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## Chapter 1

# A Summary of the Changes in Manufacturing Output

THE economic welfare of the nation is immediately dependent upon the goods and services yielded by its natural resources and creative energies. We live on the products of field, mine and factory, and the measure of our material well-being rises or falls with changes in the amount, kind and quality of those commodities. The present volume, devoted to a consideration of the changes in the product of the factory, has two chief objectives. It seeks first, to gauge the growth in the aggregate output of manufacturing industries in the period 1899–1937; and second, to depict the modifications in the pattern of factory production caused by shifts in the character of goods produced and in the relative positions of the several industries that turn out the same classes of commodities.

We have confined our measurement of the physical output of manufacturing industries to the period 1899–1937 because it is only for these years that the basic source of comprehensive data on manufacturing production, the United States Census of Manufactures, is available in sufficient breadth and detail. Moreover, in tracing the major internal developments of manufacturing production during this 38-year period, we have not considered cyclical changes, but have dealt exclusively with the more persistent shifts of emphasis in production.

### MANUFACTURING AND THE NATIONAL ECONOMY

From the founding of the republic to the opening of the present century the manufacturing industries of the United States

expanded rapidly. As early as 1791 Alexander Hamilton noted substantial beginnings in his report on manufactures. By 1902 manufacturing industries had progressed to a level undreamed of a century before, and in its report issued in that year the United States Industrial Commission described their status in superlatives. Between the two years a growing proportion of the population had found employment in these industries, and the fraction of the national money income—wages, salaries, dividends and interest—distributed by them had risen sharply. The economy had ceased to be primarily agricultural and had become predominantly industrial.

For some time after 1900 the growth of manufacturing industries, as measured by the rise in the proportion of the national income paid out by them and by their relative contribution to employment, continued at a rapid pace. Although precise figures are available only for the years following 1909, all the evidence at hand indicates that the rate of advance of manufacturing was virtually undiminished during the first 15 years of the present century. In 1913, manufacturing industries distributed 19 percent of the national income, and provided employment for 8,000,000 to 9,000,000 persons—about 20 percent of the total number of workers in the United States with gainful occupations.

The War of 1914–18 supplied a particularly sharp stimulus to the growth of manufacturing industries. From 1913 to 1919 the fraction of national income paid out by them rose from 19 to 25 percent, and the number of workers engaged in manufacturing increased to 10,000,000, from 20 percent of the total in 1913 to 26 percent in 1919.

Since 1919, however, there has been no advance in the relative contribution of this group of industries to the nation's income or employment. On the contrary, the percentage of the national income attributable to manufacturing enterprises declined between 1919 and 1923 to about 22 or 23 percent, and remained at that point during the rest of the post-war

decade. From 1929 to 1937, the proportion fluctuated violently, resulting in a slight net rise to 24 percent. As for the number of manufacturing employees, it remained substantially constant during the two decades following the war, except for cyclical fluctuations. Aside from those who replaced or displaced older workers, none of the newcomers to the ranks of the working population found employment in manufacturing industries in the period 1919-37. The working population increased during those years, so that the proportion of wage and salary earners engaged in manufacturing industries fell, during 1919-37, from 26 percent of the total to 22 percent. Manufacturing had apparently reached a plateau, if not a peak, with respect to its relative contributions both to the money income of the nation and to employment.

In terms of actual commodities produced, however, manufacturing industries more than kept pace with the growth in other industries throughout all four decades of the twentieth century. If we may judge from the indexes of manufacturing output computed in the present study, and from the less precise measures of output of all types of commodities—fabricated and unfabricated goods, services and construction—that may be derived from existing series on national income and indexes of the prices paid by consumers, the aggregate physical output of manufacturing industries increased more rapidly than the net national product not only up to 1919, but thereafter as well. From 1899 to 1919 the physical output of manufacturing industries rose about 20 percent more rapidly than the net national product, and from 1919 to 1937 it went up some 35 percent more rapidly. These figures show that there was no cessation of growth during the last two decades in the relative contribution of manufacturing industries to the stream of goods available for consumption. This finding stands in striking contrast to the record of virtual stability in the percentage that wages, salaries, dividends and other money incomes distributed by manufacturing industries constituted

of all such payments in the years 1919–37, and to the decline, during the same period, in the proportion of total employment provided by these industries. There is evidence here that advances in manufacturing productivity since the World War have been greater than corresponding advances in the economy at large, which embraces not only manufacturing, but agriculture, mining, public utilities, merchandizing, personal services and a host of other industries.

### AGGREGATE MANUFACTURING OUTPUT

Perhaps the outstanding feature of the general measurements presented in this volume is their indication of a rate of advance since the turn of the century higher than the rates shown by other studies of manufacturing output. Most indexes of production have an inherent downward bias because the new and rapidly growing industries either are omitted from the samples studied or are inadequately represented. Electrical gadgets, new chemical products, new machine tools—the variegated and unstandardized products of current invention—cannot readily be included in such indexes. Thus the older industries, usually growing less rapidly as they mature, receive more complete representation than the new and tend to dominate the record. In the present study two procedures were employed in an attempt to lessen, if not to overcome, the downward bias. First, every effort was made to include in the sample as many industries as possible, new and old, large and small. Second, the sample was adjusted for changes in its coverage of all manufacturing industries. The indexes of aggregate manufacturing output thus obtained show an advance of 276 percent between 1899 and 1937. The only other comprehensive index covering this period, that computed by E. E. Day and Woodlief Thomas and extended by other investigators, indicates a rise of 203 percent between 1899 and 1937.

The annual rate of increase of manufacturing output over the 38 years from 1899 to 1937, as averaged over good years and bad, was 3.5 percent, according to the indexes constructed for the present study. At this rate, the total volume of manufactured goods was doubling every 20 years. These figures reveal a notable expansion, yet they take no account of improvements in the quality of goods produced. Although the limitations of the available data have permitted us only to note the unknown territory that remains to be explored, even superficial investigations suggest that the improvements have been so widespread as to affect many standardized as well as unstandardized commodities. If physical output could be measured not merely by volume but also in terms of quality, the average annual rate of increase shown by our index—3.5 percent—would certainly appear as an understatement.

This average is inadequate on still another count, for it fails to indicate the marked changes in the rate of growth of manufacturing production over the years we are reviewing. Between 1899 and 1937 there were actually nine occasions on which manufacturing output suffered an absolute decline. Though often sharp, most of the declines covered only one calendar year. The contraction beginning in 1929 was the most severe as well as the longest in duration: by 1932 manufacturing output had dropped to a point practically equal to that of 1913, according to the indexes we have constructed.

During the period 1899–1937, taken as a whole, the average rate of growth of manufacturing output exceeded by a substantial margin the average rate of increase in the population of the country. While total manufacturing output increased by 276 percent between 1899 and 1937, population rose by 73 percent, so that per capita production of manufactures increased by 120 percent during the 38 years. Per capita manufacturing output rose not only for the entire span of years but also for the greater part of it. There were, however, three periods of five years or more during which there was virtually

no net increase in per capita output. Output in 1907 was followed by a slump, and was not substantially exceeded until 1912, and the 1916 peak, for similar reasons, was not surpassed until 1923; but population grew in all these years, as it did indeed in every year from 1899 to 1937. The most recent period, 1929-37, is of particular interest. During that time the population increased by almost 8,000,000, a 6 percent rise, yet by 1937 manufacturing output had registered a net gain of only 3 percent, barely surpassing its 1929 level.

Because output failed to advance appreciably from 1929 to 1937, many persons have concluded, with varying degrees of alarm, that the United States has almost exhausted its capacity for industrial expansion. Others, influenced perhaps by current misconceptions concerning the growth in manufacturing production, have viewed the recent period as one of definite retrogression. The misconceptions, in turn, have originated in the shortcomings of those current measures of total manufacturing output which have been compiled almost exclusively from samples of mature manufacturing industries and have taken little account of the output of the newer, more rapidly growing, industries. Thus the index presented here, which is based on comprehensive Census data, rose 3 percent from 1929 to 1937, while the index of manufacturing production prepared by the Board of Governors of the Federal Reserve System indicated, before its revision in August 1940, a decline from 1929 to 1937 of 8 or 9 percent. To be sure, even the indexes computed in the present study, as well as the revised Federal Reserve index, show only a slight rise in output between 1929 and 1937, and one that certainly failed to keep pace with the increase in population. Yet, if we look beyond the general averages, and observe in detail the changes in production from 1929 to 1937, we find that many industries were making net gains, and that some important new ones were advancing very rapidly. The forces working for growth, though

almost completely counterbalanced by the forces making for decline, were not entirely absent even in this disturbed period.

## COMPOSITION OF MANUFACTURING OUTPUT

When we turn from the averages and concentrate upon the movements of manufacturing production in individual industries, we find sharp differences in the secular rates of change in the physical output of these industries. In every period some decline, some forge ahead, and only a few industries follow closely the general trend of manufacturing output. These disparate rates of growth affect and are affected by changes in the structure of industry, in technical processes, in the kinds of goods produced and in the distribution of employment.

If related industries are grouped together and the period 1899–1937 is considered as a whole, certain outstanding developments emerge from the general picture. There were, for instance, very large increases, from 1899 to 1937, in the physical output of transportation equipment, petroleum and coal products, chemical products, paper products, and products of the printing and publishing industries. The physical output of each of the first two groups was more than 12 times as large in 1937 as it had been in 1899. Chemical products, paper products, and printing and publishing grew six- or seven-fold during the 38 years under review. In contrast, the physical output of the forest products group actually declined by 7 percent, while leather products rose only 69 percent, less rapidly than population, which increased by 73 percent. Beverages and textile products, which rose 132 and 180 percent respectively, lagged behind total manufacturing output, which increased 276 percent. Moderate advances, approximating the growth in total manufacturing output, are recorded for foods, tobacco products and iron and steel products.



Although accurate data on the output of four other major groups—rubber products, stone, clay and glass products, nonferrous metals, and machinery—are not available, the complete figures on money value added by manufacture (value of products less cost of materials and fuel), and such fragmentary data on physical output as can be obtained, do afford some clues. From them it may be inferred that during 1899–1937 the physical output of stone, clay and glass products rose somewhat less rapidly than total manufacturing output but more rapidly than population; that the output of nonferrous metals increased at the same or at a slightly faster rate than total manufacturing; and that the physical output of machinery and of rubber products rose considerably more rapidly than the aggregate.

The indexes for the entire period 1899–1937 provide a broad background against which recent events may be observed in perspective. For example, there was a severe decline, from 1929 to 1937, in the output of the forest products industries. The physical output of this group fell by 24 percent, as compared with a rise of 3 percent in total manufacturing. The indexes which go back to 1899 show, however, that the resulting relative decline, 26 percent, is not an isolated phenomenon. It reflects, at least in part, trends dating back to the opening of the present century. For the output of forest products declined continuously in relation to total output: 36 percent between 1899 and 1909, 33 percent between 1909 and 1919, and 22 percent between 1919 and 1929.

The changes in the indexes for major groups of manufacturing industries, though marked, are nevertheless slight in comparison with the enormous changes in the output of individual industries from 1899 to 1937. Of the 61 individual industries for which we have adequate measurements for both these years, 11 declined in output and 13 other industries increased less rapidly than population grew. Among the 11 declining industries were virtually all those specializing in

transportation equipment other than automobiles and aircraft, i.e., carriages and wagons, locomotives, railroad cars, ships and boats; and also linen goods; turpentine and rosin, and lumber-mill products; clay products; flour; pianos; and chewing and smoking tobacco. At the other extreme there was one industry—automobiles—whose 1937 production was 1,800 times greater than that of 1899, and there were four—cigarettes, petroleum refining, condensed and evaporated milk, and beet sugar—whose 1937 output was more than 15 times as great as it had been in 1899. These were followed in order of speed in growth by cement, canned fruits and vegetables, miscellaneous chemicals, and manufactured ice.

Diversity of trends in the output of individual manufacturing industries is to be expected in a dynamic economy. For in such an economy tastes change, purchasing power fluctuates both in the aggregate and in distribution, technology advances, old natural resources are exhausted and new ones are discovered. Quite naturally, too, the incidence of these changes upon different industries varies. Especially among competitive industries do the alterations in relative status resulting from such developments lead to divergence of trends. The growth in the output of the sugar, confectionery and ice cream industries occurred at the expense of the output of other food industries. Automobiles rose while carriages declined. Cigarettes displaced other tobacco products. Silk and rayon woven goods and knit goods made of all types of yarn rose in relation to cotton and woolen woven goods. Limited forest reserves as well as changes in types of buildings and in methods of construction explain in some measure the relative decline in lumber production and the increases in cement and steel output.

Although displacement of one industry by another was often pronounced, as in the case of automobiles versus carriages, it did not always lead to an actual decline in the output of the less favored industry. The detailed indexes of

physical output show, indeed, that comparative retrogression has often consisted merely of a slower rate of growth. Relatively few individual industries, and only one major group, actually declined in physical output from 1899 to 1937. The great increases that occurred in the output of some industries, perhaps at the cost of older competitors, did not prevent the latter from growing also, in a period when the total was rising. Thus butter and oleomargarine both increased; cane sugar as well as beet sugar rose in output; and cotton and woolen woven goods grew although their rates of growth fell below those of silk, rayon, and total knit goods.

Industries producing goods related sequentially or complementarily resembled one another in growth more closely than competitive industries, but the rates were far from identical. One cause of the divergence in the trends of sequentially related industries was a revision of consumers' budgets as standards of living moved upward. With the increase in national income there was a shift from home baking and sewing to corresponding operations in factories; as a consequence, the baking and clothing industries grew more rapidly than the industries producing flour and cloth. Another cause was savings in materials, brought about in large degree by improvements in the productivity of labor and enterprise. The consistently lower rate of growth in blast-furnace products, as compared with steel-mill products, reflected—along with other developments—the more efficient use of ferrous materials in the production of steel, and the increasing substitution of scrap steel for pig iron among the raw materials consumed in steel mills. A third cause of the divergence in rates of growth even among sequentially related industries was a change in the character of our foreign trade, a change that did not apply to related manufacturing industries with equal force. For example, the decline in the export of leather between 1899 and 1937 was not accompanied by any corresponding drop in domestic shoe production.

The divergence of trends in the output of industries related complementarily to one another may be attributed in part to the factors just cited, and to certain others as well. Automobiles, gasoline and rubber tires all made tremendous advances between 1899 and 1937. However, because each of these commodities has a different life span, the advances in output could not progress at identical rates.

For a more complete record of the changes in the output of individual industries, the reader must turn to later chapters of this volume. One set of details is worth anticipating, however. We have already noted that during the final period 1929-37 the aggregate physical output of manufacturing industries scarcely rose. Nevertheless, as our data on separate industries show, the output of about half of them advanced during these years, in some instances by substantial amounts. Refrigerators and rayon, each with an increase of over 200 percent, head the list. There were important gains also in the output of glass and tin cans, each of which rose by about 60 percent; canned fruits and vegetables and lace goods, about 50 percent each; washing machines, radios, miscellaneous chemicals, and wood pulp, 40 percent each; cigarettes, and silk and rayon goods, 30 percent each; cheese, 29 percent; asbestos products, 26 percent; women's clothing, 25 percent; petroleum refining, 19 percent; paper, hosiery, woolen and worsted goods, shoes, leather, paints and varnishes, ice cream, and confectionery, 9 to 15 percent. All these industries produced, in 1937, a physical quantity of goods greater than their output in 1929, sufficiently greater, in fact, to keep pace with or exceed the rise in population during the interval. Unfortunately, deficiencies in the data make it impossible to measure the growth of physical output in certain new industries, notably aircraft manufacture, but despite these gaps it can be observed that the forces making for growth in our economy were not dormant in what is widely viewed as a period of stagnation.

On the other hand, we must not minimize the trends in the opposite direction: half the industries declined absolutely in physical output between 1929 and 1937, and more than half declined in relation to population growth. The output of locomotives, lead, planing-mill products, clay products, pianos, cement, lumber-mill products, dropped in proportions ranging from 57 to 25 percent; of manufactured ice, copper, cigars, tires and tubes, ships and boats, linoleum, from 25 to 17 percent; and of flour, coke, and pig iron, from 14 to 12 percent.

It is sometimes held that a substantial increase in total output can come about only through a direct contribution to that total by a new and rapidly growing industry which gives promise of continuing expansion, and through the indirect stimulation by such an industry of the others which supply it with raw materials or produce goods used jointly with its product. Ranked in order of gains in output, the industries heading the list for the period 1929-37 were rayon and mechanical refrigerators, industries perhaps more limited in potential growth than was, for example, the motor vehicle industry. These industries appear unlikely to expand to the size that the automobile industry had attained by 1930—when it consumed 15 percent of all the steel produced in the United States, 69 percent of the plate glass, 18 percent of the hardwood lumber, 51 percent of the upholstery leather, 15 percent of the copper, and 26 percent of the lead—and cannot therefore be expected to absorb equivalent quantities of other goods. We should not, however, be too easily tempted to forecast our future development. The story of the automobile industry alone should guard us from hasty predictions at close range. In the earlier part of this century it would have been difficult if not impossible to anticipate how great a role automobile manufacture would come to play in the national economy; back in 1899 that industry was not even accorded separate classification in the Census.

The foregoing outline of the course of manufacturing

production gives rise to speculations concerning the mobility of labor and capital. Here also we must refrain from going beyond our statistical materials, although we may point out some of their implications. All industrial systems are characterized by the growth of new industries and the decline of older ones, and labor and capital must always preserve sufficient flexibility for adaptation to these changes. The gravity of the problem of mobility depends, however, on the rate of growth in the whole economy. When the total volume of output, of employment and of capital investment, is rising rapidly, the problem is far less pressing than when the aggregate is stable or declining. The migration and retraining of labor, the formulation of policies relating to the investment of depreciation reserves and corporate savings, take on increasing importance when the rate of growth in total output, employment and capital investment is low or negative. Whether these problems will be of crucial interest depends on the future rate of flow of manufactured goods.

## MANUFACTURING OUTPUT AND PRODUCTIVITY

The changes that have occurred in production cannot be appraised in isolation from the concomitant changes in the productivity of labor, capital and business enterprise. An increase as great as that which occurred in manufacturing production between 1899 and 1937 could not have come about without large gains in productivity. Had there been no increase in productivity the rise in output would have been much less than the rise that did in fact occur, even if both population and capital stock had grown at the rates at which they actually did grow. However, without a rise in productivity there would have been a slower growth in capital stock, if not also in population, and output would have been even smaller than in the hypothetical situation just described.

The shifting array of individual products also has been as-

sociated with new developments in the efficiency of machines, labor and management. On the one hand, the general advance in productivity, by raising the standard of living and thereby stimulating a demand for luxury goods, has contributed to the divergence of trends in output. On the other hand, the pervasive stimuli to gains in productivity and thereby to change in technical methods have been powerful enough to cause the industries manufacturing the tools of production to grow at a speedier rate than most other manufacturing industries. The more rapid growth of the former is indicated by the statistics for the machinery industries. The machinery group rose, between 1899 and 1909, 2 percent more rapidly (measured in terms of value added by manufacture) than did all manufacturing; between 1909 and 1919, 25 percent more rapidly than the total; and between 1919 and 1929, 18 percent more rapidly than the total. The machinery industries were severely hit by the recession of 1929-33, but revived sufficiently to make the net change in their value added between 1929 and 1937 almost equal to that of total manufacturing, so that in the latter year they reattained the relative position they had held in 1929. The substitution of machine processes for hand labor, of large machines for small, and of complex mechanical devices for simple ones appears to have been—at least up to 1929 if not thereafter as well—a fundamental means of progress. It is true, however, that additions to our stock of capital goods are not the sole means by which productivity is advanced. Thus the discovery and exploitation of new and inexpensive catalytic agents may prove as strategically important in the growth of the chemical industries as the development of mechanical power was in the rise of all manufacturing. And changes in the character of the capital stock, as well as additions to it, have contributed to the growth of output.

Enhanced efficiency in the utilization of raw materials is another factor that bears directly on the course of produc-

tivity. Economies in the use of raw materials often lead to large increases in productivity. These economies give rise in turn to economies in the use of labor and capital in the production of the raw materials required for a given number of commodities. The end result is a decline in the total cost of the final product. The saving in raw materials may be far greater than the cost of effecting that saving, and often may lead to a substantial decline in the total cost of the particular manufacturing process in which the saving occurs. In plants in which nonferrous ores are dressed, concentrated and smelted, there have been large economies in the use of raw material; since the latter is an important constituent of cost, the gains in productivity from this source alone have been striking. Significant savings of materials have been made also in the manufacture of beet sugar, in steel mills, and in coke ovens, to cite some of the examples treated in detail below.

Improvements in the quality of goods produced are another cause, as well as a result, of increasing productivity. A bettering of the quality of consumer goods, made possible by more efficient methods of production, brings about an increase in the value and usefulness of the products of industry. Improved capital equipment leads directly to further gains in productivity. Examples of both types of improvement are easily found. Gains in the productivity of the men's hosiery industry have been made possible by the introduction of new knitting machines which require less labor and at the same time produce hose with patterns and designs that could not have been turned out formerly except at prohibitive cost. The improvement in the machine also made possible the improvement in the product. Similar, and more broadly significant, have been the results of the development of standardization, which has enhanced precision and hence quality of product and has been a contributing factor in the rising efficiency of manufacture. This interaction of changes in the quality of goods, in industrial processes and in productivity is



a prime characteristic of a developing economy. Progress occurs on all fronts, each advance supporting and stimulating the others. It is true that as population expands pressure upon natural resources may lead to the deterioration of the quality of some raw materials; but the resulting disadvantages are usually more than offset by improvements in the extraction and refinement of these materials, and by discoveries of new sources of supply or of substitutes. The risk of deterioration in the quality of food products, to which urbanization and the increased distance between source of supply and market contribute, is lessened by the improvements resulting from speedy transportation, refrigeration, canning and freezing.

Related to the foregoing considerations is the finding that a decline in the aggregate price received for the services of labor, capital and other agents of fabrication (i.e., value added per unit of physical product, measured in relation to the change in the average value added per unit in all manufacturing) has often been associated with an exceptionally rapid rate of growth in output. Those manufacturing industries which have forged ahead of others in production are usually the ones in which these prices have been cut in relation to the average for all manufacturing. On the other hand, increases in these prices, relative to the average, are commonly found in the laggard industries. There is evidence here that reductions in price have made possible gains in output; and, in turn, that gains in output, perhaps by fostering larger scale production, have promoted reductions in costs and thereby in prices.

Trends in employment and productivity are found to have been similarly related. Many of the industries which cut drastically the amount of labor utilized per unit of product, from 1899 to 1937, expanded so greatly that they actually increased the number of workers employed. Industries in which employment declined or rose only slightly usually ef-

affected only moderate reductions in the quantity of labor employed per unit of output. This interrelationship will be considered in detail in the second volume of this study; at this point we shall merely cite one or two outstanding examples. In 1899 the automobile industry employed 2,200 wage earners and produced 3,700 automobiles and trucks. In 1929 the industry employed 447,000 wage earners who turned out 4,360,000 passenger automobiles and 820,000 commercial vehicles. The number of man-years required for the production of one car or truck dropped from six tenths in 1899 to less than one tenth in 1929, yet the number of wage-earner jobs rose by 445,000, an increase running into thousands in percentage terms. Rayon, an industry which between 1929 and 1937 effected one of the most drastic reductions in the number of workers employed per unit of product, nevertheless increased its volume of employment more than 40 percent in this difficult period.

#### THE GROWTH OF MANUFACTURES: AN ASPECT OF GENERAL ECONOMIC DEVELOPMENT

Manufacturing is but a segment of the entire industrial system. Its output, its productive efficiency, and the changes in them, are only facets of the economic development of the entire nation. We conclude this brief survey, therefore, with some remarks on the interrelations between manufacturing and nonmanufacturing industries, placing particular emphasis on the added significance with which they invest developments in manufacturing itself.

The total product of manufacturing and nonmanufacturing industries combined more than doubled between 1899 and 1937, rising some 30 percent more rapidly than population during the 38 years. One reason for the increase in the per capita national product was, of course, the great advance in manufacturing industries. But the converse is true as well:

the relatively greater rise in manufacturing output was in an important sense a consequence of the growth in the total national product. During the period under consideration the increase in average per capita income led to an even greater rise in average per capita expenditure on factory-made goods. There was a shift from domestic to factory production of such articles as bread, canned food and clothing, as housewives cast off the burden of domestic chores. In some of their household duties women were aided increasingly by manufactured appliances such as washing machines and vacuum cleaners. There is a limit to this sort of development, since eventually there must come a time when all domestic production has been completely transferred to the factory; but that ultimate state of things was not reached during the first four decades of this century. The rise in standards of living was accompanied also by greater fabricational elaboration of consumer goods passing through factories. And an ever larger part of the increased household budget was devoted to such highly processed goods as automobiles and radios. Working in the other direction was the tendency for expenditures on services to rise with standards of living. Apparently, however, the service industries did not progress rapidly enough to cause a decline in the fraction of income expended on manufactured consumer goods. An indirect effect of their advance was the stimulation of the demand for another group of manufactured goods—equipment and materials used by the service industries themselves.

Another set of influences making for growth in manufactures relative to other forms of economic activity may be traced to the forces underlying the increase in productivity, which in turn was responsible in large measure for the rise in total output. The industrial division of labor grew finer. Manufacturing industries took over some of the work formerly done in other industries, and by producing machines and supplies assisted nonmanufacturing industries in their

operations. Mechanization in agriculture is a vivid example of this interchange of functions. By producing tractors, agricultural machinery, gasoline and oil, manufacturing undertook a number of tasks formerly relegated to the farm, so that farmers found it less necessary to breed draught animals and grow feed. The increased division of labor is to be observed also in the shift toward factory slaughter of meat animals and toward factory production of butter. Manufacturing itself often profited from assistance of this sort—witness the development of electric power—but the net result seems to have been a gain in the fraction of the total physical output that was contributed by manufacturing industries.

A third reason why manufacturing rose in relation to other industries is connected with the preceding one. The growth of population, and the consequent pressure upon natural resources, exerted a deep influence on the character of our foreign trade. (Tariffs here and abroad also played a part, of course.) Apparently, it became more profitable for us to devote an increasing proportion of our energies to manufacture and a declining proportion to farming. Instead of exporting as much wheat and cotton as formerly, we turned to the export of more automobiles and machinery in order to secure products not made in this country. In 1899 crude foodstuffs and crude materials bulked large in our exports. Together their value accounted for 43 percent of the total value of all exports in that year, but by 1937 the percentage had dropped to 25. Manufactured exports rose from 57 percent to 75, and the greatest rise occurred in finished manufactures, the most highly fabricated type. These constituted, in terms of value, 22 percent of all our exports in 1899 and as much as 49 percent in 1937.

The divergence we have found in the trends of individual manufacturing industries also was a characteristic of the general development of our economy. As we have already observed, changes in consumer budgets, greater division of

labor, and modifications in our foreign trade did not affect all manufacturing industries equally. The varying effects of these influences are discussed at greater length in the following chapters and are shown in detail in the basic tables presented in the appendices to this volume.