

# The Rise of Multiunit Firms in U.S. Manufacturing\*

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The modern multiunit enterprise has been touted by historians and economic historians as a major and important phase of organizational change and a significant source of growth. However, most studies concerning this phenomenon have been based on a sample of the very largest enterprises. This article utilizes data on a complete sample of firms provided by the pioneering works of Thorp (1924) and Thorp *et al.* (1941) and the Census Bureau's *Enterprise Statistics* and other census sources to document and examine the rise of modern multiunit firms in U.S. manufacturing over the twentieth century. The analysis of the data suggests that the modern multiunit firm arose to take advantage of economies of marketing rather than those of scale and scope. © 1999 Academic Press

## INTRODUCTION

The modern multiunit business firm is one of the most prominent and important organizational innovations in manufacturing production of recent times.<sup>1</sup> During most of the eighteenth and the nineteenth centuries, manufacturing enterprises were predominantly organized as traditional single-unit firms.<sup>2</sup> These enterprises operated in a local or regional market, produced a single line of product, and were

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<sup>1</sup> The multiunit firm is defined as a firm that controls and manages from a central administrative organization the production decisions of establishments or plants in at least two different localities. Multiunit firms are usefully categorized into the following three types: horizontal, vertical, and conglomerate or diversified. Horizontal firms produce the same product in different locations, vertical firms use outputs of some of their plants as intermediate inputs to some of their other plants, and conglomerate or diversified firms manage plants in unrelated industries.

<sup>2</sup> See Sokoloff (1984a, 1984b, 1986) and Atack (1977, 1987) for analyses concerning the rise of single-unit firms in the United States. Also see Sokoloff and Dollar (1997).

owned and managed by a single individual or a partnership. During the last two decades of the nineteenth century, the multiunit business firm emerged and began to displace the single-unit firm in a number of industries. These multiunit enterprises operated plants in many regions, produced different lines of products, and were controlled by a hierarchy of managers. During the twentieth century, the predominance of multiunit firms in manufacturing activities grew domestically and internationally in the form of multinational firms.

For the business historian Alfred Chandler, the rise of the modern multiunit firm was an epochal event in the history of the modern world. It signaled the coming of managerial capitalism where economic growth is dependent upon the "visible hand" of multiunit firms rather than the Smithian "invisible hand" of markets. In his classic work, the *Visible Hand* (1977), and more recently in *Scale and Scope* (1990), Chandler provides an analysis of the sources of modern economic growth based on the modern business firm. For Chandler, modern economic growth is based upon high volume production technology which takes advantage of economies of scale and scope. However, economies of scale and scope cannot be realized by firms organized as traditional single-unit firms. Chandler argued that it was necessary for firms, in order to realize these economies, to vertically integrate forward into distribution to ensure sales of sufficient volume and to vertically integrate backward into raw materials to ensure a constant flow of inputs.<sup>3</sup> The vertical multiunit firm also necessitated innovations in the management structure. Whereas activities of single-unit firms were coordinated and monitored by the market mechanism, those of modern multiunit firms were coordinated and monitored by middle managers.

For economists, the analysis of the rise of the modern multiunit firm, and of firm size in general, is based on the transaction cost theory of the firm.<sup>4</sup> This theory, originating from Coase (1937); revived and popularized by the works of Williamson (1975, 1985); Alchian and Demsetz (1972); and Klein, Crawford, and Alchian (1978), argues that firms internalize production because they incur greater transaction costs when they use markets. However, production is not organized as one giant firm because there are costs of organizing production within a firm as well. Workers on a fixed wage may not have the incentive to exert the optimal level of effort unless firms expend resources to monitor their employees.<sup>5</sup>

The transaction cost theory of the firm explains the boundaries of firms, but the

<sup>3</sup> Chandler has influenced the work of historians and economic historians. See Schmitz (1993) for a review of the literature. Also see Atack (1985), Lamoreaux (1985), Field (1987), and Hannah (1980, 1997).

<sup>4</sup> The traditional industrial organization literature based on the "structure-conduct-performance" perspective, identified with Joe Bain, explains the existence of the multiunit firm using economies of management, distribution, and pecuniary economies of large-scale buying from suppliers. See Bain (1968, p. 166). Other important sources of multiplant economies are research and development, management services, risk spreading, finance, and sales promotion. Although numerous estimates of single-unit economies (minimum efficient scale) have been made, few empirical studies exist which attempt to estimate the importance of multiunit economies. See Scherer (1975, 1980).

<sup>5</sup> See Jensen and Meckling (1976) and Grossman and Hart (1986).

theory must be modified to explain the boundaries of multiunit firms. The multiunit firm differs from other firms in that it owns and operates plants in at least two different localities. The international trade literature, in an attempt to explain the multinational firm, a subspecies of the multiunit firm, explains why multiunit firms exist by combining the theory of trade with the transaction cost theory of the firm. First, the theory of trade explains why there is one or more plants operating in different localities. The location of plants depends upon factors such as advantages of location due to geographic variation in resources, local externalities, or nearness to markets.<sup>6</sup> Second, the transaction cost theory explains whether firms will be single-unit or multiunit (i.e., whether plants in different locations will be owned by separate firms or by one firm).<sup>7</sup> Drawing on the international literature, this article focuses on the second issue using the U.S. domestic market.

These two theories, Chandler's theory using economies of scale and scope and Coase's using transaction costs, are efficiency-based explanations of the rise of the modern multiunit firm. However, economists and business historians have long argued for the potential inefficiencies imposed by the emergence of the modern multiunit firm. Indeed, one of the historically leading explanations for the rise of the modern multiunit firm is the pursuit of market power.<sup>8</sup> According to this theory, firms organized as multiunit firms not because they were more efficient, but because their ability to restrict production and raise prices made them more profitable.

Although the modern multiunit enterprise has been touted by Chandler (1977, 1990) and others as a major and important phase of organizational change and as a significant source of growth, most studies concerning this phenomenon, except those based on the pursuit of market power, have been based on a sample of the very largest enterprises. The perception that complete data on firms are unavailable or that they are too costly to construct has deterred most scholars from undertaking a more systematic analysis of the modern business firm. This article argues that several sources of complete firm level data, supplemented by other census sources, provide important information on single-unit and multiunit firms. More specifically, this article utilizes the pioneering works by Thorp (1924) and Thorp *et al.* (1941) and the Census Bureau's *Census of Manufactures and Enterprise Statistics* to document and examine the rise of the modern multiunit firm in U.S. manufacturing over the twentieth century.

The data show that the multiunit manufacturing firm, which emerged during the last two decades of the nineteenth century, grew steadily over the twentieth century and was clustered in a few industries whose identities changed over time. The multiunit firms were predominantly organized as horizontal rather than as vertical or conglomerate firms. In addition, when firms were vertically integrated, they were more often integrated forward into distribution rather than backward

<sup>6</sup> These issues are addressed in Kim (1995, 1998a, 1999a).

<sup>7</sup> The recognition of the importance of ownership advantages in explaining multinational firms was first explored by Hymer (1976). Also see Dunning (1977, 1981) and Caves (1996).

<sup>8</sup> See Lamoreaux (1985) and Schmitz (1993).

into raw materials. The growth of multiunit activity was accompanied by growth in the size of middle management, which monitored and coordinated the activities of multiunit firms. In fact, the data on central administrative organizations of multiunit firms show that employment in central administrative organizations grew at twice the rate of employment in multiunit firms during the second half of the twentieth century. The data also suggest that the costs of managing the activities of multiunit firms rose with firm size, number of establishments, involvement in nonprimary industries, and geographic dispersion of establishments.

This article proposes to reverse the causality of Chandler's argument on the rise of modern multiunit firms. Chandler argued that it was necessary for modern multiunit firms to vertically integrate forward into distribution and backward into raw materials in order to take advantage of economies of scale or speed of throughput. To the contrary, this article argues that the essence of the multiunit firm lies in the transaction cost economies in marketing.<sup>9</sup> Since brand names, trade marks, and reputation are difficult assets to transfer from one plant to another through the use of contracts, it was often optimal for plants which produced similar lines of products to operate under a common ownership. Thus, multiunit firms integrated forward into distribution in order to take advantage of multiunit economies in marketing. However, multiunit firms did not integrate backward into raw materials since backward integration provided little multiunit economies.

Finally, the article suggests a cautious interpretation of the importance of the pursuit of market power in causing firms to organize as multiunit firms. Although the cross-sectional evidence indicates a positive correlation between the four-firm concentration ratio and the extent to which the industry is organized as multiunit firms, it is difficult to disentangle the direction of causality. Firms may have become multiunit in order to capture gains from increased market power, but firms that become multiunit for alternative reasons are likely to increase the concentration ratio as a by-product. The works of two scholars, Nutter (1969) and Lamoreaux (1985), cast some doubt on the causal explanation. Nutter's calculations of four-firm concentration ratios show little time-series correlation with the extent of multiunit activity. In addition, Lamoreaux finds a limited relationship between concentration and sustained market power, suggesting only a minor role for the pursuit of market power as an explanation for the rise of multiunit firms.

The remainder of the article is organized as follows. The next section presents systematic information on single-unit and multiunit firms. "Organization of Multiunit Firms" and "The Visible Hand" examine data on the organizational structure of multiunit firms as well as data on their central administrative organizations. "Determinants of Multiunit Activity" estimates the determinants

<sup>9</sup> Hounshell (1994) also finds that marketing rather than economies of scale provided the decisive advantage for the McCormick Harvesting Machine Company and the Singer Manufacturing Company.

of multiunit activities and examines the various explanations concerning the rise of multiunit firms.

### THE MODERN BUSINESS ENTERPRISE, 1919–1987

This section documents the growth of multiunit firms in the twentieth century using data from Thorp (1924), Thorp *et al.* (1941), and the Census Bureau's *Census of Manufactures* and the *Enterprise Statistics*. In the past, scholars like Chandler have relied extensively on the sample of the very largest firms to derive information concerning the extent and nature of the growth of the modern business enterprise.<sup>10</sup> The sources used in this section are derived from census data on a complete sample of firms. From these sources, it is possible to determine the extent of multiunit activity versus single-unit activity, the industry clustering of multiunit activity, the firm size of multiunit and single-unit firms, the number of establishments owned by multiunit firms, and how this information varies with different size classes of firms.<sup>11</sup>

Before the data on firms are presented, it is important to note that the data, those from Thorp (1924), Thorp *et al.* (1941), the *Census of Manufactures*, and the *Enterprise Statistics*, report information on different bases. The unit of measurement for the former data source is the "establishment," whereas for the latter, it is the "company" or the "firm."<sup>12</sup> In principle, these two types of data sources provide identical information only if all firms produce goods in a single industry. However, if firms operate in more than one industry, then the information reported by the two sources differs. For example, suppose that 90% of a firm's production or employment is carried out in nine chemical establishments and that the remaining 10% is devoted to one food establishment. The *Census of Manufactures* categorizes the nine chemicals and the one food plant in separate industries, noting that they all are part of a multiunit firm. On the other hand, the *Enterprise Statistics* classifies the food establishment as part of the chemicals industry, noting that 10% of the production of the firm is in a nonprimary industry.

#### *Extent of Single-Unit and Multiunit Activity*

The *Census of Manufactures*' Type of Organization reports, 1947–1987; Thorp (1924); and Thorp *et al.* (1941) provide the most complete information yet

<sup>10</sup> See Chandler (1977, 1990, 1994).

<sup>11</sup> See Kim (1999b) for information on single-unit and multiunit firms in the minerals, construction, transportation, wholesale trade, retail trade and other select service industries.

<sup>12</sup> The *Census of Manufactures* classifies data by establishment which is defined as follows: "As a rule, the term 'establishments' signifies a single plant or factory. In some cases, however, it refers to two or more plants operated under a common ownership and located in the same city, or in the same county but in different municipalities or unincorporated places having fewer than 10,000 inhabitants. On the other hand, separate reports are occasionally obtained for different lines of manufacturing carried on in the same plant, in which event a single plant is counted as two or more establishments. In every industry, however, the difference between the number of establishments and the actual number of plants or factories is negligible" (*Census of Manufactures*, 1935, p. 5). The *Enterprise Statistics* classifies data by firm or "company." For more detail, see the Appendix.

TABLE 1  
The Extent of Multiunit Activity in U.S. Manufacturing by Industry, 1919–1987

	Percentage of establishments operated as part of multiunit firms				Percentage of employees in establishments of multiunit firms		
	1919	1937	1958	1987	1937	1958	1987
20 Food	7.4	19.0	21.5	35.0	47.9	60.4	78.5
21 Tobacco	5.2	—	39.9	50.4	—	89.2	97.1
22 Textiles	9.9	13.1	23.6	31.0	41.1	65.9	78.1
23 Apparel	—	—	8.3	14.0	—	33.1	52.6
24 Lumber	7.1	14.0	5.6	10.0	33.4	33.2	45.3
25 Furniture	—	—	7.9	14.3	—	37.3	59.4
26 Paper	—	31.4	36.4	45.4	55.0	78.7	82.0
27 Printing	2.5	4.0	6.3	10.9	21.0	45.6	56.3
28 Chemicals	19.7	31.6	31.9	44.2	71.5	85.9	86.5
29 Petroleum	—	48.3	46.7	62.2	90.0	92.3	89.0
30 Rubber	—	23.0	17.3	29.5	68.2	71.3	67.6
31 Leather	7.7	15.0	15.8	22.0	43.5	50.8	66.7
32 Stone	8.8	21.8	22.1	31.8	54.3	66.0	68.7
33 Primary	8.0	18.2	27.0	36.7	64.0	84.7	80.6
34 Fabricated	4.2	8.9	11.8	19.6	49.1	55.3	61.1
35 Machinery	—	14.4	9.4	13.4	54.4	67.7	65.6
36 Electrical	—	—	23.3	26.9	—	81.4	80.4
37 Transportation	1.4	23.6	18.3	23.5	79.7	87.3	90.0
38 Instruments	—	—	16.7	25.1	—	79.3	84.7
39 Miscellaneous	6.3	8.5	7.7	8.6	40.6	60.4	45.7
All industries	7.4	15.4	14.0	21.9	51.1	65.5	73.1

*Note.* The industrial categories for the 1919 and 1937 data differ from those of the latter years. In 1919 the primary metals category is defined as iron and steel and their products, the fabricated metals category is metals and metal products other than iron and steel (in 1937, nonferrous metals and their products), the textiles industry includes apparel, the lumber industry includes furniture, and the machinery industry includes electrical machinery. See *Census of Manufactures 1919* and Thorp *et al.* (1941) for the product lists for 1919 and 1937, respectively. The data are classified by establishments.

*Sources:* Thorp (1924); Thorp *et al.* (1941); Bureau of Census: *Census of Manufacturers, Type of Organizations*, 1958, 1987.

available on the extent of multiunit activity by industry in terms of establishments and employment.<sup>13</sup> The data indicate that the relative importance of the multiunit over the single-unit firm depends upon the method used to measure this importance. If one measures the importance of multiunit activity by establishments, then the data in Table 1 demonstrate that single-unit firms dominate multiunit firms by a wide margin. In 1919, only 7.4% of establishments belonged to multiunit firms.<sup>14</sup> In 1929 and 1937, the percentages of establishments in

<sup>13</sup> Thorp (1924) and Thorp *et al.* (1941) used the original census returns to construct data on multiunit activities for 1919 and 1937.

<sup>14</sup> This estimate is likely to be biased downward since several industries, paper, petroleum, rubber, machinery, and electrical machinery, were omitted in Thorp's (1924) 1919 study.

multiunit firms were 12.0 and 15.4 respectively, and the percentage grew steadily from 14.6 to 21.9% between 1947 and 1987. On the other hand, if multiunit activity is measured in terms of employment, then the multiunit firms overtook the single-unit firms early in the twentieth century. In terms of employment, 48.0 and 51.4% of employees worked in establishments belonging to multiunit firms in 1929 and 1939 respectively; this figure rose from 56.0 to 73.1% between 1947 and 1987.<sup>15</sup>

The data in Table 1 show that the multiunit activity by establishments in 1919 was the highest in the chemicals industry followed by textiles (this includes apparel). Multiunit activity in the primary metal (iron and steel) industry was relatively high, but was lower than in stone, clay, and glass and was only slightly higher than in the leather industry. Multiunit activity in the food and lumber and wood (this includes furniture) industries was near average, while it was the lowest in the transportation industry. However, the clustering of multiunit activity in certain industries did not stay constant over time. By 1958, the industries characterized by the highest proportions of multiunit firm employment were petroleum, tobacco, transportation, chemicals, and primary metals, closely followed by electrical machinery, instruments, and paper. On the other hand, the industries which fell below average in multiunit activity in terms of employment were apparel, lumber and wood, furniture, printing, leather, and fabricated metal. Between 1958 and 1987, the pattern of industry clustering remained relatively stable, except for a few changes. The importance of multiunit activity in the food and textiles industries rose relatively more rapidly, whereas it declined for rubber and plastics and machinery.

### *Firm Sizes of Single-Unit and Multiunit Firms*

Multiunit activity measured in terms of employment was more important than that measured in terms of establishments because multiunit firms were considerably larger than single-unit firms. Table 2 shows that the size of single-unit firms was 21.8 and 17.8 employees per firm, whereas for the multiunit firms it was 1002.1 and 852.7 employees per firm for 1958 and 1987 respectively.<sup>16</sup> As the figures indicate, the average firm size of both single-unit and multiunit firms fell over the second half of the twentieth century. Multiunit firm sizes in the primary metal, rubber and plastics, leather, and electrical machinery industries declined substantially, while they decreased more moderately in the transportation, machin-

<sup>15</sup> The impact of the rise of multiunit firms on the economy depends upon whether single-unit and multiunit firms are good or poor substitutes for organizing production. See Kim (1999b) for a more detailed discussion on the social savings of multiunit firms.

<sup>16</sup> A general explanation for the sizes of firms involves an explanation for the firms' plant sizes as well as the number of plants owned by firms. This paper provides an explanation for why firms own many establishments (i.e., why firms are multiunit) but it does not provide an explanation for why firms' plant sizes differ across industries. An attempt at a full explanation for this latter phenomenon is beyond the scope of this article. See Kim (1995) for the historical trends in U.S. manufacturing plant sizes.

TABLE 2  
Firm Size for Single-Unit and Multiunit Firms: U.S. Manufacturing by  
Industry, 1958–1987

	Single-unit firms		Multiunit firms	
	1958	1987	1958	1987
20 Food	21.3	23.3	520.9	832.0
21 Tobacco	32.9	19.6	2243.8	8419.2
22 Textiles	55.7	35.2	1126.2	1056.3
23 Apparel	30.0	25.8	420.6	526.1
24 Lumber	11.2	12.5	271.2	280.0
25 Furniture	23.9	20.8	383.0	659.8
26 Paper	37.6	32.2	1172.0	1236.1
27 Printing	15.1	11.9	483.8	610.3
28 Chemicals	13.7	16.4	1073.0	1120.3
29 Petroleum	17.0	15.0	3212.4	2178.0
30 Rubber	29.1	26.2	1318.6	507.3
31 Leather	47.6	25.0	859.2	340.9
32 Stone	17.3	14.9	494.2	417.4
33 Primary	37.5	32.3	2885.9	975.6
34 Fabricated	22.5	19.6	656.3	369.7
35 Machinery	17.2	14.1	1060.7	615.6
36 Electrical	36.2	26.3	2336.5	1123.7
37 Transportation	39.8	22.7	5016.2	4190.1
38 Instruments	22.2	19.9	1309.6	1593.2
39 Miscellaneous	18.0	13.4	519.3	264.4
All industries	21.8	17.8	1002.1	852.7

*Note.* Firm size is defined as the number of employees divided by the number of companies in each industry category. Data are classified by firms.

*Sources:* Bureau of Census, *Enterprise Statistics*, 1958; Bureau of Census, *Company Statistics*, 1987, Table 6.

ery, fabricated metal, petroleum, miscellaneous, stone, clay, glass, and textiles industries. However, there were some exceptions to this declining trend. The size of multiunit tobacco firms showed the greatest increase, almost quadrupling between 1958 and 1987. Multiunit firm sizes of the food, apparel, lumber and wood, furniture, paper, printing, chemicals, and instruments industries also increased.

Multiunit firms were larger in terms of employment than single-unit firms because they owned and operated many plants and because the plants that they operated were considerably larger in size.<sup>17</sup> Data in Table 3 show that although the

<sup>17</sup> The data show that firm sizes of multiunit firms changed for the following two reasons. For the tobacco and food industries, firm sizes increased when both the number of establishments and plant size increased. Firm sizes of the petroleum, rubber and plastics, leather, primary metal, and electrical machinery industries fell when both the number of establishments and plant size decreased (see Tables 2 and 4). However, firm sizes of the furniture, paper, printing, and chemicals industries increased



TABLE 3  
Average Number of Establishments per Company for Multiunit Firms:  
U.S. Manufacturing by Industry, 1919–1987

	1919	1937	1958	1987
20 Food	4.2	5.8	9.2	12.9
21 Tobacco	4.6	—	12.2	55.4
22 Textiles	3.1	3.3	6.2	8.4
23 Apparel	—	—	4.1	6.7
24 Lumber	3.0	3.6	4.6	4.2
25 Furniture	—	—	4.3	7.7
26 Paper	—	4.6	8.1	12.2
27 Printing	3.4	3.5	4.3	8.0
28 Chemicals	3.8	5.7	11.7	14.8
29 Petroleum	—	6.5	162.2	71.1
30 Rubber	—	3.8	17.8	8.8
31 Leather	3.4	3.9	13.0	6.0
32 Stone	2.5	3.8	6.4	8.2
33 Primary	3.4	4.8	13.3	10.6
34 Fabricated	3.7	4.2	5.8	4.9
35 Machinery	—	3.6	9.6	6.8
36 Electrical	—	—	15.2	10.5
37 Transportation	4.4	6.2	10.3	20.1
38 Instruments	—	—	12.8	12.6
39 Miscellaneous	3.8	3.9	4.8	3.8
All industries	3.7	4.6	10.5	9.7

*Note.* The industrial categories for the 1919 and 1937 data differ from those of the latter years. In 1919 the primary metals category is defined as iron and steel and their products, the fabricated metals category is metals and metal products other than iron and steel (in 1937, nonferrous metals and their products), the textiles industry includes apparel, the lumber industry includes furniture, and the machinery industry includes electrical machinery. See *Census of Manufactures, 1919* and Thorp *et al.* (1941) for the product lists for 1919 and 1937, respectively. The figures for 1919 and 1937 only include manufacturing establishments.

*Sources:* Thorp (1924); Thorp *et al.* (1941); Bureau of Census, *Enterprise Statistics, 1958*; Bureau of Census, *Company Statistics, 1987*.

overall number of establishments operated by multiunit firms remained relatively stable at 10 between 1958 and 1987, a few industries had a considerably larger number of establishments. Firms in the petroleum industry operated 163 plants per firm in 1958, but that number fell to 71 by 1987. On the other hand, firms in the tobacco and transportation firms increased their number of establishments during this period from 12 to 55 and 10 to 20, respectively. Data in Table 4 show

despite a fall in plant size because the number of establishments rose. Firm sizes of the transportation and stone, clay, and glass industries decreased despite the acquisition of more establishments because their plant sizes fell.

TABLE 4

Plant Size of Single-Unit and Multiunit Firms: U.S. Manufacturing by Industry, 1947-1987

	Plant size of single-unit firms				Plant size of multiunit firms			
	1947	1958	1967	1987	1947	1958	1967	1987
20 Food	21.1	20.6	35.2	23.3	84.7	114.4	133.4	157.7
21 Tobacco	26.1	30.2	52.4	19.1	387.2	374.7	432.5	629.0
22 Textiles	85.4	52.5	64.9	35.2	375.2	327.8	323.8	278.9
23 Apparel	27.9	29.4	44.1	25.7	132.7	161.1	202.1	175.1
24 Lumber	18.2	10.9	25.6	12.5	56.3	91.6	105.5	92.6
25 Furniture	32.6	23.3	43.1	20.8	161.8	161.6	197.7	182.6
26 Paper	53.9	35.3	46.2	31.9	212.1	227.8	201.5	175.7
27 Printing	18.0	14.2	29.8	11.9	149.9	176.5	195.5	125.1
28 Chemicals	24.2	12.8	24.6	16.4	152.6	166.6	165.4	132.2
29 Petroleum	40.3	16.1	23.6	15.2	280.2	220.2	127.5	74.2
30 Rubber	93.8	27.1	41.8	26.2	1,050.7	321.1	232.4	130.5
31 Leather	46.4	45.1	72.4	25.0	239.3	246.7	262.2	178.1
32 Stone	20.1	16.1	26.2	14.8	155.1	110.3	105.5	69.8
33 Primary	64.4	35.6	53.2	32.2	682.1	534.3	495.8	231.2
34 Fabricated	33.9	21.6	35.5	19.6	264.3	200.4	193.6	126.1
35 Machinery	44.3	16.1	28.0	14.1	464.7	325.0	325.8	172.9
36 Electrical	68.1	33.7	49.6	26.3	667.7	484.8	527.0	293.7
37 Transportation	75.0	36.7	50.0	22.7	1,382.2	1,126.6	981.8	662.4
38 Instruments	41.8	20.9	36.2	19.8	423.8	400.5	353.0	324.6
39 Miscellaneous	23.3	17.2	32.3	13.4	160.1	314.5	171.7	120.6
All industries	30.6	20.7	36.3	17.7	227.4	240.7	250.8	177.7

*Note.* Plant size is defined as the number of employees divided by the number of establishments. The data are classified by establishments rather than by firms.

*Sources:* Bureau of Census, *Census of Manufactures, Type of Organizations*, 1947-1987.

that plant sizes of multiunit firms were many times larger than that of single-unit firms. In general, the plant size of multiunit firms was 7 to 10 times that of single-unit firms.

#### *Single-Unit and Multiunit Firms by Employment Size Class, 1958*

The study of firms by employment size distribution shows that employment was concentrated in very large firms. Although the majority of firms were organized as single-unit firms, these firms accounted for a considerably smaller fraction of the workforce in manufacturing in 1958. Table 5 shows that even though more than 90% of all firms were organized as single-unit firms, these firms were responsible for only one-fifth of all employees. Data in Table 5 show that the distribution of manufacturing employment among firms was highly skewed toward the largest multiunit, multi-industry firm. Multiunit firms which operated in only one industry accounted for 1.7% of firms, 4.0% of establishments, and 7.9% of employment. On the other hand, the multiunit, multi-industry firms which represented only 2.6% of all firms accounted for 28.1% of establishments

TABLE 5  
Single- and Multiunit Firms by Employment Size Class, 1958

	All	Less 20	20-99	100-249	250-499	500-999	1,000-2,499	2,500-4,999	5,000-9,999	10,000+
Total manufacturing										
Companies	269,834	194,750	57,582	10,674	3,559	1,604	955	333	196	181
Establishments	379,896	195,931	63,655	17,392	10,313	8,396	12,321	9,199	12,038	50,651
Emp. (1,000)	17,273	1,129	2,430	1,627	1,231	1,102	1,468	1,142	1,386	5,756
Est/co.	1.4	1.0	1.1	1.6	2.9	5.2	12.9	27.6	61.4	279.8
Firm size	64.0	5.8	42.2	152.4	345.9	687.2	1,537.6	3,430.4	7,072.5	31,802.8
Plant size	45.5	5.8	38.2	93.5	119.4	131.3	119.2	124.2	115.2	113.6
Percentages										
Companies	100	72.2	21.3	4.0	1.3	0.6	0.4	0.1	0.1	0.1
Establishments	100	51.6	16.8	4.6	2.7	2.2	3.2	2.4	3.2	13.3
Employees	100	6.5	14.1	9.4	7.1	6.4	8.5	6.6	8.0	33.3
	All	Less 20	20-99	100-249	250-499	500-999	1,000-2,499	2,500-4,999	5,000+	
Single-unit manufacturing										
Companies	258,210	193,795	54,013	8,049	1,836	433	75	6	3	
Establishments	258,210	193,795	54,013	8,049	1,836	433	75	6	3	
Emp. (1,000)	5,625	1,119	2,238	1,202	617	283	106	17	44	
Est/co.	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
Firm size	21.8	5.8	41.4	149.3	335.8	652.6	1,415.5	2,761.8	14,627.0	
Plant size	21.8	5.8	41.4	149.3	335.8	652.6	1,415.5	2,761.8	14,627.0	
Percentages										
Companies	100	75.1	20.9	3.1	0.7	0.2	0.0	0.0	0.0	
Establishments	100	75.1	20.9	3.1	0.7	0.2	0.0	0.0	0.0	
Employees	100	20.6	39.3	21.1	10.7	5.1	1.9	0.4	0.9	
	All	Less 20	20-99	100-249	250-499	500-999	1,000-2,499	2,500-4,999	5,000+	
Multiunit single-industry manufacturing										
Companies	4,448	294	1,573	1,247	726	412	197	28	11	
Establishments	15,008	653	3,769	3,587	2,806	2,057	1,470	492	174	
Emp. (1,000)	1,371	4	85	202	253	284	280	91	172	
Est/co.	3.3	2.2	2.4	2.9	3.9	5.0	7.5	17.6	15.8	
Firm size	305.4	12.1	54.0	161.9	348.2	689.0	1,422.6	3,267.1	15,630.9	
Plant size	91.3	5.4	22.5	56.3	90.1	138.0	190.7	185.9	988.2	
Percentage										
Companies	100	6.6	35.0	27.8	16.2	9.2	4.4	0.6	0.2	
Establishments	100	4.4	25.1	23.9	18.7	13.7	9.8	3.3	1.2	
Employees	100	0.3	6.2	14.7	18.4	20.7	20.4	6.7	12.5	
	All	Less 20	20-99	100-249	250-499	500-999	1,000-2,499	2,500-4,999	5,000-9,999	10,000+
Multiunit multi-industry manufacturing										
Companies	7,136	661	1,996	1,378	997	759	683	299	187	176
Establishments	106,678	1,483	5,873	5,756	5,671	5,906	10,776	8,701	11,898	50,614
Emp. (1,000)	10,278	7	107	223	362	536	1,082	1,034	1,325	5,602
Est/co.	14.9	2.2	2.9	4.2	5.7	7.8	15.8	29.1	63.6	287.6
Firm size	1,440.3	10.2	53.7	162.0	362.9	705.9	1,584.2	3,459.1	7,085.2	31,828.2
Plant size	96.3	4.5	18.2	38.8	63.8	90.7	100.4	118.9	111.4	110.7
Percentage										
Companies	100	9.3	28.0	19.3	14.0	10.6	9.6	4.2	2.6	2.5
Establishments	100	1.4	5.5	5.4	5.3	5.5	10.1	8.2	11.2	47.4
Employees	100	0.1	1.0	2.2	3.5	5.2	10.5	10.1	12.9	54.5

Source: Bureau of Census, *Enterprise Statistics*, 1958, Part 1, General Report, Table 8.

and 59.5% of all employees. Furthermore, even within the multiunit, multi-industry firms, a small number of firms whose firm size was larger than 5000 accounted for the majority of employment. The 363 multiunit, multi-industry firms whose firm sizes were larger than 5000 accounted for 67.4% of the total multiunit, multi-industry employment. Thus, these 363 firms, or 0.013% of all firms, accounted for almost 40% of all employment.

The very large firms attained their size by operating more establishments than firms in other size categories. The multiunit, multi-industry firms whose firm sizes were between 20 and 5,000 employees operated between 2 and 29 units per firm. However, firms whose sizes were between 5,000 and 10,000 owned 64 plants per firm while firms whose sizes were greater than 10,000 (averaging 31,828 employees per firm) owned 288 plants per firm. Surprisingly, the average plant size of the multiunit firm shows relatively little variation across firm sizes of above 1,000 employees per firm.<sup>18</sup> Thus, the large multiunit firms increased their firm sizes predominantly through increasing the number of establishments they operated rather than by operating larger establishments.

### ORGANIZATION OF MULTIUNIT FIRMS

The multiunit firms' organization, whether they are vertical, horizontal, or conglomerate, provide important clues to the causes of their rise and continued growth. This section estimates the extent to which multiunit manufacturing firms are vertically integrated forward into distribution, backward into raw materials or conglomerately. Forward integration is measured as the portion of wholesale trade accounted for by manufacturers' sales branches and offices as compared to that accounted for by wholesale merchants, jobbers, and other wholesale middlemen such as agents, brokers, and commission merchants. Backward integration into raw materials and conglomerate integration is measured as the inverse of a firm's specialization in its primary industry.<sup>19</sup> The data for calculating forward integration come from the *Census of Distribution*, whereas the data for calculating backward and conglomerate integration come from the *Enterprise Statistics*.

The data in Table 6 provide some evidence for Chandler's hypothesis that multiunit firms emerged and grew by vertically integrating forward into distribution. By the early twentieth century, roughly a third of the distribution of goods was handled by manufacturers' sales branches and offices. According to the *Census of Distribution*, the manufacturers' sales branches accounted for about

<sup>18</sup> Note that the plant sizes of multiunit firms in Table 5 are not comparable to plant sizes in Table 2. The figures in Table 5 are categorized by company, whereas the figures in Table 2 are categorized by establishment.

<sup>19</sup> The *Enterprise Statistics* assigns firms to one of the three-digit company industry categories by the level of their primary activity. It also reports data on the firms' activities in other industries. Unfortunately, it is extremely difficult to determine from the published sources whether industries are vertically or conglomerately related to the primary industry. Thus, the other industry category provides an upper-bound estimate on the importance of vertical integration and economies of scope.

TABLE 6  
Organizations Engaged in Wholesale Distribution of Manufactures, 1929–1987

	Wholesale trade sales (\$ million)			Percent accounted for by manufacturers' sales branches (percentage)		
	1929	1958	1987	1929	1958	1987
20 Food	19,048	57,786	430,377	19.2	21.8	22.3
21 Tobacco	1,692	5,439	25,465	45.8	32.1	23.0
22 Textiles	4,672	7,512	25,668	14.1	23.8	32.4
23 Apparel	2,140	5,126	44,515	20.6	17.9	27.5
24 Lumber	1,340	10,551 <sup>a</sup>	45,878	7.7	31.7	12.5
25 Furniture	345	4,814	18,630	25.0	30.8	15.6
26 Paper	1,133	6,659	83,173	28.4	36.8	43.8
27 Printing	203	—	14,696	16.6	—	30.6
28 Chemicals	2,563	16,577	165,602	32.8	67.4	57.0
29 Petroleum	3,366	—	234,874	1.9	—	39.5
30 Rubber	508	2,068	—	89.3	66.3	—
31 Leather	1,018	936	11,293	33.7	43.8	16.9
32 Stone	1,010	—	34,069	39.4	—	33.1
33 Primary	4,440	22,104	101,143	64.0	67.0	34.7
34 Fabricated	1,686	7,913	57,126	20.2	10.4	12.6
35 Machinery	2,850	23,460	307,379	44.1	39.1	36.3
36 Electrical	2,435	8,255	173,174	53.1	14.3	30.1
37 Transportation	1,869	21,420	309,389	12.8	64.8	46.8
38 Instruments	577	2,281	53,217	52.5	35.1	39.0
39 Miscellaneous	669	22,046	62,481	23.3	21.6	6.4
All industries	53,561	224,947	2,198,146	27.5	36.8	34.3

*Note.* The remainder is accounted for by the following wholesale organizations: merchant wholesalers, converters, exporters, importers, cash-and-carry, drop shippers, mail order wholesalers, wagon distributors, distributing warehouses, bulk tank stations, chain store warehouses, district and general sales offices, cooperative sales agencies, agents and brokers, assemblers and country buyers, and all other types.

<sup>a</sup> Lumber and Wood industry in 1958 includes stone, clay, and glass products.

*Sources:* *Census of Wholesale Distribution*, 1929, Tables 5–7; *Census of Business*, Wholesale Trade, 1939, Tables 1A; *Census of Wholesale Trade*, 1987, Table 1.

28% of sales in wholesale trade in 1929.<sup>20</sup> However, the proportion of sales accounted for by manufacturers' sales branches increased only marginally over the twentieth century. In 1987, the manufacturers' sales branches were responsible

<sup>20</sup> The Census Bureau also provides a slightly different picture of the distribution of manufacturers' sales. The figures reported in Table 6 are based on canvassing of wholesale establishments. The Census Bureau also asked manufacturing establishments to report on the distribution of their sales for 1929, 1935, and 1939. The percentage of sales accounted for by manufacturers' own branches or offices were 17.5, 21.7, and 23.8% for those respective years. See *Census of Business, Volume V, Distribution of Manufacturer's Sales, 1939*.

TABLE 7  
Industry Specialization Ratios in U.S. Manufacturing by Industry, 1958–1987  
(in Percentages)

	Industry specialization by establishments		Industry specialization by employees	
	1958	1987	1958	1987
20 Food	81.8	61.3	88.9	70.6
21 Tobacco	84.5	19.7	90.5	28.7
22 Textiles	85.9	68.7	87.9	73.3
23 Apparel	96.3	86.0	96.9	93.2
24 Lumber	97.4	96.0	94.1	90.0
25 Furniture	97.1	83.5	96.1	83.8
26 Paper	76.5	60.3	72.5	60.2
27 Printing	97.2	91.5	93.6	85.5
28 Chemicals	75.5	59.0	72.1	59.5
29 Petroleum	6.6	12.2	57.3	28.1
30 Rubber	60.4	71.1	78.6	81.2
31 Leather	69.1	77.1	92.9	93.1
32 Stone	90.1	84.1	83.7	75.0
33 Primary	74.1	58.0	74.4	70.2
34 Fabricated	93.8	88.6	82.8	79.1
35 Machinery	92.8	89.5	79.5	76.6
36 Electrical	68.4	74.0	72.4	72.3
37 Transportation	82.8	52.6	72.0	56.4
38 Instruments	78.8	63.5	78.0	52.4
39 Miscellaneous	76.6	95.1	72.1	91.8
All industries	82.4	81.9	78.5	71.3

Sources: Bureau of Census, *Enterprise Statistics*, 1958, Part 1, General Report, Table 4; Bureau of Census, *Company Statistics*, 1987, Table 8.

for about 34% of total sales. The wholesale merchants continue to distribute a great majority of the goods in the U.S. economy.

The data in Table 6 also show that the relative importance of distribution accounted for by manufactures' sales branches varied across industries and over time. In 1929, distribution through manufacturers' sales branches was higher in the rubber and plastics, primary metals, electrical machinery, instruments, tobacco, and machinery industries, whereas it was relatively low in the petroleum, lumber and wood, textiles, transportation, printing, and food industries. In 1987, distribution through manufacturers' sales branches was relatively more important in the paper, transportation, and chemicals industries, whereas it was less important in the miscellaneous, lumber and wood, furniture, fabricated metals, and leather industries.

The data from Thorp *et al.* (1941) and the *Enterprise Statistics* provide little evidence for the proposition that multiunit firms grew by vertically integrating backward into raw materials or conglomerately. The data presented in Table 7

indicate that firms were predominantly organized as horizontal rather than as vertical or conglomerate firms. In 1958, the specialization ratio, primary industry activity divided by total firm activity, when calculated by establishments and employment was 82.4 and 78.5% respectively; in 1987, the ratio was 81.9 and 71.3% respectively.<sup>21</sup> However, the extent of activity outside the multiunit firms' primary industries was high for firms in some industries. In 1958, the firms in the petroleum industry operated only 6.6% of their establishments and 57.3% of their employment in their primary industry. In 1987, the firms in the tobacco industry operated 19.7% of their establishments and 28.7% of their employment in their primary industry.<sup>22</sup>

### THE VISIBLE HAND

The rise of the modern multiunit firm was accompanied by the emergence of the central administrative organization (CAO), which controls, monitors, and coordinates the production decisions of establishments often located in different regions.<sup>23</sup> The multiunit ownership advantages could not be realized by merely changing ownership patterns from single-unit to multiunit firms. The decisions concerning materials purchasing, production, pricing, and marketing were administered from the firm's CAO through a managerial hierarchy. The substitution of markets with a managerial hierarchy came with costs. The data indicate that management costs were considerable and were positively correlated with firm size, the number of establishments, and involvement in other industries.

The size of management in CAOs increased as the importance of multiunit activity increased during the twentieth century. In fact, the increase in multiunit activity in manufacturing was accompanied by an even greater increase in the

<sup>21</sup> The *Enterprise Statistics* also provide a more detailed list of other industry activities in 1958. In addition to the aggregate firm specialization ratio, the *Enterprise Statistics* reports data on firms' activities in each of the 135 industries. According to this data, only 13 of 91 industries employed more than 30% of their employees in vertical or unrelated industries. A closer examination of the data indicate that if horizontal integration is measured by two-digit rather than by three-digit industries, the level of diversification falls sharply for firms in three industries: pulp paper and board, engines and turbines, and aircraft engines and propellers. For most firms that are diversified, vertical, or unrelated, employment occurred in other manufacturing rather than in nonmanufacturing industries. The major exceptions were the integrated petroleum industry, which employed 25% of its employment in the mineral and transportation industries and 17% in wholesale and retail trade, and the office machines industry, which employed 24% of its employment in wholesale and retail trade (see Kim 1999b). Also see Adelman (1955), Gort (1962), and Stuckey (1983) for different measures of vertical integration.

<sup>22</sup> Although the identify of firms is not revealed by the *Enterprise Statistics*, the decline in the specialization of firms in the tobacco industry is consistent with the actions of RJR Nabisco, who has diversified for regulatory reasons.

<sup>23</sup> The Census Bureau's *Enterprise Statistics* defines the central administrative offices as an establishment that is primarily engaged in general administrative, supervisory, purchasing, accounting, and related management functions performed centrally for other establishments of the same company. An auxiliary is an establishment which provides a supporting service—central warehouse, research laboratory, and so on—to the operating establishments of the same company, generally located separately from the establishment served.

TABLE 8  
Central Administrative Organization: U.S. Manufacturing, 1958 and 1987<sup>a</sup>

Industries	1958				1987			
	CAO	Adm.	R&D	Other	CAO	Adm.	R&D	Other
20 Food	63,337	86.0	3.1	10.9	110,244	69.9	7.6	22.6
21 Tobacco	7,521	88.2	5.0	6.8	18,643	52.6	12.5	35.0
22 Textiles	15,367	85.0	4.2	10.8	27,203	60.4	5.9	33.7
23 Apparel	7,519	85.7	0.1	14.1	33,893	60.9	1.6	37.5
24 Lumber and wood	5,677	96.7	1.1	2.2	13,658	62.3	4.5	33.2
25 Furniture and fixtures	3,005	91.3	0.0	8.7	12,006	66.9	4.8	28.3
26 Paper	22,254	92.0	2.3	5.8	43,420	65.5	22.2	12.3
27 Printing and publishing	7,118	79.4	2.5	18.2	88,077	62.2	1.8	36.0
28 Chemicals	85,635	74.0	24.0	2.0	214,317	56.4	25.0	18.6
29 Petroleum and coal	68,274	77.6	18.9	3.5	40,051	67.8	15.7	16.5
30 Rubber and plastics	8,267	90.1	9.1	0.8	28,711	60.9	16.4	22.6
31 Leather	9,319	82.4	0.1	17.5	6,738	55.6	1.9	42.5
32 Stone, clay, and glass	22,268	83.5	13.2	3.4	31,252	66.5	9.9	23.7
33 Primary metal	37,585	87.5	6.1	6.4	28,248	68.1	10.7	21.1
34 Fabricated metal	29,774	87.7	7.2	5.0	41,063	63.6	9.5	26.9
35 Machinery	35,524	83.1	12.7	4.1	158,985	65.0	13.1	21.8
36 Electrical machinery	77,838	46.9	46.0	7.2	127,953	58.1	15.1	26.8
37 Transportation	79,431	58.4	37.2	4.4	135,531	43.6	34.2	22.3
38 Instruments	7,436	84.5	9.7	5.8	60,306	60.4	15.0	24.6
39 Miscellaneous	7,637	92.0	5.5	2.5	11,950	61.6	8.4	29.9
All industries	600,786	74.9	19.4	5.8	1,232,249	60.0	16.0	24.0

*Note.* Other category includes electronic data processing, sales to customers directly, and other activities such as communications, trucking, repair, and so on.

*Sources:* Bureau of Census, *Enterprise Statistics*, 1963, Part 2, CAO and Auxiliaries, Table 3A; Bureau of Census, *Enterprise Statistics*, 1958, Part 2, CAO and Auxiliaries, Table 2; Bureau of Census, *Enterprise Statistics*, 1987, Auxiliary Establishments, Table 1.

<sup>a</sup> The CAO is given as number of employees; Adm., R&D, and Other are given as percentages.

work force of CAOs. The level of multiunit employment in manufacturing rose by 31%, from 10.1 to 13.8 million employees, between 1958 and 1987. However, over the same period, the number of CAO establishments and employment increased by 78.9 and 68.9% respectively. The data in Table 8 show that the majority of CAO employees were involved in management and fewer than 20% were involved in research and development. Moreover, research and development was concentrated in a few industries. In 1958, more than 80% of all employees in research and development in CAOs were accounted for by just four industries: electrical machinery, transportation, chemicals, and petroleum; in 1987, the number increased to six: chemicals, transportation, machinery, electrical machinery, paper, and instruments.

The costs of internalizing market functions with an administrative hierarchy are reflected in costs of management represented by the size of CAOs. The management costs of multiunit firms, estimated using the salary costs of CAOs, grew over



the latter half of the twentieth century. In 1958, the salary cost of CAOs was \$4.48 billion or 3.62% of manufacturing gross national product; in 1987, the respective figures rose to \$46.7 billion or 5.47%. The salary cost of the CAOs also rose with firm size. In 1958, each multiunit company which had fewer than 20 employees only expended on average \$46,000 on CAO employees while a firm with more than 10,000 employees expended \$24.5 million.<sup>24</sup>

Managerial intensity (or management costs) in multiunit firms rose as firm size increased, but rose even more as the number of establishments increased. Thus, the cost of coordinating the activities of plants located in different regions was higher than the cost of managing a similarly sized firm with only one plant. Managerial intensity also rose with a firm's activities in industries other than in its primary activity.<sup>25</sup> For firms in industries such as apparel, lumber, furniture, textiles, printing, and paper, management costs per firm were low and rose moderately as firm size increased, and for firms in the food, tobacco, rubber and plastics, leather, stone, clay and glass, fabricated metal, machinery, instruments, and miscellaneous industries, management costs increased more moderately with firm size. However, for the firms in the petroleum, transportation, and to a lesser extent in the instruments, chemicals, and primary metal industries, management costs per firm escalated with firm size.

### DETERMINANTS OF MULTIUNIT ACTIVITY

This section examines some of the potential causes of the rise and continued growth of multiunit firms by constructing cross-sectional data from the *Enterprise Statistics*, 1958; the *Census of Manufactures*, 1958; the *Concentration Ratios in Manufacturing Industry*, 1958; and the *Census of Transportation*, 1963. The basic unit of observation is the 90 three-digit industry categories from the *Enterprise Statistics*. Since the *Enterprise Statistics'* three-digit definitions differ slightly from those of the other two sources, comparable figures were constructed from the reported four-digit level data for the *Census of Manufactures*, the *Concentration Ratios in Manufacturing Industries*, and the *Census of Transportation*.<sup>26</sup> The importance of multiunit activity as a dependent variable is captured by the

<sup>24</sup> See Kim (1998b) for more detail.

<sup>25</sup> A simple regression of managerial intensity (CAO employee per company) on firm size (employee per company), number of establishments per firm, and percentage of employment in industries other than the firm's primary industry is reported below.

Managerial Intensity

Constant	Firm size	No. of est.	Other ind.	R <sup>2</sup>	N
-49.3	0.017	4.87	2.48	0.93	91
(0.63)	(6.14)	(23.3)	(3.27)		

Note. *t* Statistics are in parentheses.

<sup>26</sup> Given the relative stability of multiunit industry patterns over time, the regression was performed for 1958 only. For the regression, the number of industries was reduced to 90 due to the lack of data on the four-firm concentration ratio of ordnance.

TABLE 9  
Descriptive Statistics for Manufacturing Industries, 1958

	Mean	Standard deviation
Percentage of multiunit industry employment	61.6%	22.1
R&D intensity	0.44%	0.90
Sales intensity	4.47%	4.34
Managerial intensity	4.01%	3.26
Plant size (workers per est.)	137.6	398.9
Percentage employed in other industries	15.6%	10.8
Localization	0.37	0.16
Capital intensity (\$ per worker)	11,230	11,744
Energy intensity (\$ per worker)	482.8	671.4
Four-firm concentration ratio	33.7%	17.2
Raw material intensity (\$ per worker)	19,899	23,537
Percentage transported less than 200 miles	38.7%	17.0
Number of observations	90	90

*Note.* R&D, sales, and managerial intensities are given as the percentage of employees in these activities for multiunit firms. Plant size is defined as employment divided by establishment. Localization is Hoover's coefficient of localization calculated at the nine census division level (see Kim 1995). Capital is the value of gross depreciable assets, energy is the total cost of purchased fuels and electric energy, and raw material is the cost of materials consumed in manufacturing. The intensities (\$/labor) of these variables are derived by dividing them by production workers for each industry. Four-firm concentration ratio is the percentage of value of shipments accounted for by the four largest firms. Also note that the data on R&D intensity, sales intensity, and managerial intensity is categorized on company basis while the data on plant size, localization, capital intensity, and energy intensity is categorized on establishment basis.

*Sources:* Bureau of Census, *Census of Manufactures*, 1958; *Enterprise Statistics*, 1958; *Concentration Ratios in Manufacturing Industries*, 1958; and *Census of Transportation*, 1963.

percentage of industry employment in multiunit firms.<sup>27</sup> The independent variables include measures of research and development (R&D) intensity, managerial intensity, sales intensity, plant size, nonprimary industry activity, capital intensity, energy intensity, raw material intensity, industry localization, four-firm concentration ratios, and a proxy for transportation costs of final goods. Table 9 provides descriptive statistics of these variables.

These independent variables are motivated by the theories of multiunit firms proposed by Chandler (1977) and the literature on transaction costs and the pursuit of market power. As argued by Chandler, plant size measures economies

<sup>27</sup> One potential problem with this measure is that two industries which have the same percentage of multiunit activities, but which differ in their number of establishments, are treated as identical. For example, industries A and B may both have 70% of their employees in plants that are organized in multiunit enterprises but firms in industry A may have, on average, three establishments, whereas firms in B may have five. However, there is no a priori reason to believe that these two cases should be treated differently. Moreover, the dependent variable used in this study is likely to be superior to most alternative measures. For examples of other measures, see Scherer *et al.* (1975) and Caves (1996).

of scale, whereas the level of activity in nonprimary industry activity measures the importance of economies of scope and vertical integration. Since Chandler also emphasized the importance of other factors such as capital, energy, management, and raw material intensities, they are also included. Although the inability to measure most types of transaction costs precludes their inclusion in the regression analysis, two measures, sales and R&D intensities, are motivated by the transaction cost literature. This literature argues that certain proprietary assets, such as knowledge gained from marketing and selling skills or R&D, are difficult to transfer from one firm to another by sale due to the fact that they are, to some degree, public goods and are subject to opportunism.<sup>28</sup> Finally, despite its flaws, the four-firm concentration ratio is used as a proxy for market power.

This study also includes two additional variables, managerial intensity and industry localization, whose interpretation depends upon the theoretical framework one adopts. In the standard industrial organization literature, managerial intensity and industry localization may capture the multiunit economies of management and economies of coordinating activities that are geographically dispersed. However, in the transaction cost literature, these variables may capture the cost of monitoring and coordinating multiunit plants which often are geographically dispersed. This study also includes a proxy for the transportation cost of final goods.

Since the theories of multiunit firms do not specify how the dependent variable is related to the independent variables, there is an important issue of choosing a functional form.<sup>29</sup> To avoid placing an undue restriction on the functional form of the multiunit regression, a Box-Cox model was used. For a dependent variable,  $y$ , and independent variables,  $x_k$ , a Box-Cox model can be specified as follows:

$$y^{(\theta)} = \alpha + \sum \beta_k x_k^{(\lambda)} + u, \quad (1)$$

where

$$y^{(\theta)} = \frac{y^\theta - 1}{\theta}, \quad x^{(\lambda)} = \frac{x^\lambda - 1}{\lambda}.$$

If the values of  $\theta$  and  $\lambda$  are restricted to equal 1, then the equation reduces to a linear model; if  $\theta$  and  $\lambda$  are restricted to equal 0, then the equation reduces to a log-linear model.<sup>30</sup>

<sup>28</sup> See Caves (1996, pp. 3–4).

<sup>29</sup> Another econometric issue pertains to the use of group mean data. Since the *Enterprise Statistics* report only group means to preserve the anonymity of firms, the parameter estimates are less efficient due to the loss of information. However, the information loss may be minimal here. Information loss increases when variation within groups is discarded. To the extent that firms in the same industry category are likely to be similar, the estimates using the group mean data may lose little efficiency. See Greene (1993, pp. 277–279).

<sup>30</sup> The Box-Cox estimation first chooses the transformation which best fits the data by maximizing the appropriate log-likelihood function. The estimated value of the power transformation is then used to estimate the parameters of the regression. See Greene (1993).

TABLE 10  
Estimates of the Determinants of Multiunit Activities, 1958

Independent variables	Dependent variable: percentage of multiunit industry employment			
	Linear model	Box-Cox ( $\lambda = 1$ ) model	Box-Cox ( $\theta = \lambda$ ) model	Box-Cox ( $\theta = \lambda$ ) model
Constant	16.6*** (3.08)	-253.5** (1.71)	1.35*** (5.78)	1.41*** (5.07)
R&D intensity	2.05* (1.45)	85.6** (2.20)	0.006 (0.39)	0.006 (0.39)
Sales intensity	0.74*** (2.62)	22.1** (2.29)	0.008** (2.33)	0.01*** (3.33)
Managerial intensity	0.10 (0.19)	2.89 (0.20)	0.03 (1.19)	0.03* (1.43)
Plant size	0.49* (1.55)	0.20** (2.29)	0.15*** (5.87)	0.23*** (8.46)
Other industry employment	0.79*** (5.40)	25.9*** (6.28)	0.16*** (5.84)	0.17*** (5.72)
Capital intensity	0.05 (0.26)	0.002 (0.37)	0.05 (1.02)	0.07 (1.00)
Energy intensity	7.15*** (2.64)	0.24*** (3.28)	0.02 (0.64)	0.03 (0.63)
Localization	14.5** (1.76)	628.1*** (2.77)	0.01 (0.37)	0.01 (0.52)
Four-firm concentration	0.50*** (5.71)	14.4*** (6.00)	0.21*** (5.15)	—
Raw material intensity	-0.04 (0.49)	-1.90 (0.93)	0.02 (0.66)	0.03 (1.04)
Transportation less 200 miles	0.05 (0.71)	0.98 (0.48)	0.002*** (2.67)	0.002*** (2.26)
Adj- $R^2$	0.78	0.83	0.85	0.80
No. of obs.	90	90	90	90

*Note.* The coefficient on plant size was multiplied by  $10^2$  and the coefficients on capital and energy were multiplied by  $10^3$ .

*Sources:* See Table 9.

\*, \*\*, \*\*\* Indicate statistically significant coefficients at the 10, 5, and 1% levels, respectively.

Table 10 reports the regression estimates of the linear and Box-Cox models.<sup>31</sup> The estimates of the linear model and the classic Box-Cox model, where only the dependent variable is transformed (i.e., where  $\lambda = 1$ ), both suggest that most of the Chandlerian variables, the proxies for economies in marketing and R&D, and the proxy for market power are all statistically significant. However, the estimates

<sup>31</sup> Due to computational limitations, a full Box-Cox model, where  $\theta$  and  $\lambda$ 's are allowed to vary, could not be estimated. In addition, the variables, R&D, sales intensity, and the proxy for transportation costs, could not be transformed and their  $\lambda$ 's were set to 1. These variables could not be transformed because they contain observations which have a value of 0 and the Box-Cox regression estimate for  $\lambda$  was  $-0.08$ .

of a more general Box-Cox model, where both the dependent and independent variables are transformed, show slightly different results. Chandlerian variables, plant size, and other industry employment continue to be significant, but this is no longer true for energy intensity. The sales intensity continues to be significant, but not R&D intensity. The four-firm concentration ratio continues to be significant. In the linear model, the localization variable is significant, but in the general Box-Cox model, the transportation proxy variable is significant instead. Since the linear model can be rejected at the 5% significance level, this article focuses on the results of the general Box-Cox model.

The cross-sectional regression estimates of the Chandlerian variables, plant size, and other industry employment are statistically significant. In addition, their elasticities at the mean range from 0.14 to 0.20. However, it is not clear that these results confirm Chandler's interpretation of these variables. According to Chandler, the modern multiunit firms vertically integrated forward into distribution and backward into raw materials to take advantage of economies of scale and scope. As a result, the economic contribution of the modern multiunit firm is measured by estimating the increases in productivity or the fall in the costs of production brought on by these economies. However, a number of writers have questioned the logical link between economies of scale and multiunit firms.<sup>32</sup> If there are economies of scale in production, then these economies should be exploited, whether a firm is organized as a single-unit or multiunit firm.

The doubt as to the importance of Chandler's explanation concerning the rise of the modern multiunit firm is further raised by some basic information on firms reported in "The Modern Business Enterprise, 1919-1987" and "Organization of Multiunit Firms." First, contrary to claims made by Chandler, most firms did not integrate backward into raw materials to ensure a constant flow of inputs. Second, while the other industry variable is significant in the cross-sectional regressions, that is to be expected since, by definition, any firm which engages in other industry activity is a multiunit firm.<sup>33</sup> Rather, it is important to note that, contrary to claims made by Chandler, the data from Thorp (1941), Thorp *et al.* (1941), and the *Enterprise Statistics* suggest that multiunit economies of scope were small. Finally, information on multiunit firms by different size classes suggests a limited role for economies of scale. The data indicate that the very large multiunit firms within each industry became larger by owning a larger number of establishments rather than by operating larger establishments.

The regression estimates appear to support the hypothesis that firms became multiunit in order to attain market power: the proxy variable, four-firm concentration ratio is statistically significant and its elasticity at mean is 0.22. In addition, the fact that multiunit firms were predominantly organized as horizontal rather than as vertical combinations is also consistent with a market power explanation.

<sup>32</sup> See Schmitz (1993, p. 57).

<sup>33</sup> In essence, the other industry variable acts as a control variable so that the regression explains why multiunit firms are horizontally integrated.

However, the four-firm concentration ratio variable in the regression must be interpreted with extreme caution. It is virtually impossible to disentangle whether firms became multiunit in order to obtain market power or whether firms became multiunit for alternative reasons and increased the four-firm ratio as a by-product. However, there are several reasons to lean toward the latter explanation. First, Nutter (1969) finds that the extent of monopoly in manufacturing industries was virtually unchanged between 1899 and 1958, the period during which multiunit firms grew rapidly. Second, Lamoreaux (1985) argues that while many firms consolidated to escape extreme price wars during the turn of the twentieth century, few were able to maintain their market positions for long. Finally, if the main goal of multiunit firms was to restrict output and set higher prices, the size of CAOs as documented in "The Visible Hand" seems excessively large and unnecessarily costly.

The cross-sectional regressions provide little evidence for the existence of multiunit economies in management or of economies in coordinating geographically dispersed economic activities. It is more likely that multiunit firms' managerial intensities are likely to represent the cost of monitoring and coordinating multiunit establishments. Moreover, the regressions suggest that multiunit firms were correlated with a proxy for transportation costs of final goods, suggesting that the costs of coordinating and monitoring multiunit establishments increased with distance.

This article proposes that the essence of the modern multiunit firm lies in economies of marketing rather than of R&D, scale, or scope.<sup>34</sup> The proxy for marketing economies was statistically significant and its elasticity at the mean was between 0.05 and 0.08. In addition, the data in Tables 6 and 7 indicate that most multiunit firms were horizontal firms that produced and sold similar lines of products. Since proprietary assets such as brand names, trademarks, and reputation are difficult assets to transfer from one plant to another through the use of contracts, firms organized as multiunit firms to take advantage of these multiunit economies.<sup>35</sup> In general, the plant sizes of multiunit firms were larger than those of single-unit firms because economies of marketing were likely to be higher

<sup>34</sup> The Federal Trade Commission (FTC) data on multiunit retail firms also suggest that these firms became multiunit in order to take advantage of economies in marketing rather than to take advantage of economies of scale and scope. In addition, there is little evidence that multiunit retail chains became horizontally integrated to exploit market power. The FTC data on prices of goods sold by multiunit retail chains and independent stores show that multiunit retail chain-store prices were considerably lower than that charged by independent stores. The data compared identical grocery and drug items sold by chains and independents in four cities, Washington DC, Cincinnati, Memphis, and Detroit, between 1929 and 1931. For more details, see Kim (1999b).

<sup>35</sup> Franchising is a contractual solution to transferring trademarks and brand names. While an analysis of franchising is beyond the scope of this article, it appears that franchising is a less costly method of transferring trademarks or brand names when the number of distributor outlets becomes too numerous to be managed effectively through ownership by the parent firm (see Dicke 1992 and *Franchising in the Economy*). There was also a sizable market for transferring technology in the late nineteenth and the early twentieth centuries (see Lamoreaux and Sokoloff 1999).

when the output sizes of firms were higher. Thus, the economic contributions of the multiunit form of organization are more likely to be in terms of lower costs of distribution.

## CONCLUSION

The modern multiunit firm, which emerged during the last decades of the nineteenth century, continued to grow throughout the twentieth century.<sup>36</sup> Multiunit firms were predominantly organized as horizontal rather than as vertical or conglomerate firms and were clustered in industries such as petroleum, tobacco, transportation, chemicals, primary metal, electrical machinery, instruments, and paper. In addition, multiunit employment was skewed toward the largest firms. These very large firms accounted for a disproportionate share of multiunit employment because they owned considerably large numbers of plants. However, the growth in multiunit activities was accompanied by an even greater increase in employment in CAOs, which monitored and coordinated the geographically dispersed plants.

The analysis of the data on multiunit firms provides limited evidence for Chandler's hypothesis that multiunit firms vertically integrated forward into distribution and backward into raw materials in order to take advantage of economies of scale and scope. Data on firm size distribution and firm industry specialization provide little evidence of multiunit economies of scale and scope. The very large multiunit firms achieved their size not by operating a few very large plants, but by operating multiple establishments. Moreover, these establishments were more often likely to operate in the same industry. The multiunit firms concentrated the majority of their employment in their primary single three-digit industry.

Even when multiunit firms integrated forward into distribution, they did so to take advantage of economies in marketing similar products rather than those of scale and scope. Since advertising, brand names, and reputation could more easily be established for the selling of similar products, and since these proprietary assets associated with marketing are difficult to contract, horizontal multiunit firms integrated forward into distribution. Multiunit firms also tended to form in industries with economies of scale since economies in marketing were likely to be more significant in these industries. On the other hand, multiunit firms did not integrate backward into raw materials since purchasing these supplies through the market was relatively easy.

The rise of the modern multiunit firm greatly increased the visibility of firms in the modern economy. However, it is unclear that the arrival of the multiunit

<sup>36</sup> The emergence of the multiunit firm was aided by significant developments which lowered the costs of coordinating and monitoring multiunit firms for all industries. Numerous advances in communications technologies and innovations in management and accounting techniques significantly lowered the costs of operating geographically dispersed plants. See Chandler (1977), Williamson (1985), Yates (1989, 1991), Levenstein (1991), and Johnson (1991).

method of organizing production in manufacturing was necessary for modern economic growth. While the evidence of the rapid displacement of single-unit firms by multiunit firms in a cluster of industries may signal the relative efficiency of the latter organizational form, it unfortunately does not indicate the magnitude of the multiunit firm's superiority. The economic importance of multiunit firms depends upon whether multiunit and single-unit firms are a reasonably good substitute means of organizing production. The evidence presented in this article suggests that the contribution of modern multiunit firms on economic growth is likely to hinge on the magnitude of economies of marketing rather than those of scale and scope.

## APPENDIX

A number of factors were responsible for the development of the company statistics program: the conducting of economic censuses by mail instead of field enumeration; the integration of economic censuses of manufacturing, retail trade, wholesale trade, construction, minerals, and service industries; and the availability of high-speed computers. The census bureau, for the purposes of administrative control in conducting a census by canvass mail, found it more convenient to obtain individual establishment reports on a centralized basis from the main office of each firm which owned and operated more than one establishment.<sup>37</sup> As a result, information on firms and their establishments were systematically collected.<sup>38</sup> However, information on firms was limited to each census type of activity until all the economic censuses were integrated. For example, until the coordination of all the censuses, a manufacturing firm's size was limited to its ownership and control of manufacturing establishments. With the coordination of all economic censuses, it became possible to construct information on firm activities in all sectors of the economy.<sup>39</sup> Finally, without the advent of computers, the information on firms could not be constructed and released on a timely basis.

In 1954, the census bureau began providing information on firms with the publication of the *Enterprise Statistics*. The *Enterprise Statistics*, unlike the *Census of Manufactures*, reports data classified by firm or "company." The *Enterprise Statistics'* definition of the company consists of all operating establishments (such as factories, mines, stores, sales offices, etc.) including any administrative or auxiliary activities (such as central offices, central warehouses, research

<sup>37</sup> See Thorp *et al.* (1941, pp. 102–103).

<sup>38</sup> Moreover, the identification of company–establishment relationships was also required in order to determine whether the tabulated totals could be published without disclosing confidential data from individual companies.

<sup>39</sup> In 1929, the first separate census of business on retail and wholesale trade and the first census of construction were taken. In 1933, various services were also included in the census of business. The integrated economic census began in 1954 covering the censuses of retail and wholesale trade, selected service industries, manufactures, and mineral industries.



and development laboratories, and other support services) which were reported as being under common ownership or control.<sup>40</sup>

Classifying multiunit firms by industry categories was slightly more problematic than classifying their separate establishments. The Census Bureau discovered that if the multiunit firms were categorized at the four-digit industry level, only a small fraction of a firm's activities might be in a four-digit industry and that the information would prove to be rather uninformative. Thus, rather than assigning firms to one of the census of manufactures four-digit industry codes, the Census Bureau created a more aggregate set of industry categories for the *Enterprise Statistics*. The Census Bureau established several criterion for a company classification system which has changed only marginally over the years. One criteria was that at least 50 to 75% of a firm's activities were in a specific industry category. Thus, the classification system attempted to minimize multi-industry activities by construction. However, these criterion were not enforced to unreasonableness and for many industries, one or several of the criterion were violated.<sup>41</sup> The industry categories for the firm resembles, in general, the three-digit industry categories.<sup>42</sup> For example, in 1958 there were 135 industry categories in the company classification system: 91 in manufacturing, 5 in mining, 11 in wholesale trade, 16 in retail trade, and 11 in other services.<sup>43</sup> The industries that were out of scope of the census surveys were agriculture, forestry, fisheries, construction, transportation, communication, electric, gas, sanitary services, finance, insurance, real estate, and miscellaneous services.<sup>44</sup> Once the firms were categorized using the company classification system, however, the establishments were categorized using the census's four-digit industries.

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<sup>40</sup> To aid in identifying establishments under common ownership or control, the following set of questions were asked for each establishment report: (a) does this company operate more than one place of business under the same Employer Identification Number (item on the Employers Quarterly Tax Report, Treasury Form)?; (b) does this company own or control another company?; and (c) is this company owned or controlled by another company? See the link of census establishment in *Enterprise Statistics* and IRS corporation data.

<sup>41</sup> See *Enterprise Statistics*, 1958.

<sup>42</sup> In manufacturing, 38 out of 91 industries correspond directly to the census of manufacture's three-digit SIC category. Many of the remaining industry categories correspond to the census of manufactures' four-digit industries, the sum of four-digit industries (sometimes across the three-digit categories), and the sum of three-digit industries. All the company statistics categories are less aggregated than the SIC two-digit categories (except for tobacco) and in no instance were categories across the two-digit industries aggregated to form a company statistics category.

<sup>43</sup> When the Census Bureau, due to disclosure laws, reported information by category estimates, the midpoint of these estimates are used.

<sup>44</sup> If a firm's primary activity was in one of the out of scope activities, then it was excluded from the *Enterprise Statistics*. However, data on out of scope activities are included when examining the firms in the census scope industries.

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