>
</table>

**Notes:**

(a) Survey of Current Business, 19 (May, 1939), pp. 16-17, raised to industry totals from original data gathered by the Rubber Manufacturers Association.

(b) Computed.

CHART A
PRODUCTION AND PRICES
AUTOMOBILE TIRES AND TUBES, 1922-38
1926=100
SOURCE: TABLE 3
except to portray a general trend, inasmuch as such complicating factors as improvement in the quality of the product, increases in the size and particularly in the weight of tires, product differentiation, shading from the listed price and other forms of quasi-price competition have become so widespread in the tire industry that the quoted price becomes a fiction. For purposes of rough comparison of trends, however, the production figures are converted into an index with the same base period as the price data. (See also Chart A.)

Several important characteristics of the industry as a whole stand out in this table: First, there has been a sharp decline in prices, even when no account is taken of cuts from list prices and of quasi-price competition. That this is not a readjustment from abnormally high postwar prices can be seen by the fact that on the same base, the price index number for 1913 was 207.2. The downward price trend which was not significantly reversed until 1936 may give us a clue to the intensity of competition in the industry, while the rise in 1937 and 1938 seems to suggest that recent years have seen something of a cessation of price hostilities. Second, and a relatively minor point, the ratio of production of tubes to tires has fallen steadily. This is a sign of product improvement. Third, the 1920's was a period of considerable expansion in the industry as a whole, as measured by the volume of production, but the
recovery from the depression of 1929-1932 has not at-
tained the earlier high levels. This left the industry
with a serious problem of overcapacity during the early
1930's, and is often counted as one of the major reasons
for the violence of competition among tire manufacturers
at that time. Each manufacturer strove to maintain the
level of his own production in the face of a declining
total demand, and as each tried to increase his relative
share of the market, conflict became bitter.

Table 4 (next page) will show some of the
most widely quoted estimates of total and unused capacity
in the industry. The differences in these estimates can-
not be fully reconciled. The Kress estimate (d) is based
upon an assumption of 281 days operation per year, and a
daily capacity of 350,000 tires. (Because of the season-
ality of production, Kress holds that in order to meet
the peak load the industry should have a "stand-by" capacity

Data for 1939, recently come to hand, indicate that while
total tire output as measured by number of casings pro-
duced is still 17% below the 1929 level, the tonnage of
1939 output of tires exceeds 1929 by about 17%. This is
attributable to the increased size of modern tires and to
the growing proportion of tire output devoted to the pro-
duction of truck, bus, and tractor tires. Cf. Goodyear
Tire and Rubber Company, 41st Annual Report to Stockholders
(Akron, Ohio: February, 1940), p.34. Cf. also infra, pp.84-85

There is a 36% variation from November, the low month,
to the high in April. A.L. Kress, op. cit., p.9.
<table>
<thead>
<tr>
<th>Year</th>
<th>Estimated Practical Capacity (000's of tires per year)</th>
<th>Percentage of Practical Capacity Utilized</th>
</tr>
</thead>
<tbody>
<tr>
<td>1921</td>
<td>45,645(a)</td>
<td>59.8(a)</td>
</tr>
<tr>
<td>1922</td>
<td>46,480(a)</td>
<td>88.1(a)</td>
</tr>
<tr>
<td>1923</td>
<td>61,840(a)</td>
<td>73.5(a)</td>
</tr>
<tr>
<td>1924</td>
<td>62,000(a)</td>
<td>82.0(a)</td>
</tr>
<tr>
<td>1925</td>
<td>64,692(a)</td>
<td>90.9(a)</td>
</tr>
<tr>
<td>1926</td>
<td>65,634(a)</td>
<td>87.6(a)</td>
</tr>
<tr>
<td>1927</td>
<td>74,501(a)</td>
<td>85.3(a)</td>
</tr>
<tr>
<td>1928</td>
<td>86,691(a)</td>
<td>87.1(a)</td>
</tr>
<tr>
<td>1929</td>
<td>91,600(a)</td>
<td>76.2(a)</td>
</tr>
<tr>
<td>1930</td>
<td>106,000(b)</td>
<td>65.8(b)</td>
</tr>
<tr>
<td>1931</td>
<td>91,600(a)</td>
<td>56.3(a)</td>
</tr>
<tr>
<td>1932</td>
<td>.......</td>
<td>.......</td>
</tr>
<tr>
<td>1933</td>
<td>82,026(c)</td>
<td>54.0(c)</td>
</tr>
<tr>
<td>1934</td>
<td>98,500(d)</td>
<td>.......</td>
</tr>
</tbody>
</table>


of 80 million tires in order to produce 69 million tires annually. The Rubber Manufacturers Association estimate assumes 6,000 hours annual operation of each plant, the industry as a whole having a capacity of 13,671 tires per hour. The Standard Statistics estimate is based on 252 days' operation per year. The Brookings figures are drawn from data provided by a single tire manufacturing company, and can be counted as accurate only to the degree that that company's estimates are representative of the industry.

A further difficulty involved in these estimates, and one which has deterred students of the industry from making similar estimates for more recent years, arises from the fact that adequate measurement of capacity in the tire industry is dependent on more than a mere count of the number of molds owned by all the tire manufacturers. The significance of such a count is questionable not only because the molds used in shaping a 6:00 X 16 tire cannot be compared with truck tire molds, but also because a notable increase in the weight of all types of tires can

21
The 1939 production.

22
Assuming, of course, that all the producers have the same seasonality of production, and that seasonal variations cannot be alleviated by producing for inventory in the low months.

23
From the Commercial Research Department, United States Rubber Company.
be discerned over the years. Even though a company might have mold capacity to produce many more tires than it does, its effective productive capacity would be far less than its mold capacity if it lacked the machinery needed to mix the material required in the present day heavier tire.

Granting, therefore, that the estimates in Table 4 can be accepted as meaningful only with sharp qualification, they nevertheless indicate some indisputable changes that have occurred in the tire manufacturing industry. Although there may have been variations among individual companies, they show that a large amount of plant expansion took place in the industry as a whole during the 1920's, especially from 1927 to 1929, and that disinvestment between 1930 and 1934 did not keep pace with the decline in total production during these years.

As corroboratory evidence, it is reported that four major tire companies increased their plant investment by 32% ($82,000,000) between 1927 and 1930, while during that same period a fifth company wrote off $4,000,000. A similar tabulation indicates that the

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24 Letter from C.W. Halligan, Assistant Secretary, Rubber Manufacturers Association, March 28, 1940. See also L.E. Carlsmith, Economic Characteristics of Rubber Tire Production (New York: The Rubber Age, 1934).

plant investment of the principal tire companies was reduced by about one third between 1930 and 1934.

Since then, it is important to note, investment has been increased again. In the registrations of the four largest tire companies with the Securities and Exchange Commission, the following changes are evident in their valuations of land, buildings and equipment:

Table 5

Valuation of Land, Buildings and Equipment, Big 4, 1934-1938 (Millions of dollars)

<table>
<thead>
<tr>
<th>Company</th>
<th>1934</th>
<th>1935</th>
<th>1936</th>
<th>1937</th>
<th>1938</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goodyear</td>
<td>161.2</td>
<td>164.6</td>
<td>166.5</td>
<td>174.1</td>
<td>177.4</td>
</tr>
<tr>
<td>Firestone</td>
<td>87.6</td>
<td>92.2</td>
<td>90.2</td>
<td>99.2</td>
<td>107.3</td>
</tr>
<tr>
<td>Goodrich</td>
<td>80.5</td>
<td>92.9</td>
<td>94.6</td>
<td>95.0</td>
<td>94.4</td>
</tr>
<tr>
<td>U.S. Rubber</td>
<td>131.1</td>
<td>130.5</td>
<td>134.4</td>
<td>137.2</td>
<td>126.5</td>
</tr>
</tbody>
</table>


It is not possible to tell from these data precisely how much of each change is attributable to revaluation, and how much represents new investment or disinvestment. We shall see, however, that it is reasonable to assume that at least some of the increases in 1937 and 1938 represent new investment on the part of these
companies, but that this new investment is more connected with increasing diversification of production than with expansion of tire manufacturing facilities.

The discussion thus far has dealt primarily with aggregates, citing statistics of the rubber manufacturing and of the rubber tire producing industries as a whole. As first approximations, these data can be useful since they indicate some of the changes that present problems common to the individual units which make up the industry. Since the impact of these changes is not always evenly divided and since the measures adopted by the separate units to meet their common problems are by no means always the same, attention must be devoted to the constitution of the actual units concerned with tire manufacture and to the major differences among them.

The following pages will attempt to identify some of the principal units which have dominated the competitive policies of the tire industry. We shall look first to the legal entities, the tire companies, especially the Big 4, then to the units within them, their subsidiaries and plants, and, finally, to the alliances among them.
4. Rubber Tire Manufacturing Companies

It has been pointed out that the product tires antedates the automobile. There is record as early as 1835 of the manufacture of solid rubber tires. A set of tires "one and one half inches wide and one and one fourth inches thick," presumably invented by Thomas Hancock and manufactured by Charles McIntosh, covered the wheels of one of Queen Victoria's carriages. In 1845 the first patent on pneumatic tires was granted to Robert William Thompson. This first air cushion was a crude affair consisting of canvas layers saturated with rubber and covered with a leather casing. The pneumatic type was not used successfully, however, until 1888 when John Boyd Dunlop, a veterinary, developed an inner tube and outer "bandages" so that his son could win a tricycle race.

Shortly thereafter Dunlop began to manufacture his tires and tubes for use on bicycles and carriages, under British patent. Since both France and the United States refused to grant him patents, on the grounds that his product was not basically different from Thompson's, a number of other business units turned to the manufacture of pneumatic tires, causing the industry to grow rapidly.

---

H.S. Firestone, Jr., op. cit., pp. 28, 26, 29.
during the 1890's.

B.F. Goodrich Company, which had been organized in 1871 to manufacture mechanical rubber goods and hose, established a tire department during this period. Firestone entered the field in 1896 as the first American company to make tires for carriages. The Goodyear Company was organized in 1898. Other important units in the American industry at this time were the two major manufacturers of bicycle tires, the Gormully and Jeffery Manufacturing Company and the Morgan Wright Company, which is reported to have had 70% of the industry's sales at one time. These last two companies were finally taken over in 1910 by the United States Rubber Company, which was originally formed in 1892.

As, with the turn of the century, the automobile industry offered a new and rapidly expanding outlet for tire production, these companies expanded and many others grew up. Among the other early companies were:

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27 In 1895, it is reported that sixty million pounds of crude rubber was consumed in the manufacture of bicycle tires alone. Cf. C.W. Depew, ed., op. cit., p.500.


29 The first automobile tires were built of solid rubber. In 1896 Alexander Winton had Goodrich make him the first set of pneumatic automobile tires. The reputed price for the set was $500.
Fisk, Miller, Kelly-Springfield, Ajax, Marathon, Star, Portage, Federal, Racine, Diamond, Hood, Swinehart, Mason, Murray, Owen, Lee, Norwalk and Dayton. Some of these have survived, but most of them have disappeared through merger or bankruptcy. The relative importance in production at each of several dates of the principal units which have survived up to those dates is indicated by the following table constructed by Leigh. (Table 6, next page.)

This table shows that as early as 1920 the production of tires was concentrated in the hands of a small number of companies. The eight listed controlled over 80% of the total capacity of the industry, while the remainder was distributed among about 170 other producers.

The continuation of this trend, and data indicating the relative size of all the tire manufacturing companies in 1933 is to be found in Table 7, taken from a brief submitted to NRA by India Tire and Rubber Review.

Here we find that the "Big 4" have remained predominant even while the total capacity of the industry

30 W.W. Leigh, op. cit., p.17.  
### Table 6

Daily Plant Capacity, Selected Tire Companies, Selected Dates (a)

<table>
<thead>
<tr>
<th>Company</th>
<th>1911-12</th>
<th>1914-15</th>
<th>1920</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goodyear</td>
<td>8,000(b)</td>
<td>10,000(e)</td>
<td>25,000(1)</td>
</tr>
<tr>
<td>Goodrich</td>
<td>........</td>
<td>14,000(e)</td>
<td>20,000(1)</td>
</tr>
<tr>
<td>U.S. Rubber</td>
<td>........</td>
<td>9,000(h)</td>
<td>20,000(1)</td>
</tr>
<tr>
<td>Firestone</td>
<td>2,600(d)</td>
<td>7,500(e)</td>
<td>18,000(1)</td>
</tr>
<tr>
<td>Fisk</td>
<td>1,000(c)</td>
<td>2,500(f)</td>
<td>15,000(1)</td>
</tr>
<tr>
<td>Ajax</td>
<td>........</td>
<td>........</td>
<td>10,000(1)</td>
</tr>
<tr>
<td>Miller</td>
<td>........</td>
<td>1,000(g)</td>
<td>7,500(1)</td>
</tr>
<tr>
<td>Kelly-Spring-</td>
<td></td>
<td>1,000(d)</td>
<td>7,000(1)</td>
</tr>
<tr>
<td>field</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>........</td>
<td>........</td>
<td>25,000(1)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>147,000(1)</td>
</tr>
</tbody>
</table>

(a) W.W. Leigh, op. cit., p.17.
(b) Horseless Age, September 25, 1912, p.450.
(c) India Tire Review, March 10 1913, p.122.
(d) Automobile, June 10, 1915, p.1045.
(e) Ibid., October 7, 1915, p.658.
(f) Ibid., November 4, 1915, p.856.
(g) Ibid., November 23, 1916, p.871.
(h) Ibid., June 17, 1915 p.1086.
(i) Tires, October, 1920 p.19, and estimates based on interviews with men engaged in the industry.
Table 7
Estimated Daily Capacity of Individual Tire Manufacturing Companies, 1933(a) (in tire units)

<table>
<thead>
<tr>
<th>Company</th>
<th>Capacity(b)</th>
<th>Percent of Total Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goodyear Tire and Rubber Company</td>
<td>90,000</td>
<td>26.42</td>
</tr>
<tr>
<td>Firestone Tire and Rubber Company</td>
<td>46,500</td>
<td>13.65</td>
</tr>
<tr>
<td>United States Rubber Company</td>
<td>42,000</td>
<td>12.53</td>
</tr>
<tr>
<td>The B.F. Goodrich Company</td>
<td>41,000</td>
<td>12.04</td>
</tr>
<tr>
<td>Fisk Rubber Corporation</td>
<td>31,000</td>
<td>9.10</td>
</tr>
<tr>
<td>Kelly-Springfield Tire Company</td>
<td>12,000</td>
<td>3.52</td>
</tr>
<tr>
<td>Mainsfield Tire and Rubber Company</td>
<td>9,500</td>
<td>2.79</td>
</tr>
<tr>
<td>General Tire and Rubber Company</td>
<td>9,000</td>
<td>2.64</td>
</tr>
<tr>
<td>Seiberling Rubber Company</td>
<td>6,000</td>
<td>1.76</td>
</tr>
<tr>
<td>Pharis Tire and Rubber Company</td>
<td>5,500</td>
<td>1.62, and</td>
</tr>
<tr>
<td>Gates Rubber Company</td>
<td>5,000</td>
<td>1.47</td>
</tr>
<tr>
<td>Lee Rubber Tire Company</td>
<td>5,000</td>
<td>1.47</td>
</tr>
<tr>
<td>Murray Rubber Company</td>
<td>5,000</td>
<td>1.47</td>
</tr>
<tr>
<td>Dayton Rubber Manufacturing Company</td>
<td>4,500</td>
<td>1.32</td>
</tr>
<tr>
<td>Dunlop Tire and Rubber Corporation</td>
<td>4,500</td>
<td>1.32</td>
</tr>
<tr>
<td>Pennsylvania Rubber Company</td>
<td>4,000</td>
<td>1.17</td>
</tr>
<tr>
<td>Master Tire and Rubber Company(c)</td>
<td>3,500</td>
<td>1.04</td>
</tr>
<tr>
<td>Mohawk Rubber Company</td>
<td>2,500</td>
<td>0.73</td>
</tr>
<tr>
<td>India Tire Company</td>
<td>2,500</td>
<td>0.75</td>
</tr>
<tr>
<td>Corduroy Tire Corporation</td>
<td>2,000</td>
<td>0.59</td>
</tr>
<tr>
<td>Inland Rubber Company</td>
<td>2,000</td>
<td>0.59</td>
</tr>
<tr>
<td>Denman Tire and Rubber Company</td>
<td>1,500</td>
<td>0.43</td>
</tr>
<tr>
<td>McLaren Rubber Company</td>
<td>1,000</td>
<td>0.29</td>
</tr>
<tr>
<td>Monarch Rubber Company</td>
<td>1,000</td>
<td>0.29</td>
</tr>
<tr>
<td>Norwalk Tire and Rubber Company</td>
<td>1,000</td>
<td>0.29</td>
</tr>
<tr>
<td>Armstrong Rubber Company</td>
<td>500</td>
<td>0.15</td>
</tr>
<tr>
<td>Hamilton Rubber Manufacturing Company</td>
<td>500</td>
<td>0.15</td>
</tr>
<tr>
<td>Lakeshore Tire and Rubber Company</td>
<td>500</td>
<td>0.15</td>
</tr>
<tr>
<td>P.G. Schenecty Rubber Company</td>
<td>500</td>
<td>0.15</td>
</tr>
<tr>
<td>Standard Four Tire Company</td>
<td>500</td>
<td>0.15</td>
</tr>
<tr>
<td>McCready Tire and Rubber Company</td>
<td>300</td>
<td>0.09</td>
</tr>
<tr>
<td>Overman Cushion Tire Company</td>
<td>300</td>
<td>0.09</td>
</tr>
</tbody>
</table>

Total estimated daily capacity: 340,600 100.00

(a) Brief submitted to NRA by India Tire and Rubber Review, 1933, cited in NRA Evidence Study No. 36, op. cit., p.5.

(b) Capacities of subsidiaries of Goodyear, Firestone, United States, and Goodrich are included with the parent companies.

(c) The capacity listed for this company is the combined capacity of its three subsidiaries, Fall Rubber Company, Cooper Corporation and Giant Tire and Rubber Company.
has increased threefold. Their relative positions have changed somewhat, with Goodyear now twice the size of its nearest competitor, and Firestone moving from fourth to second place in the industry. Among the four of them, however, is controlled 64.44% of the total, as compared with 56.46% in 1920. The total number of companies has been reduced to 32.

It is also important to note that in 1933 two companies which were ranked in the first eight in 1920 have disappeared: Ajax, which failed in 1930, and Miller, which, being in financial straits during that same year, was purchased by Goodrich. Since 1933, the other two which ranked just below the Big 4 in 1920 have also fallen by the wayside. Kelly-Springfield has been taken over by Goodyear and, at the time of writing, negotiations are under way for the transfer of Fisk to the control of the U.S. Rubber Company.

Meanwhile one company which was unranked in 1920 and which was eighth in tire capacity in 1933 has risen to challenge the leaders. This is the General Tire and Rubber Company which was incorporated in 1915.

33 New York Times, December 26, 1939, p.27.

34 At best, General offers a feeble challenge. We shall see that this company is a significant factor in the renewal market for high quality tires, and that its record for profitable operations has been good, but it ranks far below the Big 4 in size.
The most recent estimates of plant capacity of the principal tire companies, as published in Standard Corporation Records during 1939, give the following ranking:

**Table 8**

Estimated Daily Plant Capacity, Leading Tire Companies, 1938 - 1939 (a)

<table>
<thead>
<tr>
<th>Company</th>
<th>Estimated Daily Capacity (number of tires)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goodyear</td>
<td>over 100,000</td>
</tr>
<tr>
<td>U.S. Rubber</td>
<td>over 50,000</td>
</tr>
<tr>
<td>Firestone</td>
<td>45,000</td>
</tr>
<tr>
<td>Goodrich</td>
<td>45,000</td>
</tr>
<tr>
<td>Fisk (b)</td>
<td>18,000</td>
</tr>
<tr>
<td>General</td>
<td>7-12,000</td>
</tr>
<tr>
<td>Mansfield</td>
<td>10,000</td>
</tr>
<tr>
<td>Samson (c)</td>
<td>6,500</td>
</tr>
<tr>
<td>Seiberling</td>
<td>6,000</td>
</tr>
<tr>
<td>Pharis</td>
<td>5,000</td>
</tr>
<tr>
<td>Lee (d)</td>
<td>3,400</td>
</tr>
<tr>
<td>Dayton</td>
<td>3,000</td>
</tr>
<tr>
<td>Mohawk</td>
<td>2,000</td>
</tr>
<tr>
<td>Master</td>
<td>2,000</td>
</tr>
<tr>
<td>Norwalk (e)</td>
<td>1,800</td>
</tr>
</tbody>
</table>

(a) From Standard Corporation Records, 17, Nos. 3868, 3853, 3768B, 3848, 3830, 3823, 3872, 3870B, 3806, and 3763.

(b) In process of merger with U.S. Rubber.

(c) Controlled by U.S. Rubber, not consolidated in its statements.

(d) 850,000 annual capacity, assuming 250 days operation.

(e) 450,000 annual capacity, assuming 250 days operation.
Of the other companies listed in 1933, no data are available regarding the present capacity of Gates, Dunlop, Pennsylvania, Corduroy, and Armstrong, but reports of their net sales indicate that their shares of the tire market are almost negligible. Little can be discovered about the remaining small companies except that a number of them have disappeared entirely, by merger or liquidation, and most of them have been in financial difficulties. The relative unimportance of these companies can be gauged by the fact that the aggregate capacity in 1933 of those for whom no 1938 data are available was only 5,300 tires daily.

If a company's tire capacity can be taken as a gauge of its relative importance as a producer in the industry, we may regard this table as evidence of an


36 E.g. McLaren was bought out by Dayton in 1935, Standard Corporation Records, 17, No. 3806.

37 E.g. India was liquidated in 1936, Moody's Manual of Investments, Industrials, 1938, op. cit., p.3019. Overman was in process of liquidation in April, 1939, Standard Corporation Records, 17, No. 3830.

38 E.g. Murray failed, Fortune, November, 1936, op. cit., p.99; Denman was reorganized in 1936-1937, Standard Corporation Records, op. cit., 17, No. 3847. See also Dun and Bradstreet tabulation of failures, infra, p.108.

39 Inland, Monarch, Hamilton, Lakeshore, Scheuget, Standard Four, McCreary. Of these, Hamilton and Standard Four are no longer in operation. Letter from Rubber Manufacturers Association, op. cit.
oligopolistic situation, with the Big 4 and, possibly, General as the key units in the industry. This is borne out further by the following data showing the volume of sales of the Big 4, as compared with other units in the industry. (Table 9, next page.)

Table 9 was constructed by piecing together a number of estimates from scattered sources. In each case the percentage figure expresses the sum of the net sales of the leading four tire companies as an approximate proportion of the total sales of all units classified by the Census as members of the tire industry. The 1914 and 1919 figures are distorted by the inclusion of a certain number of mechanical rubber goods producers. Column B is included to give an indication of the declining number of units remaining in the industry to share the rest of the sales. These numbers would be even smaller if they represented companies instead of plants, inasmuch as each of the Big 4 operates more than one plant.

More accurate information is available for the period since 1934, owing to the registration requirements of the Securities and Exchange Commission. The net sales of the leading companies in the tire industry are tabulated separately in Table 10.

Although these figures are significant as indications of the relative total volume of business conducted
Table 9

Estimated Share of the Market Controlled by the "Big 4,"
Selected Dates, 1914-1933 (a)

<table>
<thead>
<tr>
<th>Year</th>
<th>(A) Big 4's Percent of Total Sales of Tire Industry</th>
<th>(B) Total Number of Establishments in the Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>1914</td>
<td>66</td>
<td>301</td>
</tr>
<tr>
<td>1919</td>
<td>56</td>
<td>437</td>
</tr>
<tr>
<td>1921</td>
<td>58</td>
<td>178</td>
</tr>
<tr>
<td>1923</td>
<td>58</td>
<td>160</td>
</tr>
<tr>
<td>1925</td>
<td>57</td>
<td>126</td>
</tr>
<tr>
<td>1927</td>
<td>61</td>
<td>109</td>
</tr>
<tr>
<td>1929</td>
<td>75</td>
<td>91</td>
</tr>
<tr>
<td>1931</td>
<td>79</td>
<td>48</td>
</tr>
<tr>
<td>1933</td>
<td>77</td>
<td>44</td>
</tr>
</tbody>
</table>

Table 10

Net Sales, Leading Companies in the Tire Industry, 1934-1938(a)

<table>
<thead>
<tr>
<th>Company</th>
<th>Fiscal Year Ends</th>
<th>1934</th>
<th>1935</th>
<th>1936</th>
<th>1937</th>
<th>1938</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goodyear</td>
<td>12/31</td>
<td>136.8</td>
<td>164.9</td>
<td>185.9</td>
<td>216.2</td>
<td>165.9</td>
</tr>
<tr>
<td>U.S. Rubber</td>
<td>12/31</td>
<td>105.5</td>
<td>127.8</td>
<td>160.4</td>
<td>186.3</td>
<td>142.1</td>
</tr>
<tr>
<td>Samson(b)</td>
<td>12/31</td>
<td>6.5</td>
<td>7.5</td>
<td>11.2</td>
<td>12.8</td>
<td>(c)</td>
</tr>
<tr>
<td>Firestone</td>
<td>10/31</td>
<td>99.1</td>
<td>121.7</td>
<td>135.7</td>
<td>156.8</td>
<td>141.9</td>
</tr>
<tr>
<td>Goodrich</td>
<td>12/31</td>
<td>102.9</td>
<td>116.7</td>
<td>141.1</td>
<td>150.0</td>
<td>115.0</td>
</tr>
<tr>
<td>General</td>
<td>11/30</td>
<td>14.5</td>
<td>15.5</td>
<td>17.9</td>
<td>21.4</td>
<td>20.1</td>
</tr>
<tr>
<td>Fisk</td>
<td>12/31</td>
<td>10.2</td>
<td>10.9</td>
<td>13.5</td>
<td>17.8</td>
<td>16.0</td>
</tr>
<tr>
<td>Lee</td>
<td>10/31</td>
<td>7.4</td>
<td>8.5</td>
<td>10.6</td>
<td>13.8</td>
<td>12.2</td>
</tr>
<tr>
<td>Mansfield</td>
<td>12/31</td>
<td>(c)</td>
<td>(c)</td>
<td>(c)</td>
<td>10.5</td>
<td>11.8</td>
</tr>
<tr>
<td>Seiberling</td>
<td>10/31(d)</td>
<td>6.3</td>
<td>6.1</td>
<td>7.3</td>
<td>8.8</td>
<td>8.1</td>
</tr>
<tr>
<td>Dayton</td>
<td>10/31</td>
<td>3.6</td>
<td>4.5</td>
<td>7.2</td>
<td>8.4</td>
<td>7.5</td>
</tr>
<tr>
<td>Pharis</td>
<td>12/31(d)</td>
<td>3.4</td>
<td>4.1</td>
<td>4.9</td>
<td>5.7</td>
<td>5.9(e)</td>
</tr>
<tr>
<td>Mohawk</td>
<td>12/31</td>
<td>2.8</td>
<td>2.5</td>
<td>2.6</td>
<td>2.9</td>
<td>3.1</td>
</tr>
<tr>
<td>Master</td>
<td>12/31</td>
<td>3.2</td>
<td>3.0</td>
<td>2.1</td>
<td>2.3</td>
<td>3.1</td>
</tr>
<tr>
<td>Norwalk</td>
<td>9/30</td>
<td>(c)</td>
<td>1.2</td>
<td>1.7</td>
<td>2.2</td>
<td>2.8</td>
</tr>
</tbody>
</table>

(a) Adapted from Selected Information on Manufacturers of Tires, etc., op. cit., pp. 35-39, and Standard Corporation Records, 17, op. cit.
(b) U.S. Rubber is the indirect parent of Samson through its ownership of Meyer Rubber Company which owns Samson Corporation which owns the controlling interest (100% common and some preferred stock) in Samson Tire and Rubber Corporation.
(c) Data not available.
(d) Data for 1934-1936 refer to predecessor company of the same name, since Pharis was reorganized in 1937.
(e) Ten months only. Fiscal year was changed to end on October 31 in 1938.
by the leading tire manufacturing companies, they do not give an accurate representation of the shares of each in the tire market. Since these corporations are concerned with the manufacture of many other rubber products, and some products which contain no rubber, only a part of this sales volume is connected with tires. And the proportion of tire to other sales varies widely among the principal companies.

Unfortunately for our purposes, no precise data are available on this subject, but only the crudest of estimates. Nevertheless, as rough approximations of the importance of tires to each manufacturer, and as clues to the relative importance of these companies to the total tire market, they are worth quoting.

In 1929, it was reported that between 90% and 95% of Firestone’s total business was concentrated in tires. For Goodyear the estimate was 75%; for Goodrich, 50%; and for U.S. Rubber, 35-40%. Similar figures for later years suggest that significant changes in this proportion had occurred by 1938, but that subsequent readjustments up to 1939 have been slight. For ready comparison,

42 Standard Corporation Records, 17, Nos. 3788B, 3868, 3849, 3853.
these estimates appear below in tabular form:

Table II
Estimates of the Percentage of Total Volume of Business Concentrated in Tires, Big 4, Selected Dates, 1929-39

<table>
<thead>
<tr>
<th>Company</th>
<th>1929-30</th>
<th>1935-36</th>
<th>1938-39</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firestone</td>
<td>90-95</td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>Goodyear</td>
<td>75</td>
<td>67</td>
<td>75</td>
</tr>
<tr>
<td>Goodrich</td>
<td>50</td>
<td>55</td>
<td>60</td>
</tr>
<tr>
<td>U.S. Rubber</td>
<td>35-40</td>
<td>53</td>
<td>50</td>
</tr>
</tbody>
</table>

(a) *Fortune*, September, 1930, op. cit., p.85ff.
(b) *Fortune*, November, 1936, op.cit., p.99.
(c) *Standard Corporation Records*, 17, Nos. 3788B, 3868, 3848, 3853.

If these estimates are reliable, they provide information which is extremely important to the investigation at hand. In the first place, they show that in 1929, the major units in the tire industry were distinctly dissimilar in the degree of their concentration on their principal product, but that their depression adjustments tended to equalize these differences. In the light of other information regarding the competitive tactics of these units, which will be discussed in subsequent pages, this raises a very interesting possibility which may be a key to understanding the nature of pluralistic competition - the
relationship between heterogeneity among units in the same market and the amount of conflict existing in the market, and the relationship between the degree of diversification or concentration by a unit on a single product and the intensity of its competition.

At this stage of the analysis, these relationships are best stated as hypotheses, to be tested by the facts which will be brought out later, but tentatively it may be suggested that heterogeneity breeds conflict and is a bar to alliance among business units, and that when units are organized in such a way that some are much more diversified than others, the units which concentrate their activities in the fewest areas are likely to be the most active in their competitive adjustments in these areas. In this connection we shall find that during the late 20's and early 30's, Firestone, which was more completely involved in the tire industry than any of its important competitors, was by all odds the most aggressive of the Big 4 in the tire market. Goodyear, which was next most concentrated in tires, was also active in the conflict and recently, as its relative concentration has moved it to first place, has taken the lead in policies of conflict. At the other extreme, U.S. Rubber, the most diversified of the tire producers, and Goodrich, which had a large stake in rubber footwear production,
were almost never the innovators of competitive tactics with respect to tires. Further, as long as they differed in the degree of their interest in the tire market, successful alliance among them was difficult to maintain, but as they became more alike in this respect, the severity of their conflict tended to diminish. There still remains, of course, the possibility of conflict among these more homogeneous units with respect to their relative shares of the market, especially if their relative productive capacities are at variance with their shares of the market, but the mutual advantages of alliance have been made more clear than formerly.

The estimates in Table 11 also shed some light on this question. They provide data with which it is possible to adjust our earlier net sales figures in order to have a more accurate picture of the relative shares of the tire market controlled by each of the Big 4 in recent years. Table 12 (next page) represents an attempt to make such adjustments for the years 1934-38, and present approximate figures of the net sales of tires and tubes in those years of the leading tire companies.

The estimates in this table, particularly when they are taken together with the capacity data in Table 8, offer a good indication of the relative size and...
Table 12
Estimated Net Sales of Tires and Tubes, Leading Tire Companies, 1934-1938

<table>
<thead>
<tr>
<th>Company</th>
<th>1934</th>
<th>1935</th>
<th>1936</th>
<th>1937</th>
<th>1938</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goodyear</td>
<td>91.7</td>
<td>110.5</td>
<td>130.1</td>
<td>151.3</td>
<td>124.4</td>
</tr>
<tr>
<td>Firestone</td>
<td>74.3</td>
<td>85.2</td>
<td>95.0</td>
<td>109.8</td>
<td>99.3</td>
</tr>
<tr>
<td>U.S. Rubber</td>
<td>55.9</td>
<td>67.7</td>
<td>85.0</td>
<td>98.7</td>
<td>75.3</td>
</tr>
<tr>
<td>Goodrich</td>
<td>57.1</td>
<td>65.3</td>
<td>77.6</td>
<td>82.5</td>
<td>69.0</td>
</tr>
<tr>
<td>General(a)</td>
<td>14.5</td>
<td>15.5</td>
<td>17.9</td>
<td>20.3</td>
<td>19.1</td>
</tr>
<tr>
<td>Mansfield(b)</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>10.5</td>
<td>11.8</td>
</tr>
<tr>
<td>Fisk(c)</td>
<td>6.1</td>
<td>6.5</td>
<td>8.1</td>
<td>10.6</td>
<td>9.6</td>
</tr>
<tr>
<td>Seiberling(d)</td>
<td>5.9</td>
<td>5.7</td>
<td>6.9</td>
<td>8.3</td>
<td>7.6</td>
</tr>
<tr>
<td>Lee(e)</td>
<td>4.4</td>
<td>5.1</td>
<td>6.4</td>
<td>8.3</td>
<td>7.3</td>
</tr>
<tr>
<td>Pharils(a)</td>
<td>3.4</td>
<td>4.1</td>
<td>4.9</td>
<td>5.7</td>
<td>6.4</td>
</tr>
<tr>
<td>Dayton(c)</td>
<td>2.2</td>
<td>2.7</td>
<td>4.3</td>
<td>5.0</td>
<td>4.5</td>
</tr>
<tr>
<td>Mohawk(b)</td>
<td>2.3</td>
<td>2.5</td>
<td>2.6</td>
<td>3.8</td>
<td>3.1</td>
</tr>
<tr>
<td>Master(b)</td>
<td>3.2</td>
<td>3.0</td>
<td>2.1</td>
<td>2.3</td>
<td>3.1</td>
</tr>
<tr>
<td>Norwalk(f)</td>
<td>...</td>
<td>.7</td>
<td>.9</td>
<td>1.2</td>
<td>1.5</td>
</tr>
</tbody>
</table>


(b) Reported as manufacturers of tires, tubes and tire repair materials exclusively. Cf. Standard Corporation Records, op. cit., 17, Nos. 3830 and 3870B.

(c) Since Fisk and Dayton each have a considerable mechanical rubber goods business, their concentration in tire production is estimated to be not more than 60%. Cf. Standard Corporation Records, op. cit., 17, Nos. 3868 and 3806.

(d) Seiberling's business was 94% in tires in 1936. Cf. Standard Corporation Records, op. cit., 17, No. 3832.

(e) Lee is reported to receive about 60% of its revenue from tire sales. Cf. Standard Corporation Records, op. cit., 17, No. 3830.

(f) The "major portion" of Norwalk's revenue comes from tire sales. Cf. Standard Corporation Records, op. cit., 17, No. 3769. However, since it has a sizeable auto accessory and footwear volume, its concentration in tires is estimated to be not more than 55%.
strength of the principal concerns which manufacture tires. The Goodyear Company is clearly the largest producer and it has the largest volume of sales, but its relative superiority in size, as measured by productive capacity, is much greater than its relative advantage in the market. As compared with the other major producers, Goodyear seems to have the greatest overcapacity in relation to its own volume of tire sales. Firestone, which ranks a good second in sales, with a volume about four-fifths the size of Goodyear's, has less than half of Goodyear's capacity. Assuming, as seems to have been the case recently, that this volume was not attained by profitless sales, this speaks well for the shrewdness of Firestone's competitive adjustments. About equal to the Firestone Company in productive capacity, but 25-30% below it in volume of tire sales, U.S. Rubber and Goodrich have been competing for third place in the industry, with U.S. Rubber maintaining a slight advantage since 1935.

Far behind the Big 4 but well ahead of the others comes General with a net sales volume one-fourth to one-sixth as large as the major companies'. Mansfield ranks next with only half of General's sales volume even though its productive capacity is about the same, while Fisk, with double General's capacity has a volume of sales which was 20% behind Mansfield in 1938. The capacities and relative market shares of Seiberling, Lee, Pharis, and Dayton follow
behind, while even the smaller companies such as Mohawk, Master and Norwalk are found at the bottom of the list.

With the possible exception of General, none of these companies offers any substantial threat to the Big 4. In fact, it is reasonable to suppose that most of the small units are on the decline. In this connection it is worth noting that while the combined capacity of the small companies listed here (about 70,000 tires daily) is almost one-third of the Big 4 capacity, their aggregate sales of tires in 1938 (about $75 millions) represented only one-fifth of the total tire sales of the Big 4. This would seem to indicate that the four major units have been leaving a progressively smaller relative share of the tire market to the remaining units in the industry and that the competitive pressures upon and among the smaller companies are accordingly likely to be intensified. Such has certainly been the case in the development of the industry up to the present.

The intensity of this conflict is nowhere more clearly to be seen than in material bearing on the decline of numbers in the tire industry. Table 1, page 72, which

43 Notable exceptions are Mansfield, Lee, Pharis, and Dayton, which have been able to expand because they have gained a foothold in special markets. Cf. infra, pp.132 ff.
44 W.W. Leigh, op. cit., p.238, speaks of the severe competition 1921-1934 of the "many small, financially weak producers who had to fight for business at any costs in order to keep out of the hands of receivers."
gives Census data on the number of establishments in the entire rubber industry since 1849, is probably too crude for our purposes, but Table 3, page 79, and Table 9, page 97, which give similar data for tire producing establishments alone since 1921 may be more useful. According to these figures, the number of plants principally engaged in the manufacture of tires declined continuously from 178 in 1921 to 42 in 1935, and increased to 46 in 1937. In these latter years, a single corporation in several instances controlled more than one plant.

Since these data refer primarily to the number of producing units rather than to the number of income-receiving units, they should be supplemented with an indication of the decline in the number of tire manufacturing companies. The most striking evidence on this point is to be found in a 1933 publication of the U.S. Department of Commerce which attributes to an unnamed tire company the statement that "since 1912, 537 tire companies have started in business, of which only 32 now remain." 45

More precise information bearing on the annual mortality of tire manufacturing companies is available in two special tabulations prepared by Dun and Bradstreet. The first, made in 1935 for the NRA Research and Planning

Division, offered data on the number of failures among tire manufacturing companies during the period 1925-1934. This has been revised and brought up to date by a similar tabulation made especially for the writer in March, 1940. These data are presented in Table 13, (next page.)

Inasmuch as there are no easily available data regarding each of the new companies which may have been organized during this period, nor concerning the participants in each merger and reorganization in the tire industry since 1925, the exact number of companies existing at each date, and the identity of each, even if it were significant, would be difficult to ascertain.

The most relevant facts, however, are known. The number of tire manufacturing companies declined steadily all during the 1920's until there were only 32 remaining in 1933. Between 1933 and 1939 there have been eighteen failures in the industry, but not every failure has resulted in the disappearance of the affected company. The operations of a number of the smaller or weaker companies have been sufficiently unprofitable to cause these failures, but most of these companies which were able to survive until 1933 have been reorganized and have remained in the industry as marginal or sub-

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NRA Division of Review, Evidence Study No. 36, op. cit., p. 12.
### Table 13

**Number of Failures and Amount of Liabilities, Rubber Tire Manufacturers, 1925-1939(a)**

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Failures</th>
<th>Amount of Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1925</td>
<td>12</td>
<td>$3,162,200</td>
</tr>
<tr>
<td>1926</td>
<td>8</td>
<td>1,132,600</td>
</tr>
<tr>
<td>1927</td>
<td>12</td>
<td>1,080,124</td>
</tr>
<tr>
<td>1928</td>
<td>14</td>
<td>4,609,963</td>
</tr>
<tr>
<td>1929</td>
<td>7</td>
<td>1,131,000</td>
</tr>
<tr>
<td>1930</td>
<td>5</td>
<td>465,200</td>
</tr>
<tr>
<td>1931</td>
<td>9</td>
<td>1,219,938</td>
</tr>
<tr>
<td>1932</td>
<td>3</td>
<td>25,400</td>
</tr>
<tr>
<td>1933</td>
<td>2</td>
<td>1,779,241</td>
</tr>
<tr>
<td>1934</td>
<td>1</td>
<td>523,000</td>
</tr>
<tr>
<td>1935</td>
<td>3</td>
<td>201,000</td>
</tr>
<tr>
<td>1936</td>
<td>3</td>
<td>42,000</td>
</tr>
<tr>
<td>1937</td>
<td>3</td>
<td>554,000</td>
</tr>
<tr>
<td>1938</td>
<td>1</td>
<td>21,000</td>
</tr>
<tr>
<td>1939</td>
<td>5</td>
<td>9,000</td>
</tr>
</tbody>
</table>

(a) Research and Statistical Division, Dun and Bradstreet, Inc.
marginal producers.

This can be seen by comparing the names of the companies manufacturing tires in 1933 with a similar list of the companies now in existence. As of March 28, 1940, the Rubber Manufacturers Association lists the following as manufacturers of tires and tubes:

- Armstrong Rubber Company, West Haven, Conn.
- Armstrong Tire and Rubber Company, Natchez, Miss.
- Carlisle Tire and Rubber Company, Carlisle, Penna.
- Corduroy Tire Corporation, Grand Rapids, Mich.
- Cuplees Company, St Louis, Mo.
- Dayton Rubber Manufacturing Company, Dayton, Ohio.
- Denman Tire and Rubber Company, New York, N.Y.
- Dunlop Tire and Rubber Corporation, Buffalo, N.Y.
- Durkee-Atwood Company, Minneapolis, Minn.
- Firestone Tire and Rubber Company, Akron, Ohio.
- Gates Rubber Company, Denver, Colo.
- General Tire and Rubber Company, Akron, Ohio.
- B.F. Goodrich Company, Akron, Ohio.
- Goodyear Tire and Rubber Company, Akron, Ohio.
- Holfast Rubber Company, Atlanta, Ga.
- Inland Rubber Corporation, Chicago, Ill.
- Kelly-Springfield Tire Company, Cumberland, Md.
- Lake Shore Tire and Rubber Company, Des Moines, Iowa.
- Lee Rubber and Tire Corporation, Goshen, Conn.
- Mansfield Tire and Rubber Company, Mansfield, Ohio.
- Martin Custom Made Tires Corporation, New York, N.Y.
- Master Tire and Rubber Company, Findley, Ohio.
- Mohawk Rubber Company, Akron, Ohio.
- Monarch Rubber Company, Hartville, Ohio.
- Norwalk Tire and Rubber Company, Norwalk, Conn.
- Overman Tire Company, Inc., Belleville, N.J.
- Pacific Rubber and Tire Manufacturing Company, Oakland, Calif.
- Pharis Tire and Rubber Company, Newark, Ohio.
- Polson Rubber Company, Garretsville, Ohio.
- Robbins Tire and Rubber Company, Muscle Shoals, Ala.
- P.G. Schenott Rubber Company, Baltimore, Md.
- Seiberling Rubber Company, Akron, Ohio.
- United States Rubber Company, New York, N.Y.

47 Cf. supra, Table 7, p. 92
48 Letter from Rubber Manufacturers Association, op. cit.
Of the thirty-six companies listed here, eight can be disregarded as irrelevant to our purposes. Six of them, Carlisle, Cupples, Durkee-Atwood, Holfast, Polson and Robbins are small firms which manufacture tubes only. Two are duplications; the Armstrong Company of Natchez, though listed separately, is merely the new southern branch of the Armstrong Company of West Haven, and the Kelly-Springfield Company has been a subsidiary of Goodyear for more than five years.

The remaining twenty-eight companies can be counted as the effective tire producing units remaining in 1940. Twenty-five of these companies were listed in 1933, while three of them, Ford, Martin and Pacific, are new to the field. Martin and Pacific are relatively insignificant units in the industry and Ford is thus far, although the manufacture of tires by an automobile company may be the first step in an important new development in the tire industry.

Seven of the companies included in the 1933 list are no longer active in tire manufacturing. The departure from the industry of McLaren, Murray, India, 

49 It should be noted that the fourteen companies included in earlier tabulations represent only half of the total number of companies active in the industry but the characterization of them as "leading companies" is amply justified by the fact that they represent well over 90% of the productive capacity of the industry and an equally large proportion of all tire sales.
Coast, Fisk, Hamilton and Standard Four, even though partially compensated by the entry of three new companies, indicates a net decline in numbers of four companies within seven years.

Before entering into a discussion of the nature of the competitive adjustments which brought about the decline in the number of tire manufacturing companies, however, it is necessary to investigate the leading companies further if we are to differentiate properly among them in our identification of the strategic policy-forming units in the tire industry. This will require a glance into the organization and structure of the principal tire corporations.

5. Internal Organization of Tire Manufacturing Companies

Analysis of competition in the tire industry customarily deals with the activities of the major corporate units which directly and through their subsidiaries control the manufacture and sale of tires. It has already been noted, however, that the producing units and the income-receiving units in the tire industry are not always the same, and that the corporate units which are superimposed on them do not restrict their activities to the manufacture and sale of tires alone, but also engage in many other manufacturing and selling activities. And
since these other activities may be more or less connected
with tire production or tire marketing, they require that
the corporations' competitive policies with respect to
tires be integrated with all other corporate policies.
Consequently, before we can properly comprehend the
competitive policies of the corporate units which act
in the tire market we must look to the organization and
functions of their subsidiaries and plants.

Table 14 presents in summary fashion the number
of active subsidiaries and tire manufacturing plants con-
trolled by each of the leading tire corporations. This
table shows clearly the extent to which complicated cor-
porate structure goes hand in hand with size in the tire
industry, and suggests the large number of units the com-
petitive policies of which must be integrated by the big-
gest tire corporations. In sharp contrast is the relative
simplicity of the smaller concerns in the industry. The
Big 4, for instance, control 209 active subsidiaries;
General controls fifty-nine, most of which are selling
organizations, while Fisk has ten subsidiaries, Seiberling
has five, and the remaining seven companies have eight
subsidiaries among them. Of the twenty-nine domestic tire
plants listed here, fifteen are controlled by the Big 4,

50 The remainder of the forty-six establishments enumerated by
the Census in 1937 consist of the plants of tube manufacturing
companies and the small plants of such companies as Gates,
Pennsylvania, Armstrong, Dunlop, Denman, Corduroy and Overman,
which are not included in this tabulation.
### Table 14

**Active Subsidiaries and Principal Plants, Leading Tire Companies, 1938(a)**

<table>
<thead>
<tr>
<th>Company</th>
<th>Total</th>
<th>Manufacturing and</th>
<th>Number of Tire Plants</th>
<th>Number of Tire Fabric Plants</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Selling and</td>
<td>U.S. Foreign</td>
<td>U.S. Foreign</td>
</tr>
<tr>
<td>Goodyear</td>
<td>50</td>
<td>18</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Firestone</td>
<td>107</td>
<td>20</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>U.S. Rubber</td>
<td>33(b)</td>
<td>(b)</td>
<td>4(c)</td>
<td>3(c)</td>
</tr>
<tr>
<td>Goodrich</td>
<td>17</td>
<td>8</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>General</td>
<td>59</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Mansfield</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Fisk</td>
<td>10</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Seiberling</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Lee</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Pharis</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Dayton</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Mohawk</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Master</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Norwalk</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

(a) Sources: Selected Information on Manufacturers of Tires, etc., op. cit., pp.3, 6-13, Standard Corporation Records, op. cit., 17, Moody's, op. cit., 1938, and Annual Reports of the various companies.

(b) U.S. Rubber data is only approximate. For several years, this corporation has been simplifying its structure. 20 subsidiaries were dissolved during 1937 and 1938. At the end of 1938 it had 35 subsidiaries remaining, 21 of which were foreign.

(c) These data are probably not complete with respect to foreign plants. The company's reorganization has also resulted in the closing of many of its domestic plants. Only the major plants remaining are tabulated here.
while the other ten companies own fourteen plants, three of which are at present inactive, and one of which makes only solid tires and mechanical rubber goods. Only the Big 4 are important in foreign production, having twenty-one foreign tire plants among them as compared to four for the other ten companies. Only the large companies are vertically integrated to the extent of manufacturing their own tire fabrics. The Big 4 have twelve fabric plants in the United States, while General and Fisk have one each. And only the Big 4 have additional plants which manufacture other rubber and allied products.

Further indication of the variety of activities carried on by the major tire producers, and of the structural and functional differences among them is to be found in the following brief descriptions of the principal 52 units within the leading tire corporations:

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51 Not in this tabulation, but the same sources show the Big 4 to operate more than 25 domestic and foreign plants which are devoted to the production of goods other than tires and tire fabrics.

52 Summarized from:

H. Allen, op. cit.
Annual Reports
Fortune articles
Moody's, 1938
Selected Information on Manufacturers of Tires, etc., op. cit.
Standard Corporation Records, op. cit.

and other sources listed in bibliography.
Goodyear Tire and Rubber Company

This company operates directly or through subsidiaries twelve tire manufacturing plants. The principal plant, consisting of two units with an aggregate productive capacity of 50,000 tires daily is located in Akron, Ohio. Other domestic tire plants are in Gadsen, Alabama, Cumberland, Maryland, Los Angeles, California, and Jackson, Michigan. Five foreign plants, at Wolverhampton, England, Sydney, Australia, Buenos Aires, Argentina, Buitenzorg, Java, and New Toronto, Ontario have been in operation for some years, and two other new ones, at Sao Paulo, Brazil, and Nonkoping, Sweden, were still under construction in 1938.

The greater part of the corporation's tire fabric requirements is produced from raw cotton in seven textile mills located at Cartersville, Cedarstown, and Rockmart, Georgia, Decatur, Alabama, Los Angeles, California, New Bedford, Massachusetts, and St. Hyacinthe, Quebec. Some of the cotton used in these mills is produced on a 36,000 acre cotton plantation owned by the Goodyear Company in Arizona. Coal for the Akron plants is produced in mines owned and operated by Goodyear, in Adena, Ohio.

In each of its tire plants, Goodyear also produces mechanical rubber goods. These goods are produced separately in another plant at Bowmanville, Ontario. In addition to its main tire plant in Akron, Ohio, Goodyear
also operates an airship factory for the production of lighter-than-air craft, a dock, and a plant manufacturing truck tire rims in that same city. Goodyear, which is the world’s largest manufacturer of rubber heels (400,000 pairs daily), produces most of these in a factory in Windsor, Vermont, which was purchased in 1936. A small part of the crude rubber which is consumed by this company in its various rubber manufacturing activities is produced on the company’s own plantations in Sumatra, the Philippines, Panama and Costa Rica.

In addition to automobile tires, mechanical rubber goods, rubber heels and airships, Goodyear also manufactures and sells such products as rubber solexing for shoes, bicycle tires, hose, molded goods, rubber derivatives including “pliofilm” for wrapping, “pliolite”, a raw material for paint manufacturers, “air foam” for upholstery, and a number of the chemical compounds used in the rubber industry.

For the distribution of its products, Goodyear maintains sixty branches in the United States and Canada, and ninety three branches, depots and warehouses in foreign countries. In addition to its original equipment and other sales to industrial consumers, it is estimated that Goodyear products are sold through more than 100,000 retail outlets, including about 650 owned retail stores which are organized primarily to sell Goodyear tires but
which also carry a full line of automobile accessories, including batteries, spark plugs, heaters, oil, fans, horns and radios sold under the Goodyear trade name.

These activities are carried on directly by the parent company or are organized under the following subsidiaries, all of which, except as otherwise indicated, are wholly owned:

1. Goodyear Tire and Rubber Co. of Alabama, operates the tire plant at Gadsen, Ala.
2. Kelly-Springfield Tire Co., operates the tire plant at Cumberland, Maryland.
3. Goodyear Tire and Rubber Co. of California, operates the tire and fabric plants at Los Angeles, Calif. and administers 168 acres of urban and rural real estate.
4. Goodyear Tire and Rubber Co. of Michigan, operates the tire plant at Jackson, Michigan.
5. Goodyear Tyre and Rubber Co. (Gt. Brit.), Ltd., (Goodyear owns all ordinary shares, but some preference shares are outstanding in other hands), operates the tire plant at Wolverhampton, and maintains distribution branches throughout the United Kingdom.
6. Goodyear Tyre and Rubber Co. (Australia), Ltd. (100% of common shares are owned), operates the tire and mechanical goods plant at Sydney and maintains distribution branches in the principal Australian cities.
8. Goodyear Tire and Rubber Co., Ltd. (Java), operates the tire plant at Buitenzorg.
9. Goodyear Tire and Rubber Co. of Canada, Ltd. (78.8% common, 7.6% preferred, owned), operates the tire plant at New Toronto, the mechanical goods plant at Bowmanville, and maintains eleven distribution branches throughout Canada.
10. Companhia Goodyear de Brasil (Brazil), operates the plant at Sao Paulo.
11. Goodyear Gummiaktiebolag (Sweden), operates the plant at Nonköping.
15. Goodyear Cotton Co. of Canada, Ltd., operates the fabric mill at St. Hyacinthe.
16. Southwest Cotton Co., operates the cotton plantation, gins, and a vacation resort in Arizona.
17. Wheeling Township Coal Mining Co., operates the coal mine at Adena, Ohio.
18. Windsor Manufacturing Co., operates the rubber heel and sole plant at Windsor, Vt.
19. Goodyear Rubber Plantations Co., operates the plantations in Sumatra, the Philippines, Panama and Costa Rica.
20. Goodyear Tire and Rubber Co., Inc. (Del.), handles sales in the United States.
22. Goodyear Tire and Rubber Export Co., Ltd. handles sales in foreign countries.
23. Goodyear-Zeppelin Corporation, operates the airship plant at Akron, Ohio.

In addition to these, Goodyear has twenty seven other active subsidiaries, for the facilitation of its business. These other units, which are mostly sales and holding companies, are incorporated in seven states and seventeen foreign countries.

**Firestone Tire and Rubber Company**

Firestone’s tire manufacturing is carried on in three domestic and six foreign plants. The principal plant in the United States, with a daily productive capacity of over 25,000 tires, is located at Akron, Ohio. A plant at Los Angeles, California, has about half that capacity, and the rest of Firestone’s domestic production
is centered in its new plant at Memphis, Tennessee. The six foreign plants, which have an aggregate capacity of about 6,500 tires daily, are located at Hamilton, Ontario, Buenos Aires, Argentine, Brentford, England, Port Elizabeth, South Africa, Bilboa, Spain, and Pratteln, Switzerland.

Tire fabrics are produced in Firestone's own mills at New Bedford, Mass., Gastonia, S.C., and Woodstock, Ontario. Raw cotton for the New England plant is stored in a company warehouse with a capacity of 100,000 bales. A small part of Firestone's rubber requirements is grown on the company's plantation in Liberia, where 30,000 acres of mature trees are tapped annually, and where a rubber preparation plant was under construction in 1938. Such a plant is already in existence in Singapore, where Firestone does a large part of its crude rubber purchasing. This plant is reported to be able to wash and dry two million pounds and pack and ship 5,000 tons of rubber per month. Firestone also operates plants in Akron, Los Angeles and Memphis to reclaim rubber.

Mechanical rubber goods are produced in the Akron and Memphis tire plants, and in a separate plant at Noblesville, Indiana. Since May, 1938, latex thread has been manufactured in a plant at Fall River, Mass., which also produces sponge rubber and mechanical rubber
goods.

In addition to the rubber products manufactured by Firestone, a wide variety of automobile parts and accessories are produced in three domestic plants. One of these, at Akron, can produce 55,000 steel auto rims daily, a second plant at Riverview, Michigan makes auto rims and cushions, and the third plant, opened at Wyandotte, Michigan in 1938, manufactures rims, stampings and a number of plastic products. The extent of Firestone's diversification and extension of its non-tire manufacturing activities can be seen by the fact that in addition to the products mentioned above, Firestone now produces wringer rolls, hose, matting and some six thousand other rubber and rubber-to-metal items. The only significant reversal of this trend occurred in November, 1935, when Firestone sold its rubber footwear plant at Hudson, Mass. to U.S. Rubber for a reputed price of $3,000,000.

In addition to its direct sales to large purchasers, Firestone markets its products through over 37,000 dealers in the United States and 10,000 dealers and distributors in foreign countries. This company also operates over 600 (631 in 1938) retail stores. Carrying an extensive line of automobile tires and automobile accessories, most of which are manufactured in the Firestone plants, these stores also serve to some extent as
warehousing centers for independent dealers.

All of these activities are controlled directly by the parent company or by its subsidiaries, the principal ones of which are organized to perform the following functions. Each of these corporations is wholly owned either directly or through other subsidiaries.

1. Firestone Tire and Rubber Co. of California, operates the tire plant at Los Angeles, Calif.
2. Firestone Tire and Rubber Co. of Tennessee, operates the tire, mechanical goods, and rubber reclaiming plant at Memphis, Tenn.
3. Firestone Tire and Rubber Co. of Canada, Ltd., operates the tire plant at Hamilton and the fabric plant at Woodstock.
5. Firestone Tyre and Rubber Co., Ltd., operates the tire plant at Brentford, England.
6. Firestone South Africa (Pty.), Ltd., operates the tire plant at Port Elizabeth.
7. Firestone Hispania, S.A., operates the tire plant at Bilbao.
8. Fabrik fur Firestone Produkte, A.O., operates the tire plant at Pratteln.
12. Firestone Plantations Co., owns a lease of one million acres in Liberia and operates rubber plantations there.
16. Firestone Tire and Rubber Co. (S.S.), Ltd., operates the rubber plantation at Singapore.
17. Xylos Rubber Co., operates the rubber reclaiming plant at Akron. Daily capacity 285,000 pounds.
18. Xylos Rubber Co. of California, operates the rubber reclaiming plant at Los Angeles. Daily capacity 80,000 pounds.
19. Schacht Rubber Co., operates the mechanical rubber goods plant at Noblesville, Indiana.
21. Firestone Rubber and Latex Products Co., operates the latex, sponge rubber and mechanical rubber goods plant at Fall River, Mass.
22. Firestone Steel Products Co., operates the tire rim plant at Akron, Ohio, and rim and cushion plant at Riverview, Michigan.
23. Firestone Rubber and Metal Products Co., operates the rim, stamping, plastic and auto accessory plant at Wyandotte, Michigan.
25. Firestone Park Insurance Agency Co., operates an insurance agency for Firestone employees.
26. Finance Corporation of America, is organized to purchase and hold securities in other corporations.
27. Firestone Tire and Rubber Export Co., handles export sales.
28-34. The following companies are organized to promote sales in foreign countries:
   Compania Cubana de Gomas Firestone, S.A.
   Firestone Tire and Rubber Co. of New Zealand, Ltd.
   Firestone Tire and Rubber Co. of the Philippine Is.
   Firestone Tyre and Rubber Co. of India, Ltd.
   Firestone Rengastukku, Osakeyhtio.
   Pneus Firestone Lusitano Limitada
   Societe Anonyme Francaise Pneumatiques et Accessoires

In addition to these subsidiaries, Firestone has organized a West Virginia corporation, Firestone Tire and Rubber Company, under which over seventy of its retail stores are separately incorporated.

United States Rubber Company

Ever since 1928 when duPont interests gained control of this company, it has been undergoing drastic reorganization. Inasmuch as a number of its subsidiaries were still being dissolved or consolidated and its
production activities were still being rearranged in 1938, it is not possible to describe the functions and structure of the constituent units of U.S. Rubber in the same fashion as has been done for Goodyear and Firestone.

This company first became important early in the twentieth century when it merged a number of small rubber manufacturing companies, particularly producers of rubber footwear. As already noted, it entered the tire business when it took over Morgan and Wright and Gormully and Jeffery in 1910. U.S. Rubber grew by expansion and merger until it became the largest of all rubber companies. It maintained this position until 1926 when it was surpassed by Goodyear. All during this period, its various plants, which were listed as divisions of the company, usually retained their original corporate names, and a large part of their individuality. It is reported that they competed vigorously with one another, as well as with outside companies. As a consequence of the structural reorganization of U.S. Rubber, however, many of the operations of these formerly separate units have been consolidated with respect both to their manufacturing activities and to

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their corporate identities. Although this company is no longer the largest, it is still the most diversified of the major rubber manufacturers.

At present, U.S. Rubber's principal tire manufacturing plant, which makes automobile and airplane tires, molded rubber goods and automobile steering wheels, is located at Detroit. (U.S. Rubber is the only one of the Big 4 which does not have a plant in Akron.) Tires are also produced by a plant in Eau Claire, Wisconsin, which was acquired with the Gillette Rubber Company in 1931, and at Los Angeles, where an indirect subsidiary, the Samson Tire and Rubber Corp. makes "United States" brand tires, tubes and tire accessories, which it sells to the parent company on a "cost-plus" basis. A plant at Indianapolis, Indiana produces tubes, bicycle tires and tubes, tire accessories and repair materials. Complete data are not available regarding foreign production of tires by the U.S. Rubber Company, but it is known that its Canadian subsidiaries operate plants at Montreal and St. Jerome, Quebec, and at Kitchener, Ontario. These plants are reported to manufacture a full line of rubber products.

Tire fabrics are produced in mills at Hogansville, Georgia, Winnsboro, South Carolina and Shelbyville, Tennessee. These mills provide most of U.S. Rubber's
fabric requirements. A plant at Naugatuck, Connecticut, reclaims rubber and produces chemicals for rubber manu-
ufacturing. About 20% of the company's crude rubber consumption comes from its own plantations in Sumatra
and Malaya, where 99,000 acres have been planted.

A large mechanical rubber goods plant is operated at Passaic, N.J., where U.S. Rubber also maintains a research laboratory. The principal rubber footwear plant is located at Naugatuck, Connecticut, but a second plant at Mishawaka, Indiana, produces rubber footwear in addition to waterproof clothing, auto topping, sponge rubber and upholstery material. To supplement its footwear production, U.S. Rubber owns a plant at Waterbury, Connecticut, which manufactures aluminum boot and shoe lasts, buckles and slide fasteners. A plant at Bristol, Rhode Island, produces rubber insulated wire and cable. Finally, its allegedly most profitable operations since about 1933, the production of latex and rubber sundries, is carried on in a plant at Providence, Rhode Island.

Because of the extreme diversification of U.S. Rubber's production, the distribution of its goods is complicated. Many sales are made direct from its factories and many others are handled through its sales branches which are located in all of the large trading areas of the country. In tires, it is important to note, this company has a larger proportion of its sales in the original equipment market
than any other tire producer. Also, that part of its replacement sales which is not handled through large distributors is entirely sold through independent retail outlets. Although U.S. Rubber formerly operated its own retail stores, this activity has been given up since 1935.

The corporate structure of this company is such that the functional responsibility of each subsidiary cannot be clearly determined. However, the principal relationships between the major subsidiaries and the productive activities of the U.S. Rubber Company can be outlined as follows. (Certain details of intercorporate holdings have been omitted.)

By June 30, 1938, U.S. Rubber's Canadian operations were centralized under its 95.6% owned subsidiary, the Dominion Rubber Co. Ltd., which in turn controlled the activities of sixteen subsidiary companies. Another major subsidiary, the wholly owned General Rubber Company, controlled U.S. Rubber's operations in the United Kingdom through two holding companies and five subsidiaries, and U.S. Rubber's crude rubber plantations through one holding company and four subsidiaries. A large part of its domestic production was controlled through the wholly owned Meyer Rubber Co., which in turn controlled Central Idaho Telephone and Telegraph Co., Coeur d'Or Development Co., Dispersions Process, Inc.,

B.F. Goodrich Company

The principal manufacturing facilities of this company are located at Akron, Ohio. Within six units operated in this city, Goodrich produces approximately two-thirds of its total tire output, and 85% of its mechanical rubber goods output, in addition to rubber chemicals, druggists' sundries and reclaimed rubber. Other domestic tire production is centered in a plant at Oaks, Pennsylvania and in Los Angeles, California, where certain other rubber products also are manufactured. Goodrich's only wholly owned foreign tire plant is operated at Kitchener, Ontario. This plant also produces canvas
footwear and mechanical rubber goods. In addition, 
Goodrich is associated with English, French, Japanese 
and Mexican companies which operate tire and rubber 
manufacturing plants at Leyland and Burton-on-Trent, 
England, Colombes, France, Yokohama, Japan, and 
Mexico City, Mexico. There is also record of an in-
directly owned plant located in Argentina.

Unlike the other members of the Big 4, Goodrich 
operates no plantations, but buys all of its chief raw 
materials, rubber and cotton, from outside sources. 
The company’s tire production is vertically integrated 
in one important respect, however, by the operation 
of a large textile mill at Silvertown, Georgia.

Goodrich is one of the largest producers of 
rubber and canvas footwear. This is manufactured at 
its Hood plant at Watertown, Massachusetts. The rest 
of this company’s domestic production is carried on in 
a plant at Cadillac, Michigan which manufactures a 
wide variety of products, principally mechanical rubber 
goods and other items connected with the automobile in-
dustry.

The diversified production of this company is 
indicated by the fact that it is reported to produce 
over 32,000 different items, the chief of which in addi-
tion to tires include tire accessories and repair mater-
ials, batteries, polishes, mats, belting, packing, hose,
tubing, molded and sponge rubber goods, sundries and
footwear.

About 30% of Goodrich’s total tire output in
recent years has been sold to the General Motors Cor-
poration as original equipment. Other tire sales are
made to large retail distributors, but the greater
part of the Goodrich replacement sales are handled by
small independent dealers and distributors, and by 450
Goodrich owned retail stores. Other Goodrich products
are distributed both directly to many industrial con-
sumers and through the wholesale and retail trade. In
this connection Goodrich maintains over 550 branches,
including its retail stores, in this country, and about
270 foreign branches.

Most of the domestic manufacturing activities
of this company are controlled directly by the parent
corporation, but the functions of its principal sub-
sidiaries can be summarized as follows:

1. Hood Rubber Co., Inc., operates the footwear
   plant at Watertown, Mass. This company has
   seven active subsidiaries.
2. B.F. Goodrich Co. of Canada, Ltd. (99.4% owned),
   operates the tire, footwear and mechanical
   rubber goods plant at Kitchener, Ontario.
3. Miller Rubber Co., sells Miller brand tires, sundries,
   and mechanical rubber goods.
5. Goodrich Co. Straits Settlements, (99.4% owned), is
   organized to purchase and sell crude rubber.
6. Goodrich Silvvertown, Inc. is a holding company.
7. International B.F. Goodrich Corporation (99.4% owned) is a holding company for foreign investments. This corporation has six unnamed foreign subsidiaries, some of which are probably the following, in which Goodrich is reported to have an interest:

8. British Tyre and Rubber Co., Ltd., formerly British Goodrich Rubber Co. This company operates the plants at Leyland and at Burton-on-Trent, England. At one time it had an agreement with Goodrich by which it restricted its sales to the British Empire. It is now reported to sell in world markets even while it still receives the benefit of Goodrich's manufacturing and technical advice. In 1933 this company also acquired voting control of India Rubber, Gutta Percha and Telegraph Works, Ltd., which operates factories in England, France and Argentina.

9. Société Goodrich, formerly Société Française Goodrich, operates the plant at Colombes and sells Goodrich products throughout the French Empire and Continental Europe.

10. Yokohama Rubber Co., Ltd., operates the plant at Yokohama and sells Goodrich brands in Japan.

11. Compañía Hulera "Euzkada" S.A., manufactures Goodrich brand tires and tubes at the plant in Mexico City.

Goodrich is also reported to have a substantial stock interest in American Anode, Inc., which owns patents on the production of latex by electro-deposition. Goodrich is a licensee under these patents.

The General Tire and Rubber Company

This company, which is the most important of the smaller tire producers, concentrates primarily on the manufacture of tires and tubes for the replacement market.

Its principal plant, located at Akron, is almost exclusively occupied with the production of tires and tubes. Since 1937, however, it has undertaken the
manufacture of mechanical rubber goods in this plant, but to date the volume of this production has been negligible, not only as compared to the total volume of such products made by the industry but also as a contributing factor to General's total income. General also operates one foreign plant, which manufactures tires and tubes at Toronto, Ontario, and has an interest in a small plant in Mexico. The only other plant which it owns is a textile mill in Barnesville, Georgia which supplies about 70% of the company's tire fabric requirements. General buys its cotton and rubber in the open market.

This company sells some truck tires as original equipment, and supplies a few truck, bus, and taxi fleets with renewal tires. The rest of the tires manufactured by General are distributed by the Pure Oil Company in a restricted territory through about 2,000 dealers, and through its own retail stores. These stores sell batteries and certain automobile accessories, but these products are not manufactured by General.

The parent company operates the Akron plant, while its principal subsidiaries perform the following functions: (The first four listed are wholly owned.)
1. General Tire and Rubber Co. of Canada, Ltd., operates the tire plant at Toronto.
2. Aldora Mills, operates the fabric mill at Barnesville, Georgia.
3. General Tire and Rubber Export Co., handles foreign sales, which aggregate about 6% of General's total sales.
4. General Tire and Rubber Co., Ohio, handles domestic sales and acts as a holding company for over 50 separately incorporated retail stores, which are more than 50% owned by General.
5. General Tire Acceptance Corp., 44.6% owned, finances installment sales of tires.

General is also reported to hold a 17.6% interest in Compania Hulera "El Popo," S.A., which operates a tire and rubber goods plant in Mexico. In addition, General entered into an agreement with Stomil, Poznan, Poland in 1936, whereby tire manufacture by Stomil would be carried on under the supervision and according to the specifications of General's engineers.

Other tire companies

The corporate structure and productive organization of the other leading tire companies can be described more briefly.

The Mansfield Tire and Rubber Company has a single plant, and no active subsidiaries. In its plant at Mansfield, Ohio it manufactures tires and tubes for passenger automobiles, busses and trucks. It was recently reported to be starting the manufacture of bicycle tires. All tires made by this company supply the
replacement market. At present, about 60% of its sales are made to volume accounts which include two mail order houses, one oil company, one large hardware wholesaler and two wholesale tire distributors. Most of these tires are made as private brands.

In 1938, the Fisk Rubber Corporation had ten subsidiaries all of which were sales organizations. It operated a plant at Chicopee Falls, Mass., for the manufacture of automobile tires, tubes and tire accessories, bicycle tires, mechanical rubber goods, fan belts, hose and automobile mats. In December, 1938 this company is reported to have combined with certain Swedish interests to acquire a factory at Viskafors, Sweden and to form the Fisk Scandinavian Rubber Corporation to manufacture and sell automobile tires and mechanical rubber goods. Fisk's domestic fabric requirements are filled by its own mill at New Bedford, Mass. This company maintains branches and warehouses in thirty one cities and its products are distributed primarily through independent tire dealers.

The Seiberling Rubber Company owns two plants in this country, one in Canada and is affiliated with

54 Although this company lost its independence in 1940, supra, p.69, it is included here in order that the data in this section referring to leading companies in 1938 and 1939 may be complete.
four other foreign producers. Of the domestic plants, one, at Newcastle, Pennsylvania, has been inactive for some years, while the other, at Barberton, Ohio, concentrates on the production of automobile tires and tubes and rubber heels. Its Canadian plant, at Toronto, Ontario has a daily capacity of about 1,400 tires and 2,000 tubes. In 1930 Seiberling made an agreement with Avon India Rubber Co. Ltd., England whereby Avon was given the exclusive right to manufacture and sell Seiberling tires in Great Britain. The technical knowledge and organization of the two companies were to be pooled for their mutual benefit. In 1933, Seiberling signed a contract with Société Générale des Etablissements de Bergougnan, France by which tire production of the French company was to be supervised by Seiberling engineers. The Seiberling Company is also affiliated with Gentleman and Co., Lodz, Poland, and Companhia Brasiliera de Artefactos de Borracha, Rio de Janeiro, Brazil. Seiberling tires and tubes, which bring in 94% of the company's revenues, are sold in the replacement market, while sales of its rubber heels, contributing 4% of revenue, are made to shoe repairers. This company has five subsidiaries, one of which operates its Canadian plant, one of which finances the installment sales of its dealers and the others of which are primarily sales and holding companies.
The Lee Rubber and Tire Corporation, a domestic producer, has one sales subsidiary and two plants. Tires and tubes are manufactured at its plant at Conshohocken, Pennsylvania and solid truck tires and mechanical rubber goods at a plant at Youngstown, Ohio. Mechanical rubber goods sales constitute 40% of the gross business done by this company. About one half of Lee’s tire sales, which are restricted to the replacement and fleet markets, are made through its own retail stores. Most of the rest of its sales are handled through the outlets of three oil companies, Phillips Petroleum Co., Atlantic Refining Co, and Signal Oil Co.

The Pharis Tire and Rubber Company reports that it has no subsidiaries and that it operates a single manufacturing plant. This plant, located at Newark, Ohio has a daily capacity of 5,000 automobile tires and 3,500 bicycle tires. All of its automobile tires and tubes are sold in the replacement market, but its bicycle tires are sold both as original equipment and as replacements. About 40% of this company’s sales volume comes from the sales of Pharis brands to wholesale distributors and independent dealers, while while 60% of its volume is obtained from the sale of private brands manufactured for mail order houses and chains.
The Dayton Rubber Manufacturing Company since 1933 has operated one plant at Dayton, Ohio for the manufacture of tires, tubes, mechanical rubber goods and sponge rubber. A considerable proportion of production is devoted to the manufacture of fan belts, for which this plant has an estimated daily capacity of 60,000. This company has a patent affiliation with General Motors on "V-belts." Dayton has two direct subsidiaries, the Dayton Rubber Manufacturing Company of Delaware, a selling subsidiary, and Dayton-Roderwald Company. It is also affiliated with the Sponge Rubber Company of America, which it owns jointly with the Liquid Carbonic Corporation. In 1935 Dayton bought out McClaren, taking over its name, goodwill, molds and dealers. It now manufactures McClaren brand tires and distributes them through McClaren dealers. In addition Dayton makes its own brands, distributing them through independent wholesalers and dealers, and manufactures some of the "Super All-State" brand for Sears-Roebuck.

The Mohawk Rubber Company has a sales subsidiary, the Mohawk Rubber Co. of New York, and one plant at Akron. This plant, with a capacity to produce about 3,000 tires daily, manufactures tires, tubes and tire repair materials for the replacement trade.
The Master Tire and Rubber Corporation was formed in 1930 by the merger of Cooper Corporation, Falls Rubber Co., and Giant Tire and Rubber Co. Production is concentrated upon the manufacture of tires and tubes for the replacement market. This corporation owns three plants, but operates only one of them. Its active plant, with a daily capacity of 2,000 tires, is located at Findlay, Ohio. A second plant in the same city, and a plant at Cuyahoga Falls, Ohio, are inactive.

The Norwalk Tire and Rubber Company owns one subsidiary, which is a selling organization, and operates a single plant at Norwalk, Conn. This plant has an annual capacity of about 400,000 tires. It also manufactures tubes, storage batteries, fan belts, radiator hose and other rubber products for the automobile trade, and a small quantity of rubber footwear. The major portion of its revenue is derived from its sale of tires and tubes. This company sells its products direct to dealers, most of whom are located in New England.

These descriptions of the structure and the productive functioning of the leading tire manufacturing corporations indicate the existence within and among them of a considerable number of quite dissimilar producing and income-receiving units. While most of these
smaller units are directly or indirectly involved in
the manufacture and/or the (initial) sale of tires, we
cannot properly count them as separate policy-forming
groups because they are effectively allied in so far
as their policies are subject to the jurisdiction of
their respective parent corporations. At the same
time recognition and identification of the various
smaller units is essential not only because they help
to define the principal differences in the organiza-
tion, size, strength and degree of interest in the mar-
ket of the parent units, but also because they provide
important data for the understanding of the competitive
policies of the superior units. While for most purposes
of analysis we can count the parent companies as our
central policy-forming units, and can conceive of the
competitive adjustments among tire producers as if
they were made exclusively by parent companies, we can
interpret the causes and consequences of the particular
measures which are taken only in the light of the organ-
izational and functional differences which exist among
the leading companies.

For instance, we can expect that, other things
being equal, companies such as Goodyear, Firestone and
U.S. Rubber, which own rubber plantations and operate
their own tire fabric mills will be somewhat less
troubled than other units in the industry by increases
in materials costs. Likewise, the Big 4, General, Fisk and Seiberling, which operate plants in foreign countries, will feel the impact of a war quite differently from strictly domestic producers. Highly diversified producers such as U.S. Rubber, Goodrich or even Lee and Norwalk will be better able to survive a vigorous price war in tires than such companies as Seiberling, Pharis, Mansfield, Master and Mohawk which concentrate heavily on tire manufacture. Moreover, companies the sales volume of which is principally dependent on special markets such as Pharis with its mail order private brands, Lee with its oil company outlets, or U.S. Rubber, with its large share of the General Motors original equipment business, will be most sharply affected by and must resist most vigorously any raids upon their special markets. By the same token, General, Fisk and Firestone would have relatively less to lose by intense competition in any of these areas and might even find it profitable to initiate such a raid.

6. Alliances among Tire Companies

It is noteworthy in this industry that alliances among the leading companies have been rare, temporary and, in most instances, unsuccessful in promoting the mutual interests of the tire producers. Whether this fact is to
be interpreted, _Fortune_ fashion, in terms of the conflict of personalities of the most powerful individuals in the industry, the late Harvey S. Firestone of the Firestone Co., Paul Litchfield of Goodyear, James D. Tew of Goodrich, the duPont group of U.S. Rubber and William O'Neil of General, or whether it should be attributed to the more impersonal structural and functional differences among their companies, it is generally recognized that typically, and in most respects, the leading tire producers have acted independently and have remained in sharp conflict with one another. In the process, as we shall see, they have frequently found other allies, e.g. Firestone and Ford for almost forty years, Goodyear and Dodge after 1927, because of their common control by Dillon, Read, and Co., Goodyear and Sears Roebuck from 1926-1926, and U.S. Rubber and General Motors after 1928 because of the duPont interests in each, but seldom has effective

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56  Cf. A. Abrahamson, _op. cit._, p.100.


59  C.E. Fraser and G.F. Doriot, _op. cit._, p.112.
cooperation been organized among the tire producers themselves. Other than the tacit understandings which seem to have existed among them to restrict the areas and tactics of their conflicts, - if the mores of the industry can so be interpreted, - the best known active attempts to bring these companies together have generally broken down.

During the World War the British who then controlled most of the world's supply of crude rubber threatened to cut off their shipments to this country unless American producers would guarantee to prevent re-export to the Central Powers. Faced with this emergency which affected them relatively equally, American rubber manufacturers jointly established a Rubber Control Committee which for a time effectively policed the industry. This alliance ended with the war.

In 1926 the Rubber Institute was formed, with General Lincoln C. Andrews, formerly a prohibition enforcement officer, installed as Director. Unofficially he was termed the Czar of the industry. The principal purpose of this organization was to "stabilize" tire prices through a system of open-price filing. Previously

60 H.S. Firestone, Jr. op. cit., pp.51-58.
61 Fortune, November, 1936, op. cit., p.100.
there had been a considerable amount of secret price-cutting in the original equipment market, with the automobile manufacturers allegedly making the most of their quasi-monopolistic bargaining position. This alliance did not survive for long. After its "first serious brush with one of the larger units which was determined to increase its sales with secretly lower prices as the instrument, the plan of the Institute went into the discard."

A different sort of alliance, superimposed from above, was attempted in 1930 and 1931 when Cyrus Eaton endeavored to acquire control of the major tire producing companies through stock purchases by Continental Shares, Inc. This company, formed as an investment subsidiary of Otis and Company, a banking house in Cleveland, at one time held substantial shares of the common stock of the Big 4. During 1931, the Eaton-Otis group, along with others including Frank A. Seiberling, was reported to control 7% of the outstanding common stock of Firestone, 9.8% of Goodrich, 7.5% of U.S. Rubber and 22.9% of Goodyear. At this time, rumors were widespread that a merger was being planned for Goodyear, U.S. Rubber and Seiberling. With the

subsequent collapse of Continental Shares and the 
liquidation of its holdings, this attempt at alliance 
was abandoned.

After extremely bitter rivalry in the early 
1930's, aggravated particularly by huge inventory 
losses taken by the large companies and characterized 
by the financial distress of a number of the smaller 
companies, the next attempt to bring the tire producers 
together was made under the National Recovery Adminis-
64 
tration. There, a code was proposed by members of the 
industry on July 31, 1933, rejected, then revised and 
resubmitted under the sponsorship of the Rubber Manu-
facturers Association on October 3, 1933. These codes 
provided among other things for allocation of production, 
for mandatory methods of costing and cost recovery, for 
the fixing of prices at which manufacturers would sell, 
and at which retail outlets of every type would be per-
mittted to sell, and for the prohibition or restriction 

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NRA Hearing No. 412, Rubber Manufacturing Industry, 
Washington, D.C., October 25, 1933, and NRA Hearing 
No. 413, Rubber Tire Manufacturing Industry, Washing-
ton, D.C., October 3, 1933 (recorded on microfilm in 
the Yale University Library), NRA, Codes of Fair 
Competition, Vol. IV, Nos. 156 and 174 (Washington, 
325-353, W.H. Cross, G.S. Harsman and J.H. Lenaerts, 
of a wide variety of competitive practices. In a greatly modified form, a code restricting certain trade practices and providing for open price filing was finally approved on December 21, 1933. Meanwhile the Code authority was instructed to prepare a plan for market differentials between various lines of tires and various types of tire outlets, to be presented within sixty days. As an example of cooperation among the various policy-forming units involved in the manufacture and sale of tires, the operation of this code was one of the most notorious failures of the NRA. Within a week of the promulgation of the code, the industry was plunged into some of the sharpest conflict it had ever experienced. Precipitated by one of the major mail-order houses' offer to give trade-in allowances of 25-30% on tires, it spread through the small independent dealers, the tire manufacturers' own retail stores and other retail markets until it led to an active price war among the large and small tire manufacturing companies. A number of attempts were made to stabilize the situation. A forty day truce was declared on March 30, 1934, classifying the different lines of tires and establishing price differentials for different types of retail outlets, pending the completion of a Retail Tire Code. This was quickly violated. Subsequent attempts at price classification, various emergency orders made on May 14, June 14, June 27, July 16, conferences and
hearings on July 12 and August 3, and a final Administrative Order on August 22, 1934 were equally unsuccessful. By the first of September, 1934, all attempts at minimum price regulation through the NRA were abandoned. For the next thirteen months price and quasi-price conflict was bitter throughout the industry.

Since November 1, 1935, however, there is evidence that at least a tacit alliance has existed among the tire companies to restrict their conflict to a limited number of areas and tactics. At that time the press reported that "the leading tire manufacturers had agreed to a truce in price-cutting and that retail tire prices were to be stabilized at the existing published lists." Although there is no evidence that the non-price competition among these companies has been mitigated in the slightest,—in fact, product differentiation and advertising and selling campaigns have been fully as active as formerly,—the past five years have been notable for the absence of vigorous price competition, and for the stabilization of many forms of quasi-price competitive tactics. Only recently, when

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This fact can be inferred from the recent action of the Department of Justice which filed suit in the Federal Court, New York, on behalf of the Treasury Department, seeking over one million dollars damages from eighteen leading tire companies. The complaint charged a conspiracy to fix the prices of tires on sales to the United States Government. Cited as evidence was the fact that four sets of bids submitted by the tire companies in 1936 and 1937 were identical to the penny in each instance on eighty-two (cont. on next page)
Goodyear "enraged its competitors" by cutting its tire prices in November, 1939, has there been a break in this apparently solid front. Whether this represents the first move in a new and bitter conflict among the tire manufacturing companies or whether it is merely a minor adjustment that will not substantially disturb the existing competitive relationships among the principal units in the tire industry remains to be seen.

7. Summary

The foregoing has attempted to identify the central policy-forming units involved in the manufacture and initial sale of tires. In tracing the broad outlines of the development of tire manufacture, first as a minor adjunct to rubber manufacturing, then as the dominant activity of the rubber industry, we have seen the emergence of a number of independent policy-forming units. In the early days when the market for tires was increasing rapidly we witnessed the establishment of many new enterprises, some of which have grown to become the principal tire manufacturers of today, but most of which have succumbed in the competitive struggle, leaving

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67 Time, February 26, 1940, p. 30.
production concentrated in the hands of twenty-eight companies. Of the present survivors we have directed our attention particularly to the four largest, but also to ten other leading companies. Although there are many similarities among them, we cannot treat them as if they were homogeneous because we have discovered sharp differences in their size, market strength and degree of interest in the tire market, and many important variations in their internal structure. Finally we have suggested that recognition of these differences is significant to an understanding of the competitive policies adopted by the individuals who control the activities of the leading tire companies, and that the heterogeneity of these units may be important in explaining the apparent failure, until recently, of these companies to temper their mutual conflict by alliance. Counting the leading tire manufacturing companies, then, as our central policy-forming units, the following pages will be devoted to a discussion of the major areas and tactics of their competition.

8. Major Factors Affecting the Competition of Tire Manufacturers

In discussing competition in the rubber tire industry, most analyses have centered their attention on one or more of four major characteristics of the industry:

1. Foreign control of the supply of crude rubber
2. The improvement of the product
3. The declining demand for tires

4. The changing channels of tire distribution

and treated them as if they presented common problems to
all units in the industry.

Analyses of this sort, while extremely valuable
as points of departure for the student of competitive
policies, tend to lose much of their significance by
virtue of the fact that their failure to allow for dif-
f erences among the policy-forming units involved leads
them to dangerous oversimplifications.

A more complete differentiation of the units
in the industry, such as has been attempted in preceding
pages, may obviate some of these weaknesses. For while
in many respects the impact of these four problems is
felt by all units and is often due to circumstances be-
yond the tire producers' control, in many other instances
the impact is felt unevenly, leads to differing adjust-
ments among them and is attributable in part to the
nature of previous competitive adjustments of the various
units in the industry.

The article by L.C. Reynolds, op. cit., is a case in
point. After indicating a few of the difficulties in-
volved in fitting the tire industry into the framework
of Chamberlinian theory, he suggests that "the only
people who at present are in a position to plan for
the industry are the directors of the Big 4" (p. 468)
and implies that together they could "rationalize the
industry." Likewise, W.W. Leirg, op. cit., in his study
of marketing problems in the tire industry almost in-
variably confines his analysis to the activities of the
Big 4, taken as a group, and sometimes separately.
It can now be seen that in developing our own analysis of competition in the tire industry we cannot successfully adopt the simplified technique suggested previously of dealing with "homogeneous units" without sharp qualification. At times, however, we can conceive of the leading rubber companies as homogeneous units in instances when outside influences fall equally upon them or where they adopt similar measures to combat them, and we can, in part, at least, deal with their tactics under the separate categories of structural adjustments, market competition in its various forms, and extra-market competition.

Consequently the following pages will consider in turn the four major problems mentioned above, together with a number of their subsidiary problems, first as aggregate problems confronting all tire producers, then as manifestations of pluralistic competition by indicating the principal policy-forming units involved, and studying the competitive tactics which they employ to meet their problems.

We shall look first to some of the principal problems involved in the manufacturing activities of the industry. After a crude indication of trends in industrial costs, and a brief reference to the major types
of structural adjustments that have been made with respect to production costs, more detailed treatment will be accorded to the competitive tactics developed by various tire producers in their relations with the policy-forming units with which they deal in securing their materials.

Then on the selling side we shall examine the chief factors affecting the total demand for tires, the structural adjustments which are made by tire companies in their attempts to gain control of a market for their products and, finally, the competitive tactics of separate tire companies and the other policy-forming units with which they ally or conflict in sales.

9. Costs of Tire Production

Adequate cost data with respect to tire manufacture are extremely difficult to find, and the few studies which are in existence suffer from glaring weaknesses. Production costs of the rubber manufacturing industry are difficult to break down to get tire costs alone, as long as plants are diversified. A per unit tire cost derived by dividing total costs of tire manufacture by the number

It must be pointed out at the outset that certain structural adjustments will have relevance to both the manufacturing and selling activities of individual companies, e.g. to a single company, product improvement may be at once cost-reducing and demand-creating; diversification of production may be both a manufacturing cost adjustment and a marketing adjustment.
of tires produced loses significance by virtue of the wide variety of tire sizes. And comparisons of cost elements per tire over a number of years are of doubtful meaning because of changes in the product, particularly the increasing size and weight of modern tires. Finally, industry aggregates cannot legitimately be counted on as equally representative of the cost situations of individual companies. The struggles of the Federal Trade Commission and of company lawyers to produce meaningful cost estimates in the Goodyear case bear ample witness to the difficulties involved in attempts at tire cost analysis and of the questionable value of any results achieved.

Fortunately, since the purpose of this study is not the development of detailed and accurate cost analysis, but is rather the investigation of competitive policies, we can use the available measures in spite of their crudities. Even though they lack precision, they cannot fail to indicate the relative importance of the major cost elements of tire manufacture, and hence the principal areas in which tire producers are obliged to make their competitive adjustments.

The following three tables present data which are useful for this purpose. Table 15 is made up primarily

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70 Federal Trade Commission, Docket 2116, op. cit.
of costs reported by tire manufacturing establishments to the Census of Manufactures. Because of changing schedules, the Census materials are not complete, but 71 when the few missing figures have been filled in, this table shows the major elements of tire production cost since 1927 as allocated by the manufacturers themselves. Tables 16 and 17, computed from these data according to a technique developed by the Rubber Section of the United States Bureau of Foreign and Domestic Commerce for a similar study restricted to the years 1927, 1929 72 and 1931, are designed to reveal more fully the significance of the aggregate dollar costs found in Census tables. Table 16 expresses the various cost as percentages of the total value of products for each year.  


72 Ibid., pp.1-6; Rubber Industry Letter No. 13, Special Circular No. 3505, December 29, 1933, pp.1-11. It should be noted that the tables presented here diverge from the Rubber Section tables in two respects, (1) the Rubber Section data on cost of tire fabrics are more complete than mine, which, to be comparable for all years, have been taken from Census reports on cotton manufactures, and which do not include secondary fabric production. Consequently, my figures on fabric costs are probably underweighted by about 30% and fully one fourth of the "other materials costs" in my tables are fabric costs; (2) the Rubber Section tables on unit costs express the cost factors as relatives to a 1927 base of $10.00, rather than using absolute dollar figures, such as are found in my Table 17. Also the Rubber Section tables do not indicate that the unit includes tubes and a changing proportion of accessories.
Table 17 indicates the share of each element in a computed unit cost; the unit representing one tire and its complement of tubes together with a gradually increasing proportion of accessories. (see also Charts B and C.)

These data reveal sharp changes in the relative importance to the tire producer of several major elements of his manufacturing costs, and suggest the principal areas in which he has made significant adjustments. It will be seen that some of these changes are the results of structural adjustments initiated by tire companies to their advantage, and some can be traced to external pressures which have required tire companies to make compensatory adjustments in the attempt to avoid being placed at a disadvantage.

The full implications to policy of all of these changes involve a number of problems deserving of separate study, e.g. the relations between changing wage costs and labor policy, or the proportion of profits as compared to overhead costs included in the category of "other added costs" and its relation to policy with respect to dividends, but since these problems are not manifested directly in the market, they will not be discussed here. However, the relevance of changing elements of total and unit costs of tire production to areas and tactics of competition among tire companies and certain other business units will be examined.
## Table 18

**Production Costs, Rubber Tire Manufacturing**

<table>
<thead>
<tr>
<th>Item of Cost</th>
<th>1927</th>
<th>1929</th>
<th>1931</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude Rubber</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long Tons (000's)</td>
<td>316.3</td>
<td>400.4</td>
<td>286.6</td>
</tr>
<tr>
<td>Cost ($ millions)</td>
<td>266.8(b)</td>
<td>180.6</td>
<td>60.0</td>
</tr>
<tr>
<td>Reclaimed Rubber</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long Tons (000's)</td>
<td>105.7</td>
<td>115.9</td>
<td>74.0</td>
</tr>
<tr>
<td>Cost ($ millions)</td>
<td>19.9(b)</td>
<td>16.6</td>
<td>7.0</td>
</tr>
<tr>
<td>Tire Fabrics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lbs. (millions)</td>
<td>197.4</td>
<td>280.1</td>
<td>137.4</td>
</tr>
<tr>
<td>Cost ($ millions)</td>
<td>81.0</td>
<td>126.5</td>
<td>41.3</td>
</tr>
<tr>
<td>Power and Fuel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost ($ millions)</td>
<td>11.1</td>
<td>10.3(b)</td>
<td>7.0(b)</td>
</tr>
<tr>
<td>Other Material</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost ($ millions)</td>
<td>120.4</td>
<td>95.6</td>
<td>58.3</td>
</tr>
<tr>
<td>Total Materials</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost ($ millions)</td>
<td>499.2</td>
<td>429.6</td>
<td>173.6</td>
</tr>
<tr>
<td>Number of Employees</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(000's)</td>
<td>78.3</td>
<td>83.3</td>
<td>49.2</td>
</tr>
<tr>
<td>Wages</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>($ millions)</td>
<td>120.1</td>
<td>127.1</td>
<td>63.1</td>
</tr>
<tr>
<td>Other &quot;added costs&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>($ millions)</td>
<td>250.4</td>
<td>213.5</td>
<td>169.6</td>
</tr>
<tr>
<td>Total Value of Products</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>($ millions)</td>
<td>869.7</td>
<td>770.2</td>
<td>406.3</td>
</tr>
<tr>
<td>Number of Tires Produced</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Millions)</td>
<td>64.4</td>
<td>70.2</td>
<td>49.1</td>
</tr>
<tr>
<td>Number of Tubes Produced</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Millions)</td>
<td>70.9</td>
<td>74.0</td>
<td>47.7</td>
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(b) Rubber Industry Letter No. 12, op. cit., p. 2.

(c) Computed by same method as employed by U.S. Department of Commerce; cf. ibid., p. 2.

(d) Computed.

(e) "Value added," less wages.
Table 18
Rubber Tire Manuf acturing Industry, 1927-1937 (a)

<table>
<thead>
<tr>
<th></th>
<th>1931</th>
<th>1933</th>
<th>1935</th>
<th>1937</th>
</tr>
</thead>
<tbody>
<tr>
<td>60.0</td>
<td>286.6</td>
<td>315.7</td>
<td>378.5</td>
<td>424.0</td>
</tr>
<tr>
<td>7.0</td>
<td>74.0</td>
<td>40.2</td>
<td>26.3</td>
<td>44.8</td>
</tr>
<tr>
<td>137.4</td>
<td>31.8</td>
<td>111.8</td>
<td>118.3</td>
<td>167.7</td>
</tr>
<tr>
<td>41.3</td>
<td>5.3(a)</td>
<td>7.7</td>
<td>7.7</td>
<td></td>
</tr>
<tr>
<td>73.6</td>
<td>64.3</td>
<td>120.8</td>
<td>135.0</td>
<td></td>
</tr>
<tr>
<td>49.2</td>
<td>139.4</td>
<td>265.5</td>
<td>366.9</td>
<td></td>
</tr>
<tr>
<td>53.0</td>
<td>57.1</td>
<td>63.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>54.7</td>
<td>78.3</td>
<td>96.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>63.1</td>
<td>102.3</td>
<td>112.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>69.6</td>
<td>299.3</td>
<td>446.1</td>
<td>575.9</td>
<td></td>
</tr>
<tr>
<td>49.1</td>
<td>45.4</td>
<td>48.7</td>
<td>54.1</td>
<td></td>
</tr>
<tr>
<td>47.7</td>
<td>46.8</td>
<td>47.8</td>
<td>52.4</td>
<td></td>
</tr>
</tbody>
</table>

Sources: 780, 782, 776,
Table 16

Percentage Distribution of Production Costs, Rubber Tire Manufacturing Industry, 1927-1937(a)

<table>
<thead>
<tr>
<th>Item of Cost</th>
<th>1927</th>
<th>1929</th>
<th>1931</th>
<th>1933</th>
<th>1935</th>
<th>1927</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude Rubber</td>
<td>30.7</td>
<td>23.5</td>
<td>14.8</td>
<td>11.6</td>
<td>21.1</td>
<td>30.3</td>
</tr>
<tr>
<td>Reclaimed Rubber</td>
<td>2.3</td>
<td>2.2</td>
<td>1.7</td>
<td>1.0</td>
<td>.6</td>
<td>.9</td>
</tr>
<tr>
<td>Tire Fabrics</td>
<td>9.3</td>
<td>16.4</td>
<td>10.2</td>
<td>10.6</td>
<td>9.0</td>
<td>8.2</td>
</tr>
<tr>
<td>Power and Fuel</td>
<td>1.4</td>
<td>1.3</td>
<td>1.7</td>
<td>1.8</td>
<td>1.8</td>
<td>1.2</td>
</tr>
<tr>
<td>Other Materials</td>
<td>13.7</td>
<td>12.4</td>
<td>14.3</td>
<td>21.5</td>
<td>27.0</td>
<td>23.1</td>
</tr>
<tr>
<td>Total Materials</td>
<td>57.4</td>
<td>55.8</td>
<td>42.7</td>
<td>46.5</td>
<td>59.5</td>
<td>63.7</td>
</tr>
<tr>
<td>Wages</td>
<td>13.8</td>
<td>16.5</td>
<td>15.5</td>
<td>18.2</td>
<td>17.6</td>
<td>16.8</td>
</tr>
<tr>
<td>Other &quot;added costs&quot;</td>
<td>28.9</td>
<td>27.7</td>
<td>41.8</td>
<td>35.3</td>
<td>22.9</td>
<td>19.5</td>
</tr>
<tr>
<td>Total Value of Products</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

(a) Computed from data in Table 15.
Table 17

Production Costs per Tire
(and complement of tubes and accessories)
Rubber Tire Manufacturing Industry, 1927-1937(a)

<table>
<thead>
<tr>
<th>Item of Cost</th>
<th>1927</th>
<th>1929</th>
<th>1931</th>
<th>1933</th>
<th>1935</th>
<th>1937</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude rubber</td>
<td>$4.14</td>
<td>$2.57</td>
<td>$1.22</td>
<td>$0.77</td>
<td>$1.94</td>
<td>$3.22</td>
</tr>
<tr>
<td>Reclaimed rubber</td>
<td>.31</td>
<td>.24</td>
<td>.14</td>
<td>.07</td>
<td>.06</td>
<td>.10</td>
</tr>
<tr>
<td>Tire fabrics</td>
<td>1.26</td>
<td>1.80</td>
<td>.84</td>
<td>.70</td>
<td>.82</td>
<td>.87</td>
</tr>
<tr>
<td>Power and fuel</td>
<td>.17</td>
<td>.15</td>
<td>.14</td>
<td>.12</td>
<td>.17</td>
<td>.14</td>
</tr>
<tr>
<td>Other Materials</td>
<td>1.87</td>
<td>1.36</td>
<td>1.19</td>
<td>1.41</td>
<td>2.46</td>
<td>2.45</td>
</tr>
<tr>
<td>Total Materials</td>
<td>7.75</td>
<td>6.12</td>
<td>3.53</td>
<td>3.07</td>
<td>5.45</td>
<td>6.78</td>
</tr>
<tr>
<td>Wages</td>
<td>1.87</td>
<td>1.53</td>
<td>1.29</td>
<td>1.20</td>
<td>1.61</td>
<td>1.79</td>
</tr>
<tr>
<td>Other &quot;added costs&quot;</td>
<td>3.88</td>
<td>3.33</td>
<td>3.45</td>
<td>2.33</td>
<td>2.10</td>
<td>2.08</td>
</tr>
<tr>
<td>Total unit cost</td>
<td>$13.50</td>
<td>$10.98</td>
<td>$6.27</td>
<td>$6.60</td>
<td>$9.16</td>
<td>$10.65</td>
</tr>
</tbody>
</table>

Unit composed of:

<table>
<thead>
<tr>
<th>Item</th>
<th>1927</th>
<th>1929</th>
<th>1931</th>
<th>1933</th>
<th>1935</th>
<th>1937</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tires</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Number</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tubes</td>
<td>1.10</td>
<td>1.05</td>
<td>0.97</td>
<td>1.03</td>
<td>0.95</td>
<td>0.97</td>
</tr>
<tr>
<td>Number</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accessories</td>
<td>11.3</td>
<td>12.0</td>
<td>10.0</td>
<td>14.0</td>
<td>16.0</td>
<td>16.9</td>
</tr>
<tr>
<td>Percent of</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Share in Unit</td>
<td>$1.53</td>
<td>$1.32</td>
<td>$0.82</td>
<td>$0.92</td>
<td>$1.57</td>
<td>$1.74</td>
</tr>
<tr>
<td>Cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(a) Computed from data in Tables 2 and 15.
CHART B
PERCENTAGE DISTRIBUTION OF PRODUCTION COSTS, 1927-37
RUBBER TIRE MANUFACTURING INDUSTRY

SOURCE: TABLE 16
CHART C
PRODUCTION COSTS PER TIRE
(CAND COMPLEMENT OF TUBES AND ACCESSORIES)
RUBBER TIRE MANUFACTURING INDUSTRY
1927-37

SOURCE: TABLE 17
10. Fixed Costs

In the first place, it is clear from these tables that fixed costs are much less important than variable costs of tire production. The principal variable costs, materials and wages, constitute from about three fifths to over four fifths of the total reported value of goods produced by tire manufacturing establishments. The remainder, "other added costs", a category which includes such fixed costs as interest, depreciation, insurance, rent and salaries, together with some sales and advertising costs, taxes, legal expenses and, when received, profits, has been relatively higher in the depression years when production volume was low than in subsequent years. This fact suggests the importance to members of the industry of choosing among the alternatives of disinvesting when they have unused capacity and a high proportion of overhead, of competing vigorously in the market in independent attempts to increase their own volumes of sales even while total sales are declining, or of allying to restrict production and maintain prices at

73 Since "other added costs" is a derived, not a reported figure, consisting of the difference between the reported factory sales price and the reported materials and wages costs, it can be assumed to include factory profits in prosperous years, but not losses in depressed years. Hence, overhead may have been even higher in 1931 and 1933 than the "other added costs" computed for those years.
a level high enough to cover overhead even though fixed cost per unit may be large.

We have already seen that some disinvestment took place between 1930 and 1933, that failures have removed other units from the industry, and that attempts at alliance prior to 1935 were unsuccessful, but it is notable in the tire industry that the other choice was more frequently taken. For a number of years direct and indirect price cutting was widely resorted to by tire companies trying separately to spread their overhead expenses over a larger volume. In more recent years which are known not to be completely profitless, and which are suspected to be characterized by the existence of at least tacit alliances among tire manufacturers, it is evident that overhead charges have been reduced in the industry. This reduction can be found both with respect to aggregate overhead costs, and thus represents disinvestment and/or the development of more efficient productive organization, and with respect to fixed charges per unit, which reflects the increased volume of total sales, and higher tire prices.

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74 Supra, p. 83
75 Supra, p. 108
76 Supra, pp. 139 ff
Another method of reducing overhead which has been widely employed in other industries but which thus far has not been important in tire manufacturing has been employed in two known instances. In 1920 Kelly-Springfield moved its plant from Akron to Cumberland, Md., "where it was given a free site." In 1927 the Armstrong Rubber Co. started construction of its plant in Natchez, Miss. on a site provided by the city through the public flotation of a $300,000 municipal bond issue. In return, Armstrong agreed to invest $1,000,000 in plant equipment and to provide employment for four hundred men. Such relocation of plants, or construction of new plants in other areas, not only represents an attempt to reduce overhead by the alliance of tire companies with other interests, but also is a structural adjustment in other respects.

The location of a Goodyear plant at Gadsden, Ala., and a Firestone plant at Memphis, Tenn., is certainly not unconnected with differentials in northern and southern labor costs, and the establishment by each of the Big 4 of tire plants in the Los Angeles area is not unrelated to reduction in transportation costs, the existence of a relatively unorganized labor force in that area and the proximity to a large market for tires.

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77 N. Allen, op. cit., p. 339
11. Wage Costs and Labor Productivity

Of the variable costs, which are relatively much more important in this industry than fixed costs, it is noteworthy that materials costs are roughly from three to four times as large as labor costs, and have fluctuated much more sharply.

It is the boast of the tire industry that wage rates have always been typically higher than in most other branches of manufacturing, even though they declined from 10 to 30% between the 1920's and the early 1930's. During this same period, however, labor productivity increased steadily and rapidly because of technological improvement and/or, it is often claimed, the introduction of "speed-up" systems.

A detailed investigation of labor productivity in six large plants operated by the Big 4, and representing in the aggregate over one half of the total volume of production in the industry, was conducted by the United States Department of Labor in 1933. According to this study, output per man hour during the ten year period 1922-1931 almost doubled as measured by the number of


80 Cf. Fortune, November, 1926, p. 151b. The Bedaux system, by which bonus payments are made for output above a standard set task, is widely used in the tire industry.

tires produced (increasing continuously from .70 to 1.37 tires per man hour), and almost tripled as measured in terms of the weight of tires produced (increasing continuously from 11.28 to 30.67 pounds of tires per man hour). The extent of the reduction in labor costs per unit is even greater than is indicated by these figures when it is remembered that the labor force in tire manufacturing establishments has been increasingly occupied with the production of accessories in addition to tires. It is important to note, however, that more recently, especially since the effective formation of the CIO United Rubber Workers Union, which staged its first significant strike in February, 1936, the upward trend in labor productivity has been checked and the downward trend in wage rates has been reversed.

These changes in wage rates and wage costs are largely matters connected with labor policy, having to do with the tire companies' attitudes towards union-

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82 Ibid., p.7. See also R.C. Tugwell, Industry's Coming of Age (New York: Harcourt, Brace, 1927), p.3, which indicates a threefold increase of labor productivity between 1914 and 1927, and Exhibit No.2435, Hearings before the Temporary National Economic Committee, (Washington, D.C.: April 8, 1940), which indicates an increase of 85.3% in output per man hour in the rubber tire industry between 1929 and 1935.

ization and with their conflicts with unorganized and organized workers over wage rates, hours, and definition of the basic task in the piece-rate system. Nevertheless, as cost changes they have relevance to the market in that they represent the effect of major structural adjustments that have operated to the market advantage of tire companies, or that have served to minimize their disadvantages which may have arisen from other competitive pressures. Clearly, for instance, the price and quasi-price wars of 1927-1935 would have been devastating in their effect on all tire producers had not the reductions in income which they brought about been offset in part by reductions in cost.

The nature of the reorganization of productive functions in the tire industry since 1920, particularly the technological innovations which increased the ratio of capital to labor involved in tire production have been treated in some detail in the Department of Labor study. Although increased productivity in the tire industry is probably attributable primarily to the cumulative effect of many small evolutionary

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84 E.g. in 1936 alone there is record of 32 strikes in the tire industry, involving 70,571 workers. *Monthly Labor Review*, 44 (May, 1937), p.1225.

changes in the techniques of production, certain innovations stand out as particularly important to the structural adjustments made in the manufacturing activities of tire companies.

Chief among these is the development of huge mechanized "plasticators" with which six men can perform the formerly separate functions of cracking, washing, drying and breaking down crude rubber, which had required the labor of twenty-seven men, and of "Banbury mixers," mechanically churning caldrons which have made possible a net reduction of 50-60% of the labor force required for the milling, compounding and mixing of crude rubber with chemicals. Another major factor in labor displacement and the reduction of labor costs has been the growth of tire building on flat drums instead of on cores, a technique which requires much less skill and strength on the part of the worker and which is especially adapted to the construction of standardized small sized tires. The supplanting of "pot-heaters" by "watch-case vulcanizers" which require one fourth the labor force in the vulcanization process, and the use of chutes and conveyors, which has reduced by one third the labor involved in handling materials throughout the process of production, are further examples of

this technological change in tire manufacture. The principal innovation in the manufacture of tubes, the development of machinery for the production of endless molded tubes, has more than doubled the labor output under the older "mandrel" method of curing tubes on poles and then splicing them.

Most of these innovations have characteristically caused similar structural adjustments among all members of the industry. It is true, of course, that some technological advances have been adopted by one company first, but the others have quickly followed suit, or generally failed to survive. The only differences between companies in this respect that have given some of them significant relative cost advantages or disadvantages have been that a few companies have gained patent protection on the use of certain productive techniques, some have had temporary advantages because they

The early history of the industry is full of instances of this, which gave rise to long and bitter extra-market competition in the form of patent infringement and patent litigation. Cf. H. Allen, op. cit., pp.10-13, 23. Goodyear almost went out of business when its earnings were put in escrow during 1901 and 1902 pending the outcome of a suit charging the infringement of Kelly patents on tire-mounting equipment. Later, between 1909 and 1920, Goodyear was in the advantageous position of controlling the patents on the State tire-building machine, which was so great a technological advance that other tire companies became licensees of Goodyear in order to use it. This arrangement was broken up in 1920 by action under the Sherman Act.
were quicker than others in adopting new techniques, and some have enjoyed the advantages of financial strength when new machinery was particularly expensive.

On the whole, however, the companies that have survived in the industry have been alike in their adoption of new methods of production, and the unit costs of machinery and men have varied only a little among the leading tire companies. Most of the leading companies installed plasticators in late 1930 or early 1931, the large companies acquired Banbury mixers at about the same time in 1922, the drum method of tire building, first developed in 1919, was found in all plants by the middle 1920's, chutes and conveyor systems were installed by most between 1924 and 1926, and molded tubes

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88
U.S. Rubber enjoyed a relative cost advantage in 1930 when it put into operation the first continuous assembly line for tires. When combined with tire building on drums, during the next year, this so-called "merry-go-round" reduced production costs considerably. Cf. C.E. Fraser and G.F. Loriot, op. cit., p.107. Other companies have since constructed their own "merry-go-rounds."

89
Only the largest companies have been able to afford to install the huge Banbury mixers which are reported to cost about $1,000,000. Fortune, September, 1930, p.98.

90
It is important in this connection that size of plant is believed to have little influence on cost of production in the tire industry. E.G. Holt, in Rubber Industry Letter No. 12 says, "the size of plant per se has practically no influence on the cost of production in the rubber industries. Specifically, granting identical material and labor costs per unit, and the same management, a plant which at capacity produces 1,000 tires a day in two six hour shifts is about as economical to operate as a plant which at capacity produces 10,000 or 20,000 tires a day in two six hour shifts."
supplanted mandrel tubes in the late 1920's and early
1930's. The only major change which has been uneven
and slow to take hold is the substitution of watchcase
vulcanizers for pot-heaters. Since these vulcanizing
molds are expensive and durable, most firms have made
this transition slowly and have continued to operate
both types ever since the early 1920's.

12. Materials Costs

In sharp contrast to the relative similarity
of overhead and labor costs among individual tire manu-
ufacturers are the differences which can be found in the
costs of their materials. This is extremely significant
to the relative competitive positions of the various
tire companies in several respects. Materials costs
not only constitute the largest element of tire manufact-
uring costs, but also they have fluctuated more widely
than the other cost elements. And because of differences
in the organization and practices of tire producers,
the impact of these fluctuations on the various tire
companies is uneven and gives rise to a number of dif-
ferent competitive adjustments within and among them.

Separate data are available with respect to the
costs of only a few of the materials used in tire manu-
facture. The costs of the principal materials, rubber
and fabrics, are reported separately to the Census, and their relative importance to the total costs of tire manufacture can be determined from Tables 15, 16 and 17. Power and fuel costs, which are also segregated, are not a significant item in tire manufacture; it can be seen that they are not large enough and have not fluctuated widely enough to cause the tire companies any particular concern. Unfortunately, analysis of the relevance of changes in the costs of other materials to the competitive adjustments made by tire companies cannot be subjected to quantitative test for lack of detailed information. The "other materials" category, however, warrants brief attention, inasmuch as some data are available with respect to a few of its components.

As already indicated, this category includes a considerable proportion of fabrics. Its other major elements consist of the principal rubber chemicals, carbon black, zinc oxide and sulphur, along with other chemical pigments, fillers, anti-oxidants and organic accelerators, wire for the tire bead, hardware fittings for the valves and paper for wrapping. In addition to these materials that can be found in the final product as it appears on the retailer's rack, the "other materials-cost" classification includes an increasing number of miscellaneous materials used in the production of accessories. Moreover, this category is believed, be-
cause of the accounting techniques of some of the companies reporting to the Census, also to include some machinery maintenance, mill and shop supplies, some machinery, perhaps some inventory depreciation, costs for water supplies, and, in some cases, scrap rubber. The relative importance of a few of these cost elements can be inferred from such fragmentary sources as a special tabulation of rubber chemicals costs made in the 1929 Census of Manufactures, U.S. Department of Commerce estimates, and scattered trade association estimates.

Although fluctuations from year to year are not available for separate items and sharp increases in the total of "other materials costs" in recent years raise significant questions as to the relative responsibility of each constituent of the total, only the following generalizations can be made: From one fifth to one third of the total of other materials costs are fabrics and cotton goods, from one fourth to one third are chemicals costs, of which carbon black, zinc oxide and sulphur are most important, and slightly under one tenth are hardware fittings. The remainder,

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91 Ibid., pp.5,6,8.
which varies as low as one fourth in the depression years and as high as one half in prosperous years, consist of unsegregated cost items.

The unsegregated cost items, of course, cannot be analysed, the costs of hardware fittings can be dismissed as relatively unimportant, and fabrics will be discussed in subsequent pages. A word, however, is in order with respect to the relevance of rubber chemicals costs to the competitive adjustments of tire manufacturers.

13. Chemicals Costs

In this connection, it is important to note that the costs of carbon black typically fluctuate much more widely than the costs of such other major rubber chemicals as zinc oxide and sulphur. As high as 88% of the total sales of carbon black are made to the rubber industry, with the remainder going to scattered producers of printing-ink and paint. Consequently, in the years when the volume of tire production is high, the principal carbon black plants, which are located primarily in Texas and Louisiana and which manufacture their product by the imperfect combustion of natural

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gas, are strained to capacity, and carbon black prices soar. Conversely, when the tire industry is depressed, carbon black manufacturers have only a small market for their product, compete more violently among themselves, and weaken the bargaining position of their industry; hence, the cost of carbon black to the tire producers tends to fall sharply.

On the other hand, the sulphur industry is not at all sensitive to changes in the fortunes of tire companies. The rubber industry's consumption of sulphur is negligible as compared with the quantities of sulphur taken by the fertilizer, insecticide, pulp and paper, explosives, paint, and dye industries; hence, tire companies, in their sulphur purchases,

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94 The great sensitivity of price to changes in the quantity of carbon black demanded can be inferred from the following Census data regarding production and value of production of carbon black:

<table>
<thead>
<tr>
<th></th>
<th>1933</th>
<th>1935</th>
<th>1937</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lbs. produced (millions)</td>
<td>273.1</td>
<td>352.7</td>
<td>510.6</td>
</tr>
<tr>
<td>1933 = 100</td>
<td>100.0</td>
<td>129.1</td>
<td>186.9</td>
</tr>
<tr>
<td>Value of products ($ millions)</td>
<td>7.6</td>
<td>13.8</td>
<td>17.4</td>
</tr>
<tr>
<td>1933 = 100</td>
<td>100.0</td>
<td>181.6</td>
<td>228.9</td>
</tr>
</tbody>
</table>


95 Between 1927 and 1937, the entire rubber industry consumed only from 2.0% (1937) to 3.3% (1931) of all sulphur produced in the U.S. Cf. Exhibit No. 373, Hearings before the Temporary National Economic Committee, Washington, D.C., March 14, 1932.
neither have the bargaining power of monopsonists nor create a costly bottleneck for themselves by sharp increases in their demand. To the contrary they are obliged to deal with a highly concentrated industry dominated by two large producers, The Texas Gulf Sulphur Company and the Freeport Sulphur Company, which between them have produced on an average over 94% of total production in the United States since 1924. These companies, which divide the world market for sulphur with Sicilian producers and with two other small domestic producers, the Jefferson Lake Oil Company and the Duval Sulphur Company, through the instrumentality of the Sulphur Export Corporation formed under the Webb-Pomerene Act, have set a price for prime grade sulphur of $16.00 per ton, f.o.b. the mines. This price has not varied more than three cents per ton for the past ten years. Most of the other chemicals that are used in tire manufacture are bought under somewhat similar circumstances.

In fact, with the exception of carbon black purchases in depression years, the tire companies tend to have a relatively weak competitive position in their chemicals purchases. When they are relatively unimportant purchasers of a chemical, as in the case of sulphur,

they are not strong enough to demand and receive special treatment. When they are large buyers of other chemicals, as in the case of zinc oxide or the organic accelerator, diphenylguanidine, they are usually obliged to deal with such a large chemical producer as duPont, which is so thoroughly diversified as to feel little pressure from a buyer, however large, of only a few of its many products.

As a result, certain tire companies have made structural adjustments in an effort to improve their relative positions as consumers of chemicals. These adjustments have generally taken one of three forms: vertical integration, by which the tire companies manufacture their own chemicals, alliance with a chemical manufacturer, or the establishment of laboratories concerned with the improvement of rubber chemistry.

A number of the larger tire companies have their own research laboratories and manufacture some of their own chemicals. This has grown to such an extent that at least two of the major companies, Good-year and U.S. Rubber, are known to manufacture an excess over their own needs and to sell chemicals to some of the smaller rubber and tire manufacturers. This places the small companies in the unenviable position of securing materials from a market competitor.

The duPont company provides a large proportion
of the rubber chemicals used by the industry and its alliance with U.S. Rubber probably does not work to that company's disadvantage. DuPont and Rubber Service, which supply compounding materials, also offer certain testing facilities and technical advice to the smaller companies which do not maintain their own laboratories. It is claimed that the high quality of this technical service, together with its low cost, is such that the smaller companies at present suffer no disadvantage in this regard.

In the earlier days of the industry, however, the large companies often grew in part because of the relative advantages they enjoyed through the discoveries of their own technical staffs. Much product improvement and reduction in production costs, particularly in the time required in the vulcanization process, is directly attributable to the development of rubber chemistry within the laboratories of individual tire companies. And, wherever possible, each company kept the fruits of its discovery to itself. For instance, the greatest single advance in rubber chemistry was

97 By the same token, the fact that David M. Goodrich, Chairman of the Board of Directors of the B.F. Goodrich Company, is also a Director of the Freeport Sulphur Company and of Commercial Solvents Corporation is probably not without significance. Cf. Exhibit No. 380, Hearings before the TNEC, op. cit.

made by George Oenslager in 1906 when he discovered the superiorities of organic materials, first aniline oil and later thio-carbanilide, for accelerating vulcanization. At this time he was with the Diamond Tire and Rubber Company, which thereupon began to grow rapidly until it was the third largest in the industry. In 1911 this company was merged with Goodrich which thereby gained a considerable advantage over its competitors in tire manufacture. The advantage was maintained by keeping the Oenslager process a secret until 1912, when it was patented through a foreign subsidiary of Goodrich. Subsequently other companies developed their own organic accelerators, so that the Goodrich advantage was lost.

14. Fabrics Costs

Much more significant structural adjustments than these, however, have been made by members of the tire industry with respect to their fabric costs. Customarily, fabrics have been second only to crude rubber

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100 E.g. in 1922 Goodyear laboratories developed a greatly improved organic accelerator, mercaptobenzothiazole, which permits vulcanization over a wide range of temperatures. Since 1926 this has been sold to other rubber manufacturers under the trade name, "Captax."
in the manufacturing costs of tires, and at certain
times in the history of the industry, fluctuations in
their costs have raised serious problems for tire com-
panies. Since the 1920's, however, these problems have
been reasonably well solved.

In the early days of the industry, tire manu-
ufacturers purchased their fabrics from New England mills.
There was constant friction between mill owners and tire
manufacturers both with respect to fabric prices and
specifications, with the mill owners reluctant to scrap
their existing machinery and install new machinery
every time the tire companies demanded an improvement
in the product. This was particularly so because tire
fabrics represented only a small part of the total
sales of these mills.

Fabric costs are believed to have exceeded rubber
costs in tire manufacture between 1931 and 1933, when
crude rubber prices were extremely low. Although this
cannot be seen in Tables 15, 16 and 17, the likelihood
is strong that such was the case if we remember that
the fabric cost data in those tables are only about
70% complete.

H. Allen, op. cit., pp.156-158.

Even now, when the tire industry is much larger, it
consumes only a small part of cotton manufactures.
In 1935, for instance, the entire rubber industry
used less than 7% of the total value of cotton manu-
factures. Cf. Special Circular No. 3640 (Washington,
The Goodyear Company led the way in a revolt against the textile manufacturers when in 1916, failing to find a mill that would provide a fabric of equal strength to a new fabric just developed by British competitors, it bought a mill at Killingly, Conn., and began to manufacture its own fabrics. Other tire companies did not follow suit immediately, but waited until after the end of the war.

At this time, a crisis was reached for the tire companies. A boom in the textile industry, high cotton prices, a bottle-neck in the production of textile machinery and a sharply increased demand for tire fabrics combined during 1919 and 1920 to raise fabric prices from 30¢ to $1.25 a pound. And in order to secure fabrics at any price, the tire companies were obliged to contract for commitments from one to three years ahead.

With the recession of 1921, a number of the tire companies suffered grave losses. The largest ones in particular were burdened with heavy commitments for 104 fabrics at high prices, while the smaller companies, some of which had almost shut down in 1920 for lack of fabric, were temporarily at a relative advantage.

---

As a result of this experience, the large companies all began to establish their own fabric plants, while the small companies lacked both the capital and the motive to do so. Thus all during the 1920's the Big 4, together with General and Fisk, were integrating vertically to avoid a recurrence of the circumstances which had placed them in a disadvantageous competitive position.

An interesting temporary alliance of two tire companies came out of this situation. In 1921 both Goodyear and Fisk had commitments at the same plant in New Bedford, Mass. Finding it cheaper to buy the mill than to take delivery under these commitments, these two companies purchased the mill in 1924 and operated it jointly for several years. The arrangement must have been successful, because in 1926 Fisk and Goodyear jointly bought another mill, at Passaic, N.J. Subsequently this alliance broke down and Goodyear moved its half of the spindles to its plant in Cedartown, Georgia.

In connection with their fabric costs, the tire companies have also operated in the raw cotton markets. Goodyear alone has attempted to grow its own cotton and this venture, a plantation in Arizona, has been more lucrative as a vacation resort in recent 105 years than as a cotton producer. The other large

105

E. Allen, op. cit., pp. 146-151.
companies, however, speculated heavily in cotton
during the middle and late 1920's and variously
made inventory gains or losses in their fabric costs.
Firestone is reported to have been most successful
in these dealings, at one time buying a three year
supply for its fabric mills at the relatively low
prices of 1926. It was during this year that Fire-
stone acquired its warehouse at New Bedford, Mass.,
in order to store its cotton. With the declining
trend of cotton prices since 1928, most of the tire
companies, obliged to hold cotton inventories, have
suffered more losses than gains in their cotton spec-
ulation. As a consequence, they have adopted the
practice in recent years of hedging their cotton pur-
chases.

Thus a materials cost which used to fluctu-
ate violently and give rise to sharp differences in the
relative competitive positions of various tire companies
has been brought reasonably well under control by the
adjustments of the separate companies. The price of
cotton itself has not fluctuated widely in the past
few years, and when it does its impact is approximately

the same on the small companies who buy from textile manufacturers as on the large companies that operate their own fabric mills. The integrated companies maintain a slight advantage when fabric manufacture is profitable and the unintegrated companies gain when they can secure fabrics at distress prices. One possible advantage that exists for the large companies lies in the fact that they make a practice of controlling a mill capacity which is not large enough to satisfy even their minimum requirements, so that their mills can operate at capacity throughout the year.

A recent development that may upset this balance is the substitution of rayon for cotton in tire fabrics. Although this is still in the experimental stage, over one million pounds of rayon cord were produced in 1936, mostly by the large tire companies in their own fabric mills. Thus far rayon fabric is expensive and though its use is growing in truck and bus tires because it can stand friction and heavy loads better than cotton fabric, it is not advantageous for passenger automobile tires. If, however, significant proportions of rayon should ever be used in tire fabrics, some of the tire companies would have to make sharp readjustments in their productive organization.

108 C.E. Fraser and G.F. Doriot, op. cit., p.93.
109 Rubber Section, Special Circular No.3640, op. cit., p.6.
15. Crude Rubber Costs

The most important single element of tire manufacturing costs, and a consistently vexing problem to the tire companies, has been the cost of crude rubber. Its wide fluctuations, from 11.6% to over 30% of total tire manufacturing costs, and from $0.77 to $4.14 in the unit cost of tire manufacture, even within the short span of years covered in Tables 16 and 17, has been an extremely unsettling factor in the competition of the tire industry. This is particularly true because crude rubber costs have varied widely among different companies.

The full story of the irregular development of crude rubber production, with its dramatic relocation, its feverish speculation, its violent price fluctuations, its restriction schemes and their breakdowns, and its conflicts and alliances among imperialistic nations, plantation owners and native tappers of wild rubber trees, is far too long and complicated to be detailed here. Nevertheless, certain highlights

should be indicated in so far as conflicts and alliances among rubber producers have presented problems to tire manufacturers, and necessitated adjustments by them.

Until about 1906, thirty years after Henry Wickham had smuggled out of Brazil the seeds of the rubber trees which eventually started the plantations of the Middle East, the only rubber sold commercially in appreciable quantities was wild rubber grown in the Amazon valley and in tropical Africa. That year, in the face of a rapidly expanding rubber and tire industry, Brazilian traders in Para engineered a virtual corner on crude rubber which was maintained until after 1912 when they secured governmental sanction of their restriction schemes. This action forced the price of crude rubber up to such high levels as to give great impetus to the development of rubber culture in other parts of the world, particularly on plantations in British Malaya, Ceylon, the Netherlands Indies and adjacent territories.


112 Although the Brazilian government's Defesa de Borra-cha was not promulgated until April 17, 1912, it was "practically in force from 1906 to 1912." P.W. Barker, Rubber Statistics, 1900-1937, op. cit., p.42.
Rubber prices increased sharply, although fluctuating widely, until they reached a peak of almost $3.00 per pound in 1910. With increasing supplies of rubber coming on the market as the trees on the new plantations became ready for tapping, crude rubber prices began to decline sharply. This decline, which was scarcely checked even during wartime, was continuous, although characterized by wide fluctuations, until a low of 11½ cents per pound was reached in 1921.

At that time British interests, which controlled about 67% of the total output of crude rubber, began to agitate for a plan of governmentally-enforced restriction of production. On November 1, 1922, the Stevenson Act was passed, establishing machinery to set export quotas for all production in the major British-controlled rubber-growing areas of British Malaya, Ceylon, India, Borneo and Sarawak. For a few

113 The extent of the speculative frenzy that accelerated the expansion of plantations in the Middle East may be inferred from the fact that a Belgian plantation company paid a cash dividend of 520% in November, 1910. This company is reported to have received net profits of over six million dollars in eight years on an original investment of less than two hundred thousand dollars. H.S. Firestone, Jr., op. cit., pp. 41-42.

114 The volume of plantation production had considerably surpassed the volume of wild rubber production by 1914. Cf. infra, Table 19, p. 89. The boom in planting had occurred earlier, but it requires about six years for a rubber tree to mature.

115 Cf. infra, Table 18, pp. 126-127

116 C.E. Fraser and G.F. Doriot, op. cit., p. 85. H. Allen, op. cit., p. 85, sets the figure at 86% of total plantation rubber production.
years this plan was effective in raising rubber prices; in fact, the price per pound went above one dollar for a time in 1925. At the same time, however, it offered a strong incentive for an increase of production in the non-regulated areas, particularly the Netherlands Indies, where both plantation production and native wild rubber tapping expanded rapidly. When, by 1927, the British-controlled share of world production had fallen to 53%, the Stevenson Act was deemed a failure, and was abandoned in the following year. With the lifting of restrictions on British production, large additional quantities of rubber came on the market, and as world depression reduced the demand for rubber, its price

Crude rubber production in the Netherlands Indies increased from 25.6% of total world production in 1922, before the passage of the Stevenson Act, to 38.2% of the total in 1927. W.H. Cross, G.S. Harsenman and J.R. Lenaerts, op. cit., p.89. Cf. also infra, Table 20, pp. 192-7. In 1922, 2.98 millions of acres of rubber trees had been planted in British controlled areas; by 1928 this acreage had increased 21.5% to 3.62 millions. In 1922, Dutch plantations covered .94 million acres and native planting covered .54 million acres, a total of 1.48 million. Under the stimulus of the Stevenson Act, the total Dutch-controlled acreage increased 150.0%, with plantation acreage increasing to 1.30 millions and native planting to 1.40 millions, making a total acreage planted of 3.70 millions, or slightly in excess of the British acreage. The native planting, though large, is not nearly as productive as plantation acreage. Cf. C.R. Whittlesey, op. cit., p.109.

continued to decline until it reached an all time low of less than three cents per pound in 1932 and again in 1933.

As a result, plantation owners in all the major producing areas clamored for relief. On July 1, 1934, an International Rubber Regulation Agreement was signed, by which production was regulated through the establishment of flexible rubber export quotas for British Malaya, Ceylon, India and Burma, North Borneo, Sarawak, the Netherlands Indies, French Indo-China and Siam. The first such agreement, which was to terminate at the end of 1938, has since been extended until 1943. Under this plan, which has set quotas as high as 90% (second half of 1937) and as low as 45% (second half of 1938) of allotted capacity, prices have been raised, and their fluctuations have been restricted to a range of from about ten to twenty-five cents per pound. Meanwhile, there has been a slight increase in production in the unregulated areas, the Amazon Valley, parts of Africa, Central America, Mexico, Papua and the Philippines and, it is believed, an increase in smuggling on the part of native tappers in regulated areas,

but as yet this volume has been far too small to offer any threat to the producers allied under the International Rubber Regulation Agreement.

Tables 18, 19 and 20, on the following pages, show the magnitude of the price fluctuations in plantation and wild rubber, and the changing relative importance of the major sources of crude rubber supply. (see also Chart D, showing the range of fluctuations in the New York spot price of the leading grade of plantation rubber since 1906.)

In 1938, 97% of total world rubber shipments were made from regulated areas. P.W. Barker, Rubber Industry of the United States, op. cit., p.8. In that same year, productive capacity, as measured by the number of acres of cultivated rubber trees, was distributed as follows:

<table>
<thead>
<tr>
<th>Country</th>
<th>Acres Cultivated</th>
<th>Rubber Exports (1,000 tons)</th>
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<tbody>
<tr>
<td>British Malaya</td>
<td>3,273,100</td>
<td>372,048</td>
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<td>Netherlands Indies</td>
<td>3,214,900</td>
<td>297,771</td>
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<tr>
<td>Ceylon</td>
<td>805,200</td>
<td>49,549</td>
</tr>
<tr>
<td>French Indo-China</td>
<td>314,200</td>
<td>58,618</td>
</tr>
<tr>
<td>Siam</td>
<td>312,000</td>
<td>41,080</td>
</tr>
<tr>
<td>Sarawak</td>
<td>228,000</td>
<td>17,792</td>
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<td>India</td>
<td>128,000</td>
<td>8,223</td>
</tr>
<tr>
<td>British North Borneo</td>
<td>126,600</td>
<td>9,512</td>
</tr>
<tr>
<td>Burma</td>
<td>104,400</td>
<td>6,738</td>
</tr>
<tr>
<td>Others: Amazon Valley, Philippines, Papua, other America and Mexican guayule</td>
<td>120,000</td>
<td>27,200</td>
</tr>
<tr>
<td>Total</td>
<td>8,426,400</td>
<td>888,431</td>
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Table 18
New York Annual Low and High Spot Rubber Prices, 1900-1938 (a)

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<td>(b)</td>
</tr>
<tr>
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<td>(b)</td>
<td>(b)</td>
</tr>
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<td>150(c)</td>
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<td>93(c)</td>
<td>138(c)</td>
</tr>
<tr>
<td>1908</td>
<td>75(c)</td>
<td>130(c)</td>
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<td>1909</td>
<td>128(c)</td>
<td>208(c)</td>
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<td>140(c)</td>
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<td>59</td>
<td>113</td>
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<td>17 3/4</td>
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Upper River Fine, Para (cents per pound)

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<td>1905</td>
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<td>1938</td>
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(For footnotes see following page)
(a) Prices for 1900-1937 reported by India Rubber World, as published in Rubber Statistics, 1900-1937, op. cit., p. 43. Prices for 1938 from Annual Report, 1938, Firestone Rubber Company and Mr. M.E. Lerner, Managing Editor, The Rubber Age.

(b) Plantation rubber was not regularly on the market at this time.

(c) Annual high and low given on first day of the month. In 1906-10, the equivalent of this grade was called "Ceylon Plantation fine sheet;" in 1912-15, "Plantation fine smoked sheet."
CHART D

NEW YORK ANNUAL LOW AND HIGH SPOT RUBBER PRICES, 1900-1938
PLANTATION RIBBED SMOKED SHEETS

SOURCE: TABLE 18
<table>
<thead>
<tr>
<th>Year</th>
<th>Amazon Valley</th>
<th>Africa</th>
<th>Middle East</th>
<th>World Total</th>
<th>United States Consumption (Net Imports)</th>
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<td>278.1</td>
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</tr>
<tr>
<td>1918</td>
<td>22.3</td>
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<td>181.1</td>
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</tr>
<tr>
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<td>7.0</td>
<td>349.0</td>
<td>399.7</td>
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<tr>
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<td>379.5</td>
<td>406.4</td>
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</tr>
<tr>
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</tr>
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</tr>
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<td>782.9</td>
<td>796.3</td>
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</tr>
<tr>
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</tr>
<tr>
<td>1933</td>
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<td>838.8</td>
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</tr>
<tr>
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<tr>
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<td>5.0</td>
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<td>861.2</td>
<td>888.4</td>
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</tr>
</tbody>
</table>

Table 20

Principal Sources of Supply, Crude Rubber, 1926-1938 (a)
Percentage of Total World Production

A. British-Controlled Sources

<table>
<thead>
<tr>
<th>Year</th>
<th>British Malaya</th>
<th>Ceylon</th>
<th>India and Burma</th>
<th>British North Borneo</th>
<th>Sarawak</th>
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<td>1926</td>
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</tr>
<tr>
<td>1927</td>
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<td>9.2</td>
<td>1.9</td>
<td>1.1</td>
<td>1.8</td>
</tr>
<tr>
<td>1928</td>
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<td>1.7</td>
<td>1.0</td>
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</tr>
<tr>
<td>1929</td>
<td>52.8</td>
<td>9.3</td>
<td>1.4</td>
<td>.9</td>
<td>1.3</td>
</tr>
<tr>
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<td>53.9</td>
<td>9.2</td>
<td>1.3</td>
<td>.8</td>
<td>1.3</td>
</tr>
<tr>
<td>1931</td>
<td>52.9</td>
<td>7.8</td>
<td>1.0</td>
<td>.8</td>
<td>1.3</td>
</tr>
<tr>
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<td>7.0</td>
<td>.6</td>
<td>.8</td>
<td>1.0</td>
</tr>
<tr>
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<td>7.5</td>
<td>.5</td>
<td>.9</td>
<td>1.3</td>
</tr>
<tr>
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<td>1.2</td>
<td>1.1</td>
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<td>5.6</td>
<td>1.7</td>
<td>1.1</td>
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</tr>
</tbody>
</table>

Table 20 (continued)

Principal Sources of Supply, Crude Rubber, 1926-1938 (a)
Percentage of Total World Production

B. Non British-Controlled Sources

<table>
<thead>
<tr>
<th>Year</th>
<th>Netherlands Indies</th>
<th>French Indo-China</th>
<th>Thailand (Siam)</th>
<th>Amazon Valley</th>
<th>Africa</th>
<th>Others (b)</th>
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<tbody>
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<td>.6</td>
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<td>1.4</td>
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<td>4.7</td>
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<td>1.2</td>
</tr>
<tr>
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<td>1.5</td>
<td>.7</td>
<td>3.2</td>
<td>.9</td>
<td>.7</td>
</tr>
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<td>29.5</td>
<td>1.0</td>
<td>.6</td>
<td>2.4</td>
<td>.5</td>
<td>.2</td>
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<tr>
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<td>1.3</td>
<td>.5</td>
<td>1.7</td>
<td>.5</td>
<td>.2</td>
</tr>
<tr>
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<td>1.5</td>
<td>.6</td>
<td>1.5</td>
<td>.4</td>
<td>.0</td>
</tr>
<tr>
<td>1932</td>
<td>29.7</td>
<td>2.0</td>
<td>.5</td>
<td>.9</td>
<td>.2</td>
<td>.0</td>
</tr>
<tr>
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<td>33.0</td>
<td>2.2</td>
<td>.9</td>
<td>1.2</td>
<td>.2</td>
<td>.1</td>
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<tr>
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<td>37.4</td>
<td>1.9</td>
<td>1.7</td>
<td>.9</td>
<td>.3</td>
<td>.1</td>
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<tr>
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<td>32.4</td>
<td>3.3</td>
<td>3.2</td>
<td>1.3</td>
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<td>.4</td>
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<tr>
<td>1936</td>
<td>36.2</td>
<td>4.8</td>
<td>4.0</td>
<td>1.7</td>
<td>.7</td>
<td>.4</td>
</tr>
<tr>
<td>1937</td>
<td>38.1</td>
<td>3.5</td>
<td>3.1</td>
<td>1.4</td>
<td>.7</td>
<td>.3</td>
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<tr>
<td>1938</td>
<td>35.6</td>
<td>6.6</td>
<td>4.6</td>
<td>1.6</td>
<td>.9</td>
<td>.5</td>
</tr>
</tbody>
</table>


(b) The other minor producing areas are in Central America, Mexico, the Philippines and Papua.
The importance to tire manufacturers of the price fluctuations and changes in the sources of rubber supply which are indicated by these tables should not be underestimated. The rubber industry in the United States consumes roughly half of the world's production of rubber, all of which is imported. And three quarters of this rubber is used by the tire industry. Consequently, with the price of their principal raw material as unstable as it has been under alternate restriction programs and unrestricted production, tire manufacturers have sought for means to stabilize their sources of supply. This has led to many different types of adjustment among the various companies.

Customarily the large tire companies have bought most of their rubber directly or through agents in the Middle East, or at the Singapore rubber auctions, while the small companies more frequently have secured

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122 According to the Census of Manufactures in 1937, rubber was consumed in the following proportions by the following principal classes of products: Pneumatic casings - 62.88%, Inner tubes - 9.69%, Solid and Cushion Tires - 3.51%, Tire sundries - 2.29%; Non-tire rubber production - - Mechanical rubber goods - 10.63%, Boots and Shoes - 3.81%, Heels and Soles - 2.48%, Rubber Thread, Cement and Gloves - 1.79%, Rubberized Fabrics - 1.96%, Other Rubber Products - 4.34%. Cf. P.W. Barker, Rubber Industry in the United States, op. cit., p.24.

123 Firestone and Goodrich have separate subsidiary corporations to handle their rubber purchases in the Middle East.
their supplies through brokers and from organized 124 markets in London and New York. The major companies are obliged to carry an inventory of four months' supply at the minimum and have no way of hedging their large purchases, while the smaller companies 125 can buy from hand to mouth at New York spot prices and can hedge the risks of inventory losses. As a consequence, the range of price fluctuations is of great importance to the large companies and the trend of prices is significant to the relative advantages of large as against small companies. The large company that has shrewd or fortunate buyers who can secure rubber in the primary markets at the low point in a temporary price fluctuation has a cost advantage over all other producers, while the company which has bought at the peak is at a disadvantage. When the trend of rubber prices is rising, the large companies, 

124 The New York Rubber Exchange was organized in 1926 to deal in rubber futures. Its daily volume is so small that the large companies cannot trade there. Cf. Fortune, November, 1936, op. cit., p.150.

125 This is sometimes a matter of policy and sometimes a financial exigency. Norwalk, for instance, has a policy of making no future commitments longer than 60 days in its materials purchases. Cf. Norwalk Tire and Rubber Company, Annual Report, 1938. Other small companies often lack the working capital to make future commitments at all.
which are always at least four months long on the market, have an advantage over the smaller companies, and conversely the smaller companies stand to gain relatively by falling rubber prices.

It is for this reason that most of the major tire companies have not protested strongly against the restriction schemes of crude rubber producers. It is more important to them that rubber prices be stable than that they be low, and it is better that they be rising than that they be falling. Even in the days of the Stevenson Act, Harvey S. Firestone was the only representative of the Big 4 who objected strenuously to restriction of rubber production. He led a campaign that resulted in the appropriation by Congress

127 Goodyear took an inventory loss of $30,000,000 when prices fell sharply between 1920-1921, and was reorganized as a consequence. President Seiberling was ousted and Dillon, Read took control. Ibid., pp.114 ff. Between 1926 and 1934, the seven largest tire companies incurred inventory losses of over $83,000,000. Brief of Rubber Manufacturers Association NRA Hearings, cited in W.H. Cross, G.E. Earsman and J.H. Lenaerts, op. cit., p.93. U.S. Rubber was the greatest loser during this period, writing off almost $50,000,000. Fortune, November, 1936, op. cit., p.146.
128 Cf. C.E. Fraser and G.F. Doriot, op. cit., p.86.
129 H.S. Firestone, Jr., op. cit., pp.65-68.
of $500,000 to investigate the possibility of developing new sources of rubber supply. When the Stevenson Act failed to prevent wide price fluctuations, however, the heads of the other large companies joined the campaign. In 1926 they even allied temporarily, along with automobile manufacturers, to form the Crude Rubber Agency, a purchasing pool with resources of about $40,000,000, which endeavored to maintain a floating supply of crude rubber in the United States and to time its purchases in such a way as to reduce the price fluctuations which accompany independent action by large buyers. Because of falling rubber prices after 1926, the operations of this pool were unprofitable, and its existence is unreported after April, 1928.

After the large inventory losses incurred by the major companies during the price decline which lasted until 1933, the establishment of the International Rubber Regulation Agreement was a welcome change. And its operation, both in raising rubber prices and in reducing the violence of their fluctuation, has

130 C.E. Fraser and G.F. Doriot, op. cit., p.87.
131 Firestone lost three and one quarter million dollars in this pool. Ibid.
been relatively advantageous to the large tire manufacturers. Moreover, their interests are now consulted before the quarterly quotas are established, inasmuch as a representative of the Rubber Manufacturers Association serves in an advisory capacity at the meetings of the International Rubber Regulation Committee.

In addition to the divergent procedures adopted by different tire companies in buying their rubber, certain other devices have been employed by various members of the industry in an effort to soften the impact upon them of unstable rubber costs. Chief of these are the establishment of rubber plantations by some of the major consumers of rubber, the promotion of rubber growing in unregulated areas, the search for substitute materials, the constant efforts to improve and cheapen synthetic rubber and the development of rubber reclaiming.

Only the largest and financially strongest of the tire companies have integrated vertically to the extent of operating their own rubber plantations, and even these can fill only a fraction of their re-

uirements from their own rubber production. Three of the Big 4 own rubber plantations. U.S. Rubber is the leader in this activity, both because it started its plantations earliest and because it produces the most rubber. After a false start in 1903, when this company acquired large concessions in South America, only to let them lapse when rubber production moved to the Middle East, it started its present plantations in Sumatra in 1911. These holdings, together with later acquisitions in Malaya, have grown from an original planting of 14,000 acres to about 100,000 acres of matured trees in 1938, and are sufficient to supply about one fifth to one quarter of the company's requirements. Goodyear followed suit in 1916 when it acquired plantations in Sumatra. At present, these holdings cover about 90,000 acres, of which only about half are covered with trees in bearing. These plantations produce an estimated one tenth of Goodyear's rubber requirements. This company also has small

133
134
C.E. Fraser and G.F. Doriot, op. cit., p.88.
135
It should be noted that the major holdings of both U.S. Rubber and Goodyear are in territories which are controlled by countries which are parties to the International Rubber Regulation Agreement. Hence, production on these plantations is subject to restriction.
plantations in Panama, Costa Rica and the Philip-
136 pines. In 1924, stimulated by the operations of the
Stevenson Act, Firestone became the third major Amer-
ican tire company to establish its own plantations.
its rubber growing activities are centered in Liberia,
where extensive concessions were obtained on a 99
year lease. In 1938 only about 30,000 acres of trees
were in bearing, enough to provide less than ten per-
137 cent of the company's requirements. The other member
of the Big 4, Goodrich, has not established rubber plan-
tations on the grounds that a large investment in crude
rubber growing is unnecessarily risky in view of the
138 potentialities of synthetic rubber. None of the other
139 American tire companies, except the Ford Motor Company,
which is thus far a distinctly minor factor in the
industry, has chosen to grow its own rubber. In most
instances, the other companies have lacked the finan-

136 American tire producers are irate at the Philippine
land law which prohibits holdings by a single owner
of more than 2,500 acres. Lobbying attempts to revise
this legislation have been unsuccessful. Cf. H. Allen,
138 President Tew of the Goodrich Company has been quoted
as explaining this policy by saying, "We're going to
have synthetic rubber as sure as you live." Ibid., p.151.
139 Michelin, the leading French tire producer, has a planta-
tion in French Indo-China, and Dunlop, the major British
119-120.
cial strength to tie up the necessary amount of capital for the requisite period of time. Ford has started a large plantation at Boa Vista, Brazil, which is the first important move to return rubber production to the Western Hemisphere.

A comparison of the size of the tire companies' plantations with the total world acreage indicates that the aim of establishing a controlled rubber supply is far from achieved by the present vertical integration in the tire industry. Not more than three percent of the total rubber acreage is in the hands of tire companies, and their share could be increased substantially only by tremendous investments.

Consequently, other means have been sought by

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140 Because of their weak bargaining position as rubber buyers and their dependence on distant, regulated sources of supply, which might be cut off during wartime, American tire manufacturers, led by Paul Litchfield of the Goodyear Company, have recently been campaigning for the revival and extension of Latin-American rubber growing under governmental auspices. Cf. New York Times, March 26, 1940, p.31.

141 Cf. supra, p.187, footnote 121.

142 E.g. the U.S. Rubber Company plantations, covering less than 100,000 acres of mature trees, out of a world total of almost eight and one half million acres, represents an investment of more than thirty million dollars. Cf. United States Rubber Company, 47th Annual Report, March 1, 1939, pp.7-8.
tire manufacturers to mitigate their dependence on foreign controlled rubber supplies. Notable efforts have been made to find substitute materials. At first this took the form of experimenting with the gums of trees other than *hevea brasiliensis* from which commercial crude rubber is collected. The best substitutes that could be found were a small tree indigenous to Madagascar, "intinsy," and a tropical tree known as "Castilloa." Intinsy was used by French tire manufacturers as early as 1905, but its cost of production was over one dollar per pound. Technicians of the Firestone Company, which established experimental plantations in Southern Mexico at the time of the Stevenson Act, thought they had found a practical substitute for *hevea* in the Castilloa tree, but subsequently discovered that Castilloa could be tapped only two or three times per year, as compared with the daily tapping of *hevea*. Other experiments have been made with the *Gnara* tree in the Philippines, but large scale exploitation of this possibility has been blocked by the Philippine land law.

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143 C.E. Fraser and G.F. Doriot, op. cit., p.80.
145 W.C. Geer, op. cit., p.84.
The industry's hopes have been raised several times by experiments with small plants instead of trees. Labor costs could be reduced sharply if a plant were found that could be handled by machinery. Thomas Edison devoted the last six years of his life to this search and finally extracted a rubber-like substance from goldenrod. The desert milkweed and Indian hemp have also been used in this connection. The only such plant that has proved to be commercially practical thus far, however, is the Mexican guayule. The Intercontinental Rubber Company developed this plant and makes small shipments of its product annually. Because it contains resin, it is used for coating cotton cord and between treads, rather than on the exterior of tires.

During the past few years, chemists have made significant contributions to the rubber manufacturing industry by their development of synthetic rubber. The duPont Company's "duprene" and "neoprene" and the I.G. Farbenindustrie's "buna" rubber and "thickol" are the best-known examples of these synthetic products. Du-

147 W.C. Geer, op. cit., pp.85-86.
prene is made by the rearrangement of the molecular structure of acetylene, salt and water, and the basic material of buna rubber is petroleum. Another synthetic rubber is made from sugar and turpentine. Although most production of synthetic rubber is carried on in plants in the United States and Germany, other plants have recently been established in Japan, Italy, and Poland. Thus far, Germany is the only nation that has substituted synthetic for natural rubber on a large scale; the cost differential has proved too great a deterrent in other countries. At the same time, if crude rubber prices should rise, or if synthetic rubber pro-

149 Rubber News Letter, April 15, 1939, p.83.
151 Rubber News Letter, January 15, 1939, p.3.
152 Rubber News Letter, April 15, 1939, p.82.
154 A single plant producing buna rubber was reported to have an annual capacity of 25,000 metric tons, which is "approximately one-fourth of German rubber requirements." Germany is believed to have two such plants in operation and several others under construction. Rubber News Letter, March 31, 1939, p.75.
155 United States consumption of synthetic rubber in 1938 was 1,824,375 pounds, most of which was used in the production of mechanical rubber goods. Rubber News Letter, October 15, 1939, p.198.
duction costs should be reduced, substitution would follow as rapidly as synthetic rubber plants could be built.

Even now, the threat of such a substitution has placed a ceiling over natural rubber prices of about thirty cents per pound. Consequently, it appears that the problems created by the most troublesome element of tire manufacturing costs may finally be on the way to solution.

Meanwhile, the tire companies have employed one other means of alleviating the effect of fluctuating crude rubber prices: the substitution of reclaimed for new crude rubber. A process for reclaiming rubber has been in use since 1871, and whenever crude rubber prices have risen sharply, it has been the practice of rubber manufacturers to increase the proportion of reclaimed to crude rubber in their final compounds. In the rubber industry as a whole, this proportion has varied since 1919 from a low of 19.2% in 1922 to a high of 51.0% in 1927. In 1938, 27.6% as much reclaimed rubber was consumed in the United States as crude rubber. The peculiar

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156 It is noteworthy that in anticipation of this possibility, the Standard Oil Company of New Jersey early in 1940 acquired from I.G. Farbenindustrie the rights for production of buna rubber in the United States. Its first plant is expected to commence production during 1940. Production costs are anticipated to be not more than thirty cents per pound, and possibly less. *New York Times*, February 2, 1940, p. 2, February 11, 1940, p. 1, Section 2.


characteristics of reclaimed rubber, which has less elas-
ticity but more resistance to abrasion than live rubber,
have led to its wider use in some rubber products than
others. Mechanical rubber goods and rubber heels, for
instance, are likely to contain twice as much reclaimed
as crude rubber, while medical supplies contain almost
no reclaimed rubber. In tire manufacture, the contra-
abrasive qualities of reclaimed rubber offer technical
reasons for its regular inclusion in tires almost regard-
less of crude rubber prices. Even when live rubber prices
fell, as they did from twenty-six cents per pound in 1929
to less than five cents per pound in 1931, the proportion
of reclaimed rubber consumed in tire manufacture only
159 dropped from 22.2% to 18.3%. But when rubber prices rise
sharply, reclaimed rubber is often added to tire com-
pounds in increasing proportions.

In this connection, it should be pointed out that
about half of the secondary rubber used in tire manufacture
160 is reclaimed in plants owned by the major tire companies.

159 Rubber Section, U.S. Bureau of Foreign and Domestic
Commerce, Special Circular No. 3527, April 8, 1934, p. 4.
160 Rubber Section, Special Circular No. 3634, February 27, 1937,
p. 7.
such as the Firestone plants at Akron, and the U.S. Rubber plant at Naugatuck, while the rest is bought from independent reclaiming companies. And the use of reclaimed rubber has been more regularly maintained by companies operating their own reclaiming plants than by other tire producers. Until the day when synthetic rubber can be produced at costs comparable to those of crude rubber, reclaiming will be the chief protection of tire companies against high prices of their principal raw material.

161. Diversification of Production

The leading tire companies have made a number of other significant structural adjustments which have influenced them not only in their capacities as producers by altering their manufacturing costs but also in their capacities as sellers by changing their relative controls over the market, and hence affecting their revenues. The most important such adjustments, which have served to give some companies temporary relative advantages over others, but which customarily have led to the adoption of compen-

161 Rubber Section, Special Circular No. 3527, op. cit., p.5.
162 Within six years the cost of producing synthetic rubber has been reduced from $1.00 per pound to about thirty cents per pound. Cf. Fortune, November, 1938, op. cit., p.151, New York Times, February 11, 1940, p.4, Section 3.
sating adjustments or retaliatory measures by the companies which found themselves operating at a disadvantage, are connected with diversification of production, or with product changes.

The full implications of diversification cannot be discussed in detail with respect to each company, but certain quantitative data included earlier indicate the approximate magnitude of this type of adjustment. Table 2 offers data for tire plants and for the rubber manufacturing industry as a whole, Table 11 shows the differing degrees of diversification of production among the Big 4, and the footnotes in Table 12 present similar information for ten other leading tire companies.

According to these data, an increasing proportion of the production of tire manufacturers is being devoted to products other than tires. This is even true within the very plants where tires are produced, and has been

163 Supra, p. 75
164 Supra, p. 100
165 Supra, p. 163
166 As measured by value of products. Since tire values have fallen more sharply than the values of other products made by the members of the tire industry, the physical magnitude of diversification tends to be exaggerated by the use of a measure of value. Cf. Rubber News Letter, January 15, 1939, pp. 5-6.
especially noticeable since 1931. At that time 10.0%, by value, of the production of these plants was attributed to non-tire products; this percentage increased continuously through 1937 when it reached 16.9%. And in the rubber manufacturing industry as a whole, which is dominated by the major tire producing companies, the value of products other than tires increased from 34.7% of the total in 1925 to 40.4% in 1931 to 45.8% in 1937.

This increasing diversification has not occurred evenly among all tire companies. Among the large companies, Firestone has been extending its manufacturing activities so widely that it has cut its concentration in tires from over 90% to about 70% since 1929. During the same period U.S. Rubber and Goodrich, even while adding new products to their lines, have increased their relative concentration in tire manufacturing. Among the smaller tire producers, some, such as Mansfield, Pharis, Master and Mohawk, have remained almost exclusively tire manufacturers, while others, such as Lee, Norwalk and Pennsylvania, receive much of their revenue from the sale of other products. Even General, which for years concentrated almost entirely on tires and tubes, has recently undertaken the production of mechanical rubber goods.

Several factors have contributed to this situa-
tion, of which the following are probably the most im-
portant: the policies adopted in the early development
of the several companies, the declining demand for tires,
the discovery of new uses for rubber and the requirements
of the tire companies' own retail stores.

From their very beginnings some of the compan-
ies which rank among the leading tire producers in the
country have been organized primarily to manufacture and.sell tires, while others were general rubber manufacturers
that added tires to their other lines of products, and sub-
sequently found them to be their most important single
source of revenue. Firestone and Goodyear are in the former
category, while Goodrich and U.S. Rubber should be classi-
ified among the latter. During the first three decades of
the twentieth century, while tire production increased at
geometric rates, each of these companies developed in its own way. The Firestone Company cast its lot with the
automobile industry and operated prosperously for many years as a producer almost exclusively of tires. Good-
year, which grew to be the biggest of the Big 4, largely
because of its tire volume, remained primarily a tire
producer, but branched out into the other established
fields of rubber manufacture: footwear, rubberized

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Cf. "Four Giants, and All Different," Fortune, Septem-
clothing, mechanical rubber goods and sundries, and pioneered in lighter-than-aircraft production. Goodyear also carried vertical integration further than its competitors. Meanwhile, by mergers and by expansion from within, Goodrich and U.S. Rubber continued their growth as general rubber manufacturers. Tires became the principal item of their production, but never the dominant one, since each of the other departments of rubber manufacture of these companies was also enlarged. Various of the smaller companies followed the lead of Firestone and restricted their production to tires, while others emulated Goodrich and U.S. Rubber, as far as they were able, and diversified their production.

When, after 1929, the demand for tires began to fall off sharply, more sharply in fact than the demand for most other rubber products, the companies which were least diversified were placed at a relative disadvantage. Moreover, as the likelihood became manifest that, even with recovery, the market for tires would probably never expand again at its earlier rates, this disadvantage promised to become permanent. As a consequence, the companies most concentrated in tire production began to seek means to improve their competitive positions. In some cases their

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168 E.g., when Goodrich merged with Hood, it acquired a major footwear plant. Its merger with Miller gave it control of one of the largest plants then manufacturing druggists' supplies, rubber toys and sundries. Cf. C.E. Fraser and G.F. Doriot, op. cit., p.100

169 Cf. infra, pp.232 ff.
Immediate reaction was to become more active in promoting the sales of their tires, trying independently to secure larger relative shares of the contracting market for this product. Often they attempted to capture particular tire markets, by making alliances with large distributors, by changing their marketing methods, or by product differentiation. This led to the market competition which was so bitter until 1935. In other cases, or simultaneously, they sought to eliminate their relative disadvantages by diverting their productive facilities to other fields and selling a wider line of products.

There were already a large number of different products made from rubber. Not counting differences in style, size, color and shape, almost one thousand separate

Selecting at random from an alphabetical list compiled by the U.S. Department of Commerce, one finds, in addition to the major products, tires, mechanical rubber goods and footwear, such articles as the following: ankle slenderizers, campaign buttons, cuspidor mugs, dice, embalmers' apparatus, flutes, girdles, harness, insulating tape, jigsaw puzzles, knitting needles, life preservers, police maces, nipples, oxygen masks, prophylactics, piano keys, quoits, roller skates, sink stoppers, tents, tree surgery putty, umbrellas, vacuum cleaner parts, weather stripping, x-ray aprons, y-connections of a stethoscope and zipper bags. Cf. P.W. Barker, Rubber Industry of the United States, op. cit., pp.35-42.
and distinct rubber articles could be listed as early as 1925, but other than tires only mechanical rubber goods and footwear were important sources of revenue during the 1920's and 1930's. And the market for these had long been dominated by U.S. Rubber, Goodrich and Goodyear. Nevertheless, after 1929 a few other companies, notably Firestone and, recently, General, went into mechanical rubber goods production, and some of the smaller companies tried to break into the footwear market or to expand their production of sundries. At the same time, almost all of the major producers were trying to exploit the undeveloped fields of rubber manufacture. Most of these fields are strictly limited, e.g. balloons, rubber gloves, tennis balls, toys, etc., and some have not received acceptance, e.g. rubber paving, but a few new uses for rubber have been discovered, which offer promise of expansion. The most important of these are the elastic thread which goes under the trade name "lastex," the development of

After the World War, the Rubber Growers' Association, Ltd., of London, in an effort to stimulate the use of crude rubber, offered a substantial cash prize for suggestions of possible new uses for rubber. They received over ten thousand separate suggestions, but when duplications had been eliminated, a list was compiled and published in 1923, containing just under one thousand items. Ibid., p.33.

Meanwhile the three large diversified producers increased their relative concentration in tires.

rubber tires and treads for tractors, the use of rubber in upholstery and mattresses, and the use of molded rubber goods for noise abatement, insulation and vibration dampening in automobile construction. Since 1935, it is products such as these that the tire companies have been promoting most actively, and around which their most vigorous competition has centered.

One other important circumstance has given rise to further diversification of the productive activities of tire companies, even leading them to manufacture certain finished goods that are not made of rubber. As we shall see, one of the principal marketing adjustments that has been made by several of the tire companies, in order to insure control of at least some of the outlets for their tires, has been the establishment of company-owned retail stores. In order to conform to the prevailing consumer

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176 Each of the Big 4 has used its mechanical rubber goods division to manufacture these products. Their importance can be gauged by the fact that there is almost as much rubber being used in the chassis and the body of the modern automobile as on the wheels. Goodyear has recently started operation of a new molded goods plant at St. Mary's, Ohio, primarily to serve this market. Goodyear Tire and Rubber Company, 41st Annual Report to Stockholders, op. cit., pp. 8, 25.

177 Cf. infra, pp. 305ff.
buying habits, and to secure an adequate volume of total sales, these stores have been obliged to carry stocks of many other products, most of which, like tires, are automobile accessories, e.g. batteries, spark-plugs, heaters, radios, rims, fans, horns, etc. At first, the tire companies supplied these items to their stores by purchasing them in quantities and usually as private brands, from other manufacturers. More recently, however, a few of the larger companies, Goodyear, Goodrich and, particularly, Firestone, have undertaken to manufacture certain of these products themselves. At present, the automobile accessories produced by tire companies are being distributed primarily by their own stores, but increasingly these products are being sold to independent dealers. If this

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178 This is still done, at least in part. E.g., General distributes batteries and accessories which it does not manufacture; the Goodyear retail stores sell many "Goodyear" brand products which are manufactured by other companies.

179 Firestone now has three plants engaged in the manufacture of automobile accessories; one at Akron, Ohio, one at Wyandotte, Michigan, and one at Riverview, Michigan. A large part of this company's declining concentration in tires since 1929 can be ascribed to its development of this field of production. Goodrich now manufactures fifty-seven accessory items, the chief of which are batteries, heaters and spark plugs. The B.F. Goodrich Company, Goodrich Products, 1940 (Akron, Ohio: 1940), p.19. U.S. Rubber, which has eliminated its retail stores, makes automobile parts, steering wheels, mats, molded parts and engine mountings, but no automobile accessories. Cf. United States Rubber Company, Forty Seventh Annual Report (New York: 1939), p.18.
trend continues, it is only a matter of time until a substantial proportion of the revenue of tire and rubber companies will be derived from the sale of automobile accessories, many of which contain no rubber. In this instance, a structural adjustment that started as a marketing change to facilitate the distribution of one type of product, has led the tire companies to produce and distribute other products that are totally unconnected technically with their other manufacturing activities.

17. Changes in the Product

The other major type of structural adjustment that relates directly to both the manufacturing and the marketing activities of tire companies consists of changes made in the physical characteristics of their principal product, tires. This has taken two forms which cannot be clearly distinguished: improvement of the product and product differentiation. Here the conflicting members of the tire industry have long faced an awkward situation, for many of the separate attempts by various companies to increase their relative shares of the market by product differentiation have caused a general improvement in the durability of tires which has sharply limited the volume of their aggregate sales.

The most important such changes in the construction of tires are the following: the development of straight-
sided tires to supplant the former clincher type tires, the substitution of cord for fabric in their internal construction, the replacement of high pressure cord tires by low pressure balloon tires, and the improvement of the wearing qualities of the rubber compounds in tire treads. The consequences of these changes are made evident to every automobile owner by the increased mileage he can drive before replacing his tires, and by the decreasing frequency of punctures and blowouts. They can be shown in more precise terms by the data in the following table, which indicates the increasing average durability of tires since 1910, as estimated by the United States Department of Commerce.

180 It has been estimated by the Rubber Manufacturers Association that the average mileage per tire has increased from 3500 miles in 1914 to 6000 miles in 1922, to 15,000 in 1920, to 20,000 in 1933. Cf. W.H. Cross, G.S. Earleman and J.H. Lenaerts, op. cit., p.14. A similar figure for the current year would probably be over 25,000 miles. Cf. Albert Abrahamson, op. cit., p.87.

181 The decline in punctures and blowouts is also a function of advances in the quality of inner tubes and of highway improvements.

182 These estimates of tire durability are derived from studies of the rate of tire replacement by automobile owners. Only indirectly do they measure actual changes in the serviceability of tires. For instance, these data indicate sharp increases in "tire durability" during depressions, when it is customary for car owners to wear tires thin before replacing them, and decreases during recovery, when replacement revives and the mileage-driven increases. These short run fluctuations, however, do not hide the secular increase which is primarily attributable to product improvement.
Table 21

Tire Durability, 1910-1938 (a)

<table>
<thead>
<tr>
<th>Year</th>
<th>Average Length of Life of a Tire, in Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1910</td>
<td>.73</td>
</tr>
<tr>
<td>1911</td>
<td>.86</td>
</tr>
<tr>
<td>1912</td>
<td>.79</td>
</tr>
<tr>
<td>1913</td>
<td>.81</td>
</tr>
<tr>
<td>1914</td>
<td>.72</td>
</tr>
<tr>
<td>1915</td>
<td>.77</td>
</tr>
<tr>
<td>1916</td>
<td>.76</td>
</tr>
<tr>
<td>1917</td>
<td>.71</td>
</tr>
<tr>
<td>1918</td>
<td>.89</td>
</tr>
<tr>
<td>1919</td>
<td>.93</td>
</tr>
<tr>
<td>1920</td>
<td>1.28</td>
</tr>
<tr>
<td>1921</td>
<td>1.49</td>
</tr>
<tr>
<td>1922</td>
<td>1.30</td>
</tr>
<tr>
<td>1923</td>
<td>1.51</td>
</tr>
<tr>
<td>1924</td>
<td>1.57</td>
</tr>
<tr>
<td>1925</td>
<td>1.58</td>
</tr>
<tr>
<td>1926</td>
<td>1.77</td>
</tr>
<tr>
<td>1927</td>
<td>1.66</td>
</tr>
<tr>
<td>1928</td>
<td>1.55</td>
</tr>
<tr>
<td>1929</td>
<td>1.85</td>
</tr>
<tr>
<td>1930</td>
<td>2.47</td>
</tr>
<tr>
<td>1931</td>
<td>2.42</td>
</tr>
<tr>
<td>1932</td>
<td>2.69</td>
</tr>
<tr>
<td>1933</td>
<td>2.43</td>
</tr>
<tr>
<td>1934</td>
<td>2.57</td>
</tr>
<tr>
<td>1935</td>
<td>2.73</td>
</tr>
<tr>
<td>1936</td>
<td>2.70</td>
</tr>
<tr>
<td>1937</td>
<td>3.07</td>
</tr>
<tr>
<td>1938</td>
<td>3.42</td>
</tr>
</tbody>
</table>

(a) Rubber News Letter, October 15, 1939, p.199.
Each of these major product changes is attributable to the development work done by technicians of particular tire companies. But each independent attempt by a tire manufacturer to increase his relative share of the market by adopting such an improvement in the quality of his tires has led his competitors to make similar changes in their products. This has been one of the most significant forms of quasi-competition in the tire industry.

The general adoption of each important improvement has often been so swift that it is sometimes difficult to identify the originator of a given innovation. However, the Goodyear Company claims to have stolen a march on its competitors in 1905 by being the first to develop the straight side tire, which was easier to mount than the then existing clincher tires, which were made with a rubber bead and could be mounted only by being stretched over the rim. The straight side tire also was much less subject to rim cuts which plagued the users of clincher tires. After a vigorous advertising campaign to gain acceptance of the new type tires, Goodyear found itself at a relative advantage over those of its

competitors which had resisted the innovation, but by 1909, all of the major manufacturers were producing straight side tires.

The next major change, the substitution of cord for square woven fabric in tires, is estimated to have increased tire mileage 250% in ten years, principally by the strengthening of the internal construction, the reduction of friction and the alleviation of the effects of stone bruises. The first cord tires were made by a British firm, the Palmer Tire Company, and was introduced in the United States by the Diamond Rubber Company which shortly thereafter merged with Goodrich. Almost at the same time Goodyear developed its own cord tires, and other companies soon followed suit. Cord tire production supplanted fabric tire production rather slowly during the

Allen attributes the following growth of Goodyear's net sales primarily to the advantage the company gained during this period. *Ibid.* , p.19.

<table>
<thead>
<tr>
<th>Year</th>
<th>Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>1907</td>
<td>$2,000,000</td>
</tr>
<tr>
<td>1908</td>
<td>4,000,000</td>
</tr>
<tr>
<td>1909</td>
<td>9,500,000</td>
</tr>
<tr>
<td>1910</td>
<td>12,000,000</td>
</tr>
<tr>
<td>1911</td>
<td>25,000,000</td>
</tr>
</tbody>
</table>

Inasmuch as the 30 X 3½ tires used on Fords and Chevrolets were clincher tires, this type continued to be manufactured in quantities until after 1925 when they were supplanted by the 6:00 X 16 balloon tires.


H. Allen, *op. cit.*, p.27.
war, growing from 1% of total production in 1912 to 6% in 1916 to 15% in 1918, but by 1923 more than half of all tires produced were cord tires. This predominance was short-lived, however, because while fabric production declined after 1923, balloon tires were introduced in that year and gained predominance within less than four years.

A good example of the rapidity with which one company's innovation is borrowed by others is to be found in the case of balloon tires. James E. Hale of the Firestone Company is generally credited with the technical development of low pressure tires, but the General Tire and Rubber Company was the first to place balloon tires on sale. These tires were quickly adopted by automobile manufacturers. At first, only Buick and Reo adopted cord tires.

The acceptance of a new type tire is primarily stimulated by its adoption as original equipment by automobile manufacturers. At first, only Buick and Reo adopted cord tires.

See Table 22, next page.

As Allen phrases it, "Development work is slow. Secrets are hard to keep." Ibid., p.76. According to Fortune, "... O'Neil of General ... grants that a little bird told him what Hale was doing in the Firestone laboratories on the other side of the town and, by driving his engineers, he managed to produce his own balloon in a month." Fortune, November, 1936, op. cit., p.151.
### Table 22

Estimated Production of Automobile Casings, by Types, 1910-1938
(Percentage of Total Production)

<table>
<thead>
<tr>
<th>Year</th>
<th>Fabric</th>
<th>High Pressure</th>
<th>Balloon</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Cord</td>
<td></td>
</tr>
<tr>
<td>1910(a)</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>1911(a)</td>
<td>100.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>1912(a)</td>
<td>99.0</td>
<td>1.0</td>
<td>0.0</td>
</tr>
<tr>
<td>1913(a)</td>
<td>98.0</td>
<td>2.0</td>
<td>0.0</td>
</tr>
<tr>
<td>1914(a)</td>
<td>97.0</td>
<td>3.0</td>
<td>0.0</td>
</tr>
<tr>
<td>1915(a)</td>
<td>95.0</td>
<td>5.0</td>
<td>0.0</td>
</tr>
<tr>
<td>1916(a)</td>
<td>92.0</td>
<td>8.0</td>
<td>0.0</td>
</tr>
<tr>
<td>1917(a)</td>
<td>90.0</td>
<td>10.0</td>
<td>0.0</td>
</tr>
<tr>
<td>1918(a)</td>
<td>86.0</td>
<td>15.0</td>
<td>0.0</td>
</tr>
<tr>
<td>1919(a)</td>
<td>75.0</td>
<td>25.0</td>
<td>0.0</td>
</tr>
<tr>
<td>1920(a)</td>
<td>65.0</td>
<td>35.0</td>
<td>0.0</td>
</tr>
<tr>
<td>1921(a)</td>
<td>60.0</td>
<td>40.0</td>
<td>0.0</td>
</tr>
<tr>
<td>1922(b)</td>
<td>51.4</td>
<td>48.6</td>
<td>0.0</td>
</tr>
<tr>
<td>1923(b)</td>
<td>42.6</td>
<td>55.4</td>
<td>2.0</td>
</tr>
<tr>
<td>1924(b)</td>
<td>29.7</td>
<td>58.8</td>
<td>11.5</td>
</tr>
<tr>
<td>1925(b)</td>
<td>14.1</td>
<td>51.8</td>
<td>34.1</td>
</tr>
<tr>
<td>1926(b)</td>
<td>5.3</td>
<td>47.2</td>
<td>47.5</td>
</tr>
<tr>
<td>1927(b)</td>
<td>1.5</td>
<td>44.6</td>
<td>53.9</td>
</tr>
<tr>
<td>1928(b)</td>
<td>0.6</td>
<td>33.0</td>
<td>66.4</td>
</tr>
<tr>
<td>1929(b)</td>
<td>0.0</td>
<td>25.2</td>
<td>74.8</td>
</tr>
<tr>
<td>1930(b)</td>
<td>0.0</td>
<td>16.9</td>
<td>85.1</td>
</tr>
<tr>
<td>1931(b)</td>
<td>0.0</td>
<td>14.2</td>
<td>88.8</td>
</tr>
<tr>
<td>1932(b)</td>
<td>0.0</td>
<td>12.2</td>
<td>87.8</td>
</tr>
<tr>
<td>1933(c)</td>
<td>0.0</td>
<td>11.9</td>
<td>88.1</td>
</tr>
<tr>
<td>1934(c)</td>
<td>0.0</td>
<td>11.5</td>
<td>88.7</td>
</tr>
<tr>
<td>1935(c)</td>
<td>0.0</td>
<td>8.0</td>
<td>92.0</td>
</tr>
<tr>
<td>1936(d)</td>
<td>0.0</td>
<td>8.0</td>
<td>92.0</td>
</tr>
<tr>
<td>1937(d)</td>
<td>0.0</td>
<td>7.0</td>
<td>93.0</td>
</tr>
<tr>
<td>1938(d)</td>
<td>0.0</td>
<td>6.0</td>
<td>94.0</td>
</tr>
</tbody>
</table>

(a) U.S. Department of Commerce, as cited in C.E. Fraser and G.F. Doriot, op. cit., p.103.
(b) Rubber Section, Special Circular No. 3500, December 1, 1933, Table V.
(c) Computed from data on tire shipments in Automobile Facts and Figures, 1936, p.15.
(d) Computed from data on tire shipments in Automobile Facts and Figures, 1939, p.15.
manufacturers. Reo and Dodge were among the first, and volume sales were assured when both Ford and Chevrolet adopted balloon tires in 1925.

Since that time, changes in the product have been less spectacular but none the less important in improving the quality of tires. The cumulative effect of improvements in the internal construction of tires, particularly the development of superior fabrics, the constant increase in the resistance to abrasion of rubber compounds, and the strengthening of inner tubes, has been to increase tire mileage by about 50% since 1925. And each new development by one company has been matched by other companies.

At the same time, there have been many minor changes in the product, which are more properly counted as manifestations of product differentiation than product improvement. But here again an innovation by one manufacturer has customarily brought retaliatory adjustments by his competitors. These adjustments have taken forms

In the first years of their use, however, they created new problems for automotive engineers, since they created new strains on axles and frames and required reconstruction of brakes. Especially since balloon tires increased gasoline consumption, reduced speeds and caused automobiles to "shimmy" automobile manufacturers; threatened for a time to change back to high pressure cords. This would have left the members of the tire industry with a large amount of useless new tire-building equipment.
which can be classified separately as structural adjustments, as quasi-price competition and as non-price competition.

Thus far in the discussion, we have referred to the automobile tire as if it were a single product, the physical characteristics of which have been changing because of technological advances, but which is virtually identical at any point of time whether it is manufactured by one company or another, and whether it is sold to one buyer or another. The actualities are more complicated, for "the automobile tire" is a category of products, within which at each instant there are sharp variations. Important differences can be found among the products of a single manufacturer and among the products of different manufacturers. The major fields of differentiation are in sizes, in lines, in style and in tread design, and each is significant to the competitive policies of all units involved in the manufacture and sale of tires.

Differences in tire size in most instances reflect a structural adjustment that is forced upon tire manufacturers by the technical requirements of automobile manufacturers. Consequently, what variation there is in the number of sizes of tires produced by each tire com-

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pany depends upon the completeness with which it desires to cover the possible market. At present, most of the larger companies manufacture and sell tires of practically all of the sizes used on new and old model automobiles, while the smaller companies, having fewer molds, tend to concentrate on the production of the most popular standard sizes which can be sold in the replacement market.

In the early days of the industry, variation in tire sizes was a vexing problem to tire manufacturers, because changes in automobile design were rapid and differences among automobile manufacturers were particularly great. Each new tire size constituted a separate problem in design, necessitated additional expense for new molds and added to distributors' inventories. A few attempts were made by tire manufacturers to promote standardization, but no success was achieved until, during the World War. Then, "the government stipulated eight sizes as war standard and so simplified the line."

Since that time, the number of tire sizes has increased again. The export market has required tire

193 E.g. in 1936 Goodyear was building about 800 different sizes and types of tires. H. Allen, op. cit., p. 62.

194 30 x 3½ and 31 x 4 in clincher tires and 33 x 4, 34 x 4½, 35 x 5, 36 x 6, 38 x 7 and 40 x 8 in straight side tires.

195 Ibid., p. 62.
sizes measured in millimeters, the development of balloon tires, particularly in its first experimental stages, increased the variety of tire sizes, and the tendency towards reduction of wheel diameters and towards the construction of low-slung automobiles has also necessitated tire size changes. In the last decade, however, the tendency has been in the other direction. The disappearance from the road of automobiles with odd-sized wheels, and the concentration of automobile manufacture in the hands of a few companies making standardized cars, have served both to decrease the number of tire sizes which must be manufactured, and to relieve the inventory problem.

Meanwhile another type of product differentiation has developed to more than offset the simplification of manufacturing and selling activities that arose from standardization of tire sizes. The progressive establishment of "second," "third," and even "fourth" and "fifth" line tires, and the sporadic jockeying of price and quality differentials among them has long been one of the most significant forms of quasi-price competition within the tire industry.

Until after the war, it was customary for each tire company to manufacture a single brand of tire. The

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At present the preponderance of tire manufacturing and sales is concentrated in a limited number of sizes, of which the following are the most important: 6:00 x 16, 6:50 x 16 and 7:00 x 16.
only qualitative distinction recognized among the products of different companies was between the "standard brands" made by reputable manufacturers and the "gyp" brands of unknown or doubtful quality. Firestone broke with this practice in 1919 when he introduced a secondary brand, the "Oldfield." Goodyear started making the "Path-finder" in 1921 through a pseudo-independent company.

By 1922 most of the other leading companies had also brought out a second line of tires, of inferior quality, to sell at a lower price. By 1926, a substantial portion of tire sales were of these second line products. In 1927, led by Goodyear and closely followed by Firestone, a third line was put on sale by the leading tire companies, primarily in order to meet the price competition of the mail-order houses which were then beginning to expand their tire sales. During the following year, Firestone, which was most aggressive

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198
According to a tabulation made by W.W. Leigh of data secured from the Federal Trade Commission, Docket No. 2116, op. cit., Respondent's Exhibit No. 21909 and Commission's Exhibit No. 360, and from confidential sources, 45.6% of Goodyear dealers' total sales in 1926 were of second line tires. Similar percentages were 42.3% for U.S. Rubber and 28.1% for Firestone. Ibid., pp.344-345.

199
It is generally believed that these third line tires were inferior in quality to the mail-order tires, though designed to be sold at about the same retail price. Cf. C.E. Fraser and G.F. Doriot, op. cit., p.95.
against the mail-order competition, began to sell a fourth line. Meanwhile, U.S. Rubber continued to sell only three lines and Goodyear brought out a "de luxe" line which was claimed to be superior in quality to the standard first line tires.

After 1927 almost all of the leading tire companies extended their lines, many of them manufacturing and selling as many as six grades of quality in their branded tires, with similar or intermediate grades of private brands being made for large distributors. Inasmuch as there are no accepted standards by which the quality of a tire can be measured accurately, or by which the products of different manufacturers can be compared, the development of this number of lines has served primarily to complicate the price structure and to leave the consumer in doubt as to the relations of price to quality in the tires which are offered for sale.

Independently, the tire companies have sought by advertising to convince the consumer of the high qualities of their respective products, but some of

Variations in workmanship, in materials, and in chemical, engineering, and vulcanizing specifications are so great that actual performance is the only significant test. But even among tires of the same grade produced by a single company, performance tests have shown that "300% variability is possible." A. Abrahamson, op. cit., p. 84.
their non-price competition in this respect has tended to be self-defeating because superlatives have been applied even to fourth and fifth line tires, and sales of the lower priced lines have often increased at the expense of first line tire sales. At the same time, each line has eventually reached an established position in the price scale of the several companies even though certain members of the industry have occasionally resorted to a juggling of price margins, and quality differences, in the attempt to break into their competitors' markets.

From 1927 to 1935, at first to counteract the selling advantages of large distributors, and later to meet the generally chaotic competition among all units selling tires, tire manufacturers were particularly active in this sort of competition. Even the alliances promoted and the truces negotiated by the NRA were powerless to check their conflict, and the price and quality differentials fluctuated widely among the products of large and small manufacturers, among manufacturers' brands and private

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202 E.g. by 1933, only 39.3% of Firestone dealers' sales were of first line tires; 26.8% were second line, 20.4% were third line, and 13.5% were fourth line tires. In the same year, 0.4% of Goodyear dealers' sales were of 'de luxe' tires, 44.0% were first line, 34.8% were second line and 20.8% were third line tires. W.W. Leigh, op. cit., pp.344-345.
brands, and among the products sold by mail-order houses, oil companies, automobile accessory chains, and independent dealers.

Since 1935, the situation has become more stabilized, at least with respect to prices. The price differentials among the various lines of different companies have gained tacit acceptance if only because of the disastrous effect on revenues of the entire industry that followed when the differentials were fluctuating. At present, less important variations remain among the companies, and these are differences in the quality of their products, or in the number of lines which they manufacture.

E.g., the General Tire and Rubber Company specializes in high quality tires and sells its products on a quality rather than a price appeal. The Martin Custom-made Tire Corporation and the Pennsylvania Rubber Company attempt to do likewise. Since 1938, the large tire companies have been bringing out new "high quality" tires.

E.g., at present, Goodrich brands are sold in six lines, ranked as follows: "Life-saver Silvertown," "Patrician Silvertown," "Ribbed-type Silvertown," "Golden Ply Safety Silvertown," "Standard" and "Commander." The "Patrician" brand was added in 1940. Goodyear brands are sold in five lines, ranked as follows: "Double Eagle Air-wheeler," "Deluxe All-weather," "G-3 All-weather," "Marathon," and "Pathfinder." Firestone brands are sold in six lines, ranked as follows: "Imperial," "Champion," "High Speed," "Standard," "Sentinel," and "Courier." "Imperial" and "Champion" were added in 1938.
In place of the price and quasi-price com-
petition which was so keen prior to 1936, the conflicts
among the leading tire companies now occur primarily in
the field of non-price competition. Minor changes in
their product, virtually negligible in their effects on
production costs, have been the basis of extensive adver-
tising and selling campaigns conducted by each company
to maintain or, if possible, to increase its relative
volume of sales.

In recent years, some of this advertising has
stressed style and quality to promote sales of de luxe
tires, many of which are made with white walls, and con-
tain six or eight instead of the customary four plies,
and a few of which are made with rayon instead of cotton
fabrics. Other promotional activity has featured changes
in the tread design, some of which have eliminated noise,
and others of which are calculated to increase traction

And which has been resumed, though with lesser intensity,
since the fall of 1939 at the initiative of Goodyear.
Cf. Goodyear Tire and Rubber Company, 41st Annual Report
to Stockholders, op. cit., p.8; cf. also Norwalk Tire
and Rubber Company, Annual Report, 1939 (Norwalk, Conn.: 1939).

E.g. Firestone’s “Champion,” Armstrong’s “Streamline.”
E.g. Pennsylvania’s “RX” and “Aerolux,” General’s “Dual 10.”
E.g. Goodyear’s “Double Eagle Airwheel” made with rayotwist.
E.g. Goodrich’s “Patrician,” Martin’s “Silent hi-speed.”
on bad roads, or claim to reduce the dangers of skidding.

And lately, the emphasis has been on safety, with new "puncture proof" tubes and special "inner tires" being developed by the leading tire manufacturers. Each of these devices of product differentiation, whether it is an actual change in the physical characteristics of a tire, or an imagined superiority in the mind of the buyer, has brought temporary relative advantages to some of the tire companies. By virtue of that very fact, however, it has led their competitors to adopt similar tactics or to seek other devices in an effort to restore their competitive positions. As a consequence, although minor product changes are constantly being made, each successful device of product differentiation is so quickly adopted by all tire manufacturers, that few, if any, significant differences remain among the various companies in this respect.

18. The Demand for Tires

Thus far our attention has been directed primarily to the areas and tactics of competition involved in the manufacturing activities of tire companies. We have examined the major problems confronting them on the cost side and pointed out the principal similarities and differences among the methods by which independent tire

---

210 E.g. Firestone's "Groundgrip," Pennsylvania's "W. C. Cleat."
211 E.g. Goodrich's "Lifesaver," U.S. Rubber's "Royal Master."
212 E.g. Seiberling's "Bulkhead Tubes."
213 E.g. Goodyear's "Lifeguard," Firestone's "Life Protector."
producers have attempted to meet these problems. Reference has been made to the various companies' selling activities only in those cases where manufacturing adjustments in the form of diversification and product changes have related to revenues as well as costs.

The following pages will be devoted to a consideration of the primary factors affecting the revenues of tire producers. In that connection, it is necessary first to take account of the principal factors affecting the total demand for tires, to distinguish the major divisions of the tire market, and to identify the main channels of tire distribution. Then we shall be in a position to evaluate the role played by the leading tire companies in these various markets, and the tactics of conflict and alliance which have been prevalent among the business units which control the most prominent outlets for tires.

Although separate tire companies have at their disposal a number of means by which they can attempt independently to enlarge their own volume of tire sales at the expense of their competitors, nevertheless in the aggregate, tire manufacturers are almost helpless to control the total volume of tire sales.

---

214 It is true, of course, that joint agreement among tire producers to lower the quality of their product by constructing tires of diminished (continued on next page)
Primarily this situation exists because there is no independent demand for their product. A tire is, in the last analysis, an accessory of the automobile, and the demand for tires is contingent upon the production and use of automobiles. Other important secondary factors may enter into the picture, but only as qualifications of this basic relationship.

When automobiles are first put on sale, they must be equipped with tires before they can be used. The cost of tires, however, constitutes only a small part of the final price of an automobile, and therefore cannot be counted a significant factor affecting the demand for automobiles. To the contrary, the demand for tires, for original equipment at least, is almost perfectly inelastic at any instant, and changes over time in the numbers of tires which can be sold as original equipment are directly dependent upon the volume of sales of new automobiles. Table 23, on the following page, presents quantitative data to indicate the growth and fluctuations of new automobile sales. A multiplication of these figures by four would give a rough indication of the annual de-

214 (continued from preceding page) durability, might serve to increase the volume of tire sales, but the writer has encountered no evidence that such a practice has even been seriously suggested, let alone adopted.
Table 23
Motor Vehicle Factory Sales in the United States, 1900-1938 (a)  
(thousands of vehicles)

<table>
<thead>
<tr>
<th>Year</th>
<th>Passenger Cars</th>
<th>Motor Trucks</th>
<th>Total Motor Vehicles</th>
</tr>
</thead>
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<td>...</td>
<td>4</td>
</tr>
<tr>
<td>1901</td>
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<td>1</td>
<td>23</td>
</tr>
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</tr>
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</tr>
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<td>1938</td>
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</table>

(a) Adapted from Automobile Facts and Figures, 1939, op. cit., p. 4.
(b) Figures for 1921-1938 include production of Canadian plants.
mand for original equipment tires.

Since automobiles are relatively more durable than tires, the demand for tire replacements becomes the second major factor affecting the total volume of tire sales. And this is primarily dependent upon the number of automobiles in use, the extent of their use, and the serviceability of tires. Table 24 shows the annual changes since 1900 in the number of automobiles in use, Table 25 gives estimates as to their use in recent years, as measured by the average annual mileage driven since 1931, and Table 26 indicates the average annual rate of tire replacement per automobile since 1910.

Table 23 shows that the sales of new automobiles, which dominate the original equipment demand, grew steadily, except for temporary setbacks in 1918, 1921, 1924, and 1927, until they reached a peak in 1929. This peak has never since been regained, even though the sale of trucks, and the consequent demand for truck tires have increased substantially in recent years.

It would not give an accurate indication of the volume of tire sales to automobile manufacturers since 1926, inasmuch as an increasing proportion of cars have been equipped with spare tires since that year. Cf. infra, pp. 250 ff.

When spare tires are included in original equipment figures, higher peaks were reached in 1936 and 1937. Cf. infra, Table 27.
Table 24 shows a continuous increase in the number of motor vehicles in use until 1930. This was followed by a three year decline which has been more than offset by subsequent increases. Meanwhile, as shown by Table 25, the mileage driven per car has increased. It might be expected, therefore, that the replacement market would become increasingly important to members of the industry, especially in recent years, but this has not been the case. The rate of increase of motor vehicle registration has slackened considerably since 1926, and the net increase from 1926 to 1928 has been only about 34%. Meanwhile, in spite of such secondary factors tending to increase tire consumption as increased mileage driven, the reduction in the diameter of automobile wheels, increased driving speeds, and the construction of more powerful brakes, the rate of tire replacement has fallen sharply. In fact, it has declined so drastically that it has more than compensated for the effect on the demand for replacement tires, of an increase in the number of cars in use. We find from Table 26 that in the same thirteen year period (1926-1938) during which the number of cars in use has increased by about one third, the number of replacement tires required annually

217

<table>
<thead>
<tr>
<th>Year</th>
<th>Passenger Cars</th>
<th>Motor Trucks</th>
<th>Total Motor Vehicles(b)</th>
<th>Percentage Increase</th>
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(a) Adapted from Automobile Facts and Figures, 1939, op. cit., p.16
(b) Exclusive of tax-exempt vehicles owned by federal and local governments. The number of these vehicles has increased continuously from 172,250 in 1931 to 367,230 in 1938.
Table 25
Annual Mileage Driven per Motor Vehicle, 1931-1938

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<th>Year</th>
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<td>8410</td>
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<td>1938(b)</td>
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</table>

(a) Computed by the U.S. Department of Commerce from estimates of total mileage driven, made by the National Safety Council. These estimates are derived from data on annual gasoline consumption. Cf. Rubber News Letter, February 15, 1939, p.24.

Table 28

Number of Tires Required Annually per Motor Vehicle Registered in the Previous Year, 1910-1938(a)

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<th>Number of Tires Required</th>
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<tr>
<td>1938</td>
<td>1.03</td>
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</table>

per car has been cut virtually in half. The decline since 1926 from 2.03 to 1.03 in the number of annual tire replacements per car is primarily attributable to three major factors: improvement in the quality of tires, improved roads, and the development of tire retreading. The first of these factors has been discussed earlier, the second is hardly amenable to analysis and must be taken as a given factor by tire manufacturers, but the third merits at least brief attention.

The practice of retreading or "rebuilding" tires has been extended in the United States during the past ten years to a point where it has become the "chief single factor in the lengthening of tire life." With the substitution of balloon tires for high pressure cord tires, and the consequent decrease in the frequency of blow-outs, the carcass of a tire began greatly to outlast its tread. Prior to 1929 casings with the tread worn smooth or down to the fabric were customarily discarded; only a few truck tires were rebuilt. With the advent of the depression, the practice of tire retreading made rapid headway, particularly in California where small rubber manufacturers in the Los Angeles area began to produce the so-called "camel-back" which is applied to an old carcass as a new tread. During the decline of rubber prices which lasted

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218 Rubber Section, Special Circular No. 3585, September 4, 1935, p. 6.
until 1933, this new industry grew rapidly, because it could make the cost of retreading very low to price conscious tire users. Since 1934, retreading has not only increased in California, but also has spread to other parts of the country, to such an extent that by 1937 it was estimated that over four million tires were being retreaded annually.

The major tire companies have not been passive in this development. When, after 1933, they saw that the practice of rebuilding tires was cutting into the replacement market for their new tires, particularly for their lower priced third and fourth line tires, they entered the industry themselves. Since early 1935, each of the

219
It is estimated that the number of tires retreaded in California grew from 250,000 in 1929 to over 1,000,000 in 1935. Ibid., p. 2.

220
By 1935 there were forty-five different companies retreading tires in the Los Angeles area. Each of the largest five of these companies had facilities to re-build 500 tires daily. Ibid., p. 2.

221
On the West Coast, most of the market for rebuilt tires has been in passenger car tires; in the East, most of the tires rebuilt have been truck and bus tires. Ibid., p. 3.

222

223
A rebuilt tire, if the carcass is in good condition, often can provide the economical driver with a lower cost per mile than a third or fourth line tire. Tire rebuilders claim that the mileage of the average retread increased from 6,000 miles in 1928 to over 15,000 miles by 1934. Rebuilt tires usually retail for about half the price of new tires. Cf. W.W. Leigh, op. cit., p. 106.
Big 4 and a number of the other tire companies have manufactured "camel-back," and with rising rubber prices the large companies have operated at a relative advantage in this market. At first, the tire manufacturers sold retread stock to independent vulcanizers, but by the end of 1935 "nearly all" of the leading companies were "conducting retreading operations in connection with their company-owned stores and service stations." In a sense this constitutes a form of competing with themselves, which may or may not be profitable, but it represents the only feasible adjustment which they could make to meet the new situation. Moreover, it constitutes the only significant instance in which tire manufacturers have been able to soften the effects of a factor which is operating to diminish the total demand for tires. Each of the other such factors listed in the preceding pages: the sale of new automobiles, the use of automobiles, highway improvements, increased mileage driven, etc., has been beyond their power to control.

224 Special Circular No. 3585, op. cit., p.106.
225 The dealer profit per tire is higher on a retread than on a new low priced tire. Consequently, the tire companies that handle retreads in their own retail stores may balance the loss of revenue on new tires by the additional revenue received by their retail subsidiaries.
19. Principal Divisions of the Tire Market.

The net effect of the factors influencing tire demand can be estimated from the data in Tables 27 and 28, which relate to the volume of tire sales in each of the principal tire markets since 1910. These markets consist of the original equipment market, the renewal (or replacement) market, and the export market.

These tables suggest that because of the accelerated production and use of automobiles, total sales expanded rapidly for the tire industry as a whole from 1910 to 1928. All during that period, the greatest sales volume was in the renewal market, which averaged over two-thirds of total sales. After 1928, however, renewal sales declined sharply from their 1928 high of fifty million tires a year to their present levels, which have been maintained for five years at about thirty million tires a year. Export sales have been relatively small all through the years, never amounting to more than five percent of total sales, and averaging just over three percent of the total for the entire period. Accordingly,

Although foreign markets are unquestionably of minor importance to American tire companies, their significance is somewhat greater than these figures would suggest. In the first place, exports of tires, tubes, and tire repair materials since 1914 have amounted to only a little over one half, by value, of the (continued on next page)
### Table 27

**Tire Sales by Principal Markets, 1910-1938 (a)**

*(thousands of tires)*

<table>
<thead>
<tr>
<th>Year</th>
<th>Original Equipment</th>
<th>Exports</th>
<th>Renewals</th>
<th>Total Sales</th>
</tr>
</thead>
<tbody>
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<td>2300</td>
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<tr>
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<td>139</td>
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(a) Rubber Section, Special Circular No. 3500, op. cit.; Table III; Rubber Section, Special Circular No. 3544, op. cit., p.9; Survey of Current Business, May, 1939, op. cit., pp.16-17; W.W. Leigh, op. cit., pp.343,347.
Table 28

Percentage Distribution of Tire Sales, by Principal Markets, 1910-1938 (a)

<table>
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<tr>
<th>Year</th>
<th>Original Equipment</th>
<th>Exports</th>
<th>Renewals</th>
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<td>72.2</td>
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</table>

(a) Computed from data in Table 27.
whatever recent increases have occurred in total tire sales from the depression low of 1932 must be attributed primarily to recovery in the automobile industry, and to the consequent increase in original equipment sales.

The fact that this increase may be temporary constitutes a grave problem for the tire industry. It is widely believed that the market for new automobiles has reached the peak of its expansion, and that future automobile sales will be at an average rate of about three million a year. Hence the greater automobile sales during the years 1935, 1936 and 1937 are interpreted as making up for the small sales of the immediately preceding years, rather than as representing increases which will be sustained. The possible loss of volume in sales of tires to equip new automobiles, coupled with the already declining rate of tire replacement, offers a dismal prospect to the tire manufacturers.

(continued from preceding page) total exports of rubber manufactured goods. The remainder consists of other rubber products most of which are manufactured and sold by diversified tire companies. Cf. P.W. Barker, Rubber Statistics, op. cit., p.53. In the second place, trade barriers and transportation costs have led a number of tire companies to establish foreign plants or to ally with foreign producers instead of exporting from domestic plants to distant and protected markets. Cf. supra, Table 14 and pp.115 ff.

In the past, members of the tire industry have met declines in the total demand for tires as depression phenomena, and have adjusted their productive organizations and competitive tactics accordingly. In general, the companies with the greatest financial strength have survived what they counted as temporary, cyclical losses, while the weaker companies have passed through reorganizations or have disappeared from the industry.

Many of the methods which have been employed by tire manufacturers to deal with temporary declines in demand have been studied before. In most instances the tire companies have acted independently and their conflict has been bitter. If the phenomena tending to decrease the demand for tires become permanent, or if the tire market begins to stabilize at a lower figure than was reached in the 1920's, we may see the adoption of new tactics by the various companies. The incentive for them to ally instead of conflict is likely to grow out of their common danger. There is some evidence that a movement in this direction

W.W. Leigh, op. cit., represents the most detailed investigation of marketing in the tire industry, but his study covers the period up to 1934. Hence it does not deal with the subsequent period when trends were reversed and original equipment sales increased while replacement sales declined. Nor did it contemplate the present situation where a permanent decline in total tire sales may be expected.
started as early as 1935, but before we can assess the effectiveness of this new development, we must first look to the roles which have been, and still are played by the separate companies in each of the major tire markets. Differences in their selection of competitive tactics, and significant elements of heterogeneity among the leading tire companies may prove important bars to their effective alliance.

20. The Original Equipment Market

At present original equipment sales are divided among the Big 4. Earlier in the history of the industry, two other companies shared this market, but since 1930

Before the end of the World War certain automobile companies not operating under the Selden patents complained that they were being discriminated against in tire deliveries. Consequently they established their own company, Ajax, which expanded rapidly until 1918. Ajax sold a considerable proportion of original equipment tires during the early 1920's, but was not important in the market after 1927. This company failed in 1931. Ibid., p.121. Through a community of banking interest between Fisk and Chrysler in 1928, Fisk secured what was reported to be an extremely profitable cost-plus contract to supply practically all of the Chrysler and Dodge tires, about two and one half million tires per year. Fisk held this contract until 1930 when Goodyear secured it. Fisk thereupon went into receivership. It is worth noting that at the time when Goodyear took this business away from Fisk, Dillon, Read had important interests in both Goodyear and Dodge. Cf. C.E. Fraser and G.F. Doriot, op. cit., pp.94, 112, Wall Street Journal, December 10, 1928, p.5.
virtually all tire sales to automobile manufacturers have been made by Goodyear, U.S. Rubber, Firestone and Goodrich.

This fact helps to explain the increasing concentration of total tire production in the hands of these companies during recent years, since original equipment is the only market that has expanded appreciably since 1932; the replacement market, in which the smaller companies share, having declined slightly since that year. This relative advantage of the large over the small companies has been accentuated within the past ten years by the growing practice of equipping new automobiles with spare tires, which represents an indirect invasion of the replacement market.

Until 1926 it was the customary practice for automobile distributors to sell spare tires as "extras." They usually obtained these tires through wholesale channels like other retail tire dealers. At this time, therefore, the small tire companies could compete in the market. In 1927, however, the manufacturers of expensive

It cannot be said that the Big 4 manufacture all original equipment tires inasmuch as Ford produces a small proportion of his tire requirements in its River Rouge plant. Ford started the production of tires on a small scale in 1927. Cf. Eva Flugge, "Possibilities and Problems of Integration in the Automobile Industry," Journal of Political Economy, 37 (April, 1929), p.166.
automobiles, and of sport models with fender wells, began to equip their cars with spare tires at the factory. This practice spread slowly to other types and models during the next few years, and grew rapidly after 1931. Since 1934 practically every car leaving the assembly line has been equipped with one, and sometimes two spare tires. Inasmuch as these tires are all provided by the Big 4 through their connections with the automobile manufacturers, the small tire companies not only have suffered a reduction of their previous sales, but also face a situation in which replacement purchases are postponed by new automobile buyers until their spares have been used.

Data are not available regarding the volume of original equipment sales of each of the major tire companies. Conflicting claims are made that U.S. Rubber and Goodyear control the largest volume of these sales, but there seems

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W.W. Leigh, op. cit., p.99, secured the following estimates from the industry with regard to the percentage of cars sold equipped with spare tires:

<table>
<thead>
<tr>
<th>Year</th>
<th>Percentage of Cars with Spares</th>
</tr>
</thead>
<tbody>
<tr>
<td>1928</td>
<td>3.5</td>
</tr>
<tr>
<td>1929</td>
<td>7.5</td>
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<tr>
<td>1930</td>
<td>12.4</td>
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<tr>
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<tr>
<td>1933</td>
<td>90.0</td>
</tr>
<tr>
<td>1934</td>
<td>100.0</td>
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</tbody>
</table>

Fortune, November, 1936, op. cit., p.145.

to be little doubt that Firestone follows these two and that Goodrich trails behind. It is safe to assume, however, that the relative shares of these four companies are not too unequal, since the highest claim made for any of the companies is that it controls from 28 to 30% of total original equipment sales.

The automobile companies to which the Big 4 sell, and the models which they equip are well-known. The facts suggest that while a few alliances have been made between tire companies and automobile manufacturers, in most instances the latter have chosen to maintain their bargaining power as large buyers by spreading their business among the various tire manufacturers. The principal arrangements which have remained unchanged over the past few years are those by which Goodyear has equipped all of the Hudson, Nash and Chrysler cars, U.S. Rubber has supplied International Harvester and Rolls Royce, and Firestone has monopolized the original equipment sales to Studebaker. Meanwhile Goodrich and U.S. Rubber are reported to share equally in tire sales to Chevrolet. For many years Firestone and Ford have been very close, but

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this has not resulted in complete control by Firestone of original equipment on Ford cars. It is estimated that Firestone has supplied from 50 to 60% of the Ford tires, but Ford, in addition to manufacturing some of its own, also purchases tires from Goodyear and U.S. Rubber. Since duPont management took over U.S. Rubber, that company is reported to have had a working agreement with General Motors, by which U.S. Rubber, by meeting its competitors' prices, is assured of up to 50% of all General Motors business. In recent years, U. S. Rubber, in addition to its sales to Chevrolet, has supplied the greater part of the tires mounted on the Oldsmobile, Pontiac, La Salle and Cadillac cars. At the same time, each of the other members of the Big 4 have had a share in the sales to General Motors.

It should not be assumed that the large sales volume which accrues to the Big 4 from their sales to these automobile companies is necessarily the source of large profits. The relative advantage which the big tire companies maintain over the little companies by their control of the original equipment market is sharply curtailed by the competitive strength of the automobile manufacturers. Ford, the divisions of General Motors, and other automobile companies are known to be shrewd and close buyers, well able to play one tire company off against the other.

235

Cf. Fortune, November, 1936, op. cit., p.145. "Contracts have reportedly changed hands over a matter of seven cents on a set of tires."
In addition, like other large buyers, they hold the ultimate threat of producing tires themselves. Since the loss of a major contract would represent a serious blow to any one of the tire producers, as the loss of volume would increase its unused capacity and raise its unit costs, the automobile producers have been able to obtain extremely favorable terms.

Each order for original equipment tires is executed under a negotiated contract, and so the precise terms of each sale are not available to the student of the industry. Court records in the Goodyear case have thrown some light on the question. If the Goodyear terms can be counted as typical of the industry, it would appear that from 1926 to 1933 original equipment sales were made at an average price about 40% below the price to independent dealers. This price is probably barely enough to cover direct costs, and even though it spreads overhead there is some question as to the long run profitability of these

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237 It is reasonable to assume that they can, inasmuch as the other members of the Big 4 had to meet these terms in order to make original equipment sales, and there have been no major shifts in the volume of original equipment business enjoyed by each of the Big 4.
sales. In certain years, notably 1929 and 1930, it is generally agreed that original equipment tires were sold at a net loss to the tire industry, and there is no reason to believe that the relative bargaining strength of the tire companies has increased appreciably since then.

The relatively weak competitive position of the tire manufacturers as compared with the automobile companies has operated against them in one other respect. When spare tires were first sold directly to automobile producers, the tire companies tried to distinguish them from original equipment sales by selling them on different terms. They maintained that a spare tire was merely another form

Professor Leigh made an analysis of the cost and sales data presented in the Goodyear case, and came to the conclusion that during the period April 1, 1926 through December 31, 1933, Goodyear's original equipment sales constituted 29.1% of its sales volume as measured by the number of tires sold, but only 26.1% of its dollar volume and 7.0% of its total profits. The total net sales of original equipment tires over this period amounted to $255,900,000, but operating profits on this volume (that is, excluding all financial charges) was reported to be $10,236,000 or 4.0%. Leigh estimates net profits on these sales to be 2.0% at most, as compared to an estimated net profit of 11.9% on sales to independent dealers in the replacement market during the same period. Ibid., pp.95, 240, 242.

In 1936, Fortune, November, 1936, op. cit., p.145 refers to original equipment sales as carrying "little or no profit."
of replacement tire, and should be priced accordingly. Consequently, up to 1933 spare tires were customarily sold to the automobile manufacturers at the "best dealer price" which averaged about 50% higher than the original equipment price. All tires were shipped as original equipment but when payment was due the automobile manufacturer would remit the difference between the original equipment and the "best dealer" price for the tires he had used as spares. Since 1933 the difference has been increasingly shaded whenever contracts have come up for renewal so that "it would appear to be but a matter of time until the price (for spare tires) will be on the original equipment level."

Since sales of tires to automobile companies have low profitability at best, it may seem strange that the tire companies compete so vigorously for this market. If they could ally, and present a common front to the automobile industry, they might be able to improve their competitive position. However, as a group they would face the possibility that the large automobile companies might turn to tire manufacturing themselves, and might even compete with them in the more profitable replacement market. And independently, each tire company not only

fears the effect on its productive organization of the
loss of volume that would follow if it failed to maintain
its share of original equipment sales, but also claims to
find strong advantages in remaining in this market. The
tire manufacturers feel that supplying tires to automobile
companies, even at cost, gives them useful market connec-
tions and valuable advertising. They believe that this
affiliation puts them in touch with large organizations
of automobile dealers who will be prospective dealers
for their replacement tires. They argue that low original
equipment tire prices permit the automobile manufacturer
to lower the price of automobiles, thus extending car regis-
trations and future renewal sales. They find it desirable
to keep on good terms with the automobile manufacturers
because they sell them many rubber products other than

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It would probably be difficult for the separate mem-
bers of the Big 4 to reach an amicable settlement of
their relative shares of this market because though
their present shares are not greatly unequal, there
are great differences among the companies in the pro-
portion of its own total sales that each company makes
in the original equipment market. For instance, Good-
year and U.S. Rubber each provide one quarter of the
original equipment tires sold, but this volume repre-
sents about 40% of U.S. Rubber's total tire sales,
and 25% of Goodyear's.

244
Leigh, op. cit., p.95.
tires. And finally they believe that they can build up consumer preference for their particular brands by having it known that their products have been selected as stock equipment on a well-known automobile. Until considerations such as these, which appear to offer real or potential advantages to particular tire companies, are outweighed by the general unprofitability of original equipment sales, there is little likelihood of successful alliance of the members of the Big 4 against the automobile manufacturers.

21. The Replacement Market

The most spectacular conflicts in the tire industry have occurred in the replacement market. Here we find not merely the competition among four large units selling to a limited number of large buyers which distinguished the original equipment market, but a much more complicated situation, characterized by conflicts and shifting alliances among many different sorts of business units. The various tire producers, large and small, have customarily remained independent of one another and have adopted a wide variety of competitive tactics in their attempts to secure advantages in the renewal market. In the process they have often bound themselves to other, non-tire-producing, enterprises in their search for re-
placement volume. Not the least of their troubles have arisen from these alliances.

The principal problem facing the tire company selling renewal tires is that of making its product accessible to the ultimate buyer under circumstances that are profitable to the company. There are a few large buyers of replacement tires,—taxi companies, truck and bus fleets, and governmental agencies,—with which the tire companies can deal directly, but the greatest volume of renewal sales are finally made at retail to individual passenger car owners who buy only one or two tires per year. In order to serve this market, the tire companies need a large number of small, conveniently located, geographically dispersed retail outlets.

The methods employed by the separate members of the industry to obtain these outlets have frequently proved unfortunate, for when they have sought sales volume by promoting increases in the number of retail outlets they have discovered that this volume is attainable only at increased distribution costs, wider distributors' margins, or at the expense of their control over the retail market.

In the early development of the tire industry the outlets for replacement tires were largely under the control of the tire manufacturers. This arose from the technical problems involved in mounting and servicing the
first tires. At this time the tire companies established branches in the major cities where automobiles were being sold. These branches sold, mounted and repaired tires. As automobile use increased, the repair and service functions were gradually taken over by independent garages, and the retail selling by independent tire dealers many of which were also garage and automobile repair-men. Consequently the manufacturers' branches developed into warehousing centers and sales offices. Meanwhile, some of the independent tire dealers that grew with the industry expanded into wholesaling, and in many areas, took over the functions of the manufacturers' branches.

This was substantially the situation until the middle 1920's. The essential marketing pattern then was such that the tire companies sold original equipment tires direct to automobile manufacturers, and sold a portion of their renewal tires to large buyers direct from the factory or through their branches, but marketed almost all of the rest of their replacement tires through independent retail dealers, who secured their tires from independent wholesalers or from the manufacturers' branches. At this time a more or less standardized structure of trade discounts obtained throughout the industry. Large buyers were given special treatment under separate contracts while independent wholesalers and dealers who combined the retailing and wholesaling functions were customarily given
about 25% off the listed price to consumers together with
graduated quantity discounts. Inasmuch as the total volume of sales was expanding rapidly, both the tire companies
and the independent dealers profited under this arrangement.

During the 1920's, several new developments began
to disrupt the marketing pattern. Although their full ef-
fect was not felt while the demand for replacement tires
was still expanding they became of prime importance when
the renewal market began to contract. The physical handling
of the product did not change substantially, except at the
retail level, but there large distributing organizations,
with established facilities for retailing, undertook to
sell replacement tires as a side-line. In succession

W.H. Cross, G.S. Earleman, and J.H. Lanaerts, op. cit.,
pp.95-98.

p.123, tabulates the distributed sales of tires in 1929
and 1935 as follows:

<table>
<thead>
<tr>
<th>Channel</th>
<th>Percentage of Total Distributed Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1929</td>
</tr>
<tr>
<td>Industrial and other</td>
<td></td>
</tr>
<tr>
<td>large users</td>
<td></td>
</tr>
<tr>
<td>Manufacturers' own</td>
<td></td>
</tr>
<tr>
<td>wholesale branches</td>
<td>48.5</td>
</tr>
<tr>
<td>Independent Wholesalers</td>
<td></td>
</tr>
<tr>
<td>and Jobbers</td>
<td>8.2</td>
</tr>
<tr>
<td>Manufacturers' Retail Stores</td>
<td>.5</td>
</tr>
<tr>
<td>Independent Retailers (including chains)</td>
<td>17.0</td>
</tr>
<tr>
<td>Household Consumers</td>
<td>.2</td>
</tr>
<tr>
<td>Total Distributed Sales</td>
<td>100.0</td>
</tr>
</tbody>
</table>
mail-order houses, through their catalog sales and their retail stores, automobile accessory chains, and oil companies, through their service stations, entered the renewal tire market.

By providing outlets to increase the sales volume of particular tire companies they offered significant competitive advantages to the tire manufacturers who would ally with them, but as the large buyers they began to threaten the tire companies' dominance of the retail market. In self defense many of the tire companies established their own retail stores to protect their market position. Faced by all of these new and stronger competitors the small independent dealers were obliged to accept a smaller share of the renewal market. And as the total renewal demand began to

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It should be noted that these price concessions were obtained primarily because of the size of the orders given by large distributors and only secondarily because of any transference of marketing functions from tire companies to large retailing organizations. Most of the oil companies and chains perform only a few of the functions of tire wholesalers; their retail units are often supplied directly from the manufacturers' branches.

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This is particularly so when the large distributors handle private brands instead of the manufacturers' brands.
decline, the competition among all of these units became intense.

Table 29 shows the changing proportions of total renewal sales that were made by each of the principal types of retailers between 1922 and 1938. During that time, if these data are reliable, the independent dealers have lost half of their market to the large distributing organizations. Chain stores, which were not important until the middle or late 1920's now command almost one sixth of the total renewal sales. The oil companies, which had barely entered the market in 1930, have grown to control more than one sixth within eight years. The competing company-owned stores expanded during the early 1930's, reached their peak in 1936 when they made about one eighth of the renewal sales, but have since seen their share of the market decline to little more than one twelfth. The remainder of the market is either scattered among other retailing organizations, the chief of which are the mail order houses, and department stores, or is handled by shipments direct from the factory.

The principal circumstances which have given rise to these changes in market control, and their relevance to the competitive positions of the several tire companies will be examined briefly in the following pages. Our attention will turn first to the relationships of tire companies with the business units involved in each of the
Table 29

Percentage Distribution of Replacement Tire Sales, by Principal Channels of Distribution, 1922-1938 (a)

<table>
<thead>
<tr>
<th>Year</th>
<th>Direct Factory</th>
<th>Owned Retail Stores</th>
<th>Independent Dealers</th>
<th>Mail Order</th>
<th>Chain Stores</th>
<th>Oil Companies</th>
<th>Other Channels</th>
</tr>
</thead>
<tbody>
<tr>
<td>1922</td>
<td>...</td>
<td>.1</td>
<td>98.1</td>
<td>1.8</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>1923</td>
<td>...</td>
<td>.1</td>
<td>96.7</td>
<td>2.7</td>
<td>.3</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>1924</td>
<td>...</td>
<td>.1</td>
<td>94.7</td>
<td>4.3</td>
<td>.6</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>1925</td>
<td>...</td>
<td>.1</td>
<td>91.0</td>
<td>7.2</td>
<td>1.4</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>1926</td>
<td>1.1</td>
<td>.5</td>
<td>69.3</td>
<td>6.2</td>
<td>2.4</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>1927</td>
<td>1.0</td>
<td>.7</td>
<td>86.6</td>
<td>4.8</td>
<td>4.4</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>1928</td>
<td>1.0</td>
<td>1.3</td>
<td>84.2</td>
<td>4.6</td>
<td>6.3</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>1929</td>
<td>1.0</td>
<td>4.5</td>
<td>74.0</td>
<td>5.5</td>
<td>13.3</td>
<td>.9</td>
<td>...</td>
</tr>
<tr>
<td>1930</td>
<td>1.1</td>
<td>7.4</td>
<td>69.3</td>
<td>4.6</td>
<td>13.9</td>
<td>3.0</td>
<td>.7</td>
</tr>
<tr>
<td>1931</td>
<td>.9</td>
<td>8.5</td>
<td>66.7</td>
<td>3.6</td>
<td>13.1</td>
<td>6.5</td>
<td>.7</td>
</tr>
<tr>
<td>1932</td>
<td>.8</td>
<td>9.6</td>
<td>65.0</td>
<td>3.5</td>
<td>13.5</td>
<td>6.8</td>
<td>.8</td>
</tr>
<tr>
<td>1933</td>
<td>1.2</td>
<td>8.4</td>
<td>66.2</td>
<td>2.8</td>
<td>11.1</td>
<td>9.4</td>
<td>.9</td>
</tr>
<tr>
<td>1934</td>
<td>1.0</td>
<td>9.5</td>
<td>61.7</td>
<td>3.6</td>
<td>11.9</td>
<td>11.2</td>
<td>1.1</td>
</tr>
<tr>
<td>1935</td>
<td>1.0</td>
<td>12.1</td>
<td>56.2</td>
<td>3.8</td>
<td>12.8</td>
<td>12.7</td>
<td>1.4</td>
</tr>
<tr>
<td>1936</td>
<td>.9</td>
<td>12.4</td>
<td>54.8</td>
<td>3.3</td>
<td>14.1</td>
<td>13.0</td>
<td>1.5</td>
</tr>
<tr>
<td>1937</td>
<td>.9</td>
<td>9.4</td>
<td>53.0</td>
<td>4.3</td>
<td>14.6</td>
<td>16.5</td>
<td>1.3</td>
</tr>
<tr>
<td>1938</td>
<td>.8</td>
<td>6.7</td>
<td>51.4</td>
<td>5.2</td>
<td>16.2</td>
<td>16.7</td>
<td>1.0</td>
</tr>
</tbody>
</table>

(a) Adapted from estimates made by Professor W.W. Leigh, found in: W.W. Leigh, op. cit., p.126, (for the period 1922-1933), Rubber Section, Special Circular No. 3650, August 16, 1937, (for the period 1934-1936), Rubber News Letter, May 31, 1939, p.120, (for the period 1937-1938).

(b) Considerable tolerance must be allowed for error in the estimates if the independent dealers' share of the replacement market. The percentages expressed here represent a residual rather than a reported figure, and therefore may be high. This is especially true inasmuch as many dealers are ostensibly independent but actually controlled or dominated by manufacturers or large distributors.
major channels of replacement tire distribution, and then to the conflicts and alliances among these units, insofar as they affect the competitive positions of the tire manufacturers.

22. National and Commercial Accounts

The one part of the renewal market that has suffered least from the invasion of the large distributors, but which nevertheless has been intensely competitive is the sale of replacement tires to governmental, industrial and commercial users. Most of these sales are arranged between the tire companies and the large consumers and handled direct from the factory, from the manufacturers' branches, or from the manufacturers' retail stores.

According to the custom of the industry, large consumers are classified as "national accounts" when they operate fleets of one hundred or more automobiles, and "commercial accounts" when they operate fleets of from five to ninety nine automobiles. The national accounts

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are generally held by the larger tire companies, and negotiated by the home office, but the commercial accounts are the objects of bitter competition among tire companies of all sizes, and the various wholesaling and retailing agencies.

The terms upon which renewal tires are provided to these non-private car owners vary sharply, and suggest a possible classification of this market. Governmental purchases are generally made after competitive bidding or through official purchasing agents. Some bus and taxi companies secure their tires on a rental basis, leasing tires at a specified rate per mile or per day. The truck and commercial vehicle fleets buy their renewal tires outright at special rates from the tire companies or from other tire distributors.

A rough idea of the relative importance of the governmental market may be given by the following data. In 1938 the Federal government was reported to own 17,971 passenger cars, 647 motor buses, and 91,143 motor trucks, while in the same year, state, county and municipal governments combined were reported to own 50,284 passenger cars, 22,290 motor buses and 117,239 motor trucks. Purchases by agencies of the Federal government have increased much

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Automobile Facts and Figures, 1939, op. cit., p.71
more rapidly than by local governments; the former owned
301% more motor vehicles in 1938 than it did in 1932,
while the latter has increased its ownership less than
80% during the same period. The principal governmental
accounts include the following: U.S. War Department, with
a fleet of 11,621 trucks and 968 passenger cars, U.S. Navy
Department, with 1,755 trucks and 202 passenger cars, U.S.
Department of Commerce, with 997 trucks and 112 passenger
cars, and U.S. Bureau of Public Roads with 636 trucks and
385 passenger cars. Among state and local governments,
the largest accounts are: New York City Department of
Sanitation with 3,692 trucks and 165 passenger cars,
North Carolina State Highway Commission with 2,144 trucks
and 313 passenger cars, Texas State Highway Commission
with 2,059 trucks and 93 passenger cars, the California
Department of Finance with 2052 trucks and 2129 passenger
cars, and the Ohio Department of Highways with 1,691 trucks
and 736 passenger cars.

Governmental accounts such as these are large
enough to be sought after eagerly by the tire companies.

251
Cf. ibid., p.16.

252
These data are gathered from a survey conducted in 1937
by the Automobile Manufacturers Association, cited in
Since they are secured primarily by price competition, the particular companies that have secured them cannot have found them particularly profitable. Only recently, when identical bids have been prevalent among the leading companies, has there been a cessation of price hostilities in this market.

Between 1926 and 1938 the number of buses in use increased from about 53,000 to 132,600. Some of these, along with taxis, lease their tires, but most of them buy tires outright. The tire rental and mileage business, which has been estimated to gross from ten to twelve million dollars annually, and to provide for approximately 12,000 vehicles, is handled almost exclusively by the Big 4. The Greyhound Company represents the major account of this sort. Bus tires are reported to be leased at about one eighth of a cent a mile, and the average return per tire is about forty dollars.

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Quality differentials as gauged by laboratory or performance tests, and, possibly, personal connections, may also affect the awarding of these contracts.

Cf. supra, pp. 145-146, footnote 66.

Automobile Facts and Figures, 1930, op. cit., p. 28.

Automobile Facts and Figures, 1939, op. cit., p. 72.

W.W. Leigh, op. cit., p. 113.

Ibid., p. 113.
The most important accounts, however, and ones which are continually growing, are the truck and passenger car fleets of private commercial enterprises. In 1938 there were over 25,000 fleets of eight or more vehicles aggregating over 950,000 trucks, and a lesser number of passenger cars. Among the largest of these, which would be classified as national rather than as commercial accounts, are 129 companies which in the aggregate operated about 143,000 trucks and 58,500 passenger cars. Chief among the companies owning large fleets are the Bell Telephone Companies, Standard Oil Company of New Jersey, Railway Express Agency, Borden Company, National Dairy Products, Standard Oil Company of Indiana, Socony-Vacuum, Continental Baking Company, General Baking Company, Swift and Company, Pure Oil Company, Cities Service, Standard Brands, Inc., Ward Baking Company and Armour & Company.

Inasmuch as the small companies lack the facilities to service these large accounts, most of this business is handled by the Big 4. But among them, the competition

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Automobile Facts and Figures, 1938, op. cit., p. 63. In 1934 Leigh noted the existence of 109 such fleets, aggregating 130,000 trucks and 45,500 passenger cars. W.W. Leigh, op. cit., p. 112.

261

Ibid., p. 63.
has been violent. The large buyers of renewal tires, like
the large buyers of original equipment tires, are in a
position to play one company off against another. Hence
they "invite competitive bidding and so-called 'account-
stealing' and commercial price wars are common." This
situation has been aggravated in recent years by the fact
that even though the volume of these sales is growing
several of the largest of the national accounts have been
lost to the tire companies. As oil companies, with large
fleets, such as the Standard Oil Companies of New Jersey
and Indiana, Socony-Vacuum, Pure Oil Company and Cities
Service, have become tire distributors themselves, they
have obtained their renewal tires on even more favorable
terms than formerly.

The most vigorous price and quasi-price competi-
tion, however, has been manifested in the rivalry for the
smaller commercial accounts. Here, all of the different
business units which sell tires have entered the conflict.
This has been an unstable and at times a demoralized mar-
et since the early 1920's.

262
W.W. Leigh, op. cit., p.iii.

263
Cf. Ibid., pp.247-252, W.H. Cross, G.S. Earseman and
Hearings, op. cit.
At first these accounts were handled primarily by the local independent dealers, but increasingly the manufacturers' branches took them over. The competition among the dealers and branches of the various companies became so acute that by 1925 many of the dealers declined to enter the market, claiming that it had become unprofitable. In 1927, with the spread of manufacturers' retail stores, much of the commercial account volume was handled by these outlets. In 1929, retail dealers were given an extra 10% to handle commercial accounts, but within a year the competition among them was so violent that they had more than wiped out this additional margin. The period from 1930 to 1933 was characterized by bitter price and discount wars among independent dealers, manufacturers' branches, and manufacturers' retail stores. When the independent dealers began to drop out of the market again, they were induced to remain by being given a 10% commission on commercial account sales, regardless of price. Under these circumstances, they were merely the instrumentalities through which the manufacturers competed. Meanwhile successive discounts were added until at one time thirteen 10% discounts were given from the list price. In December, 1932, the tire

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70% of the Goodyear retail stores' volume between 1927 and 1930 was reported to come from commercial accounts. W.W. Leigh, op. cit., p.163.
manufacturers allied temporarily and agreed to standardize discounts, but within a month their agreement had broken down. Another truce was called early in 1933, and this time the Rubber Manufacturers Association tried to police the industry to prevent further price cutting. But this attempt and later efforts under the NRA Code also failed. With an expanding market in 1934 and 1935 the violence of this competition abated somewhat, as far as price was concerned, but took on other forms which had been tried earlier. Instead of allowing extra 10% discounts to commercial accounts, dealers, retail stores and branches adopted other forms of quasi-price competition, selling first line tires as seconds, called new tires "change-overs," giving long guarantees, extra services, and high turn-in allowances, and making spurious adjustments. In addition this competition became contagious; commercial discounts were given to owners of four, three and two, instead of a minimum of five automobiles, truck tire discounts were given on passenger car tires, and extra discounts were given to employees who passed them on to their friends. And most recently this competition has been intensified by the entrance into the commercial market of the large retailing organizations, the oil companies, mail-order houses, and chains. Previously these mass distributors had confined their competition to the renewal market for privately-owned passenger car tires, but in the past few years both Sears Roebuck
and Atlas have been extremely active in soliciting comercial accounts. Since 1935 other large distributors have followed suit. Their invasion of this field has been primarily at the expense of the independent dealers' volume of sales, and consequently to the detriment of the tire companies' net revenues.

23. Retail Outlets

By far the greater part of replacement sales are made to private individuals who are unorganized and occasional buyers. Separately these consumers have little bargaining power in the market, but in the aggregate they have long been the chief beneficiaries of the conflict among the various business units competing for their favor. Given generally declining prices and a steadily improving product, offered a wide range of choice among the products of rival manufacturers, each of whom presents a selection

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About three fourths, by number of tires, and two thirds, by manufacturers' dollar volume, of replacement sales are made at retail to private car owners.

266
Cf. Albert Abrahamson, op. cit., p.108. Cf. also Automobile Facts and Figures, 1939, op. cit., p.49. The Automobile Manufacturers Association has constructed the following index (1926=100) of tire and tube costs per mile for passenger cars: (continued on next page)
arrayed according to price and quality, and enabled to buy from many different tire outlets, each of which can augment the price and quality differentials by offering extra inducements in the form of service, guarantees, trade-in allowances, free deals, and arrangements for installment purchase, etc., the final consumer of tires has been in a fortunate position through no act of his own.

Successful alliance, at the manufacturing level, among the tire companies, or, at the selling level, among tire retailers, could erase the consumers' advantage, but the partial alliances that have been made thus far have not been particularly effective in this respect. The divergence of interest among the business units involved, and their organizational heterogeneity, has minimized the incentive for them to ally and has led instead to the adoption of a wide variety of competitive tactics.

266 (continued from preceding page)

<table>
<thead>
<tr>
<th>Year</th>
<th>Tire and Tube Cost per Mile</th>
</tr>
</thead>
<tbody>
<tr>
<td>1926</td>
<td>100</td>
</tr>
<tr>
<td>1927</td>
<td>82</td>
</tr>
<tr>
<td>1928</td>
<td>70</td>
</tr>
<tr>
<td>1929</td>
<td>58</td>
</tr>
<tr>
<td>1930</td>
<td>48</td>
</tr>
<tr>
<td>1931</td>
<td>39</td>
</tr>
<tr>
<td>1932</td>
<td>29</td>
</tr>
<tr>
<td>1933</td>
<td>31</td>
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<td>1934</td>
<td>33</td>
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<td>1935</td>
<td>27</td>
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<td>1936</td>
<td>33</td>
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<td>1937</td>
<td>37</td>
</tr>
<tr>
<td>1938</td>
<td>36</td>
</tr>
</tbody>
</table>
The most significant differences among tire retailers are differences of size, financial strength, organization, and degree of interest in the market. And here the various types of retailing organizations fall into three major classifications within which there are important sub-categories: (1) the independent dealers, which, though there are sharp variations among them with respect to their size and strength, and the extent of their diversification, represent as a type the weakest and least diversified class of tire retailers; (2) the large distributing organizations, mail order houses, chains, and oil companies, which are horizontally integrated, financially strong, and which sell tires as side-lines; (3) the retailing units controlled by the tire companies which tend to be unprofitable in themselves, but the prime object of which is to insure a place in the market for the manufacturers' tires. Each of these three classes of retailers tends to conflict with other units in its class, and with units in other classes, and the tire producers, as such, are significantly related to each type of unit.

The fundamental interrelationships of these units are shown in Chart E, on the following page. This chart, of the marketing organization of the tire industry, indicates the principal tire outlets and the sources from which they obtain their supplies.
CHART E

TIRE OUTLETS IN THE UNITED STATES

Tire Manufacturing Companies

Mail Order Houses

Mail Order Houses

Oil Companies

Oil Companies

Auto Supply Chain

Auto Supply Chain

Jobbers

Jobbers

Manufacturing Dealers

Manufacturing Dealers

Mfrs. Branches

Mfrs. Branches

Mfrs. Retail Stores

Mfrs. Retail Stores

Retail Stores

Retail Stores

Distributing Points

Distributing Points

Retail Stores

Retail Stores

Filling Stations

Filling Stations

Jobber Sub-Dealers

Jobber Sub-Dealers

Dealers (some consignment)

Dealers (some consignment)

Dealer Sub-Dealers

Dealer Sub-Dealers

Final Consumers

Final Consumers

(Renewal market except

(Renewal market except

Government National and Commercial Accounts

Government National and Commercial Accounts

Adapted from: Rubber Section, Special Circular No. 3553
24. Independent Dealers

The independent dealers are by no means a homogeneous group. As the tire industry has developed, many different sorts of independent units have arisen to handle the distribution of tires. Primarily the independent tire retailers operate as automobile accessory stores, garages and filling stations, or new or used car dealers, but tires are also sold in hardware stores, department stores, and general stores, and even in drug stores and barbecue stands. Variously these dealers obtain their tires from jobbers, from other dealers, from warehousing dealers, from the manufacturers' branches or retail stores, or direct from the manufacturer.

It is impossible to get an accurate count of the number of these dealers, or a measure of the relative volume of their tire sales. The tire companies themselves

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267 Cf. Rubber Section, Special Circular No. 3625, November 3, 1936, pp.1-5.


269 Census data are not very helpful here, since they classify retailers according to their principal line of products, and tires often represent a major, though not the chief line of products handled by a dealer. Ibid., p.4. The potential maximum number of dealers is indicated by the following data showing the number of retail establishments in 1935 of the (continued on next page)
do not know how many independent outlets they have for their
tires, since they deal primarily with the larger of the in-
dependents and seldom have direct relations with their sub-
dealers. Estimates range all the way from 60,000 to 140,000,
but of these less than 15,000 have tires as their principal
source of revenue, and not more than 2,000 have gross tire
sales of as much as $25,000 per year. Over half of these

(continued from preceding page) principal types which
handle tires. This tabulation, it should be noted, in-
cludes both independent and non-independent units. Cf.
Rubber Section, Special Circular No. 3525, op. cit., p.1.

<table>
<thead>
<tr>
<th>Type of Retailer</th>
<th>Number of Establishments, 1935</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor vehicles, new, dealers</td>
<td>30,265</td>
</tr>
<tr>
<td>Used car dealers</td>
<td>4,752</td>
</tr>
<tr>
<td>Garages, repair only(1)</td>
<td>66,183</td>
</tr>
<tr>
<td>Other automotive dealers(2)</td>
<td>1,068</td>
</tr>
<tr>
<td>Automobile accessories, tire</td>
<td>14,285</td>
</tr>
<tr>
<td>and battery dealers(3)</td>
<td>196,649</td>
</tr>
<tr>
<td>Filling stations(4)</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>313,202</strong></td>
</tr>
</tbody>
</table>

(1) Does not include parking and storage garages, nor body, fender, paint, radiator shops.
(2) Motorcycle, trailer, aircraft, motor-boat.
(3) Includes most tire company service stations.
(4) Includes garages and tire company stations with principal sales in gasoline and oil. Includes oil companies' stations.


Rubber Section, Special Circular No. 3553, op. cit., p.6.

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2,000 are jobbers, who obtain their tires direct from the
manufacturers and sell most of them to or through sub-
dealers, while the rest are warehousing-dealers, or other
large independents who service or control sub-dealers.

The gap between the large and small independents
has been growing wider in recent years, for while total
sales by independent dealers have been declining, the
large units have been relatively more successful than the
small ones in maintaining their sales volume. As a conse-
quence there has been a noticeable trend towards the con-
centration of dealer sales in the hands of the larger in-
dependents. Meanwhile, although this has reduced the share
of the smaller dealers, their aggregate numbers have not
declined. Even while the numbers of automobile accessory,

273
A "jobber" is defined in the tire industry as a business
unit "who sells at least 75% of his total volume of tires
and/or tubes through or to dealers for resale to consumers,
whether or not such dealers are owned or affiliated with
or controlled by such jobber, and who performs the services
of a jobber such as maintaining a stock, selling, shipping,
billing, and carrying accounts receivable." NRA Code
No. 174, op. cit., p.341.

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A warehouse dealer in the tire industry is a retailer
"who acts as a shipping agent for a member of the Indus-
try (tire company) with sales, credits and collections
handled by that member." Ibid., p.341.

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In 1935 it was estimated that one eleventh of the inde-
dependent dealers controlled 70% of the dealer market. Cf.

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tire and battery dealers, to which tire sales are most im-
portant, have declined, there has been a more than compen-
sating increase in the numbers of other types of retailers 
that handle tires as a side-line. Hence, in this part of 
the retail market, a few large dealers who perform whole-
saling functions are increasing their share of replacement 
tire volume while the remaining business units are becom-
ing more diversified and less reliant on tire sales for 
their revenues.

In their relations with these independent dealers, 
the tire companies have usually taken account of these dif-
ferences only when it served their purposes, or when obliged 
to by the organized pressure of alliances of dealers. The 
dealer is important to a tire company primarily as an outlet 
for its tires, and unprofitable dealer operations concern 
the tire manufacturer only when they threaten to reduce the 
effectiveness of his scheme of retail distribution, by weak-
ening his link with the final consumer. As a consequence, 
the small tire companies, such as Pennsylvania, Norwalk, 
Gates and Seiberling, that are not affiliated with large 
retailing organizations, and Firestone, which has refused 
to jeopardize the market for its own tires by making pri-
ivate brands for chains and oil companies, tend to cater to 
the independent dealers more than the tire producers which 
distribute their tires through other outlets. In the aggre-
gate, however, the dealer market is still too large to be
disregarded by any tire producer, so all of the leading tire companies have frequently granted concessions in the effort to keep their dealer organizations intact.

In the past these concessions have generally taken the form of extra discounts to enable the dealers to meet their competitors' prices. In times of price wars this has often degenerated into a progressive increase of discounts without an increase of dealers' margins; at other times, the dealers have benefited. These discounts are calculated from the consumers listed price published by the tire companies. The size of these discounts and the conditions under which they have been given have varied sharply from time to time, and among the different tire companies, but in most cases an innovation by one manufacturer has obliged his immediate competitors to adopt a similar practice. Commonly, almost any business unit that purchases tires for resale will be granted an initial discount of about 25% from the list price. Further discounts have been given to the larger

Consumer price lists have long been used in the tire industry. After their abolition in 1922 they were re-established in 1929. Customarily the price lists of the larger companies, under the leadership of Firestone or Goodyear, tend to be identical for each line of tires, while the smaller companies' lists maintain a differential of about 10% below these lists. Cf. W.W. Leigh, op. cit., pp. 253-255.

The amount of this discount is graduated according to the quality of the tire. (Continued on next page.)
so-called "Key dealers" who supply sub-dealers, to warehousing dealers, to exclusive dealers, and to dealers who handle commercial accounts. In addition, various forms of quantity discounts, freight allowances, and bonuses for large total purchases, discounts for cash, discounts for special sales, and discounts to "meet competition" have been available to both large and small dealers. The aggregate effect of these discounts may be gauged from the statement made in 1936 that "It is safe to say that usually the dealer pays list minus the regular discounts down to forty per cent of list price. When price wars become particularly bitter, the price to the dealer may go as low as twenty per cent of list." In 1938 the dealers' discounts were estimated as follows: exclusive of volume discounts and commissions, the "Key dealers" were given aggregate discounts of 37.3% from the consumers' list prices, while the other dealers who sold only at retail received discounts of 30%. Additional quantity discounts available to all dealers included 2½% for orders of $500 or over, and progressive bonuses on total purchases ranging

(continued from preceding page) "Deluxe" and "first line" tires may be given discounts as high as 33½%, and "fourth line" tires as low as 12½%. The usual range, however, is from 25% to 22½%.

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from 1% on purchases of $15,000 to 2 1/2% on $50,000 and over.

Other concessions which are frequently made by the tire companies to their independent dealers have taken the form of consignment sales, price guarantees, advertising allowances, and assistance in sales promotion.

Consignment sales are of two sorts: to warehousing dealers and to dealers who are bad credit risks. The warehousing dealers, who have grown in importance ever since 1933 when they first began to assume some of the functions of manufacturers' branches, customarily receive a commission of about 5% for warehousing and handling field stocks. It is reported that these stocks are shipped to warehousing dealers on consignment and are presumably held separate from their own stocks, but that these dealers are able to maintain a high turnover by charging out their stocks only as they make sales. In addition to these consignments, a certain number of smaller dealers are not permitted to take title to the tires they distribute because of their lack of financial

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"Prices Still Plague Tire Industry," Business Week, November 25, 1939, pp.22-23. These discounts were reduced slightly at the end of 1939 when the major tire companies, following Goodyear, cut the list prices.

responsibility. The number of these accounts was estimated to be 14,000 in 1934, but since that time there is reason to believe that this number had been diminished by failures or by the manufacturers' taking over of retail stores.

Tire dealers have been given guarantees against price declines as a device to encourage them to carry stocks in the off-seasonal months, and thus make it easier for tire manufacturers to regularize their production. This has been accomplished by the practice of "spring dating," some form of which has been in effect almost from the beginning of the industry. This represents a potential area of competition which generally has been restricted by active alliance of the tire manufacturers. By agreement they all begin to solicit dealers' orders on a given day late in October or early in November. Even though these tires may not be sold at retail until the seasonal advance in April, the manufacturers induce the dealers to accept delivery during the winter months by guaranteeing against price declines until May. A variation of this arrangement occurs when shipments are made in installments. Then the prices on each shipment are guaranteed for a ninety-day period. According to the customary terms of these sales, payment is due on one third of the invoice,

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Rubber Section, Special Circular No. 3553, p.3.
less 2\% for cash, on each of the following dates: April 10, May 10, and June 10. Most recently the spring dating agreement has been altered, and a policy of "winter dating" is in effect. At present prices are guaranteed only through December 31, instead of the usual six month period beginning in the fall.

Other means by which the tire companies have endeavored to sustain their independent dealers are by the granting of advertising allowances, and by assisting them in sales promotion. Advertising allowances have sometimes been employed as disguised price concessions, but many other times have been bona fide. It has been reported that the large tire companies have made a practice of contributing 50\% towards the dealers' local advertising costs. In other cases the large, and small companies, too, have provided advertising matrixes, lantern slides for theater advertising, materials for direct mail advertising, and radio continuity to be used at the dealers' expense. And it is a general practice for all companies to advise their dealers on store lay-out and sales technique, to provide them with signs, tire racks, pennants, streamers, posters, and calendars, etc., and to sell them at cost stationery, uniforms, and advertising specialities such

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Business Week, November 25, 1939, p. 23.

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as pencils, ashtrays, key-cases and book-matches.

A few of the tire companies have promoted alliances among their dealers, designed to further the mutual interests of manufacturer and dealer. Goodrich has a "Goodrich Buying and Selling Organization" consisting of several hundred dealers who agree to purchase tires and accessories through the organization in return for which Goodrich provides a wholesaling service and sends out field supervisors to aid the dealers. Gates is reported to operate a similar voluntary chain of more than one thousand affiliated independent dealers.

U.S. Rubber has a somewhat different arrangement. In January, 1937, this company established a subsidiary, the U.S. Tire Dealers' Mutual Corporation, to which it sells tires on a cost-plus basis with no discounts for volume. All U.S. tires, except the private brands made for Montgomery Ward, Atlas, Western Auto Supply and Arkansas Fuel Oil Company, are distributed through this subsidiary. Net revenues, if any,


This subsidiary was originally established as a device to protect U.S. contracts with the large distributors and still stay within the provisions of the Robinson-Patman Act. Cf. United States Rubber Company, Forty-Eighth Annual Report (New York: 1940), p.3. This attempt has not been fully successful, however, for in April, 1939, U.S. Rubber and U.S. Tire Dealers Corporation, after two years of investigation, were served with a "cease and desist" order by the Federal Trade Commission. The FTC found that U.S. Rubber was illegally discriminating in its prices between the large buyers of private brands and the distributors which secured their tires from the U.S. Tire Dealers Corporation. Cf. Federal Trade Commission Docket No. 3685 (Washington, D.C.: FTC, 1939).
are distributed among the dealers according to the volume of their purchases. The annual disbursements under this plan have amounted to from one to two percent of the dealers' purchases. The plan is reported to be extremely valuable to the U.S. Rubber Company in that it has promoted dealer good-will.

Of the other members of the Big 4, Goodyear's treatment of its independent dealers has probably given rise to the most resentment because the details of its dealings with Sears Roebuck were aired in court, but Goodrich and Firestone, too, have lost dealers to the smaller companies because of the activities of their owned retail stores.

In a few scattered instances the independent dealers have allied without the sponsorship of tire companies, for the purpose of combatting the interests of

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Sixty-six dealers testified in the Goodyear case and expressed bitterness at the arrangement by which they were obliged to meet the Sears Roebuck price competition with the identically-priced but qualitatively inferior "Pathfinder" line. Cf. Goodyear vs. Federal Trade Commission, Brief for Respondent, No. 7369, op. cit., pp.26a-30a.
tire manufacturers, or of other types of retailers. Prior to 1932 there were several abortive attempts to establish cooperative buying organizations, but the first successful group was formed in that year under the name of the American Tire Alliance. This organization claimed to include six hundred dealers by 1936. Greater success in bringing independent tire dealers together has been achieved by Trade Association activities. In 1936 the National Association of Independent Tire Dealers, together with the Motor and Equipment Wholesalers Association, the National Automobile Dealers Association, and the National Association of Petroleum Retailers convened and formulated rules of fair trade practice for submittal to the Federal Trade Commission. These rules forbade "selling goods below cost, false representation, secret rebates, defamation of competitors' goods, and false marking or branding," and other competitive practices including "price discrimination between different purchasers." Inasmuch as the large retailers were not represented, these groups did not represent a majority of the industry, so this agreement had little more than a moral effect. In California, however, independent dealer pressure was strong enough to induce tire companies to enter into "fair

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trade" contracts in 1937, and similar price maintenance agreements were reached in Chicago in 1938. Independent dealers' associations are now trying to extend this arrangement to other areas, but are constantly blocked by the opposition of the large retailing organizations.

The tire companies, in turn, have allied to protect their position in the retail market. After the extremely unprofitable discount wars that lasted through 1935, the leading companies made "earnest efforts...to stabilize competition in the retail market." Hence, since 1936, by concerted action, they have sought to eliminate "all quantity discounts in excess of 10%, all unearned advertising allowances, and all the many special commissions, bonuses, and extras which were available to favored customers,... and which were a chief cause of rampant price-cutting and discontent among the independent tire dealers during the depression." Absolute agreement has not been reached by all of the leading companies with respect to this phase of

298 Ibid., p.22.
their competition; variations remain in their discount schedules, and in the aids they give their distributors, and occasional changes are made by separate companies in search of a relative advantage in a particular market, but the intensity of competition in this area has been sharply reduced.

23. Large Retailing Organizations

The most notable change in the distribution of replacement tires has been the entrance into the market of large retailing organizations. Within a fifteen year period (1924-1938) their aggregate share of renewal sales have grown from less than five percent to almost forty percent of the total. To a large degree these units, particularly the mail order houses, have dominated the price and competitive practices in the retail market since 1927. Their competitive advantages over the other units are considerable, because they not only maintain a distinct cost advantage over the independent dealers, are more highly diversified and have greater financial strength, but also they are in a particularly strategic position with respect to the tire companies by virtue of the fact that many of them have

gained acceptance of their private brands. These advantages could be minimized by alliances of other tire distributors, or of the tire companies, or of both together, but attempts in this direction have met with only minor successes thus far. Instead, the individual tire companies that are affiliated with large retailing organizations have usually chosen to make whatever concessions were necessary in order to maintain the affiliation.

About sixty large retailing organizations were handling tires in the United States in 1938, of which seven were mail order houses or automobile accessory chains, and over fifty were oil companies. In the aggregate, these organizations control about half of all the retail outlets for tires. In addition to a substantial mail order volume, Sears Roebuck sells tires through 497 retail stores, and Montgomery Ward through about 600 stores. The most important accessory chains, Western Auto Supply of Kansas City

300 The invocation of the Robinson-Patman Act or appeals to the Federal Trade Commission, as in the Goodyear-Sears Roebuck case, probably offer the best possibilities in this direction.

301 Cf. Rubber Section, Special Circular No. 3691, October 1, 1938, pp.1-3.

302 Standard Corporation Records, 17, No. 3893.

303 Standard Corporation Records, 17, No. 3870B.
and Western Auto Supply of California operate 185 and 300 retail stores respectively, while other chains such as Gamble Skogmo in Minneapolis, The Pep Boys in Philadelphia, the Hicks Rubber Company in Texas, and the Bohack Stores in Brooklyn, operate among them about 400 more stores.

Some of these accessory chains also serve as wholesalers or buying agents for affiliated voluntary chains of independent dealers. Most important numerically, even though the sales volume per outlet is small, are the oil companies, practically all of which now handle tires as a side-line through their filling stations. Among them are controlled

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304 The controlling interest in this company was reported to be purchased by Gamble Skogmo in July, 1939. Cf. Standard Corporation Records, 17, No. 3915B.

305 Standard Corporation Records, 17, No. 3833.

306 Standard Corporation Records, op. cit., 17, No. 3915B.


308 The total number of retail stores operated by mass distributors, other than oil companies or tire manufacturers' stores, was reported in October, 1938 to be 1,868. Rubber Section, Special Circular No. 3691, op. cit., p. 3.

309 Cf. Rubber News Letter, May 31, 1939, p. 120. Western Auto Supply of Kansas City, for instance, supplied 1,035 associated independent dealers in 1938. Cf. Standard Corporation Records, op. cit., 17, No. 3833. This type of alliance has grown rapidly in recent years.
well over 100,000 potential tire outlets, of which about half were actually engaged in selling tires in 1938. The pioneer, and still the leader in this field, is the Atlas Supply Corporation, formed in 1929 under the joint ownership of the Standard Oil Companies of New Jersey, Ohio, Indiana, Kentucky, California, and Nebraska, which supplies tires both to Standard Oil owned filling stations, and to Standard Oil leased stations. As early as 1936 it was estimated that there were at least 30,000 stations selling Atlas tires.

The relations of the tire companies with these large retailing organizations are in certain ways similar to their relations with automobile manufacturers. Just as in the original equipment market they are faced with large buyers who command special treatment, here also contracts are negotiated separately, and secretly. The large retailers either spread their purchases to maximize their bargaining power or grant contract renewals to their existing suppliers only on increasingly advantageous terms.

310 Cf. Rubber Section, Special Circular No. 3691, op. cit., p.3.
311 C.E. Fraser and G.F. Doriot, op. cit., p.94.
312 These are stations which were made "independent" in some areas to avoid chain store taxes. Cf. W.W. Leigh, op. cit., p.144.
313 Ibid., pp.143-145.
Likewise, although there is sharp question as to the ultimate profitability of their dealings with these large buyers, the individual tire companies are generally unwilling to lose sales volume to their competitors by giving up their share of large orders. The situation is aggravated by two other conditions that do not exist in the original equipment market: the competition of the small as well as the large companies, and the immediate conflict in the replacement market of the manufacturers' brands with the private brands which they make for the large distributors.

Three of the Big 4 share most of the sales to the large retailers and hence may be expected to increase their shares of tire production as these sales grow. Nevertheless, a number of the smaller companies have gained a foothold in this market, which, though it may be precarious, gives them extra volume as long as they hold the contracts. Account stealing is somewhat more prevalent in this area than in original equipment sales, and spells potential danger to both the large and small companies. The large companies are in constant fear that a large distributor is going to take over one of their smaller competitors, and enter the tire industry as a manufacturer as well as a seller. The small companies welcome the impetus to their production that follows the negotiation of a contract to supply a chain
or an oil company, but dread the risks of being dominated by their powerful customer when the time comes for renewal. And to the small company, loss of one of these large accounts spells almost certain disaster.

The present arrangements, which have not been substantially disturbed during the past few years, include the following: The Sears-Hoebuck account is shared by a number of the smaller companies, including Pharis, Mansfield and Dayton. Sears tires were made by the Murray Rubber Company until 1926, when the first of the famous Goodyear-contracts was signed. Murray subsequently failed, and the Goodyear contracts were given up in 1936. Montgomery Ward was supplied by the Gillette and Samson companies until 1931 when U.S. Rubber secured the account by acquiring control of these two companies. In recent years, Mansfield and Pharis have had shares of the Montgomery Ward business. Atlas divides its purchases between Goodrich and U.S. Rubber, and Shell Oil distributes both Goodyear and Goodrich brands. While a number of the other oil companies, including the Texas Oil Company, also spread their purchases, there are several important accounts that are held exclu-

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sively by tire manufacturers. Goodyear has the Sinclair account, U.S. Rubber supplies the General Oil Company, Les sells tires to Phillips Petroleum, Atlantic Refining, and Signal Oil, and General makes the "Yale" tire which is distributed by the Pure Oil Company. Of the automobile accessory chains, U.S. Rubber is reported to have the most important account: Western Auto Supply, and Goodrich, Mansfield and Pharis supply a number of the smaller chains. The only other type of large buyer, the National Cooperatives, who sell their members an estimated 50,000 tires annually, distribute tires which are made by Minwau.

About 70% of the tires which were distributed through these outlets in 1938 were private brands. All of the mail order tires are privately branded; about 90% of the tires supplied to retail chains are also private brands, but only 42% of the tires sold by the oil companies were other than manufacturers' brands. The best known of the private brands are the "All-State," "Crusader" and "Compan-

316 Cf. ibid., pp. 120-121. A favorable circumstance for the tire manufacturers is the fact that Standard Oil is the only oil company of significance that has insisted on private brands. As other oil companies have been increasing their share of the market in recent years the proportion of private to manufacturers' brands has declined.
ion" of Sears Roebuck, the "Riverside" and "Rambler" of
Montgomery Ward, the "Davis" of the Western Auto Supply,
and the "Atlas" of the Standard Oil stations.

The practice of private branding represents a
distinct threat to both the tire manufacturers and the in-
dependent dealers. As private brands have gained accep-
tance they have tended to destroy one of the few competi-
tive advantages that were enjoyed by the independent
dealer,—the benefits they gained by handling nationally
advertised products. The reflected prestige of the manu-
facturers whose brands they sell is an important factor
to small dealers. Much more significant, however, is the
disadvantage that is suffered by the tire producer who
makes private brands, because he is put in the position
of competing with himself when his own and the private
brands he manufactures are sold in the same market. Since
the profit on his own brands exceeds that on private brands,
and since the private brand distributor can always transfer
his patronage to another manufacturer, the growth of private
brand sales means that the tire company tends not only to

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This sort of advantage of course accrued primarily to
the dealers that sold the products of the Big 4. The
smaller tire companies, e.g. Gates, Norwalk and Arm-
strong, often concentrate their advertising on their
local markets.
lose revenue, but also to lose his control of the market. To the separate companies, however, this ultimate disadvantage has seemed to be offset by the immediate increases in sales volume which they have gained by private brand manufacture, especially since each company has felt that if it did not supply these tires some of its competitors would. In addition, tire manufacturers fear that if they jointly refuse to produce private brands, the large distributors will become manufacturers. Consequently, virtually all of the leading tire companies have vied for private brand contracts.

The precise terms of these contracts are seldom made public, but certain facts are known about them in the past. The two mail order houses have been supplied under cost-plus contracts, but most of the other private brand

For a summary of the provisions of the Goodyear-Sears Roebuck contracts, see Albert Abrahamson, op. cit., pp.109-110. Copies of the contracts can be found in Federal Trade Commission Docket No. 2116, op. cit., pp.12-35. According to Federal Trade Commission accountants the net effect of these contracts was to make the average net sales price to Sears Roebuck between 1926 and 1933 on eight sizes of tires between 29% and 40% below the average net sales price to independent dealers. During this period Goodyear supplied nineteen million tires to Sears Roebuck. Goodyear vs. Federal Trade Commission, Brief for Respondent, No. 7362, op. cit., pp.1a-4a.
accounts were sold tires at stipulated unit prices, with the terms varying according to the relative bargaining power of the business units concerned. The small chains distributing manufacturers' brands were given the same sort of terms that were accorded to large jobbers, and the oil companies were generally granted special treatment in the form of discounts from the "best dealer price." Since the passage of the Robinson-Patman Act

An analysis of price differentials to various types of tire distributors was made by the NRA Division of Review in 1934. Of eighty-three private brand accounts, forty-three were classified as jobbers, twenty as mail order and chain stores, five as distributors (essentially jobbers), and four as dealers. Ten were unclassified. An arithmetic average of the prices paid by these distributors was 54% below the consumers listed price. This was about the same as the average price to jobbers, but the lowest private brand price was considerably lower than the lowest jobber price. W.H. Cross, G.S. Earleman and J.H. Lenzaerts, op. cit., p.147.

The terms to large dealers and jobbers on twenty-seven manufacturers' brands in 1934 showed the following range:

<table>
<thead>
<tr>
<th>Number of Brands</th>
<th>Total Discount from Consumer List</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>35-40%</td>
</tr>
<tr>
<td>7</td>
<td>40-45%</td>
</tr>
<tr>
<td>6</td>
<td>45-50%</td>
</tr>
<tr>
<td>2</td>
<td>50-55%</td>
</tr>
<tr>
<td>1</td>
<td>55-60%</td>
</tr>
<tr>
<td>1</td>
<td>over 60%</td>
</tr>
</tbody>
</table>

Ibid., p.147.

Oil companies distributing manufacturers' brands are reported to pay the "best dealer price" less 10%. Cf. W.W. Leigh, op. cit., p.168. In addition, the oil companies are frequently spared most of the expense (cont. on next page)
and the Federal Trade Commission's "cease and desist" order in the Goodyear-Sears Roebuck case, both in 1936, the tire manufacturers' bargaining position has been strengthened against the large buyers, and the differentials among various types of tire distributors have been narrowed.

One major tire company has pursued an opposite course to that of the other members of the industry with respect to the large retailing organizations. Firestone, almost single-handed, has waged a vigorous battle against the mail order houses and chains ever since their entrance into the market, and has consistently refused to make private brands. The struggle between this company and Sears Roebuck, against which it particularly directed its attack, contributed significantly to the intensity of competition in the tire industry after 1927, for as each attempt by Sears to expand its market brought a retaliatory adjustment

(continued from preceding page) of storage. Since rubber tends to deteriorate when kept in close proximity to oil, many of the oil company stocks are warehoused by the tire manufacturers' branches or, in some instances, their retail stores. (This is not shown on Chart E).

Cf. supra, p. 289.

It has been reported that Harvey S. Firestone once tried to arrange a contract to supply tires to Montgomery Ward and that when the negotiations failed he became a bitter enemy of the large retailing organizations. Hugh Allen, op. cit., p. 336, Fortune, November, 1936, op. cit., p. 105.
by Firestone, the other tire producers and tire distributors were obliged to meet this competition or suffer reductions in their share of the market. In the process, the tire buyer benefited, the weaker tire companies disappeared from the industry, and the smaller tire distributors, if they survived, lost a large part of their market.

The details of this struggle, and the aggravation of its effects by such further factors as depression, product improvement, and declining demand have been discussed too fully elsewhere to be repeated here, but it should be noted that the tactics employed by the Firestone company included numerous forms of price, quasi-price, non-price,

and extra-market competition as well as structural adjustments with respect both to manufacturing and selling activities. The most notable of these competitive practices were the following: successive reductions in the listed price, the granting of extra discounts to independent dealers to enable them to meet the mail order house prices, the production of third, fourth and fifth line tires, vigorous advertising campaigns, including direct comparisons of Firestone and specified private brands, attempts to arouse consumer antipathy to mail order and chain store products, efforts to enlist dealer support, including a circularization of Goodyear dealers informing them that Goodyear was manufacturing the product which was invading their market, and the establishment of retail stores and service stations to compete directly in the retail market, particularly to give more service than the mail order stores. At times Firestone gained the support of some of the smaller tire companies and groups of independent dealers, but, in general, the former tended to be alienated because Firestone's activities were depressing prices, and the latter because of Firestone's establishment of retail stores. After the disastrous price wars which lasted until 1935, and particularly since the death of Harvey S. Firestone in February, 1938, the violence of this conflict has considerably diminished. Although active competition is still to be found in non-price adjustments, and at the retail level,
the drastic changes in consumer lists, in discounts, and the juggling of price and quality differentials among various lines of tires, which characterized the earlier struggle, are no longer in evidence.

26. Manufacturers' Retail Stores

The third major type of retail tire outlet, which is considerably more important than its share of the market would indicate, is the manufacturers' owned or controlled retail store. The establishment of these outlets, which range in character all the way from the elaborate "One-Stop Master Service Stations" controlled by Firestone to the small one-man stores of Dunlop, represents a significant structural adjustment made by the tire companies to meet the changing conditions of the tire market. The manufacturers' retail store is a device by which the tire company independently attempts to insure its place in the retail market, to police its independent dealers, and to meet the competition of the large distributing organizations.

Strangely enough, the company which pioneered in this development has repudiated its earlier policy, while the later entrants into the field have shown no signs of making such a change in their market tactics. Aside from maintaining retail sales rooms at their branch
offices, none of the tire companies were significant participants in the retail market after the rise of the independent dealer. In the early 1920's, however, U.S. Rubber entered the field when it took over the "Smith Tire Service" in the Southwest. Subsequently, U.S. Rubber added other stores under the name of the Royal and the Mercantile Tire Companies until it was operating about thirty-five such stores. Since 1930, however, U.S. Rubber has been withdrawing from this activity, until now it is the only member of the Big 4 which has not a large immediate interest in tire retailing.

The greatest impetus was given to manufacturer-retailing by Firestone when, in 1928, that company established over one hundred retail stores as a direct challenge to the mail-order house chains which were then beginning to encroach seriously upon its share of the replacement market. Within the next three years Firestone increased the number of its retail stores by 300 and other tire companies added about 600 to the total. By 1934 approximately 1600 such stores were in existence. In 1938 2,199 retail

\[325\] Cf. supra, pp. 259-260
\[327\] Ibid., p.142.
stores were reported as owned by tire companies, of which 631 were Firestone's, 850 were Goodyear's, and 450 were Goodrich stores. The remainder were operated by U.S. Rubber, General, Lee, and Dunlop, with the Dunlop stores being very small outlets, giving limited service and having an inconsiderable sales volume.

The details of ownership and management of the stores controlled by the various tire companies do not follow a single pattern. In addition, the manufacturer's connection with his stores has often been disclaimed, even while in other cases it is strongly emphasized. The Firestone policy in establishing retail outlets was to buy 51% control of strategically located independent stores, with the dealer holding 49% and continuing as manager so long as he acquiesced to Firestone policies. These stores were given the Firestone name. Goodyear originally followed the practice of buying dealerships outright, staffing the stores with Goodyear employees, but continuing the stores

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328 Rubber Section, Special Circular No. 3691, op. cit., p.3.
332 In 1936 Dunlop was reported to be operating over 400 small retail stores. Fortune, November, 1936, op. cit., p.142.
333 Fortune, September, 1930, op. cit., p.102.
under their former names. Since about 1931 these stores have operated under the Goodyear name. Goodrich, Lee and Dunlop have usually opened their own stores, with the Goodrich "Silvertown stores" carrying a wide line of automobile accessories, while Lee and Dunlop stores tend to concentrate on tires and rubber products. General entered the retail market in another way. As the principal creditor, it took over the stores of dealers who were delinquent in their accounts. Up to the present the General name has not been attached to these stores.

As developed by Firestone, these retail outlets were designed primarily to combat private brand competition, but since their establishment by other tire companies, manufacturers' stores have played a number of other roles in the tire market. At present they both cooperate and conflict with the other business units in the retail market. The tire manufacturers have used them as wholesaling and distributing points as well as sales and sales promotion agencies. In many cases the retail stores have assumed the functions of manufacturers' branches, and hold stocks to supply independent dealers and sub-dealers, or even to

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334 C.E. Fraser and G.F. Doriot, op. cit., p.97
335 Fortune, November, 1936, op. cit., p.142. After 1932 a number of the other tire companies gained control of retail stores in this fashion.
supply oil company outlets and the retail outlets of chains in their area. They handle much of the local advertising of the manufacturers' brands which was formerly conducted by independent dealers who were given advertising allowances. They are extremely active in handling commercial accounts. They often provide supervision of the sales policies of the independent dealers, and advise them as to their merchandising methods. And they have frequently been used as laboratories to experiment with new techniques of competition.

In spite of these other activities, however, the original purpose of these stores has remained unchanged. Basically, they have been the instruments with which the tire companies have attempted to offset the competitive pressure of large retailers. Wherever independent dealers have proved to be too weak to withstand the invasion of their market, the tire companies have created their own outlets to protect their market. And although there is good reason to believe that the operations of these stores have been unprofitable, their activities have been maintained and extended until they now share the lead with the large distributors in dominating the competitive policies of the retail market.

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The profitability or unprofitability of a manufacturer's store is so often determined by the (cont. on next page)
27. Market Competition at the Retail Level

The principal competitive tactics adopted by the tire companies directly or through their controlled outlets include a number of significant forms of market competition at the retail level. Certain of these tactics in this respect have been discussed in earlier pages, e.g. product differentiation, and readjustments of the relations of quality and price, but a few other measures of competitive policy warrant our brief attention, before concluding this study.

Until recent years the most spectacular form of competition was in price. Prior to 1927 when the large retailers entered the market, 'power over prices resided principally in the hands of the Big Three, --Goodyear, Goodrich and Firestone, --since U.S. Rubber remained in a rather passive role. One of the large companies made an announcement and other companies followed the lead, and each took its accustomed place in the price scheme. The price change was not always welcomed and frequently was bitterly challenged by one of the larger companies. The small manufac-

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(continued from preceding page) manufacturer's procedure of cost allocation that this statement is not subject to proof or disproof. Goodyear, Goodrich, Dunlop and Firestone all have claimed that their retail stores are operated at a loss. Cf. Albert Abrahamson, op. cit., p.104, W.W. Leigh, op. cit., pp.169, 240.

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For an excellent summary of the price competition in the tire market from 1927-1935 see W.W. Leigh, op. cit., pp.254-270.
turer was in no position to protest due to his limited volume of sales. During this period, changes in the list price, which were generally downward, were likely to be made, if at all, at one of two times in the year: in the fall, just before the beginning of solicitation of dealers' orders, and in the spring after the expiration of price guarantees. The discount schedules to dealers tended to remain stable, and the retail prices bore a direct relationship to the published consumers' lists. With the active participation of large distributors in tire retailing, the mail order houses beginning in 1927 and 1928, and the oil companies after 1930, the control over retail prices changed hands and the entire price structure became unstable. With the initiative generally taken by Sears Roebuck or Firestone, but with the situation often aggravated by the actions of marginal dealers or of near-bankrupt tire manufacturers who could not withstand the competitive pressure, the list prices fell sharply, the discount structure fluctuated widely, the relationships of quality and price were the subjects of constant readjustment, and the retail prices bore little relationship to the consumer lists. Only after a series of unsuccessful efforts under NRA, or under Trade Association sponsorship was a truce reached in 1935. On

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Ibid., p.255.
November 1 of that year price hostilities among the tire companies, and between the tire companies and the large retailers ceased. A delegation of sales executives of the leading companies toured the country holding meetings of tire dealers and distributors urging "more orderly competition" and executives of the major companies made public statements decrying "unsound marketing practices."

The list prices were advanced about 20% and dealer discounts were narrowed. Meanwhile the existing differentials among lines of tires and among types of outlets were subjected to no further attacks. The leading manufacturers' brands were listed approximately as follows: (counting the first line tire price as 100), second line, 86, third line, 74, fourth line, 68. On the same basis the mail order house retail store prices were: deluxe tires, 94, first line, 86, second line, 68, the oil companies' first line, 90, second line, 70, and the small tire companies' complete lists were about 10% below the major companies or equivalent lines. Since that time, listed tire prices have been raised five successive times, up to March, 1939, for a net increase of

about 100% from the 1933-34 lows, and these differentials have not been substantially disturbed. Late in 1939 tire list prices were reduced for the first time in five years, following the lead taken by Goodyear.

This apparent unanimity of action has not been fully attained at the retail level. Local sales and price wars have continued, the mail order houses have offered periodic price reductions in their Spring and Winter Flyers, and the manufacturers, through their retail stores, and by granting special discounts to their dealers from time to time, have temporarily fostered this price competition.

The only time when it threatened to become general, however, was in June and July of 1939 when virtually all of the leading manufacturers supported their dealers in the so-called "bargain-counter" sales at that period.

Not only price competition but many other forms of market competition have decreased in intensity since 1935. Except for sporadic outbursts of violent competition in restricted areas, such quasi-price inducements as long-term guarantees, large trade-in allowances and free deals,

342 Tire prices April, 1936-October, 1939 courtesy of Mr. K.E. LaPointe, Buyer, Tire Department, Sears Roebuck and Company.
343 Ibid.
by which the various retail outlets vie for customers, have been significantly restricted.

The practice of giving long guarantees was carried to its greatest extreme by the mail order houses and small tire manufacturers, but eventually brought retaliation from independent dealers and manufacturers' stores. One of the first acts of the tire manufacturers under the NRA was to attempt to establish a "standard warranty" such as was then in force among most of the larger tire manufacturers. This provided for adjustments for defective tires, but offered no protection against road hazards. The prevailing practice among mail order houses or small tire manufacturers was to offer unconditional guarantees of their tires' length of life or their mileage. When this type of competition was most intense, mileage guarantees went as high as 40,000 miles and time guarantees to twenty-four months or over, but more recently the situation has become more stabilized. Sears Roebuck now offers an eighteen-month guarantee of its "All-State" tires. Small companies such as Armstrong, Dayton, Lee and Norwalk variously offer 18-24 month or 20-25,000 miles guarantees, and the larger companies, (which formerly made no such guarantees but instructed their dealers and retail stores to be liberal in their interpretation of allowances for defective tires), now offer time guarantees.

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Trade-in allowances were originally given primarily by independent dealers who also sold used tires or who collected rubber to sell as scrap to reclaimers. Later, manufacturers sponsored the practice in order to sell deluxe tires. The new private car owner would trade in his new stock tires for deluxe brands, and the dealers would then sell the trade-ins at a discount as "change-overs." This practice was often abused by dealers who sold new tires from the factory as "change-overs," and the NRA code attempted to check this type of competition. In 1933 the mail-order houses used what they termed "trade-ins" as a price-cutting device, by offering a substantial discount to any buyer who would bring in a piece cut from the side wall of an old tire. At present independent dealers and manufacturers' stores, especially those which rebuild tires, offer trade-ins to the tire buyer, but except for isolated instances, and special local bargain sales, the allowances have not been so excessive as to constitute a significant form of quasi-price competition.

A favorite device of all types of retailers has been the free deal, or combination sale. Since nearly all

retail tire outlets also handle other automobile accessories, it has been almost inevitable that in their independent efforts to stimulate sales they would offer tires in combination with allied products at reduced margins. At times these offers have been most attractive to the buyer. They have varied all the way from a gallon of oil or a tube repair kit free with each tire purchased to a "two-for-one" sale in which two tires were offered at the consumers' listed price for one. The most customary offer of this sort has been to provide a free tube with each tire purchased. This sort of practice has persisted among all retailers up to the present, but tends to be carried to lesser extremes than formerly.

While most forms of price and quasi-price competition in the retail tire market have been limited in recent years, there are a few types of market competition which give evidence of being extended. Their importance lies in the fact that each tends to increase the total costs of tire distribution. These include: installment sales of tires, tire advertising and the rendering of extra services to the tire buyer.

The extent to which these practices are used, and

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Ibid., pp.101-102.
their precise contribution to distribution costs is not subject to quantitative verification, but members of the industry testify to their great increase in recent years.

Installment sales have been promoted by the tire manufacturers, both through their retail sales, and by their financing of independent dealers. The customary terms for tires are one dollar down and three months to pay, but in some cases no down payment is required. Lately some of the chain store organizations have entered this field. Western Auto Supply, in particular, has been promoting installment purchases. Although advertising is less bitter now than in the days when Firestone was attacking the chains and causing complaints to the Federal Trade Commission and to Better Business bureaus, the tire manufacturers in national and local advertising, and the distributors in local advertising are bending every effort to capture the attention and the allegiance of the tire buyer, by price, quality, durability, style, safety, and convenience appeals. Finally, most of the tire distributors are stressing the extra services

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In this connection it is worth noting that Goodrich advertises its Hood and Miller tires as if they were products of independent companies. Dayton does the same with McLaren tires.
they perform for their customers. This is the one area where the mail order and automobile accessory chains tend to operate at a disadvantage, while the oil company outlets enjoy a relative advantage. Independent garage-men dealers used to be the only outlets that stressed this feature, but most of the other retail organizations now compete in this respect. Many of the manufacturers' owned retail outlets, e.g. Firestone's and Goodyear's, are garages or service stations that mount, repair and sometimes rebuild tires, that install automobile accessories, and that provide complete automotive service. Thus far, however, the mail order retail stores have done little more than to provide parking space and tire mounting facilities. It will be interesting to see whether the greater relative increase of oil company sales in recent years, at least part of which can be attributed to the service and convenience features of their retail outlets, continues, or whether the other outlets will devise some new tactics to regain their relative competitive positions in the retail market.
28. Analysis of Competition in the Tire Industry

The preceding pages have indicated the principal factors affecting the incomes of tire manufacturers and the competitive policies which they have adopted from time to time, in independent or joint efforts to maximize their incomes. In the presentation of these data, the approach suggested in Part Two has been employed only partially. An attempt has been made to identify the chief policy-forming units in the industry, and to point out the most important similarities and differences among them; but in the treatment of their competitive policies significant departures have been made from the pattern of analysis outlined earlier.

Strict adherence to that pattern would have required us to deal in turn with policies classified as manifestations of price, quasi-price, non-price, and extra-market competition, and structural adjustments, examining in each case the extent of conflict or cooperation existing among the units involved, and then attempting to arrive at some conclusions as to the net consequences of all the tactics employed. Instead, our attention has been focussed on changes in the environmental framework within which the tire companies operate. Stress has been laid upon the principal factors which have been beyond the manufacturers' power to control, and to which they were obliged to make compensating
adjustments. And attention has been directed to the major areas in which the tire companies have felt pressure upon their incomes, either through increasing costs or decreasing revenues, and to the types of competitive adjustments made by the heterogeneous units within these areas. Thus far, no attempt has been made to integrate the analysis of the separate problems and policies discussed, nor to reach conclusions regarding their net consequences to the members of the industry, or to the consumers of tires.

This divergence from the approach suggested earlier is attributable in part to the inadequacy of any rigid theoretical pattern to encompass the peculiarities of the industry being studied, especially the heterogeneity of the units involved and the impact of forces originating outside the industry. It is also due in part to the fact that clarity of exposition demanded that many interrelated problems and policies be treated separately in order to show their changes through time.

Certain of these difficulties can perhaps be eliminated by a cross-section analysis of competitive policies at given points of time; others suggest problems for which the pluralistic approach as defined here is incomplete, invalid, or unnecessary. Accordingly, the final sections of the dissertation will attempt to remedy the first defect, and acknowledge the second. The following pages offer a summary analysis of competition at each of three periods
when problems and policies had important differences. Then, in conclusion, a brief section will evaluate the approach which has been suggested and tested in this paper.

Although many of the changes in the factors affecting the competitive policies of tire producers have been evolutionary in character, and many important measures of policy have been adopted to meet these changes over time, (or can be explained only by reference to anticipations of further changes so that analysis tends to lose reality by being abstracted from time), the most essential features of the competition in the tire industry can be indicated by reference to the situation existing at each of several points of time.

Since the early 1920's competition among tire manufacturers may roughly be said to have passed through three phases: The first, which reached its peak in about 1927, was a period of rapid growth when the tire companies cooperated only a little, but when those which survived the conflict enjoyed profitable operations. The second phase, at its climax in the years 1933 and 1934, was a period of chaotic conflict, marked by many disturbing elements beyond the power of the tire companies to control, in which sporadic attempts at cooperation broke down, and almost all units received little or no net revenues. The third phase, which has lasted since 1933, can be characterized as a period of more mature
competition, in which the conflicts among the separate units are considerably tempered by cooperation, and in which most units are operating at a profit. The nature of the competition typical of each of these periods will be detailed in the following pages.

29. The Nature of Competition in 1927

Any attempt, such as the following, to analyse the competition in an actual rather than a hypothetical industry encounters serious obstacles. The data refuse to behave in strict accordance with a logical pattern, and efforts to account for their perversity or to readjust theoretical concepts to comprehend their variations inevitably tend to obscure the essential framework of one's reasoning. In trying to bridge the gap between price theory and market reality one is likely to err in one of two directions. One either makes gross oversimplifications by restricting analysis to too few variables, to the exclusion of other important complications found in the actual market, or else indulges in tangential discussions of each complication, losing the central train of thought in a welter of detail.

The ensuing analysis of competition in the tire industry seeks to compromise this difficulty by starting with oversimplifications in order to analyse the most significant variables first, then successively introducing
other complications and indicating their relevance to the simplified analysis. Accordingly, we shall commence with a crude analysis of the competition that might be expected to result from the total cost situation and the nature of total demand for the product of the industry. Thereafter, in turn, other complications will be introduced: disturbing cost factors, variations in the product according to size and line, product differentiation, functional separation of markets, and heterogeneity among the sellers. Then will follow an analysis of competition by markets, and by tactics, together with an assessment of the net consequences of all forms of competition to the various types of sellers.

1927 can be described either as the last year in which the large tire manufacturers enjoyed practical dominance of the industry, or as the first year in which major disturbing elements arose, which were to contribute significantly to the later unsettled competition among all units involved in the manufacture and/or sale of tires.

At the beginning of that year the situation facing the tire companies can be characterized essentially as follows: (For purposes of analysis, the ensuing data, drawn from the descriptive material in the preceding sections, may be taken as the principal given factors in their competitive environment.)

Production costs had been falling, and promised to continue their decline, but with the possible exception
of fluctuating crude rubber costs and rising fabrics costs, this decline was relatively steady and evenly distributed over the principal elements of cost. Such cost changes as there were, therefore, constituted on the whole a favorable rather than a disturbing element in the competitive environment of the tire manufacturers.

The decline in production costs per unit, which was taking place at this time, was mainly attributable to the cumulative effect of the technological changes outlined in earlier pages: the development of mechanical plasticators, the adoption of the drum method of tire building, the installation of chutes and conveyor systems, the manufacture of molded tubes, and the speeding up of the vulcanization process, both mechanically by the introduction of watch-case vulcanizers, and chemically by the improvement of organic accelerators. In addition, time and motion studies, with readjustments in the piece-rate under the Bedeaux system, tended to bring about a steady reduction in the wage costs per unit of product. Finally, while the cost data reported to the Census suggested that fabrics costs were increasing at this time, this was much more than offset by the sharp decline in crude rubber costs that marked the breakdown of the Stevenson Act. It is important to notice, however, that in 1927, our point of reference, crude rubber prices fluctuated much less widely than in the preceding or immediately succeeding years.
This is undoubtedly attributable to the operations of the Crude Rubber Agency,—the rubber purchasing pool in which the large tire companies and automobile manufacturers cooperated during that year. With the exception of crude rubber costs, it is reported that costs of tire production varied only slightly among the leading members of the industry. The small tire manufacturers followed the practice of hedging their rubber purchases through the Crude Rubber Exchange which had been organized in 1926, and carried small inventories. Thus they avoided the risks of price fluctuations, and suffered negligible inventory losses during the period of falling rubber prices. The large tire manufacturers, however, were unable successfully to shift the risks of fluctuating rubber prices, although their short-lived buying pool reduced the fluctuations for a little more than a year. Since the scale of their operations required them to hold at least four months' supply of crude rubber, they incurred substantial inventory losses all during the period (1926-1932) of falling rubber prices. These losses were mitigated only slightly by the operations of rubber plantations owned by three of the large companies.

Two other cost factors represent significant adjustments which were being made throughout the industry during this period. The first of these factors derived from a major alteration in the physical construction of the product, while the second is connected with significant
changes in the total volume of tire production.

The last revolutionary innovation in tire construction, from high pressure cord to balloon tires, was introduced in 1923, but not until about 1930 was the full effect of this change reflected in tire production. 1927, therefore, was a year during which this transition was being made. In that year 53.9% of the tires produced were balloons, while 44.6% were cord tires. Since the shift from the one type to the other necessitated certain alterations in productive techniques, in materials, and in fixed equipment, particularly tire molds, it must be recognized that the production costs of the companies making this transition cannot be counted as stable.

This readjustment was not the disturbing element it might have been, however, if the total demand for tires had remained unchanged, and if consumers had shifted their tire purchases quickly from cord to balloon tires. Because of the durability of automobiles, a substantial replacement demand remained for the older type of tires long after balloon tires had been adopted as standard equipment on new automobiles. Consequently, the machinery for building cord tires became obsolete slowly, and, in most instances, it was necessary merely to replace it with the machinery used in constructing balloon tires. Further, since the total demand for tires was increasing substantially during most of this period, new investment was directed towards the expansion
of facilities to manufacture the new type product.

This new investment, however, did constitute a change which was ultimately disturbing to the industry. The rapid expansion in automobile production and use during the 1920's brought with it a sharply increasing total demand for tires. This led the tire companies not only to substantial expansion of their productive capacities, but also to overly-optimistic anticipations with respect to the future demand for tires. From 1922 to 1928 the excessiveness of this optimism was not discerned, because during that period, while the total productive capacity of the industry was almost doubled, nevertheless, with the single exception of the recession year 1923, this capacity was over 85% utilized each year. In 1927, the year under study, plant facilities were being extended rapidly throughout the industry, but it has been estimated that 85.3% of the industry's practical capacity was being utilized, so that the readjustments attendant upon plant expansion cannot have been seriously disturbing at this time.

On the demand side, the situation facing the tire industry was also largely favorable to tire sellers. The total demand for tires, as has been noted, had been increasing substantially for a number of years, and no reversal of the trend was then in sight. The demand for original equipment tires, which for the industry as a whole was almost perfectly inelastic, suffered a cyclical decline in 1927.
and consequently reacted unfavorably on the large companies that supplied this market. However, the continuing increase in replacement demand, which was only slightly less inelastic, more than made up for this temporary decline. Product improvement, which was later to have such a depressing effect on renewal demand, was gradual at this time. As measured by the number of tires required annually per car registered in the previous year, tire durability increased very little between 1923 and 1928. The length of life of a tire increased only from 1.51 to 1.55 years during this period although it was somewhat greater in a few of the intermediate years.

Given, then, declining costs and increasing demand for the product of the industry as a whole, and with these changes occurring steadily enough to cause no sudden disturbances of market policies in the industry, conditions were favorable for a sharp expansion of tire production by the individual members of the industry. But since the tire companies adopted a rate of plant expansion which was slightly more rapid than the increase of demand, production by firms in the industry was carried on in the declining sector of the short-run average total unit cost curve. This fact, combined with the steady downward shift in the short-run cost curves (due to technological improvement and declining factor prices) more than offset the effect on price of the concurrent increase in total demand, and helps to explain
the progressive decline in tire prices which occurred during this period.

Before analysis is directed to the policies of firms in the industry, however, certain other complications of the competitive environment must be introduced. For although, as we shall see, the conventional framework of geometric price analysis is reasonably adequate to explain the essential features of the competitive situation in the tire industry in 1927, certain assumptions upon which this type of analysis often rests were not realized in the tire market at this time. Qualifications must be made to allow for the fact that we are not dealing with a single product, nor a single market, nor with homogeneous buyers and sellers.

Considerable variations existed among the tires produced during this period, some of which were important differences in the physical characteristics of the product, and some of which were none the less important in the market even though they largely existed in the minds of the buyers. Certain of these variations in the product complicate the conventional analysis with respect to the 1927 situation, but do not vitiate it because they were not actively used as competitive weapons at this time. Differences in tire size merely divided the total market into a number of smaller markets, substitutability not being technically feasible, so these smaller markets did not overlap. Differences in price also have divided the market; but since
no manufacturer produced more than two lines, which were sharply differentiated according to price and quality, and the relative differentials between which were consistently maintained, the first and second line tires sold in 1927 were virtually non-competing products designed to appeal to different classes of buyers.

Product differentiation among the various tire sellers presented another problem, for it constituted a competitive weapon widely employed within the industry. As such it will be discussed subsequently as a major form of quasi-price competition, but it should be mentioned here as an obstacle to simplified analysis. It will be seen that advertising and other promotional activities undertaken by the larger companies gained a special prestige for their products which was out of proportion to their extra selling costs. This not only increased their sales volumes relative-ly more than that of other companies, but also permitted them to maintain a price differential above the prices for physically similar products of smaller companies. Since this differential did not change appreciably during 1927, it can be taken as a complication of the price structure, but not as an unsettling market variable at this time.

In addition to the separation of markets in the sizes and price lines of tires, notice must be taken of a functional separation of markets which brought the tire producers into conflict with different sorts of buyers. In
1927 the export, original equipment, and the various divisions of the replacement market can be counted as almost entirely separate. Export sales, always a small proportion of total sales, (4.4% in 1927), were predominantly in the hands of the larger companies. During and after 1927 many of these sales which had formerly been handled by exporting subsidiaries of the tire corporations were transferred to the foreign plants which were being expanded at this time. This transfer took export sales even more out of the domestic scene, on which they never have had an appreciable influence.

Original equipment sales, which for years had averaged from one quarter to one third of total sales volume, but which were little more than one fifth in 1927, were also handled by the large tire companies. These sales were negotiated by separate contracts with the oligopsonistic automobile manufacturers under terms far removed from those in the renewal markets. Since, however, spare tires were not sold to automobile manufacturers as early as 1927, the original equipment and replacement markets did not overlap.

A small proportion of replacement sales was made to large buyers under separate contracts; government and national accounts, and in a small way until after 1927, to large retailing organizations, but the largest proportion of these sales (estimated at 88.5% in 1927)
was made through small independent wholesalers and retailers. The only significant exception to this occurred with respect to commercial accounts, which were variously handled by the manufacturers' branches and by the independent dealers.

The final complication to the competitive situation existing in 1927 arises from the heterogeneity of the sellers. Differences in the organization, size and market strength, and degree of interest in the tire market such as have been detailed in earlier pages, must be introduced as significant qualifications to any sort of analysis predicated on the assumption of homogeneous firms. These factors must be considered not only because heterogeneity breeds conflict and impedes cooperation, but also because it weighs the effectiveness of the various competitive policies employed by units within the industry. In this connection we must remember that the active producers of tires in 1927 consisted of a little more than one hundred companies among which sharp differences existed. Four of these companies were predominant: Goodyear, Firestone, U.S. Rubber, and Goodrich, which shared among them over 50% of the sales of the industry. A handful of others, Fisk, Kelly-Springfield, Miller, Seiberling, Mansfield, General, and Ajax, were of secondary importance, as measured by productive capacity or sales volume, while the remaining ninety-odd companies were all small units existing on the fringes of the industry. The secondary companies and Firestone concentrated their production almost exclusively on tires, but
Goodyear, Goodrich, and particularly U.S. Rubber were much more diversified, with about half or more of their revenues derived from the sale of products other than tires. The large companies were vertically integrated to a large degree and generally possessed much greater financial strength and market prestige than the smaller companies. As a consequence, their policies tended to dominate the competition within the entire industry.

Given this competitive situation, we find that it is possible to employ some of the tools of imperfect competition theory, particularly those of differentiated oligopoly, as a first approximation. If we assume competition to be manifested solely in terms of adjustments in price and the volume of output, we might expect that if the firms in the industry were in conflict, there would be a tendency towards the establishment of a profitless price structure for the product, (hereafter called a "competitive level" of prices), over time, as costs declined, tire prices in the various markets would fall. And since, though production costs for all companies were approximately the same, the larger companies enjoyed sufficiently greater prestige for their products to

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It is recognized that the term "competitive level" has other connotations, but, to simplify the exposition, in the following pages it will be used exclusively to refer to the situation where total costs equal total revenues.
command price differentials in excess of their extra selling costs, the smaller companies would be at a relative disadvantage. If conflict should be so severe that the total costs of the large companies were equal to their total revenues from all markets, the small companies would tend to be forced out of the industry. Since demand was increasing over time, however, unless the downward price adjustments were immediate, a margin would remain, allowing short run profits for the larger companies, and permitting some of the smaller companies also to remain in business.

Changing the fundamental assumption, if the firms in the industry recognized their mutual dependence, and tacitly or actively allied instead of conflicted, there would be a tendency towards the establishment of a structure of differentiated prices, in which for each firm the difference between its total revenue and its total costs is at its maximum, (hereafter called a "monopolistic level" of prices). These prices might fall over time as costs declined, but the total revenues of firms in the industry would exceed their total costs. Because of their favorable price differentials, the profit per unit of output would be greater for the large than for the small companies. These profits would be enhanced over time by the increase in demand if plant expansion did not increase costs more than proportionately. Or they could be minimized by less than
complete alliance to the point where the small companies broke even or suffered losses that would drive them from the market.

While the actualities bear out conclusions such as those reached above, inasmuch as output increased, prices declined, profits were made by the large companies, and the small companies fared less well and tended to disappear from the industry, the facts were much more complicated. Many adjustments other than those of price and output were made by firms in the industry, and the truth lies somewhere between the assumptions of conflict and of alliance. To obtain a more comprehensive picture of the situation, we need empirical evidence of the variety of policies employed in the industry, and of the areas and extents of conflict and of alliance. Our conclusions then should find prices (or their equivalent in quasi-price terms) to lie in a position intermediate between the extremes that would create monopoly profits, on the one hand, or spell profitless operations, on the other.

Analysis of price competition in the tire industry requires that distinctions be drawn among certain of the separate tire markets, inasmuch as different sets of circumstances govern price determination in each of the various markets. Given the situation existing in 1927, the essential distinction is that between the markets consisting of oligopsonists, and the markets made up of atomistic buyers.
Of the former, the most important was the original equipment market, in which the Big 4, and Ajax, which was of declining importance in 1927, were the only sellers. The buyers were the powerful automobile manufacturers who purchased large quantities of tires at a time through negotiated contracts. The prices and terms on which these tires were sold were determined in the first instance by individual bargaining between the firms concerned, but the forces that established the limits within which the bargains were made can be subjected to analysis.

There is no question but that the tire companies recognized their mutual dependence in this market, and saw the advantages that would accrue from alliance. However, mutual distrust, the inability of heterogeneous units to agree on terms and the ever present temptation for single units to seize a temporary relative advantage by undercutting the alliance rendered cooperation among sellers in this market ineffective. Active alliance was attempted in 1926 by the organization of the Rubber Institute, which proposed to stabilize original equipment tire prices by the establishment of a system of open price filing, but it required only a single major violation of the agreement to plunge the tire companies into bitter conflict again. This conflict was fostered by the large buyers who customarily used their superior bargaining position to play off one tire seller against another.
Given conflict among the tire companies, the conventional analysis would treat the competition in this market as a problem of attempted price discrimination by sellers, with the additional complication of bilateral oligopoly. According to this reasoning, the price of original equipment tires, (and of tires in each other separate market), would be determined by the intersection of the curve of marginal revenue, (or the single point at which the monopsonist made his bid), derived from this particular market with the marginal cost curve of total output. And because of the conflict among sellers, prompted by oligopsonistic buyers, the average of total costs would at the extreme tend to equal the average revenue from all markets.

Because of inadequate knowledge, irrational action, and variations in bargaining strength, there is reason to believe that the sales price of original equipment tires fluctuated above and below the theoretical equilibrium price. But these fluctuations were held within certain upper and lower limits by other conditioning factors. In the bargaining on any single contract for original equipment sales, the upper limit would be the price at which it would be cheaper for the automobile manufacturer to produce his own tires, or to subsidize plant expansion by one of the smaller companies. This limit has evidently been approached only twice, when Ford started tire production
and when other automobile manufacturers formed the Ajax company. Subsequent developments lead one to believe that in the case of Ford, at least, the limit was not reached, but that this company started small-scale tire production as a matter of bargaining strategy. At any rate, the possibility of further action of this sort offers an ultimate threat which is of grave concern to tire manufacturers, and which would place a ceiling over original equipment tire prices even under conditions of alliance.

The lower limit of the bargain, as indicated above, would theoretically be governed by the short run considerations which conventionally define the maximization of profit or the minimization of loss,—the equation of marginal revenue from each market with marginal costs for total output, as long as marginal cost exceeds variable cost. At best, of course, the tire companies can only approximate the relevant data. When the contracts call for all tires to be delivered at the same price, marginal revenue is constant, and known. When the contract stipulates successively lower prices for larger quantities, marginal revenue on these sales is theoretically calculable even though it is not a constant. Since the total quantity that will be taken at the contract price or prices is not known at the time the contract is negotiated, but is a variable dependent on the later production and sale of new automobiles, however, the tire companies would encounter difficulties in adjusting
their output to the equilibrium position even if their marginal costs were precisely calculable. But several practical considerations within the tire industry render the concept of a single marginal cost curve of tire production unattainable with any degree of accuracy. Important elements of cost are uncontrollable variables which may fluctuate violently even during the short period that an order is being filled. Diversification of production has been carried to such a degree by tire companies that it is virtually impossible to obtain a meaningful allocation of production costs for a single product. And both production and distribution costs vary for the products sold in different markets, so that even if an aggregate marginal cost curve were employed as a tool in price determination, the tire manufacturer would have to make many arbitrary adjustments in the revenue curves of the separate markets before he could find his equilibrium position. As a consequence, the actual determination of the lower limits of the price bargain in the original equipment market tends to follow a procedure which is more "rule of thumb" than founded on the niceties of the theory of price discrimination, even though the results might be approximately the same. In effect, the tire companies, after making the most careful estimates possible of the quantities that will be taken by each of their large customers, and adopting some arbitrary procedure of cost allocation, (and knowing that their
average total costs would decrease as their total output increased), have adopted the practice of treating their original equipment sales as means of "spreading overhead."

As lower limits to price, therefore, the conflicting tire manufacturers may be willing to accept prices on their original equipment sales down to the point where variable costs on this production are barely covered, in hopes of recouping from their sales to other markets. This is just another way of saying that they will equate marginal revenue in the original equipment market with marginal cost on total production. But reasoning, as they do, with respect to the "spreading of overhead," they are sometimes led to a non-profit-maximizing decision, which establishes an even lower limit to the price bargain. The ultimate price floor in the short run among the small number of conflicting manufacturers selling in the original equipment market can be set by a single tire company which refuses to acknowledge the mutual dependence of sellers in the same market. Such a company might accept an original equipment order on terms that represented a net loss as long as the loss were less than the gain which would accrue to one of his competitors if the latter should obtain the order instead, and contribute to his fixed costs by the increased production.

In 1927, the evidence suggests that original equipment prices were approaching the first of these lower
limits, after the attempt at active alliance represented by
the formation of the Rubber Institute broke down, but that
conflict was not sufficiently intense for these sales to be
absolutely profitless. One possible explanation may be
found in the fact that the automobile manufacturers did not
choose to exert their oligopolistic power to its utmost,
since tires constituted only a small part of the total
cost of an automobile, and, as such, could be passed on
without much difficulty to the automobile buyer. It is
known that tire companies and automobile manufacturers some-
times made arrangements which had the effect of alliances
against the automobile buyer. These arrangements took the
form of negotiations by which the original equipment sales
were made under cost-plus contracts, as in the Pisk-Chrysler
contract in 1928. Here the bargaining between the separate
oligopolists and oligopsonists centered on the procedure of
cost allocation, and the large buyers sometimes protected
their position by reserving the right to supply materials of
tire manufacture. At other times, the buyers and sellers in
the original equipment market allied to limit cost fluctua-
tions. The operations of the Crude Rubber Agency represented
such a joint effort by the large tire buyers and sellers to
stabilize an important element of tire cost.

There is no evidence that the competition in the
original equipment market has ever been manifested in terms
other than price adjustments among the large tire companies
supplying this market. The various alternative tactics of conflict which would be described as forms of quasi-price, non-price, and extra-market competition seems not to have been employed in such a way as to have had any significant effect on this market.

There are no appreciable differences in the physical characteristics of the first line tires of the four major companies, and product changes have been made virtually in unison. The forms of advertising and sales promotion, which represent the type of product differentiation that assumes importance in the replacement market among uninformed private car owners, tend to have little effect on the large scale buyer who bases his judgment on reports from the proving ground rather than on the prestige of a brand-name. Hence products sold to automobile manufacturers, in so far as they may have differed at all, differed because of the varying specifications dictated by the buyers, not because of active competitive adjustments made by the sellers. There is a possibility that accounts may have changed hands under circumstances which the trade would call "account-stealing," and which we might classify as forms of extra-market competition, and certainly the rapidity with which innovations were adopted by all companies suggests that trade secrets were not inviolate, (witness the introduction of balloon tires), but reliable information is not available on this point. The one area where competition
in forms other than price conflict may have played a significant role in the original equipment market is in the product differentiation between the large and small companies. It may be argued that the exclusion of the smaller tire companies from sales in the original equipment market is in part explained by the fact that their products enjoyed less prestige than those of the major producers. A more likely explanation is found in the fact that the smaller companies lacked both the financial resources and technical facilities to handle the large orders given by automobile manufacturers. It is important to point out, however, that the prestige already attached to the products of the large companies in the minds of replacement tire buyers was further enhanced by the fact that large manufacturers' brands were selected as stock equipment on new automobiles.

The foregoing analysis has suggested that the existence of conflict among the large tire companies in the oligopsonistic original equipment market precluded the establishment of prices at monopolistic levels. However, instead of an equilibrium price for each seller dictated by the equation of its marginal revenue in that market with its marginal cost, the separate price bargains, it was pointed out, actually might fluctuate within limits above and below the competitive level, but that in 1927 the tendency was for the price to remain above the lower limits. This analysis, together with the fact that conflict was primarily restricted
to price competition, also applies in the main to the other oligopsonistic markets existing in 1927.

The other large buyers of tires at this time were governmental agencies, the so-called "national accounts" of truck, bus, and taxi fleets, and a few large retailing organizations, which were just then beginning to assume importance in the tire market. Each of these groups represented a separate set of competitive problems to the tire sellers, inasmuch as they were non-competing markets which were supplied on different terms, and therefore proper subjects for price discrimination, but the basic adjustments in each instance closely paralleled those in the oligopsonistic market just discussed.

Sales to government accounts were made either on the basis of competitive bids, or through negotiations with purchasing agents. The terms to national accounts were separately negotiated agreements, sometimes for outright sales, and sometimes employing such quasi-price variations as tire rentals or mileage charges. Sales to the few large distributors then in the market were based on separate contracts, some of which were of the cost-plus variety. In spite of these variations, and in spite of the additional complication that a few of the smaller companies occasionally entered these markets, price determination was governed by bargains in each case which tended to vary between the monopolistic or competitive levels, according to the relative
bargaining strength of the units concerned, or the degree of tacit or active alliance among them. To assess these latter factors, we must deal with intangibles which are not subject to quantitative measurement.

The volume of each of these accounts was smaller than the volume represented by original equipment sales, and there were many more of the former. Hence we may presume that the relative bargaining strength of these large buyers was less than that of the automobile manufacturers, and that there would be less pressure from the buyers' side to force prices down to the competitive level. By the same token, the possibility that these buyers would become tire producers was less likely, so the upper limit to each bargain would be the monopolistic price, rather than the price at which the buyer would choose to produce his own tires. The lower limits, however, would be governed by circumstances similar to those of original equipment sales: the price at which average total cost is equal to average revenue, with the short-run possibility of a minimized loss as long as variable costs were covered, or of a net loss balancing the gain to a competitor of a transfer of sales volume.

The degree of alliance among sellers to keep prices in these markets from falling to unprofitable levels is not precisely known. The only evidence of formal organization among the sellers in 1927 which we may count as active alliance was the Rubber Institute, which unsuccessfully at-
tempted to maintain an open price-filing system; but there is a strong likelihood of the existence at this time of what we may term "tacit alliance." By this term is meant the situation in which the effect of alliance among sellers is attained, without formal organization among them, by their independent decisions to restrain their conflict. Under oligopolistic conditions, this is similar to what Chamberlin has called the "recognition of mutual dependence," and, in a single market, sellers that are "tacitly allied" would adjust their separate outputs with regard to their joint rather than their individual demands.

Even when atomistic units are numbered among the sellers, a form of tacit alliance can exist, because of inertia, or the competitive mores of the industry. Most frequently it is encountered in the form of price or other market leadership. As market customs develop in an industry, canalizing the areas and accepted forms of conflict, any change that restricts former methods of conflict or prohibits potential conflict has the effect of alliance whether it is sanctioned by formal organization among sellers or not. The separation of the various oligopsonistic markets,

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I.e. a firm is adjusting output to its individual demand curve when it contemplates its changes on the assumption of no retaliation by its competitors; adjustments are made to the "joint demand curve" under the assumption by each firm that any change which it makes will be met by similar changes on the part of its competitors.
and the disinclination of the tire companies to grant equally favorable terms to all classes of buyers in 1927 clearly represents such an example of tacit alliance.

In the absence of successful active alliance among the sellers of tires in 1927, and with the occasional entry of small as well as the large companies into these oligopsonistic tire markets, logic could drive one to the theoretical extreme of expecting prices in each market to tend toward profitless levels. To the contrary, however, the fact that buyers in these markets were not individually strong enough to achieve complete domination of the separate price bargains, coupled with the fact that the loss of any one of these contracts would not constitute a severe blow to a tire manufacturer at a time when the total demand was increasing, created a situation in which conflict was less intense than it might have been. As a consequence, while the sales in these markets were not maintained at monopolistic levels, because of the strength of the buyers and the lack of complete alliance among the sellers, the pressure on the sellers to conflict was not sufficient to force these transactions all the way down to competitive levels. Hence, in these oligopolistic markets as well as in the original equipment market, there is reason to believe that the simultaneous existence of partial conflict and partial alliance tended to create a price structure for tires which lay intermediate between the monopolistic and competitive levels.
Analysis of the other tire markets existing in 1927 encounters several problems that did not complicate the oligopolistic markets; notably, that conflict is not limited to price adjustments but is manifest in many other types of competitive tactics, and that often the tire companies are not the final sellers even though some of their competitive adjustments are made with the final sale in mind.

The ultimate buyer in those markets is either a private car owner or the owner of a small fleet of commercial vehicles. Each is buying replacement tires. In 1927 almost 90% of these tires were bought directly from independent dealers, who were supplied by the tire companies, directly or through wholesalers. A small proportion were bought directly from the factories, branches, or retail stores operated by the manufacturers, or from oligopolistic mail order houses and chains. The latter two groups did not offer a serious competitive problem in the replacement market until after 1927, so the present analysis will be restricted to competition involving the tire companies and the independent dealers.

If we assume competition to be manifested in adjustments of output and price alone, it is apparent that complete alliance among the manufacturers would establish monopolistic prices to dealers; and if the dealers were completely allied, the final prices to the consumer would also be monopolistic. If each group were in conflict,
each price would tend towards the competitive level. Similarly, if competition were in price alone and the markets did not overlap, alliance among manufacturers, and conflict among dealers would establish a monopolistic price to dealers, and they would tend to resell at profitless levels. Or if the manufacturers conflicted, and the dealers allied, the dealers who secured tires at competitive prices would resell them under monopolistic conditions. Finally, if the dealers allied as buyers, they could achieve monopsonistic bargaining power, even though they might conflict in their selling activities.

None of these hypothetical situations accurately describes the actualities of these markets in 1927. Partial alliance and partial conflict existed simultaneously in each group, and what is more, vertically among certain members of the two groups. And to the degree that the markets were inter-related or overlapping, conflict in one group tended to be contagious to the other. Unfortunately for the net incomes of the units involved, the evidence suggests that alliance was not similarly contagious, but rather that alliance among manufacturers tended to intensify the conflict among dealers, and vice versa.

To elucidate, it is necessary to recognize that competitive adjustments made by tire manufacturers and their dealers were not restricted to those in price and output alone, but included many alternatives. And the economic
consequences of these alternatives, e.g., the various forms of quasi-price, non-price, and extra-market competition, cannot properly be analysed separately in isolation from each other or from price and output adjustments. Instead, the simultaneous existence of a variety of alternative competitive adjustments must be recognised, and allowance made for the fact that, whether they represent tactics of conflict or of alliance, their separate consequences can be either mutually compensatory, or cumulative.

Conventional analysis has partially recognised this sort of problem in its acknowledgment that competition may be shifted. For instance, it conceives of one sort of compensatory consequence of competitive alternatives when it points out that a decline in price competition might be offset by an increase in non-price competition. It does not envisage the reverse possibility, however,—that sharp conflict in one area may have a sufficiently depressing effect on net incomes of the conflicting units, to induce them to ally to check the conflict in that or other areas. And it does not attempt to deal with the simultaneous variables of contagious conflict, by which rivalry becomes increasingly intense through the cumulative effect of retaliatory adjustments. That is, a given adjustment by a single firm may merely be met by identical adjustments by his competitors, or by a multitude of alternative adjustments, each of which all firms may ultimately be obliged to meet. Nor
does it take account of the fact that when alliance proves successful in one area as a means of enhancing the incomes of the cooperating units, it suggests by its example the mutual benefits which might be gained from alliance to restrict conflict in others.

When, as in the tire industry, the situation is further complicated by inter-type competition, with partial conflict and partial alliance among and between manufacturers and dealers, and with each unit offered a wide variety of alternative competitive adjustments, the problem of analysis transcends the two-dimensional geometric technique of price determination. While equilibrium for the firms or for the industry is still theoretically attainable, the actual competitive position of each firm at a given instant tends to be unstable, and the consequences of any one of its competitive adjustments is indeterminate. In the latter instance, it is necessary only to point out that a single competitive adjustment which might be presumed, ceteris paribus, to constitute an extension of conflict, and hence to represent a force creating a tendency towards the establishment of competitive levels in the market, is, more realistically, indeterminate in its effect because of the alternative possibilities of contagion, or reaction. Likewise, a single move toward alliance can be mitigated by shifting the area of competition, or can be magnified by contagion.
Certain generalizations can be made, however, on the basis of the empirical evidence introduced in preceding pages, regarding the tactics which were most prevalent in 1927, and their apparent net consequences to the firms employing them.

The ultimate price of replacement tires at this time was governed by the conditions of demand on the buyers' side, and by the competitive adjustments of both the initial and the final sellers. Price competition, accordingly, must be conceived of with reference to the principal inter-related levels of competition,—the prices at which the manufacturers supplied their dealers, and the prices at which the dealers resold to final consumers. Even though the scope of this analysis is being restricted to the problems of the tire manufacturers, the competition at the retail level cannot be completely overlooked, because of its impact upon the competitive positions of the manufacturers.

In 1927 no manufacturer could afford to press his advantage as a monopolist supplying atomistic buyers to the point where his dealers might be driven out of the market in competition with other dealers, because the greatest part of a tire producer's sales volume was obtained from the replacement market, and he needed a large number of retail outlets to maintain that volume. Although individual dealers often protected themselves as far as possible by handling several brands of tires, (so that in the aggre-
gate their bargaining position against the various tire manufacturers was stronger than it would be if they were atomistic buyers of non-substitutable products), the dealers' greatest protection at this time was the desire of each manufacturer to maintain and extend his outlets in order to meet the expanding demand for tires. Accordingly, instead of the tire manufacturers' prices to dealers tending towards the upper limits of monopolistic levels, as we might expect in the case of large-sellers of branded products, the power of the manufacturers to enjoy the extra fruits of price discrimination was so restricted by the substitutability of their products, and by their ultimate dependence on retail dealers, that prices to dealers more nearly tended toward competitive levels.

The exact prices at which manufacturers provided their dealers with tires in 1927 are obscured for purposes of analysis, both because consumer price lists, on which dealer discounts are now computed, were not in use throughout the industry between 1922 and 1929, and because the elaborate system of special discounts then prevalent,—quantity discounts, freight allowances, advertising allowances, etc.,—makes it impossible for the analyst to separate out the price from the quasi-price elements of the manufacturer-dealer transactions.

As far as possible the manufacturers individually attempted to suggest the final retail prices at which the
dealers should sell, either through suggested consumer prices or through suggested mark-ups. In either case, these prices were placed well above the competitive level to begin with, but tended to be forced down by the pressure of conflict among the units in the market. Conflict among retailers seeking to increase their relative shares of the market carried the prices to consumers below the suggested levels, and whenever this conflict became so bitter that retailers were in danger of being forced out of the market, manufacturers, to protect their outlets, tended to lower their prices to dealers. In 1927 competition of this sort was not nearly so bitter as it became later, inasmuch as the dealers were selling in an expanding market, and the manufacturers' costs were declining. In addition, there is some evidence of tacit alliance at this time in the sense that dealer margins, (except for commercial accounts, where conflict was violent), were relatively stable, prices of the major manufacturers were unchanged for eleven months of the year, (they declined about 5% in November, 1927), and no appreciable shifts were made among dealers from one manufacturer to another.

This apparent stability of price competition in the replacement market in 1927 is somewhat belied by the existence of other important areas and tactics of conflict and alliance which characterized this market at that time. Here we must introduce the complications presented by the
fact that, using means other than direct price adjustments, manufacturers competed for dealers, competed over the heads of dealers for retail sales, and were also affected by the competition among the dealers for retail sales. Analytically, most of these adjustments can be counted either as additions to cost or deductions from revenue when they represent conflict, or deductions from cost and additions to revenue when they represent alliance, from the point of view of a firm endeavoring to maximize its competitive position. But their consequences to the industry cannot be gauged without empirical reference to determine whether or not they were contagious.

It has already been noted that in 1927 the tire manufacturers relied on independent dealers as retail outlets for their products, and, if necessary, would grant concessions to dealers to maintain their dealer organizations. Active, or even tacit alliance among manufacturers might have kept these concessions to a minimum, but over a period of years independent efforts by tire companies to improve their relative shares of the renewal market by extending dealerships faster than their competitors, developed a number of practices which tended to increase the manufacturers' costs or to decrease their revenues without specifically altering price or the volume of output. Whereas these practices might promise a relative advantage to the particular firm which first employed them,
its relative advantage tended to be cancelled and a net disadvantage for all manufacturers tended to arise as fast as the other members of the industry adopted similar cost-increasing or revenue-diminishing practices. This, which is the conventional situation with respect to so-called "competitive advertising," can be held to refer to many other types of competitive adjustment. But instead of the extra costs necessarily being passed on to the consumer in the form of higher prices, we might find, in the short run, an extension of dealers' margins, price remaining the same, and a diminution of manufacturers' profits. And if conflict among dealers forced prices down, the benefits of these adjustments would be passed on to the final consumer.

The principal tactics of this sort, which have been described in some detail earlier, and which were common in the industry in 1927, included the following: discounts and allowances, consignment sales, extension of credit, assistance in sales promotion, and price guarantees. All but the last-named are familiar forms of quasi-price or non-price competition that can be incorporated into the conventional analysis of firms seeking equilibrium by slight readjustments in the scope of analysis. Discounts could be counted as simple reductions in average revenue unless they are offset by reductions in cost. A quantity discount, granted because it saved handling costs, or a functional discount granted to a warehousing dealer which relieved the manufacturer of
storage charges would relocate both the cost and the revenue curves. Consignment sales and credit extension would increase costs inasmuch as they enlarged interest charges and calculable loss from bad accounts, and manufacturers might be expected to extend these practices only as far as the point where the increase in cost was balanced by the cost decrease attributable to a larger volume of production and sales. Advertising allowances, and assistance in sales promotion, are forms of non-price competition which a firm in equilibrium would extend to the point where the anticipated increase in marginal revenue occasioned by the shift of the demand for the product was offset by the net increase in marginal costs. Guarantees against price decline cannot be fitted into a pattern of short run analysis, in the form of alterations of cost or revenue. Instead, they represent a transference of risk from the dealer to the manufacturer, and here, it is important to note, the manufacturers minimized that risk by active alliance with respect to the spring dating agreement. This was the only form of active alliance among manufacturers in existence in 1927 to restrict conflict in the replacement market.

In other tactics of conflict for dealers the tire companies acted independently. This conflict had been contagious prior to 1927 but in that year a relatively stable situation existed, so we may assume that tacit alliance existed among the leading companies, in the sense that no one
of them attempted to disturb the existing relationships. The only significant exception arose from the differences between the large and small companies at this time. While the larger companies customarily assumed leadership in competitive adjustments in the industry, which their smaller competitors could ill afford to challenge, nevertheless the small companies at this time were obliged to grant extra concessions to maintain their relative shares of dealers. Other things being equal, dealers would choose to handle the better known products of the large companies because of the reflected prestige of their products. Hence the small companies had to offer extra inducements to keep their dealers, or to extend their dealerships as fast proportionately as their larger competitors. Lacking the financial strength, geographical dispersion and facilities to service their dealers as cheaply as the large companies could do it, the small companies operated at a disadvantage in this respect, and tended either to suffer from higher distribution costs, or to lose some of their relative shares of the market.

In addition to the conflict among manufacturers to secure retail outlets, conflict also existed among them for the favor of the ultimate consumer. In some cases this conflict was carried on indirectly through the dealers, and represented a form of vertical alliance in the replacement market; but in other cases it was manifested by the direct actions of the manufacturers themselves. The use of suggested
prices and, later, consumer price lists, the granting of exclusive dealerships, the already mentioned use of advertising allowances, and manufacturer-dealer cooperation in sales promotion, represent forms of this indirect conflict, while product differentiation, national advertising, and the practice of offering product guarantees were the major forms of direct conflict in 1927.

Price suggestion, as far as it was followed, can be counted analytically as a form of alliance to restrict price competition at the retail level lest it become contagious to the manufacturers. Being a vertical arrangement between a single manufacturer and his dealers, and unsupported by agreement among manufacturers as to the relative prices of their various products, or by agreement among dealers selling the products of different manufacturers not to conflict in terms of price, this device was effective in limiting conflict only as long as tacit alliance prevented other manufacturers and/or their dealers from attacking the suggested price structure.

Another type of vertical alliance, which, being partial, would reduce conflict only if the unallied units forebore to attack it, was the granting of exclusive dealerships. In part, this device is a structural adjustment which, as such, cannot be analysed except over time. To the individual manufacturer, however, exclusive dealer arrangements tended to raise costs or to diminish revenues in
so far as they required extra supervision of, or extra con-
cessions to, dealers. This practice justified itself as long
as these factors were offset by the increased revenues or
decreased costs attributable to better market control, in-
creased sales, and lower costs of production. But whenever
other manufacturers adopted the same practice, to preserve
their relative shares of the market, the conflict tended to
place all tire companies at a disadvantage, as in the case
of competitive advertising. The use of advertising allow-
ances, (assuming they are bona fide, and not merely indirect
price concessions), and manufacturer-dealer cooperation in
sales promotion pose similar problems, being partial vertical
alliances which can stimulate conflict to the net disadvantage
of the manufacturers unless protected by tacit alliance a-
mong all of them.

The direct conflict among manufacturers for the
favor of final consumers was particularly manifest in the
practice of product differentiation. As already noted, the
physical characteristics of comparable sizes and lines
of tires varied hardly at all among the tire companies, so
we might expect a high degree of substitutability; but im-
portant differences among them were created in the minds
of private car owners by extensive advertising. This non-
price competition was one of the most significant areas of
conflict among tire companies because it not only increased
the large companies’ relative shares of total sales volume,
but also established price and net revenue differentials to the advantage of the large tire producers, and thus was instrumental in driving many of the smaller companies out of business.

The product differentiation which induced conflict usually took one of two forms: minor changes in the product, tread design, number of plies, fabric weave, construction of the bead, etc., or the development of consumer acceptance of a brand by advertising. Each device added somewhat to the manufacturer's costs, but was advantageous to him if it increased the demand for his product more than proportionately. Since each was employed by all manufacturers, the advantages tended to be cancelled out. In this instance, however, it is clear that certain companies were much more successful than others, so that their relative positions in the industry were altered by their non-price competition. The products of the four largest companies acquired the greatest prestige, and their smaller competitors were obliged to sell their tires at a discount. Within these two groups of companies, the product was substitutable, although from time to time, minor changes in the products of separate companies gained acceptance and gave the innovators temporary relative advantages until the change was imitated by their competitors.

Product guarantees were a device adopted by the smaller companies as a quasi-price alternative to setting
their prices below those of the Big 4. But the time or
mileage guarantees which they offered, as compared with the
limited guarantees against defects offered in 1927 by the
large companies, represented deductions from revenue just
as much as direct price cuts, and equally hastened the depart-
ure of the weaker manufacturers from the industry.

The direct conflict among dealers in the replace-
ment market is relevant to our analysis only in so far as
it affects the competitive positions of the manufacturers,
but it is worth mentioning that their conflict took many
forms other than price competition. Quasi-price adjustments
in terms of sale, service rendered, and in trade-in allow-
ances, non-price, and extra-market competition have always
been widespread among dealers, and to the extent that this
manifold conflict became violent enough to threaten the con-
tinued existence of dealers in the market, the effects of
this conflict were transferred to the manufacturers who came
to their dealers' assistance in order to maintain their re-
tail outlets. The only area in which this occurred in 1927
was in the competition for commercial accounts. Because
some manufacturers entered this market directly by selling
through their branches, this became so bitter that other
manufacturers were obliged to grant extra discounts to their
dealers on these sales, and even to employ the dealers as
agents, selling on commission. In the latter instance it
is clear that conflict had carried prices below the levels
at which dealers would enter the market, and approached the competitive levels of the tire manufacturers.

Any attempt to assess the net consequences of the various areas and tactics of competition necessarily suffers from lack of quantitative verification, but the foregoing analysis, supported by such empirical data as are available, suggests that the competition in the replacement market in 1927 can be characterized essentially as follows: Price competition among the tire manufacturers themselves was considerably tempered by tacit alliance. Under the leadership of the major companies, prices were initially set well above the competitive levels, with the smaller companies obliged by product differentiation to accept adverse differentials. But conflict among the manufacturers for retail outlets caused them to make extra concessions to their dealers, conflict for the favor of final consumers gave rise to other than price adjustments, and conflict among the dealers was in part transmitted to the manufacturers. These other forms of conflict increased costs or decreased revenues to the point where the short-run monopolistic profits of the large companies were sharply reduced, and many of the smaller companies were forced out of the industry. This decline of numbers and increase in concentration of production was checked at this time, however, by the concurrent decrease in production costs and expansion of tire demand.
30. The Nature of Competition in 1933-1934

A much different situation existed in the industry a few years later. Great changes had occurred in the competitive environment because of the appearance of a number of disturbing factors which had not troubled the industry before. In assessing the competition of this period, it would be repetitious to duplicate the discussion of the competitive problems which survived from 1927, so the following pages will be restricted to an analysis of the major changes which had occurred, and their relevance to the competitive pattern of 1933-1934.

In essence, the clue to understanding of the chaotic competitive situation at this time is a recognition of two sets of circumstances: first, that changes in the competitive environment were so rapid and so drastic that the policy-makers of the tire companies, (heretofore accustomed to dealing with their competitive problems separately, and secure in the knowledge that tacit alliance would stabilize most of the alternatives of conflict), apparently were bewildered by the turn of events, and pressed their conflict in all areas at once, regardless of their mutual dependence; and second, that most of the environmental changes of factors beyond the control of the tire companies were unfavorable to them, so that any attempt by a single company to maintain its previous share of the market could be success-
ful only at the expense of its competitors.

The most significant changes that occurred between 1927 and 1934 can be itemized as follows:

Total unit costs fell by more than 50% between 1927 and 1933, largely due to technological improvement, bitter conflict among rubber growers, and depression. This might have provided a cushion for extensive price reductions without adversely affecting the net revenues of members of the industry, but since half of this decline was attributable to the collapse of crude rubber prices, which caused huge inventory losses by the large tire companies, it served primarily as a factor to minimize the relative disadvantages of the smaller companies. By the end of 1933 and the beginning of 1934, recovery, the NRA, and the International Rubber Regulation Agreement combined to raise labor and materials costs again.

The total demand for tires increased until 1928, then decreased sharply and continuously through 1932, reviving slightly in 1933 and 1934. In the main, these changes in demand were attributable to cyclical elements governing the production and use of automobiles, but the decline in demand for tires was also intensified by the rise of the practice of retreading, and by product improvement. Tire durability increased about 60% during this period.

Productive capacity was greatly increased by new investment through 1928 and 1929. Although this trend was
reversed by disinvestment during the depression years as demand fell off, such crude estimates as are available indicate the existence of a large amount of unutilised capacity all during the early thirties. Data for 1934 suggest that only 65% of the practical capacity of the industry was in use at that time. Accordingly, overhead costs constituted almost half of total unit costs, and individual companies were operating under conditions of sharply decreasing total unit costs.

If the only problems facing the tire companies during this period were those of declining demand and excess capacity at a time when production costs in the industry also were declining, there would have been no strong reason to expect violent conflict or unprofitable operations. The mutual interests of tire producers were clear, and active alliance among them for production control, together with a joint program designed to equalize rates of disinvestment, or tacit agreement to prevent prices from falling as rapidly as costs, might have permitted them, as a group, to enjoy a not too unfavorable competitive position during the depression. However, a number of other factors conspired to prevent alliances of this sort, and to drive the tire companies into bitter conflict. Some of these factors arose from the heterogeneity of the tire companies themselves; others can be traced to the impact on the tire companies of the competitive activities of other types of business units involved in
the tire markets.

It has been pointed out that even in 1927 the competition in the tire industry was complicated by the fact that it was not restricted to a single product, nor to a single market, nor to the activities of homogeneous buyers and sellers. We found, however, that conventional price analysis could go a long way in explaining the competition at this time because the markets for various sizes and lines, and the sales to different types of buyers, were, in the main, separate, and did not overlap. Further, the structure of price discrimination was protected by tacit alliance. Only in the replacement market, where a large variety of competitive adjustments were employed, and where complications arose from the competitive relations within the channels of distribution, were we prevented from treating each area of competition and each tactic of conflict or alliance as a distinct problem which could properly be isolated from the rest. There, recognizing the possibility that separate adjustments could be either contagious or compensatory, it was possible only to estimate their net consequences on the basis of empirical evidence as to the intensity of conflict as compared with the completeness of alliance.

By 1933-1934, however, the previously separate tire markets overlapped to a significant degree so that the only way to have prevented conflict from being transmitted from one market to another would have been complete alliance
among tire companies covering all markets and all tactics. But since, as is shown by the descriptive material in preceding sections, the separate sellers had different interests in these various markets, were unequally diversified, and were utilizing their productive capacities to different degrees, a formula for alliance which could be agreed upon by all tire companies was extremely difficult to define.

The history of conflict in the industry was such that separate companies had little confidence that their competitors would not violate any joint agreement made whenever a relative advantage might be gained by such a violation. The incentive to independent action was magnified at this time by the fact that, relative shares of the market remaining the same, the current decline in total demand would tend to raise unit costs of the separate companies which were then operating at much less than full capacity. Even though the ultimate results of independent attempts to avoid cost increases, by increasing sales volume through direct or indirect price cuts, might be intensified conflict because of the consequent retaliatory competitive adjustments of other sellers, the short run gains of spreading overhead induced many tire companies to seek such temporary relative advantages. Naturally, conflict of this sort was fostered by oligopsonistic tire buyers. A further hindrance to successful alliance among the tire companies arose from another quarter,—the large distributing
organizations which became important in the replacement market after 1927. Since these units, mail-order houses and chains, and, later, oil companies, were favored by oligopo-
nistic purchase prices and relatively low distribution costs, they could undersell the independent dealers in the retail market, and, as they gained consumer acceptance of their private brands, they threatened the market position of the manufacturers' brands. By independent competitive adjustment these organizations were in a position to increase their shares of the tire market at the expense of their direct and indirect competitors, the dealers and manufacturers. As a consequence, the large distributors had little incentive to ally with other units involved in the replacement market. And as long as they insisted on conflicting in this market, the manufacturers and dealers had to meet the competition of the large retailers, or relinquish their markets.

In addition to the impediments to alliance that arose from mutual distrust, and the reliance of individual companies on their ability to improve their positions more by independent action than by alliance, certain competitive adjustments made by the tire manufacturers themselves, even though they may have been adopted as defensive measures, had the effect of promoting further conflict because they broke down the previous separation of tire markets and pattern of price discrimination. These adjustments consisted of the
selling of tires as spares to the automobile manufacturers, which transferred to original equipment buyers a portion of the sales volume of the replacement market; the introduction of new lines of tires and the jockeying of prices and lines among tire manufacturers and large distributors, which destroyed the previous stability of the relationship between the price and quality of tires, and introduced gradations of substitutability into formerly non-competing markets; and the establishment of manufacturer-owned retail stores, which intensified the conflict at the retail level. These adjustments can best be analysed with reference to the particular markets in which they originated.

During the depression years, the competition among the major tire companies in the oligopolistic tire markets became increasingly severe. One by one the smaller tire companies were driven out or bought out of these markets until only the Big 4 remained as significant suppliers of the large buyers. As in 1927, their conflict was restricted to price or quasi-price adjustments, but no leavening influence of tacit or active alliance remained to keep the prices above the competitive levels. The large buyers drove harder and harder bargains, and played off one against the other. The tire companies, clinging to the false hope that each could gain a relative advantage over the others, were induced by the declining total demand to make progressive price cuts in independent efforts to spread their in-
creasing overhead. As a consequence, prices in the oligopsonistic markets in 1933-1934 had descended to the lowest limits of the price bargain, and sales tended to levels which, at best, minimized losses.

The relative importance of the oligopsonistic market was sharply enhanced during this period by two significant changes to which the tire companies unenthusiastically acquiesced,—the provision of spare tires to automobile manufacturers, and the supplying of private (and sometimes manufacturers') brands to large retailing organizations. Had the tire companies jointly refused to serve these markets, and had they been able to prevent the entry into the industry of firms that would do so, in the event of their refusal, their subsequent conflict might have been less intense. But they neither allied, nor were in a position to restrict entry, so a sizeable share of their total sales were transferred from atomistic to oligopsonistic markets. This transfer had the effect of increasing the concentration of sales in the industry, since the small companies shared only in the atomistic markets, and hence was favored by the large producers. Inasmuch as sales to large buyers were at lower prices than to small ones, and since alliance was more likely to be effective in the atomistic than in the oligopsonistic markets, it is doubtful whether the large tire companies ultimately stood to gain from the transfer. However, separately, most of them felt themselves in no position to refuse to sell
spares, or supply large distributing organizations, as long as their competitors might make the sales instead. As a consequence, the major companies competed vigorously for these sales. The only important exceptions were two: first, by tacit alliance the tire manufacturers strove to maintain a differential between original equipment and spare tires, offering the latter at the "best dealer price" for replacement tires, but over the period of a few years, conflict shaded this differential; and second, one large company, Firestone, refused to supply private brands to large distributors, but this example was not followed by his competitors. Instead, Firestone intensified the conflict among them by aggressive competitive adjustments in other areas.

Conflict in the replacement market likewise was more intense in 1933-1934 than in 1927. In the earlier period we noted that although competition was manifested in several areas and by a variety of adjustments, tacit alliance managed to restrict conflict to such a degree that, even while many small companies were forced out of the market, the independent dealers and the large tire companies on the whole enjoyed profitable operations. Throughout the depression years, however, the situation was changed. Aggravated by the rise of new marketing institutions which challenged the competitive positions of the existing sellers of tires, and by the employment of new competitive tactics by both
the new and the old types of sellers, the struggle for survival in a contracting market led to a demoralized situation in which conflict was carried far beyond the theoretical extremes.

It is easy enough to insist, under the conventional assumptions of price theory, that no rational seller will make transactions in any market at which marginal cost exceeds marginal revenue, but to the tire sellers at this time the niceties of equilibrium adjustments were irrelevant. In their eyes, it was a situation in which they had to "meet competition" or perish. And since the various units in the market adopted different tactics in their efforts to survive, each new adjustment by one firm brought forth a host of retaliatory adjustments by its competitors, and these, in turn, gave rise to further retaliation. The limits to this contagious conflict were reached only when the weaker sellers were driven from the market leaving the others triumphant, or when mutual exhaustion induced a reaction, and conflict was finally restricted by alliance.

The underlying reason for the conflict of this period was the reorganization of retail marketing. Instead of the relatively simple pattern that existed in 1927, in which tire manufacturers and independent dealers were the only important units to be considered, where the manufacturers were dependent on dealers for outlets, conflicted for them, conflicted through
and over them for sales to the final consumer, and were affected by the dealers' conflicts, new areas of rivalry appeared. With the entrance into the market of various types of large retailing organizations, and of manufacturers'-owned retail stores, the large tire companies became less dependent on dealers than formerly, and conflicted less for them, than through them, and over them. In addition, through their retail stores the larger manufacturers conflicted with the dealers, as well as with the large retailers. Meanwhile the gap between the large and small tire companies grew wider, since the small manufacturers seldom had affiliations with large distributors, or sufficient financial strength to establish their own retail stores, so that they were obliged to grant extra concessions to independent dealers to retain their last foothold in the tire market. But as these dealers were squeezed by the aggressive tactics of their stronger rivals,—the manufacturers' stores and the large retailing organizations,—both the dealers and the small companies with which they were affiliated tended to be driven from the market. Since the test of survival at unprofitable levels was endurance more than it was differentials in the rate of loss, the financially weaker manufacturers and dealers were unable to hold out against the major tire producers and the large, diversified retailing organizations.

The principal tactics of conflict among the various units at this time can be described as forms of price, quasi-
price, and non-price competition, and *ceteris paribus*, analysis could be developed to show for each firm the limits to which it could best afford to carry each adjustment. However, it is evident from the wholesale failures in the industry, and from the losses incurred by all members of the industry at this time that these limits were exceeded, and that conflict was contagious during their struggle for survival.

Price conflict, which had been restricted by tacit alliance during the earlier period, under the leadership of the four major producers, broke out with violence at each level of the market. The manufacturers' prices to large distributors, as indicated earlier, were progressively lowered because of the rivalry among three of the Big 4, which was encouraged by the oligopsonistic buyers. The manufacturers ostensibly allied, after 1929, in their common practice of publishing consumer price lists, and supplying dealers at discounts from these lists. But in the declining market the dealers did not hold to the suggested prices, nor did the manufacturers' own stores, so the discounts to dealers, at first by the small tire companies that operated no stores, and later by all the tire companies, became progressively larger. And though the consumer price lists of the major companies tended to be identical, with the smaller companies accepting an adverse differential, the levels of these listed prices were being constantly lowered by the aggressive action of the Firestone company which strove to meet the price cuts of the large retailers which insisted
on underselling the manufacturers' brands in the retail market. Hence, on the initiative alternately of Firestone and the large retailing organizations, particularly Sears Roebuck, and stimulated by distress sales of small manufacturers and of independent dealers, tire prices became progressively lower.

This conflict was intensified by certain competitive adjustments other than those of pricing. In addition to the quasi-price and non-price tactics of competition which were prevalent even in 1927, several new forms of conflict became increasingly important during the depression years. The most notable of these was a combination of product differentiation and price competition. Almost all of the large distributors were selling private brands during this period, and pricing them below the consumer lists for manufacturers' brands of like quality. This practice placed the independent dealers handling the manufacturers' brands at a disadvantage, reduced the sales volume of the tire companies which did not sell private brands, and put the three large manufacturers of private brands in the position of competing with themselves in the retail markets. Several adjustments were made to this situation. In answer to their complaints, independent dealers were given extra discounts to meet the large retailers' prices, but the latter consistently retaliated with further price cuts. Certain manufacturers, led by Firestone, established their own retail stores to compete directly with the large retailers, or to recapture some of
the dwindling sales volume for their own brands by aggressive sales efforts in special local or institutional markets. These units, it is generally acknowledged, operated at a loss, and alienated independent dealers, who were more seriously affected by them than the large retailers. As a final measure, some of the manufacturers, again led by Firestone, began to produce fighting brands, third, fourth, and fifth line tires of inferior quality, which, through their dealers or their retail stores, they priced at the levels of the private brands sold by the large distributors. This completely disrupted the price structure of the industry, for not only are quality gradations extremely difficult to define and detect in tires, so that tire buyers had no clear understanding of the relationships of price and quality in the tires offered for sale, but also it broke down the previous separation of the tire markets according to price class, and made all replacement tires more or less substitutable one for the other. This was aggravated by the fact that all during this period various tire manufacturers were alternately changing the price differentials among them in independent efforts to improve their competitive positions. Their original purpose in introducing new cheap lines was not served, because the qualitative differences between a third-line manufacturers' brand and a large retailer's private brand were so apparent, (or because chain store advertising made it appear so), that buyers increasingly chose the private brands. Then, too, many of the manufacturers
found that they were increasing the sales of their inferior
tires at the expense of their first line tire sales volume.

Other forms of non-price and quasi-price competition
were intensified at this time, particularly at the retail level,
though, as might be expected, they became contagious throughout
the industry. With the initiative usually taken by indepen-
dent dealers, but with rapid retaliation by the manufac-
turers' stores, large trade-in allowances, spurious adjustments,
free deals, extra service, special discounts, and excessive
credit terms, all of which increased costs or reduced revenues,
were offered as special inducements to buyers at retail. The
large retailing organizations participated less in this sort
of conflict than other retailers, since they relied primarily
on price appeal to sell their tires, but they competed vigoro-
ously with the manufacturers in advertising, and in product
guarantees.

The net consequences of the various forms of conflict
during this period were unfortunate for all but the large re-
tailing organizations, and the buyers of tires. The former
increased their share of tire sales substantially during
this period, and the latter obtained a steadily improving
product at progressively lower prices. The other units con-
cerned with the sale of tires did not fare so well. A large
number of independent dealers were driven out of the market,
while many of those that survived, did so only because they
were diversified. As a group they lost a full third of
their share of the market, and the market itself contracted by over one third over the depression years. Finally, many of the tire manufacturers were forced out of the industry. Of the 109 in 1927, only 33 remained in 1933. And even the larger and stronger units which were successful in remaining in business suffered serious losses during this period. The contagion of conflict and the breakdown of the pattern of price discrimination must be counted as fundamental causes.

31. The Nature of Competition in 1938

There is good reason to believe that the members of the tire industry which managed to survive the depression years were taught a severe lesson by their experience with unrestricted conflict, and have now reached a stage where they are not only aware of their mutual dependence, but also act accordingly. At any rate, there is evidence that tacit or active alliance has been widely and successfully employed since 1935 in practically every area where it is feasible to restrict conflict. Although it is true that some areas and tactics of conflict remain, that certain units are more cooperative than others, and that a few disturbing factors beyond the control of members of the tire industry still threaten to unsettle their competitive environment, it is clear that recent years have witnessed a more mature and more stable form of competition than formerly.
Steps in the direction of alliance were taken as early as 1933 and 1934 when successive attempts were made under the NRA to define and restrict the areas and tactics of conflict in the tire markets, but as has been pointed out earlier, the impediments to alliance at this time were too great for these attempts to be successful. Nevertheless, though conflict remained bitter throughout the life of the NRA, out of the negotiations which it sponsored eventually there emerged a formula of alliance and a pattern of competitive behavior which has sharply limited the previous intensity of conflict. This process was hastened by the fact that some of the environmental factors which formerly had been conducive to conflict were changed by 1935.

The long decline in unit costs of production, which reached its low point in 1933, was reversed. Over the next four years these costs increased by about 60%. A large part of this increase (about 80%) was attributable to the revival of crude rubber prices which accompanied the formation of the International Rubber Regulation Agreement in 1934, but labor and other materials costs also increased somewhat. On the face of it, this cost increase might be taken as an unfavorable factor for the tire companies, since it offered no cushion for price conflict. However, it turned out otherwise. The increase in the price of rubber was a given factor to all tire manufacturers, completely beyond their control. It was substantial enough so that all companies realized that it necessitated an
increase in tire prices. Accordingly, coming as it did at a
time when disastrous price wars had made the tire manufacturers
acutely conscious of the lowness of tire prices, it seems to
have caused a pendulum swing in the other direction, and served
as the excuse, under tacit alliance, for increases in tire
prices which were proportionately much greater than the in-
crease in rubber costs. As an additional factor favoring a
part of the industry, it should be pointed out that rising rub-
ber prices checked the inventory losses incurred by the large
companies, and made their plantation operations profitable
in their own right.

Another favorable environmental factor was the re-
vival in the demand for tires after 1933. Although the ear-
lier peaks of 1928 and 1929 were not regained, the mere fact
that the total tire market was expanding instead of contract-
ing, relieved a large part of the pressure on tire sellers to
conflict, for even with its relative share remaining the same,
each seller could now enjoy an expanding volume of sales. Two
important qualifications to this interpretation must be made,
however. First, the large distributors had sufficient market
advantages to increase their relative as well, as their abso-
lute shares of the expanding sales; hence pressure to conflict
remained for the independent dealers whose relative shares
were being diminished. Second, the increase in tire demand
promises to be temporary. Expected saturation of the automo-
bile market, coupled with continuous increases in tire dura-

bility because of product improvement, highway improvement,
and the growing practice of retreading old casings, suggests
that tire sales are less likely to expand than to contract
in the future. It will be interesting to see whether another
decline in demand will intensify conflict as it did in the
past, or whether this time it will prove an incentive to al-
liance among tire sellers.

A further change from the situation existing during
the depression years is to be found in the rate of utilization
of productive capacity. The large proportion of unused capacity
and the consequent decreasing cost situation which had induced
separate manufacturers to conflict independently in attempts
to spread their overhead in previous years, is no longer a
major problem in the tire industry. All during the years fol-
lowing 1929, there was disinvestment in the tire industry.
Many companies disappeared from the industry, and much of
their equipment was scrapped. Among the larger companies
that survived, worn out machinery was not replaced. Although
in certain heavy equipment, particularly vulcanizers, the
rate of obsolescence is slow, almost a decade without much
replacement has been more than enough to reduce total capacity
of the industry to the point where it is almost fully utilized
at current levels of production. In fact, beginning around
1937 there was a wave of new investment throughout the indus-
try. Part of this new investment was connected with the re-
location of plants, as certain members of the industry began
to move some of their operations out of Akron. In this in-
stance, a certain amount of unused capacity remained in Akron
plants, while the expanding Southern and Western plants tended
to be fully utilized. Another part of the new investment by
tire companies was only indirectly related to the tire market;
it represented the trend towards diversification of production
by which many of the tire manufacturers have sought to im-
prove their general competitive positions. Finally, some of
the new investment was necessitated by changes in the product.
New tread designs, alterations in the construction of tires,
particularly increases in the size and weight of tires, and
the growing importance of truck tires, required new equipment,
for some of the processes of production. Here, it should be
noted, exception must be taken to the earlier measures of
practical capacity in the tire industry,—by count of the num-
ber of tire molds,—because, although an excessive number of
molds may still exist in the industry, the increasing size
and weight of tires has made the mixing machinery the new
bottle-neck, and the more significant measure of capacity.
Given this situation of little idle capacity, the overhead
cost fallacy which drove the tire companies into bitter con-
flict has lost much of its significance in explaining the
lower levels of the price bargain on large orders.

With the environmental pressures to conflict re-
duced as they were after 1935, so that whatever conflict occurred would be manifested in the form of jockeying among business units seeking a relative advantage over their competitors, rather than as a struggle for survival, the stage was set for alliance which would diminish the variety of competitive practices and, particularly, the severity with which they were employed.

The terms of this alliance, by virtue of the complications of the tire market, were difficult to establish. Differences among buyers and sellers, and variations in the product still presented a multitude of potential areas of conflict, which were sufficiently interrelated that adjustments in one area might have serious repercussions in another. As a result, successful alliance required both that conflict be restricted in the various areas, and that steps be taken to keep conflict from spreading from one area to another.

Essentially this has been attained to a large degree by an acceptance, on the part of the principal units in the industry, of the status quo with respect to their relative shares of the market, and a tacit agreement not to initiate aggressive competitive adjustments in the hope of obtaining relative advantages over their competitors. Each company has learned to its cost that such moves only bring retaliation.

The principal feature of this alliance was the re-establishment of an accepted pattern of price discrimination and the stabilization of the price differentials of different
sizes and lines of tires in different markets. Attempts under the NRA to reach agreement among the various sellers of tires had been unsuccessful primarily because the major tire companies and the large distributors were unwilling to compromise their differences. In rapid succession during 1933 and 1934 schedules of differentials between manufacturers' and private brands, for various lines of tires, were proposed, and were violated by whichever group felt at a disadvantage. For example, the first line private brand sold in mail-order chain stores was offered at a listed price 25% below the manufacturers' first line in 1927. In succeeding years, while Firestone and other manufacturers were fighting the large distributors, this differential was narrowed to 23%, to 18% and in March, 1933, to 10%. The chains retaliated with price cuts, and with extensive quasi-price concessions. After chaotic conflict, another truce was called, and the differential was re-established at 12½%. Again violent conflict broke out. By 1935, however, the manufacturers capitulated to the extent of permitting a differential of 14%. Since that time, except for occasional special sales, it has remained at 14-15%. (For a fuller statement of the pattern of differentiation between brands and lines since 1935, see supra, pp. 310-311.)

By the same token, the pattern of differentials among the manufacturers' prices to other buyers has become stabilised. Counting the consumers' listed price as a base, prices to small independent dealers have been maintained at about 70% of the
list, to larger warehousing dealers at 60-65% of the list, to original equipment buyers at 35-40% of the list, and to other oligopsonistic buyers, depending upon their bargaining strength, between 40-60% of the list. Although extra concessions have been made from time to time, and, in individual cases, these approximate limits have been exceeded for members of the various classes of buyers, the tire companies have moved together in changes in their list prices and in the proportion of the list charged each type of buyer.

Evidence of this, and of the fact that prices are established at levels which return a profit to tire companies, can be found with respect to several of the major types of markets. The clearest case is to be found in the bidding for governmental accounts. In the pending anti-trust case, U.S. vs. Cooper Corporation et al., all of the leading tire companies except Armstrong, Gates, Mansfield and Pharis, are claimed to have made four sets of bids between 1936 and 1938, which were identical to the penny, on more than eighty different sizes of tires. That the prices at which these tires were offered were not at competitive levels can be inferred from the fact that when in 1937 the United States Treasury Department rejected identical bids, it secured tires at lower prices from Sears Roebuck, which was supplied by Mansfield and Pharis, and by some of the allied tire producers. Subsequently, the leading companies resubmitted bids which were lower than the Sears Roebuck prices, even though retail prices
meanwhile had remained unchanged.

Tacit alliance in other oligopsonistic markets has been less complete, but nevertheless has been present among the largest companies. Instead of conflicting bitterly among themselves for contracts to supply large buyers, the principal tire producers have evidently established lower limits below which they are unwilling to offer tires in these markets. As a consequence, a number of the smaller tire companies have taken over contracts which were formerly held by Goodrich, Goodyear, and U.S. Rubber. Pharos, Mansfield, and Dayton supply tires to the mail order houses, and some chains, while Lee and General now hold some of the principal oil company accounts. The fact that the profit rate of these small companies is recent years considerably exceeds that of the larger tire manufacturers would suggest that these quantity sales are made at higher than strictly competitive prices. Since the smaller companies lack the facilities to supply more than a fraction of this market, and know that they hold their contracts only on sufferance of the larger manufacturers, so that they do not contemplate rapid expansion, these prices also operate to the benefit of the major companies, which hold the rest of these contracts.

The complexity of the retail market, with respect both to the diversity of interest among the units involved, and to the variety of competitive tactics which they employ, has prevented alliance from being more than partial. Neverthe-
less, the alliances which have been effected have, on the whole, reduced the intensity of conflict rather than merely shifting it to other areas. The principal object of alliance throughout the industry has been the achievement of a stabilized price structure. From the point of view of the manufacturers, this has largely been attained, even at the retail level. To be sure, periodic price wars occur among independent dealers, into which the chains and manufacturers' stores are drawn, but most of this sort of conflict is short-lived, localized, and not too violent. With an expanding rather than a contracting market, the incentive for all types of retailers to conflict has been diminished. The independent dealers have become increasingly aware of their mutual dependence, and have organized in attempts to restrict the forms of conflict which were contagious during the depression years. And, individually, many dealers have diversified their sales to such a degree that their interest in and dependence upon the tire market is much less than formerly. The large retailers are already in an advantageous position, continually increasing their share of the market, and have little incentive to risk the profitability of their sales volume by price-cuts. The manufacturers, through their retail stores, are apparently resigned to the fact that large retailing organizations are growing in importance as outlets for replacement tires, and have not chosen to conflict with them. They are encouraged in this decision by the fact that private brands, which
threatened the prestige of their own brands, are apparently on the wane, since the most rapidly growing class of large distributors, the oil companies, are increasingly handling the manufacturers' brands.

With this decline in price competition has come a similar decline in the intensity of most forms of quasi-price and non-price conflict. The quasi-price concessions made by manufacturers to dealers in the form of discounts and allowances have been restricted and standardized. Guarantees against price decline remain, but the time period has been shortened by the practice of winter-dating. Competition among retailers still includes some conflict in service, and such practices as free-deals, trade-in allowances, and installment sales, but seldom are they used aggressively as competitive weapons. Instead they tend to remain as relatively fixed elements of competitive policy. Even the conflict between manufacturers and large distributors has largely become stabilized. The tire companies no longer change the quality of their tires and introduce new lines to meet the chain-store prices, nor do the chains retaliate with extensions of product guarantees, or excessive trade-in allowances. The retail stores of the manufacturers are now operated at a profit, and are not used as means of obtaining sales volume for manufacturers' brands at all costs. Quality lines have been stabilized and product guarantees have become similar. Only in non-price forms of product differentiation is there evidence
of any increase in the intensity of conflict. There minor product changes and advertising are still used extensively by the various manufacturers in attempts to increase their relative shares of the market, but there is no reason to believe that this is carried to the point where it seriously offsets the effects of alliance restricting other forms of conflict.

In summary, it may be said that the net consequences of the conflict and alliance in the industry since 1935 have been as follows: Assisted by favorable environmental factors, and persuaded by their previous experience with unrestricted conflict that their separate competitive policies should recognize the mutual dependence of units in the market, members of the tire industry have sharply reduced the intensity of their conflict. Under the leadership and protection of the large tire manufacturers, a price structure has been established which permits profitable operations. Some of the smaller companies have taken advantage of this situation to gain footholds in special markets, but thus far have not pressed their advantage to the point where the larger companies would attack them. The conflict between large retailing organizations and tire manufacturers, which upset the industry for almost a decade, has been compromised, with most of the concessions made by the manufacturers, at the expense of the independent dealers. As a consequence, the independent dealers are steadily losing their share of the market to the large retailers. The
net results of this competition have been to permit gains to all units concerned in the market, except the small dealers, and the ultimate consumer.

The mutual advantages of this arrangement are such that one might expect the tire manufacturers to be disinclined to conflict again, except in a very limited, non-price fashion. However, before venturing any such prediction for the future, several potential disturbances to this stable situation must be recognized. First, two environmental factors promise to cause trouble: the expected decline in the demand for tires, and the possible changes in the supply and price of the major raw material, rubber. The consequences of each are unpredictable. The decline in demand could contribute to a renewed intensity of conflict as it did during the depression, or it could be met by production control. The effect of war on domestic supplies of rubber is as yet undetermined, but if supplies are cut off, and synthetic rubber is substituted, the ensuing structural adjustments could be very upsetting to the tire companies. Second, some units in the industry are uncooperative. A few of the small companies have found it advantageous to act independently of the present alliance. Should they gain substantially in their share of the market, conflict would probably break out between them and the larger companies. By the same token, the increasing importance of the large retailers may constitute a threat to other units. Independent dealers might in desperation initiate vigorous
conflict which could become contagious. The manufacturers who supply the large retailers might come to fear the steady increase of their sales to oligopsonistic buyers, and join the conflict. And finally, even with limited forms of conflict which exist at present, some manufacturers may be more successful than others.

If the relative shares of the various units change appreciably, the companies at a disadvantage may well be expected to try to remedy their situation. The recent actions of the Goodyear Company, which seems to be breaking away from the alliance among manufacturers, may well be an indication of this circumstance, or it might even be an aggressive move of the strongest member of the industry which has little to fear from retaliation. Third, the legal status of the existing forms of alliance is not entirely clear. Active alliance in the form of codes and trade practice agreements defining and limiting the types of quasi-price, non-price and extra-market conflict, and tacit alliance as manifested by the general acceptance of the competitive customs of the industry are not likely to suffer serious interference under existing law. To the contrary, the trend of legislation and judicial interpretation since 1933 can be said to favor much of this type of alliance. However, the central framework on which successful alliance in the tire industry depends, the maintenance of price differentials among the various sizes and lines of tires in different markets, and the
unanimity of action in price changes, is already subject to legal investigation. Whether the present arrangements are the consequence of organized conspiracy to restrain trade, or whether it represents price leadership, the possibility must be recognized that legal action, or the threat of it, might, in the same way that it broke up identical bids on governmental purchases, precipitate a new wave of conflict. Although the present recognition of their mutual dependence would undoubtedly lead the tire companies to seek new forms of alliance, in the event that the present forms were held illegal, legal action against them must be counted as a potential disturbance of the first magnitude to their alliance.

32. Conclusion

The reality of the tire industry lies so much in its detail that generalization from the description and analysis in the preceding pages tends to lose both accuracy and significance as it gains simplicity. Nevertheless, if proper acknowledgment is made of the need for qualification, a few conclusions can be offered by way of a summary.

Throughout each of the three periods under consideration, the nature of competition in the tire industry seems to have been dominated by certain environmental factors which were not only reflected in changes in the conditions of supply and demand, but which also caused the members of the industry
to adopt different competitive tactics and to apply them with differing degrees of intensity.

Phrased in its simplest form, the fortunes of the tire industry are intimately connected with those of the automobile industry, with the price of crude rubber, and with the business cycle. And special complications have arisen from technological change, from reorganization of the channels of distribution, and from differences among sellers, their products, and the markets in which their products are sold.

On the whole, prices have varied directly with total production costs, and profits have varied directly with total demand, but the factors immediately affecting price determination and the profitability of operations require explanation in terms of the tactics of competition and the relative intensity of conflict.

Production costs declined continuously from 1927 to 1933, and rose thereafter. These changes were dominated by the fall and rise of crude rubber prices, which were directly connected with the breakdown and reestablishment of rubber restriction schemes. Because of the necessity of holding large inventories of rubber, the large tire companies have been at a relative disadvantage during periods of falling rubber prices, and have enjoyed a relative advantage when these prices rose. During the depression years, the growth of unutilized capacity throughout the industry meant
that all firms were operating under conditions of decreasing costs, and that they became acutely aware of the increasing proportion of fixed to variable costs. Accordingly, they occasionally went to unprofitable extremes in their marketing policy in attempts to spread their overhead. Selling costs were probably greater for the larger than for the small companies, but this extra expenditure was more than made up by the additional net revenue attained through increased sales and higher prices. Otherwise, costs varied only slightly among the firms in the industry. Conflict led to price cuts during the period of declining costs, so that when costs rose, prices had to be increased in order to cover them. However, alliance during recent years seems to have protected price increases which were in excess of the rise in costs.

In the aggregate, the demand for tires is primarily dependent on the production and use of automobiles. Consequently, when consumers' incomes declined after 1929 so that fewer new automobiles were being sold, and existing automobiles were being used less than before, the demand for original equipment and for replacement tires also declined. As automobile production and use revived after 1933, the demand for tires did likewise. In the meantime, however, product improvement has decreased the rate of tire replacement, so the revival in tire demand has not been commensurate with the revival in automobile production and use. A concept of total demand for tires tends to be misleading for the
analyst of price, even though it is significant to the pro-
fitability of the industry, because tires are sold in many
different markets at different prices. Each tire manufac-
turer sells tires of different sizes and qualities, to dif-
ferent sorts of buyers. Ideally, this should enable the
sellers to discriminate in price among these markets to the
point where the marginal revenue from each market was equal
to the seller's marginal cost for total output. However,
the actualities have been more complicated. There is no
demand curve in some markets, because of oligopoly. The
seller is aware only of the single bid which is made by the
oligopsonist. Furthermore, each seller has the option of
adjusting his output to the joint demand curve for all sel-
lers in each market, where there is active or tacit alliance,
or of acting independently and adjusting his output to his
individual demand curve. The actual range of competitive
policy lay between these two extremes. While total demand
was increasing, and costs were falling, as in the 1927
period, the sellers were able to discriminate successfully
among these markets. Since their conflict in some of these
markets was not so severe as to carry prices down to competi-
tive levels, they enjoyed profits from their total operations.
When total demand began to decline, their conflict became more
intense, and the accustomed structure of price discrimination
broke down. Sellers, independently seeking relative advantages,
adopted tactics of conflict that caused these markets to ever-
lap. New marketing organizations appeared to disturb the situation. As a consequence, prices in some markets were carried to irrationally low levels, and net losses were incurred throughout the industry. Since 1936, the revival of total demand has relieved the pressure on tire sellers to adopt every device at their disposal in their struggle for survival. And a belated recognition of their mutual dependence has given rise to compromises among the formerly conflicting units. Therefore a pattern of price differentials for the different markets has been reestablished, and, subject only to sporadic attacks in a few markets, prices have been held at levels that permit profitable operations again.

The heterogeneity of the units involved in the production and/or sale of tires has presented a major problem to the analysis of competition in the industry. Differences in size, organization, market strength, diversification, and degree of interest in the market are all complications which are customarily assumed away in conventional price theory, but, as shown in the previous descriptive and analytical sections, they are distinctly relevant to an understanding of the nature of competition in the tire industry. In particular, these differences have offered impediments to successful alliances. Practically every tire company has a relative advantage over its competitors in some respect, even though it may be at a disadvantage otherwise. The differences among the companies have induced them to employ different tactics in pursuing
their separate advantages. And independent action of this sort often becomes contagious once it is started. Only after a long and bitter experience with unrestricted conflict did the tire companies reach the conclusion that their several interests were better served by joint than by independent competitive adjustments. And even now, given the present variety of possible tactics, price, quasi-price, non-price, and extra-market, and the number of different markets in which to employ them, it must be acknowledged that, however much the heterogeneous units in the tire industry recognize their mutual dependence, any alliance among them is precarious, and can be disrupted whenever a single unit believes that it can serve its particular interests better by independent action. If such a unit is willing to brave retaliation, it can precipitate conflict whenever it desires.

One final word. Having suggested a pattern of analysis, criticized existing analyses for failing to conform to that pattern, and conducted an empirical investigation of a particular segment of the economy in an attempt to illustrate and test his hypothesis, the writer feels that a brief recapitulation of his position and evaluation of his results would constitute an appropriate conclusion to this dissertation.

In essence, the writer has accepted the lay conception of competition as rivalry among business units, motivated by a desire to maximize net income. This has led him
to the conclusion that all policies of these units which are relevant to this quest for income are appropriate fields of economic study, and that the failure to include them all, or to recognize their interrelations, may lead the analyst to incomplete or erroneous conclusions. Accordingly, it was suggested that comprehensive analysis should be developed which could encompass all such forms of policy. Fundamental to this attempt, it was held, is an accurate identification of the units which make policy, and a study of the actual measures of policy which they employ, or which are available to them. With emphasis placed upon the alternatives of conflict or alliance among business units, and upon elements of homogeneity or heterogeneity among them, an effort was made to construct a system of classification within which their competitive policies might profitably be studied. As the principal categories, distinctions were drawn among what was called market competition, which included the sub-categories of price, quasi-price and non-price competition, each of which may be counted as a manifestation of rivalry for sales; extra-market competition, which represented measures to minimize the net incomes of one's competitors; and structural adjustments, which consisted of reallocation of the factors of production, or reorganization of market channels, in order to reduce costs or to achieve greater market control. In the development of this classification, suggestions were offered as to the type of readjustments of conventional anal-
ysis that would be required to analyse these separate forms of policy.

A case study of a particular industry indicated that the conventional analysis, notwithstanding its limitations, provides most of the necessary tools to reason about the complications of an actual instance of business rivalry, but that certain of the customary assumptions were questionable, and certain important variables were overlooked.

The framework of conventional price theory, it was found, provided an essential point of departure for the study of the competition of the industry as a whole, and not only supplied the tools by which separate tactics in separate markets could best be analysed, but also served to suggest the essential features of the inter-relations of the individual firms. Nevertheless, and here is the major contribution of this dissertation, when conventional analysis was applied to the particular problems of the tire industry, it seemed to suffer from three important weaknesses. Two of these weaknesses are unavoidable in any logical system, but the third is subject to remedy.

1. It was not equipped to deal with the particulars of simultaneous conflict and alliance among business units in those cases in which some but not all units ally to restrict conflict in some but not all possible areas of conflict. The two dimensional aspect of price theory by which complete alliance or complete conflict is assumed, or by which
a single tactic is analysed, ceteris paribus, cannot deal with all of the relevant variables at once. Although theoretically determinate solution is attainable by multi-dimensional analysis, on practical grounds it is possible only to conclude that this situation, which was termed "pluralistic competition" leads to an unstable level of price and volume of output, which would tend to vary between the extremes attainable under complete alliance or unrestricted conflict.

2. Although it conceives of the alternative possibilities under pluralistic competition,—that both conflict and alliance could become either compensatory or cumulative,—it offered no clue to the rationale of units in the market which determine the intensity of conflict or the completeness of alliance. Within the framework of conventional reasoning one may conclude that if conflict and alliance are compensatory, an equilibrium might be attained with price and output somewhere between monopolistic and competitive levels, and that if they are cumulative, there would be a tendency towards the extremes, but only by redefining our assumptions of economic behavior can we explain the contagious conflict in the tire industry which carried price below the theoretical extreme.

3. It oversimplified market realities by its assumption that competition occurred among homogeneous units. Hence no notice was given to the possibility that heterogen-
eity among units in the same market is a significant factor affecting not only the choice of competitive tactics made by the various units, but also the relative effectiveness of the measures taken. Nor was it recognized that the very existence of heterogeneity tends to impede the adoption of policies that would seem obvious to homogeneous firms aware of their mutual dependence.

This dissertation has attempted to make a negative contribution to economic analysis by its examination of these weaknesses in conventional analysis and by its organization of the illustrative material in such a way as to emphasize them. Its constructive contribution is much smaller. It has explored some problems of which students of price policy are already well aware, and has suggested a terminology and an approach to them which contain certain elements of novelty, but it has not progressed appreciably in the solution of these problems. It has suggested a term descriptive of simultaneous conflict and alliance, and has indicated the instability inherent in that situation. It has tried, in the illustrative case, to employ a concept of the "intensity" of competition, together with its converse, the completeness of alliance, and to search for empirical evidence of the cumulative or compensatory nature of conflict and alliance within each of several competitive environments. And it has endeavored to define the principal elements of heterogeneity among units in the tire industry, and to indicate their relevance
to the nature of competition in the industry.

In the process of preparing the illustrative case, however, several weaknesses of the approach suggested earlier have been uncovered. These deficiencies arise in part from inadequate foresight on the part of the writer, and in part from the difficulties inherent in any attempt to establish an inclusive pattern of analysis which will encompass all the variables of economic phenomena. One weakness consists of the fact that the classification of types of competition, however useful it might be as an analytical simplification, overlaps seriously when tested by the actualities of the market. A given measure of competitive policy, e.g., a change in the product, may simultaneously represent a "quasi-price," a "non-price," and a "structural" adjustment. The fact remains, however, that it can be analysed separately in each of these categories, so that its several consequences can be assessed. Other weaknesses, due primarily to the writer's initial preoccupation with market adjustments alone, are found in the scanty treatment accorded, in setting up the hypothesis, to structural adjustments on the cost side, and to the significance of changes in the competitive environment. It was quickly discovered, in the investigation of the tire industry, that there are elements of cardinal importance in explaining the nature of competition in an actual situation. Finally, the process of working through the problems of this dissertation, both on the theoretical and the empirical levels, has convinced
the writer that the impossibility of precise solution, of infallible prediction, and of comprehensive understanding of problems of modern competition, derives not so much from deficiencies in the methods of analysis as from the perversity of the data. Analysis of competition can successfully deal with only a few variables at a time; the judgment of the analyst is required to weight them or to assess their inter-relations. This dissertation, therefore, though it initially directed its attack on methods of analysis, has come to find its contribution in the suggestion of certain types of variables which have not yet been exhaustively analysed.

There is reason to believe that the particular industry selected for analysis may not be the best adapted to illustration of the problems which have been discussed, and it is certain that generalizations regarding pluralistic competition cannot be made from a single case study. Nevertheless, it is the hope of the writer that he has introduced some useful alternative assumptions for price analysis, and stressed the importance of some market variables that warrant further study.
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