

PART I

THE GROWTH OF INDUSTRIAL
ESTABLISHMENTS

19

I.

THE EMERGENCE OF THE FACTORY SYSTEM.

In 1791 Alexander Hamilton, as Secretary of the Treasury, in obedience to an order from the House of Representatives, submitted a "Report on Manufactures." Although this document was intended primarily as a plea for a governmental policy encouraging manufacture in the United States, it gives some indication of the industrial development of the country at that time. The Revolutionary War had created, of necessity, many infant industries. Although a considerable number were unable to survive the foreign importation of goods which succeeded the artificial period of protection afforded by the war, Hamilton found 17 industries which had "grown up and flourished with a rapidity which surprises, affording an encouraging assurance of success in future attempts." In addition to these "manufactures carried on as regular trades," which included those industrial activities which one might expect to be first developed in a new country—the manufacture of agricultural implements and fire-arms, the work done by sawmills and gristmills, the dressing of skins and hides, etc.—Hamilton describes "a vast scene of household manufacturing which contributes more largely to the supply of the community than could be imagined without having made it an object of particular inquiry * * * . It is computed in a number of districts that two-thirds, three-fourths, and even four-fifths of all the clothing of the inhabitants are made by themselves."

A similar report was called for by the House of Representatives in 1809, and in the following year Albert Gallatin, then Secretary of the Treasury, submitted a statement which has been called "an admirable summary of the condition of American manufactures at that date."¹ The significant feature of this report is the list of reasons which Gallatin assigns for the admittedly tardy development of manufactures in the United States. They are five: (a) The abundance of land; (b) the high price of labor; (c) the scarcity of capital; (d) the preference for agriculture and commerce during the Continental War; and (e) the force of tradition and habits. But these reports submitted by the Secretaries of the Treasury were necessarily inaccurate and unsatisfactory, and

¹ Census of 1900, Manufactures, vol. 1, p. xlix.

it was soon realized that an adequate report could be obtained only by a special inquiry.

The census of manufactures taken by the United States Government had its beginning in 1810, when Congress, by the act of May 1, 1810, authorized the expenditure of \$40,000 to compensate the marshals and their assistants for taking "an account of the several manufacturing establishments and manufactures within their several districts, territories, and divisions." A later act, that of May 16, 1812, authorized the expenditure of \$2,000 "to employ a person to digest and reduce" the data, the first digest of manufactures. No copy of the schedule² used in collecting the data is known to exist, but the inquiries at that census, as shown by the printed digest made by Tench Coxe in 1813, were confined apparently to the kind, quantity, and value of goods manufactured.

Gallatin estimated that the value of the products of American manufactures in 1809 exceeded \$120,000,000, while Tench Coxe, in his digest of the census of 1810, sets a figure of \$198,613,471. Such figures seem small indeed as compared with those of 50 years later, which were 20 times as large, and of 100 years later, when the value of products had multiplied considerably over 100 times.

The factory system had been introduced into this country in the later part of the eighteenth century. In 1789 Samuel Slater, called by President Jackson the "father of American manufactures," set up in Pawtucket, R. I., the first complete cotton machinery to operate in this country, constructing the machinery entirely from memory of that in England.

Although the factory system made rapid strides in England, it developed in the United States at a much slower rate. The system really gained its first foothold during the period of embargo and the War of 1812, which was followed by the first protective tariff, that of 1816. The manufacture of cotton and wool passed rapidly from the household to the mill; but the methods of domestic and neighborhood industry, even in these lines of manufacture, continued to predominate down to and including the decade between 1820 and 1830. The rapidity with which the factory system expanded is evidenced by the growth of the cotton

² In census terminology, the schedule is the form used by the enumerator in recording the answers to the census inquiries. The manufactures schedules contain definitions and state the questions exactly.

industry, the number of spindles in operation in Massachusetts during this period being as follows:³

1830.....	340,000
1840.....	624,000
1850.....	1,288,000
1860.....	1,688,500

It was not until about 1840 that the factory method of manufacture was widely introduced in miscellaneous industries and began gradually to force from the market the handmade products with which every community had hitherto supplied itself.

It is unfortunate that census records fail to throw any light on this period of industrial development. The manufactures census of 1820 was so defective that Congress did not authorize the publication of the figures.⁴ The enumeration of 1830 omitted the inquiry into manufactures entirely. In 1840 the census included a discussion of manufactures in a group entitled "Schedule of Mines, Agriculture, Commerce, Manufactures," but no attempt was made even to foot up the aggregate value of the products returned.⁵ Consequently, until the middle of the century no adequate figures concerning industrial development can be found in the census reports except for the year 1810.

There are at least three official sources, however, from which supplementary information can be drawn. These sources consist of data on the urban and rural distribution of the population, the occupational distribution of the population, and, finally, the issuing of patents.

Any considerable development of manufacturing under the factory system should reflect itself in the urban and rural distribution of the population. In Table 1 is given, for each census year, the percentage of the population in communities of 8,000 inhabitants or more. The beginning of the nineteenth century recorded very little urban concentration. There was no marked increase up to 1820, but since that date the rate of increase has been enormous, reaching its height during the decade 1840 to

³ *Tariff History of the United States*, F. W. Taussig, p. 141.

⁴ *Twelfth Census of the United States*, 1900 Vol. VII, p. 1.

⁵ No attempt was made to foot up the aggregate value of the products returned at the census of 1840, for the reason that for certain items only the quantities of products and not the values were given. In 1855 Robert C. Morgan and W. A. Shannon, at the request of the Secretary of the Treasury, estimated the total value of manufactures for 1840. In preparing their estimates the values of those classes for which values were not reported in 1840 were calculated from unit prices current in that year. (Vol. VII, p. 1, *Twelfth Census reports*.) The result of this estimate was a figure for the total value of manufactured products of \$483,278,215. Excluding "manufactures produced in families," the total value of manufactured products in 1840 was \$454,254,835. Based on this total the period 1810 to 1840 recorded a trebling of the value of manufactured products, while the increase between 1840 and 1850 was 124 per cent. These percentages correspond closely to the rate of development indicated by other sources.

1850, but still continuing at such a rate that the end of the nineteenth century found one-third of the total population in these larger communities. It is interesting to note that the decade from 1840 to 1850 returned the highest rate, since it was approximately at that time that the factory system was being most rapidly introduced.

TABLE 1.—POPULATION OF PLACES OF 8,000 INHABITANTS OR MORE: 1790 TO 1920.

CENSUS YEAR.	Total population.	PLACES OF 8,000 INHABITANTS OR MORE.			CENSUS YEAR.	Total population.	PLACES OF 8,000 INHABITANTS OR MORE.		
		Population.	Number of places.	Per cent of total population.			Population.	Number of places.	Per cent of total population.
1790.....	3,929,214	131,472	6	3.3	1860.....	31,443,321	5,072,256	141	16.1
1800.....	5,308,483	210,873	6	4.0	1870.....	38,558,371	8,071,875	226	20.9
1810.....	7,239,881	356,920	11	4.9	1880.....	50,155,783	11,365,698	285	22.7
1820.....	9,638,453	475,135	13	4.9	1890.....	62,947,714	18,244,239	445	29.0
1830.....	12,866,020	864,509	26	6.7	1900.....	75,994,575	25,018,335	547	32.9
1840.....	17,069,453	1,453,994	44	8.5	1910.....	91,972,266	35,570,334	768	38.7
1850.....	23,191,876	2,897,586	85	12.5	1920.....	105,710,620	46,307,640	924	43.8

It is possible to extend this study to the different occupational groups. In 1787 Tench Coxe had estimated that less than one-eighth of the population was engaged in manufactures, fishing, navigation, and trade, a category so broad that it includes nearly everything save agriculture. Since that time the Census Bureau has collected data on this subject (Table 2). Unfortunately, these data are not strictly comparable, but, nevertheless, they do shed some light on the situation. The data for 1820 and 1840 may be used comparatively and indicate, even at that early period, a moderate increase in the proportion of the population engaged in manufacture. Likewise, the next two censuses, those for 1850 and 1860, furnish data which can be compared. However, the 1850 census of occupations included only males, while the 1860 census included both males and females. Since the bulk of female labor at that time was engaged in agriculture, the inclusion of women in 1860 kept the percentage engaged in manufactures lower than would be recorded in a strictly comparable figure. The censuses from 1870 to date are comparable and demonstrate a continual increase in the proportion of the employed group which is engaged in manufacturing and mechanical industries.

TABLE 2.—PERSONS GAINFULLY EMPLOYED IN MANUFACTURING AND MECHANICAL INDUSTRIES: 1820 TO 1920.

CENSUS YEAR.	GAINFULLY EMPLOYED (OVER 10 YEARS OF AGE).			CENSUS YEAR.	GAINFULLY EMPLOYED (OVER 10 YEARS OF AGE).		
	Total number.	In manufacturing and mechanical industries.			Total number.	In manufacturing and mechanical industries.	
		Number.	Per cent of total.			Number.	Per cent of total.
1820 ¹	2,490,770	349,326	14.0	1880.....	17,392,099	3,784,726	21.8
1840 ¹	4,798,869	791,749	16.5	1890.....	23,318,183	5,678,468	24.4
1850 ²	5,329,506	1,291,875	24.2	1900.....	29,073,233	7,085,309	24.4
1860 ³	8,235,557	2,062,828	25.0	1910.....	38,167,336	10,807,642	28.3
1870.....	12,505,923	2,677,765	21.4	1920.....	41,614,248	12,818,524	30.8

¹ Free and slave, regardless of age. ² Free males over 15 years of age. ³ All free over 15 years of age.

In addition to the above data material is available relative to the issuance of patents. On April 10, 1790, because of the ardent advocacy of Thomas Jefferson, the first American patent system was founded. Records have been kept, of necessity, and, to the extent that activity in manufacturing begets technical improvements, the increase in the issuing of patents as demonstrated in Table 3 may be taken as indicating industrial development within the country. These data indicate that the period during which the invention of technical improvements was increasing at the fastest rate was from 1850 to 1870. Although this development has continued to the present time, it has been at a much slower rate. These facts bring additional evidence to justify the hypothesis that the middle of the nineteenth century saw the factory system firmly established in the United States and destined to much greater expansion, though at a somewhat slower rate.

TABLE 3.—PATENTS AND DESIGNS ISSUED, BY DECADES: 1790 TO 1920.

PERIOD.	PATENTS.		DESIGNS.		PERIOD.	PATENTS.		DESIGNS.	
	Num-ber.	Per cent of in-crease.	Num-ber.	Per cent of in-crease. ¹		Num-ber.	Per cent of in-crease.	Num-ber.	Per cent of in-crease. ¹
During 1790...	3	.....	.....	.....	1851-1860.....	23,140	289.4	1,025	201.5
1791-1800.....	304	.....	.....	.....	1861-1870.....	79,612	244.0	3,181	210.3
1801-1810.....	1,093	259.5	.....	.....	1871-1880.....	125,520	57.4	7,535	136.9
1811-1820.....	1,783	63.1	.....	.....	1881-1890.....	207,850	65.6	8,357	11.0
1821-1830.....	3,044	70.7	.....	.....	1891-1900.....	220,840	6.3	13,374	60.0
1831-1840.....	5,652	85.7	.....	.....	1901-1910.....	315,351	42.9	7,250	-45.8
1841-1850.....	5,942	5.0	340	.....	1911-1920.....	383,885	21.8	15,781	117.6

¹ A minus sign (—) denotes decrease.

Certain of these changes in technique were of profound influence on industrial development. During the first third, and in some districts half, of the century hay was cut with a scythe and grain with a sickle or cradle, and both were hand-raked; but the mowing machine, the horserake, and the reaper appeared soon thereafter. In 1833 the first reaping machine was patented, although its use was not extensive until some time later. Threshing machines were in fairly general use by 1840 and separators by 1850.⁸ The use of steam instead of horses as a source of power for driving threshing machines began as early as 1860. The manufacture of agricultural implements was an old industry, but its nature was entirely changed by these new developments.

In the iron and steel industry important developments also appeared. Until nearly 1840 iron was smelted only by charcoal, the process differing little from that employed in colonial times. It was not until the decade between 1830 and 1840 that puddling was generally introduced into the United States. The rails used for the construction of the early railways were made of iron and were only gradually superseded by steel rails. It is interesting to note that all the steel rails used in this country prior to 1860 were obtained by importation. Steel rails were first manufactured in the United States in that year, and the first Bessemer steel was produced in 1864.

Changes in industrial technique have occurred in nearly all industries, though with varying importance and at different times. In many cases such changes appear to be cumulative in nature. An improvement at one point in a process often stimulates development at some other point, because it demonstrates the economy resulting from technical improvement, and more especially because it upsets the customary balance within the total process, focusing attention on some step which in particular retards the total activity. The tendency toward improvement of industrial technique was clearly indicated in the figures for the issuing of patents, previously cited. It is probable that the major technical changes were made in the nineteenth century, and more and more the present-day developments take on the nature of

⁸ The early threshing machines, sometimes called "quill wheels" and sometimes "ground hogs," merely threshed the grain without separating it from the straw and chaff; that is to say, the machine delivered the threshed grain mingled with the straw and chaff. It was practically nothing more than the cylinder and concave of the threshing machine. The separator was a threshing machine which not only threshed the grain but separated it from the straw and chaff. All threshing machines in use for many decades past have been of this type. The term "threshing machines" and "separators" now have the same significance, the threshing machine of early days, which did not separate, having long since passed out of existence.

refinements. As early as 1900 the Census Bureau reported concerning the cotton-spinning industry:

"No radical improvement has been made during the past decade in spinning machinery of either kind, nor do the makers of such machinery anticipate great changes in the future. The mule is already a perfect machine, in the sense that it is automatic in every part and that in none of the various operations which it performs without human guidance does any part act as a drag upon the other."⁷

Cotton spinning was practically the first industry to introduce the use of power machinery, and it is therefore of particular interest to note that it has reached a point beyond which no further improvement is visible. In most industries, of course, such mechanical perfection has not been attained, but the great changes in technique, particularly along lines of applying power, began early in the nineteenth century and spread rapidly, until all industries had been affected.

The data concerning American manufactures in the first half of the century have been shown to be very scanty. With the year 1850, however, the Census Office undertook the task of compiling more detailed information concerning the manufacturing activity of this country. In the censuses of 1850, 1860, and 1870 the inquiries relating to manufactures were contained in a schedule entitled "Products of Industry," which comprehended the products of manufactures, mines, and the fisheries. The collecting of data concerning manufactures still remained, however, a mere adjunct to the population enumeration. This task was put in the hands of the assistant marshal (enumerator) for each district, who was paid in the case of the census of 1870 but 15 cents for each establishment "fully taken and returned." Since these persons usually had no technical knowledge, and since the rate of payment was so ridiculously low this method of collecting data proved unsatisfactory. A schedule relating to products of industry was used, comprehending all products of industry except agriculture (provided for in a separate schedule) and including, in addition to manufactures, the products of mines and the fisheries. Finally, in 1880, separate special agents were appointed to record the data dealing with manufactures. In 1880 and 1890 a general schedule for manufactures was used, and in 1890, for the first time, an individual and separate return for each establishment was required. The number of inquiries on the schedule had

⁷ Census of Manufactures, 1900, Vol. IX, Part III, p. 47.

grown from 3 in 1810 to 88 in 1890, not counting the special inquiries made in certain industries.

The records of these censuses are graphically presented in Chart A, and the actual numerical data are given in Tables 4 and 5. A change in scope of the census of manufactures which occurred after 1899 makes it impossible to extend these tables beyond that year (see p. 35).

In Table 4 the changes in number of establishments and in number of wage earners during the latter half of the nineteenth century are stated. Before noting more than the outstanding fact that the number of wage earners has increased more rapidly than the number of establishments, with an increasing average number of wage earners per establishment, it is important to note the conditions at the various censuses.

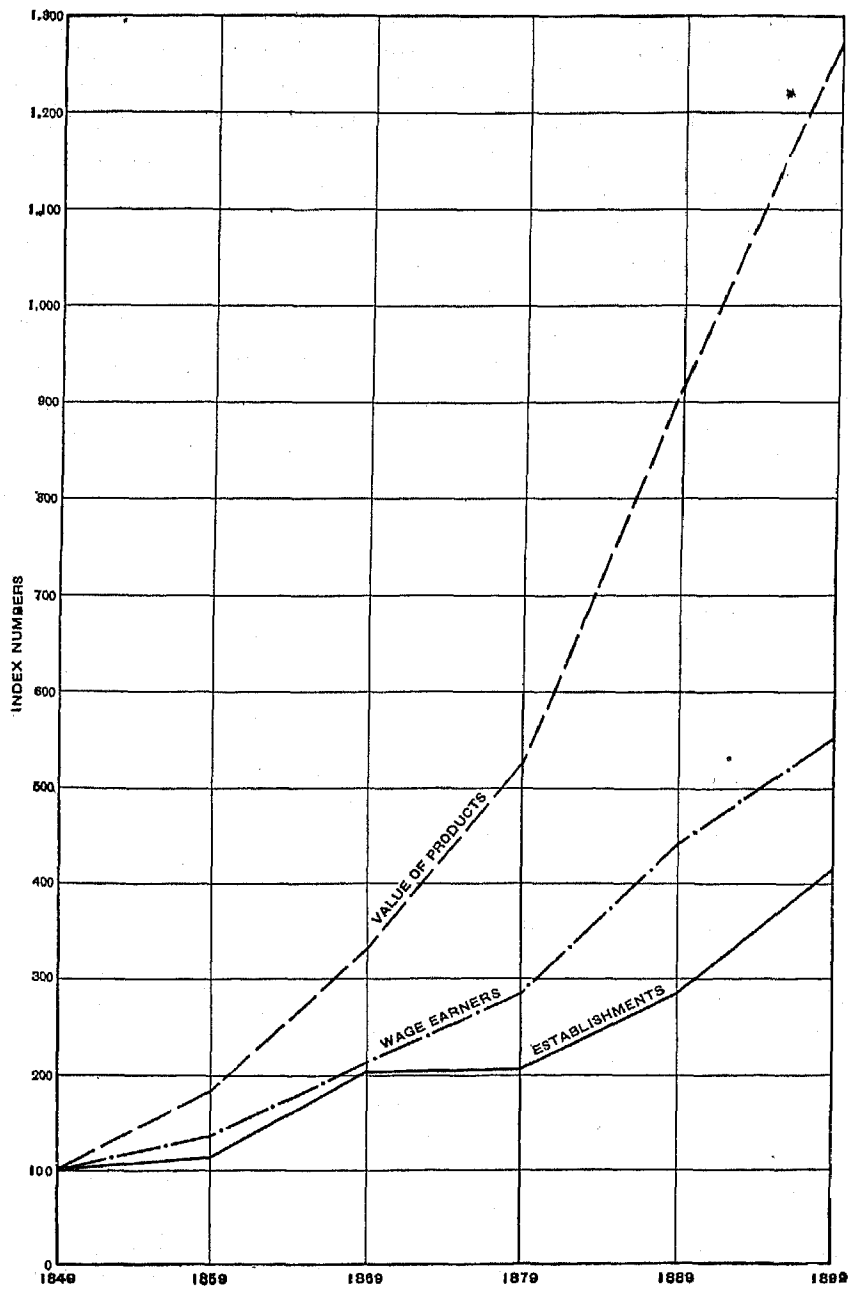
TABLE 4.—SIZE OF ESTABLISHMENTS MEASURED IN TERMS OF WAGE EARNERS:
1849 TO 1899.

CENSUS YEAR.	FACTORIES AND HAND AND NEIGHBORHOOD INDUSTRIES.					
	Establishments.		Wage earners.			
	Number.	Per cent of increase.	Total (average number). ¹	Per cent of increase.	Average per establishment.	Index number based on average per establishment in 1849.
1849.....	123,025	.....	957,059	.....	7.8	100.0
1859.....	140,433	14.1	1,311,246	37.0	9.3	119.2
1869.....	252,148	79.6	2,053,996	56.6	8.1	103.8
1879.....	253,852	0.7	2,732,595	33.0	10.8	138.5
1889.....	353,405	40.0	4,251,535	55.6	12.0	153.8
1899.....	512,191	44.1	5,306,143	24.8	10.4	133.3

¹ For method of computing average, see p. 30.

There was an enormous expansion of industry during the Civil War decade, as shown by the increase of 56.6 per cent in wage earners. The fact that the average number of wage earners per establishment decreased during this period requires some explanation. It is to be found, not in industry, but in the nature of the census enumeration. It has been the custom of the Census Office to exclude from the list of manufacturing establishments all enterprises having a product of less than \$500 during the census year. The census of 1860, however, had failed to record many artisans whose activity entitled them to record in the census of manufactures. In the census of 1870, however, the

CHART A.—NUMBER OF ESTABLISHMENTS, WAGE EARNERS, AND VALUE OF PRODUCTS: 1849 TO 1899.



omissions appear to have been proportionally less numerous, first, because of a general advance in prices between 1860 and 1870, bringing many enterprises which had not been recorded in 1860 incontestably above the \$500 minimum, and, second, because of stringent instructions to the assistant marshals concerning establishments of this smaller type. The addition of a considerable number of small establishments naturally resulted in a decrease in the average number of wage earners per establishment and is doubtless the explanation for the low figure of 1869.⁸

From 1869 to 1879 there appeared practically no increase in the number of manufacturing establishments. This did not seem at all strange at the time, for it was felt that the internal development of industry was the important factor. The growth of sash, door, and blind factories, of machine-made furniture factories, of a contract system of construction, and other similar forms of consolidation of enterprises was taking place, and therefore no further increase in number of establishments was to be expected. An interesting demonstration of this tendency is quoted from the 1880 census report, as follows:

"While the settled area of 1840 was but a little over one-half that of 1880, and the value of its manufactured products perhaps not more than one-seventh or one-eighth, there were almost as many gristmills at the former as at the latter date, and an even greater number of sawmills.

"The figures for the two censuses are as follows:

	1840	1880
Gristmills	23, 661	24, 338
Sawmills	31, 650	25, 708

"This fact shows strikingly the tendency to the concentration of productive industry during the past 40 years, due chiefly to the increased facilities for transportation." ⁹

The census of 1890 showed a further increase in all respects. This is particularly noticeable in the hand trades and in certain industries of which the census had taken no previous cognizance, such as bottling, steam-railroad repairs, china decorating, etc.

With regard to the average number of wage earners shown for 1899, a technical difficulty may be raised. Prior to that census the average number of wage earners represented the average

⁸ Not only were smaller establishments included because of more careful census taking, but also because the census of 1870 followed the method of counting as an establishment each separate branch of industry, whether conducted independently or in connection with other manufacturing operations. Thus, "leather tanned" and "leather curried" being considered separate establishments, 2,741 fictitious establishments grew out of the effort to show the separation of these industries. The total number of establishments which were thus added by the separation of combined industries was 3,871, a relatively small number.

⁹ *Census of Manufactures, 1880, p. viii.*

number employed while the plant was in operation. For 1899 and 1904 the method was to divide the sum of the monthly averages by 12. In 1909, 1914, and 1919 the number of wage earners carried on the pay roll on the 15th of each month was reported, and the average was calculated by dividing the sum of these numbers by 12. In many industries such changes would make little difference, but in the highly seasonal occupations the variation between the averages calculated by the several methods is considerable.

In the light of these various comments, then, Table 4 is of significance chiefly in that, despite an increasing efficiency in returns and a reduction of the omissions, which were naturally the smaller enterprises, the average number of wage earners per establishment shows, in general, an upward trend throughout the period.

The data given in Table 5 project this development of industry from a somewhat different angle from that of Table 4. It is quite conceivable that the capital equipment of an establishment might considerably increase without an increase in the number of wage earners. Such a development should be reflected in the product of the establishment. During the period under discussion the value of the products of manufacturing establishments showed an enormous increase.

TABLE 5.—SIZE OF ESTABLISHMENTS MEASURED IN TERMS OF VALUE OF PRODUCTS: 1849 TO 1899.

CENSUS YEAR.	Factories and hand and neighborhood industries.					
	Establishments.		Value of products.			
	Number.	Per cent of increase.	Total.	Per cent of increase.	Average per establishment.	Index number based on average per establishment for 1849.
1849.....	123,025	.....	\$1,019,106,616	.....	\$8,284	100.0
1859.....	140,433	14.1	1,885,861,676	85.0	13,429	162.1
1869.....	252,148	79.6	3,385,860,354	79.5	13,428	162.1
1879.....	253,852	0.7	5,369,579,191	58.6	21,152	255.3
1889.....	355,405	40.0	9,372,378,843	74.5	26,371	318.3
1899.....	512,191	44.1	13,000,149,159	38.7	25,382	306.3

In addition to the fluctuations in census adequacy the use of this index involves certain other difficulties. It will at once be recognized that the value of products is a function of both the

physical production and the price level. An increase in the figure, therefore, may be only a reflection of an increase in price level. An increase in the value of products may or may not be significant as an indication of industrial growth.

The first grave difficulty appeared in 1870, when the value of products was recorded in terms of greenback dollars, whose exchange value in gold dollars was in the ratio of 5 to 4. In the figure given in Table 5 this deficiency has been corrected, according to an estimate made by the superintendent of the census, reducing the original figures by 20 per cent, "the average premium on gold being for the 12 months—June 1, 1869, to May 31, 1870—25.3 per cent, which is closely equivalent to a discount on currency of 20 per cent."¹⁰

Correcting for the monetary unit, however, does not eliminate the factor of price fluctuations. An attempt to correct for this element was made and recorded in the census of 1870, but unfortunately the method used was not reported. "After much thought and extensive inquiry on the subject and the application of numerous tests the superintendent is disposed to regard * * * the increase in manufacturing production in the 10 years to be represented by 52 per cent."¹¹ The fact that no change in the value of products per establishment occurred during the decade 1859-1869 must be explained by the inclusion of many smaller establishments in the census of 1870, as discussed above.¹²

After 1870 the price level fell until nearly the end of the century, so that the figures for value of products are, if anything, not indicative of the full extent of the increase in physical production. It is interesting to note this striking increase, however, not only as indicating enormous industrial development, but also as demonstrating the gradual concentration of industry into fewer and larger enterprises. During the last half of the century the value of products per establishment trebled not because of price fluctuations, which were, as stated above, in the opposite direction, but rather because of improved machine methods and the development of larger units of economic enterprise.

During the last 50 years of the century the number of wage earners multiplied about five and one-half times, whereas the value of products increased to nearly 13 times its earlier figure.

¹⁰ Census of 1890, Part I.

¹¹ Ninth Census of the United States. Industry and Wealth, 1870, p. 379.

¹² See footnote 8. p. 30.

Such an inequality indicates in a very definite way the vast improvement in technique, and particularly the part played by the capital investments which appear in the factory system. It is not probable that wage earners were much more skillful as laborers in 1900 than in 1850, but with the assistance of new capital equipment they were able greatly to increase their per capita output.¹³

It is possible to obtain some indication of the increase in capital equipment from the census data concerning power used in manufacturing establishments. The increase in power requirement is a natural result of the introduction of machinery into the manufacturing process. Figures of horsepower used 1869 to 1899 are presented in Table 6.

TABLE 6.—HORSEPOWER USED IN MANUFACTURING INDUSTRIES: 1869 TO 1899.

CENSUS YEAR.	PRIMARY HORSEPOWER.						Electric horse-power operated.
	Total.	Owned.			Rented.		
		Steam engines and turbines. ¹	Water wheels and motors.	Internal-combustion engines.	Electric.	Other.	
1869.....	2,346,142	1,215,711	1,330,431	.....	.....	.....
1879.....	3,410,837	2,185,458	1,225,379	.....	.....	.....
1889.....	5,938,635	4,586,089	1,255,045	8,930	.....	88,571
1899 ²	10,097,893	8,189,564	1,454,112	134,742	182,562	136,913	

¹ Figures include "other" owned power as follows: 1889, 4,784 horsepower; 1899, 49,985 horsepower.

² Excludes power reported for custom sawmills, gristmills, and cotton ginneries. The amount of power used in these establishments is comparatively small.

Primary power, as the term is used by the Bureau of the Census, comprises all power which is primary from the standpoint of the manufacturing establishment using it. It includes, therefore, not only the power of engines and water wheels owned and operated by the manufacturing establishments, but also rented power—that is, the power of electric motors run by purchased current or any other power that may be purchased or rented from outside sources. Primary power does not include the power of electric motors which are run by current generated in the same establishment since the inclusion of such power would result in duplication.

In the 30 years here presented, total horsepower more than quadrupled, steam engines and turbines being responsible for

¹³ The Census Bureau has collected statistics concerning capital invested. However, these data are considered defective and according to the Census Bureau, "have no great significance." A discussion of them is presented on p. 37. These data, unsatisfactory as they are, indicate the enormous increase in capital investment suggested above, being for 1849, \$533,245,351, and for 1899, \$9,813,834,300.

nearly all of the development. Electric motors and internal-combustion engines were just beginning to be introduced at the end of the nineteenth century. Although much of this power development may have been required merely by the adapting of old hand machinery to automatic action, it is doubtless true that for the most part, the enormous increase in horsepower was accompanied by a corresponding increase in capital equipment, taking the form of new, larger, and more productive machinery.

There is perhaps no better method of summarizing the development than to show the shifting proportions of the three main branches of economic activity—agriculture, manufacturing, and mining. In Table 7 these data are given. In 1850 the product of the activity of manufacturing establishments—"value added by manufacture," in census terminology—represented but one-quarter of the total product for the three groups.¹⁴ Manufacturing increased at a much faster rate than agriculture, and at the close of the century the value added by manufacture had actually surpassed the total value of agricultural products. The greatest height in manufacturing yet reached was reported in 1919, when manufacturing activity yielded more than one-half of the total return for these three major economic activities. The United States entered the twentieth century a manufacturing nation. The events of the twentieth century have served only to intrench her in that position.

TABLE 7.—PERCENTAGE DISTRIBUTION OF TOTAL OF VALUE ADDED BY MANUFACTURE, VALUE OF AGRICULTURAL PRODUCTS, AND VALUE OF MINERAL PRODUCTS: 1850, 1870, 1899, AND 1919.^a

CENSUS YEAR.	PERCENTAGE OF TOTAL COMPRISING—			CENSUS YEAR.	PERCENTAGE OF TOTAL COMPRISING—		
	Value added by manufacture.	Value of agricultural products.	Value of mineral products.		Value added by manufacture.	Value of agricultural products.	Value of mineral products.
1850.....	26.5	71.5	1.9	1899.....	46.7	45.6	7.7
1870.....	40.1	56.3	3.5	1919.....	51.0	42.6	6.4

^a For explanation of method of obtaining data, see Appendix B, Increase of Population in the United States, 1910-1920, Census Monograph I.

¹⁴ The value of products is not always a satisfactory measure of either the absolute or the relative importance of a given industry, because only a part of this value is actually created by the manufacturing processes carried on in the industry itself. Another part, and often by far the larger one, represents the value of the materials used. For many purposes, therefore, the best measure of the importance of an industry, from a manufacturing standpoint, is the value created by the manufacturing operations carried on within the industry. This value is calculated by deducting the cost of the materials used from the value of the products. The figure thus obtained is termed in the census reports "value added by manufacture."

II.

THE SIZE OF INDUSTRIAL ESTABLISHMENTS.

The opening of the twentieth century found the factory system a firmly established institution in the United States. The study of industrial development is no longer one dealing with the introduction of factories, but rather with their nature and growth.

Congress officially recognized the factory system in 1902. By act of March 3, 1899, Congress had provided for "a census of the * * * manufacturing, [and] mechanical * * * products." Laws back to 1850 had required a census of establishments of "productive industry"; but the Act of Congress, approved March 6, 1902, which directed the taking of the 1905 census of manufactures, required: "That in the year nineteen hundred and five, and every ten years thereafter, there shall be a collection of the statistics of manufactures, *confined to manufacturing establishments conducted under what is known as the factory system*, exclusive of the so-called neighborhood and mechanical industries."

The problem of defining the "factory system" was by no means a simple one. Before this time the census had been excluding establishments which produced less than \$500 per annum. To set a minimum value-of-products figure and designate as factories all establishments producing above the set figure would be most arbitrary. The records of capitalization were felt to be unreliable. The number of wage earners fluctuates to such a degree as to make difficult any definition based on such grounds. The distinction finally made rested not on the grounds of size, but rather upon the relationship between the enterprise and its market. To quote from the census of 1905: "The fact that an establishment manufactured for the *general* market has been the controlling factor to determine whether it should be included in the census of 1905." An exact statement of the nature of establishments included in the censuses of manufactures from 1905 to the present time will be found in Appendix A. The census of 1900 was revised by retotaling the returns, omitting the neighborhood and mechanical industries, and thereby was made comparable with the more recent tabulations.

The above survey of the gradual development in the scope of the census of manufactures, and the particular change which took place at the beginning of the twentieth century, is sufficient to indicate the field covered by the records. It is likewise important to have clearly in mind the exact nature of the unit of economic enterprise employed by the Census Bureau. This unit is known as the industrial establishment. It is defined as follows:

"As a rule, the term 'establishment' represents a single plant or factory, but in some cases it represents two or more plants which were operated under a common ownership or for which one set of books of account was kept. If, however, the plants constituting an establishment as thus defined were not all located within the same city, county, or State, separate reports were secured in order that the figures for each plant might be included in the statistics for the city, county, or State in which it was located."¹

In general, then, the qualification test of an establishment is that it must keep a single set of books of account and must not extend geographically outside a single locality.

As a rule, the establishment corresponds to an industrial plant, as that term is ordinarily used; in other words, it represents a single plant or mill and represents it as an entirety. Two or more plants are, however, counted as a single establishment only when they are operated under a common ownership and their accounts are kept in a single set of books and when such a grouping will not render inaccurate the geographical and industrial records of the census; that is to say, the establishments must be in the same community and active in the same industry. On the other hand, in some cases a single plant is treated by the Census Bureau as comprising two or more establishments. This is done only where the plant has departments engaged in different branches of industry and keeps separate records. The object of such subdivision is to obtain, as far as practicable, complete statistics for each industry distinguished by the census classification. Instances in which such separations are most frequently made are: Manufacture of coke in connection with blast furnaces; operation of blast furnaces and of tin-plate mills in connection with rolling mills; manufacture of clothing in connection with textile mills; manufacture of sulphuric acid in connection with copper smelting, etc. According to the Census Bureau:

¹Census of Manufactures, 1919.

"The number of instances where a single plant has been treated as consisting of two or more establishments is comparatively small, and the fictitious increase in the number of establishments due to this method of enumeration is much more than offset by the fictitious decrease due to the practice of counting two or more distinct plants operated under a single ownership as a single establishment."²

Having discussed the industrial activities which are included in the scope of the census and the units of economic enterprise used, there remains but one question to be met before attacking the problem of the changing size of economic enterprises. The method of measure must be determined. A man may be measured in terms of height, weight, chest expansion, salary, college degrees, etc. There are at least four conceivable methods for measuring size of establishments:

1. *The capitalization of the establishment.*—Data of this nature have been collected by the Census Bureau. However, the fact that many concerns have no capital accounts whatever; the variation of accounting methods, particularly in dealing with depreciation; the continual divergence between original cost, cost of reproduction, market value, etc., which often can not be standardized; the presence of "watered" stock; and the error due to the omission of rented buildings and rented land all tend to make this measure an inadequate one.

2. *Value of products or value added by manufacture per establishment.*—These measures have one decided advantage, namely, that they express the activities of all plants in terms of a common denominator, the dollar. Two cautions are necessary, however, with regard to the use of these indexes: First, that such measures take into account more than the physical volume of business. The manufacturer of bricks appears to operate a smaller establishment than the jewelry manufacturer, because the value of each unit of his product is much less; Second, these measures, when used in comparing activity at different points of time, permit a variation due to changes in the price level. It is very difficult to make adjustments for such price changes, for price records have been very inadequate even in recent years.

3. *Number of wage earners per establishment.*—This is a very significant measure of the size of an establishment, although, like the value-of-products measure, it presents only one aspect of the situation. In a case where improved technique has resulted in a greater output by the same number of men the plant has increased

²Census of 1910, Vol. VIII, p. 20.

in size, at least in terms of its social significance, although the wage-earner index would show no increase. One caution must be made in regard to this measure. The census regards the number of wage earners as the average number *during the year*. In highly seasonal industries, such as lumbering and canning, the number of wage earners per establishment would appear to be much lower than it actually is during the time of activity, because of the depressing influence of the inactive months.

4. *Physical product per establishment*.—Similar to this type of measurement are such measures as amount of material used or machinery in operation, etc., expressed not in monetary but physical units. Unfortunately, the census does not make such records for all industries, but in those cases in which it does this measure is of considerable value, representing the effect of increased wage earners plus the effect of increased technique plus the effect of increased capital equipment and involving no difficulties due to changes in price level. On the other hand, this type of measure has one main defect not inherent in the wage earner or value-of-products classification, namely, that it furnishes no common denominator for comparison between different industries.

Considering these four methods of measurement, the first has been entirely discarded because of its inadequacy, but the remaining three have been used, the last two whenever possible, with the value of products substituted for the physical product when no figures on that subject are available.

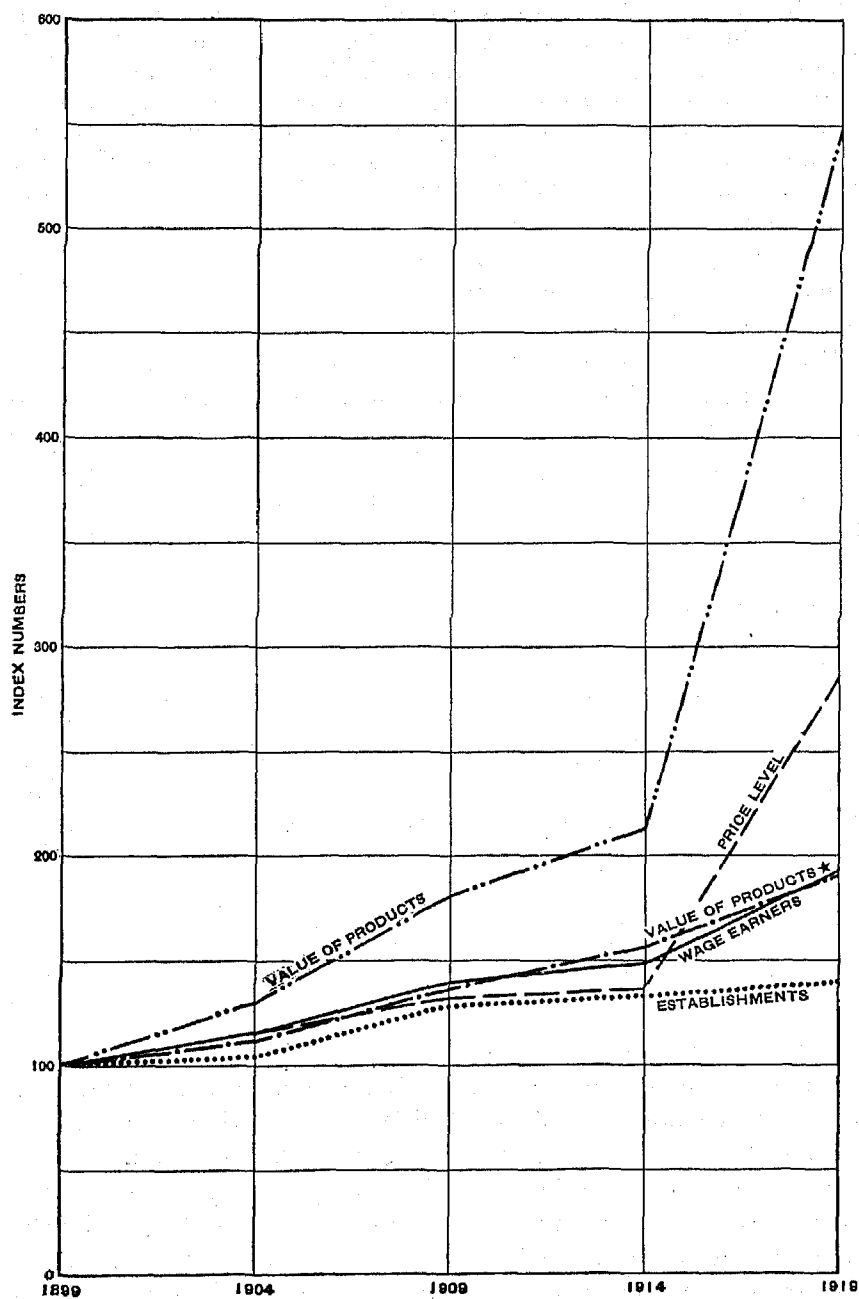
The data which have been collected by the Census Bureau covering the 20-year period 1899 to 1919 are given in Tables 8 and 10 and are presented graphically on Chart B. Since these figures deal with factories only, excluding the hand and neighborhood trades, they can not be compared with the figures of censuses taken prior to 1900.

Of the 512,191 establishments recorded by the census of 1900, 207,514, or approximately two-fifths, were factories. It is interesting to note that this small proportion of establishments reported 88.8 per cent of all the wage earners and 87.8 per cent of the total value of products.

In Table 8 are given the increases in establishments and in wage earners.³ The increase in establishments during the five

³ The increase in size of a census establishment does not necessarily indicate a larger factory in which a larger number of men work under one superintendent. It may mean a multiplication of factories in one locality under one ownership. Therefore, when a corporation adds a new plant in a new locality, the effect may be a reduction in average size, whereas if the new plant had been constructed within the same community as the other activities of the concern it would have increased the average size of establishments.

CHART B.—NUMBER OF ESTABLISHMENTS, WAGE EARNERS, AND VALUE OF PRODUCTS: 1899 TO 1919.



*Value of products represents production expressed in dollars adjusted on 1914 basis. See Table 10, p. 43.

years 1904 to 1909 is explained by an improvement in census methods.

"Although * * * the scope of the manufactures census of 1909 was intended to be the same as that of the census of 1904, it seems probable that the canvass for the later year was somewhat more complete than that for the earlier year, particularly with reference to small establishments, and that the increase in the number of establishments shown for a good many industries may be due, in whole or in part, to this more complete canvass rather than to a change in actual conditions."⁴

Although this more complete return evidenced itself in many industries, it was most pronounced in the returns for sawmills, which increased by nearly 14,000, or 73.1 per cent.

The first 15 years of the century indicate no very definite trend toward larger establishments, if measured in terms of wage earners. The greatest development came during the war period, when the average number of employees per establishment increased from 25.5 to 31.4. While the increment to establishments was only about 15,000, more than 2,000,000 workers were added to the pay rolls.

TABLE 8.—SIZE OF ESTABLISHMENTS MEASURED IN TERMS OF WAGE EARNERS: 1899 TO 1919.

CENSUS YEAR.	FACTORIES, EXCLUDING HAND AND NEIGHBORHOOD INDUSTRIES.					
	Manufacturing establishments.		Wage earners.			Number based on average per establishment in 1899.
	Number.	Per cent of increase.	Total (average number). ¹	Per cent of increase.	Average per establishment.	
1899.....	207,514.....		4,712,763.....		22.7	100.0
1904.....	216,180.....	4.2	5,468,383.....	16.0	25.3	111.5
1909.....	268,491.....	24.2	6,615,046.....	21.0	24.6	108.4
1914.....	275,791.....	2.7	7,036,247.....	6.4	25.5	112.3
1919.....	290,105.....	5.2	9,096,372.....	29.3	31.4	138.3

¹ For method of computing average, see p. 30.

A detailed examination of this change between the years 1914 and 1919 is made possible by Table 9. The wide variation between different industry groups in terms of the average number of wage earners per establishment is worthy of note. These wide differences are graphically demonstrated in Chart C. Obviously, an average for all industry is a somewhat misleading figure. These industry groups, textiles, liquors, and vehicles for land transporta-

⁴ Census of 1910, Vol. VIII, p. 20.

tion, showed smaller establishments in 1919 than in 1914. In the vehicle group the decrease in size is due to the addition of automobile repairing, which increased greatly the number of establishments without increasing the number of wage earners in the same proportion. The manufacture of liquors and beverages was obviously affected by the prohibition amendment. Since the wage earners figure is a yearly average, in certain industries the increase may represent merely a more nearly complete utilization of plant than in 1914, a less favorable business year. The great increase in the miscellaneous group was due largely to the presence of the electric-apparatus industry, the steel shipbuilding industry, and the tire industry in this group. In each of these industries there was an enormous expansion between 1914 and 1919, accomplished largely by the formation of establishments of considerable size.

TABLE 9.—SIZE OF ESTABLISHMENTS MEASURED IN TERMS OF WAGE EARNERS, BY INDUSTRIAL GROUPS: 1919 AND 1914.

Group number.	GENERAL GROUP OF INDUSTRY.	ESTABLISHMENTS.		WAGE EARNERS.				
				Total (average number). ¹		Average per establishment.		
		1919	1914	1919	1914	1919	1914	Per cent of increase. ²
	All industries.....	290,105	275,791	9,096,372	7,036,247	31.4	25.5	23.1
1	Food and kindred products.....	61,312	59,317	684,672	496,234	11.2	8.4	33.3
2	Textiles and their products.....	28,552	23,463	1,611,309	1,507,374	56.4	64.2	-12.1
3	Iron and steel and their products...	20,120	17,719	1,585,712	1,061,058	78.8	59.9	31.6
4	Lumber and its remanufactures....	39,955	42,036	839,008	833,529	21.0	19.8	6.1
5	Leather and its finished products...	6,397	6,758	349,362	307,060	54.6	45.4	20.3
6	Paper and printing.....	36,403	37,196	509,875	452,900	14.0	12.2	14.8
7	Liquors and beverages.....	6,354	7,562	55,442	88,152	8.7	11.7	-25.6
8	Chemicals and allied products.....	12,224	12,374	427,008	299,569	34.9	24.2	44.2
9	Stone, clay, and glass products....	12,529	14,747	298,659	334,612	23.8	22.7	4.8
10	Metals and metal products other than iron and steel.....	10,667	10,023	339,469	262,154	31.8	26.2	21.4
11	Tobacco manufactures.....	10,291	13,951	157,097	178,873	15.3	12.8	19.5
12	Vehicles for land transportation....	21,152	9,909	495,939	263,076	23.4	26.5	-11.7
13	Railroad repair shops.....	2,368	2,011	515,709	365,902	217.8	181.9	19.7
14	Miscellaneous industries.....	21,781	18,725	1,227,111	585,755	56.3	31.3	79.9

¹ For method of computing average, see p. 30.

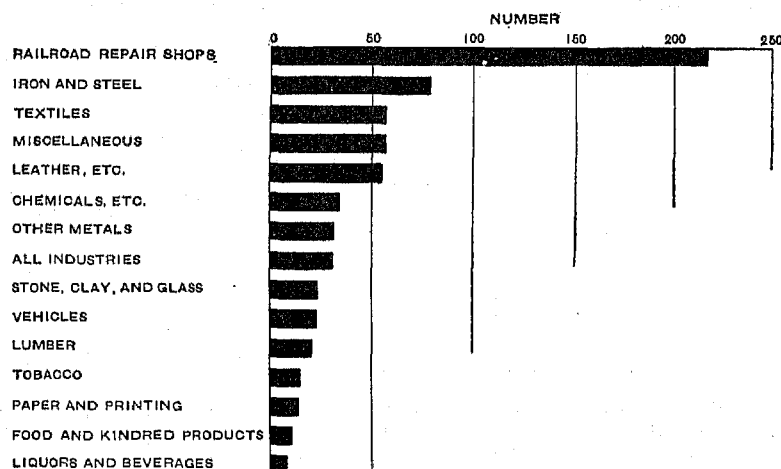
² A minus sign (-) denotes decrease.

The large addition in the food and kindred products group is of particular significance. It is due chiefly to an increase of 62,000 employees in the slaughtering and meat-packing industry, although over 30,000 wage earners were added in the confectionery and ice-

cream industry during the same period. Of the various industries listed as manufacturing food and kindred products only three, with a total of less than 2,500 wage earners in 1914, showed decreases during the five-year period in number of wage earners employed.

As might be expected, the war particularly developed the metal industries. In the iron and steel industry the average number of employees per establishment increased from 59.9 to 78.8, while in the "metals and metal products, other than iron and steel" group the average increased from 26.2 to 31.8. This increase was due, in some part, to the more continuous operation of plants in 1919

CHART C.—AVERAGE NUMBER OF WAGE EARNERS PER ESTABLISHMENT, BY INDUSTRY GROUPS: 1919.



than in 1914, but there can be little doubt that the abnormal demand for these products during the war period had resulted in considerable expansion of plants and equipment.

A table, such as Table 9, serves to indicate that much of significance is lost in discussing industry as a whole, for each separate industry has its own problems and its own trend, all of which are lost in the summation of the whole. Because of this fact the following chapter contains a more detailed discussion of the growth of establishments over a period of 40 or 50 years in 18 selected industries.

The general growth of establishments is given in Table 10 in terms of value of products. It is very important that some other dimension be measured in addition to the number of workers, since

the wage-earner index fails to consider the possible developments in equipment and plant. The ideal arrangement would be to procure accurate data for wage earners, capital, and product; but the figures on capital are so incomplete that they can not be used. However, any substantial increase in the capital investment should appear in the product figure, which, after all, is the fundamental measurement of the activity of an industrial concern. The size of an establishment is not the acreage which it covers nor even the number of hands it employs but, primarily, the extent of its activity; and whether the product is turned out by machinery or by manual labor does not alter the size of the establishment in the business man's eyes. His measure is product.

TABLE 10.—SIZE OF ESTABLISHMENTS MEASURED IN TERMS OF VALUE OF PRODUCTS: 1899 TO 1919.

CENSUS YEAR.	FACTORIES, EXCLUDING HAND AND NEIGHBORHOOD INDUSTRIES.						
	Manufacturing establishments.		Value of products.			Wholesale price index, Bureau of Labor Statistics.	Average value of products per establishment, adjusted on 1914 basis. ¹
	Number.	Per cent of increase.	Total.	Per cent of increase.	Average per establishment.		
1899.....	207, 514	.....	\$11, 406, 926, 701	.....	\$54, 969	74	\$74, 282
1904.....	216, 180	4. 2	14, 793, 902, 563	29. 7	68, 433	86	79, 573
1909.....	268, 491	24. 2	20, 672, 051, 870	39. 7	76, 993	97	79, 374
1914.....	275, 791	2. 7	24, 246, 434, 724	17. 3	87, 916	100	87, 916
1919.....	290, 105	5. 2	62, 418, 078, 773	157. 4	215, 157	212	101, 489

¹ The items in this column are expressed in terms of hypothetical dollars having the same purchasing power as that actually possessed by the dollar in 1914. See second paragraph below.

The value-of-products figures can not be used for comparison between industries because of the wide differences in the cost of materials used by various industries and further differences in the amount of labor and capital expended in converting the materials into the products. By using the totals for all industries, however, these objections may be largely eliminated.

As has been mentioned before, the average value of products is an unsatisfactory figure, because it is affected by changes in price level. Fortunately, sufficient data have been recorded with regard to prices during this period to permit the Bureau of Labor Statistics to construct an index of wholesale prices. Although the data used in this index do not correspond absolutely to the price data which would be used in constructing an index of factory

prices, of which the value of products is the sum, it can nevertheless be presumed that, *relatively*, the changes in wholesale prices and factory prices have been similar. Consequently, this index of wholesale prices has been used as an adjustment for the change in general price level during the period. Each total value of products was therefore divided by the corresponding index number of wholesale prices, to obtain an index of the value of products, eliminating changes in the price level. The unit used was the dollar of 1914.

The most notable fact shown by Table 10 is the increase in the *physical* product per establishment⁵ during the period from 1914 to 1919. There can be no doubt that such an increase did take place. It is, however, difficult to tell to what extent this was due to a more nearly complete utilization of plant in 1919 than in 1914, rather than to any considerable increase in capacity. The great increases in shipbuilding and in manufacture of electrical apparatus and automobiles were the result of the creation of large new establishments and of rapid expansion of those previously in existence. In many other industries, however, a considerable part of this increase must be explained by the more complete utilization of equipment in 1919, which was a relatively active year, than in 1914, which was a year of depression. The fact that the number of wage earners increased at a greater rate than the *physical* product would tend to substantiate this theory.

On the basis of these somewhat inadequate data it is impossible to discover any definite trend toward larger manufacturing establishments. The five-year period from 1914 to 1919 did show a very considerable increase, but it is probably true that the major part of this increase is due, in the first place, to operation nearer capacity than at any previous census, and, in the second place, to the overdevelopment of certain industries, such as steel shipbuilding, which reported 162 shipyards averaging 2,124 wage earners per establishment in 1919, as compared with 79 averaging 424 in 1914.

One other body of census data can be brought to bear upon this matter, which offers some indication of factory expansion, namely, the record of power facilities, presented in Table 11:

⁵ Measured by the figures in the right-hand column of Table 10, p. 43.

TABLE 11.—HORSEPOWER USED IN MANUFACTURING INDUSTRIES: 1899 TO 1919.

CENSUS YEAR.	PRIMARY HORSEPOWER.						Electric horse-power operated.
	Total.	Owned.			Rented.		
		Steam engines and turbines. ¹	Water wheels and motors.	Internal-combustion engines.	Electric.	Other.	
1899.....	10,097,893	8,189,564	1,454,112	134,742	182,562	136,913	492,936
1904.....	13,487,707	10,917,502	1,647,880	289,423	441,589	191,313	1,592,475
1909.....	18,675,376	14,228,632	1,822,888	751,186	1,749,031	123,639	4,817,140
1914.....	22,437,072	15,591,593	1,826,443	991,905	3,897,248	129,883	8,835,970
1919.....	29,504,792	17,037,973	1,765,263	1,259,400	9,347,556	94,600	16,317,277

¹ Figures include "other" owned power as follows: 1899, 49,985 horsepower; 1904, 92,154 horsepower; 1909, 29,293 horsepower.

These figures indicate a steady increase in power plant through the entire period. This expansion has been most rapid in the use of electricity. By 1919, electric motors had reached a horsepower practically equaling that of steam engines, though much of the electric power used was originally generated by means of steam power. These figures very definitely indicate an increase in equipment of marked regularity throughout the period, greater in degree than the increase in number of wage earners.

That there is, in general, some trend toward larger establishments must be expected, for new industries are growing rapidly which require large establishments for profitable operation, such as automobile, rubber-tire, beet-sugar, and electrical-apparatus enterprises. Since these and other similar industries are expanding at a much more rapid rate than the older industries they naturally tend to raise the general average for industry as a whole; but the census data certainly can not be used to support the hypothesis that the tendency for industrial establishments since 1900, has been, in general, to increase in size. The rapid concentration, so evident in the nineteenth century, is by no means so marked in the twentieth. That certain industries apparently do follow this tendency, and that certain other industries follow directly the opposite tendency, will be demonstrated in the following chapters.

III.

THE SIZE OF ESTABLISHMENTS IN 18 SELECTED INDUSTRIES.

To talk of the development of industry in generalizations is to lose much of vital significance. In the problem of growth, and particularly of size, industry as a whole is a rather unsatisfactory unit. This chapter has been introduced, therefore, to present more detailed historical records of growth in 18 selected industries.

Perhaps the greatest flaw in the use of general data for all industry is that in such a presentation particular industries whose establishments differ widely in size are merged. The establishments engaged in steel shipbuilding averaged 2,124 wage earners each in 1919, but the previous census recorded a greater number of wooden shipyards averaging but 10 employees each. The automobile manufacturing establishments reported an average employment of 668 wage earners per establishment, but there are only 315 establishments; whereas more than 2,000 establishments making carriages and wagons averaged but eight wage earners per establishment. Among those industries with high averages of wage earners appear: Sugar refining, 901; watches, 882; boots and shoes, rubber, 804; steel works and rolling mills, 750.

There are a great number of industries which record no such concentration. The establishments manufacturing cheese averaged in 1919 but 1.1 wage earners each and less than 1 in 1914; the establishments making lard, other than meat-packing houses averaged 2.2 employees; engraving and diesinking averaged 4; and the many flour and grist mills employed an average of 4.3 employees each.

Between these two extremes range all the other industries, varying widely in the average size of their manufacturing establishments. The changes which are taking place in the average size of establishment, therefore, can be much more significantly discussed in terms of particular industries. Since it is impossible to discuss all industries, 18 have been selected, chiefly because the desired data concerning each are available. An attempt has also been made to represent the different types of industrial activity.

Such industries have been chosen that two indices might be employed in measuring size. The first, average number of wage earners per establishment, has been utilized as indicating a very important type of growth in the size of economic enterprises; but developments taking the form of increased plant, machinery, and equipment may greatly increase the output of the establishment, though perhaps decreasing the number of wage earners. Since the data concerning capital are most inadequate, the index of most significance representing capital development is that which deals with the output of the plant. Although the custom of the Census Bureau has always been to express output in terms of value of products, such an index is rendered inaccurate for comparisons from census to census by fluctuations in the general level of prices. Therefore, the 18 industries selected have been chosen from those concerning which the Census Bureau or the Geological Survey has collected data either of physical volume of product, or of the quantity of materials used, or, in the case of the textile industries, of the number of spindles operating. The use of such an index makes possible a recognition of increase in size of establishment due to factors other than increase in labor force and eliminates the influence of price fluctuations.

There are several generalizations concerning the data in the following tables which must be kept in mind. In the first place, the data are often not strictly comparable. When the discrepancy is of any importance, its nature has been stated in the text. These data, however, do afford in rather sketchy outline a picture of the growth of each industry. Further refinement of these data is impossible because of the incompleteness or destruction of census records. In the second place, the factors of child labor, of diminishing hours of labor, of greater regularity of plant operation, and especially the development of methods of transportation and communication must be kept in mind as influencing the general trends throughout the period. In the third place, censuses have been taken heretofore only at considerable intervals, and sometimes a census in a good industrial year has been preceded by one in a less favorable period. Such abnormal conditions must be carefully described in any attempt to determine general trends of growth. This is particularly true of 1914 and 1919. It is necessary that all these elements be kept in mind as the particular industries are examined.

SALT.

The salt industry is perhaps the outstanding example of changing size of establishment in the direction of concentration. As seen from Table 12, each census since 1869 has reported a decrease in the number of establishments, each census has reported an actual and very considerable increase in physical output, and but two censuses returned smaller numbers of wage earners than those preceding. It is interesting to note that the salt industry was the first to have a recognized "trust" in the Michigan Salt Association, which controlled the product from that State for a number of years. It is still the leading State in the industry, and its establishments are much larger than those found elsewhere.

TABLE 12.—SIZE OF ESTABLISHMENTS—SALT: 1869 TO 1919.

CENSUS YEAR.	SALT.									
	Establishments.		Wage earners.		Physical product.		Wage earners per establishment.		Physical product per establishment.	
	Number.	Percent of decrease.	Total (average number). ¹	Percent of increase. ²	Amount (thousands of barrels).	Percent of increase.	Actual number.	Index number.	Actual amount (barrels).	Index number.
1869.....	282		2,921		3,521		10	100.0	12,486	100.0
1879.....	268	5.0	4,289	46.8	5,961	69.3	16	160.0	22,243	178.1
1889.....	200	25.4	4,255	-0.8	10,407	74.6	21	210.0	52,035	416.7
1899.....	159	20.5	4,774	12.2	15,188	45.9	30	300.0	95,522	765.0
1904.....	146	8.2	4,666	-2.3	17,129	12.8	32	320.0	117,322	939.6
1909.....	124	15.1	4,936	5.8	29,933	74.8	40	400.0	241,395	1,933.3
1914.....	98	21.0	5,089	3.1	34,805	16.3	52	520.0	355,153	2,844.4
1919.....	86	12.2	6,495	27.6	49,164	41.3	76	760.0	571,674	4,578.5

¹ For method of computing average, see p. 30.² A minus sign (-) denotes decrease.

Various censuses have mentioned in their reports the increasing concentration in this industry, a development which apparently has taken place most extensively in California. The decline in number of establishments in the earlier years was due chiefly to the abandonment of salt making from sea water in plants located along the Atlantic coast. Upon comparing the records of wage earners and physical product per establishment it becomes evident that the product has increased at a more rapid rate than the number of wage earners, indicating technical improvement and greater capital investment.

There has been a gradual elimination of operation at less profitable deposits and concentration at the more profitable

points. A comparison of the total value of salt and the total amount of salt produced gives some indication of the importance of larger and more efficient establishments. Disregarding 1919 as an abnormal year in terms of price levels, the salt industry had experienced from 1869 to 1914 less than the trebling of the value of its products, though the amount had increased nearly ten times. Until the census of 1919 each census taking had reported salt at a lower value per barrel. This development parallels the concentration of the industry into larger establishments.

The salt industry lends itself particularly to large-scale production because of the standardization of its product, its expansion being limited chiefly by the supply of raw material. As transportation has developed, the extension of the market has made feasible such production on a large scale.

MANUFACTURED ICE.

The manufactured ice industry represents a type of development quite different from that of the salt industry. Table 13 reveals no very great change in the size of establishments during the period under consideration, although the industry underwent enormous expansion. From 35 establishments in 1879, the number increased to 2,867 in 1919. During the entire period the number of wage earners per establishment showed no very pronounced change, although the product per establishment increased considerably between 1904 and 1919.

TABLE 13.—SIZE OF ESTABLISHMENTS—MANUFACTURED ICE: 1869 TO 1919.

CENSUS YEAR.	MANUFACTURED ICE.									
	Establishments.		Wage earners.		Physical product.		Wage earners per establishment.		Physical product per establishment.	
	Num-ber.	Per cent of in-crease.	Total (average num-ber). ¹	Per cent of in-crease.	Amount (thou-sands of tons). ²	Per cent of in-crease.	Ac-tual num-ber.	Index num-ber.	Actual amount (tons). ²	Index num-ber.
1869	4	.....	97	.....	.....	.....	24.2	271.9	.....	.....
1879	35	775.0	447	360.8	.....	.....	12.8	143.8	.....	.....
1889	222	534.3	2,826	532.2	.....	.....	12.7	142.7	.....	.....
1899	775	249.1	6,880	143.5	4,294	.....	8.9	100.0	5,541	100.0
1904	1,320	70.3	10,101	46.8	7,199	67.7	7.7	86.5	5,454	98.4
1909	2,004	51.8	16,114	59.5	12,647	75.7	8.0	89.9	6,311	113.9
1914	2,543	26.9	23,011	42.8	18,324	44.9	9.0	101.1	7,206	130.0
1919	2,867	12.7	30,247	31.4	25,293	38.0	10.6	119.1	8,822	159.2

¹ For method of computing average, see p. 30.

² Tons of 2,000 pounds.

The decrease in number of wage earners per establishment between 1889 and 1899 is doubtless due to the change which took place in the method of computation at that time. Manufactured ice is a highly seasonal industry, and consequently the figures 1869 to 1889, which represent average wage earners during months operated, are considerably higher than the later years, which represent average number of wage earners during the entire year. The seasonal nature of this industry is evidenced by the fact that in 1919 the number of wage earners increased from 20,796 on January 15 to 41,078 on July 15, and dropped to 23,224 by December 15, the minimum being 50.6 per cent of the maximum.

The activity of an ice-manufacturing establishment is quite definitely limited by its market. Transportation costs forbid an extension of the market to points at any great distance from the plant. The majority of these establishments are located in small southern towns and are able to meet the demands of their particular localities without further expansion. Consequently, the industry has expanded not so much by increasing the size of its units as by increasing their number. As late as 1909 there were still seven States in which no artificial ice plants were located.

Since the plants first constructed in the South were in the larger cities, the tendency there has been for the new plants, introduced into smaller communities, to be smaller in capacity. The increase in size shown for the 15-year period 1904-1919 was due to the introduction of artificial-ice plants into many northern cities.

BEET SUGAR.

The beet-sugar industry, an industry active in the United States in but two establishments in 1889, had expanded to 85 establishments by 1919. Data are given in Table 14. During every intercensal period an increase took place in the average number of wage earners per establishment, being most pronounced from 1904 to 1909. During the same period, 1904 to 1909, the daily slicing capacity of beet-sugar factories increased by nearly one-half, a record which has not been approached since that time. The only inconsistent figure in the table is that for the physical product in 1919, which shows a decrease explainable by the fact that not only was the percentage of sucrose reported in that year the lowest ever recorded by the Department of Agriculture, but the beet-sugar crop in 1919 was unusually small. That this was an abnormal occurrence is indicated by Department of Agriculture

figures for the 1920 beet-sugar production, which shows a total product 50 per cent greater than that of 1919.¹ The beet-sugar industry differs from those previously discussed in its dependence upon agriculture, which dependence is very apparent in the 1919 reports. In connection with this check in beet-sugar production, it is significant to note that in 1919 the amount of cane sugar imported reached a new maximum.

TABLE 14.—SIZE OF ESTABLISHMENTS—BEET SUGAR: 1889 TO 1919.

CENSUS YEAR.	BEET SUGAR.									
	Establishments.		Wage earners.		Physical product.		Wage earners per establishment.		Physical product per establishment.	
	Number.	Per cent of increase.	Total (average number). ¹	Per cent of increase.	Amount (thousands of tons). ²	Per cent of increase.	Actual number.	Index number.	Actual amount (tons). ²	Index number.
1889.....	2		(8)		(3)					
1899.....	30		1,970		82		66	100.0	2,733	100.0
1904.....	51	70.0	3,963	101.2	254	209.8	78	118.1	4,980	182.2
1909.....	58	13.7	7,204	81.8	502	97.6	124	187.8	8,655	316.6
1914.....	60	3.4	7,997	11.0	743	48.0	133	201.5	12,383	453.6
1919.....	85	41.7	11,781	47.3	722	-2.8	139	210.6	8,494	310.7

¹ For method of computing average, see p. 30.

² Tons of 2,000 pounds.

³ Data not given in order not to disclose activity of individual establishments.

The growth of establishments in the beet-sugar industry is indicative of a situation common in most rapidly developing fields of activity. The first establishments were largely experimental and therefore of small capacity. Moreover, their production was limited by the small area in which sugar beets were cultivated. The gradual passing of the experimental stage made the construction of larger establishments more inviting and also encouraged the more extensive cultivation of sugar beets. In industries in which the capital investment is necessarily large the early growth is often similar to that outlined above.

SLAUGHTERING AND MEAT PACKING.

The slaughtering and meat-packing industry was enabled to become more than a localized industry by the introduction of the refrigerator car. In 1850 there were but 185 establishments reported in this type of activity, having a total value of products for 1849 of \$11,981,642. In September, 1869, the first carload

¹ Department of Agriculture. See Statistical Abstract, 1921, p. 262.

of dressed beef was shipped from Chicago to Boston. By 1890 the number of establishments had increased to 1,118 and the value of products to \$561,611,668. (See data given in Table 15; also see Appendix B for explanation of construction of index of materials used.) The growth of the industry since 1849 has been almost phenomenal. The settlement of the western country and the consequent expansion of territory devoted to stock raising, the extension of railroads, the increased facilities for communication, the improved method of preserving and curing meats, the introduction and improvement of mechanical and chemical processes of refrigeration, the installation of sanitary equipment, the utilization of every part of the animal, the adoption of labor-saving machinery, and the rigid inspection of meats are some of the more important factors which have contributed to its development.

TABLE 15.—SIZE OF ESTABLISHMENTS—SLAUGHTERING AND MEAT-PACKING PRODUCTS: 1889 TO 1919.

CENSUS YEAR.	SLAUGHTERING AND MEAT PACKING.							
	Establishments.		Wage earners.		Materials used. ¹		Wage earners per establishment.	
	Number.	Per cent of increase. ²	Total (average number). ³	Per cent of increase.	Index number.	Per cent of increase. ³	Actual number.	Index number.
1889.....	1, 118	.....	43, 975	.....	100. 0	.....	39	100. 0
1899.....	882	-21. 1	68, 386	55. 5	122. 5	22. 5	78	200. 0
1904.....	929	5. 3	74, 134	8. 4	139. 0	13. 5	80	205. 1
1909.....	1, 221	31. 4	87, 813	18. 5	155. 9	12. 2	72	184. 6
1914.....	1, 279	4. 8	98, 832	12. 5	151. 3	-3. 0	77	197. 4
1919.....	1, 304	2. 0	160, 996	62. 9	205. 9	36. 1	123	315. 4

¹ For explanation of the method for obtaining this index, see Appendix B.

² A minus sign (-) denotes decrease.

³ For method of computing average, see p. 30.

The nature of the industry, especially with reference to the utilization of by-products, made the operation of large enterprises particularly desirable, and the necessary shipment and marketing of products made large-scale operations economical. In 1885 Swift & Co. was incorporated, and in 1900 Armour & Co.² The bringing of such financial combinations into the industry, thereby concentrating the control in the hands of a few individuals, made possible the consolidation of many plants and the elimina-

² Poor's Manual, 1920.

tion of others. The census of 1900 demonstrated this tendency by recording the first decrease in number of establishments, although the number of wage earners per establishment doubled from 1889 to 1899. From 1899 to 1914, however, the introduction of new plants was such as to offset any increase in the scale of production which may have taken place in plants previously established, and accordingly there was no decided change in size of establishments. During the war period, however, there occurred a very considerable increase in this respect, measured either in terms of wage earners or in terms of materials used.

The rate of increase in number of wage earners per establishment from 1889 to 1919 was nearly three times as great as that in materials used. This situation is explained by the expansion of the larger companies into allied activities, so that the materials are more fully utilized.³ Such a development is reflected directly in the records of the number of wage earners but not in the index of materials. An index of products would doubtless show an increase at a much greater rate than that for materials used in this industry.

TEXTILES.

The three textile industries—cotton, wool, and silk—might be expected to show parallel developments, but, as a matter of fact, the several branches have little in common. Chart D indicates the changes since 1879 in the number of establishments in the different (industrial) subdivisions. Cotton and silk have shown irregular but continuous increases in the number of establishments, whereas concerns engaged in wool manufacture have decreased decidedly in number. By far the greatest increase has come in the number of enterprises engaged in manufacturing knit goods; but each industry must be examined separately in order to discover the factors underlying its development.

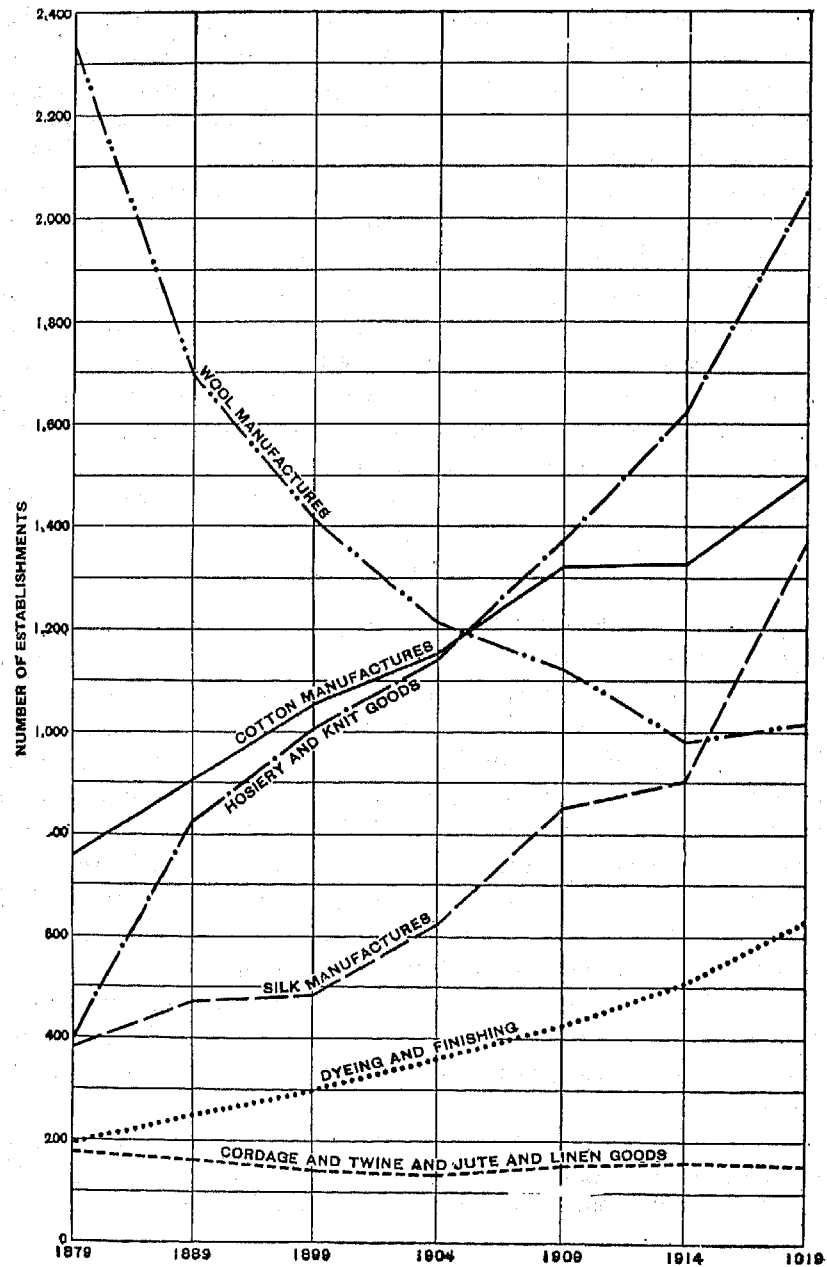
Since the physical product is so varied as to make difficult its summation into a single index, the number of spindles per establishments has been used as indicating technical and capital expansion.

"The number of working spindles is the universally accepted measure of the capacity of cotton mills and of the growth of the industry in any particular State or region."⁴

³ See Chapter XIV.

⁴ Census of Manufactures, 1900, Vol. IX, Part III, p. 45.

CHART D.—NUMBER OF ESTABLISHMENTS IN THE TEXTILE INDUSTRIES:
1879 TO 1919.



As early as 1890 the census reported that—

"Widest contrasts are presented by the organization of the cotton and wool industries. The cotton manufacture, conducted as a rule under the corporate method, is carried on in large mills, comparatively few in number, the 905 establishments reported at 1890 manufacturing a product nearly equal in value to the product of the 1,693 wool-manufacturing establishments. There are comparatively few very large mills engaged in manufacturing wool fabrics."⁵

Cotton.—There have been several outstanding features in the development of this industry. Data are given in Table 16. Perhaps the greatest single technical development during the period was the gradual change from the mule to the ring spindle, increasing the output per wage earner. The Northrop loom, invented in 1895, was immediately introduced, and likewise increased the per capita output; but the change which has chiefly influenced the industry has been the gradual shift in location from New England States to the Southern States. In 1880 approximately 60 per cent of the cotton mills in the country were concentrated in New England. In 1905 less than 30 per cent were in New England and more than one-half were in the Southern States. In 1919, however, the per cent was 30.7 for the New England States and 48.7 for the Southern States.

TABLE 16.—SIZE OF ESTABLISHMENTS—COTTON MANUFACTURES: 1879 TO 1919.

CENSUS YEAR.	COTTON MANUFACTURES. ^a									
	Establishments.		Wage earners.		Active producing spindles.		Wage earners per establishment.		Active producing spindles per establishment.	
	Number.	Per cent of increase.	Total (average number). (b)	Per cent of increase.	Number (thou- sands).	Per cent of increase	Ac- tual number.	Index number.	Actual num- ber.	Index num- ber.
1879.....	756	.....	172,544	.....	10,653	.....	228	100.0	14,091	100.0
1889.....	905	19.7	218,876	26.9	14,188	33.2	242	106.1	15,677	111.2
1899.....	1,055	16.6	302,861	38.4	19,051	34.3	287	125.8	18,058	128.1
1904.....	1,154	9.4	315,874	4.3	23,195	21.8	274	120.1	20,100	142.6
1909.....	1,324	14.7	378,880	19.9	27,426	18.2	286	125.4	20,715	147.0
1914.....	1,328	0.3	393,404	3.8	30,915	12.7	296	129.8	23,279	165.0
1919.....	1,496	12.7	446,852	13.6	33,796	9.3	299	131.1	22,591	160.3

^a The Bureau of the Census customarily divides the cotton manufacturing industries into groups of "cotton goods," "cotton lace," and "cotton small wares." These three groups are summarized here under the one head, "Cotton manufactures."

^b For method of computing average, see p. 30.

⁵ Census of Manufactures, 1890, Part III, p. 8.

The southern establishments, in general, are smaller than those in the North, and therefore the shift in location has resulted in keeping the average number of wage earners per establishment low. "During the early years of southern development it was not unusual to equip mills with machinery discarded from northern mills."⁶ More recently, however, there has been a decided increase in efficiency in the southern textile cotton factories; but records for the industry as a whole indicate a gradual increase in the size of establishments, together with a breakdown of geographical specialization. It is interesting to note that, of the 4 leading States in the cotton textile industry, the 191 mills operating in Massachusetts employed almost exactly the same number of wage earners as the 501 mills in Alabama, Georgia, and North Carolina.

The decrease in number of wage earners per establishment in 1904 was due to the fact that there was a serious strike in Fall River during part of that year.

The woolen and worsted industry shows a very different trend from that for cotton manufactures (see Table 17). Until 1919 every census had recorded a considerable increase in the average size of establishments in this industry.

TABLE 17.—SIZE OF ESTABLISHMENTS—WOOLEN AND WORSTED MANUFACTURES: 1879 TO 1919.

CENSUS YEAR.	WOOLEN AND WORSTED MANUFACTURES.									
	Establishments.		Wage earners.		Total spindles.		Wage earners per establishment.		Spindles per establishment.	
	Num-ber.	Per cent of in-crease. ¹	Total (average number). ²	Per cent of in-crease ¹	Num-ber (thou-sands).	Per cent of in-crease.	Ac-tual num-ber.	Index num-ber.	Actual num-ber.	Index num-ber.
1879.....	2,066	.....	105,307	.....	1,997	.....	51	100.0	967	100.0
1889.....	1,454	-29.6	119,893	13.9	2,570	28.7	82	160.7	1,768	182.8
1899.....	1,221	-16.0	125,901	5.0	3,278	27.5	103	201.9	2,685	277.6
1904.....	1,018	-16.6	141,998	12.8	3,748	14.3	139	272.5	3,682	380.7
1909.....	911	-10.5	163,192	14.9	4,288	14.4	179	350.9	4,707	486.7
1914.....	799	-12.3	158,692	-2.8	4,722	10.1	199	390.1	5,910	611.1
1919.....	852	6.6	166,787	5.1	4,976	5.4	196	384.3	5,840	603.9

¹ A minus sign (-) denotes decrease.

² For method of computing average, see p. 30.

The woolen factory had quite a different origin from the cotton mill. It was an extension of the custom carding mill, and the

⁶ Census of Manufactures, 1890, Part III.

older and smaller establishments have been eliminated much more slowly than in the cotton industry. Many mills containing perhaps one set of cards operated frequently in connection with a sawmill or a gristmill, but reported in earlier days as a part of the wool manufacturing industry. At the same time there has been an evident consolidation of establishments resulting in the steadily increasing dominance of large corporations. The greatest rate of increase in size of establishments recorded was for the period 1899 to 1904, but this is to be somewhat discounted by the fact that 1899 was a very bad year for the woolen industry, while 1904 was rather above the average.

A careful examination of the development of the industry reveals the fact that concentration is chiefly in the worsted branch and that were it not for this development the industry would have declined to much lower levels. In 1919, although the worsted branch represented but 34 per cent of the establishments, it employed 62 per cent of the wage earners, and the average number of wage earners per establishment in this branch was 330, as against an average of 114 in the nonworsted branch. The worsted mills operated 63 per cent of the total primary horsepower. In comparison with the cotton industry, however, there has been a very decided tendency toward concentration into larger establishments in the woolen industry.

The silk industry manifests yet another type of development, as shown in Table 18. Although the number of establishments has increased from census to census since 1879, the 10 years from 1899 to 1909 saw a decided decrease in the size of establishment as measured by numbers of spindles and of wage earners. During that period there was a great development in the machinery of the industry. The belt-driven spindle was introduced in 1899, and by 1904, 75 per cent of the spindles in the industry were of this type. This development naturally tended to reduce the number of spindles and number of wage earners required by the industry, and thus brought about decreases in average numbers of wage earners and spindles per establishment. The considerable development from 1914 to 1919 was due to the abnormal demand for silk goods in 1919, although it is important to note that the rate of increase was much greater in number of establishments than in either of the other two factors. Apparently the silk industry reached its point of largest establishments in 1899, since which year their average size has decreased considerably.

That these indexes do not tell the whole story is made clear by the figures for primary horsepower. Although the establishments in the silk industry may not have increased in terms of wage earners or spindles per establishment since 1899, the horsepower used increased 208 per cent during that period as compared with an increase in number of establishments of 184 per cent. The greatest increase in power ever reported in the industry occurred during the five years from 1914 to 1919. The smaller establishments in terms of the indexes used above has been made possible by the introduction of power machinery and more rapid spindles.

TABLE 18.—SIZE OF ESTABLISHMENTS—SILK MANUFACTURES: 1879 TO 1919.

CENSUS YEAR.	SILK MANUFACTURES.									
	Establishments.		Wage earners.		Active spinning spindles.		Wage earners per establishment.		Active spinning spindles per establishment.	
	Number.	Per cent of increase.	Total (average number). ¹	Per cent of increase.	Number (thousands).	Per cent of increase.	Actual number.	Index number.	Actual number.	Index number.
1879.....	382	.....	31,337	.....	262	.....	82	100.0	686	100.0
1889.....	472	23.6	49,382	57.6	718	174.0	105	128.0	1,521	221.7
1899.....	483	2.3	65,416	32.5	1,213	68.9	135	164.6	2,511	366.0
1904.....	624	29.2	79,601	21.7	1,394	14.9	128	156.0	2,234	325.6
1909.....	852	36.5	99,037	24.4	1,762	26.4	116	141.4	2,069	304.2
1914.....	902	5.9	108,170	9.2	2,159	22.5	120	146.3	2,394	344.1
1919.....	1,369	51.8	126,782	17.2	2,669	23.6	93	113.4	1,950	291.3

¹ For method of computing average, see p. 20.

In summing up this discussion of the textile industries no general conclusions can be drawn except that the three branches here considered show no apparent similarity but have each been subject to peculiar factors causing quite different types of development. In the cotton industry the average size of establishment has increased but little; in the woolen and worsted industry the average has practically doubled in 20 years; in the silk industry the average has decreased since its peak in 1899.

IRON AND STEEL.

Although the concentration of financial control in this industry is generally recognized, the extent to which centralization into fewer and larger establishments has taken place is perhaps not so well known.

Blast furnaces.—In this branch of the iron and steel industry the trend toward concentration has been in existence for 50 years. As shown in Table 19, the outstanding development is the enormous increase in output per establishment, which was at a rate nearly 11 times as great as the rate of increase in number of wage earners per establishment during the same period.

TABLE 19.—SIZE OF ESTABLISHMENTS—BLAST-FURNACES¹: 1869 TO 1919.

CENSUS YEAR.	BLAST FURNACES.									
	Establishments.		Wage earners.		Physical product. ¹		Wage earners per establishment.		Physical product per establishment.	
	Num-ber.	Per cent of in-crease. ²	Total (average num-ber). ³	Per cent of in-crease. ²	Amount (thou-sands of tons). ⁴	Per cent of in-crease. ²	Actu-al num-ber.	Index num-ber.	Actual amount (tons). ⁴	Index number.
1869.....	386	.....	27,554	.....	1,833	.....	71	100.0	4,749	100.0
1879.....	341	-11.7	41,695	51.3	3,376	84.2	122	171.8	9,900	208.4
1889.....	304	-10.9	33,415	-19.9	8,845	162.0	110	154.9	29,095	612.6
1899.....	223	-26.6	39,241	17.4	14,448	63.3	176	247.9	64,789	1,364.2
1904.....	190	-14.8	35,078	-10.6	16,624	15.1	185	260.5	87,495	1,842.3
1909.....	208	9.5	38,429	9.6	25,652	54.3	185	260.5	123,327	2,596.9
1914.....	160	-23.1	29,356	-23.6	23,270	-9.3	183	257.7	145,438	3,062.4
1919.....	195	21.9	41,660	41.9	30,543	31.3	214	301.4	156,631	3,298.1

¹ Pig iron, including spiegeleisen, ferromanganese, ferrosilicon, other ferro-alloys, and direct castings.

² A minus sign (-) denotes decrease.

³ For method of computing average, see p.30.

⁴ Tons of 2,240 pounds.

The much greater increase in product than in wage earners is the result of the introduction of labor-saving machinery, notably the use of pig-casting machines in place of sand-casting, and improvements in general charging devices and in ore-handling machines for stocking and charging.

The large number of wage earners reported for 1879 and the apparent decrease from 1879 to 1889 are due chiefly to the fact that in the census of 1879, through error, a large number of employees engaged in mining and other operations were included as blast-furnace employees. From 1899 to 1914, the number of wage earners showed very little change, though the increase in product was very considerable. There has been a progressive increase in the average annual output per wage earner from 265 tons in 1889 to 368 tons in 1899, 474 tons in 1904, 668 tons in 1909, and 793 tons in 1914. In 1919, however, the enormous output was accomplished only by an increase of workers more than

proportional to that of product, bringing the average annual output per worker down to 735 tons of pig iron.

During the period 1880 to 1900 many furnaces were abandoned or dismantled, owing to inability to compete with more modern, better located, and larger furnaces. Since the figures for each year represent only the number of furnaces active, they closely parallel business conditions, the iron and steel industries being notable for their accurate reflection of the general condition of business. This feature is particularly evident in the low figures for 1914, a depression year, and the high figures for 1919, when the industry reached its greatest activity.

Steel works and rolling mills.—This branch of the iron and steel industry shows likewise an increasing concentration in larger establishments. Data are given in Table 20. Although the number of establishments has shown no great variation throughout the entire period, the nature of these establishments has changed decidedly. The earlier figures include many country forges and bloomeries. There were 82 in 1869, and in 1879, 93 such establishments, enterprises chiefly operated by farmers or mountaineers and producing for a local market. The number of such establishments rapidly declined as the larger and more efficient mills, with their cheaper product, were enabled by improved transportation methods to enter into competition with them.

The rapid increase in physical product can be explained in part by the introduction of the Bessemer process, which produced 53 per cent of the total product in 1890, as against only 26 per cent in 1880.

The condition of industry in general is directly reflected in the activity of the steel works and rolling mills as well as of blast furnaces, and therefore 1914 shows a reduction in activity, and 1919 a substantial increase. Although the output per establishment in 1909 and 1914 were almost identical, the fact that steel production in 1914 represented 52.7 per cent of computed capacity as compared with 72 per cent in 1909 indicates the presence of the 1914 depression. It is interesting to note that, up to 1909, the output increased at a faster rate than the number of wage earners, but since that date the number of wage earners employed has increased at a higher rate than the physical volume of product and the product per wage earner is therefore decreasing.

TABLE 20.—SIZE OF ESTABLISHMENTS—STEEL WORKS AND ROLLING MILLS:
1879 TO 1919.

CENSUS YEAR.	STEEL WORKS AND ROLLING MILLS.									
	Establishments.		Wage earners.		Physical product. ¹		Wage earners per establishment.		Physical product per establishment.	
	Number.	Per cent of increase. ²	Total (average number). ³	Per cent of increase.	Amount (thousands of tons). ⁴	Per cent of increase. ²	Actual number.	Index number.	Actual amount (tons). ⁴	Index number.
1879.....	451	.....	99,103	.....	3,046	.....	220	100.0	6,754	100.0
1889 ⁵	415	-8.0	137,766	39.0	7,388	142.5	332	150.9	17,802	263.6
1899.....	445	7.2	183,249	33.0	15,056	103.8	412	187.3	33,834	500.9
1904.....	415	-6.7	207,562	13.3	18,218	21.0	500	227.3	43,899	650.0
1909.....	446	7.5	240,076	15.7	26,723	46.7	538	244.5	59,917	887.1
1914.....	427	-4.3	248,716	3.6	25,523	-4.5	582	264.5	59,773	885.0
1919.....	500	17.1	375,088	50.8	36,212	41.9	750	340.9	72,424	1,072.3

¹ Rolled, forged, and other classified steel and iron products.² A minus sign (-) denotes decrease.³ For method of computing average, see p. 30.⁴ Tons of 2,240 pounds.

⁵ At the census of 1889, an establishment operating a rolling mill but using the rolled product in the manufacture of some more advanced commodity was classified as a whole under the industry designated by the name of that commodity, provided it constituted the chief final product of the establishment. Consequently many establishments which in other censuses would have been regarded as rolling mills were classified under other heads. At the same census, however, special tables were presented which showed the total business of all establishments having rolling mills, including those classified under more specific designations in the general tables. These combined totals for all rolling mills for 1889 are approximately comparable with those for later years, and are the figures here utilized.

LUMBER.

The records for this industry, given in Table 21, are not strictly comparable. For example, the 1879 enumeration does not include the operation of independent timber camps, and the census of 1899 includes a slight duplication and therefore is somewhat inflated; but nevertheless, the figures are substantially analogous. Concerning this industry, the census report for 1904 states:

"That the number of establishments has fluctuated within comparatively narrow limits since 1850, while the volume of their products has increased enormously, is due in the main to a rapid and remarkable development of the transportation facilities of the country. Another factor that has aided in this concentration of the industry into larger establishments has been the improvement in sawmill machinery."⁷

⁷ Census of 1905, Part III, p. 585.

TABLE 21.—SIZE OF ESTABLISHMENTS—LUMBER AND TIMBER PRODUCTS: 1879 TO 1919.

CENSUS YEAR.	LUMBER AND TIMBER PRODUCTS.									
	Establishments.		Wage earners.		Products.		Wage earners per establishment.		Product per establishment.	
	Num-ber.	Per cent of in-crease. ¹	Total (average num-ber). ²	Per cent of in-crease. ¹	Amount (millions of feet, b. m.).	Per cent of in-crease. ¹	Ac-tual num-ber.	Index num-ber.	Actual amount (M feet, b. m.).	Index num-ber.
1879	25,758	.....	148,290	.....	18,091	.....	5.8	100.0	702	100.0
1889	22,607	-12.2	444,008	199.4	23,842	31.8	19.6	349.7	1,055	150.2
1899	23,043	1.9	413,257	-6.9	35,084	47.5	17.9	311.5	1,523	216.9
1904	19,121	-17.0	404,563	-2.1	34,127	-2.7	21.2	367.4	1,785	254.2
1909	33,090	73.1	547,178	35.3	44,510	30.4	16.5	287.0	1,345	191.5
1914	27,229	-18.0	479,786	-12.3	37,346	-16.1	17.6	305.9	1,371	195.2
1919	26,119	-4.1	480,945	0.2	34,552	-7.5	15.4	319.6	1,323	188.4

¹ A minus sign (—) denotes decrease.² For method of computing average, see p. 30.

The 1904 census noted this development at its peak, for since that date the establishments in this industry have shown a tendency to decrease in size, due to the increasing scarcity of lumber and development of substitutes for its use as building material. It would appear that the manufacture of lumber and timber products is an industry similar to silk manufacture, having passed its point of largest industrial establishments. This fact is still further demonstrated by the statistics of primary horsepower. The steady increase in power used, which continued to 1909, was checked at that date, the greatest increase in horsepower per establishment being recorded during the decade 1889 to 1899. Steam engines and turbines still predominate, providing 92.4 per cent of the primary horsepower in the industry in 1919.

LEATHER.

Leather, tanned, curried, and finishea.—The leather industry furnishes an example of continuous and considerable development of large establishments, as is shown in Table 22. During the 50 years from 1869 to 1919 the number of establishments decreased to one-eleventh of its original size, while the number of individuals employed in the industry doubled. Explanation of the method of obtaining the index of materials used is given in Appendix B.

TABLE 22.—SIZE OF ESTABLISHMENTS—LEATHER, TANNED, CURRIED, AND FINISHED:
1869 TO 1919.

CENSUS YEAR.	LEATHER, TANNED, CURRIED, AND FINISHED.							
	Establishments.		Wage earners.		Index of materials used. ¹		Wage earners per establishment.	
	Num-ber.	Per cent of de-crease.	Total (average num-ber). ²	Per cent of in-crease. ³	Amount.	Per cent of in-crease. ³	Ac-tual num-ber.	Index num-ber.
1869.....	7,569	.....	35,243	.....	.....	.....	5	12.5
1879.....	5,628	-25.6	40,282	14.3	.....	.....	7	17.5
1889.....	1,787	-68.2	42,392	5.2	.....	.....	24	60.0
1899.....	1,306	-26.9	52,109	22.9	100.0	.....	40	100.0
1904.....	1,049	-19.7	57,239	9.8	112.3	12.3	55	137.5
1909.....	919	-12.4	62,202	8.7	123.2	9.7	68	170.0
1914.....	741	-19.4	55,936	-10.1	116.2	-8.7	75	187.5
1919.....	680	-8.2	72,476	29.6	134.5	15.7	107	267.5

¹ For explanation of the method of obtaining the index, see Appendix B.² For method of computing average, see p. 30.³ A minus sign (—) denotes decrease.

This concentration can be explained to a large extent by the introduction of labor-saving machinery. Until about 1880 leather manufacturers were inclined to discourage the superseding of manual work by machine processes and continued to utilize old formulæ, although the development of chemistry afforded many decided improvements. Prior to that year, therefore, the evolution of the industry was very slow and resulted in a very gradual elimination of the nonprogressive firms.

There are also technical reasons which account in some measure for the enormous change shown by Table 22. First, there is the probability of duplication by recording separately at the earlier censuses the activity of establishments engaged in tanning and in currying. Another reason is found in combinations of firms making different types of leather product, the majority of side-leather tanneries having consolidated with tanneries producing upper leather.

The rapid decrease in number of establishments and the continuous and considerable increase in number of wage earners per establishment are remarkable. In only one year, 1914, was there a decrease in wage earners and materials, and even then the decrease in number of establishments was so much greater that the average size of establishment increased considerably.

The boot and shoe industry (recorded in Table 23) is one in which there was an early development of large establishments. The introduction of machinery, which took place to a large extent in the boot and shoe industry at a comparatively early date, resulted in a greater increase in product than in wage earners in the earlier years. Specialization into boot-and-shoe and cut-stock factories made possible a more effective utilization of those employed. In 1890 the census included a number of small establishments doing contract work, a practice which had reached notable proportions in some parts of New England. From special investigations made by the Census Bureau it appeared that the number of such shops had greatly decreased by 1900.

TABLE 23.—SIZE OF ESTABLISHMENTS—BOOTS AND SHOES:¹ 1879 to 1919.

CENSUS YEAR.	BOOTS AND SHOES. ¹									
	Establishments.		Wage earners.		Physical product.		Wage earners per establishment.		Physical product per establishment.	
	Number.	Per cent of increase. ²	Total (average number). ³	Per cent of increase.	Amount (thousands of pairs).	Per cent of increase.	Actual number.	Index number.	Actual amount.	Index number.
1879.....	1,959	.....	111,152	.....	125,479	.....	57	100.0	64,053	100.0
1889.....	2,082	6.3	133,690	20.3	173,862	38.6	64	112.2	83,507	130.4
1899.....	1,599	-23.2	141,830	6.1	217,965	25.4	89	156.1	136,313	212.8
1904.....	1,316	-17.7	149,924	5.7	242,110	11.1	114	200.0	183,974	287.2
1909.....	1,343	2.1	185,116	23.5	285,017	17.7	138	242.1	212,224	331.3
1914.....	1,355	0.9	191,555	3.5	292,666	2.7	141	247.4	215,990	337.2
1919.....	1,449	6.9	211,049	10.2	331,225	13.2	146	256.1	228,589	356.9

¹ Includes manufacture of men's, women's, and children's shoes, boots, slippers, sandals, and similar articles.

² A minus sign (-) denotes decrease.

³ For method of computing average, see p. 30.

Since 1904 the industry has shown little change in total number of establishments. As a matter of fact, however, an examination of establishments by location indicates that a decided reorganization has taken place. The geographical specialization, centering the industry in New England, has been gradually overthrown. In 1890 Massachusetts produced more than one-half of the national output, but in 1914 its product had declined to one-third of the total. The construction of new establishments in other parts of the country has promoted the introduction of new types of machinery such as might not have been installed by an old and unchallenged concern, whose already established machinery creates a vested interest. Since 1909, however, the increases in both indices

of size have been slight. The year 1919 was abnormal with reference to industry in general, which situation was also reflected in the data concerning the manufacture of leather.

PETROLEUM REFINING.

This industry naturally reflects the extension of the use of the gasoline engine, and therefore indirectly of the automobile. Data on size of establishments are given in Table 24. The increase in crude petroleum used has been extensive during each intercensal period. During the more recent years, 1909 to 1919, this increase has been accomplished only by adding a more than proportional number of wage earners.

TABLE 24.—SIZE OF ESTABLISHMENTS—PETROLEUM: 1879 TO 1919.

CENSUS YEAR.	PETROLEUM REFINING.									
	Establishments.		Wage earners.		Crude petroleum used.		Wage earners per establishment.		Crude petroleum used per establishment.	
	Num-ber.	Per cent of in-crease. ¹	Total (average num-ber). ²	Per cent of in-crease. ¹	Amount (thou-sands of barrels).	Per cent of in-crease.	Ac-tual num-ber.	Index num-ber.	Actual amount (barrels).	Index num-ber.
1879.....	86	.....	9,869	.....	17,417	.....	115	100.0	202,523	100.0
1889.....	94	9.3	11,403	15.5	30,663	76.0	121	105.2	326,202	161.1
1899.....	67	-28.7	12,199	7.0	52,011	69.6	182	158.3	776,284	383.3
1904.....	98	46.3	16,770	37.5	66,983	28.8	171	148.7	683,500	337.5
1909.....	147	50.0	13,929	-16.9	120,775	80.3	95	82.6	821,599	405.7
1914.....	176	19.7	25,366	82.1	191,263	58.4	144	125.2	1,086,722	536.6
1919.....	320	81.8	58,889	132.2	365,272	91.0	184	160.0	1,141,475	563.6

¹ A minus sign (-) denotes decrease.

² For method of computing average, see p. 30.

The expansion in 1892 of the Standard Oil Co. of New Jersey, which had been formed in 1882, to include certain other holdings, thereby creating the Standard Oil Trust, is definitely reflected in the table. The first census after that date indicated the natural result of consolidation—that the number of establishments in the country had decreased, there being but 67 refineries reported in the census of 1899. It will be remembered that a similar decrease appeared in the meat-packing industry upon the formation of a large combination. Since 1899 the growth of the petroleum-refining industry has been considerable. The one exception is the apparent decrease in the number of wage earners from 1904 to 1909. This is, however, chiefly a matter of classification, for at that time one of the largest companies began returning separate

reports for its box, cooperage, and tin shops, which at prior censuses had been included with the reports for its refineries.

There has been a remarkable expansion of equipment as evidenced by the horsepower figures. Prior to 1904 the development of machinery had evidently not been great. Between 1904 and 1909 primary horsepower doubled; between 1909 and 1914 it increased 40 per cent; and between 1914 and 1919 it once more doubled. Since these increases have been to a large degree the result of the construction of new establishments, they have been only partially reflected in increased output per establishment. Since 1909 the increase in wage earners has been greater than that in primary horsepower.

The extraordinary development in the period from 1914 to 1919 is due chiefly to the increased demand for the product and to the opening of new fields in Texas and Oklahoma. The expansion in number of wage earners at a more rapid rate than in materials used is to be explained, at least in part, by the development of supplementary and varied product manufacture—an expansion similar in nature to that already indicated as present in the slaughtering and meat-packing industries.

COKE.

The coke industry (Table 25) is another industry in which the technical process has been subject to change, the introduction of by-product ovens having resulted in the gradual supplanting of the old beehive process. This development accounts for the very noticeable increase in physical product per establishment during the 40-year period. Because of the change in process the increase in product has been accomplished by a less than proportional increase in the number of wage earners employed.

In 1919 the 56 by-product establishments employed 15,553 wage earners, or 278 per establishment, whereas the 222 beehive establishments employed 13,766 wage earners, or 64 wage earners per establishment. The beehive establishments in 1919 averaged fewer wage earners than did all coke plants in 1899, although in that year over 95 per cent of all coke produced was the product of beehive ovens. In 1919 the average product of by-product establishments was 447,000 tons per year as compared with 85,000 tons per year for beehive establishments. Such a comparison makes it evident that the apparent concentration in the coke industry has been almost entirely the result of the introduction of the by-product process.

TABLE 25.—SIZE OF ESTABLISHMENTS—COKE:¹ 1879 TO 1919.

CENSUS YEAR.	COKE. ¹									
	Establishments.		Wage earners.		Physical product.		Wage earners per establishment.		Physical product per establishment.	
	Number.	Per cent of increase. ²	Total (average number). ³	Per cent of increase. ²	Amount (thousands of tons). ⁴	Per cent of increase. ²	Actual number.	Index number.	Actual amount (tons). ⁴	Index number.
1879.....	126	.....	3,140	.....	2,752	.....	25	100.0	21,841	100.0
1889.....	218	73.0	8,998	186.6	10,008	263.7	41	164.0	45,908	210.1
1899.....	241	10.6	16,999	88.9	19,641	96.3	71	284.0	81,498	373.1
1904.....	278	15.4	18,981	11.7	25,143	28.0	68	272.0	90,442	414.1
1909.....	315	13.3	29,273	54.2	39,315	56.4	93	372.0	124,810	571.4
1914.....	231	-26.7	21,107	-27.9	34,556	-12.1	91	364.0	149,593	684.9
1919.....	278	20.3	29,319	38.9	44,181	27.9	105	420.0	158,924	727.6

¹ Not including gas-house coke.² A minus sign (-) denotes decrease.³ For method of computing average, see p. 30.⁴ Tons of 2,000 pounds.

Since about 90 per cent of the coke used is utilized by the iron and steel industry, a close correlation between the variations in production of the two industries may be expected. In 1914 for the first time the output of blast furnaces was less than that of the previous census year. This situation was reflected in the coke industry, when, also for the first time, the physical product showed an actual decrease. And in 1919 each industry reached a new maximum in production.

In 1904 and in 1919 the same number of establishments, 278, were reported. During the 15 years, however, the number of wage earners in the industry had increased 54.5 per cent and the output 75.7 per cent. Subject, as it is, to the fluctuations in both the coal-mining industry and the iron and steel industry, the manufacture of coke is peculiarly dependent upon external conditions for its activity and development.

FERTILIZER.

This industry has had a varied history. Fertilizers have been of many types, one of the earliest fertilizers known being fish scrap. The use of fish as a fertilizer was known to the American Indians before the arrival of the whites, for it is stated in the records of the Plymouth colony that Squantum, a friendly Indian, showed the colonists how to manure their corn by putting a fish into each hill. The menhaden industry, the products of which yielded fish oil and fertilizer scrap, reached its height in 1880 and declined there-

after. For a short time guano was imported in considerable quantities, but the exhaustion of the sources of supply precluded its continued use. The possibilities for utilization of the refuse of meat-packing and canning establishments were soon recognized. The residue from crushing cottonseed for cottonseed oil, known as cottonseed cake, also furnished a new source of material. The mining of phosphate rock, an industry producing less than half a million tons of rock per year until 1889, recorded more than 2,000,000 tons in 1919.

This statement of the changing materials utilized indicates that the fertilizer industry is actually a group of different industries, the use of the product being in certain cases the only bond between them. Consequently the figures which are found in Table 26 are not so significant as they would seem to be. They indicate only that the enormous increase in physical product per establishment has not been accompanied by a similar increase in wage earners. From 1904 to 1914, although the product per establishment increased substantially, the average number of wage earners decreased, probably because the processes involved have become chiefly machinery processes.

TABLE 26.—SIZE OF ESTABLISHMENTS—FERTILIZER: 1879 TO 1919.

CENSUS YEAR.	FERTILIZER.									
	Establishments.		Wage earners.		Physical product.		Wage earners per establishment.		Physical product per establishment.	
	Num-ber.	Per cent of in-crease. ¹	Total (average num-ber). ²	Per cent of in-crease.	Amount (thou-sands of tons). ³	Per cent of in-crease. ¹	Ac-tual num-ber.	Index num-ber.	Actual amount (tons). ⁴	Index num-ber.
1879.....	364	.....	8,598	.....	727	.....	24	100.0	1,997	100.0
1889.....	390	7.1	9,026	5.0	1,898	161.1	23	95.8	4,867	243.7
1899.....	422	8.2	11,581	28.3	2,887	52.1	27	112.5	6,841	342.6
1904.....	399	-5.5	14,184	22.5	3,592	24.4	36	150.0	9,003	450.8
1909.....	550	37.8	18,310	29.1	5,618	56.4	33	137.5	10,215	511.5
1914.....	784	42.5	22,815	24.6	8,432	50.1	29	120.8	10,755	538.6
1919.....	600	-23.5	26,296	15.3	8,237	-2.3	44	183.3	13,728	687.4

¹ A minus sign (-) denotes decrease.

² For method of computing average, see p. 30.

³ Tons of 2,000 pounds.

It must be added that there are a great number of plants which have in rather recent years undertaken the manufacture of fertilizer as a secondary product, and therefore have to some extent limited the market of the factories in which fertilizer is the primary product of manufacture.

INTERDEPENDENT INDUSTRIES.

Certain industries are interdependent in that their products may be substituted for one another. One such group of industries comprises those manufacturing vehicles for land transportation—the carriage and wagon, bicycle and motor-cycle, automobile, electric-car, and steam-railroad and passenger-car industries. The growth of these industries, except the manufacture of electric and steam passenger cars, is indicated in Chart E. It can be readily seen that the boom in the bicycle industry, which reached its height about the year 1895, had but a brief and slight influence upon the production of carriages and wagons, whereas the expansion of automobile manufacture severely undermined the carriage industry.

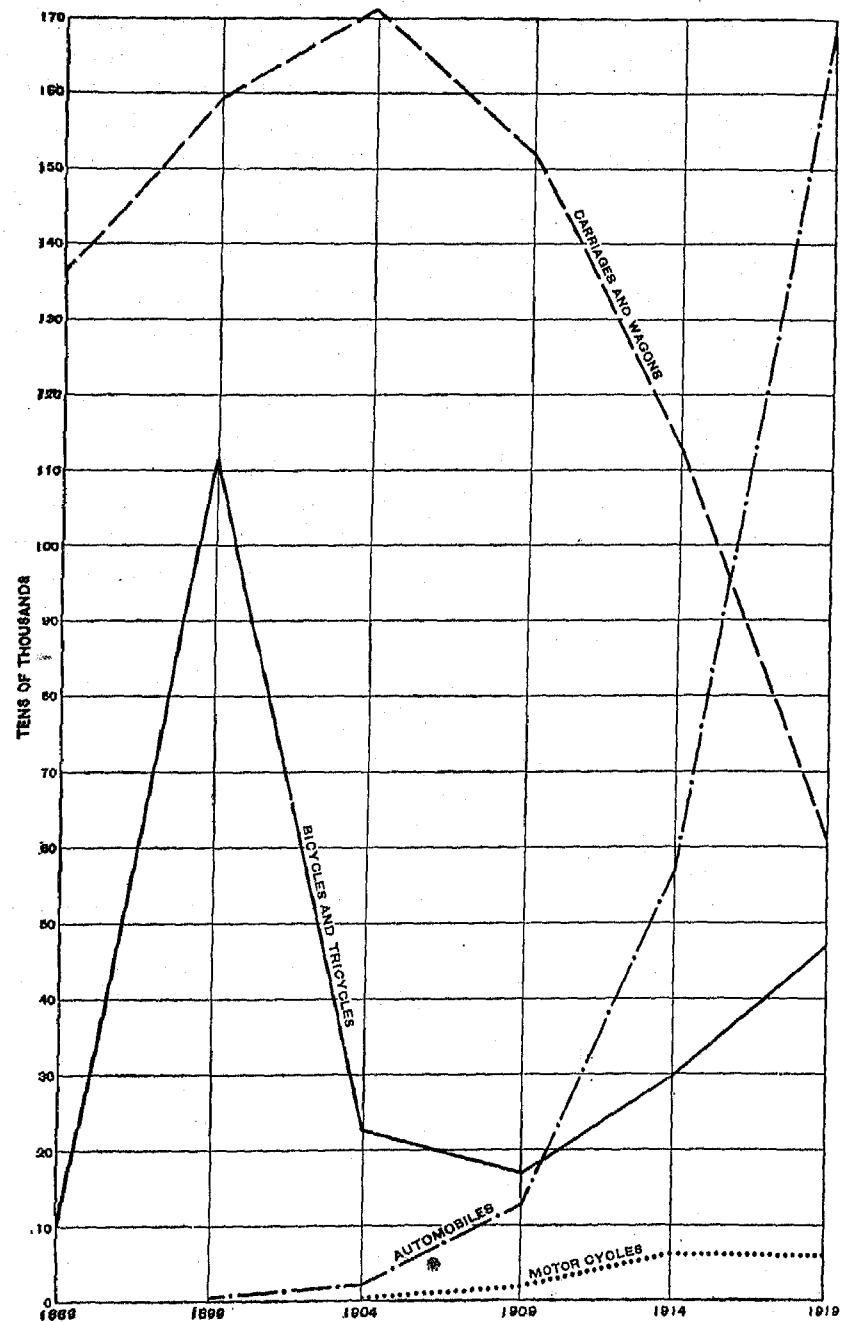
The carriage and wagon industry showed a growth in production until 1904 and has declined since that date, as indicated by Table 27. The greatest increase in number of wage earners, occurring during the decade from 1879 to 1889, is due to the fact that in 1879 the industry suffered from a general depression, whereas in 1889 it experienced unparalleled prosperity. Many of the establishments became specialized at early dates, devoting themselves solely to the manufacture of parts and materials. Nevertheless, production reached its peak early in the present century, and since 1904 there has been an absolute decrease.

TABLE 27.—SIZE OF ESTABLISHMENTS—CARRIAGES AND WAGONS: 1879 TO 1919.

CENSUS YEAR.	CARRIAGES AND WAGONS.									
	Establishments.		Wage earners.		Vehicles produced.		Wage earners per establish- ment.		Vehicles produced per establishment.	
	Num- ber.	Per cent of in- crease. ¹	Total (average number). ²	Per cent of in- crease. ¹	Num- ber (thou- sands).	Per cent of in- crease. ¹	Actu- al num- ber.	Index num- ber.	Actual num- ber.	Index num- ber.
1879.....	3,841	.....	45,394	.....	.....	.....	12	.....	.....	.....
1889.....	4,572	19.0	56,525	24.5	1,365	.....	12	100.0	299	100.0
1899.....	6,204	35.7	58,425	3.4	1,594	16.8	9	75.0	257	86.0
1904.....	4,956	-20.1	60,722	3.9	1,712	7.4	12	100.0	345	115.4
1909.....	4,870	-1.7	52,540	-13.5	1,520	-11.2	11	91.6	312	104.3
1914.....	4,601	-5.5	41,304	-21.4	1,126	-25.9	9	75.0	245	81.9
1919.....	2,286	-50.3	18,173	-56.0	610	-45.8	8	66.6	267	89.3

¹ A minus sign (-) denotes decrease.² For method of computing average, see p. 30.

CHART E.—PRODUCTION OF DIFFERENT VEHICLES FOR LAND TRANSPORTATION:
1889 TO 1919.



The size of establishment, measured both by the average number of wage earners and the average number of vehicles produced, has decreased since 1904. The establishments which have survived the competition with street car and automobile are presumably in most cases the smaller ones, although some of them may be the larger ones considerably reduced in size. A number of manufacturers in this industry transferred their activity to production of automobiles. For the most part these manufacturers have been active in the carriage industry on a large scale, and therefore the establishments remaining in the industry are of somewhat smaller average size.

The automobile industry has expanded with great rapidity and to a remarkable degree. The number of establishments has apparently reached an approximate maximum, but the ultimate size of these enterprises is by no means determined (see Table 28). The census of 1919 reported very much larger establishments than those recorded in 1914. Since the production of automobiles requires a large capital investment and permits standardization to a high degree, the development of large establishments is especially favored.

TABLE 28.—SIZE OF ESTABLISHMENTS—AUTOMOBILES: 1899 TO 1919.

CENSUS YEAR.	AUTOMOBILES.									
	Establishments.		Wage earners.		Physical product.		Wage earners per establishment.		Physical product per establishment.	
	Number.	Per cent of increase.	Total (average number). ¹	Per cent of increase.	Number.	Per cent of increase.	Actual number.	Index number.	Actual number.	Index number.
1899.....	57	.....	2,241	.....	3,723	.....	39	100.0	65	100.0
1904.....	121	112.3	10,239	356.9	21,692	482.6	85	217.9	179	275.4
1909.....	265	119.0	51,294	401.0	126,593	483.6	194	497.4	478	735.4
1914.....	300	13.2	79,307	54.6	568,781	349.3	264	676.9	1,896	2,916.9
1919.....	315	5.0	210,559	165.5	1,678,926	195.2	668	1,712.8	5,330	8,200.0

¹ For method of computing average, see p. 30.

Although the period from 1914 to 1919 showed very little increase in the number of establishments whose finished product was automobiles, in the branch of the industry manufacturing automobile bodies and parts, the expansion was enormous. The number of such establishments increased from 971 to 2,515, or 159 per cent, with a slightly greater increase in number of

wage earners. Since these establishments are little other than feeders for the automobile factories proper, it is evident that the expansion has been chiefly into specialized lines, and the automobile factories proper have developed the function of fabrication. The value of products of the automobile bodies and parts establishments equals nearly one-half the total value of materials used in the automobile factories proper.

It is interesting to note that in 1914 only 25,375 of the total number of motor vehicles produced were trucks, while in 1919, 305,142 trucks were manufactured. The automobile industry represents extremely rapid development on a large scale, which had not reached nor even closely approached its peak in 1919.

SHIPBUILDING.

The shipbuilding industry (Table 29) provides one of the most interesting industrial histories. Prior to 1919 the wooden and steel shipbuilding branches had reached in 1899 and 1904, respectively, the greatest production recorded at any census. The height of American shipbuilding, however, measured by tonnage annually added to the merchant marine, had come in an earlier decade, 1850 to 1860. At that time the American clipper was superior to any other vessel made, but the supremacy of America on the sea was soon lost with the introduction of more modern vessels, and the American shipyards devoted themselves thereafter to manufacture for domestic trade and for the United States Navy. The enormous developments of internal commerce, particularly on the Great Lakes, have been of great importance in keeping the American shipbuilding industry alive. The decline in the steel shipbuilding branch during the period 1904 to 1909 is no doubt due to a withdrawal of Government work from private shipyards.

The outstanding feature in the industry has been the gradual change from wooden to steel ships. The dissimilarity in the two types of construction is reflected in the figures for size of establishments. The contrast in terms both of wage earners per establishment and of tonnage per establishment is noteworthy. The majority of establishments engaged in steel shipbuilding are of great size, requiring costly and extensive equipment, while wooden ships are made in small yards, which are active chiefly in making minor repairs and constructing vessels of small tonnage, such as

barges. In the wooden shipbuilding branch since 1904 and in the steel shipbuilding branch since 1889 there has been, in general, a rather pronounced tendency toward an increase in the number of employees per unit of output.

TABLE 29.—SIZE OF ESTABLISHMENTS—SHIPBUILDING: 1889 TO 1919.

CENSUS YEAR.	SHIPBUILDING.									
	Establishments.		Wage earners.		Tonnage launched.		Wage earners per establishment.		Tonnage launched per establishment.	
	Num. ber.	Percent of in-crease. ¹	Total (average num-ber). ²	Percent of in-crease. ¹	Gross tons (hun-dreds).	Percent of in-crease. ¹	Actual num-ber.	Index num-ber.	Actual amount (gross tons).	Index num-ber.
WOODEN.										
1889.....	988	.....	14, 116	.....	3, 607	.....	14	100. 0	365	100. 0
1899.....	1, 063	7. 6	15, 841	12. 2	4, 246	17. 7	15	107. 1	399	109. 3
1904.....	1, 043	-1. 9	14, 012	-11. 5	3, 754	-11. 6	13	92. 8	360	98. 6
1909.....	1, 300	24. 6	12, 363	-11. 8	2, 210	-41. 1	10	71. 4	170	46. 6
1914.....	1, 068	-17. 8	10, 981	-11. 2	1, 867	-15. 5	10	71. 4	175	47. 9
1919.....	913	-14. 5	43, 432	295. 5	7, 795	317. 5	48	342. 8	854	234. 0
STEEL.										
1889.....	18	.....	8, 165	.....	1, 240	.....	454	100. 0	6, 889	100. 0
1899.....	44	144. 4	30, 906	278. 5	2, 625	111. 7	702	154. 6	5, 966	86. 6
1904.....	54	22. 7	36, 742	18. 9	3, 527	34. 4	680	149. 8	6, 531	94. 8
1909.....	53	-1. 9	28, 143	-23. 4	2, 608	-26. 1	531	117. 0	4, 921	71. 4
1914.....	79	49. 1	33, 508	19. 1	2, 688	3. 1	424	93. 4	3, 493	49. 3
1919.....	162	105. 1	344, 014	926. 7	38, 829	1, 344. 5	2, 124	467. 8	23, 968	347. 9

¹ A minus sign (-) denotes decrease.

² For method of computing average, see p. 30.

The abnormality of the figures for 1919 requires brief mention. In both branches of the industry the war period was one of extreme expansion. The number of steel shipyards more than doubled, and their wage earners multiplied to more than 10 times their 1914 total. Output went up in even greater proportion, increasing 1,346.1 per cent. With an average of 2,124 employees per establishment, steel shipbuilding leads all other industries in average size of establishment. There can be little question that the 1919 figures are quite outside the general trend in this industry, and that the records for 1921, though only two years later, will indicate a considerable slump from the heights reached during the war.

CONCLUSION.

The records of these 18 industries have indicated wide differences in the nature of industrial development. Certain industries—those manufacturing salt, beet sugar, leather, woolen goods, automobiles, iron and steel, and coke—have shown notable increases in average size of establishments. Other industries, such as slaughtering and meat packing, artificial ice, cotton goods, and boot and shoe manufacture, have maintained a more nearly constant level in size of establishments, and the silk, lumber, carriage and wagon, and shipbuilding industries have recorded tendencies to decrease in average size of establishments.

Such diversity only serves to show that the use of the concept indicated by the blanket phrase "industry as a whole" conceals many different industrial developments, each of which must be explained by factors often differing widely in nature. Although the general average of all industry may remain fairly constant, within this average are certain industries whose establishments are expanding rapidly and others in which the average establishment is growing smaller and smaller.

IV.

THE SCALE OF PRODUCTION.

Up to this point the size of industrial establishments has been discussed by means of averages. The use of the average, although providing a convenient method of comparison between groups which include many items, has certain definite drawbacks. An average gives only a statement of the central point about which the data are distributed. It affords no indication of the amount of scatter or dispersion. In the problem of the scale of production of industrial establishments the size distribution is of very great importance. There is a fundamental difference between an increase in the average size caused by the addition of a few wage earners to all establishments and an increase resulting from the replacing of a number of small establishments by large ones. In both cases the average might record the same increase, yet, in terms of large-scale production, the latter case is much more significant. It becomes necessary, therefore, to examine distributions as well as averages.

In Table 30 is given the distribution, in terms of wage earners employed, of all establishments for the last three censuses. The same data are reproduced in graphic form in Chart F. In 1919, 2.2 per cent of all establishments employed more than 250 wage earners each. The total pay roll of this small group, however, included 53.5 per cent of the wage earners employed by all manufacturing enterprises. Thus, while the large establishments are small in number, they are of the utmost significance in terms of employment. Moreover, this group is rapidly increasing in importance, since in 1914 it employed but 46.3 per cent of all wage earners and in 1909, 43.2 per cent.

Every size group increased in number of establishments from 1914 to 1919, although in the previous five-year period the middle-sized establishments, employing an average of 6 to 50 wage earners, decreased in number. The most pronounced proportional increase came in the larger groups, but the greatest number of establishments actually added appeared among those employing no wage earners. During the last 10-year period 10,000 were added to this group of smallest-size establishments. The increase in price level, when considered in its relation to the fixed limit of \$500, the value-product minimum for census investigation, has, of

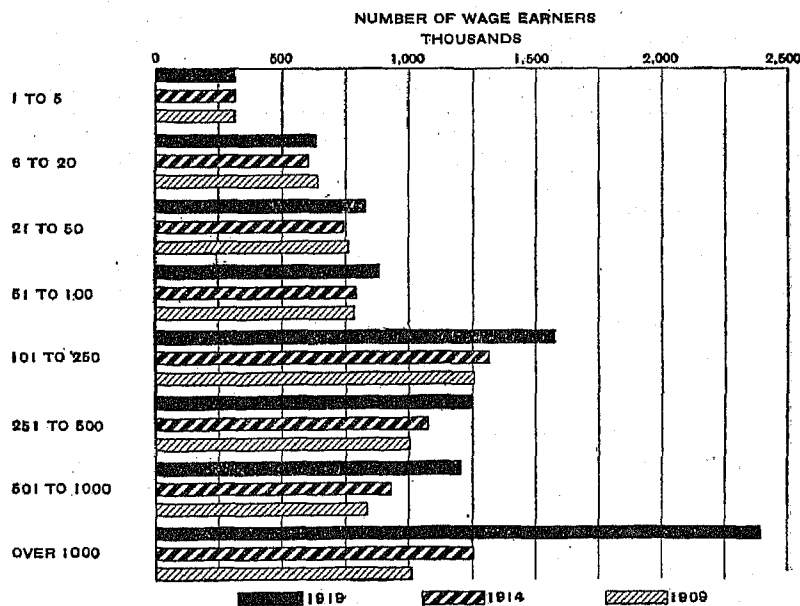
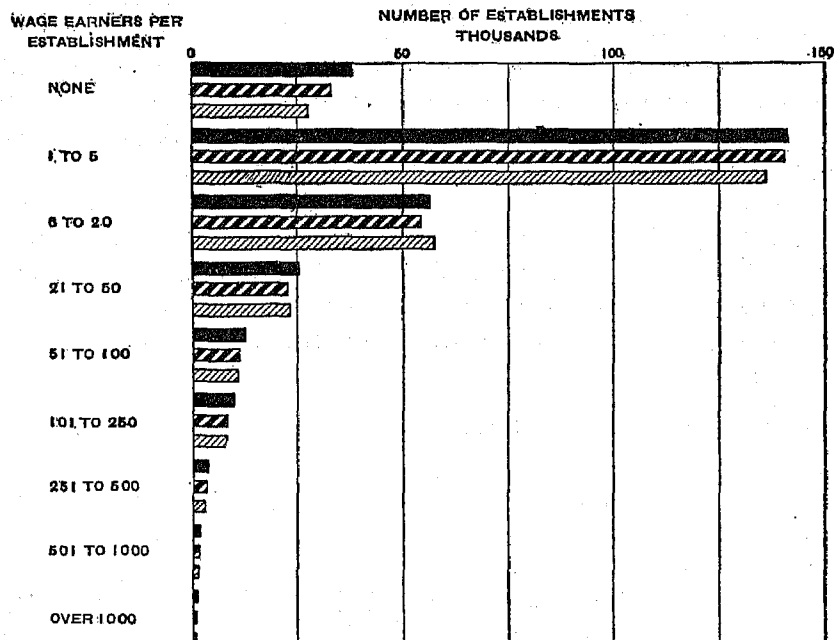
course, made certain enterprises eligible for enumeration in the later censuses which otherwise would have remained below the minimum. Nevertheless, the increase between 1909 and 1914 in number of establishments having no wage earners was greater than that during the following five years, despite the fact that prices increased only slightly during the earlier period but more than doubled during the later period.

TABLE 30.—DISTRIBUTION OF ESTABLISHMENTS, BY NUMBER OF WAGE EARNERS: 1909, 1914, AND 1919.

WAGE EARNERS PER ESTABLISHMENT.	NUMBER.			PER CENT OF TOTAL.		
	1919	1914	1909	1919	1914	1909
MANUFACTURING ESTABLISHMENTS.						
All establishments.....	290, 105	275, 791	268, 491	100.0	100.0	100.0
No wage earners.....	37, 934	32, 856	27, 712	13.1	11.9	10.3
1 to 5 wage earners.....	141, 742	140, 971	136, 289	48.9	51.1	50.8
6 to 20 wage earners.....	56, 208	54, 379	57, 198	19.4	19.7	21.3
21 to 50 wage earners.....	25, 379	22, 932	23, 544	8.7	8.3	8.8
51 to 100 wage earners.....	12, 405	11, 079	10, 964	4.3	4.0	4.1
101 to 250 wage earners.....	10, 068	8, 470	8, 116	3.5	3.1	3.0
251 to 500 wage earners.....	3, 599	3, 108	2, 905	1.2	1.1	1.1
501 to 1,000 wage earners.....	1, 749	1, 348	1, 223	0.6	0.5	0.5
Over 1,000 wage earners.....	1, 021	648	540	0.4	0.2	0.2
WAGE EARNERS.						
All establishments.....	9, 096, 372	7, 036, 247	6, 615, 046	100.0	100.0	100.0
No wage earners.....	311, 576	317, 216	311, 704	3.4	4.5	4.7
1 to 5 wage earners.....	631, 290	606, 609	640, 793	6.9	8.6	9.7
6 to 20 wage earners.....	829, 301	742, 529	764, 408	9.1	10.6	11.6
21 to 50 wage earners.....	888, 344	791, 726	782, 298	9.8	11.3	11.8
51 to 100 wage earners.....	1, 581, 763	1, 320, 972	1, 258, 639	17.4	18.8	19.0
101 to 250 wage earners.....	1, 250, 875	1, 075, 108	1, 006, 457	13.8	15.3	15.2
251 to 500 wage earners.....	1, 205, 627	926, 828	837, 473	13.3	13.2	12.7
501 to 1,000 wage earners.....	2, 397, 596	1, 255, 259	1, 013, 274	26.4	17.8	15.3

It is evident from these data that the development of large-scale enterprises was greatly accelerated during the last five years, but it is impossible to determine how much of the 1919 expansion was permanent and how much temporary. At any rate, the growth of large-scale concerns has not been carried on to the exclusion of smaller enterprises, these also having increased in number. A distinction, therefore, must be made between size increase due to the addition of large-scale enterprises and that due to the expansion of small scale production.

CHART F.—DISTRIBUTION OF ESTABLISHMENTS, BY NUMBER OF WAGE EARNERS:
1909 TO 1919.



The variation in size of establishment is depicted from another angle in Table 31. No comparison with previous censuses can be made because of the changes in price level, but the distribution of concerns in terms of the value of their products in 1919 is of considerable importance. Of most significance is the fact that 3.6 per cent of the total number of establishments reported a product in 1919 valued at more than \$1,000,000 each. This proportion, approximately one twenty-eighth of all the establishments, employed 56.9 per cent of all wage earners and produced 67.8 per cent of the total value of products during that year. If the group of establishments next smaller in size be added, it appears that nearly one-fifteenth of the establishments employ seven-tenths of the wage earners and produce nearly four-fifths of the total value of products.

TABLE 31.—DISTRIBUTION OF ESTABLISHMENTS, BY VALUE OF PRODUCTS: 1919.

VALUE OF PRODUCT.	ESTABLISHMENTS.		WAGE EARNERS.		VALUE OF PRODUCTS.		VALUE ADDED BY MANUFACTURE.	
	Number.	Per cent distribution.	Average number. ¹	Per cent distribution.	Amount (expressed in thousands).	Per cent distribution.	Amount (expressed in thousands).	Per cent distribution.
All classes.....	290,105	100.0	9,096,372	100.0	\$62,418,079	100.0	\$25,041,698	100.0
Less than \$5,000.....	65,485	22.6	45,813	0.5	167,085	0.3	106,653	0.4
\$5,000 to \$20,000.....	87,440	30.1	249,722	2.7	945,603	1.5	539,698	2.2
\$20,000 to \$100,000....	77,911	26.9	793,528	8.7	3,571,283	5.7	1,747,729	7.0
\$100,000 to \$500,000...	39,547	13.7	1,719,982	18.9	8,965,872	14.4	4,152,284	16.6
\$500,000 to \$1,000,000.	9,208	3.2	1,114,615	12.3	6,467,132	10.4	2,882,620	11.5
\$1,000,000 and over...	10,414	3.6	5,172,712	56.9	42,301,104	67.8	15,612,714	62.3

¹ For method of computing average, see p. 30.

Since the proportion of the value of products found in the group producing on the largest scale is 67.8 per cent and the value added by manufacture 62.3 per cent, while the wage earners in this group constitute but 56.9 per cent of those in all industry, it is obvious that in those larger establishments the value of products per wage earner is greater. The explanation of this situation usually presented is that it arises from the various economies and efficiencies which are possible in the larger establishments. However, it must also be remembered that these larger establishments are most often found in industries which require a large capital investment, such as sugar refining or steel works and rolling mills, and in which, because of the relatively smaller part played by

labor than in other industries, the value of products is high in proportion to the number of wage earners.

In order to make the discussion of large-scale production more definite, the 16 industries in which the largest proportion of establishments employ over 250 wage earners, and the 16 industries in which the largest proportion of establishments produce over \$1,000,000 value of products, were determined. The results are given in Table 32. As can readily be seen, 13 industries are common to both lists. These 13 industries, therefore, represent the most extreme cases of large-scale production, measured both by wage earners and by value of products.

TABLE 32.—LEADING INDUSTRIES IN LARGE-SCALE PRODUCTION: 1919.

INDUSTRY.	MANUFACTURING ESTABLISHMENTS.						
	Total number.	Employing over 250 wage earners (average number). ¹			Value of products over \$1,000,000.		
		Number.	Per cent of total.	Rank.	Number.	Per cent of total.	Rank.
Sugar, refining.....	20	19	95.0	1	20	100.0	1
Boots and shoes, rubber.....	25	22	88.0	2	21	84.0	5
Shipbuilding, steel.....	162	101	62.3	3	100	61.7	13
Watches.....	18	11	61.1	4	6	33.3	.....
Iron and steel, steel works and rolling mills....	500	305	61.0	5	330	66.0	10
Locomotives.....	17	10	58.8	6	11	64.7	11
Cars, electric-railroad.....	7	4	57.1	7	4	57.1	14
Smelting and refining, copper.....	34	19	55.9	8	30	88.2	2
Belting and hose, rubber.....	15	9	60.0	9	11	73.3	7
Ordinance and accessories.....	26	12	46.2	10	14	53.8	15
Cars, steam-railroad.....	99	44	44.4	11	53	53.5	16
Smelting and refining, lead.....	25	12	48.0	12	22	88.0	3
Smelting and refining, zinc.....	39	17	43.6	13	29	74.4	6
Wire.....	66	28	42.4	14	33	50.0	.....
Pencils, lead.....	12	5	41.7	15	5	41.7	.....
Iron and steel, blast furnaces.....	195	51	26.2	16	130	66.7	9
Oilcloth and linoleum.....	32	8	25.0	.....	20	62.5	12
Sugar, beet.....	85	9	10.6	.....	58	68.2	8
Oil, linseed.....	26	1	3.8	.....	22	84.6	4

¹ For method of computing average, see p. 30.

Leading in both lists is sugar refining. The nature of the sugar-refining process is such as to make production on a small scale well-nigh impossible. The machinery is very complex, and quantity production is essential. The enormous capital investment

required to prepare a refinery for activity has been concentrated, therefore, in a small number of very large establishments.

The industry ranking second is the rubber boot and shoe industry, with which may be discussed the rubber belting and hose industry. In these fields there are three fundamental reasons for large-scale operation: First, the fact that the control of these industries is centered in the hands of a small number of individuals; second, the technical requirements of the industrial processes, and third, the use of raw materials which must be imported from South America or the East Indies. Since the most economical method is to acquire this material in bulk, the rubber industries require a large outlay of capital. This same situation is a factor of importance in the sugar-refining industry in those cases in which unrefined sugar is imported from the West Indies.

The remaining 10 industries in which concentration is outstanding are all metal or metal-product industries. The three smelting and refining industries—copper, lead, and zinc—appear, and also steel works and rolling mills and blast furnaces. Five industries making complex metal products complete the list—steel ship-building, locomotives, steam-railroad cars, electric cars, and ordnance. In these industries the scale must be large because the unit manufactured is large. Locomotives can not be made by one man turning out a small value-product per year. It is perhaps because of this situation that the tendency toward large-scale production is apt to be exaggerated. To a large extent, the development has arisen from new industries which require large-scale methods in their operation rather than from the expansion of production in the older and more established industries.

Having noted certain industries in which large-scale production prevails, it is of importance to determine how extensive such large-scale activity is among manufacturing enterprises in other fields. The extreme differences among industries are at once evident. In Table 33 are given, for 1919, the distributions of establishments according to number of wage earners for the six industries which employed more than 300,000 workers each. In the lumber and timber products and the foundry and machine-shop products industries most of the establishments are small, although in the one case it is due to the scattered location of raw materials and in the other to the nature of its market. Cotton goods and steam-railroad cars and repairs show their greatest concentration in establishments employing 101 to 250 wage earners; and the

remaining two industries—steel works and rolling mills and steel shipbuilding—show their concentrations in even larger establishments. There could be no clearer indication of the fact that industry at the present time is operating on all scales of production.

TABLE 33.—DISTRIBUTION OF ESTABLISHMENTS BY NUMBER OF WAGE EARNERS IN SIX INDUSTRIES EMPLOYING OVER 300,000 WAGE EARNERS: 1919.

INDUSTRY.	Number of establishments.	Wage earners (average number). ¹	ESTABLISHMENTS EMPLOYING—								
			No wage earners.	1 to 5 wage earners.	6 to 20 wage earners.	21 to 50 wage earners.	51 to 100 wage earners.	101 to 250 wage earners.	251 to 500 wage earners.	501 to 1,000 wage earners.	Over 1,000 wage earners.
Cars and general shop construction and repairs by steam-railroad companies.....	1,744	484,437	.....	125	206	253	255	397	238	164	106
Cotton goods.....	1,288	430,966	2	26	81	118	183	417	218	152	91
Foundry and machine-shop products.....	10,934	482,767	757	3,814	2,784	1,636	868	703	228	107	37
Iron and steel, steel works and rolling mills.....	500	375,088	.....	5	13	32	48	97	103	102	100
Lumber and timber products.....	26,119	480,945	843	16,640	5,333	1,547	662	698	296	85	15
Shipbuilding, steel.....	162	344,014	1	6	12	11	17	14	17	10	74

¹ For method of computing average, see p. 30.

But perhaps more important than the problem of the present scale of operation is the problem of the direction in which industry is tending—the nature of the change taking place over a period of time. On page 75 it was demonstrated that an increasing share of enterprise is carried on by these larger establishments—that they are increasing in number, in proportion of total wage earners, and in proportion of total value of products. There can be no doubt that much of this increase in apparent scale of production is merely the development of certain new industries which naturally operate on a large scale, such as the automobile industry or the steel shipbuilding industry from 1914 to 1919. The elimination of such factors can be accomplished best by examining various old and not necessarily large-scale industries.

The nine such industries selected were chosen because pertinent material is available, because the establishments are in sufficient number to give an indication of a regular distribution, and because there has been relatively little change in the number of estab-

lishments during the period. It should be noted that, in general, most industries show very slight fluctuation in size distribution from census to census. Unfortunately, data can not be carried back further than 1909, for, although size distributions were formulated before that year, they were based upon the maximum number of wage earners employed rather than the average number, as is the present method.

TABLE 34.—DISTRIBUTION OF ESTABLISHMENTS BY NUMBER OF WAGE EARNERS IN THREE SELECTED INDUSTRIES IN WHICH THE SCALE OF PRODUCTION INCREASED: 1909 TO 1919.

INDUSTRY AND CENSUS YEAR.	Number of estab- lish- ments.	WAGE EARNERS.		ESTABLISHMENTS EMPLOYING—									
		Total (average num- ber). ¹	Average per estab- lish- ment.	No wage earn- ers.	1 to 5 wage earn- ers.	6 to 20 wage earn- ers.	21 to 50 wage earn- ers.	51 to 100 wage earn- ers.	101 to 250 wage earn- ers.	251 to 500 wage earn- ers.	501 to 1,000 wage earn- ers.	Over 1,000 wage earn- ers.	
Paper and wood pulp:													
1909.....	777	75,978	97.8	.....	36	157	196	156	166	49	16	1
1914.....	718	88,457	123.2	.....	29	114	172	134	183	60	21	5
1919.....	729	113,759	156.0	.....	24	87	158	139	204	70	38	9
Steel works and rolling mills:													
1909.....	446	240,076	538.3	.....	5	21	34	60	89	98	82	57
1914.....	427	248,716	582.5	.....	3	16	30	46	92	94	87	59
1919.....	500	375,088	750.2	.....	5	13	32	48	97	103	102	100
Flour and grist mills:													
1909.....	11,691	39,453	3.4	1,849	8,591	996	189	50	12	1	3	.....
1914.....	10,788	39,718	3.7	1,887	7,667	953	195	65	16	3	2	.....
1919.....	10,708	45,481	4.2	3,181	6,220	922	251	82	42	7	1	2	

¹ For method of computing average, see p. 30.

In many industries, particularly those in which the introduction of machinery has been tardy, the scale of production is doubtless increasing. Instances are given in Table 34. The paper and wood-pulp industry furnishes a perfect illustration of such development. There was little change in the number of enterprises in this industry between 1909 and 1919. The number of wage earners, on the other hand, continued to increase, thereby affecting the size distribution of establishments. The number of establishments in all size groups of 50 or fewer employees decreased during both five-year periods, and the number in all size groups of over 100 employees increased in both periods. The intermediate group employing 50 to 100 wage earners decreased during the first period and increased during the second. These changes may have been brought about by the expansion or consolidation of small plants or by the actual elimination of small plants and the introduction of larger ones. A similar tendency can be readily seen in

the corresponding distribution for steel works and rolling mills and for flour mills and gristmills. It must be kept in mind that the increases in the no-wage-earner group are due chiefly to the addition of shops so small that they had not been included in the census reports prior to 1919, but had then become eligible for enumeration because of the rise in the level of prices.

Certain industries are interesting because they reported a changing tendency during the ten-year period. Two such instances are given in Table 35—machine shops and foundries and establishments producing tanned, curried, and finished leather changed but little in size distribution during the period 1909 to 1914 but showed a decided tendency toward concentration during the following five years. This development evidenced itself in the fact that all categories of over 100 wage earners reached their highest point while all under that, except "no wage earners," reached their lowest point in 1919. In the foundry and machine-shop industry the early quinquennial period witnessed a decline in every size group except that comprising establishments reporting no wage earners. The latter five years returned the larger establishments to approximately their 1909 status, but left the smaller ones still considerably less numerous. Consequently, although there were in the industry approximately the same number of large-scale enterprises in 1919 as in 1909, they formed a larger proportion of the total number of machine shops and foundries in operation.

TABLE 35.—DISTRIBUTION OF ESTABLISHMENTS BY NUMBER OF WAGE EARNERS IN TWO SELECTED INDUSTRIES IN WHICH THE SCALE OF PRODUCTION DECREASED AND INCREASED: 1909 TO 1919.

INDUSTRY AND CENSUS YEAR.	Number of estab- lishments.	WAGE EARNERS.		ESTABLISHMENTS EMPLOYING—									
		Total (average number). ¹	Average per estab- lishment.	No wage earn- ers.	1 to 5 wage earn- ers.	6 to 20 wage earn- ers.	21 to 50 wage earn- ers.	51 to 100 wage earn- ers.	101 to 250 wage earn- ers.	251 to 500 wage earn- ers.	501 to 1,000 wage earn- ers.	Over 1,000 wage earn- ers.	
Foundry and machine- shop products: ²													
1909.....	13, 253	531, 011	40.1	639	4, 936	3, 625	1, 895	1, 007	765	244	101	41	
1914.....	10, 640	362, 471	34.1	664	4, 305	2, 801	1, 377	695	536	181	57	24	
1919.....	10, 934	482, 767	44.2	757	3, 814	2, 784	1, 636	868	703	228	107	37	
Leather, tanned, curried, and finished:													
1909.....	919	62, 202	67.7	30	213	166	200	150	116	26	14	4	
1914.....	741	55, 936	75.5	18	113	152	141	175	103	24	12	3	
1919.....	680	72, 476	106.6	23	75	124	131	140	126	37	19	5	

¹ For method of computing average, see p. 30.

² The figures used for 1909 not fairly comparable with those for other years.

An examination of separate industries brings to light the fact that not only are certain industries tending toward large-scale production, but certain other industries are tending toward production on a small scale. There are 17 industries which, during the period 1914 to 1919, increased in total number of establishments and decreased in total number of wage earners. In four more industries the number of establishments remained unchanged but the number of wage earners decreased. Furthermore, there are many industries in which the number of establishments increased more rapidly than the number of wage earners, thus lowering the average number of wage earners per establishment in 1919 as compared with 1914. The 21 industries in which an increase or no change in number of establishments took place concurrently with a decrease in number of wage earners are:

Artificial flowers.
Belting, leather.
Canning and preserving, oysters.
Clothing, women's.
Copper, tin, and sheet-iron work.
Corsets.
Cotton lace.
Fireworks.
Gold and silver, leaf and foil.
Grindstones.
Lard, not made in meat-packing establishments.

Matches.
Mirrors, framed and unframed.
Nets and seines.
Paving materials.
Rules, ivory and wood.
Shirts.
Smelting and refining, lead.
Statuary and art goods.
Wall paper, not made in paper mills.
Windmills.

Detailed figures are given in Table 36 for the manufacture of women's and men's clothing. The tendency toward small-scale production is most evident in the women's clothing industry, being exactly the reverse of the development noted in the discussion of the paper and wood-pulp industry. The number of establishments in each size group up to 50 wage earners increased and the number in each size group above 100 wage earners decreased during each five-year period, and the intermediate group increased during the first five years and decreased during the second. A more or less different tendency appears in men's clothing, where there appears to have been a noticeable development of medium-sized shops during the later five-year period, but the average size of establishments was somewhat smaller in 1919 than in 1909. The fact that the trend in the direction of manufacturing on a smaller scale appears also in industries such as hats and knit goods, in which the number of wage earners is

increasing (the list above includes only industries in which the number of wage earners is decreasing), emphasizes a development hitherto little recognized—the tendency toward small-scale production.

TABLE 36.—DISTRIBUTION OF ESTABLISHMENTS BY NUMBER OF WAGE EARNERS IN TWO SELECTED INDUSTRIES IN WHICH THE SCALE OF PRODUCTION DECREASED: 1909 TO 1919.

INDUSTRY AND CENSUS YEAR.	Number of establishments.	WAGE EARNERS.		ESTABLISHMENTS EMPLOYING—								
		Total (average number). ¹	Average per establishment.	No wage earners.	1 to 5 wage earners.	6 to 20 wage earners.	21 to 50 wage earners.	51 to 100 wage earners.	101 to 250 wage earners.	251 to 500 wage earners.	501 to 1,000 wage earners.	Over 1,000 wage earners.
Clothing, women's:												
1909.....	4, 558	153, 743	33. 7	68	770	1, 668	1, 268	486	247	45	5	1
1914.....	5, 564	168, 907	30. 4	127	1, 024	2, 132	1, 436	562	233	44	5	1
1919.....	7, 711	165, 649	21. 5	208	1, 891	3, 284	1, 649	483	176	16	4	.....
Clothing, men's, including shirts:												
1909.....	6, 354	239, 696	37. 7	191	1, 358	2, 355	1, 510	535	263	90	38	14
1914.....	5, 622	225, 719	40. 1	228	1, 338	1, 965	1, 209	486	253	87	40	16
1919.....	6, 154	214, 873	34. 9	362	1, 711	1, 945	1, 214	532	271	76	35	8

¹ For method of computing average, see p.30.

Two other industries are to be considered in which activity is on the decline. Data are given in Table 37. In the carriage and wagon industry there were actual increases from 1909 to 1914 in the two groups of establishments having no wage earners and not more than five wage earners, together with considerable decreases in all the other groups except the highest. From 1914 to 1919, however, every group except 501 to 1,000 appears to have suffered, the reduction being most noteworthy in the three groups employing from 1 to 50 wage earners. In the marble and stone work industry the 1909 to 1914 tendency is somewhat similar to that shown for carriages and wagons, the decline being concentrated, however, in the middle-size groups; but from 1914 to 1919, when the decline was felt in all groups of establishments employing wage earners, it was most pronounced among the larger ones.

In these two cases it is evident that the development has not been one in which the few large firms have maintained their position at the expense of the smaller, but have suffered severely as well.

TABLE 37.—DISTRIBUTION OF ESTABLISHMENTS BY NUMBER OF WAGE EARNERS IN TWO DECLINING INDUSTRIES: 1909 TO 1919.

INDUSTRY AND CENSUS YEAR.	Number of estab- lishments.	WAGE EARNERS.		ESTABLISHMENTS EMPLOYING--									
		Total (average num- ber). ¹	Average per estab- lishment.	No wage earn- ers.	1 to 5 wage earn- ers.	6 to 20 wage earn- ers.	21 to 50 wage earn- ers.	51 to 100 wage earn- ers.	101 to 250 wage earn- ers.	251 to 500 wage earn- ers.	501 to 1,000 wage earn- ers.	Over 1,000 wage earn- ers.	
Carriages and wag- ons and materials:													
1909	5,492	69,928	12.7	440	2,996	1,466	325	159	81	17	6	2	
1914	5,057	52,391	10.4	509	3,006	1,087	271	113	55	11	3	2	
1919	2,544	24,682	9.7	485	1,461	370	112	73	33	7	3	....
Marble and stone work:													
1909	4,964	65,603	13.2	264	2,865	1,145	455	140	78	14	2	1	
1914	4,901	54,981	11.2	603	2,874	857	354	124	70	16	2	1	
1919	4,240	32,768	7.7	684	2,506	697	240	70	37	5	1	....

¹ For method of computing average, see p. 30.

ADVANTAGES OF LARGE-SCALE PRODUCTION.

From this point the discussion will deal with the logical advantages of large-scale production and with the types of industry which particularly favor large and small-scale operations, respectively. It is impossible to evolve an adequate theory concerning the scale of production from only three collections of data at five-year intervals, and the task is rendered particularly difficult by the wide variation in business activity between the years 1914 and 1919.

There are certain advantages which should logically develop from large-scale production. The following outline is, in general, a presentation of the various possible economies of producing on a large scale. They represent potentialities and are conditioned by both the type of industry and the nature of management.

A.—Economies in production.

1. The materials required, as well as fuel or electric power, can usually be obtained more cheaply if purchased in large quantities. In addition large purchasers secure more ready attention and more careful consideration from the sellers.

2. The labor force may be more advantageously utilized, since the processes can be divided, resulting in saving due to division and specialization of labor.

3. The plant and equipment may be more advantageously utilized. The demand for products will be more exactly forecast and therefore there need not result slack and rush periods of work. According to figures collected by the National Bureau of Economic Research, however, the large enterprises showed greatest variation in activity from 1919 to 1922.¹

4. The materials may be more effectively utilized, either by by-product manufacture or by disposing of waste in bulk.

5. Standardization can be more easily applied, resulting in better coordination within the process.

6. Research and development through investigative agencies may be carried on at less cost per unit of output and may result in a saving in the technical processes of the industry.

B.—Economies in marketing.

1. Transportation may be done in greater bulk, resulting in a saving per unit transported.

2. Advertising costs will represent a smaller burden on each unit of output, although the amount of advertising may actually be increased.

3. The selling force required will not increase in the ratio in which the sales increase, therefore resulting in less cost per unit of product.

4. Distributing and selling agencies may be maintained.

5. The value of good will and of trade-marks and designs will increase with the volume of business.

C.—Economies in management.

1. The overhead cost per unit of product, particularly the fixed charges, will not increase proportionately to the production.

2. Better management can be afforded, with skilled heads for the different departments and branches. This factor is somewhat offset by the greater impersonality of large concerns.

3. Cost accounting, production standards, etc., may be introduced at less cost per unit of product.

D.—Economies in financial administration.

1. Borrowings can be made at cheaper rates as a result both of larger issues of bonds and of better security.

¹ Employment, Hours and Earnings in Prosperity and Depression. National Bureau of Economic Research, 1923.

2. The amount of risk taken will be less because of the pooling of profits and losses, the greater ability to study outside market conditions, and the more able administration.

3. Greater financial resources will be available in case of depression or business strain.

These various potential advantages of large-scale production must be taken into account in explaining the situation in certain industries. Although the manufacturer in all probability expands his business because of pure acquisitiveness, personal pride, or the necessity of investing a surplus, it is nevertheless true that the factors in the above outline are those which, by entering into such a reorganization, insure its life.

The advantages of large-scale production give but one view of the situation. There are certain industries which are more eligible for large enterprises than others. In general, the following types of industry appear to have developed production on a large scale to the greatest degree:

1. Industries which require a large capital investment, particularly in plant and equipment: Sugar refining, copper smelting, steel mills.

2. Industries which are monopolies, and which have a sufficiently large market to make operation on a large scale feasible. This includes artificial monopolies, such as those based on patent rights, as well as the monopolies by nature: Public utilities, manufactured ice.

3. Industries in which a natural resource is required and in which that natural resource is limited in amount and localized in geographical distribution: The manufacture of lead and zinc products.

4. Industries in which the product is capable of standardization and particularly in which a test for quality is required: Sugar, salt, meat packing, etc.

5. Industries in which the product is highly complex and can be constructed, therefore, only by an intricate fabricating system or a large and diversified organization: Typewriters, adding machines, textile machinery, and automobiles.

6. Industries in which the product is large in size, requiring complex equipment for construction and large capital investments: Shipbuilding, locomotives, ordnance.

Although the enumeration of the many advantages of large-scale production presents a very strong argument for such a form

of economic organization from the social viewpoint, there are, nevertheless, various elements which interfere with such a complete organization of economic enterprise. Certain enterprises do not lend themselves to large-scale operation. Some of the general types of industry in which small-scale production is necessary are:

1. Industries whose product can not be standardized and establishments which attempt to make products to suit the differing tastes of consumers. Such industries produce "tailored" suits, high-grade furniture, art goods, finely bound books, etc.
2. Industries producing for a small market, such as those manufacturing artists' materials, nets and seines, models and patterns.
3. Industries in which the local market is small and whose product has a high transportation cost. In the manufacture of artificial-stone products, or bricks in many localities, the activity could never be conducted on a large scale because of the limitation of the market for its product and the expense of transportation.
4. Industries in which the material used is widely scattered and can not be concentrated because of high transportation cost or rapid deterioration. Cheese factories and cider mills may be included in this class.
5. Industries in which skilled labor is the chief element, such as engraving, job printing, etc., whose products are really services rather than commodities.

The problem of the scale of production can be significantly analyzed only by recognizing the many factors which enter into each particular situation. No general theory can be of any great value. In addition to the factors already mentioned, there are numerous others, such as the amount of labor warfare in the industry, which often favors smaller shops; the managerial capacity of the enterpriser; the general trend of the industry as a whole, since it is much easier to develop large-scale production in an industry which is expanding rapidly than in one which is steadily losing ground; the traditional nature of the enterprise, etc.

To summarize: Until 1914 industry as a whole showed but little tendency toward an increase in average size of plant, but there was a noticeable growth from 1914 to 1919. Those developments present are chiefly the result of the unusually rapid expansion of certain industries in which production is carried on in large establishments and the more nearly complete utilization of plant in the abnormal year of 1919. There is no adequate measure of increase in the industrial capacity of establishments.

Throughout industry as a whole, no general tendencies of growth can be found. Although the number of large-scale establishments is rapidly increasing, the size of establishments at any given moment varies to a marked degree from industry to industry. The tendency to increase or decrease in size varies both from industry to industry and from period to period. The problem of the scale of production, therefore, is one of particular industries and even of particular periods, the factors entering into each situation being often very different and always very numerous.

V.

THE CHANGING CHARACTER OF OWNERSHIP.

Coincident with the development of the factory system and the enlarged scale of production has come a change in the legal organization of industrial enterprises. Although the corporate form of organization is not the cause of the increased scale of production, there can be no doubt that it is a *sine qua non*. Were it not for this legal development an industrial venture would still have to be financed by a single person, by a few individuals in a partnership, or by a large group of individuals, each of whom would necessarily assume full liability for the entire enterprise.

In many industries modern methods of manufacture require an enormous capital investment such as few individuals could make. The corporation makes possible the concentration of capital from many sources in a single enterprise, although the individuals concerned assume only a limited liability.

The earliest census to inquire into the character of ownership was that of 1900. At that time there were 37,123 establishments in the country operated by corporations, representing 17.9 per cent of the total number of establishments. Inasmuch, however, as the census of 1900 included neighborhood industries and hand trades, these figures are not closely comparable with those shown for later censuses, from which such industries and trades were omitted. The data for the censuses since that of 1900 are given in Table 38.

Ownership prior to 1914 was reported under four headings, "Individuals," "Corporations," "Firms," and "All others." For the purpose of this study the last two classes are combined. The group "all others," therefore, is made up chiefly of establishments operated by firms, but includes cooperative associations and miscellaneous forms of ownership that could not be classed as "individuals" or as "corporations." As can be seen from the table, and even more clearly from Chart G, the greatest number of establishments are operated by individuals, although corporations have increased from 23.6 per cent of the total number in 1904 to 31.5 per cent in 1919. This growth in the proportion of corporations was quite regular throughout the period, and thus far has given no signs of diminution.

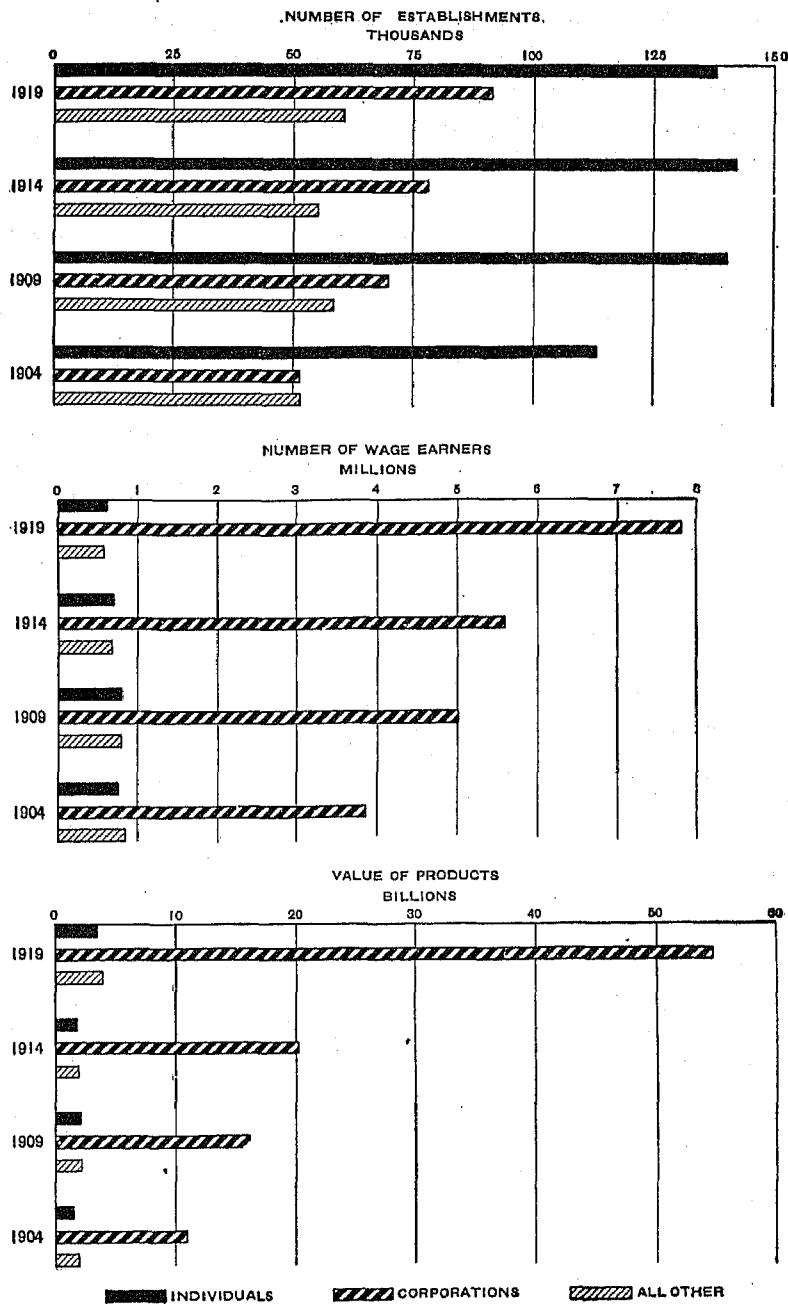
TABLE 38.—ESTABLISHMENTS, WAGE EARNERS, AND VALUE OF PRODUCTS, BY CHARACTER OF OWNERSHIP: 1904 TO 1919.

CHARACTER OF OWNERSHIP.	ESTABLISHMENTS.		WAGE EARNERS.		VALUE OF PRODUCTS.	
	Number.	Per cent distribution.	Number.	Per cent distribution.	Amount in millions.	Per cent distribution.
All classes:						
1904.....	216,180	100.0	5,468,383	100.0	\$14,794	100.0
1909.....	268,491	100.0	6,615,046	100.0	20,672	100.0
1914.....	275,791	100.0	7,036,247	100.0	24,246	100.0
1919.....	290,105	100.0	9,096,372	100.0	62,418	100.0
Individuals:						
1904.....	113,946	52.7	755,923	13.8	1,703	11.5
1909.....	140,605	52.4	804,883	12.2	2,042	9.9
1914.....	142,436	51.6	707,568	10.1	1,925	7.9
1919.....	138,112	47.6	623,469	6.9	3,536	5.7
Corporations:						
1904.....	51,097	23.6	3,862,698	70.6	10,904	73.7
1909.....	69,501	25.9	5,002,393	75.6	16,341	79.0
1914.....	78,152	28.3	5,649,891	80.3	20,183	83.2
1919.....	91,517	31.5	7,875,132	86.6	54,745	87.7
All other:						
1904.....	51,137	23.7	849,762	15.5	2,187	14.8
1909.....	58,385	21.7	807,770	12.2	2,289	11.1
1914.....	55,203	20.0	678,788	9.6	2,138	8.8
1919.....	60,476	20.8	597,771	6.6	4,137	6.6

The most significant figures, however, are those which show the extent of the industrial activity of the corporations. Although including only 31.5 per cent of the establishments, they employed 86.6 per cent of the wage earners and manufactured 87.7 per cent of the total value of the products. The contrast in activity is brought out very clearly by the averages per establishment, in which the corporations far exceed the other forms. Whereas establishments operated by corporations employ an average of 86.1 wage earners per establishment, those operated by individuals average only 4.5 wage earners per establishment.

It has already been stated that the corporate form of ownership is more prevalent among the newly formed enterprises. In Table 39 the character of ownership figures are given for 12 industries, which have been selected because they represent industrial activity whose development has been relatively recent. Five of these industries for which comparable figures are available operated a total of 440 establishments in 1889, as compared with 4,454 in 1919, an increase to more than 10 times the original number.

CHART G.—CHARACTER OF OWNERSHIP: 1904 TO 1919.



The remaining 7 industries are of less importance, since in 1919 they totaled but 1,338 establishments. Most of the establishments in the 12 industries, taken as a group, must therefore have been organized in comparatively recent times. It is significant to note the character of ownership in these industries. The smallest proportion of corporate ownership is more than two-thirds larger than the average for all industry, and in 10 of the 12 more than three-fourths of all establishments are corporation owned. These facts afford fairly positive evidence that enterprises which are now entering for the first time into industrial activity are prone to adopt the corporate form of organization.

TABLE 39.—CORPORATE OWNERSHIP IN 12 RECENTLY DEVELOPED INDUSTRIES: 1919.

INDUSTRY.	ESTABLISHMENTS.		
	Total number.	Owned by corporations.	
		Number.	Per cent of total.
All industries	290, 105	91, 517	31. 5
Total for 12 industries	5, 792	4, 301	74. 3
Aeroplanes	31	26	83. 9
Automobiles	315	292	92. 7
Sugar, beet	85	84	98. 8
Cement	123	118	95. 9
Electrical machinery, apparatus, and supplies	1, 404	1, 066	75. 9
Ice, manufactured	2, 867	1, 911	66. 7
Rubber goods	437	368	84. 2
Oleomargarine and other butter substitutes	42	41	97. 6
Phonographs	166	132	79. 5
Aluminum manufactures	83	65	78. 3
Coal-tar products	183	168	91. 8
Pens, fountain and stylographic	56	30	53. 6

In industries in which large capital investments are necessary for the proper operation of enterprises the establishments are, as a rule, operated by corporations, since it is easier under this form of ownership to obtain the required capital. This generalization has as its logical corollary that the larger the establishments in an industry the more apt are they to operate under the corporate form of ownership. Data on this point are given in Table 40. The 13 industries which, in Chapter IV, were determined as operating on the largest scale are here listed, ranked according to their concentration in terms of wage earners and of value of products, with the percentages of establishments which are corporate

owned. Only two industries fall below the 90 per cent mark. It is a definite demonstration of the relation of large-scale operation and corporate ownership in industrial organization. Apparently a very close correlation exists between the average size of establishment and the extent to which corporate ownership has entered the industry. It is probable that development in either direction stimulates it in the other. The corporation makes expansion possible, while large-sized enterprises feel the need for corporate organization.

TABLE 40.—CORPORATE OWNERSHIP IN THE 13 INDUSTRIES LEADING IN TERMS OF LARGE-SCALE PRODUCTION: 1919.

INDUSTRY.	RANK.		ESTABLISHMENTS.		
	According to wage earners. ¹	According to value of products. ²	Total number.	Operated by corporations.	
				Number.	Per cent of total.
Sugar refining.....	1	1	20	17	85.0
Boots and shoes, rubber.....	2	5	25	24	96.0
Smelting and refining, copper.....	8	2	34	34	100.0
Iron and steel, steel works and rolling mills..	5	10	500	481	96.2
Shipbuilding, steel.....	3	13	162	148	91.4
Belting and hose, rubber.....	9	7	15	15	100.0
Smelting and refining, lead.....	12	3	25	24	96.0
Locomotives.....	6	11	17	16	94.1
Smelting and refining, zinc.....	13	6	39	39	100.0
Cars, electric-railroad.....	7	14	7	6	85.7
Iron and steel, blast furnaces.....	16	9	195	187	95.9
Ordnance and accessories.....	10	15	26	25	96.2
Cars, steam-railroad.....	11	16	99	98	99.0

¹ According to proportion of establishments employing over 250 wage earners.

² According to proportion of establishments producing over \$1,000,000 products.

At the other end of the scale are certain industries into which the corporate form of organization has not entered to such a degree. In general, these are the smaller and less significant industries. The Census Bureau has constructed a group of 75 composite industries, formed by combining closely related activities such as the manufacture of butter, cheese, and condensed milk, so that each of the composite industries employed an average of 18,000 wage earners or more. Of these industries 44, or 58.7 per cent, were above the general average of industry in the proportion of value of products produced by corporations; for the industries not included in these groups, the smaller and more isolated ones, the percentage is much lower.

These 75 composite industries are worthy of further examination. Of the 75, 61 showed an increase in the proportion of the value of products produced by corporations during the last five-year period. In no case of decrease was it extensive in amount. In 1900 there were 19 industries in which less than 70 per cent of the product was made in establishments owned by corporations. By 1914 this number had decreased to 10, and in 1919 to 9. The industries which recorded low percentages in 1919 were:

INDUSTRY.	Per cent.	INDUSTRY.	Per cent.
Clothing, women's.....	32.9	Jewelry.....	55.4
Millinery and lace goods.....	46.9	Clothing, men's, including shirts.....	55.5
Turpentine and rosin.....	47.0	Butter, cheese, and condensed milk.....	65.8
Bread and other bakery products.....	51.8	Leather goods.....	67.1
Marble and stone work.....	52.6		

Of the major industries these nine are therefore those in which the development of corporate ownership has shown the least progress. They are all industries in which the average size of establishment is small. They average 12.3 wage earners per establishment, as compared with the general average of 31.4 for all industry. If the two clothing industries, in which the lack of corporate ownership is to a considerable degree the result of the sporadic nature of many shops and of the unusual extent of family holdings, be excluded, the average number of wage earners drops to 8.2 per establishment. In other words, just as it was shown that corporate ownership appeared particularly in industries in which operations are on a large scale so it is evident that in the industries which operate on a small scale the extent of corporate ownership is less.

Although in any particular industry the corporation-owned establishments may be few, they usually carry on the major part of the activity of the industry. To illustrate this situation, Table 41 has been constructed. It covers 22 industries in which the proportion of establishments operated by corporations is very low. Four of them actually fall below the 10 per cent mark in this respect. In three of these, however, more than one-half of the total number of wage earners were in the few establishments operated by corporations. In the tobacco, cigar, and cigarette

industry, for example, although only 8 per cent of the establishments are corporate-owned, these few establishments reported 82.7 per cent of the total value of products in the industry. Although in the 22 industries in question the proportion of establishments operated by corporations ranged from 6.1 to 25.7 per cent, the proportion of wage earners ranged from 30.4 to 76.6 per cent and of value of products from 20.7 to 83.5 per cent.

TABLE 41.—ACTIVITY OF CORPORATIONS IN 22 INDUSTRIES HAVING FEWEST ESTABLISHMENTS OWNED BY CORPORATIONS: 1919.

INDUSTRY.	ESTABLISHMENTS.			WAGE EARNERS (AVERAGE NUMBER). ¹			VALUE OF PRODUCTS (THOUSANDS OF DOLLARS).		
	Total.	Operated by corporations.		Total.	In establishments owned by corporations.		Total.	In establishments owned by corporations.	
		Number.	Per cent of total.		Number.	Per cent of total.		Amount.	Per cent of total.
Bread and other bakery products.	25,095	1,748	7.0	141,592	76,008	53.7	1,151,896	596,560	51.8
Brooms.....	1,034	154	14.9	6,313	3,254	51.5	30,205	14,585	48.3
Carpets, rag.....	339	32	9.4	2,016	612	30.4	5,597	1,749	31.2
Carriages and wagons, including repairs.....	2,286	249	10.9	18,173	12,136	66.8	91,463	68,712	75.1
Cheese.....	3,530	505	14.3	3,997	1,288	32.2	143,456	29,676	20.7
Clothing, women's.....	7,711	1,641	21.3	165,649	62,144	37.5	1,208,543	398,061	32.9
Electroplating.....	515	94	18.3	3,024	1,134	37.5	10,390	4,587	44.1
Engraving and diesinking.....	478	29	6.1	1,878	1,025	54.6	7,351	4,216	57.4
Flour-mill and gristmill products.	10,708	2,667	24.9	45,481	34,841	76.6	2,052,434	1,713,800	83.5
Fur goods.....	1,815	213	11.7	13,639	4,866	35.7	173,138	52,199	30.1
Liquors, vinous.....	342	40	11.7	1,011	709	70.1	17,454	12,236	70.1
Lumber and timber products....	26,119	3,829	14.7	480,945	351,830	73.2	1,387,471	1,050,373	75.7
Marble and stone work.....	4,240	762	18.0	32,768	20,599	62.9	129,165	67,947	52.6
Millinery and lace goods.....	3,005	651	21.7	50,850	23,456	46.1	255,725	120,016	46.9
Printing and publishing, book and job.....	13,089	3,367	25.7	123,005	90,486	73.6	597,663	445,041	74.5
Saddlery and harness.....	1,823	253	13.9	10,411	7,434	71.4	83,713	61,653	73.6
Tobacco, cigars and cigarettes....	9,926	796	8.0	138,773	96,849	69.8	773,662	639,487	82.7
Turpentine and rosin.....	1,191	247	20.7	28,067	11,552	41.2	53,051	24,946	47.0
Hats and caps, other than felt, straw, and wool.....	709	137	19.3	7,539	3,017	40.0	44,540	16,264	36.5
Iron and steel, tempering and welding.....	520	101	19.4	1,835	1,103	60.1	10,996	7,248	65.9
Models and patterns, not including paper patterns.....	928	145	15.6	6,949	3,160	45.5	25,300	12,034	47.6
Vinegar and cider.....	720	135	18.7	1,981	1,441	72.7	24,723	18,285	74.0

¹ For method of computing average, see p. 30.

The same situation with regard to ownership is found in the mining industry. In 1909, 35.4 per cent of the mining or quarrying enterprises were in the hands of corporations. This group of corporation-owned enterprises employed 90.6 per cent of all wage earners engaged in mining or quarrying and produced 91.4 per cent of the total value product. The percentages increased by 1919, at which time corporations operated 51.1 per cent of all enterprises, employed 94.2 per cent of all wage earners, and produced 93.6 per cent of the total value of products.

Notwithstanding the tendency of partnerships to change to the corporate form of organization, the partnership or firm is still important, particularly in certain industries peculiar to cities, such as those manufacturing clothing, and the allied industries such as those producing artificial flowers, feathers and plumes, buttons, fur goods, men's furnishing goods, fur-felt hats, and millinery and lace goods. Of the concerns which reported themselves as being on a cooperative basis practically all belonged either to the butter, cheese, and condensed milk industries, or the printing and publishing industry. In certain of the Northern Central States large proportions of the establishments in the dairy industry are operated by these cooperative societies. The cooperative printing and publishing concerns are controlled in most cases by societies, lodges, clubs, or labor unions.

The corporate form of organization has made possible a much closer relationship of enterprises, through financial control, than could possibly exist under any other form of ownership. The facts that corporation-owned establishments are usually above the average in size, and that the proportions of industrial activity recorded by such establishments are increasing, make the problem of interlocking share-holdings much more serious than it otherwise could be.

And so with this inquiry into the nature of ownership of establishments, the study passes on to the study of combinations of establishments. The size of industrial establishments, discussed in the previous chapters, is but one phase of the problem of the concentration of industrial operation. The further analysis of central-office groups affords some insight into concentration as it exists between and among these many individual manufacturing activities.