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CHAPTER VI

Changes in the Volume and Character of Production in the United States, 1922-1929

A PERIOD of sustained prosperity opened in the United States after the major recession of 1920-21. This prosperity was interrupted by a recession of some magnitude in 1924, and by a relatively slight fall in 1927. The recovery from each of these checks was rapid. Not until the year 1929 was well on its way was there recorded a general and widespread decline in the volume and intensity of operations in the financial and industrial structure of the country at large. The period of post-war expansion, extending from 1922 to 1929, constitutes a relatively homogeneous era which is of particular economic interest. Certain of the tendencies and conditions characteristic of this era are to be reviewed in the present and following chapters.

In Chapter I, which deals with production tendencies during the years preceding the war, reference has been made to certain problems of general interest in following the trend of production in a given country. The rate of increase in the physical volume of production, the regularity of flow of the stream of production, the relative changes occurring in extractive and fabricating industries, in agricultural and non-agricultural industries, in industries producing consumption goods and in those producing articles of capital equipment—all these concern us in tracing the course of events during the period leading up to the 1929 recession. For it was an era unique in many ways, marked by conditions widely different from those prevailing during the period immediately preceding, and in certain important respects unlike those characteristic of the years before the war. Points of similarity and of difference between the pre-war and post-war periods will be emphasized as the discussion proceeds.

In following the changes occurring between 1922 and 1929 we must bear in mind the events of the war years and the conditions prevailing at the beginning of this post-war period. At the war-time peak, in 1917 and 1918, the volume of physical production, excluding products of the construction industries, stood some 28 per cent above the 1913 level. After a decline in 1919, output stood again in 1920 at a level close to that of the war years. The drop in 1921 carried production almost down to the 1913 average. Much of this loss had been made up by 1922; in that year the volume of production had increased to a level approximately 24 per cent above the 1913 figure.

If we go beyond the averages to certain of the details, we find that in 1922 agricultural production was about 23 per cent above the 1913 level, mineral production some 2 per cent above, and manufacturing production about 29 per cent above. The standing of various other classes of goods has been indicated in the preceding chapter.

The volume of construction followed a quite different course. Dropping in 1914 and 1915 somewhat below the 1913 level, there was an advance in 1916 to a volume about 8 per cent above that base. Thereafter there was a decline, interrupted only in 1919, until in 1920 the volume of construction was only 47 per cent of that in 1913. There was a substantial increase in 1921, and in 1922 (the year from which recent movements are traced) the volume of construction was about 35 per cent greater than in 1913. In seven of the nine years which had elapsed since 1913, however, the amount of construction work done had been below that of the base year. With a rapidly expanding population this meant a large accumulated shortage, a shortage which placed its impress upon the events of the following decade.

The measurements of production and other changes occurring in the United States between 1922 and 1929 relate, as has been noted, to a period of expansion. This period opens with business reviving from relatively deep depression; it ends in a year of high prosperity. In a very real sense it constitutes a single phase of economic expansion, rather than a rounded record of the gamut of business experience. The pre-war period surveyed in earlier chapters opened in prosperity and ended with a year of declining activity. It was marked, too, by a sharp business break in 1907-08, exceed-

ing in magnitude any of the interruptions to expansion that occurred between 1922 and 1929. In comparing the developments of these two periods no assumption of identity of conditions can be made. Yet the comparison is significant, for the earlier period provides standards of reference to employ in measuring and appraising the events that led up to the recession of 1929. Such standards are particularly desirable in tracing changes in the physical volume of production.

Changes in the Volume of Production, 1922-1929

General Measurements

Post-war production movements may be traced, first, in terms of movable goods (i.e., construction is excluded). The quantitative record follows.

TABLE 105

Growth of Physical Volume of Production in the United States, 1922-1929 [a]

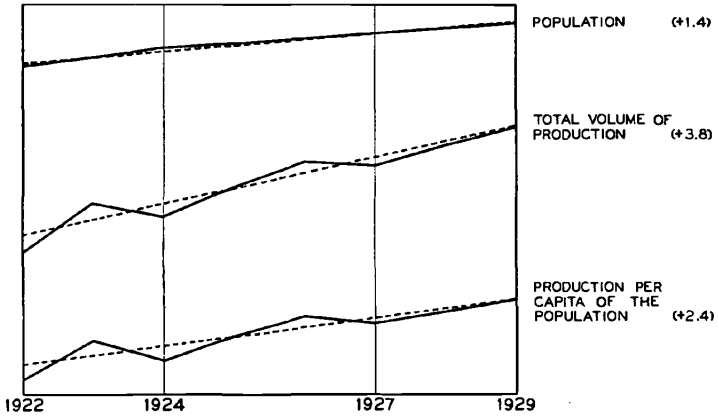
Year	Volume of production (excluding construction)	Year-to-year change in volume of production (per cent)
1922	100	——
1923	112	+12
1924	109	− 3
1925	117	+ 7
1926	124	+ 6
1927	123	− 1
1928	129	+ 5
1929	134	+ 4
Average annual rate of change (per cent)	+3.8	
Index of instability of growth	2.1	

[a] The process employed in the construction of these index numbers is similar to that used in compiling the pre-war measurements (see Appendix I). Annual index numbers of agricultural production and of the production of raw minerals have been combined with an annual index of manufacturing production (that of the Federal Reserve Board), adjusted to corrected biennial index numbers of manufacturing production based upon census records. In this correction and adjustment account has been taken of the output of non-standard commodities for which statistics of output in physical units are not generally available. (See pp. 39-43 for an explanation of the method of correction.)

These measurements, with corresponding population figures, are plotted in Figure 42.

FIGURE 42

GROWTH OF POPULATION AND OF PHYSICAL VOLUME OF PRODUCTION IN THE UNITED STATES, 1922-1929



Plotted on ratio scale. The figures in parentheses define average annual rates of change (in percentage form).

Comparing with pre-war figures the rate of growth in production shown by these index numbers, and the corresponding rate of population increase, we have the following exhibit:

Year	Average annual rate of increase in: Volume of production (per cent)	Population (per cent)	Production per capita of population (per cent)
1901-1913	+3.1	+2.0	+1.1
1922-1929	+3.8	+1.4	+2.4

Between 1922 and 1929 the aggregate output of movable goods in the United States increased 34 per cent—slightly more than one-third. The rate of increase in volume of output (3.8 per cent a year) was distinctly higher than the pre-war rate (3.1 per cent a year). The expansion of 1922-29 is clearly reflected in the comprehensive records of agricultural, mineral and manufacturing production which are summarized in Table 105.

This advance is the more impressive if account be taken of post-war retardation of the rate of growth of population. Prior to the war the physical volume of goods which might have been allocated yearly to each member of the population was increasing at a rate of 1.1 per cent a year. Between 1922 and 1929 the individual's 'share'

in annual output (a purely hypothetical share, of course, since goods of all sorts are included, and since distribution is not equal) increased at a rate of 2.4 per cent a year. If we consider that the annual per capita increment, in these terms, is more than twice as great in the later period, the significance of the change is apparent. Viewed in another way, a doubling of the annual share theoretically available for distribution to every inhabitant of the country would have required 63 years, under pre-war conditions. Between 1922 and 1929 rates of population and production change were such that the doubling of the individual's portion would have required only 29 years.[1] Since the rate of advance in production was not maintained after 1929 these figures may appear fictitious, but it is a matter of considerable moment that conditions so full of promise for the future welfare of the population of this country prevailed during the years now under survey. We have not yet garnered all the fruits of that experience.

The index numbers of production given in Table 105 are based upon the output of raw agricultural and mineral products, and of manufactured goods of all types. Productive services rendered directly, and not embodied in goods, are necessarily excluded. There is reason to believe that 'production' of this non-material type was growing in relative importance during this period, but the degree of advance cannot be estimated with any accuracy.[2] The growth of construction during this period is also omitted from these records. This is a defect which may be corrected for the post-war years, for it is possible to approximate with reasonable accuracy changes in the volume of construction of various types. In a later section of the present chapter detailed figures on construction are

[1] These figures relate, of course, to pure statistical averages. No account is taken of systems of distribution, nor of the relative importance of capital goods and consumption goods in the aggregate output.

[2] That the output of service industries increased more rapidly than that of industries producing physical commodities is indicated by figures of the Census of Occupations, 1930. In 1920 the production of physical commodities (agriculture, forestry, fishing, extraction of minerals, manufacturing and mechanical industries) absorbed approximately 65 per cent of all persons gainfully employed in the United States. (Persons engaged in clerical occupations, who cannot readily be classified either under service or non-service industries, have been excluded from both groups, as well as from the total, in the computation of these percentages. See footnote, p. 419.) In 1930 the corresponding figure was 58 per cent. The service industries (transportation, trade and finance, public and professional service, and domestic and personal service) absorbed 35 per cent in 1920 and 42 per cent in 1930. The classifications are rough, but the trend is unmistakable.

presented. At this point we consider only the course of total production, including construction of all sorts.

TABLE 106

INDEX NUMBERS OF PRODUCTION AND CONSTRUCTION IN THE UNITED STATES, 1922-1929

(1) Year	(2) Production of movable goods [a]	(3) Volume of construction [b]	(4) Total production and construction [c]
1922	100	100	100
1923	112	93	110
1924	109	103	109
1925	117	136	119
1926	124	143	126
1927	123	143	125
1928	129	149	131
1929	134	131	134
Average annual rate of change (per cent)...	+3.8	+6.1	+4.1
Index of instability of growth	2.1	8.9	2.1

[a] From Table 105.

[b] Based on the F. W. Dodge Corporation estimates for the entire United States, with correction for changes in construction costs. See pp. 266-269.

[c] Weighted average of columns (2) and (3). Weights are based upon the approximate total value of physical production and upon an estimate (50 per cent of total contracts awarded) of 'value added' in construction, in 1923 and 1925.

The index numbers in column (4) represent our best estimate of the actual course of physical production, including construction, in the United States between 1922 and 1929. It indicates a remarkably steady growth. Checks to the advance were felt in 1924 and 1927, but these brought no appreciable decline in aggregate physical output. The effect of the introduction of construction is to yield a somewhat higher average annual rate of increase (4.1 per cent a year, as against 3.8 per cent for the production index alone).

§ *On the stability of productive processes, 1922-1929.*—Of equal significance with changes in aggregate and per capita production is the stability of flow of the stream of physical goods. From 1901 to 1913, as we have seen, the fluctuations in the aggregate output of physical goods averaged 3.7 per cent per year.[1] These variations in the stream

[1] This index defines the degree of departure from a constant rate of change. It is not absolute variation from year to year which is measured, but deviations from constancy of growth.

of production are to be contrasted with fluctuations in population growth, which were estimated to average 0.3 per cent per year. Oscillations in the growth of physical production materially exceeded oscillations in population growth. The post-war record now being studied extends over a somewhat shorter period, and one marked by no recession as severe as that of 1907-08. Yet the comparison is significant, in any effort to summarize the characteristics of the eight years between 1922 and 1929. This period fell between two major economic storms (the recession of 1920-21 and that which began in 1929) and the working of the economic system during these years is of more than average interest. How stable and regular were economic processes during this era?

The index of aggregate production shows variations from a constant rate of growth averaging 2.1 per cent a year between 1922 and 1929, as contrasted with variations of 3.7 per cent a year for the pre-war period. In so far as our data are comparable,[1] these figures indicate a decrease of some 43 per cent in the amplitude of oscillations of total production. The greater stability of the flow of physical goods in the eight years from 1922 to 1929 is clearly revealed in the charts on which the different index numbers of production are plotted. (See Figures 1 and 42.) Instability of population growth during the recent period is measured by an index of 0.3, which is equal to the corresponding pre-war figure.[2]

The stability of processes of production is not capable of definition solely in terms of aggregate production. The output of constituent elements may be highly variable, while the total stream shows but slight variations. From many points of view the behavior of individual elements may be more significant than the behavior of the aggregate. For the post-war period we have measures of instability relating to 80 production series. The weighted mean of these measurements indicates an average annual fluctuation (i.e., departure from constancy of

[1] The stability of an index number of the type cited above is in part dependent upon the number of series included. When the fluctuations of economic series do not agree perfectly in timing, their movements tend to offset one another, when averaged, and this offsetting influence is the greater the larger the number of series included.

For both the pre-war and post-war periods the series relating to the production of raw materials represent practically the total production of these goods. The number of series in the post-war sample is somewhat greater than in the earlier period, but the additional commodities are chiefly minor agricultural products. For manufactures the basic samples are more comprehensive in the post-war period, but in the process of adjustment to the corrected census index numbers an attempt was made in both periods to approximate the relative stability of aggregate manufacturing production. Under these conditions there is no reason for believing that the greater stability of the index numbers for the post-war period is due to the offsetting influence of the larger number of series included in the sample.

[2] Inter-censal population estimates are based upon less satisfactory materials for the pre-war than for the post-war years.

growth) in the output of individual commodities of 6.4 per cent.[1] This may be taken as a measure of the degree of regularity of change among basic productive processes during an era of general prosperity.

For the period 1901-1913 the average of the indexes of instability relating to 59 production series was 8.2 per cent. The data for the more recent period indicate that the growth of production was substantially more stable between 1922 and 1929 than it was between 1901 and 1913. If we may take the two averages to be comparable (they do not relate to precisely the same list of commodities), they would indicate that the instability of production growth was 22 per cent less between 1922 and 1929 than between 1901 and 1913.[2]

Changes in the Character of Physical Production, 1922-1929

We turn now to the make-up of the total stream of production. Raw materials and manufactured goods, foods and non-foods, capital equipment and consumption goods—all these change in volume of production at varying rates, and in their differing rates of change are found clues to the direction in which an economy is moving.

[1] This figure relates, of course, to a single eight-year period of economic expansion, a period which terminated in a major recession. If the various series studied were extended into the recession, the measure of instability would be much greater. For our present purpose we are accepting the period 1922-1929 as a distinct economic entity.

[2] The individual measurements entering into the pre-war average have been given in Chapter I. Following are the indexes of instability of growth relating to the 80 production series studied for the period 1922-1929:

Series relating to production of materials	Index of instability of growth	Series relating to processes of fabrication	Index of instability of growth
Sheep, total slaughter	1.2	Sheep, Federal inspected slaughter	1.2
Wool	1.4	Flour, wheat	1.5
Milk	1.5	Cigars	1.6
Gold	2.4	Newsprint consumption	1.9
Poultry products	2.7	Cigarettes	2.0
Sugar, domestic	4.0	Fuel oil	2.4
Petroleum, crude	4.4	Gasoline	2.5
Natural gas	4.6	Boots and shoes	3.1
Cement	4.9	Wood pulp, chemical	3.2
Silver	5.3	Book paper	3.2
Corn	5.4	Lubricating oil	3.4
Calves, total slaughter	5.5	Kerosene	3.8
Stone	5.7	Fine paper	4.0
Cattle, total slaughter	5.8	Newsprint production	4.2
Hay	6.0	Wool machinery activity	4.6
Wheat	6.3	Silk loom activity	4.8
Tobacco	6.7	Tires, pneumatic	4.8
Swine, total slaughter	6.8	Cotton consumption	4.8
Sand	6.9	Wool rug and loom activity	4.9
Bituminous coal	7.3	Cement	4.9
Lead, crude	7.4	Silk deliveries	5.3

(*Footnote continued on following page*)

Production of Raw Materials and of Manufactured Goods

Index numbers defining changes in the output of raw materials and of manufactured goods appear in Table 107, on the following page. These are shown graphically in Figure 43.

As in the pre-war period, the output of manufactured goods increased at a rate substantially higher than that at which the production of raw materials increased—at a rate of +4.5 per cent a year, as compared with +2.5 per cent for raw materials. Corresponding pre-war figures were +3.9 and +2.2 per cent. The difference between the two rates of change is greater in the later period.

Some reasons for the sharper advance in the output of manufactured goods have been suggested at an earlier point. The general group of raw materials includes many articles of food which are consumed in a raw or but slightly processed form, and the rate of increase in the output of these commodities would not be expected materially to exceed the rate of growth of population. The rapid increase in the proportion of processed goods in our export trade

(Footnote continued from preceding page)

Series relating to production of materials	Index of instability of growth	Series relating to processes of frabrication	Index of instability of growth
Zinc, slab	7.5	Sugar meltings	5.7
Oats	8.6	Tin deliveries	5.8
Copper, mine production	8.7	Wood pulp, mechanical	5.8
Iron ore	8.9	Steel ingots	6.1
Potatoes	9.1	Lumber	6.3
Rice	9.9	Cattle, Federal inspected slaughter	6.3
Barley	10.1	Wool consumption	6.4
Apples	13.8	Plate glass	6.4
Anthracite coal	13.9	Upper leather	6.7
Oranges	14.1	Calves, Federal inspected slaughter	6.7
Cottonseed	14.3	Copper, blister	7.3
Cotton	14.3	Lead, crude	7.4
Peaches	15.4	Zinc, slab	7.5
Rye	15.6	Pig iron	8.5
Flaxseed	23.4	Common brick	8.7
		Hogs, Federal inspected slaughter	8.9
		Coke, total	9.1
		Sole leather	9.4
		Inner tubes	9.5
		Flooring	10.4
		Motor vehicles	11.4
		Vessels built	17.3
		Locomotives, railroad	27.4

These 80 production series, with a few minor additions, are the components of the annual index numbers utilized in securing the final production estimates given in Table 105. Three series (relating to the production of cement, crude lead and slab zinc) are included both among the series measuring the output of raw materials and manufactured products.

Descriptions of these production series, with statements of sources, appear in Appendix V.

TABLE 107

RAW MATERIALS AND MANUFACTURED GOODS

Index Numbers of Physical Volume of Production in the United States, 1922-1929 [a]

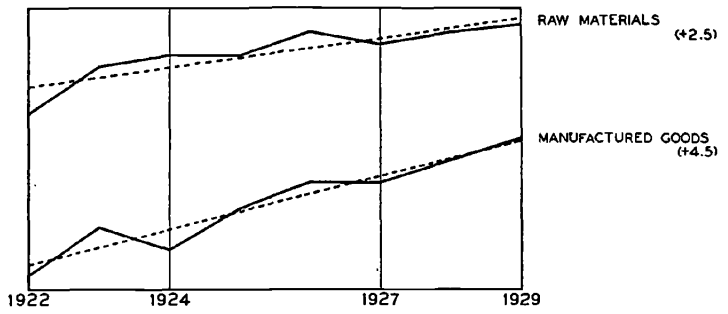
Year	Raw materials	Manufactured goods
1922	100	100
1923	112	112
1924	115	106
1925	115	118
1926	122	125
1927	119	125
1928	122	132
1929	124	140
Average annual rate of change (per cent)	+2.5	+4.5
Index of instability of growth.	2.5	2.4

[a] The index numbers of manufacturing production have been adjusted to take account of the increasing diversification of manufacturing industries. The procedure is similar to that employed for the pre-war years. Details are given in Appendix I.

FIGURE 43

GROWTH OF PHYSICAL VOLUME OF PRODUCTION IN THE UNITED STATES, 1922-1929

RAW MATERIALS AND MANUFACTURED GOODS



Plotted on ratio scale. The figures in parentheses define average annual rates of change (in percentage form).

has affected somewhat the character of domestic production.[1] Finally, the increased degree of fabrication of many classes of goods, and the performance outside the home of many operations formerly performed within the home, would also result in a more rapid increase in the output of manufactured goods. The records indicate that increasing fabrication, with a corresponding increase in the diversification of manufacturing production, has been a marked characteristic of the period 1922-1929.[2]

§ *Unrevised index numbers of physical production.*—The index numbers of manufacturing production shown in Table 105 were secured by a process of adjustment, designed to take account of the output of commodities generally excluded from index numbers of physical production. As was suggested on an earlier page, there are periods of expanding production and increasing variety of demand when index numbers based upon standard commodities, the output of which is subject to definite measurement, understate the true rate of production growth. At other times, of which the war years furnish an example, there is a decrease in the diversification of manufacturing output, and at such times the true rate of production increase may be less than is indicated by a study of standard commodities. The corrected index numbers previously presented necessarily lack the accuracy, in detail, of indexes based on the definitely measurable output of standard commodities, but there is no reason to doubt that they give a closer approximation to the actual course of production between 1922 and 1929. Unrevised index numbers, based directly upon physical quantities, are of interest, however. These are given in Table 108.

[1] Between 1922 and 1929 the aggregate values of exported goods in each of the major classes changed at the following average annual rates:

Manufactured foodstuffs	−3.8 per cent
Crude foodstuffs	−3.5 " "
Crude materials	+0.9 " "
Semi-manufactures	+5.9 " "
Finished manufactures	+9.3 " "

Exports of finished manufactures were increasing at a more rapid rate than during pre-war years (the rate between 1901 and 1913 was 7.6 per cent a year), while exports of crude materials were increasing at a much lower rate (the pre-war rate was 5.9 per cent). Manufactured foodstuffs constitute an exception to the general tendency for exports of manufactures to increase.

[2] The correction of the index of manufacturing production, to take account of the output of new types of goods, and of goods for which statistics of physical quantities are not available, involved a stepping-up of the apparent rate of increase of this index from 3.7 per cent to 3.9 per cent, for the period 1901-1913. For the period 1922-1929 this correction involved a stepping-up from a rate of increase of 3.7 per cent a year to a rate of 4.5 per cent a year. The increased margin in recent years is probably evidence of greater diversification, beyond the range of standard, readily-enumerated physical units.

TABLE 108

INDEX NUMBERS OF THE PHYSICAL OUTPUT OF MOVABLE GOODS, 1922-1929

(These index numbers are based directly upon records of physical production.)

Year	Production of raw materials	Manufacturing production [a]	Total production [b]
1922	100	100	100
1923	112	116	115
1924	115	108	111
1925	115	121	120
1926	122	124	124
1927	119	122	121
1928	122	129	127
1929	124	137	133
Average annual rate of change (per cent) ...	+2.5	+3.7	+3.3

[a] Index constructed by the Federal Reserve Board from data relating to 23 industrial groups.
[b] This index was secured by combining the index numbers of manufacturing production and raw material production given in the two columns to the left. The index of production of raw materials is the same as that appearing in Table 107. The wide coverage of the sample of raw materials, the output of which is capable of direct enumeration, made it unnecessary to correct this index by the method employed for manufactured goods.

This index of total production shows a rate of increase of but 3.3 per cent a year, between 1922 and 1929, as compared with the figure of 3.8 per cent derived from the corrected records. For manufacturing production, the above rate of advance of 3.7 per cent per year falls materially below the corrected rate of 4.5 per cent. It is significant, however, that during the period 1923-1925 the index relating to standard commodities shows a higher level of production, with reference to 1922, than does the more comprehensive adjusted index. During the first phase of this post-war expansion somewhat greater emphasis appears to have been placed on the production of the staples which are currently enumerated in physical units. After 1925 there is evidence of increasing diversification, with greater emphasis on the output of the numerous non-standard commodities which come into popularity during a period of generally high purchasing power and of consumer optimism. The narrowing of demand, and the concentration of production on a smaller number of necessary commodities which characterized the war years, was reversed during this period. As a result, the true rate of gain in manufacturing production appears to have been somewhat higher than the rate shown by a study of those commodities amenable to direct statistical treatment.

The index numbers which are based directly upon statistics of physical output are fundamental records in any study of the course of production. That they clearly understate the true rate of increase be-

tween 1922 and 1929, and require correction, is shown in the detailed discussion of manufacturing production in the later pages of this chapter.

Other index numbers of manufacturing production, based upon different samples of commodities and different methods of construction, are marked by rates of growth fairly close to that of the uncorrected index given above. An extension of Day's annual index of manufactures [1] shows an increase of 3.3 per cent a year. An index of manufacturing production computed by Y. S. Leong, with sixty component series,[2] indicates an average annual advance of 3.5 per cent.

In the discussion of production changes during the years 1901-1913 some emphasis was placed on the divergence of tendencies prevailing in different industries. These divergences were distinctly more marked among fabricated goods than among raw materials. Similar differences are found for the period 1922-1929.

When we say that the total volume of physical production increased at a rate of 3.8 per cent a year we are speaking, of course, with reference to an aggregate. This aggregate is made up of a large number of elements growing, often, at widely discrepant rates. These elements may be grouped into broad classes, as in the present classification of raw and processed goods. We secure the most realistic picture of the course of production, however, when we view these elements in all the diversity of their separate movements. The original data relating to 80 production series (36 raw materials, 44 processed goods) are plotted in Figure 44. The divergence of rates of change is illustrated graphically in Figure 45.[3]

[1] Warren M. Persons, *Forecasting Business Cycles,* John Wiley and Sons, New York, 1931, p. 171.

[2] "Indexes of the Physical Volume Production of Producers' and Consumers' Goods," *Journal of the American Statistical Association,* XXVII, No. 177, March 1932, pp. 21-37.

[3] Following are measures of the rates of change in the individual series studied. (These series, it is to be noted, are not the precise ones entering into the production indexes cited above.)

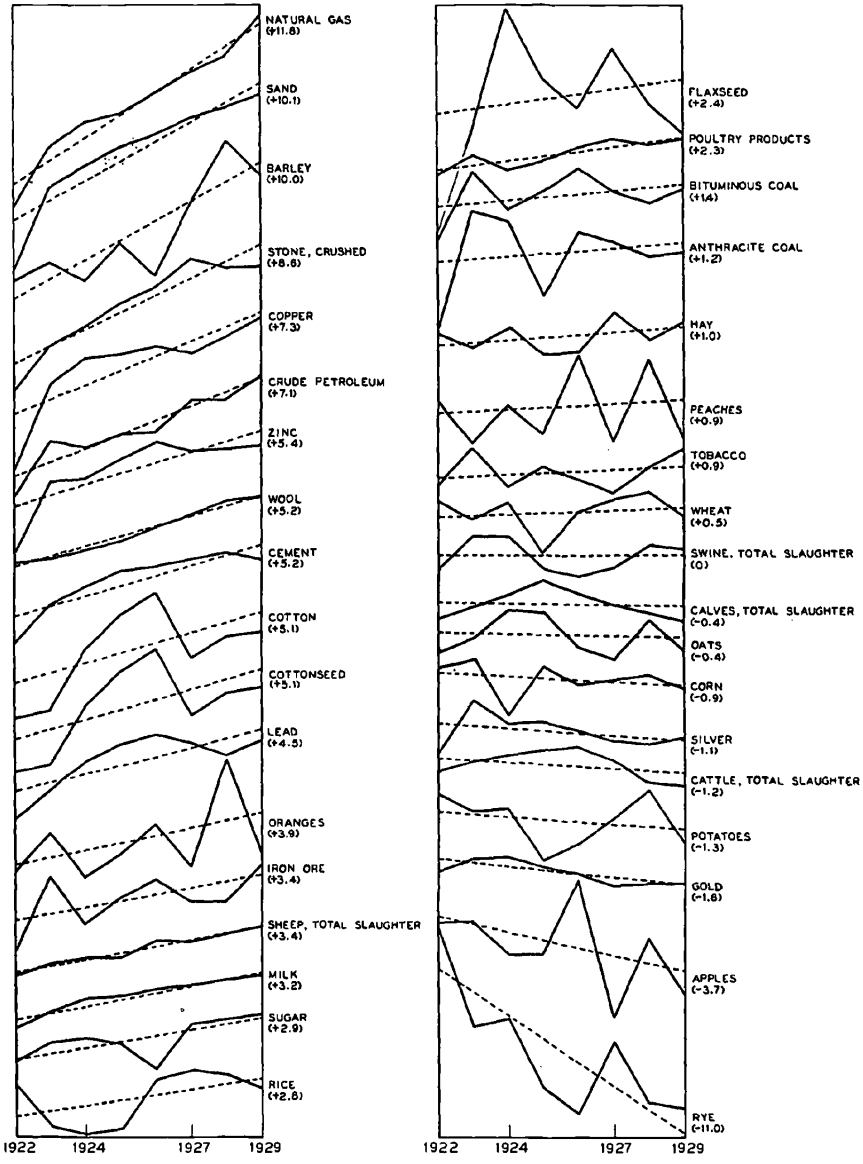
Series relating to production of materials	Average annual rate of change, 1922-1929 (per cent)	Series relating to processes of fabrication	Average annual rate of change, 1922-1929 (per cent)
Natural gas	+11.8	Gasoline	+15.9
Sand	+10.1	Cigarettes	+11.2
Barley	+10.0	Tires, pneumatic	+ 9.0
Stone	+ 8.6	Plate glass	+ 8.9
Copper, mine production	+ 7.3	Silk deliveries	+ 8.8
Petroleum, crude	+ 7.1	Fuel oil	+ 7.8
Zinc, slab	+ 5.4	Copper, blister	+ 7.5

(*Footnote continued on page 256*)

FIGURE 44

CHANGES IN PHYSICAL VOLUME OF PRODUCTION OF INDIVIDUAL COMMODITIES IN THE UNITED STATES, 1922-1929

A- RAW MATERIALS

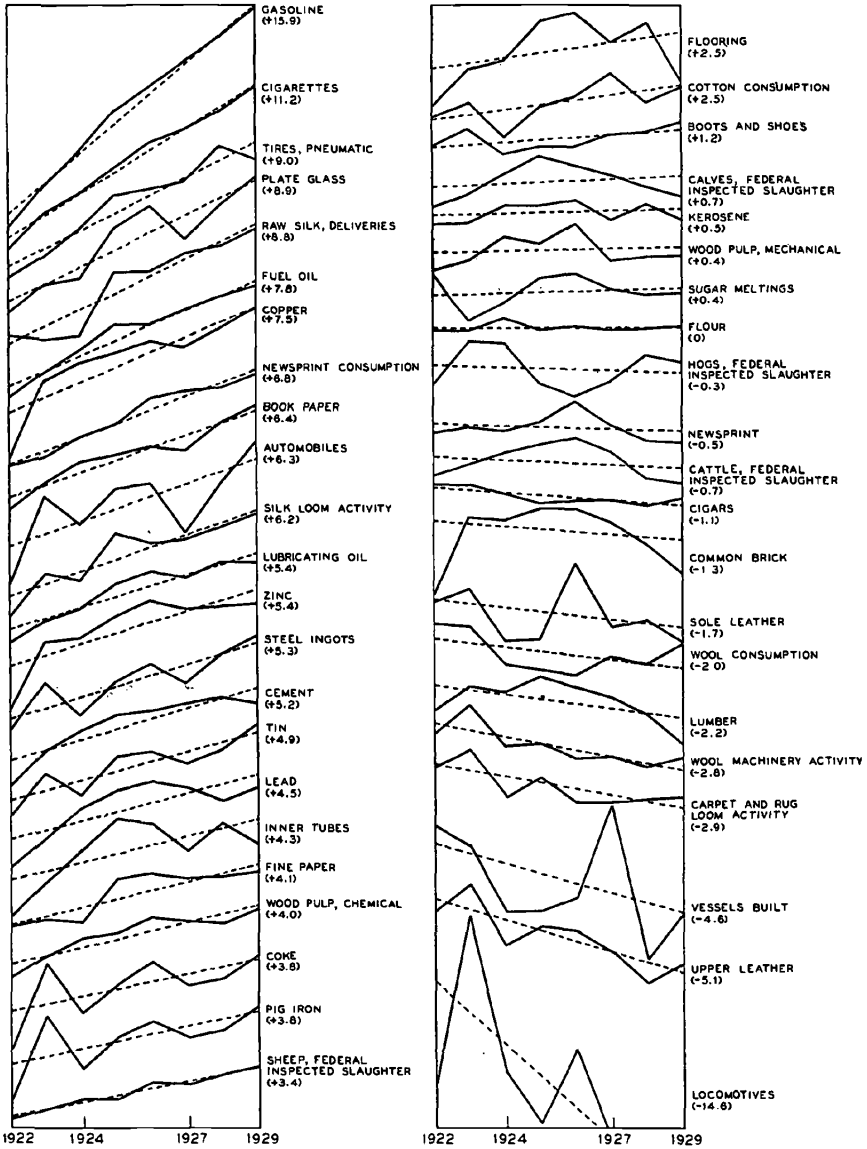


PLOTTED ON RATIO SCALE. THE FIGURES IN PARENTHESES DEFINE AVERAGE ANNUAL RATES OF CHANGE

FIGURE 44 (CONT.)

CHANGES IN PHYSICAL VOLUME OF PRODUCTION OF INDIVIDUAL COMMODITIES IN THE UNITED STATES, 1922-1929

B- PROCESSED GOODS



PLOTTED ON RATIO SCALE. THE FIGURES IN PARENTHESES DEFINE AVERAGE ANNUAL RATES OF CHANGE.

Here are widely divergent movements, surprisingly divergent for a period of general expansion such as that falling between 1922 and 1929. Within the group of raw materials average annual rates of change ranged from — 11.0 per cent for rye to + 11.8 per cent for natural gas; corresponding measurements for fabricated commodities ranged from — 14.6 per cent a year for locomotives [1] to

(*Footnote continued from page 253*)

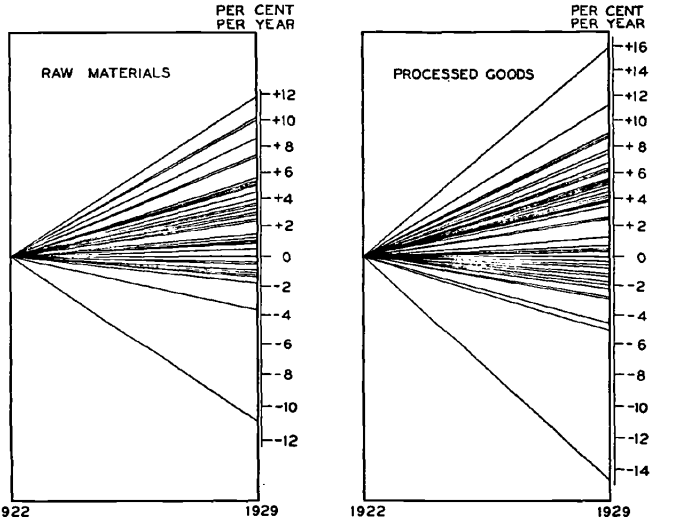
Series relating to production of materials	Average annual rate of change, 1922-1929 (per cent)
Wool	+ 5.2
Cement	+ 5.2
Cotton	+ 5.1
Cottonseed	+ 5.1
Lead, crude	+ 4.5
Oranges	+ 3.9
Iron ore	+ 3.4
Sheep, total slaughter	+ 3.4
Milk	+ 3.2
Sugar, domestic	+ 2.9
Rice	+ 2.8
Flaxseed	+ 2.4
Poultry products	+ 2.3
Bituminous coal	+ 1.4
Anthracite coal	+ 1.2
Hay	+ 1.0
Peaches	+ 0.9
Tobacco	+ 0.9
Wheat	+ 0.5
Swine, total slaughter	0.0
Calves, total slaughter	— 0.4
Oats	— 0.4
Corn	— 0.9
Silver	— 1.1
Cattle, total slaughter	— 1.2
Potatoes	— 1.3
Gold	— 1.8
Apples	— 3.7
Rye	—11.0

Series relating to processes of fabrication	Average annual rate of change, 1922-1929 (per cent)
Newsprint consumption	+ 6.8
Book paper	+ 6.4
Motor vehicles	+ 6.3
Silk loom activity	+ 6.2
Zinc, slab	+ 5.4
Lubricating oil	+ 5.4
Steel ingots	+ 5.3
Cement	+ 5.2
Tin deliveries	+ 4.9
Lead, crude	+ 4.5
Inner tubes	+ 4.3
Fine paper	+ 4.1
Wood pulp, chemical	+ 4.0
Coke, total	+ 3.8
Pig iron	+ 3.8
Sheep, Federal inspected slaughter	+ 3.4
Flooring	+ 2.5
Cotton consumption	+ 2.5
Boots and shoes	+ 1.2
Calves, Federal inspected slaughter	+ 0.7
Kerosene	+ 0.5
Wood pulp, mechanical	+ 0.4
Sugar meltings	+ 0.4
Flour, wheat	0.0
Hogs, Federal inspected slaughter	— 0.3
Newsprint production	— 0.5
Cattle, Federal inspected slaughter	— 0.7
Cigars	— 1.1
Common brick	— 1.3
Sole leather	— 1.7
Wool consumption	— 2.0
Lumber	— 2.2
Wool machinery activity	— 2.8
Wool rug and loom activity	— 2.9
Vessels built	— 4.6
Upper leather	— 5.1
Locomotives, railroad	—14.6

[1] For locomotives a mere count of the number produced furnishes a poor index of the physical volume of production because of the substantial changes that have occurred within recent years in the weight and power of locomotives. The total tractive power of all steam locomotives in service for Class I railroads increased at an average rate of 0.6 per cent a year over this period. (This is, of course, an aggregate, and is not necessarily inconsistent with a sharp decline in the annual increments to the total.) With the scrapping of the older types of engines and the introduction of heavier and more powerful locomotives, the tractive power per locomotive has increased at an average rate of 2.5 per cent a year. (*Statistics of Railways in the United States,* 1930, p. S-117.)

FIGURE 45

ILLUSTRATING THE DIVERGENCE OF PRODUCTION TRENDS IN THE UNITED STATES, 1922-1929*



* Plotted on ratio scale. The lines here plotted relate to the commodities listed in footnote on pp. 253 and 256, in the order of that listing.

+ 15.9 per cent a year for gasoline. As in the pre-war period, the degree of divergence is somewhat greater among processed goods (weighted standard deviation of rates of change 3.9) than among raw materials (weighted standard deviation of rates of change 3.1).

Comparison of pre-war and post-war periods with respect to degree of divergence is difficult. If we use rates of change relating to identical commodities in the two periods we are restricted in the later period to industries which, in the main, have passed through their most rapid stage of growth. If we include in the post-war period industries not appearing in the earlier records we cannot be sure of the comparability of our groups. If the coverage were complete in both periods the question of comparability in detail would not have to be faced, but this is far from being the case. Taking the figures as they stand, as providing the basis of a rough comparison, we note that the degree of divergence appears to have been somewhat greater among raw materials between 1922 and 1929 than between 1901 and 1913, and that divergence was less among

fabricated goods in the recent period than it was in the earlier period.[1]

Physical Output of Products of American Farms and of All Other Products

The customary classification into cultivated and non-cultivated commodities should be modified for the immediate purpose in order that products of American farms may be distinguished from all other commodities. The 'all other' group thus includes a few products such as silk goods and pneumatic tires, the raw materials of which are cultivated.

Index numbers of the physical volume of production of commodities in these two groups are given in the next table. They appear graphically in Figure 46.

There is a wide margin between the rates at which the production of farm products and of non-farm products increased during this period—a margin even wider than that which divides the rates of growth of raw and processed goods. As against an advance of 2.0 per cent a year for the group of farm products, the output of non-farm products increased at a rate averaging 5.1 per cent a year. The production of farm products kept comfortably ahead of the growth of population (1.4 per cent a year), while the output of commodities not originating on American farms expanded at a rate far in excess of the rate of population growth. The wants which have been expanding in recent years, and which augmented incomes and improvements of consumer credit have provided means of satisfying, have not, in general, been those which farm products could fill.

[1] These statements are based on the following measurements:

	Number of production series	Weighted standard deviation of rates of change
1901-1913		
Raw materials	28	2.1
Manufactured goods	31	5.7
1922-1929		
Raw materials	36	3.1
Manufactured goods	44	3.9

Weights have been based upon the value of materials at the farm and mine and upon the 'value added by manufacture' in 1909 and in 1923 and 1925. The influence of the exceptionally rapid growth in the production of motor vehicles during the pre-war period (45 per cent a year) has been reduced by adjusting the weight given this industry in the sample on the basis of its relative importance in total manufacturing production.

TABLE 109

PRODUCTS OF AMERICAN FARMS AND ALL OTHER PRODUCTS

Index Numbers of Physical Volume of Production in the United States, 1922-1929 [a]

(1) Year	(2) Products of American farms	(3)	(4) All other products [b]	(5)	(6) All products of American farms	(7) All other products
	Raw	Processed	Raw	Processed		
1922	100	100	100	100	100	100
1923	105	106	137	115	105	119
1924	110	102	130	108	107	111
1925	110	111	133	121	110	122
1926	116	112	144	131	114	133
1927	110	118	147	128	113	131
1928	116	114	146	138	115	140
1929	114	121	159	147	116	149
Average annual rate of change (per cent) ..	+1.7	+2.6	+4.6	+5.1	+2.0	+5.1
Index of instability of growth	2.2	2.0	4.7	3.0	1.2	3.1

[a] A description of the procedure followed in the construction of these index numbers is given in Appendix I, Section 2. The index numbers of the output of processed products have been adjusted to measurements representing all manufacturing industries.

[b] The commodities which have been included in the sample of raw materials not originating on American farms are all minerals. In addition to mineral products in the processed group there have been included series relating to the fabrication of lumber and of imported cultivated materials.

Within each of these two main groups the production of processed goods was increasing between 1922 and 1929 at rates which exceeded the growth in output of raw materials.[1]

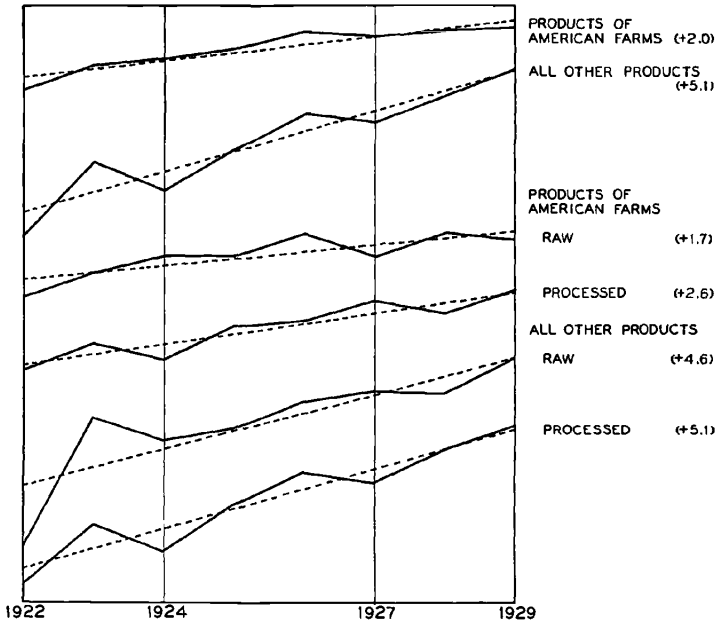
A comparison of these rates with those prevailing between 1901 and 1913 is suggestive. For all farm products (raw and processed) the rates of growth, pre-war and post-war, are practically identical—2.1 and 2.0 per cent a year. However, the pre-war advance occurred with population increasing at 2.0 per cent a year, while the rate of population growth in the recent period was but 1.4 per cent a year. Here is a material difference, the effects of

[1] The apparent discrepancy between the average annual rates of change in the production of non-farm products, raw, processed and total, is due to the fact that the weights given to processed goods in this group are much heavier than the weights given to raw materials.

FIGURE 46

GROWTH OF PHYSICAL VOLUME OF PRODUCTION IN THE UNITED STATES, 1922-1929

PRODUCTS OF AMERICAN FARMS AND ALL OTHER PRODUCTS



Plotted on ratio scale. The figures in parentheses define average annual rates of change (in percentage form).

which on the market for farm products were intensified by the changes occurring in the character of our foreign trade. Exports of both crude and manufactured foodstuffs were declining at rapid rates between 1922 and 1929, after the temporary stimulus of the war and immediate post-war years.

The more rapid advance of aggregate production in the recent period, as contrasted with 1901-1913, is attributable to the expanding output of commodities not originating on American farms. The post-war rate of 5.1 per cent a year exceeds materially the pre-war figure of 4.3 per cent. It was on non-farm products that new demands were concentrated during the expansion of the last decade.

§ *Comparison of identical commodities, pre-war and post-war.*—In the preceding comparisons of the periods 1901-1913 and 1922-1929 with respect to the movements of production, use has been made of index numbers and averages not based upon identical commodities. If index

numbers representative of conditions in each of the periods are to be used, it is, indeed, inevitable that there should be some differences among the commodities included. New industries come into being, and commodities change in relative importance with the passage of time. Nevertheless, it is desirable that we supplement the comparison of general but dissimilar index numbers and averages by a study of the behavior of identical commodities during the two periods. Relevant measurements relating to 48 commodities are given in Table 110, on page 262.

Of the 16 raw farm products on the list, seven have post-war rates of increase which exceed the pre-war rates. Comparative rates are shown for six series relating to the production of processed products originating on American farms. For only one, cottonseed consumption, did the post-war rate of increase exceed the pre-war rate. Two of the six show declining post-war rates.

Among raw products of non-farm origin (minerals) only three out of 11 were marked by rates of post-war increase exceeding the pre-war rates. Of 15 comparable series representing the production of processed products of primarily non-farm origin, four show higher post-war rates; for the other 11 post-war rates were lower than the pre-war figures.

Of the total 48 production series compared, only 15 were increasing during the period between 1922 and 1929 at rates in excess of those prevailing between 1901 and 1913. This evidence seems clearly at variance with the conclusion given at an earlier point, namely, that the rate of increase in the volume of production was somewhat greater in post-war than in pre-war years. The explanation is found in the varying importance of particular series at different times (notably, in the present case, the declining importance of agricultural products and the increasing importance of industrial products), and in the fact that series representative of the general stream of production at one time are not representative at another.

Most series measuring the production of particular commodities begin to decline in rates of growth at relatively early dates in the histories of those commodities. It is to be expected, then, that comparisons of rates of growth of identical series at different periods should in general show lower rates during the later period. But an individual series may be increasing at a lower rate during a later period, and at the same time may be contributing to a more rapid advance of the aggregate physical volume of production. Thus the output of motor vehicles increased at an annual rate of 45.0 per cent between 1901 and 1913, and at only 6.3 per cent between 1922 and 1929. But motor vehicles were almost a negligible element in aggregate production during the early part of the century, whereas they have been a dominating factor in recent years. A given percentage increase represents a far larger increment, of course, when the annual aggregate is large than it does when the absolute annual production is small.

Again, the comparison of identical series necessitates the omission

TABLE 110

AVERAGE ANNUAL RATES OF CHANGE IN THE PRODUCTION OF IDENTICAL COMMODITIES

1901-1913 and 1922-1929 [a]

(1) Products of American farms	(2)	(3)	(4) All other products	(5)	(6)
Commodity	Average annual rate of change (per cent)		Commodity	Average annual rate of change (per cent)	
	1901-1913	1922-1929		1901-1913	1922-1929
Raw materials			Raw materials		
Sugar, domestic	+5.1	+2.9	Cement, total	+13.8	+5.2
Sheep, total slaughter	+3.6	+3.4	Petroleum, crude	+9.8	+7.1
Potatoes	+3.1	−1.3	Natural gas	+7.1	+11.8
Cotton	+2.8	+5.1	Zinc	+7.0	+5.4
Tobacco	+2.7	+0.9	Copper	+5.8	+7.3
Barley	+2.7	+10.0	Bituminous coal	+5.7	+1.4
Oats	+2.4	−0.4	Iron ore	+5.5	+3.4
Cottonseed	+1.9	+5.1	Lead	+3.9	+4.5
Corn	+1.9	−0.9	Anthracite coal	+3.4	+1.2
Cattle, total slaughter	+1.7	−1.2	Gold	+1.8	−1.8
Swine, total slaughter	+1.1	0.0	Silver	+1.2	−1.1
Hay	+0.4	+1.0	Manufactured goods		
Wool	+0.3	+5.2	Motor vehicles	+45.0	+6.3
Apples	−0.2	−3.7	Cement, total	+13.8	+5.2
Wheat	−0.3	+0.5	Silk imports	+7.2	+8.8
Flaxseed	−3.0	+2.4	Steel ingots and castings	+7.1	+5.3
Manufactured goods			Zinc consumption	+6.9	+5.6
Cigarettes	+17.2	+11.2	Coke	+5.7	+3.8
Cottonseed consumption	+3.9	+7.5	Pig iron	+5.0	+3.8
Cotton consumption	+3.1	+2.5	Copper consumption	+4.8	+8.4
Wool consumption	+1.2	−2.0	Passenger cars, railroad	+4.1	+0.8
Cigars	+1.1	−1.1	Sugar, total supply	+3.9	+1.7
Flour, wheat	+0.3	0.0	Lead, available for consumption	+2.6	+4.0
			Steel rails	+1.1	+1.8
			Common brick sold	0.0	−1.3
			Freight cars	−0.6	−8.5
			Vessels built	−3.7	−4.6

[a] In some cases the post-war measurements here given differ slightly from those cited in earlier tables. For the present purpose we have sought series identical with those used for pre-war years.

of new series relating to commodities just coming into production, and perhaps playing important parts during the later of the two periods compared. Radios, electric refrigerators and similar commodities are recent examples of such novelties. A valid and adequate comparison of aggregate production during two periods can not, then, be based upon identical commodities, with identical weights. Adequate representation of the total stream of production in each period must be sought. It is notable that index numbers of manufacturing output based on standard commodities show no greater rate of increase for the post-war period than for the pre-war period, until adjustment is made to measurements reflecting the output of non-standard fabricated products. The comparison of individual commodities throws interesting light on the course of production during the two periods, but it does not tell the whole story.

The Value and Volume of Construction

During the war emphasis was placed on the production of immediately necessary articles of food and clothing, and war supplies. At the end of the first post-war depression there existed an accumulated shortage of construction, representing deferred construction of residences, roads, public works of all sorts, and commercial and industrial buildings. By 1922 the productive forces of the country were turning to the filling of this gap. This movement, and its consequences, deeply affected the course of economic events between 1922 and 1929 and played an important rôle in the subsequent recession.

The measurement of the volume of construction presents difficulties, for appropriate physical units of measurement are lacking. We may determine the amount of certain important building materials turned out, we may measure the floor space of certain types of buildings constructed, but these data fall far short of reflecting the great variety of construction of roads, bridges, dams, power plants, and industrial, commercial and residential buildings which took place during this period. Records in terms of values, with their admitted imperfections, are the most comprehensive available. We turn first to these, as given in Table 111, for a general survey of construction movements. The series are plotted in Figure 47.

From an estimated figure of 4,330 millions of dollars in 1922, total construction contracts awarded increased in value to 7,295 millions in 1928. There was a drop to 6,421 millions in 1929. The average annual rate of increase over the eight-year period was 6.7 per cent. This exceeds materially the rate of approximately 3.3 per

TABLE 111

GROWTH OF CONSTRUCTION IN THE UNITED STATES, 1922-1929

Estimated Values of Total Contracts Awarded [a]
(In millions of dollars)

(1) Year	(2) Commercial buildings	(3) Industrial buildings	(4) Public and institutional buildings	(5) Apartments and hotels [b]	(6) 1 and 2 family houses	(7) Public works and utilities	(8) Total construction
1922	642	421	804	836	899	728	4,330
1923	619	541	745	1,037	1,037	789	4,768
1924	691	413	887	1,212	1,188	846	5,237
1925	976	550	1,112	1,621	1,455	1,009	6,724
1926	1,020	744	1,082	1,627	1,331	1,259	7,062
1927	1,053	562	1,123	1,503	1,376	1,404	7,022
1928	974	699	1,081	1,513	1,556	1,472	7,295
1929	1,038	845	1,006	933	1,206	1,394	6,421
Average annual rate of change (per cent) ..	+8.1	+9.3	+4.7	+3.7	+5.1	+11.4	+6.7
Index of instability of growth	10.1	10.8	8.2	18.2	9.7	6.4	9.2

[a] These estimates of building and engineering construction have been made by the F. W. Dodge Corporation upon the basis of contracts ($5,000 and over per project) awarded in 37 states. (In 1923 36 states were covered, in 1922, 27.) They represent total construction in the United States, the data having been raised to include the omitted eleven western states by the application of correction factors based upon estimates of population and certain types of construction.

The constitution of certain of the above groups requires further definition:

Commercial: Banks, airports, garages, offices, offices and banks, stores, warehouses.

Industrial: Mineral extraction, food products, chemical industries, leather, power plants, iron and steel, vehicles, petroleum, paper and pulp, printing and binding, rubber, textile, lumber, non-ferrous metals, miscellaneous.

Public and institutional: Schools, colleges, libraries, museums, gymnasiums, hospitals, institutions, military and naval buildings, municipal buildings, post offices, churches, convents, memorial buildings, auditoriums and halls, clubs and lodges, parks, park buildings, theatres.

Public works and utilities: Waterfront developments, bridges, incinerators, lighting systems, railroad construction, railway buildings, sewerage systems, highways, water supply systems.

[b] The average rate of growth and the index of instability for construction of apartments and hotels do not indicate the true movement of this series. The rapid rise during the first part of the period and the subsequent decline are not adequately described by a compound interest curve.

cent [1] which measures the increasing aggregate value of the production of movable goods during this period.

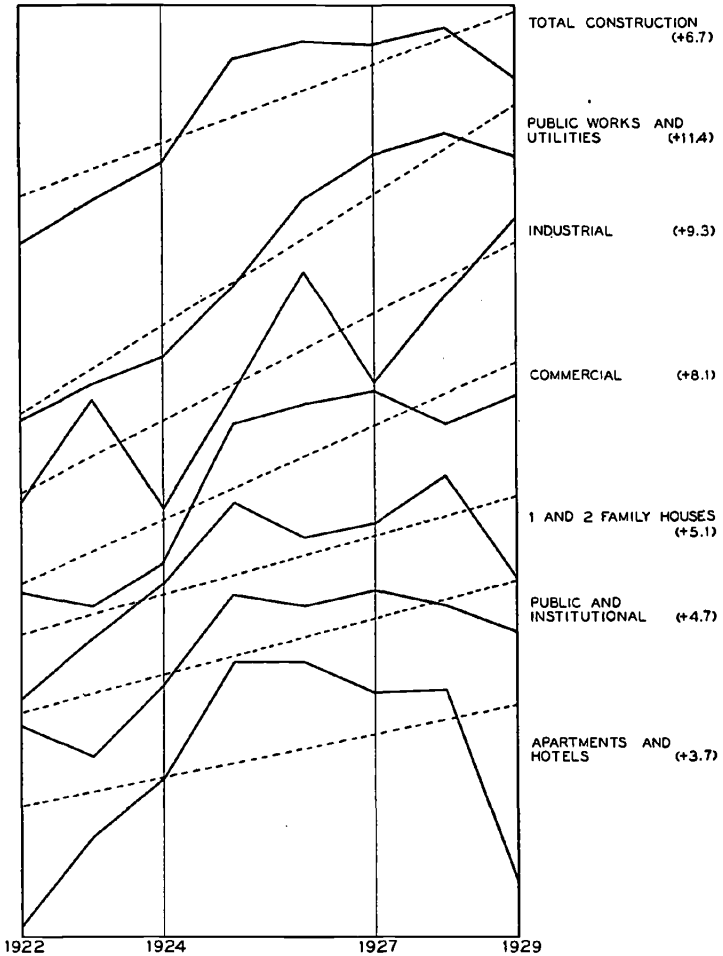
The most important element of the total in 1922 was the con-

[1] Estimated on the basis of an average increase in general production at a rate of 3.8 per cent per year, and a decrease in wholesale prices at a rate of 0.5 per cent per year.

FIGURE 47

GROWTH OF CONSTRUCTION
IN THE UNITED STATES, 1922-1929

ESTIMATED VALUES OF TOTAL CONTRACTS AWARDED, 48 STATES



Plotted on ratio scale. The figures in parentheses define average annual rates of change (in percentage form).

struction of 1 and 2 family houses, with apartments and hotels next. These classes grew most rapidly up to 1925. With minor fluctuations the values of these two groups of residential buildings remained fairly constant at relatively high levels thereafter, through

1928, but declined markedly in 1929. Commercial buildings, industrial buildings, public and institutional buildings and public works and utilities made their most rapid gains after 1924. One group only, industrial buildings, reached its value peak in 1929, advancing 50 per cent during the two years from 1927 to 1929.

These figures, estimates though they be, indicate how rapid was the rush to fill the gaps existing in the field of construction after the war years. A high level of activity had been attained by 1925. The aggregate value of construction in that year approximated 6.7 billions of dollars, as compared with 26.8 billions of dollars, the total value contribution ('value added') of all manufacturing industries of the country. This rapid advance is understandable, in view of the deficiencies of our equipment after the war, but the maintenance of construction activity at this level during the four succeeding years furnishes the most striking feature of the record. It is now clear that there occurred in this field a piling up of utilities the enjoyment of which would necessarily be spread over a considerable period of time. This condition affected not only the industries and financial agents directly concerned, but also the direction and intensity of subsequent consumer demand. More attention is given to this subject in a later section of this chapter.

§ *Construction volume.*—The preceding figures, which relate to aggregate values of contracts awarded, do not define volume changes with the greatest accuracy, for prices and costs did not remain constant during this period. It is possible to correct the value figures by index numbers of construction costs, but the results must be accepted with reservations. Changes in costs are not uniform throughout the country, or for all enterprises. It is of dubious validity to apply generally index numbers of costs based upon sample studies. If we recognize these limitations, we may make use of 'deflated' value series as approximations to the volume index numbers we should like to have. Figures derived in this fashion appear in Table 112.

Rising construction costs served to swell the values of contracts awarded between 1922 and 1929, and correction for this factor reduces the figures for the various years. Total construction gained at an average annual rate of 6.1 per cent, as compared with 6.7 per cent for the value series. The other series (except apartments and hotels) are reduced correspondingly, but the general picture is still one which shows the construction industry making a great forward leap after 1924, and remaining at a high and slightly rising level of activity until 1928. All groups except industrial buildings had passed their peaks prior to 1929.

Still further evidence on the changing volume of construction is afforded by statistics of the area of floor surface recorded in connection

TABLE 112

GROWTH OF CONSTRUCTION IN THE UNITED STATES, 1922-1929 [a]

Index Numbers of Volume of Construction Secured by Deflating Aggregate Values of Contracts Awarded

(1) Year	(2) Commercial buildings	(3) Industrial buildings	(4) Public and institutional buildings	(5) Apartments and hotels	(6) 1 and 2 family houses	(7) Public works and utilities	(8) Total construction
1922	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1923	78.6	108.2	75.6	108.2	104.9	88.3	93.3
1924	87.2	84.2	89.5	127.7	122.5	94.2	103.0
1925	128.3	113.8	116.8	177.6	152.3	117.0	136.5
1926	133.1	152.5	112.9	180.8	137.9	145.1	143.0
1927	138.7	117.5	118.3	168.7	141.9	163.3	143.3
1928	127.9	147.8	113.5	169.9	161.2	170.7	149.0
1929	136.2	179.4	105.5	104.7	125.0	161.6	131.0
Average annual rate of change (per cent) ..	+7.0	+8.9	+3.6	+4.0	+4.7	+10.5	+6.1
Index of instability of growth	11.8	11.2	9.8	18.6	9.3	9.3	8.9

[a] These are the value series presented in Table 111, deflated, and put into relative form with 1922 as 100. (The index of total construction is a weighted average of the indexes in columns (2) to (7) inclusive.) The deflating index employed varies with the series in question. The general construction cost index of the *Engineering News Record* has been used to correct for price changes in the commercial, public and institutional, and public works and utilities groups. The index of factory building costs, compiled by the Aberthaw Construction Company, was used to deflate the values of industrial buildings. For residential construction the special indexes of the American Appraisal Company were employed as deflators; an index based on costs of construction of a brick and steel frame building was applied to hotel and apartment house contracts, and a similar index for frame buildings was used for the series on 1 and 2 family houses. These index numbers follow:

INDEX NUMBERS OF CONSTRUCTION COSTS

Year	General construction (*Engineering News Record*)	Factory buildings (Aberthaw Construction Company)	Brick, steel frame (American Appraisal Company)	Frame (American Appraisal Company)
1922	100	100	100	100
1923	123	119	115	110
1924	123	116	114	108
1925	118	115	109	106
1926	119	116	108	107
1927	118	114	106	108
1928	118	112	106	107
1929	119	112	106	107

These index numbers are all published in the *Survey of Current Business.*

with contracts awarded in 36 states (F. W. Dodge Corporation figures), and by an index of total construction based upon shipments of building materials by the Associated General Contractors of America. These are given in the next table.

TABLE 113

GROWTH OF CONSTRUCTION IN THE UNITED STATES, 1922-1929

Index Numbers of Contracts Awarded, by Floor Surface Areas, and of Building Materials Booked and Shipped

(1) Year	(2) Building contracts, floor space [a] Residential	(3) Commercial	(4) Industrial	(5) Index of construction based on shipments of materials [b]
1922	100.0	100.0	100.0	100
1923	114.4	97.4	94.9	116
1924	123.6	100.6	64.7	121
1925	157.9	134.5	87.2	131
1926	146.0	125.9	101.8	133
1927	138.6	117.6	88.0	139
1928	160.4	133.9	118.3	146
1929	108.8	135.0	137.5	145
Average annual rate of change (per cent)	+3.0	+4.9	+5.8	+4.9
Index of instability of growth	11.9	6.0	13.8	3.0

[a] Contracts awarded in 36 states, compiled by the F. W. Dodge Corporation, by area of floor surface. The 1922 figure is estimated from reports from 27 states.

[b] Compiled by Associated General Contractors of America. The index is a simple average of structural steel bookings, common brick bookings, Portland cement shipments, loading of sand, gravel and stone, shipments of face brick and shipments of enameled sanitary ware. (1931 Annual Supplement, *Survey of Current Business*, p. 190.)

The index of total construction, being based upon the bookings and shipments of selected building materials, is not directly comparable with the figures given in earlier tables. Lumber movements do not enter into the index. The materials included in the index show an average annual rate of increase, during this period, of 4.9 per cent.

Index numbers based on areas of floor surface of different types of buildings under construction are, of course, far less comprehensive in scope than the value figures previously discussed. In so far as the groupings are comparable, the area figures show much the same year-to-year variations as do the value figures, but rather lower rates of increase. The very great drop in floor area of residential buildings in 1929 (a drop of 32 per cent) reduced the rate of growth for the period as a whole to 3.0 per cent a year. For the years 1922-1928 the annual rate of advance averaged 7.0 per cent. The construction of industrial buildings, which surged forward most rapidly between 1927 and 1929, increased at an average rate of 5.8 per cent a year during the whole period. Among commercial buildings the gain in floor area was at a rate of 4.9 per cent a year.

Of the various measures presented, deflated value figures probably give the best approximation to the actual changes occurring in aggregate volume of construction of all sorts. There are admitted difficulties encountered in the deflating process, but the more comprehensive character of the value compilations impels one to accept these in preference to the much more restricted statistics of areas. Further use is made of these data in later sections.

Physical Output of Finished Products, 1922-1929
Consumption Goods and Capital Equipment

In passing to categories of goods destined for human consumption and goods intended for use as capital equipment, certain difficulties of measurement are encountered. Capital goods, by their nature, are not readily enumerated, and much of this type of equipment falls outside the field covered by current statistics. In summarizing available materials, records of output in physical units will be supplemented by data measuring changes in values. This will be done only where it is reasonable to assume that the value series do not overstate the rate of advance in the physical volume of production, or where deflation by suitable price index numbers is possible.

The measurements described in the present section have been designed to indicate changes in the volume of production of *finished* goods—to measure the flow of such products in the form of ultimate consumption goods or of finished capital equipment. Immediate interest lies not in the sources of these goods but in the uses to which they are put. For this reason raw materials and partly fabricated goods have been excluded from the averages. Weights assigned to the component series have been based upon the values of the finished products. These index numbers do not measure the total productive effort of the country, except in so far as the output of raw materials is transformed into finished products ready for consumption or capital use. In this respect the averages are of the nature of indexes of consumption, rather than indexes of production, though in the long run the rates of growth of these two series must not be greatly different.[1]

[1] The exact agreement, as regards rates of change, of the index of total production of finished goods given in this section with the general production index presented on earlier pages is a fortuitous result, though the relationship is bound to be close.

Non-durable Consumption Goods

Changes in the output of non-durable consumption goods are traced in the following table, and in Figure 48.

TABLE 114

NON-DURABLE CONSUMPTION GOODS

Index Numbers of Physical Volume of Production of Finished Goods, 1922-1929 [a]

Year	Foods	Other non-durable consumption goods	Total non-durable consumption goods
1922	100	100	100
1923	106	121	108
1924	107	129	110
1925	106	132	110
1926	110	149	116
1927	110	159	118
1928	113	171	122
1929	113	185	124
Average annual rate of change (per cent)	+1.6	+8.3	+2.8
Index of instability of growth	1.3	2.5	1.4

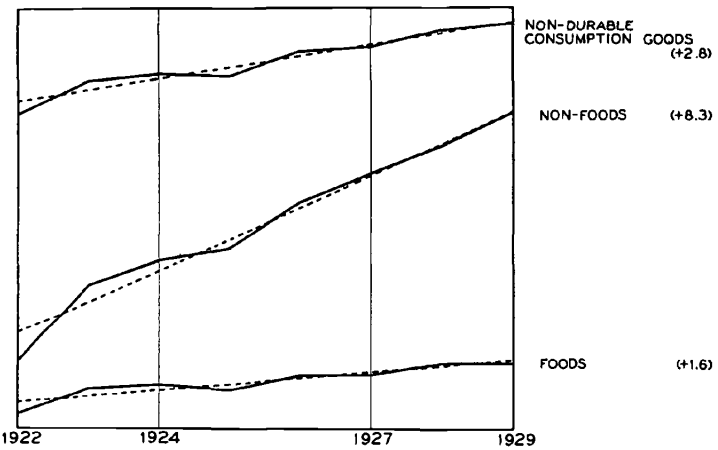
[a] The series included in the index of production of food products relate to the following commodities, or groups of commodities: Flour, meat products, poultry products, fruits and vegetables, truck crops, milk, butter, ice cream, beverages (value series), sugar, tobacco, cottonseed oil, fresh fish. Six series make up 'other non-durable consumption goods'. These relate to the production of gasoline, manufactured gas, anthracite coal, druggists' preparations (a value series), kerosene, and to the consumption of newsprint. A description of these index numbers is given in Appendix I.

The output of perishable consumption goods increased at a rate of 2.8 per cent a year between 1922 and 1929, which is below the average rate of advance in volume of production. This figure conceals a sharp divergence of the index numbers for foods and for other non-durable consumption goods. The volume of foods produced increased at a rate of 1.6 per cent a year, the 1929 aggregate being only 13 per cent greater than that for 1922. The advance in food production is barely above the rate of population increase, which averaged 1.4 per cent a year between 1922 and 1929. This condition would indicate on its face a slight increase in per capita consumption of foods. During this period there was, undoubtedly, a movement toward a more varied diet, as well as a general re-direction of consumer expenditure in which foods have declined in relative importance. The food series used above, however, are not

FIGURE 48

GROWTH OF PRODUCTION OF FINISHED GOODS IN THE UNITED STATES, 1922-1929

NON-DURABLE CONSUMPTION GOODS



Plotted on ratio scale. The figures in parentheses define average annual rates of change (in percentage form).

general enough to provide a complete picture of the changes in food habits which are known to have taken place. The figures are affected, too, by the declining importance of food exports, in both raw and processed forms.[1]

[1] The following figures relate to exports and imports of food products during the period 1922-1929:

	Average annual rate of change (per cent)	Index of instability
Exports		
Crude foodstuffs, value	−3.5	14.2
Manufactured foodstuffs, value	−3.8	3.7
Imports		
Crude foodstuffs, value	+7.1	6.4
Manufactured foodstuffs, value	−1.6	8.1

The change in our trade position, in regard to the movement of food products, has been pronounced. Imports of crude foodstuffs were increasing in aggregate value at the very high rate of 7.1 per cent a year between 1922 and 1929, while exports of both crude and manufactured foodstuffs were declining at substantial rates. The decline in exports represents, in part, a drop from the somewhat inflated levels attained in the immediate post-war years, when large volumes of food were going from this country to the war-ravaged areas of Europe. This is one aspect of a more general alteration in the international economic relations of the United States, a change already evident in the figures for the period 1901-1913. Food exports, which bulked so large in our earlier history, have been declining, while manufactured goods, particularly manufactured non-foods, have become increasingly important in our export trade.

The output of other perishable consumption goods, including gasoline, kerosene, anthracite coal, manufactured gas, druggists' preparations and newsprint, increased at a rate of 8.3 per cent a year during this period. Gasoline, which was being produced in sharply increasing volume (15.9 per cent a year), dominates this group; newsprint consumption, advancing at the rate of 6.8 per cent a year, and druggists' preparations, increasing by 7.6 per cent a year, were also factors in the increase. If gasoline, newsprint and druggists' preparations be eliminated from the total group of non-durable consumption goods, there is left a group which distinctly lagged behind in the general advance of this period. With the exceptions noted (and possibly others of lesser importance), perishable consumers' goods were not the commodities for which demand was increasing rapidly between 1922 and 1929.

Semi-durable Consumption Goods

Textile products, boots and shoes, and rubber tires constitute a group of semi-durable consumption goods. Changes in the output of these commodities are shown by the following index numbers, which are plotted in Figure 49.

TABLE 115

SEMI-DURABLE CONSUMPTION GOODS

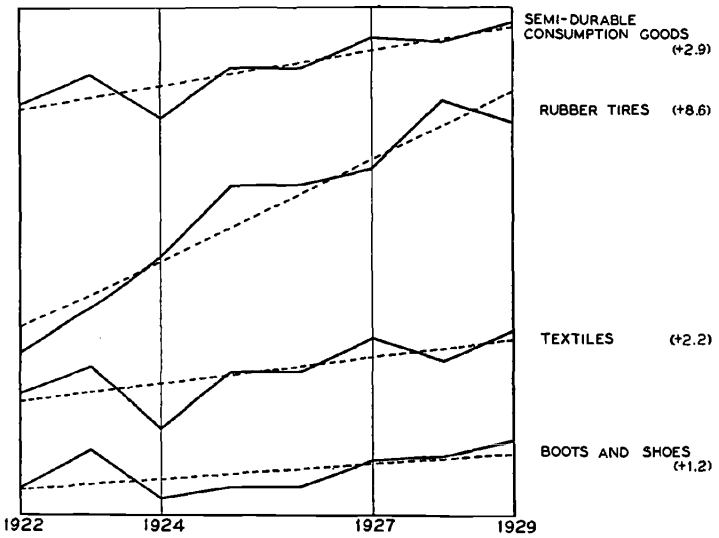
Index Numbers of Physical Volume of Production of Finished Goods, 1922-1929

(1) Year	(2) Textile products	(3) Boots and shoes	(4) Rubber tires	(5) Total semi-durable consumption goods
1922	100	100	100	100
1923	106	109	112	107
1924	92	97	127	96
1925	105	100	151	109
1926	105	100	151	109
1927	114	106	157	117
1928	108	107	187	116
1929	116	112	175	122
Average annual rate of change (per cent)	+2.2	+1.2	+8.6	+2.9
Index of instability of growth	3.7	3.1	5.0	2.7

FIGURE 49

GROWTH OF PRODUCTION OF FINISHED GOODS IN THE UNITED STATES, 1922-1929

SEMI-DURABLE CONSUMPTION GOODS



Plotted on ratio scale. The figures in parentheses define average annual rates of change (in percentage form).

The total output of semi-durable consumption goods increased at a rate approximately equal to that at which perishable consumption goods advanced, but lower than the rate of growth of total production. Such goods as a class did not feel the pressure of the new demand. The volume of production of textiles and, notably, of boots and shoes, lagged conspicuously behind the general procession in the economic advance of the 'twenties. One type of semi-durable consumption goods spurted forward, however. The expanding output of rubber tires, growing at a rate of 8.6 per cent a year during this period, reflected the phenomenal growth of the automobile industry.

Durable Consumption Goods

We turn now to durable consumption goods,[1] with which is included residential construction.

[1] The line between semi-durable and durable goods is not readily drawn in all cases. For the present purpose we have placed in the durable group articles with a period of useful service exceeding approximately two years.

TABLE 116

DURABLE CONSUMPTION GOODS

Index Numbers of Physical Volume of Production of Finished Goods, 1922-1929

Year	Durable consumption goods [a]	Residential construction [b]	Durable consumption goods, including residential construction
1922	100	100	100
1923	127	106	120
1924	120	125	122
1925	140	165	148
1926	151	159	154
1927	136	155	142
1928	154	165	158
1929	172	115	153
Average annual rate of change (per cent)	+6.3	+4.3	+5.6
Index of instability of growth	6.2	13.9	6.2

[a] The index of production of durable consumption goods is constructed from the following series:

Automobiles. Index numbers of automobile production constructed by the National Bureau of Economic Research from data compiled by the Census of Manufactures have been used, with interpolations for inter-censal years. In the construction of these index numbers an attempt has been made to adjust for changes in the type of automobiles produced.

Furniture. The furniture series has been secured from statistics of the aggregate value of household furniture production, as reported in the Census of Manufactures, interpolated for inter-censal years by means of the Federal Reserve Board's index of furniture sales, and deflated by the Bureau of Labor Statistics' index of wholesale furniture prices.

Electrical equipment. The electrical equipment series is an index based upon estimates of sales (in units) of vacuum cleaners, washing machines, sewing machines and electric refrigerators made by C. E. Persons from data presented in *Electrical Merchandising* (*Quarterly Journal of Economics,* November, 1930, p. 111).

Carpets. This series has been secured from statistics of the aggregate value of carpet and rug production as reported in the Census of Manufactures, interpolated for inter-censal years on the basis of carpet and rug loom activity.

Mattresses. The production of mattresses is represented by a series secured from the undeflated value of product as compiled by the Census of Manufactures, with estimates for inter-censal years based on the sales of one of the larger manufacturers.

Phonographs and radios. This series is based upon statistics of the value of phonographs manufactured and total retail radio sales (reduced by 50 per cent to approximate values at the factory). Changes in the size and quality of phonographs and radio receiving sets introduce an unknown bias into a series based upon number alone. The records of dollar values do not in this case exaggerate the growth of the industry, for the price of comparable units had undoubtedly fallen during the period.

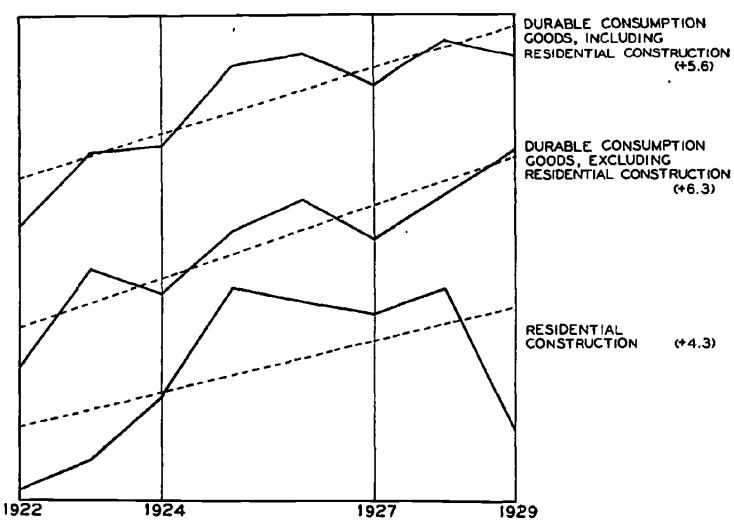
Pianos. This series has been secured from statistics compiled by the Census of Manufactures; estimates for inter-censal years have been based upon employment in industries producing musical instruments.

[b] The index of residential construction is based upon the F. W. Dodge Corporation estimates of contracts awarded for construction of apartments, hotels, and 1 and 2 family houses for the entire United States, deflated by construction cost indexes of the American Appraisal Company.

The two elements of this total follow quite different courses during the years covered above, as is clear from the graphs in Figure 50. Durable consumption goods, not including residences, rose steadily in volume of output, with slight checks in 1924 and 1927. The index for 1929 was 172, with reference to 100 in 1922, and the average annual rate of advance was 6.3 per cent. Residential construction rose sharply to a high point in 1925, dropped some-

FIGURE 50

GROWTH OF PRODUCTION OF FINISHED GOODS IN THE UNITED STATES, 1922-1929



Plotted on ratio scale. The figures in parentheses define average annual rates of change (in percentage form).

what during the next two years, but reached a new peak in 1928. From that height, 65 per cent above the base, the volume of such construction fell in 1929 to a level only 15 per cent above the 1922 standard. The average annual rate of increase, over the entire period, was 4.3 per cent. (Between 1922 and 1928 the average rate was 8.8 per cent, a truer indication of the general tendency during the time of expansion.) Combining the two series, we have an index of the changes in production of all types of durable consumption goods. This shows an advance of 53 per cent in the production

of goods of this type between 1922 and 1929, at an average annual rate of 5.6 per cent.

Clearly, it was among durable consumption goods that the expansion of output was most pronounced between 1922 and 1929. Consumers were not increasing the proportions of their incomes spent for foods, clothing, or shoes. As regards certain of these groups there may have been positive retrenchment. The rapid increase of consumer expenditures occurred, in the main, in the markets for goods which are more or less durable, for automobiles, electrical equipment, radios and houses. (Gasoline, newsprint, tobacco and automobile tires constitute the chief exceptions to this rule.) A sharp check occurred in the construction of residences after 1928, but the growing volume of production of other durable consumption goods kept the total well up through 1929. It is a fact of some significance that these goods, the swelling production of which helped to give the characteristic tone to this period of expansion, were articles of relatively long periods of usefulness. The growing proportion of such goods in consumers' budgets meant that unconsumed utilities were being held in increasing volume by consumers. A decreasing proportion of the total production of the economy was being currently consumed, an increasingly large 'inventory' was accumulating in consumers' hands. This fact has important implications, with reference to later developments, but we may not explore these at this point.

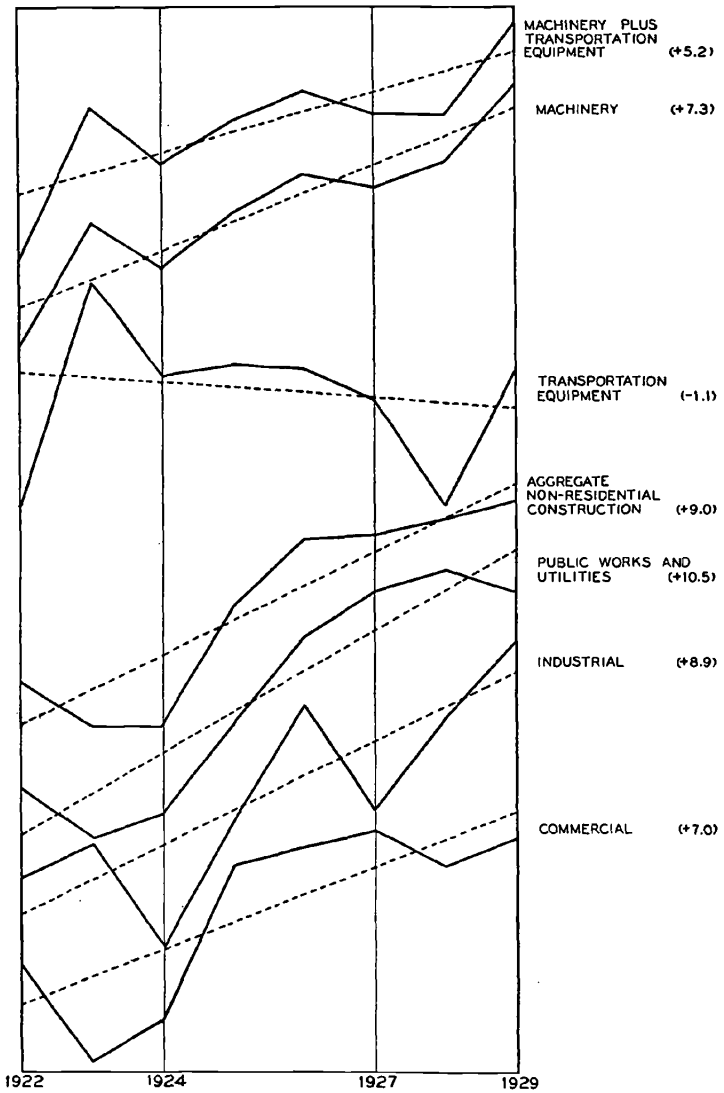
Elements of Capital Equipment

More difficult problems are faced in measuring the output of capital goods. Much of this equipment is in highly fabricated form, for which suitable measurements of volume of production are lacking. Computations based upon the production of basic materials entering into capital equipment are of doubtful validity, for differences in degree of fabrication are of the highest importance in relation to volume of capital goods produced. In the present case basic raw materials have been omitted from the calculations. The index numbers given relate to changes in the amount of *finished* equipment produced. In the absence of adequate measurements of physical volume of such equipment, a number of value series have been used. Where possible, correction for changes in the price factor have been made. In other cases value series have been used outright, on

FIGURE 51

GROWTH OF PRODUCTION OF FINISHED GOODS IN THE UNITED STATES, 1922-1929

ELEMENTS OF CAPITAL EQUIPMENT



Plotted on ratio scale. The figures in parentheses define average annual rates of change (in percentage form).

the assumption that the prices of capital equipment did not, in general, show rising trends between 1922 and 1929. The level of wholesale prices declined, on the average, over this period.

Measurements of changes in the output of various forms of capital equipment appear in the next table. They are plotted in Figure 51, on the preceding page.

The index which defines changes in capital equipment other than construction (i.e., the index for machinery plus transportation equipment) stood at its highest points in 1923, 1926 and 1929. A

TABLE 117

ELEMENTS OF CAPITAL EQUIPMENT

Index Numbers of Physical Volume of Production of Finished Goods, 1922-1929

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Non-residential construction [c]			
Year	Machinery [a]	Transportation equipment [b]	Machinery plus transportation equipment	Industrial	Commercial	Public works and utilities	Total
1922	100	100	100	100	100	100	100
1923	134	175	145	108	79	88	89
1924	121	136	125	84	87	94	89
1925	138	141	139	114	128	117	120
1926	153	139	150	153	133	145	142
1927	146	129	142	118	139	163	144
1928	157	99	142	148	128	171	150
1929	191	139	177	179	136	162	157
Average annual rate of change (per cent) ..	+7.3	—1.1	+5.2	+8.9	+7.0	+10.5	+9.0
Index of instability of growth	6.6	12.7	8.1	11.2	11.8	9.3	7.6

[a] The index of production of machinery is based upon the following items:

Agricultural equipment. Domestic sales as reported to the Bureau of the Census, deflated by the Bureau of Labor Statistics' index of wholesale prices of agricultural implements.

Foundry equipment. Value of shipments. Figures for 1922-1924 are estimated on the basis of new orders. Data from Foundry Equipment Manufacturers' Association, covering about 65 to 70 per cent of the industry.

Stokers. Sales in horsepower from data collected by the Bureau of the Census.

Machine tools. Shipments (number of machines) for the years 1925-1929; estimates for 1922-1924 on the basis of new orders. The data, compiled by the National Machine Tool Builders' Association, cover about one-third of the industry.

Electrical equipment. The value of output of stationary electric motors (rated at one horsepower and over), transformers, generators, and miscellaneous industrial and commercial apparatus, as given by the Census of Manufactures. Figures for inter-censal years have been

rapid advance occurred between 1922 and 1923; thereafter there were oscillations about the 1923 level, until the notable advance between 1928 and 1929. Over the whole period the annual rate of increase averaged 5.2 per cent. The three series relating to non-residential construction,[1] combined in a weighted average, show a steady advance from a low of 89 in 1923 and 1924 (on the 1922 base) to a high of 157 in 1929. The high rate of increase in this type of construction, an increase averaging 9.0 per cent per year, reflects the temporarily low levels at which this index stood in 1923 and 1924. Subsequently, non-residential construction advanced with a rush. The index for machinery and transportation equipment was high, in relation to 1922, during the entire period from 1923 on.

Capital Equipment, Consumption Goods and all Finished Goods

The union of these two series gives us the index of production of total capital equipment, including construction, which appears in the table following. The present figures differ from data relating to changes in the volume of capital funds, discussed in Chapter

[1] Public and institutional buildings, such as schools and museums, are not included in the average.

interpolated on the basis of the Federal Reserve Board's index numbers of employment in the manufacture of electrical machinery.

Wood working machinery. Number of machines shipped, as compiled by the Association of Manufacturers of Wood Working Machinery, representing about fifty per cent of the industry.

Textile machinery. Value of product as reported in the Census of Manufactures, with figures for inter-censal years estimated on the basis of activity in the textile industry.

Engines, turbines, and waterwheels. Value of product as reported in the Census of Manufactures, with estimates for inter-censal years.

Pumps, steam, power and centrifugal. Value of shipments of 23 identical firms, believed to represent about two-thirds of the industry, compiled by the Hydraulic Society.

Foundry and machine shop products. Value of product for census years, deflated by an average of the index numbers of wholesale prices of iron and steel, agricultural implements, and 'other metal products' compiled by the U. S. Bureau of Labor Statistics. Figures for inter-censal years have been estimated on the basis of factory employment in the machinery industry.

b The index of production of transportation equipment is based upon five component series:

Motor trucks and commercial vehicles
Shipbuilding, gross tons completed
Locomotives, number completed
Railroad freight cars, number
Railroad passenger cars, number

As a result of the exceptionally high peak in 1923 and the sharp drop in 1928 the average tendency during these years is downward. If information were available on the production of railroad rolling stock in terms of capacity or weight, the average rate of decline would be somewhat less. Construction of railroad trackage, stations, etc., is included in the estimates of construction of public works and utilities.

c The construction series are estimates of the F. W. Dodge Corporation relating to value of contracts awarded in the United States (48 states) for commercial, industrial, and public works and utilities construction. (The value figures have been deflated by the index numbers of construction costs constructed by the *Engineering News Record* (commercial buildings, public works and utilities) and by the Aberthaw Construction Company (industrial construction).

IX, in that they relate to volume of capital equipment and, more particularly, in that they deal with annual increments, not aggregate amounts. These are the annual additions to, and replacements of, existing capital equipment. Incremental figures of this type may properly be compared with the annual flow of consumption goods. Index numbers measuring changes in the output of finished consumption goods and in all finished goods are also given in this table.

TABLE 118

CONSUMPTION GOODS, CAPITAL EQUIPMENT AND TOTAL PRODUCTION

Index Numbers of Physical Volume of Production of Finished Goods, 1922-1929

Year	Consumption goods, total, including residential construction	Capital equipment, total, including non-residential construction and public works	Total production of finished goods
1922	100	100	100
1923	111	125	113
1924	110	112	110
1925	120	132	122
1926	125	147	128
1927	124	143	127
1928	130	145	132
1929	131	170	137
Average annual rate of change (per cent)	+3.7	+6.4	+4.1
Index of instability of growth	2.3	5.7	2.7

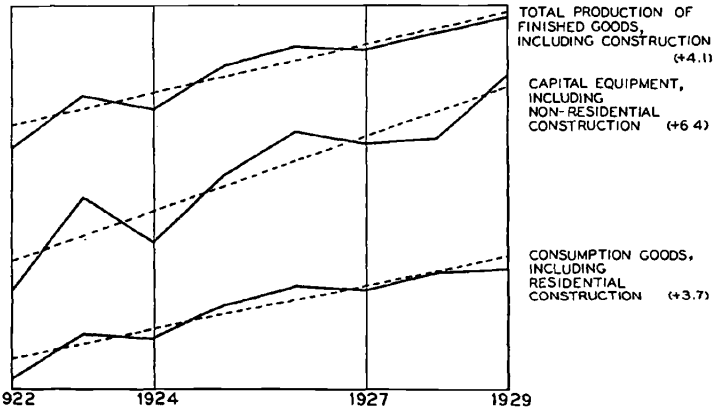
These index numbers are shown graphically in Figure 52.

The output of both consumption goods and capital equipment advanced in three spurts between 1922 and 1929, these spurts being far more pronounced for capital equipment than for goods ready for consumption and use. The year 1923 marks the peak of one advance, 1926 another and 1929 a third. In percentage terms, these three movements brought gains of 11, 14, and 6 per cent in the output of consumption goods, of 25, 31, and 19 per cent in the production of capital equipment. The sharp gain of capital equipment between 1928 and 1929, when the production of consumption goods remained practically constant in volume, is notable. For the

FIGURE 52

GROWTH OF PRODUCTION OF FINISHED GOODS IN THE UNITED STATES, 1922-1929

TOTAL PRODUCTION, CAPITAL EQUIPMENT AND CONSUMPTION GOODS



Plotted on ratio scale. The figures in parentheses define average annual rates of change (in percentage form).

period 1922-1929, as a whole, the output of consumption goods increased at a rate of 3.7 per cent a year, while the volume of additions to capital equipment rose at an average annual rate of 6.4 per cent a year.

The present index numbers show an appreciably more rapid growth of those products of economic activity which may be called procreative, than of end-products in the form of consumption goods. The equipment for producing goods for ultimate consumption was being augmented year by year at an exceptionally rapid rate. An increasing proportion of our total annual output of goods took the form of equipment designed to further the processes of roundabout production. So wide a margin of difference raises a question as to whether too large a proportion of the country's productive energies was being devoted to the construction of capital equipment. The subsequent collapse, and the phenomena of excess capacity of which there were signs even before the break in 1929, would suggest that this was so. We lack a criterion, however, for determining the optimum relations between output of consumption goods and of capital equipment, relations which may conduce to equilibrium. Here we require a greater knowledge of economic

processes than we now possess if we are to set up standards for the division of our labor between these two types of production.[1]

The index of total production of finished goods which is secured by combining the two series just compared shows an increase of output between 1922 and 1929 at a rate of 4.1 per cent a year. This happens to agree precisely with the rate of advance in general production shown by the index first constructed (see Table 106). In the present case all raw materials, except those which are consumed in the raw state, and semi-manufactured goods are excluded.[2] (The distribution of weights is correspondingly altered.) We are dealing here with the output of end-products, ready for consumption, and of capital equipment ready for use in production. If comprehensive records were available this would perhaps be the form which all index numbers of total production should take. It is of interest that index numbers so derived should come so close to agreement, year by year, with index numbers of aggregate production based upon raw and semi-finished as well as finished goods.

Durable and Non-durable Goods

For the purpose of a final comparison we group together all durable consumption goods and capital equipment, including in this combination all construction, residential and non-residential.[3] This class contains all those goods which contain stored up utilities, which render their services to producers or to consumers over a period of years. Against this group we set a combination of perish-

[1] If full account were taken of the trends of exports and imports during this period, one would be in a better position to appraise domestic processes. The export of foods, as we have seen, was declining steadily. Capital equipment shared in the general advance in the exports of finished manufactures. Figures which are uncorrected for movements of foreign trade probably over-emphasize somewhat the margin between the rates of change of consumption goods and capital equipment. But there is no reason to think that the picture would be materially different if full correction were made for such movements of trade. Between 1923 and 1929, when exports of manufactures were increasing steadily, the proportion of domestic manufactures exported advanced from 7 per cent to 8 per cent. In absolute terms the increase was considerable, but it exerted no profound influence on the make-up of total domestic production.

An economy which devotes a large part of its resources to the production of capital equipment is subject to wide variations of activity with changing business conditions. This is true whether the capital equipment be exported or sold at home.

[2] Certain finished commodities such as lumber, cement, paints, and structural steel are also excluded, to avoid duplication in the construction indexes.

[3] Excluding public and institutional construction.

able and semi-durable consumption goods—foods, gasoline, tobacco, textiles, tires, shoes, etc. These series are shown graphically in Figure 53.

TABLE 119

COMPARISON OF PRODUCTION TENDENCIES, 1922-1929

Durable and Non-durable Goods

Year	Durable goods [a]	Non-durable goods (including semi-durable goods)	All finished goods
1922	100	100	100
1923	122	108	113
1924	118	106	110
1925	142	109	122
1926	151	114	128
1927	142	118	127
1928	153	120	132
1929	159	123	137
Average annual rate of change (per cent)	+5.9	+2.8	+4.1
Index of instability of growth	5.5	1.1	2.7

[a] This group includes all construction, and the production of machinery, ships, locomotives, railroad cars, automobiles, trucks, furniture, and electrical equipment.

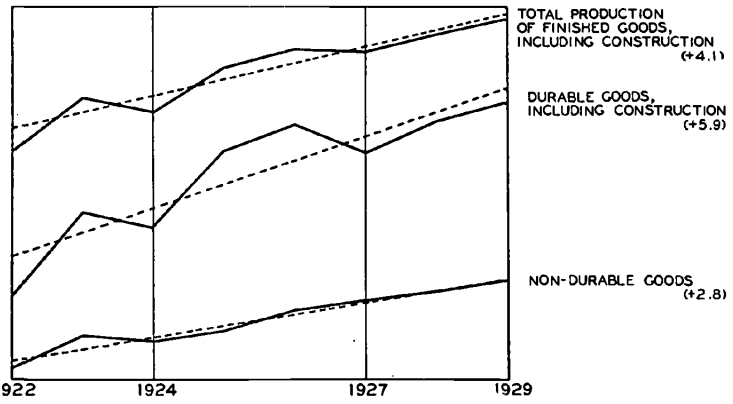
The output of goods which are completely consumed over a short period of time increased without great variation from 1922 to 1929. The volume of production in 1929 was 23 per cent greater than in 1922. The average annual rate of advance was 2.8 per cent, comfortably in excess of the rate of growth of population (1.4 per cent). Average annual variation from a constant rate of growth amounted to but 1.1 per cent. Quite different is the story of durable goods. The output of such goods in 1929 was 59 per cent greater than in 1922; the average rate of advance was 5.9 per cent a year. Variation from constancy of growth averaged 5.5 per cent a year. These figures tell a great deal about the character of the economic advance which occurred between 1922 and 1929. The pressure of advertising, of installment selling, of all the devices which tended to speed up buying during this period, had their richest fruits in the marketing of durable consumption goods.[1] Combined with this

[1] Gasoline, tobacco, druggists' preparations and newsprint, commodities from the non-durable group, shared in this advance.

FIGURE 53

GROWTH OF PRODUCTION OF FINISHED GOODS IN THE UNITED STATES, 1922-1929

TOTAL PRODUCTION, DURABLE GOODS AND NON-DURABLE GOODS



Plotted on ratio scale. The figures in parentheses define average annual rates of change (in percentage form).

was a great advance in the production of capital equipment, also durable in character.

It is probably true, in general, that wants for perishable goods are not highly expansible. An economy which finds its productive powers suddenly enhanced,[1] as was the case in the United States after 1921, is not likely to devote these new powers to the multiplication of foods, or of other goods which are used up in a short time. It will turn out more capital equipment and will seek to encourage demand for new types of consumer goods. Demand for food and clothing is stable, not varying greatly in amount. There are no great possibilities of expansion of wants here, even under strong pressure on the part of sellers, while, conversely, consumers are not in a position materially to reduce the volume of their buying except under the pressure of the strongest necessity. But by the introduction of new goods and the clever 'education' of consumers the 'damned wantlessness' of the natural man may be effectively over-

[1] This form of statement probably reverses, in part, the true course of events. Productive powers were enhanced as a result of the development of new industries, in which high productivity per worker was possible. Had the same energies gone into the production of greater quantities of foods and clothing the same increase in productivity would not have been recorded.

come.[1] It is perhaps not inevitable that such expansion should be felt primarily in the demand for durable consumption goods. Effective advertising might create an insistent demand for soap bubbles. During the decade under review, however, the new demand was directed toward durable goods—automobiles, electric household conveniences, radios, new houses.

From 1922 to 1929 the army of sellers pushed forward on this new front. Wants were stimulated, and the new goods were turned out in ever-increasing volume. The most effective selling methods ever employed were directed against consumers. High profits, high industrial wages, the availability of credit in unprecedented volume provided the means of purchasing. The sense of constantly advancing wealth was encouraged, moreover, by rising values of urban real estate and of securities.

Consumer resistance during this period was quiescent. But it is of the highest importance that so much of this buying was directed toward the purchase of durable goods. To a large extent the new buying of consumers, as well as the buying of equipment by producers, involved a storing up of utilities. In a very real sense the existence of unused utilities in the form of durable consumption goods and capital equipment represents inventories of goods, inventories in the hands of consumers and of producers. The possibility of a material diminution in the volume of buying is very much greater when a large percentage of current purchases goes to the buying of durable goods than it is when perishables are relatively more important. After heavy buying of durable goods consumers may retire from the market for a longer period than is possible when the average consumer's budget is made up almost exclusively of non-durable goods. In this respect the output of durable consumption goods may be expected to resemble in many ways the production of capital goods, which is notoriously highly variable, and which reflects in exaggerated degree the cyclical ups and downs of business.

It is not the present purpose to follow economic changes through the period of the depression, but it is proper to indicate the bearing upon the character of the depression of the rapid growth of durable goods during the years preceding. What brought about the check to buying we do not here consider. But once the check was given,

[1] Nineteenth century German traders in the backward regions of the world cursed the *verdammte Bedürfnislosigkeit* of the natives.

the existence of the stored-up utilities embodied in the heavy preceding production of durable goods made it possible for current purchases to suffer a great and prolonged decline. Consumers had a back-log, and whether necessity or desire persuaded them to utilize it, they did so, to a degree never approached in recent years. At the same time the buying of capital equipment was checked. Previous heavy installation and construction of such goods added its weight to the influence of diminishing sales of end-products. An economy geared to produce durable goods to a greater degree than ever before was bound to be deeply affected by such a cessation of buying on the part both of final consumers and of users of capital equipment.

§ *On changes in the relative importance of certain types of commodities.*—Changes in the character of aggregate output may be traced in another manner, by measuring the relative importance of goods of different types, at different periods. The division into durable and non-durable goods may be first employed. In the first category are included all durable consumption goods, as well as articles of capital equipment. Non-durable goods include perishable and semi-durable consumption goods. The following table presents data on the total value of production of agricultural, mineral and manufacturing industries at four different dates, with estimated aggregate values of the output of durable and non-durable goods at each of these dates. Fisheries and the construction industries are omitted, because of deficiencies of data or difficulties of comparison.

TABLE 120

COMPARATIVE VALUES OF DURABLE AND NON-DURABLE GOODS PRODUCED IN THE UNITED STATES, 1899, 1914, 1923 AND 1929

(In tens of millions of dollars)

(1) Year	(2) Value of total production [a]	(3) Value of durable goods	(4) Value of non-durable goods (including semi-durable goods)	(5) Value of durable goods as percentage of total value
1899	914	242	672	26.5
1914	1,949	494	1,455	25.3
1923	4,094	1,386	2,708	33.9
1929	4,795	1,688	3,107	35.2

[a] Based upon the estimated value of raw agricultural and mineral products and the 'value added' in the fabrication of these materials. Data are from issues of *Mineral Resources of the United States, Yearbook of Agriculture* and publications of the Census of Manufactures and the Census of Mines and Quarries.

These figures show a slight decline in the relative importance of durable goods in total output between 1899 and 1914, a drop from 26.5 per cent to 25.3 per cent of the aggregate.[1] By 1923 the output of durable goods had attained new high levels, and the advance continued to 1929. Of the production here included 35.2 per cent consisted of durable goods in 1929, as against 26.5 per cent in 1899 and 25.3 per cent in 1914. This represents a substantial and significant change. Whatever the reasons—changing consumer habits, increasing industrial diversification, changing character of foreign trade—the figures indicate that an increasing percentage of our economic energies was being devoted to the production of goods which render service to producer or consumer over a considerable period. The consumption (and the productive use) of such goods may be stimulated in times of prosperity, but the reverse is also true. Buyers of such goods are in position to withdraw from the market for considerable periods, even though their purchasing power be unimpaired. This is not so likely to be true of buyers of non-durable consumption goods. There is here further evidence of a change in the national economy which rendered it particularly subject to such a drying-up of demand as occurred in many lines after the stock market break of 1929 and the subsequent economic demoralization.[2]

We may approach the same problem from a somewhat different angle by attempting to estimate the relative importance of articles of food and clothing in aggregate national production. It is possible to secure the approximate value of the total production of food and clothing by combining with the total value of raw farm products which enter into foods and clothing the 'value added' in the manufacture of food and clothing. The aggregate with which this figure is compared is the same as that employed above, with, of course, the same restrictions.

[1] Corresponding percentages for 1904 and 1909 are 26.7 and 26.5. The relatively low figure for 1914 may be due to the existence of depression in that year, a condition which reduces the output of capital equipment more sharply than it does the production of non-durable consumption goods.

[2] The omissions from the above table are so numerous that conclusions must be drawn with caution. On the one hand the great growth of service industries and the increasing importance of distributive agencies are not measured by the figures we have included. Such services partake of many of the characteristics of perishable goods. (Certain of these services differ from the bulk of perishable consumers' goods, which consists of foods and clothing, in that they are conveniences or luxuries, rather than necessities.) On the other hand the exclusion of data on construction, for which adequate pre-war figures are lacking, tends to reduce the apparent growth of production of durable goods.

The index of production of durable goods presented in Table 119, which includes construction, indicates a greater increase between 1923 and 1929 than do the aggregate values of these goods as given in the table above (30 per cent, as against 22 per cent). This apparent discrepancy is due in part to the influence of the construction series, and to the dampening effect upon the aggregate value of durable goods of a decline in the prices of these commodities. That the earlier index refers only to end-products is also of some significance.

TABLE 121

COMPARATIVE VALUES OF FOOD AND CLOTHING PRODUCED IN THE UNITED STATES, 1899, 1914, 1923 AND 1929

(In tens of millions of dollars)

(1) Year	(2) Value of farm products, raw [a]	(3) 'Value added' by manufacture of food and clothing	(4) Total value, food and clothing	(5) Total value, all production	(6) Value of food and clothing as percentage of total
1899	371	158	529	914	57.9
1914	816	326	1,142	1,949	58.6
1923	1,079	790	1,869	4,094	45.7
1929	1,191	898	2,089	4,795	43.6

[a] Excludes crops fed to animals.

In general, the demand for articles of food and clothing is relatively inelastic. These are the commodities which the consumer must have, and which he will buy so long as his income permits. Growing diversification and increasing economic power probably always bring a decline in the relative importance of such commodities in total national output. Such a tendency also means that the ability of the consumer to withdraw from the market for a considerable time is growing. This may not necessarily mean that a less stable economic condition is developing. But it would appear that economic equilibrium under such conditions would be potentially less stable, more subject to starts and stoppages with the alternating stimulation and retardation of consumer demand for more durable and less essential goods.

Over the thirty-year period between 1899 and 1929 the percentage of aggregate production (as here measured) which consisted of articles of food and clothing declined from 57.9 per cent to 43.6 per cent. These figures indicate that the change occurred between 1914 and 1929, for the 1914 percentage of food and clothing was somewhat greater than that for 1899. (A condition of business depression in 1914 probably tended to increase the percentage somewhat.) Here is evidence, even clearer than that previously presented, bearing on the character of the economic shift occurring during the decade of the 'twenties. The national economy was ministering in decreasing degree to demands for non-durable goods immediately essential to existence. The tie between demands for the current necessities of life and the working of the productive mechanism appears to have been less direct during the post-war period under review than it was during the years immediately preceding the war. The maintenance of equilibrium becomes a progressively more delicate task as the bonds between the working economy and primal human needs become more tenuous.

Physical Output and Productivity of Manufacturing Industries, 1923-1929

From the detailed records compiled by the Census of Manufactures additional light may be thrown on the course and character of manufacturing production during the years prior to the recession of 1929. In the preceding chapter we have briefly noted the course of manufacturing production between 1914 and 1923—the rise during the war years, the drop that accompanied the recession of 1920-1921, and the notable increase in output between 1921 and 1923. This last advance, which swelled the volume of manufacturing production by about 48 per cent in two years, was effected through an increase of 30 per cent in number of workers employed and a gain of almost 14 per cent in per capita output. We start in 1923, therefore, at a very high level of production and with an exceptionally high standard of working efficiency among manufacturing employees.

Changes in the physical volume of manufacturing production and in certain related elements between 1923 and 1929 are defined by the index numbers in the next table. These are shown graphically in Figure 54.[1]

Over the six-year period which preceded the 1929 break the physical volume of manufacturing production, as measured by the present index numbers, increased 13.0 per cent. (This period begins, it must be remembered, with production at a very high level in 1923.) There was a concurrent decline of 7.4 per cent in number of wage-earners employed in the industries included in the sample studied. More than off-setting this drop in the human factor was the gain of 22.0 per cent in general productive efficiency, as recorded in per capita productivity. This advance occurred on top of an

[1] Adequate data relating to physical output are not available for all census industries. The size of the present sample, in relation to the total coverage of the census, is indicated by the following summary:

Year	Total value of products reported in Census of Manufactures (thousands of dollars)	Value of products in industries represented by index numbers of physical volume of production (thousands of dollars)	Percentage of total value of manufactured products represented in index numbers
1923	60,555,998	28,281,117	46.7
1925	62,713,714	29,091,937	46.4
1927	62,718,347	27,532,655	43.9
1929	70,137,459	29,476,380	42.0

For an explanation of the method employed in the construction of index numbers based on census data, see Chapter III.

TABLE 122

GROWTH OF MANUFACTURING PRODUCTION IN THE UNITED STATES, 1923-1929

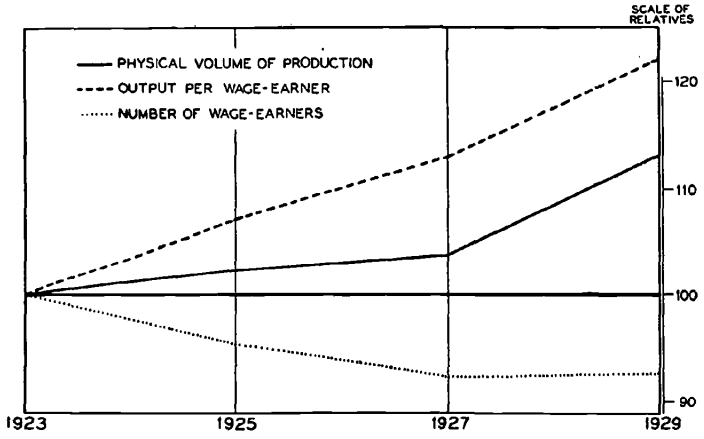
Index Numbers of Physical Volume of Production, Number of Wage-earners and per Capita Output

Year	Physical volume of production	Number of wage-earners	Output per wage-earner
1923	100.0	100.0	100.0
1925	102.4	95.4	107.3
1927	104.2	92.3	113.0
1929	113.0	92.6	122.0
Average annual rate of change (per cent)	+2.0	−1.3	+3.3

FIGURE 54

GROWTH OF MANUFACTURING PRODUCTION IN THE UNITED STATES, 1923-1929

VOLUME OF PRODUCTION, NUMBER OF WAGE-EARNERS AND OUTPUT PER WAGE-EARNER



increase of 13.6 per cent in per capita output between 1921 and 1923.

Advancing productivity was, of course, a conspicuous feature of the last decade. From 1919 to 1929 output per worker employed increased approximately 43 per cent among the industries in the present sample. The work that required 100 men in 1919 could be done by 70 in 1929. Thirty out of 100 could have been dispensed with, on the evidence of this index, if no increase in aggregate

output had been desired. Productivity per worker increased between 1919 and 1929 at an average annual rate of 3.8 per cent. This is substantially greater than the corresponding figure of 1.7 per cent for the fifteen-year period from 1899 to 1914, which itself represents a notable advance in productive efficiency.

The character of these changes is more clearly revealed when they are followed by biennial periods:

Census interval	Increase in volume of manufacturing production (per cent)	Change in number of wage-earners (per cent)	Increase in output per wage-earner (per cent)
1923-1925	+2.4	−4.6	+7.3
1925-1927	+1.8	−3.3	+5.2
1927-1929	+8.4	+0.3	+8.0

Between 1923 and 1925, years of prosperity which straddle a minor recession in 1924, there was an increase of over 7 per cent in output per employee, a decline of 4.6 per cent in number of workers and a net gain of 2.4 per cent in volume of output. During the next two years, which ended in the slightly depressed year, 1927, the process continued, with productivity increasing, number employed declining and aggregate output advancing. With the stimulus of renewed prosperity per capita output again spurted, after 1927, increasing 8 per cent during the next two years. The aggregate volume of production increased by more than 8 per cent. This notable advance brought only a slight increase (0.3 per cent) in the number of wage-earners employed in the industries included in the present sample.

If we carry this story back thirty years by census periods we note the highly suggestive fact that not once has there been a check to the increase in per capita productivity. The rate of advance has varied greatly, but the tendency toward increasing productive efficiency has persisted, in good years and bad. In general, however, the chief factor in expanding production prior to 1923 was an enlarged body of wage-earners. This was true during the great advances from 1904 to 1909, from 1914 to 1919, from 1921 to 1923. Since 1923, however, better technical equipment, improved organization and enhanced skill on the part of the working force seem definitely to have supplanted numbers as instruments of expanding production. The persistence of this tendency must compel men to consider its implications for the future.

§ *Changes in physical volume of production and in output per wage-earner, individual industries.*—The index numbers discussed above are, of course, averages. But between 1923 and 1929 there were diverse movements among the manufacturing industries of the United States. There is no thoroughly satisfactory method of representing these diverse movements by a single set of index numbers. A truer picture of the actual course of events during this period may be secured from the following records, relating to changes in volume of production in 62 industries.

TABLE 123

CHANGES IN PHYSICAL VOLUME OF MANUFACTURING PRODUCTION IN THE UNITED STATES, 1923-1929

Index Numbers for 62 Industries, with Average Annual Rates of Change

Industry	Index numbers of physical volume of production				Average annual rate of change 1923-1929 (per cent)
	1923	1925	1927	1929	
Bone black, carbon black, and lamp-black	100.0	144.8	138.9	214.1	+12.1
Canning and preserving: fish, crabs, shrimps, oysters, and clams	100.0	131.4	140.6	197.4	+11.3
Asphalted-felt-base floor coverings	100.0	131.3	185.1	169.4	+ 9.5
Petroleum refining	100.0	129.6	143.5	177.1	+ 9.4
Oilcloth	100.0	107.7	128.8	162.5	+ 8.8
Hats, wool-felt	100.0	101.4	120.9	140.5	+ 6.3
Canning and preserving: fruits and vegetables; pickles, jellies, preserves, and sauces	100.0	123.0	125.0	149.5	+ 6.3
Paints and varnishes	100.0	115.1	128.3	142.5	+ 6.0
Condensed and evaporated milk	100.0	103.6	120.9	136.5	+ 5.7
Firearms	100.0	91.2	120.7	130.1	+ 5.6
Paper and pulp	100.0	113.9	128.0	137.8	+ 5.5
Oil, cake, and meal, cottonseed	100.0	154.5	174.1	143.2	+ 5.4
Rubber products	100.0	118.6	126.5	139.1	+ 5.3
Silk manufactures	100.0	119.1	125.6	136.3	+ 4.9
Sugar, beet	100.0	144.7	120.9	146.8	+ 4.7
Sand-lime brick	100.0	151.4	152.6	137.6	+ 4.3
Fertilizers	100.0	113.9	117.2	130.7	+ 4.2
Salt	100.0	100.1	107.5	122.3	+ 3.5
Iron and steel: steel works and rolling mills	100.0	100.7	101.2	124.2	+ 3.5
Corn syrup, corn oil, and starch	100.0	103.3	124.8	118.2	+ 3.5
Cement	100.0	118.7	126.9	123.5	+ 3.4
Coke, not including gas-house coke	100.0	90.3	92.3	121.8	+ 3.4
Ice, manufactured	100.0	113.6	114.4	124.8	+ 3.4
Wood distillation and charcoal manufacture	100.0	109.2	116.2	122.1	+ 3.3
Gas, manufactured, illuminating and heating	100.0	102.3	118.0	117.7	+ 3.2
Chocolate and cocoa products	100.0	109.4	113.7	119.2	+ 2.8
Oil, cake, and meal, linseed	100.0	119.7	113.4	123.3	+ 2.8

TABLE 123—*Continued*

Industry	Index numbers of physical volume of production				Average annual rate of change 1923-1929 (per cent)
	1923	1925	1927	1929	
Motor vehicles, including bodies and parts.	100.0	103.3	90.3	123.3	+ 2.8
Turpentine and rosin	100.0	109.5	122.9	114.6	+ 2.6
Soap	100.0	99.9	105.1	115.1	+ 2.4
Rice cleaning and polishing	100.0	80.9	106.2	104.6	+ 2.0
Explosives	100.0	97.9	101.3	110.3	+ 1.7
Butter and cheese	100.0	106.9	112.1	109.8	+ 1.6
Hats, fur-felt	100.0	93.1	114.5	103.8	+ 1.6
Sugar refining, cane	100.0	122.2	115.6	115.2	+ 1.3
Cast-iron pipe	100.0	120.2	122.2	108.6	+ 1.2
Cotton goods	100.0	98.1	109.7	104.6	+ 1.2
Iron and steel: blast furnaces	100.0	91.3	90.8	106.7	+ 1.0
Sugar, cane, not including products of refineries	100.0	78.4	41.8	117.6	+ 1.0
Musical instruments: organs	100.0	106.1	128.1	97.8	+ 0.7
Linoleum	100.0	87.0	93.3	101.6	+ 0.6
Slaughtering and meat packing, wholesale	100.0	94.7	97.5	100.9	+ 0.3
Cordage and twine	100.0	100.5	99.4	101.8	+ 0.2
Clay products (other than pottery) and non-clay refractories	100.0	106.9	107.1	100.5	+ 0.1
Tanning materials, natural dyestuffs, mordants and assistants, and sizes	100.0	95.1	97.8	98.1	— 0.1
Lumber and timber products	100.0	108.0	100.4	101.6	— 0.1
Carpets and rugs, wool, other than rag	100.0	94.1	86.3	101.4	— 0.2
Lime	100.0	109.2	99.0	100.2	— 0.5
Flour and other grain-mill products	100.0	95.3	96.6	94.5	— 0.8
Jute and linen goods	100.0	97.2	94.5	94.1	— 1.0
Lace goods, cotton	100.0	86.8	88.5	92.6	— 1.1
Knit goods	100.0	94.6	95.4	91.8	— 1.2
Wool shoddy	100.0	113.4	73.1	102.8	— 1.6
Buttons	100.0	95.5	82.3	86.0	— 3.0
Woolen goods	100.0	98.0	89.1	83.5	— 3.1
Worsted goods	100.0	84.8	81.5	75.5	— 4.4
Motorcycles, bicycles, and parts	100.0	75.9	67.4	77.2	— 4.7
Musical instruments: pianos	100.0	94.5	73.9	48.9	—10.5
Carriages, wagons, sleighs, and sleds	100.0	63.8	52.5	50.1	—11.6
Cars, steam and electric railroad, not built in railroad repair shops	100.0	62.3	43.7	42.4	—14.7
Wire, drawn from purchased bars or rods	100.0	93.2	103.1	——	——
Felt goods, wool or hair	100.0	102.3	96.3	——	——
Average [a]	100.0	101.5	103.6	119.0	+ 2.8

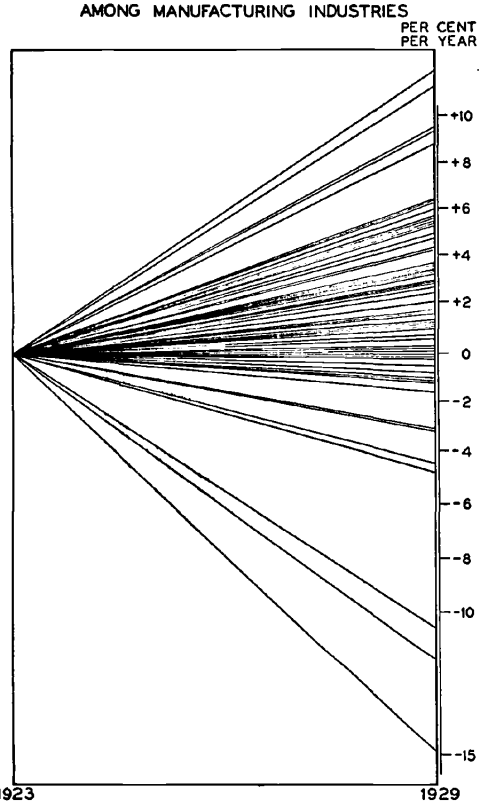
[a] An arithmetic average of the central items of a weighted frequency distribution, with weights based on 'value added', averaged for the base year and the given year. The central one-fifth of the items, by weight, were included in computing the average.

During this six-year period of general economic advance 13 of the 60 industries for which complete data are available showed net declines. In the extreme case, that of steam and electric railroad cars, the rate

FIGURE 55

GROWTH OF MANUFACTURING PRODUCTION IN THE UNITED STATES, 1923-1929*

ILLUSTRATING THE DIVERGENCE OF PRODUCTION TRENDS AMONG MANUFACTURING INDUSTRIES



* Plotted on ratio scale. The lines here plotted relate to the industries listed in Table 123, in the order of that listing.

of fall averaged almost 15 per cent a year.[1] At the other limit we have an advance (in the production of bone black, carbon black and lamp-black) averaging 12 per cent a year. The degree of divergence is shown graphically in Figure 55, in which rates of change in production in

[1] The capacity, rather than the number of railroad cars, would give a far better index of the output of this type of equipment, but this information is not available. Aggregate capacity of freight cars in service on Class I steam railroads increased

different industries are represented by lines diverging from a common point. The standard deviation of these rates of change is 3.7, somewhat less than the corresponding pre-war value of 5.7.[1]

Reference has already been made to the problems arising out of sharply divergent rates of growth and decline among the elements of the industrial structure. Interchange of men and capital, adaptation of related industries and of instruments of distribution to changing conditions are necessary. Flexibility is a prime requirement of an economic system in these circumstances, if adaptation is to be made easily and without friction. The figures cited indicate that the degree of divergence was somewhat less between 1923 and 1929 than between 1899 and 1914. One extreme case, the rapidly-growing motor vehicle industry, distorts the standard deviation for the years 1899-1914. Excluding this industry [2] the pre-war standard deviation becomes 2.5, as compared with the more recent figure (correspondingly corrected) of 3.8.

There are obvious difficulties in the way of a comparison of economic periods, with respect to degree of divergence of prevailing tendencies. If identical industries are studied, the influence exerted by newly developed commodities and rapidly advancing new industries is ignored. If identical series are not used, doubts arise as to the comparability of the data employed, unless thoroughly comprehensive records for the two periods are available. The measurements last given indicate greater divergence among manufacturing industries in recent years, a condition which would make greater demands upon the productive system in the way of adaptability to changing conditions. But this is an indication which must be checked before its implications may be accepted. We shall return to this subject in a later discussion of employment shifts among manufacturing industries of the United States.

Turning to the record of changes in per capita output in the several industrial groups, we have available the detailed measurements appearing in Table 124.

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slightly between 1922 and 1929 (at an average annual rate of 0.8 per cent), but this is not necessarily inconsistent with a sharp decline in the annual additions to the total. It is also true that much railroad car construction was included under car repairs. Adequate quantity figures are not available for construction of this type. The value added in such repair work as was reported shows a decline of some 3.3 per cent per annum, between 1923 and 1929, as contrasted with an annual rate of decline of 10.9 per cent in the value added in railroad car construction. While a figure showing an average decline of 15 per cent a year perhaps overstates the rate of fall in this industry, all the evidence indicates the reality of the fall.

[1] The two measurements do not relate to the same list of industries, nor to equal periods of time.

[2] The exclusion is justified solely because of the deficiencies of the standard deviation. A single extreme value affects this measure to a degree not proportionate to the relative weight of that entry.

TABLE 124

CHANGES IN OUTPUT PER WAGE-EARNER IN MANUFACTURING INDUSTRIES OF THE UNITED STATES, 1923-1929

Index Numbers for 62 Industries, with Average Annual Rates of Change

Industry	Index numbers of physical volume of production per wage-earner				Average annual rate of change 1923-1929 (per cent)
	1923	1925	1927	1929	
Coke, not including gas-house coke	100.0	110.4	124.2	165.4	+8.8
Salt	100.0	108.1	122.8	154.4	+7.7
Condensed and evaporated milk	100.0	120.6	135.7	148.4	+6.6
Carriages, wagons, sleighs, and sleds	100.0	107.0	125.6	144.1	+6.6
Iron and steel: blast furnaces	100.0	114.8	119.2	149.0	+6.5
Sugar, cane, not including products of refineries	100.0	107.1	121.4	143.0	+6.3
Oilcloth	100.0	111.6	144.6	138.4	+6.2
Bone black, carbon black, and lamp-black	100.0	125.4	116.5	151.4	+6.1
Sugar, beet	100.0	123.5	123.6	148.3	+6.1
Soap	100.0	110.3	133.0	139.3	+6.0
Cement	100.0	108.4	122.6	139.9	+5.9
Tanning materials, natural dyestuffs, mordants and assistants, and sizes	100.0	123.7	131.4	144.3	+5.8
Petroleum refining	100.0	132.4	134.4	146.6	+5.7
Asphalted-felt-base floor coverings	100.0	89.6	127.5	126.1	+5.4
Silk manufactures	100.0	112.6	123.2	135.4	+5.1
Chocolate and cocoa products	100.0	105.5	121.6	131.0	+4.9
Paper and pulp	100.0	111.0	125.2	130.8	+4.7
Hats, wool-felt	100.0	106.7	107.9	130.5	+4.3
Rubber products	100.0	115.3	122.9	129.8	+4.2
Sand-lime brick	100.0	110.0	112.4	129.8	+4.1
Flour and other grain-mill products	100.0	104.8	113.4	125.8	+4.0
Canning and preserving: fish, crabs, shrimps, oysters, and clams	100.0	114.1	101.6	132.3	+3.8
Lime	100.0	111.0	111.6	126.3	+3.6
Iron and steel: steel works and rolling mills	100.0	105.4	108.7	122.7	+3.3
Sugar refining, cane	100.0	128.5	126.0	126.2	+3.2
Butter and cheese	100.0	124.3	116.7	126.6	+3.1
Explosives	100.0	109.7	111.5	122.0	+3.1
Lumber and timber products	100.0	114.7	120.3	120.3	+3.0
Rice cleaning and polishing	100.0	110.1	123.0	117.6	+3.0
Gas, manufactured, illuminating and heating	100.0	92.0	102.9	116.2	+2.9
Oil, cake, and meal, linseed	100.0	116.9	109.8	123.2	+2.8
Wool shoddy	100.0	108.8	92.7	124.1	+2.7
Corn syrup, corn oil, and starch	100.0	104.0	117.0	114.7	+2.7
Fertilizers	100.0	107.7	117.0	116.0	+2.6

TABLE 124—*Continued*

Industry	Index numbers of physical volume of production per wage-earner				Average annual rate of change 1923-1929 (per cent)
	1923	1925	1927	1929	
Cordage and twine	100.0	107.0	107.9	118.2	+2.6
Cotton goods	100.0	103.9	110.7	115.2	+2.5
Jute and linen goods	100.0	97.2	106.8	113.5	+2.4
Buttons	100.0	98.4	101.3	114.4	+2.2
Cast-iron pipe	100.0	112.6	115.2	115.4	+2.2
Oil, cake, and meal, cottonseed	100.0	121.5	120.4	117.0	+2.2
Firearms	100.0	126.5	122.2	118.0	+2.2
Ice, manufactured	100.0	122.4	138.9	109.8	+2.0
Canning and preserving: fruits and vegetables; pickles, jellies, preserves, and sauces	100.0	103.9	112.0	111.5	+2.0
Linoleum	100.0	111.9	108.9	114.7	+1.9
Paints and varnishes	100.0	103.1	104.3	112.5	+1.9
Motor vehicles, including bodies and parts	100.0	98.1	99.0	111.5	+1.7
Slaughtering and meat packing, wholesale	100.0	104.4	108.7	110.5	+1.7
Hats, fur-felt	100.0	102.7	120.2	105.9	+1.7
Clay products (other than pottery) and non-clay refractories	100.0	106.8	109.0	108.9	+1.4
Motorcycles, bicycles, and parts	100.0	119.1	113.8	111.8	+1.4
Wood distillation and charcoal manufacture	100.0	106.7	105.6	108.5	+1.2
Worsted goods	100.0	105.5	107.5	106.5	+1.0
Carpets and rugs, wool, other than rag	100.0	97.8	92.5	108.0	+0.9
Woolen goods	100.0	105.8	104.4	106.6	+0.9
Musical instruments: pianos	100.0	104.5	99.0	105.6	+0.6
Lace goods, cotton	100.0	90.5	99.7	99.0	+0.3
Knit goods	100.0	98.4	97.4	96.9	−0.5
Turpentine and rosin	100.0	127.8	111.2	96.3	−1.3
Cars, steam and electric railroad, not built in railroad repair shops	100.0	99.7	92.6	91.5	−1.7
Musical instruments: organs	100.0	80.0	85.8	77.0	−3.6
Wire, drawn from purchased bars or rods	100.0	107.1	110.6	——	——
Felt goods, wool or hair	100.0	114.0	101.3	——	——
Average [a]	100.0	105.3	109.7	117.8	+2.7

[a] Arithmetic average of the central items of a weighted frequency distribution, with weights based on 'value added', averaged for the base year and the given year. The central one-fifth of the items, by weight, were included in computing the average.

Of the 60 industries for which complete data are available 25 showed increases of more than 25 per cent in per capita output between 1923 and 1929. That this advance could have taken place over a period of six years is one of the most striking features of the period under

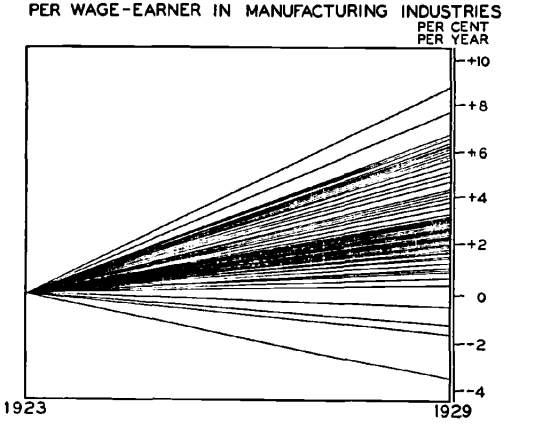
review. Only five industries showed declines in per capita output in 1929, as compared with 1923.

Here again there is evidence of the extraordinary diversity of the influences affecting manufacturing industries. In terms of average annual movements we find rates of change in output per wage-earner which range from +8.8 per cent for coke, to —3.6 per cent for organs. (We are not now concerned with the reasons for these changing rates, reasons which lie in changing marketing conditions, as well as in technical aspects of production.) The standard deviation of the rates of change in output per worker is 1.9 for the period 1923-1929, a figure almost identical with that for the period 1899-1914. The divergence of these changes is illustrated graphically in Figure 56, in which trend lines of per capita output in different industries are plotted.

FIGURE 56

GROWTH OF MANUFACTURING PRODUCTION IN THE UNITED STATES, 1923-1929*

ILLUSTRATING THE DIVERGENCE OF TRENDS IN PRODUCTION PER WAGE-EARNER IN MANUFACTURING INDUSTRIES



* Plotted on ratio scale. The lines here plotted relate to the industries listed in Table 124, in the order of that listing.

Beneath the two preceding tables are given series of averages, defining changes in production and in per capita output as recorded among central and representative manufacturing industries. These differ somewhat from the index numbers previously presented, which were derived by methods which give consistent and mathematically more elegant results. The averages just cited are probably more representative of typical conditions. These are summarized in Table 125.

Up to 1927 the record of these averages, in respect of volume of production, follows that of the index numbers previously given. Between 1927 and 1929 the stories diverge. The present averages indicate an advance in output of 15 per cent among typical American industries

TABLE 125

GROWTH OF MANUFACTURING PRODUCTION IN THE UNITED STATES, 1923-1929
Averages of Aggregate Production and of per Capita Output
(Derived from the central items of frequency distributions)

Year	Physical volume of production	Output per wage-earner
1923	100.0	100.0
1925	101.5	105.3
1927	103.6	109.7
1929	119.0	117.8
Average annual rate of change (per cent)	+2.8	+2.7

between those two years, as against the gain of 8.4 per cent shown by the 'ideal' index.

The productivity index based on central items in the frequency tables shows a somewhat lower range of values than were secured by the 'ideal' index. The story is sufficiently impressive, however, indicating a gain in per capita output among representative manufacturing industries of 17.8 per cent in six years. By far the most rapid gain occurred in the two years from 1927 to 1929.

Manufacturing Establishments and Volume of Manufacturing Production

Turning from workers and output per worker to establishments and the records of output per establishment, new aspects of recent movements in the manufacturing field may be traced. Relevant index numbers are given below, and are plotted in Figure 57.

TABLE 126

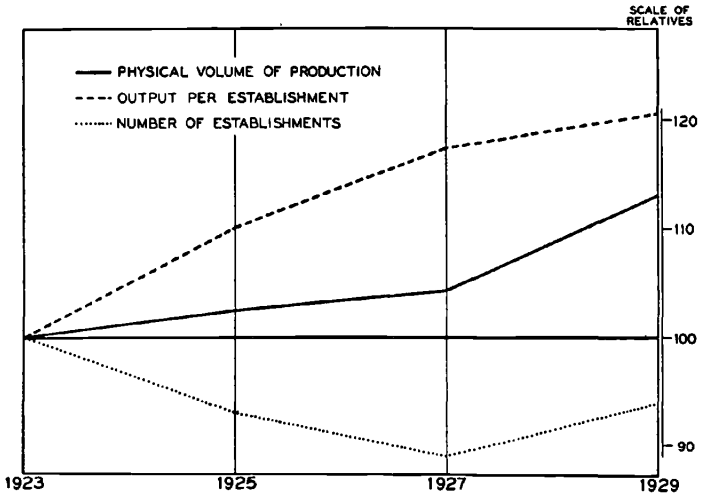
GROWTH OF MANUFACTURING PRODUCTION IN THE UNITED STATES, 1923-1929
Index Numbers of Physical Volume of Production, Number of Establishments and Output per Establishment

Year	Physical volume of production	Number of establishments	Output per establishment
1923	100.0	100.0	100.0
1925	102.4	93.0	110.1
1927	104.2	88.7	117.4
1929	113.0	93.8	120.5
Average annual rate of change (per cent)	+2.0	−1.2	+3.1

FIGURE 57

GROWTH OF MANUFACTURING PRODUCTION IN THE UNITED STATES, 1923-1929

VOLUME OF PRODUCTION, NUMBER OF ESTABLISHMENTS AND OUTPUT PER ESTABLISHMENT



The pre-war record was one of an increasing number of establishments, and a much more rapidly advancing output per establishment. Between 1914 and 1923 there was a net decline in number of establishments. (The actual loss took place during the period 1919-1921.) Output per establishment advanced throughout the war, suffered a slight check (1 per cent) from 1919 to 1921, and increased by the phenomenal figure of 41 per cent between 1921 and 1923. Taking up the story in 1923, the above table indicates a drop of 6.2 per cent between 1923 and 1929 in number of establishments, with a gain of 20.5 per cent in production per establishment.

The tendency toward large scale production is more clearly revealed if we survey a longer period. Among the industries here studied, the number of establishments was slightly higher in 1929 than in 1899, thirty years before. (The index for 1929 is 104.6 on the 1899 base.) Output per establishment was 198 per cent greater. During the decade from 1919 to 1929 the number of establishments declined 18 per cent; output per establishment increased 68 per cent. Integration, and the concentration of production in establishments turning out constantly larger quantities of goods, have

proceeded more rapidly during the last decade than in any similar period we have covered.

This movement continued uninterruptedly during the six-year period from 1923 to 1929, except for a check to the decline in the number of establishments between 1927 and 1929.[1] Changes by inter-censal periods are shown by the following figures:

Census interval	Increase in volume of manufacturing production (per cent)	Change in number of establishments (per cent)	Increase in output per establishment (per cent)
1923-1925	+2.4	−7.0	+10.1
1925-1927	+1.8	−4.6	+ 6.7
1927-1929	+8.4	+5.7	+ 2.6

§ *Changes in output per establishment, individual industries.*— There have been wide differences among industries in respect to changes in output per establishment. To trace these we must turn from the index numbers to the records for individual industries, which appear in Table 127.

We shall not here comment in detail upon the entries in this table, significant though they be. The fact that in 15 out of 60 industries output per establishment was increased by more than 50 per cent during a short six years indicates how drastic were the changes occurring in American industry. Twenty-seven of the 60 industries increased output per establishment by more than 25 per cent over the same period, a period which opens, be it remembered, after a great advance in productivity (from 1921 to 1923) which is not here considered. This was an era of dynamic change in the structure and methods of manufacturing industries in the United States.

The averages at the foot of Table 127, which are based upon the central items in the several columns, are designed to measure the changes taking place among representative industries. They do not differ materially from the index numbers given in Table 126.

This remarkable advance in output per establishment calls for further consideration. A given establishment may increase its output by adding to the number of workers employed, or by increasing productivity per worker through improved organization, better equipment or greater skill on the part of the workers. To which of

[1] The increase in number of establishments in 1929 is in part due to the more complete canvass in the decennial census of that year.

TABLE 127

CHANGES IN OUTPUT PER ESTABLISHMENT IN MANUFACTURING INDUSTRIES OF THE UNITED STATES, 1923-1929

Index Numbers for 62 Industries, with Average Annual Rates of Change

Industry	Index numbers of output per establishment				Average annual rate of change 1923-1929 (per cent)
	1923	1925	1927	1929	
Coke, not including gas-house coke	100.0	99.8	141.5	221.6	+16.0
Sugar, cane, not including products of refineries	100.0	101.8	96.2	204.9	+13.3
Motor vehicles, including bodies and parts	100.0	154.2	151.1	217.6	+12.1
Carriages, wagons, sleighs, and sleds	100.0	166.2	177.6	220.5	+12.1
Canning and preserving: fish, crabs, shrimps, oysters, and clams	100.0	148.7	150.6	203.6	+11.1
Bone black, carbon black, and lamp-black	100.0	149.2	140.9	199.4	+10.5
Salt	100.0	107.3	139.0	163.8	+ 9.2
Oilcloth	100.0	107.7	144.9	162.5	+ 9.2
Iron and steel: blast furnaces	100.0	126.5	132.3	175.2	+ 9.1
Petroleum refining	100.0	137.9	154.9	173.4	+ 8.8
Wood distillation and charcoal manufacture	100.0	126.7	162.5	165.0	+ 8.8
Hats, wool-felt	100.0	96.8	149.3	148.7	+ 8.4
Gas, manufactured, illuminating and heating	100.0	104.5	133.8	154.6	+ 8.2
Motorcycles, bicycles, and parts	100.0	82.2	90.7	150.5	+ 7.9
Silk manufactures	100.0	114.7	121.8	151.9	+ 6.9
Oil, cake, and meal, linseed	100.0	123.3	116.8	149.7	+ 6.0
Rubber products	100.0	118.4	129.7	143.4	+ 5.9
Paper and pulp	100.0	111.3	125.0	140.5	+ 5.9
Sugar, beet	100.0	136.6	128.5	150.4	+ 5.7
Firearms	100.0	95.7	126.7	130.1	+ 5.5
Rice cleaning and polishing	100.0	88.6	122.2	124.4	+ 5.0
Oil, cake, and meal, cottonseed	100.0	147.6	162.6	136.5	+ 4.7
Flour and other grain-mill products	100.0	113.0	125.3	127.7	+ 4.2
Butter and cheese	100.0	117.3	126.3	125.5	+ 3.7
Asphalted-felt-base floor coverings	100.0	107.4	138.8	117.2	+ 3.7
Knit goods	100.0	110.6	118.6	123.4	+ 3.5
Iron and steel: steel works and rolling mills	100.0	104.1	101.8	125.3	+ 3.5
Lime	100.0	116.1	114.6	126.1	+ 3.4
Canning and preserving: fruits and vegetables; pickles, jellies, preserves, and sauces	100.0	124.8	125.1	126.5	+ 3.4
Carpets and rugs, wool, other than rag	100.0	107.8	104.8	125.2	+ 3.4
Explosives	100.0	100.7	107.4	120.5	+ 3.2
Lumber and timber products	100.0	110.2	125.6	73.9	+ 3.1
Corn syrup, corn oil, and starch	100.0	106.7	148.8	107.8	+ 2.9
Buttons	100.0	111.0	120.8	117.5	+ 2.8

TABLE 127—*Continued*

Industry	Index numbers of output per establishment				Average annual rate of change 1923-1929 (per cent)
	1923	1925	1927	1929	
Cotton goods	100.0	98.8	112.0	114.2	+ 2.7
Soap	100.0	99.2	110.8	113.4	+ 2.5
Chocolate and cocoa products	100.0	105.8	95.6	119.2	+ 2.3
Fertilizers	100.0	111.2	108.1	117.4	+ 2.3
Wool shoddy	100.0	98.4	78.4	121.3	+ 2.2
Slaughtering and meat packing, wholesale	100.0	104.2	109.0	113.3	+ 2.1
Paints and varnishes	100.0	103.0	105.3	113.6	+ 2.1
Clay products (other than pottery) and non-clay refractories	100.0	109.3	115.1	112.8	+ 2.0
Tanning materials, natural dyestuffs, mordants and assistants, and sizes	100.0	95.1	100.2	110.4	+ 1.8
Turpentine and rosin	100.0	130.8	128.6	114.5	+ 1.8
Hats, fur-felt	100.0	103.9	127.8	103.2	+ 1.6
Sugar refining, cane	100.0	116.4	110.1	109.7	+ 1.0
Cordage and twine	100.0	103.1	103.6	105.3	+ 0.8
Cast-iron pipe	100.0	113.9	108.8	107.1	+ 0.8
Worsted goods	100.0	87.1	95.6	97.8	+ 0.1
Cement	100.0	108.9	104.8	102.0	+ 0.1
Ice, manufactured	100.0	114.4	112.1	100.8	0.0
Condensed and evaporated milk	100.0	97.4	98.5	99.3	0.0
Linoleum	100.0	101.6	93.3	101.6	− 0.2
Sand-lime brick	100.0	114.5	105.1	101.6	− 0.2
Musical instruments: organs	100.0	109.8	120.0	94.6	− 0.3
Woolen goods	100.0	100.0	97.0	96.0	− 0.8
Musical instruments: pianos	100.0	106.5	95.3	96.5	− 1.1
Jute and linen goods	100.0	87.7	85.2	94.1	− 1.1
Lace goods, cotton	100.0	80.6	80.2	88.1	− 2.0
Cars, steam and electric railroad, not built in railroad repair shops	100.0	61.5	45.0	43.3	−14.2
Felt goods, wool or hair	100.0	108.4	102.1	—	—
Wire, drawn from purchased bars or rods	100.0	87.8	90.4	—	—
Average [a]	100.0	107.3	114.9	124.4	+ 3.7

[a] Arithmetic average of the central items of a weighted frequency distribution, with weights based on 'value added', averaged for the base year and the given year. The central one-fifth of the items, by weight, were included in computing the average.

these factors has the recent advance in output per establishment been due? The entries in Table 128 throw light on this problem.

The answer to the question we have just raised is clear. During the entire period the number of workers in the average estab-

TABLE 128

GROWTH OF MANUFACTURING PRODUCTION IN THE UNITED STATES, 1923-1929

Factors Affecting Output per Establishment

Year	Output per establishment	Number of workers per establishment	Output per worker
1923	100.0	100.0	100.0
1925	110.1	102.5	107.3
1927	117.4	104.0	113.0
1929	120.5	98.7	122.0
Average annual rate of change (per cent)	+3.1	−0.1	+3.3

lishment decreased 1.3 per cent,[1] output per worker increased by 22.0 per cent. In this marked preponderance of the mechanical and organizational factor the recent period is unique. Between 1899 and 1914 the gain in output per establishment was due to both factors. In 1914, 20.4 per cent more workers were employed per factory than in 1899, while output per worker was 29.6 per cent greater. From 1914 to 1923 increasing output per establishment was due to an advance of 32 per cent in number of workers per establishment, of 20 per cent in output per worker. During the six years ending in 1929 an absolute decrease in workers per establishment accompanied a notable increase in productivity per worker, an increase attributable to better equipment, better organization and enhanced personal skill. Here is further evidence of the strength of the tendency toward the use of mechanical and organizational factors, as instruments for augmenting production. We have not yet solved the problems that this movement has brought with it.

Changes by census periods are shown by the following summary:

Census interval	Increase in output per establishment (per cent)	Change in number of workers per establishment (per cent)	Increase in output per worker (per cent)
1923-1925	+10.1	+2.5	+7.3
1925-1927	+ 6.7	+1.4	+5.2
1927-1929	+ 2.6	−5.0	+8.0

[1] Again a reservation must be entered because of the probably greater coverage of the 1929 census.

In each of the census periods the elements reflected in output per wage-earner were prime factors in stimulating production per establishment.

§ Records by industries of the changes in number of wage-earners per establishment between 1923 and 1929 are shown in the following table. The story they tell, and the contrasts between industries, are sufficiently clear without comment at this point.

TABLE 129

CHANGES IN NUMBER OF WAGE-EARNERS PER ESTABLISHMENT IN MANUFACTURING INDUSTRIES OF THE UNITED STATES, 1923-1929

Index Numbers for 62 Industries, with Average Annual Rates of Change

Industry	Index numbers of wage-earners per establishment				Average annual rate of change 1923-1929 (per cent)
	1923	1925	1927	1929	
Motor vehicles, including bodies and parts.	100.0	157.1	152.6	195.2	+9.8
Wood distillation and charcoal manufacture	100.0	118.7	153.8	152.2	+7.6
Canning and preserving: fish, crabs, shrimps, oysters, and clams.....	100.0	130.3	148.2	153.9	+7.0
Motorcycles, bicycles, and parts.....	100.0	69.1	79.7	134.6	+6.2
Coke, not including gas-house coke.....	100.0	90.4	113.9	134.0	+5.9
Sugar, cane, not including products of refineries	100.0	95.1	79.3	143.3	+5.6
Carriages, wagons, sleighs, and sleds.....	100.0	155.3	141.4	153.0	+5.4
Gas, manufactured, illuminating and heating	100.0	113.6	130.1	133.1	+5.0
Bone black, carbon black, and lamp-black..	100.0	119.0	121.0	131.7	+4.2
Hats, wool-felt	100.0	90.8	138.4	113.9	+4.1
Knit goods	100.0	112.4	121.8	127.3	+4.0
Turpentine and rosin.....	100.0	102.4	115.6	118.9	+3.3
Oil, cake, and meal, linseed.....	100.0	105.4	106.4	121.5	+3.1
Firearms	100.0	75.7	103.7	110.2	+3.1
Petroleum refining	100.0	104.2	115.2	118.3	+3.1
Musical instruments: organs.....	100.0	137.3	139.8	122.8	+2.9
Oilcloth	100.0	96.4	100.3	117.4	+2.7
Oil, cake, and meal, cottonseed.....	100.0	121.5	135.1	116.7	+2.7
Iron and steel: blast furnaces.....	100.0	110.1	111.0	117.5	+2.5
Carpets and rugs, wool, other than rag....	100.0	110.2	113.3	116.0	+2.4
Rice cleaning and polishing.....	100.0	80.5	99.4	105.8	+1.9
Rubber products	100.0	102.7	105.6	110.5	+1.7
Silk manufactures	100.0	101.9	98.8	112.2	+1.6
Salt	100.0	99.3	113.2	106.1	+1.5
Canning and preserving: fruits and vegetables; pickles, jellies, preserves, and sauces	100.0	120.1	111.7	113.4	+1.4

TABLE 129—*Continued*

Industry	Index numbers of wage-earners per establishment				Average annual rate of change 1923-1929 (per cent)
	1923	1925	1927	1929	
Paper and pulp	100.0	100.3	99.8	107.4	+1.1
Clay products (other than pottery) and non-clay refractories	100.0	102.3	105.6	103.6	+0.7
Buttons	100.0	112.9	119.3	102.7	+0.7
Butter and cheese	100.0	94.4	108.2	99.1	+0.6
Slaughtering and meat packing, wholesale	100.0	99.8	100.2	102.5	+0.4
Flour and other grain-mill products	100.0	107.8	110.5	101.5	+0.3
Corn syrup, corn oil, and starch	100.0	102.6	127.2	93.9	+0.3
Paints and varnishes	100.0	100.0	101.0	101.0	+0.2
Cotton goods	100.0	95.0	101.2	99.2	+0.2
Iron and steel: steel works and rolling mills	100.0	98.7	93.7	102.1	+0.1
Explosives	100.0	91.8	96.3	98.8	0.0
Sugar, beet	100.0	110.6	104.0	101.4	−0.1
Lime	100.0	104.7	102.7	99.9	−0.1
Hats, fur-felt	100.0	101.2	106.3	97.5	−0.1
Fertilizers	100.0	103.2	92.5	101.2	−0.4
Wool shoddy	100.0	90.4	84.6	97.7	−0.7
Worsted goods	100.0	82.6	88.9	91.8	−1.0
Cast-iron pipe	100.0	101.2	94.4	92.9	−1.4
Asphalted-felt-base floor coverings	100.0	119.8	108.9	93.0	−1.5
Musical instruments: pianos	100.0	101.9	96.3	91.3	−1.6
Woolen goods	100.0	94.5	93.0	90.1	−1.6
Cordage and twine	100.0	96.4	96.0	89.1	−1.7
Ice, manufactured	100.0	93.4	80.8	91.8	−2.0
Linoleum	100.0	90.8	85.7	88.6	−2.1
Lace goods, cotton	100.0	89.0	80.5	89.0	−2.3
Sugar refining, cane	100.0	90.5	87.4	86.9	−2.3
Chocolate and cocoa products	100.0	100.2	78.6	91.0	−2.6
Jute and linen goods	100.0	90.2	79.8	82.9	−3.4
Soap	100.0	89.9	83.3	81.4	−3.5
Sand-lime brick	100.0	104.1	93.5	78.2	−4.0
Tanning materials, natural dyestuffs, mordants and assistants, and sizes	100.0	76.9	76.3	76.5	−4.2
Cement	100.0	100.5	85.5	72.9	−5.2
Lumber and timber products	100.0	96.1	104.4	61.5	−5.8
Condensed and evaporated milk	100.0	80.7	72.6	61.3	−7.6
Cars, steam and electric railroad, not built in railroad repair shops	100.0	61.6	48.6	47.3	−12.7
Felt goods, wool or hair	100.0	95.1	100.8	——	——
Wire, drawn from purchased bars or rods	100.0	81.9	81.7	——	——
Average[a]	100.0	99.9	101.2	102.3	+0.4

[a] Arithmetic average of the central items of a weighted frequency distribution, with weights based on 'value added', averaged for the base year and the given year. The central one-fifth of the items, by weight, were included in computing the average.

§ *On the diversification of manufacturing production: A revision of index numbers of output.*—All attempts to measure changes in the volume of physical production are, of necessity, approximations to the truth. The output of many types of goods, particularly highly fabricated goods, is not subject to enumeration. Again, the numerous new products which are constantly appearing on the market must be omitted from an index based upon the production of standardized units over a period of years. The more diversified the economy, the more dynamic the industrial structure, the less adequate are the conventional index numbers which trace changes in the output of standard and readily-enumerated products. These conditions have been strongly-marked features of our economic development during the last decade. New commodities of a thousand types have been marketed; 'consumer education' to the use of new modes of refrigeration, heating, cooking, sanitation and recreation has been proceeding apace. And an increasing proportion of the manufactured goods produced has consisted of highly fabricated articles of constantly changing quality and character. The measurement of alteration in physical output under these conditions presents far greater difficulties than it would in an economy producing few and simple commodities of standard type.

It is a fair assumption that an index number of the conventional type, designed to measure changes in volume of output, will understate the actual rate of growth over a period of years. (This would not necessarily be true in the rebound from a period of depression, during which the output of basic commodities is likely to have been subject to sharp reduction.) The figures in Table 130 bear on this point.

Over the six-year period the value of the services of agents of fabrication of all census industries, as measured by 'value added', in-

TABLE 130

CHANGES IN VALUE ADDED BY MANUFACTURE, 1923-1929

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Year	'Value added', all census industries		'Value added', industries included in sample [a]		'Value added', industries not included in sample	
	In millions of dollars	In relatives	In millions of dollars	In relatives	In millions of dollars	In relatives
1923	25,850	100.0	9,961	100.0	15,889	100.0
1925	26,778	103.6	10,196	102.4	16,582	104.4
1927	27,585	106.7	9,729	97.7	17,856	112.4
1929 [b]	31,844	123.2	11,147	113.7	20,697	129.2

[a] These figures give the full 'value added' for all industries included in the index, without correction for adjustment of weights.

[b] In the construction of the index of production relatives were first obtained on 1927 as base, and then shifted to 1923 as 100. The entries for 1929 (preliminary) as given in the table are not directly comparable with the figures for earlier years.

creased by 23.2 per cent, while the increase for industries included in the index numbers presented on earlier pages amounted to but 13.7 per cent. It is significant that the chief divergence occurred between 1925 and 1927. The limited group of industries heretofore included dropped 4.6 per cent in 'value added' during the minor recession of 1927, while all manufacturing industries increased 3.0 per cent.[1] From 1927 to 1929 the general group and the limited group advanced at much the same rate.

But value figures do not define changes in physical production. For industries covered by the Census of Manufactures such physical changes may be approximated in two different ways, one based on the assumption that the cost of fabrication, per unit of product, changed at the same rate among all manufacturing industries as among the selected group for which quantity statistics are available, the other on the assumption that output per wage-earner changed among all manufacturing industries in the same degree as among the group of industries included in the sample. The procedure followed is illustrated in the next table.

TABLE 131

ILLUSTRATING THE DERIVATION OF INDEX NUMBERS OF THE PHYSICAL VOLUME OF MANUFACTURING PRODUCTION, 1923-1929

All Census Industries

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Derivation of index numbers based upon 'value added'				Derivation of index numbers based upon number of wage-earners employed			
Year	Total 'value added', all census industries		'Value added' per unit of product, industries included in sample	Derived index of physical volume of production	Number of wage-earners, all census industries		Index of per capita production, industries included in sample	Derived index of physical volume of production
	In millions of dollars	In relatives			In thousands	In relatives		
1923	25,850	100.0	100.0	100.0	8,778	100.0	100.0	100.0
1925	26,778	103.6	97.3	106.4	8,384	95.5	107.3	102.5
1927	27,585	106.7	92.4	115.4	8,350	95.1	113.0	107.4
1929	31,844	123.2	96.8	127.3	8,808	100.3	122.0	122.4

[1] It will be remembered that in the upswing from the depression of 1921 'value added' for all census industries increased by only 41 per cent (i.e., 'value added' in 1923 exceeded 'value added' in 1921 by 41 per cent), while 'value added' for the industries included in the index advanced by 54 per cent. Cyclical swings of business are more severe among the basic industries for which production statistics are readily available than among manufacturing industries at large.

The derived index numbers in columns (5) and (9) of the above table both show greater gains in physical production than are shown by the index based upon actual statistics of output. The two series of derived measurements follow the same general course, but with appreciable differences in all years. To secure the most satisfactory approximation to the actual changes in the volume of manufacturing production we may average the two. The results are given in column (3) of the next table. In column (2) appears the index based on actual production statistics, for census years. The Day-Thomas index in column (4) represents a different combination of census data. The other two indexes are based upon annual statistics of quantities produced.

TABLE 132

COMPARISON OF INDEX NUMBERS OF PHYSICAL VOLUME OF MANUFACTURING PRODUCTION IN THE UNITED STATES, 1923-1929

(1)	(2)	(3)	(4)	(5)	(6)
	Census index numbers of volume of fabrication			Index numbers based upon annual data	
Year	Based on 62 industries	Derived from 'value added' and number of employees, all industries	Day and Thomas [a]	Federal Reserve Board [b]	Day and Persons [c]
1923	100.0	100.0	100.0	100.0	100.0
1925	102.4	104.4	104.9	104.0	103.1
1927	104.2	111.4	105.6	105.0	102.4
1929	113.0	124.8	——	117.8	113.6

[a] *The Growth of Manufacturers, 1899-1923,* U. S. Department of Commerce, Census Monograph VIII, 1928, p. 194. The index for 1927 was prepared at the Division of Research and Statistics of the Federal Reserve Board by Aryness Joy, with the collaboration of V. S. Kolesnikoff.

[b] Annual averages of monthly index numbers. For complete data see the *Federal Reserve Bulletin,* Sept. 1931, p. 507.

[c] Warren M. Persons, *Forecasting Business Cycles,* John Wiley and Sons, New York, 1931, p. 171.

In 1927 and 1929 the derived index number of volume of manufacturing production is appreciably higher than the other four indexes. Over the entire six-year period a gain of approximately 25 per cent is shown by this index, as against gains of from 13 to 18 per cent indicated by the other measurements. The marked difference between the index numbers develops between 1925 and 1927. For this two-year period the other index numbers, based on standard commodities, record only slight advances, reflecting the check to business experienced in 1927. (One index shows a slight loss.) The all-inclusive census index shows a gain of 6.7 per cent, in spite of the recession. There is reason to accept this record as accurate, for the depression of 1927 was not

widespread. It was felt by the basic industries, but producers in general were not materially affected.

Index numbers of manufacturing production which have been adjusted to take account of diversification of output during this period have been used in the construction of the general index numbers given in earlier pages of this chapter.

Summary: Production Tendencies in the United States, Post-war

If attention be concentrated upon standard and readily-enumerated commodities little difference is found between the periods 1901-1913 and 1922-1929, in respect to the rate of increase in aggregate production. Available records indicate a pre-war gain at a rate of 2.9 per cent a year, a post-war gain at a rate of 3.3 per cent a year in the volume of output of such commodities. If, however, we take account of industrial diversification, and attempt to include the great variety of commodities which are not included in current physical records of production, the estimates for both periods are raised. The pre-war rate of advance, thus corrected, becomes 3.1 per cent a year, while the post-war rate is 3.8 per cent a year. (Construction is excluded for both periods.) Making allowance now for the rate of change in population, we obtain an estimate of 2.4 per cent as the average annual rate of increase in physical output per head of the population between 1922 and 1929, as compared with a rate of 1.1 per cent between 1901 and 1913. Expressed in other terms, these figures indicate that, at the pre-war rate, 63 years would have been required for a doubling of the individual's share in the annual output of the country, while, at the rate of increase prevailing between 1922 and 1929, such doubling would have required only 29 years.

In terms of cold figures the margin between average rates of gain of 3.1 per cent and of 3.8 per cent, between rates of 1.1 per cent and 2.4 per cent, may not look impressive. But the difference is of the highest significance. Over an eight-year period the American economy was moving forward at a rate perhaps never surpassed, a rate which represented a potential doubling of the physical income of the average citizen once every 29 years. For a period of almost a decade a rate of advance was achieved which gave promise of material comforts for the citizens at large on a broader scale than had ever before been attained. The combination of circum-

stances which permitted this rate of increase in the flow of physical goods to be maintained calls for searching investigation, if we are to wring the full meaning out of the events of this period.

Not only was the rate of increase in total production volume impressively high; it was also impressively stable, in contrast with earlier experience. The fluctuations in aggregate output between 1922 and 1929 (expressed as deviations from the output which would have been recorded had a constant rate of change prevailed) averaged but 2.1 per cent a year. The amplitude of the swings in total production was 43 per cent less than that prevailing during the thirteen pre-war years. Production records for individual commodities reveal the same tendency toward increasing stability.

Going beneath the surface of the aggregate stream of goods and tracing the movements of its major constituents, a truer conception of the actual course of events in recent years is secured. As regards domestic production the record does not indicate an exceptionally rapid advance in the output of raw materials. From 1922 to 1929 the total volume of raw material production increased 24 per cent, at an average annual rate of 2.5 per cent. The output of manufactured goods, on the other hand, increased in volume some 40 per cent over the same period, at an average rate of 4.5 per cent a year. (These figures are based upon the revised index numbers of manufacturing production, corrected to allow for the increasing diversification of output shown by statistics of value of output.) The expenditure of labor in increasing degree on refinements of fabrication, the production of an ever more diversified stream of ultimate products—these were characteristic features of the period preceding the last recession.[1]

Separating products of American farms from all other commodities, we find an even sharper divergence of production trends. Farm products, raw and processed, increased in output between 1922 and 1929 by 16 per cent, the average annual rate of advance being 2.0 per cent. The aggregate output of other products advanced by 49 per cent over the same period, at an annual rate of 5.1 per

[1] It was, of course, for these diversified, highly fabricated products that demand was increasing most rapidly. The less rapid advance in output of raw materials did not necessarily mean that the production of these materials was more closely adapted to market conditions. There were many factors other than domestic production, factors having to do with demand, and with world supply, which affected market values. The figures we have cited are not inconsistent with the fact that price weakness first appeared in the raw material markets of the world.

cent. Higher standards of living, the tapping of strata of less insistent wants, meant a swelling of demand for non-agricultural products. The farmer ministers to essential but relatively inelastic wants. Here is one important reason for the failure of agriculturists to keep pace with other groups of producers during the advance of the 'twenties.[1]

The rapidity of the advance both in volume and value of construction has been emphasized in the preceding brief survey. A notable feature of these developments was the extremely rapid growth in the volume of residential construction after 1923, and the sharp termination of this movement after 1928. For reasons which are to be found in part in the conditions left by the war years, in part in the more immediate conditions surrounding the financing of construction work, the construction industry provided one of the major channels for the economic expansion which preceded the last recession.

During the period 1922-1929 the aggregate production of capital equipment, including non-residential construction, increased 70 per cent (i.e., the 1929 total was 170 per cent of the 1922 total); the average annual rate of advance was 6.4 per cent. This was materially higher than the rate of gain in total production. Our energies were being devoted in increasing degree to the production of those durable goods which are used in the production of other goods. During this same period the volume of production of perishable consumers' goods increased at a rate of 2.8 per cent a year, while the volume of production of semi-durable consumers' goods (textile, leather and rubber products) advanced at approximately the same rate. If we now bring into the picture durable consumers' goods (residences, automobiles, house-furnishings, radios, etc.) we find a group which, in respect of rate of change, belongs with capital equipment, rather than with other consumption goods. The output of these goods increased at a rate of 5.6 per cent a year between 1922 and 1929. Here is striking evidence of the change in consumer habits. The rate of increase in the production of food, clothing, and other perishable and semi-durable goods exceeded by no great margin the rate of increase in population. Our productive energies, in excess of those necessary to maintain existing standards

[1] Slow adaptation of agricultural production to changing conditions, a tardiness due to social as well as economic conditions of rural life, is, of course, another and related factor.

of food consumption and of dress for a constantly expanding population, were devoted in the main to augmenting the aggregate supply of durable goods—capital equipment and durable articles of consumption.

If we lump together all durable goods we secure a group which increased 59 per cent in volume of output between 1922 and 1929, at an average annual rate of 5.9 per cent. Semi-durable and perishable goods together constitute a group which increased in aggregate volume by approximately 23 per cent over the same period, at an average rate of 2.8 per cent. The current flow of goods which had a useful life, either procreative or for consumption purposes, well in excess of two years was increasing at a rate more than twice that at which perishable and semi-durable goods were increasing. This rapid increase in the output of durable goods represented a tremendous storing up of utilities, either in the form of productive capacity or of potential enjoyment through direct consumption. A reservoir was being filled, an immense reserve supply created, which was not recorded in current inventories of stocks of goods on hand. Heavy buying in prosperity always leads to such an accumulation of stocks in consumers' hands and of equipment in the hands of producers. The distinctive feature of the years preceding the recession was that this accumulation continued over such a relatively long period, and that the production of goods of relatively long life was advancing at a rate so much greater than was the production of goods necessarily used up over a short period of time. The accumulation of such stocks of durable goods in the hands of producers and consumers was a potent factor, of course, in the subsequent curtailment of buying.

Additional evidence of the changing character of consumption is furnished by statistics on the comparative values of articles of food and clothing produced in the United States at different census periods. Figures in round numbers (precise records are not available) indicate that food and clothing constituted about 58 per cent, by value, of total production in the United States (excluding construction) in 1899, about 59 per cent in 1914, and only 44 per cent in 1929. The great drop from 1914 to 1929 is in part explained by the fact that the former was a year of depression, the latter one of prosperity, and in part by the declining importance of articles of food in our export trade. But it is probably safe to say that changes in the character of consumption and the heavy expenditure for

capital equipment characteristic of recent years were the chief factors in this remarkable shift.

The study of statistics compiled by the Census of Manufactures reveals certain striking aspects of recent production movements. With a steadily advancing volume of production, the number of wage-earners and the number of manufacturing establishments declined, while output per wage-earner and output per establishment showed notable gains. Most impressive of these changes is the gain in productivity per worker. Over the fifteen years from 1899 to 1914 output per wage-earner increased approximately 30 per cent—notable evidence of the growing efficiency of both the human and mechanical factors of production. Great as this gain was, it was exceeded during the decade from 1919 to 1929. Output per worker increased no less than 43 per cent during these ten years, gaining in every biennial period. The sharpest advance—approximately 14 per cent—occurred between 1921 and 1923, with a gain of 8 per cent between 1927 and 1929 next in order of magnitude.

In discussing pre-war tendencies a distinction was made between numbers of workers on the one hand and technical, mechanical and organizational elements on the other, as two factors which might be called upon, alternatively or in combination, when increases in production were sought. There was evidence that before the war technical and organizational elements, as these are reflected in output per capita, were being utilized in increasing degree in expanding production. These elements, in abeyance during the years from 1914 to 1919, have since been clearly dominant in the manufacturing industries of this country. Over large areas of economic endeavor the human factor, as an agency for expanding production, has been subordinated to the mechanical. The social and economic problems raised by this development are among the most urgent issues of the day. How the productive power thus released is to be efficiently and equitably used, how human labor is to be economized in production without dispossessing workers, how time thus gained by the relaxing of economic pressure may be fruitfully expended—these are questions pressing for solution. The economic difficulties which were precipitated in 1929 have not removed these problems; they have accentuated them.