

Productivity and Technological Development

Productivity Indexes (Series W 1-81)

W 1-81. General note.

Work in the field of productivity has been carried on by many individuals and organizations, especially the U.S. Bureau of Labor Statistics (BLS) and the National Bureau of Economic Research (NBER). Extensive work is being done by BLS, which measures productivity for the economy and for selected major sectors and industries.

Productivity can be defined generally as the ratio relating output (goods and services) to one or more of the inputs (labor, land, capital, energy, etc.) associated with that output. A variety of productivity measures can be developed, the particular form depending on the purpose to be served. Output per labor input is useful in understanding changes in employment or labor cost. A more comprehensive measure would be output per unit of labor and capital combined which is useful in studying how the economy has used these resources. The latter measures, which have been developed by John W. Kendrick for NBER, are covered in series W 5-8. Their construction is described in the NBER volume, *Productivity Trends in the United States*, 1961, General Series 71, and in *Postwar Productivity Trends in the United States*, 1973, General Series 98.

Historically, the measure of productivity which is most commonly used has been output per unit of labor input—frequently called “labor productivity.” Such a measure reflects not only labor’s effort but also other factors, including state of technology, capital per worker, availability of materials, the efficiency of management, rate of operations, and changes in the composition of the work force. Measures of this type have been developed by the BLS.

The output part of a labor productivity ratio may also be defined in several ways. The simplest one, conceptually, is what is called physical output, where the components are physical units such as pounds, bushels, number, etc. To arrive at total measures for an industry or an industry group, the units are weighted by man-hours or the closest equivalent (such as labor cost or value added). This type of measure is a weighted arithmetic average of the productivity change of its components. The BLS industry estimates are of this type. For a more detailed description of the concepts and procedures used, see chapter 26, *BLS Handbook of Methods for Surveys and Studies*, Bulletin 1711, 1971.

Estimates for broad aggregates, such as manufacturing or the total private economy, are constructed in terms of another output concept called value added or net output where purchased “intermediate” products consumed in the production process are excluded. This type of measure in relation to man-hours reflects not only the average of the individual industry productivity changes, but also shifts in the relative importance of low- or high-productivity industries.

Man-hours in labor productivity data can refer to either hours worked or hours paid for. The latter include not only hours worked but also paid leave time such as vacations, sick leave, and holidays.

The specific year chosen for the weight base may affect the trend of the productivity series. For example, output valued in 1954 prices would undoubtedly show a different trend from net output valued in 1958 prices. In general, a current year-weighted productivity index gives a lower trend than a base year-weighted index, since items which increase most in volume of output tend to be those with price declines or lower price increases.

Productivity series suffer from statistical limitations which are common to most production estimates. Quality change cannot be adequately accounted for in measuring changes in output; price indexes often do not cover a sufficiently broad industrial area; and man-hour weights for constructing physical output series are frequently not available. Productivity statistics also have additional limitations arising out of the noncomparability of output and man-hour series.

W 1-11. Indexes of national productivity, 1889-1970.

Source: Series W 1-8, John W. Kendrick, 1889-1966, *Productivity Trends in the United States*, National Bureau of Economic Research, Princeton University Press, 1961, (copyright) and *Postwar Productivity Trends in the United States*, National Bureau of Economic Research, 1973 (copyright); 1967-1970, computations supplied by John W. Kendrick. Series W 9-11, U.S. Bureau of Labor Statistics, *Productivity, Wages, Prices, and Employment*, press release issued quarterly, tables 1 and 2.

These indexes are measures of aggregate productivity for the total private economy and the major segments thereof. The NBER series (W 1-8) show the change in real gross product per unit of factor input after adjustments to exclude general government and real net factor income from abroad. The BLS series (W 9-11) exclude only general government and retain real net factor income from abroad. Since the latter amount as a percent of total product is extremely small, the difference between the two series in this regard is relatively small. For both series, the numerator is derived from the Department of Commerce gross national product series (with some adjustments), carried back from 1929 in the case of the NBER series, chiefly by the national product estimates of Simon Kuznets, supplemented by estimates of government purchases by John W. Kendrick.

Although the numerator of the indexes is adjusted gross national product, the indexes are actually measures of the net productivity of the economy. This arises as the result of “netting” out all intermediate purchases of goods and services, thus eliminating duplication and measuring only the “end product” of the system. Indexes of net productivity may therefore move differently from gross productivity indexes according to changes in the efficiency of materials utilization which are not reflected in gross output indexes of productivity.

The indexes are “real” in the sense that price fluctuations have been eliminated by various means. In the NBER series, the net goods and services produced were combined in six segments or “comparison periods” by a Marshall-Edgeworth formula using as weights the average prices in the terminal years of each period. The final production index is thus a chain index with shifting weights between links, but fixed weights within links. Over the long period, therefore, the productivity index reflects the overall shifts in the industry composition of the aggregates. The comparison bases are 1929 for 1889 to 1933 and 1958 for 1929 to 1970.

The output measure in the BLS index is derived from constant dollar aggregates of gross national product published by the Department of Commerce. These aggregates represent the deflation of current dollar values by weighted price indexes. The resultant indexes of net output approximate production indexes with 1958 representing the price base and 1967 the comparison base.

W 1-3, real gross private domestic product per man-hour. This series shows changes in over-all productive efficiency in terms of man-hours as the physical unit of labor input. In general, the estimates of man-hours were obtained by multiplying employment by average hours worked per year in the various industrial groupings. The industry hours were combined to the desired level of aggregation without explicit weights. The exception to the general rule for derivation of total hours occurred in the farm sector where the Agricultural Marketing Service estimates of farm labor requirements in terms of "average adult man-hour equivalents" were used. The AMS estimates were adjusted upwards by 10 percent in all years to attain a level comparable to that of the other sectors.

For the private nonfarm sector, employment data are based upon establishment reports or represent extrapolations of establishment-type estimates. The estimates since 1929 are by the U.S. Bureau of Economic Analysis (formerly Office of Business Economics). Prior to 1929, they are extrapolations of various benchmark estimates and are largely those used in previous NBER studies of output and employment.

W 4, product per unit of labor input. This series measures net output per weighted man-hour. Man-hours for industry groups or segments were combined by average hourly earnings, using the Marshall-Edgeworth cross-weighting formula. The comparison periods conforming to those in the output index were used. Aside from making possible a comparative study of the movements of output per weighted and per unweighted man-hour, the construction of this index makes possible the combination of the capital and labor inputs and the derivation of indexes of net output per unit of total factor input.

W 5, product per unit of capital input. This series expresses the change in total productivity in terms of real capital assets. The capital input of the private domestic economy was defined to include land and replaceable assets, such as residential and nonresidential structures, equipment, and inventories. The estimates are based primarily on those by Raymond Goldsmith in *A Study of Saving in the United States*, vol. 3, Princeton University Press, 1956. Index numbers of real capital stocks for separate industry groups were combined by use of the Marshall-Edgeworth formula, using unit capital compensation as weights. The system parallels that used in the index of labor input.

W 6-8, product per unit of total factor input. These series are conceptually more inclusive measures than those shown in series W 1-5 since they relate the quantity of net output to the real quantity of total factor input required to produce it. The index of total factor input is the weighted average of the index of labor input and the index of capital input previously described. The weights are units of factor compensation and the combination was made by applying the Marshall-Edgeworth formula.

W 9-11, real gross private product per man-hour. The output measures used in these productivity estimates—gross product originating developed by the U.S. Bureau of Economic Analysis—are based on a value added concept and represent an unduplicated count of the goods and services produced in an industrial sector. In current dollars, the output data reflect both changes in prices and the physical volume of production. For productivity measurement, only changes in the volume of production are relevant so that output is adjusted for price change and expressed in constant dollars of a base year, which is 1958 for these indexes.

Man-hours refer to hours paid rather than hours worked. They are derived primarily from the BLS establishment data on employment and average weekly hours, supplemented by employment and hours from national income data and the BLS labor force series. The latter is the source of man-hours in the farm sector. Man-hours for the private and nonfarm sectors are the simple aggregate of man-hours computed for each industrial sector. Employment and man-hours data are published in *Employment and Earnings*. A complete description of the methods and procedures used to develop these output per man-hour measures appears in chapter 25 of the *BLS Handbook of Methods*, Bulletin 1711.

W 12. Productivity—index of output per man-hour for production workers, total mining (1929 = 100), 1890-1960.

Source: John W. Kendrick, *Productivity Trends in the United States*, National Bureau of Economic Research, Princeton University Press, 1961 (copyright).

An earlier index appearing in Harold Barger and Sam H. Schurr, *The Mining Industries, 1899-1939: A Study of Output, Employment, and Productivity*, NBER, New York, 1944, provided the basis for this series. The earlier index has been extended back by Kendrick to cover years omitted by Barger and Schurr and to include the later period, 1939-1960. Since Kendrick's study of the mining industry was part of a study of national productivity, the need for consistency between the several sectors caused some modification of the Barger and Schurr index.

The mining industry covers all extraction of minerals including stone quarrying and the pumping of crude petroleum. The output index is a price-weighted aggregate of the Marshall-Edgeworth type and is of "modified chain" construction. Separate indexes were computed for each of several comparison periods using the mean of the commodity prices for the terminal years of each period. The indexes of the comparison periods were then linked to obtain an index covering the entire period.

The general weighting scheme of the original study was followed in the Kendrick revisions, except that he applied national income per unit of output as the weighting factor for combining the broad industry groups into the sector aggregate. These broad groups are metal mining, nonmetallic mining and quarrying, oil and gas wells, bituminous coal, and anthracite. For years prior to 1919, the 1919-1929 weights were used.

Basic sources of quantity and value data for the original production index were *Mineral Resources of the United States*, published annually for 1882-1931; and *Minerals Yearbook*, published annually since 1932-33. These volumes were prepared and issued by the U.S. Geological Survey from 1882 to 1923 and by the U.S. Bureau of Mines since 1924.

Labor input data for 1902 are from the U.S. Bureau of the Census, whereas later data are from accident statistics collected by the Bureau of Mines. The data are man-days used in actual mine operation; in most cases, the average number of employees times the number of days the mine operated during the year. BLS reports on employment and average hours have been used since 1939. The estimates of man-hours are the products of man-days times the "nominal" hours worked per day. Nominal hours are implicitly defined as the number of hours customarily worked on one shift in a regular workday by all persons "engaged in production."

W 13. Productivity—index of output per man-hour for production workers, total mining (1947 = 100), 1880-1950.

Source: U.S. Bureau of Labor Statistics computations, 1880-1935, based on WPA National Research Project, *Production, Employment, and Productivity in the Mineral Extractive Industries, 1880-1938; 1935-1950*, based on BLS, *Productivity Trends in Selected Industries, Indexes Through 1950*, Bulletin No. 1046.

For 1935-1945, the index for mining represents 6 individual mining industries, for 5 of which the BLS published separate series—bituminous coal, anthracite, iron, copper, and lead and zinc. The production index from which the combined index is derived is an average of the 5 separately published series plus a series for crude petroleum and natural gas weighted with current man-hours; the man-hours index is based on totals for the 6 industries. The productivity index for the years before 1935 is based on the WPA National Research Project study.

The individual mining series (W 14-21) are published annually in a BLS release, *Indexes of Output Per Man-Hour: Selected Industries*. The production data for these series are from the U.S. Bureau of Mines. Employment and average weekly hours series are those of BLS for 1939-1970. For 1935-1939, BLS series were used for the

coal industry and Bureau of Mines data for metal mining. The employment definition adopted (average number of wage earners employed during the 12 months of each year, including months of no activity) is the concept used by the Bureau of the Census.

W 14-21. Productivity—indexes of output per man-hour for production workers, selected mining industries, 1935-1970.

Source: U.S. Bureau of Labor Statistics, 1939 and 1947-1970, *Indexes of Output Per Man-Hour: Selected Industries, 1973 Edition*, Bulletin No. 1780; all other years, BLS computations.

Production data on which the indexes are based come from the U.S. Bureau of Mines, *Minerals Yearbook*, and the U.S. Bureau of the Census, censuses of mineral industries. The man-hours components of the indexes are derived from the regularly published BLS series on employment and average weekly hours adjusted by data obtained from the censuses of mineral industries. Exceptions to this are the indexes of man-hours for copper mining and iron mining for 1935-1939, which were derived from accident analysis statistics of the Bureau of Mines; and the lead and zinc mining man-hours for 1935-1939, which were derived from special WPA National Research Project tabulations of Bureau of Mines data for 1935-1939. The man-hours cover only production and related workers, and exclude salaried officers, superintendents, other supervisory employees, and professional and technical employees. They include all hours worked or paid for.

W 22-29. Indexes of output per man-hour and output per employed person, 1947-1970.

Source: U.S. Bureau of Labor Statistics, *Handbook of Labor Statistics 1972*, table 85.

The measures of output per man-hour in the private economy refer to the ratio between constant-dollar gross national product (GNP) originating in the private sector of the economy or individual sectors, and the corresponding hours of all persons employed.

Two series of output per man-hour estimates have been developed. One series is based on labor force data from surveys of households, conducted by the U.S. Bureau of the Census for the Bureau of Labor Statistics. The other series, shown here, is based primarily on BLS surveys of establishments.

The output measure (GNP) used in preparing both series represents the market value (in 1958 dollars) of final goods and services produced in the economy. It includes the purchases of goods and services by consumers, business establishments, foreign investors, and the various government agencies. The GNP data are prepared by the U.S. Bureau of Economic Analysis. The establishment series is based on an hours paid concept and includes the hours of all persons on establishment payrolls in the private economy. In the development of the establishment man-hour series, data from the labor force reports and national income series were used to supplement the BLS payroll series data.

These indexes relate output to man-hours and to employment. They do not reflect the specific contributions of labor, capital, or any other factors of production. Rather, they measure the combined effect of a number of interrelated influences, such as skills of workers, managerial skills, changes in technology, capital investment per worker, utilization of capital, layout and flow of materials, and labor-management relations.

For a discussion of the BLS indexes and those prepared by the Department of Agriculture's Economic Research Service, see the text for series W 67-81.

The indexes of output per man-hour in manufacturing (series W 25) measure changes in the real value added per man-hour of all wage and salary workers, proprietors, and unpaid family workers. Annual output data used to prepare these indexes are the gross product originating in manufacturing, in 1958 dollars, developed by the U.S. Bureau of Economic Analysis. Gross product originating excludes the cost of materials and other intermediate products consumed in the production process.

Man-hours data are developed by BLS on the basis of establishment data on employment and average weekly hours and refer to hours paid.

For a complete description of the methods used, see chapter 25 of *BLS Handbook of Methods*, Bulletin 1711.

W 30. Index of output per man-hour for production workers, total manufacturing industries, 1909-1950.

Source: U.S. Bureau of Labor Statistics, 1909, 1914, and 1919-1939 computations based on *Handbook of Labor Statistics, 1947*; 1939, 1947, and 1949-1950, *Trends in Output Per Man-Hour and Man-Hours Per Unit of Output-Manufacturing, 1939-53*, Report No. 100, 1955.

The production index used to derive the index of output per man-hour in manufacturing for 1909, 1914, and the odd-numbered years 1919-1939, is from Solomon Fabricant, *Employment in Manufacturing, 1899-1939*, NBER, New York, 1942. The production index for even-numbered years to 1939 was computed by use of the Federal Reserve Index for Manufactures. The man-hours index was derived from an employment index based on U.S. Bureau of the Census and BLS data and BLS series for average weekly hours for 1909, 1919, and 1923-1939, supplemented with estimates of the WPA National Research Project for 1920-1922. For 1939, 1947, and 1949-1950, the production index was computed by BLS.

For the period before 1936, indexes of productivity are shown in *Production, Employment, and Productivity in 59 Manufacturing Industries, 1919-1936*, a 3-volume report prepared by WPA National Research Project on Reemployment Opportunities and Recent Changes in National Techniques. BLS made some revisions in these indexes and extended most of them to 1940. These measures, together with indexes of payrolls and unit labor cost, appear in the BLS report, *Productivity and Unit Labor Cost in Selected Manufacturing Industries, 1910-1940*, and were later revised. The revised output-per-man-hour series was published in the 1947 *Handbook of Labor Statistics*.

The production pattern changed radically when the United States began its World War II program. Statistics were inadequate for measuring overall changes in manufacturing efficiency during the period of transition from peace to war. Consequently, there is a gap in the measurements between 1939 and 1947.

The index of output per man-hour in manufacturing attempts to compare the labor time required in the current year to manufacture the current year's output of goods with the time required in the base year to produce the same quantity and mixture of goods. That is, it measures the change in output per man-hour, assuming that the proportion of goods produced by each industry and within each industry in each year under consideration was also produced in the base year. It is the ratio of a production index (consisting of an aggregate of quantities produced weighted by the labor time required to produce a single unit) to a man-hours index (based upon the time of production workers). The concept of physical output holds constant the relative importance of industries. Indexes developed under this concept reflect primarily the average change in productivity of plants and industries in manufacturing.

W 31-54. Indexes of output per man-hour for production workers, selected industries, 1919-1970.

Source: U.S. Bureau of Labor Statistics. For data on 1947 base, selected years, *Indexes of Output Per Man-Hour for Selected Industries: 1919-1958*, April 1959; all other years, computations (1919-1936, based on WPA National Research Project, *Production, Employment, and Productivity in 59 Manufacturing Industries*, May 1939; 1936-1939, based on BLS, *Productivity and Unit Labor Cost in Selected Manufacturing Industries, 1919-1940*, 1942; 1939-1950, based on BLS, *Productivity Trends in Selected Industries, Indexes Through 1950*, Bulletin No. 1046); for data on 1967 base, *Indexes of Output Per Man-Hour: Selected Industries, 1973 Edition*, Bulletin No. 1780.

The indexes on the 1939 base were published in 1939 by the National Research Project on Reemployment Opportunities and Recent Changes in Industrial Techniques, a unit of the Works Progress Administration. They were based on data obtained from the U.S. Bureau of the Census, BLS, and other official and private agencies. BLS made some revisions in these series, and extended most of them through 1945. These extended and revised indexes were published, together with indexes of unit labor cost, in a series of BLS publications, *Productivity and Unit Labor Cost in Selected Manufacturing Industries, 1919-1940*, and several supplements to this report. All measures in these series refer to output per production worker and are based on an aggregate of production worker man-hours.

Relative to the data on the 1967 base, the source warns that the industries covered are not necessarily a representative cross section of U.S. industry, and their output per man-hour indexes should not be combined to obtain an overall measure for the entire economy or any sector. Each index represents only the change in output per man-hour for the designated industry or combination of industries.

Output per man-hour indexes are obtained by dividing an output index by an index of aggregate man-hours. Although the measures relate output to one input—labor time—they do not measure the specific contribution of labor or any other factor of production. Rather, they reflect the joint effect of a number of interrelated influences, such as changes in technology, capital investment per worker, and capacity utilization. Industry output per man-hour measures are limited to the extent that they do not account for quality change, and often do not reflect adequately changes in the degree of plant integration and specialization. In addition, there is not always strict comparability between output and labor input estimates. Finally, year-to-year changes in output per man-hour are irregular, and therefore not necessarily indicative of basic changes in long-term trends. Conversely, long-term trends are not necessarily applicable to any one year or period in the future.

W 55-59. Indexes of output per worker in transportation, 1869-1966.

Source: John W. Kendrick, *Productivity Trends in the United States*, National Bureau of Economic Research, Princeton University Press, 1961; and *Postwar Productivity Trends in the United States*, National Bureau of Economic Research, 1973. (Copyright.)

These series represent revisions and extensions of data by Harold Barger, *The Transportation Industries, 1889-1946: A Study of Output, Employment and Productivity*, NBER, New York, 1951. In addition to extending Barger's index, Kendrick also created an index for the trucking industry which was not separately presented in the earlier study. For details concerning underlying data and computations for these series, see the sources cited.

W 55, output per worker in all transportation industries. This index measures the change in the movement of persons and property for hire per worker employed and includes the industry groupings of the national income accounts which follow closely the U.S. Office of Management and Budget, *Standard Industrial Classification Manual*.

The production index used as the numerator is based upon revenue passenger-miles and unweighted ton-miles wherever possible. Where these items were not available, less refined units were substituted, as indicated for individual industries below. Output figures were not available for industries which, in 1929, amounted to some 20 percent of the total. For these industries, output was derived from employment on the assumption that the productivity of the uncovered portion was the same as in the covered portion. The aggregate production index of the industry was derived by weighting together the group indexes using changing national income weights and applying a Marshall-Edgeworth formula.

The employment index is based upon the U.S. Bureau of Economic Analysis (BEA, formerly Office of Business Economics), employment series since 1929. For 1870-1930, the series was extrapolated by estimates of the distribution of gainfully employed workers in census years, adjusted to exclude the unemployed.

Although only output per worker is presented here, the Kendrick series afford measures of output per man-hour for total transportation and for most individual industries.

W 56, output per worker in railroads. The output of this industry includes the freight and passenger activities of Class I, II, and III line-haul roads, switching and terminal companies, the Pullman Company, and the Railway Express Agency and its predecessors.

The production index is a weighted average of simple ton-miles and revenue passenger-miles with different weights for the different classes of passenger service.

W 57, output per worker for pipelines. This index covers companies primarily engaged in the pipeline transportation of crude petroleum and refined petroleum products. Transmission of natural gas is not included. It includes trunkline mileage in interstate as well as intrastate transmission. Gathering lines are excluded.

W 58, output per worker in waterways. The productivity estimates of waterways measure the output per person employed on U.S. flag vessels in coastwise, intercoastal, Great Lakes (domestic), inland, noncontiguous, and international water transportation. The exception is that Great Lakes passenger traffic is not included.

W 59, output per worker in airlines. The productivity estimates for this industry relate to scheduled airlines and unscheduled carriers and companies primarily engaged in operating fixed facilities or providing services to airlines.

W 60-61. Indexes of output per person and per man-hour in distribution, 1869-1969.

Source: See source for series W 55-59.

These indexes represent revisions and extensions of an earlier index prepared by Harold Barger, *Distribution's Place in the American Economy Since 1869*, Princeton University Press, 1955. The original estimates by Barger represented real margin earned per man-hour on those goods reaching the public through retail stores only. The quantities sold through retail stores were weighted by average 1869 and 1929 distributive margins to derive the production aggregate. The index is thus a "net" concept, although it is more inclusive than the usual net productivity index since packaging and other supply materials customarily considered a part of margin are not eliminated.

W 62-63. Indexes of output per employee and per man-hour, 1948-1970.

Source: U.S. Bureau of Labor Statistics, *Indexes of Output Per Man-Hour: Selected Industries, 1973 Edition*, Bulletin No. 1780.

W 62, index of output per employee in air transportation, 1947-70.

Output is measured by passenger-miles and freight ton-miles for all of the certificated air carriers. Unit revenue weights are used to combine the different output services. The index series refers to output per employee (production and nonproduction workers); man-hour data are not available. Employment data are from the Civil Aeronautics Board.

W 63, index of output per employee in petroleum pipelines, 1947-69.

The output measure is computed from the annual barrel-mile total of crude oil and products. All basic output data are published by the Interstate Commerce Commission. The index series refers to output per employee (production and nonproduction workers). Prior to 1958 man-hour data are not available. However, from 1958 forward, output per man-hour measures are available and are published in the source cited. All employment measures are computed by BLS.

W 64. Index of output per man-hour in railroad transportation, 1916-1970.

Source: U.S. Bureau of Labor Statistics, 1939, 1947-1970, *Indexes of Output Per Man-Hour: Selected Industries, 1973 Edition*, Bulletin No. 1780; all other years, BLS computations (1916-1935, based on Witt Bowden, "Productivity, Hours, and Compensation of Rail-

Series W 1-11. Indexes of National Productivity: 1889 to 1970

Year	Real gross private domestic product (NBER)									Real gross private product per man-hour (BLS)		
	Per man-hour			Per unit of labor input	Per unit of capital input	Per unit of total factor input			Total economy	Farm	Non-farm	
	Total economy	Farm	Non-farm			Total economy	Farm	Non-farm				
	1	2	3	4	5	6	7	8	9	10	11	
	1958 = 100									1967 = 100		
1970	137.2	177.5	132.6	130.9	107.5	126.4	126.5	126.6	123.7	103.8	115.6	103.5
1969	135.6	164.6	131.0	127.7	112.8	126.8	124.2	123.2	121.3	103.0	110.7	102.7
1968	135.2	163.5	127.1	125.4	115.3	126.8	124.2	123.2	121.3	102.5	100.2	102.9
1967	131.5	149.4	123.8	122.9	114.5	121.0	120.0	120.0	118.9	100.0	100.0	100.0
1966	129.5	144.2	120.3	119.4	111.9	117.7	118.9	118.9	114.5	98.8	90.5	98.4
1965	125.7	131.7	116.3	115.6	109.4	114.2	118.5	114.5	89.8	95.8	86.9	95.1
1964	121.6	117.4	113.0	112.4	108.0	111.4	111.2	111.8	89.8	93.0	79.5	92.4
1963	117.4	118.2	107.8	107.7	103.5	106.8	111.2	107.0	87.1	89.8	78.1	89.1
1962	113.5	115.8	107.8	107.7	103.5	106.8	111.2	107.0	87.1	87.1	71.7	86.4
1961	108.5	115.8	107.8	107.7	103.5	106.8	111.2	107.0	88.6	88.6	70.0	82.7
1960	104.9	106.5	104.7	104.5	104.1	104.4	105.4	104.6	81.4	81.4	64.9	80.3
1959	103.5	101.1	103.5	103.0	104.5	103.3	100.9	103.5	80.1	80.1	61.5	79.3
1958	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	77.6	77.6	60.4	76.7
1957	97.2	89.8	97.6	96.4	103.4	97.8	92.7	98.0	75.6	75.6	54.7	74.8
1956	94.6	84.6	95.6	94.4	105.6	96.6	90.4	96.9	73.8	73.8	51.6	73.2
1955	94.2	81.0	95.9	94.4	108.4	97.0	88.1	97.7	73.7	73.7	49.5	73.6
1954	89.9	80.1	91.2	90.3	103.2	92.8	86.7	93.2	70.7	70.7	49.1	70.5
1953	87.4	76.6	88.8	87.1	108.0	90.8	84.1	91.3	69.3	69.3	46.7	68.9
1952	83.5	68.0	85.6	83.8	106.7	87.9	77.1	88.7	66.8	66.8	41.2	66.9
1951	82.0	62.3	85.1	82.9	109.5	87.8	72.4	89.1	65.7	65.7	37.9	66.3
1950	80.1	61.9	83.8	82.3	109.1	87.1	74.1	88.3	64.3	64.3	37.7	65.0
1949	74.0	54.3	78.4	76.8	102.4	81.5	67.3	82.6	59.9	59.9	33.1	61.1
1948	71.4	56.2	74.8	73.5	106.7	79.5	70.0	81.0	58.3	58.3	34.0	58.8
1947	68.7	49.6	72.8	71.0	105.6	77.2	63.0	79.3	56.0	56.0	29.2	57.1
1946	68.7	51.4	73.3	71.7	109.4	78.4	66.7	80.5	56.0	56.0	29.2	57.1
1945	70.7	47.9	76.8	74.0	115.6	81.3	63.0	84.4	56.0	56.0	29.2	57.1
1944	67.2	47.6	72.7	70.1	115.7	77.8	64.3	80.3	56.0	56.0	29.2	57.1
1943	63.0	47.9	67.4	65.8	108.6	73.1	64.7	74.5	56.0	56.0	29.2	57.1
1942	62.0	49.9	66.7	65.7	102.9	72.3	67.9	73.2	56.0	56.0	29.2	57.1
1941	61.8	47.7	67.2	66.3	98.2	72.0	64.2	73.5	56.0	56.0	29.2	57.1
1940	58.5	42.7	66.1	64.9	89.3	69.3	58.3	71.5	56.0	56.0	29.2	57.1
1939	56.9	44.2	63.6	63.5	83.9	67.1	60.5	68.3	56.0	56.0	29.2	57.1
1938	54.7	43.3	61.4	61.5	76.4	64.1	59.1	65.0	56.0	56.0	29.2	57.1
1937	53.1	40.3	59.7	59.3	81.6	63.2	56.5	64.7	56.0	56.0	29.2	57.1
1936	53.2	37.0	60.2	59.2	78.6	62.7	50.1	64.7	56.0	56.0	29.2	57.1
1935	50.6	39.2	57.7	57.8	69.8	59.8	53.9	60.6	56.0	56.0	29.2	57.1
1934	49.0	36.2	55.9	56.2	62.1	56.7	48.7	57.6	56.0	56.0	29.2	57.1
1933	44.5	38.9	50.4	52.1	56.8	52.3	54.6	51.3	56.0	56.0	29.2	57.1
1932	45.4	39.8	51.6	53.2	56.2	53.0	55.8	51.9	56.0	56.0	29.2	57.1
1931	47.2	39.5	53.3	54.0	63.1	55.3	56.1	55.0	56.0	56.0	29.2	57.1
1930	46.8	35.6	52.5	52.3	68.1	55.1	50.1	55.6	56.0	56.0	29.2	57.1
1929	48.6	37.3	54.1	53.5	77.5	57.8	52.6	58.8	56.0	56.0	29.2	57.1

Year	Real gross private domestic product (NBER)								Year	Real gross private domestic product (NBER)							
	Per man-hour			Per unit of labor input	Per unit of capital input	Per unit of total factor input				Per man-hour			Per unit of labor input	Per unit of capital input	Per unit of total factor input		
	Total economy	Farm	Non-farm			Total economy	Farm	Non-farm		Total economy	Farm	Non-farm			Total economy	Farm	Non-farm
	1	2	3	4	5	6	7	8		1	2	3	4	5	6	7	8
	1929 = 100									1929 = 100							
1933	93.5	105.2	99.3	72.5	91.3	104.5	104.5	104.5	1910	64.4	90.0	64.7	67.7	82.4	71.6	92.5	
1932	95.0	102.2	100.8	71.9	91.9	100.9	100.9	100.9	1909	65.6	88.1	64.7	69.6	84.3	73.4	90.9	
1931	98.4	103.0	102.1	82.3	96.4	103.4	103.4	103.4	1908	61.1	90.5	65.6	66.6	76.2	68.2	93.7	
1930	97.5	94.0	98.8	89.0	96.3	93.9	93.9	93.9	1907	64.2	89.3	68.0	68.0	86.2	72.7	92.5	
1929	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	1906	64.4	94.0	68.5	68.5	88.1	73.5	93.1	
1928	95.7	96.1	95.9	96.1	96.0	96.7	96.7	96.7	1905	59.9	89.8	64.2	64.2	81.7	68.8	93.5	
1927	95.7	100.1	95.6	97.5	96.1	100.3	100.3	100.3	1904	58.4	89.4	63.5	63.5	78.0	67.2	93.3	
1926	94.1	93.4	94.4	99.2	95.7	95.3	95.3	95.3	1903	58.5	87.6	62.9	62.9	81.7	67.7	91.6	
1925	91.6	94.6	92.5	96.4	93.6	96.6	96.6	96.6	1902	57.2	85.6	61.9	61.9	80.7	66.7	90.0	
1924	91.7	90.0	92.9	95.3	93.6	91.2	91.2	91.2	1901	59.4	86.8	65.2	65.2	83.2	69.8	93.1	
1923	87.8	95.9	88.2	95.9	90.2	96.5	96.5	96.5	1900	55.6	87.9	61.7	61.7	77.0	65.7	92.8	
1922	83.0	90.4	84.9	85.7	85.1	90.2	90.2	90.2	1899	54.7	87.9	61.0	61.0	77.9	65.4	93.1	
1921	83.8	97.0	86.8	81.1	85.1	85.7	85.7	85.7	1898	53.7	88.4	60.9	60.9	73.3	64.1	94.2	
1920	78.3	85.8	79.6	85.4	81.2	86.4	86.4	86.4	1897	52.9	88.4	60.0	60.0	74.3	63.7	91.5	
1919	79.0	88.4	79.7	80.4	82.1	88.4	81.7	81.7	1896	49.5	88.4	56.3	56.3	69.2	59.5	86.3	
1918	74.1	86.2	75.0	86.1	78.0	87.3	87.3	87.3	1895	50.7	88.4	57.7	57.7	73.5	61.7	81.3	
1917	68.6	96.2	69.5	82.6	73.0	97.3	97.3	97.3	1894	47.7	88.4	55.3	55.3	67.6	58.5	77.4	
1916	72.3	89.6	73.7	87.5	77.4	89.9	89.9	89.9	1893	47.4	88.4	54.1	54.1	71.9	58.7	75.5	
1915	67.2	101.3	70.2	77.0	72.0	102.1	102.1	102.1	1892	49.4	88.4	56.0	56.0	79.6	61.8	78.3	
1914	64.7	92.7	67.9	76.6	70.3	95.3	95.3	95.3	1891	46.6	88.4	53.2	53.2	77.1	59.1	83.6	
1913	69.2	85.6	71.8	86.0	75.6	87.2	87.2	87.2	1890	45.7	88.4	52.4	52.4	77.8	58.6	81.3	
1912	66.9	97.2	69.7	85.1	73.7	99.8	99.8	99.8	1889	43.6	88.4	50.0	50.0	74.8	56.0	83.9	
1911	65.7	83.3	69.0	83.0	72.7	85.4	85.4	85.4									

¹ Preliminary.

Series W 12-21. Productivity—Indexes of Output Per Man-Hour for Production Workers in Mining: 1880 to 1970

Year	Total and selected mining industries (BLS)										Year	Total mining (NBER)	Total mining (BLS)
	Total mining (NBER)	Total mining	Total coal mining	Bituminous coal	Copper		Iron		Lead and zinc				
					Recoverable metal	Crude ore mined	Usable ore	Crude ore mined	Recoverable metal	Crude ore mined			
					12	13	14	15	16	17			
	1929 = 100	1947 = 100	1967 = 100						1947 = 100			1929 = 100	1947 = 100
1970			102.7	103.2	112.8	126.9	108.7	118.0			1934	119.0	73.3
1969			105.3	105.4	106.9	116.2	109.6	117.8			1933	116.0	70.9
1968			105.4	105.1	103.4	109.6	105.1	110.0			1932	112.9	69.8
1967			100.0	100.0	100.0	100.0	100.0	100.0			1931	108.9	69.5
1966			97.6	97.9	105.0	103.0	102.5	96.1			1930	102.9	65.6
1965			92.4	92.7	102.5	98.5	99.7	95.1			1929	100.0	62.9
1964			86.7	86.6	103.9	96.9	101.4	98.6			1928	98.0	61.2
1963			81.6	80.8	95.4	86.0	91.8	91.1			1927	91.0	58.8
1962			78.7	77.9	95.0	86.5	86.6	82.4			1926	85.9	57.1
1961			74.1	73.6	87.5	79.4	83.9	76.7			1925	84.9	56.3
1960	247.1		67.3	66.7	84.0	77.6	79.7	66.3			1924	79.4	54.6
1959	233.8		63.6	62.8	81.8	75.8	72.0	58.7			1923	78.8	53.1
1958	224.4		62.3	61.6	86.3	74.3	73.1	56.8			1922	75.9	51.8
1957	215.8		56.1	55.6	76.5	67.3	80.9	58.2	123.0	104.3	1921	69.5	48.8
1956	210.5		55.3	54.3	70.1	61.4	81.2	57.6	117.1	107.8	1920	68.2	46.6
1955	206.3		52.8	52.6	73.0	60.5	84.7	55.3	116.6	111.1	1919	65.9	44.6
1954	197.0		49.3	48.8	65.0	53.7	65.1	42.9	114.6	108.1	1918	66.8	44.5
1953	186.5		42.2	42.0	64.6	51.8	75.7	47.3	116.0	102.8	1917	65.2	43.7
1952	176.3		39.2	38.8	68.8	54.8	72.9	45.2	111.1	103.0	1916	64.6	43.3
1951	175.5		37.3	36.7	68.6	52.2	77.4	48.0	116.4	104.4	1915	63.6	43.7
1950	164.0	105.7	37.1	36.9	68.4	52.5	71.2	43.7	127.0	103.2	1902	47.9	30.1
1949	151.9	97.7	34.4	33.7	58.8	43.9	66.7	39.5	114.7	94.1	1890	37.3	23.0
1948	149.9	99.8	32.8	32.0	57.7	42.8	68.7	41.4	108.3	88.8	1880		17.8
1947	144.2	100.0	32.8	32.1	58.9	44.5	68.7	40.8	100.0	100.0			
1946	141.0	96.5	32.5	31.5	52.6	39.3	67.9	39.4	92.0	120.1			
1945	144.1	95.5	31.1	30.3	60.2	44.0	71.0	41.8	103.4	129.5			
1944	136.2	94.2	30.3	29.3	59.0	40.4	63.8	37.0	102.3	124.5			
1943	135.3	91.4	29.0	28.1	53.5	35.0	61.8	36.1	98.5	109.1			
1942	133.2	93.6	30.3	29.4	52.6	32.6	68.6	40.9	119.0	117.7			
1941	138.3	93.5	30.8	29.7	51.5	30.6	74.2	42.9	129.1	124.0			
1940	145.6	91.9	30.4	29.4	53.1	30.4	73.8	41.6	127.6	114.4			
1939	144.9	90.0	29.2	28.2	51.2	28.2	62.8	34.9	132.3	114.7			
1938	138.8	81.1	28.2	27.2	47.6	23.4	44.1	24.6	129.4	107.0			
1937	130.9	79.2	26.9	25.8	48.2	25.4	66.4	37.3	120.2	110.6			
1936	138.6	77.9	26.2	25.2	52.1	23.7	62.0	34.9	123.5	109.0			
1935	127.6	76.4	24.4	24.1	50.1	18.4	55.0	31.9	131.0	101.9			

Series W 22-29. Indexes of Output Per Man-Hour and Output Per Employed Person: 1947 to 1970

[1967 = 100. Man-hour estimates based primarily on establishment data]

Year	Output per man-hour in the private economy				Output per employed person in the private economy			
	Total private	Farm	Nonfarm	Manufacturing	Total private	Farm	Nonfarm	Manufacturing
	22	23	24	25	26	27	28	29
1970	104.4	119.8	103.4	108.0	102.2	116.9	101.4	106.4
1969	103.3	110.2	102.7	107.4	102.5	108.5	102.1	107.4
1968	102.9	100.2	102.9	104.7	102.4	99.0	102.5	104.9
1967	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1966	98.0	90.5	98.4	99.9	99.3	91.3	99.7	101.3
1965	94.2	86.9	95.1	98.4	96.2	88.2	96.9	99.6
1964	91.1	79.5	92.4	94.5	92.8	79.7	94.0	94.8
1963	87.7	78.1	89.1	90.1	89.5	78.1	90.8	90.1
1962	84.7	71.7	86.4	86.6	86.6	72.3	88.1	86.4
1961	80.9	70.0	82.7	81.9	82.5	69.7	84.1	81.0
1960	78.2	64.9	80.3	79.9	80.4	65.6	82.2	79.0
1959	76.9	61.5	79.3	78.6	79.5	61.7	81.7	78.6
1958	74.3	60.4	76.7	74.4	76.3	60.6	78.4	73.0
1957	72.0	54.7	74.8	74.4	74.8	55.4	77.2	73.8
1956	70.0	51.6	73.2	72.9	73.6	53.6	76.4	73.2
1955	69.9	49.5	73.6	73.7	74.1	52.5	77.2	74.4
1954	66.9	49.1	70.5	69.5	70.7	52.8	73.5	68.8
1953	65.3	46.7	68.9	68.4	69.7	51.1	72.5	68.8
1952	62.7	41.2	66.9	66.2	67.3	44.6	70.9	66.9
1951	61.5	37.9	66.3	65.9	66.2	41.4	70.3	66.5
1950	59.7	37.7	65.0	64.4	64.4	40.8	68.9	64.9
1949	55.3	33.1	61.1	60.1	59.5	36.4	64.4	58.9
1948	53.6	34.0	58.8	58.0	58.5	38.0	62.7	57.9
1947	51.3	29.2	57.1	54.9	56.5	32.9	61.4	55.2

Series W 30-54. Indexes of Output Per Man-Hour for Production Workers, Selected Industries: 1909 to 1970

Year	Total manufacturing	Canning and preserving	Flour and grain mill products	Bakery products	Sugar	Candy and other confectionery products	Malt liquors	Tobacco products	Cigarettes, chewing and smoking tobacco, and snuff	Cigars	Hosiery	Paper, paper-board, and pulp mills	Petroleum refining	Tires and inner tubes	Footwear
	30	31	32	32a	33	34	35	36	37	38	39	40	41	42	43
1967 = 100															
1970		105.9	111.2	105.5	111.1	103.0	120.3	103.4	98.8	114.7	126.2	115.8	108.6	105.4	105.3
1969		102.8	105.8	103.1	101.9	101.1	113.3	102.0	98.9	109.3	106.4	110.2	110.6	100.3	97.4
1968		107.2	106.1	101.5	103.7	103.0	105.7	103.2	103.0	103.8	93.1	106.2	103.7	105.0	103.6
1967		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1966		98.5	100.8	95.6	99.9	97.9	93.9	99.2	98.6	100.8	88.4	101.2	97.1	98.3	102.6
1965		100.8	95.3	95.1	94.4	93.7	88.7	99.5	98.1	102.8	80.1	96.4	89.9	96.7	101.2
1964		96.0	90.5	91.8	90.8	90.8	83.9	94.8	93.5	97.9	80.2	91.3	83.0	94.4	101.7
1963		91.6	84.5	89.3	85.9	89.1	77.9	93.5	95.0	90.5	75.2	86.9	78.5	86.7	102.3
1962		91.1	75.2	84.1	84.4	82.5	71.1	89.1	91.5	84.6	66.9	82.0	73.5	79.8	99.0
1961		91.0	73.9	81.0	77.3	80.9	68.2	85.9	90.4	78.9	64.5	79.0	67.1	74.4	98.3
1960		85.0	72.2	79.8	71.9	81.5	64.9	82.4	88.0	73.7	58.6	73.9	62.1	70.9	98.0
1959		80.4	68.3	79.5	68.2	77.8	62.9	77.0	84.2	66.7	57.2	70.9	59.1	68.2	98.6
1958		77.2	71.8	79.0	64.9	75.7	60.8	72.8	81.3	61.2	57.9	66.7	52.5	62.9	94.4
1957		77.4	69.2	77.3	61.8	74.3	55.4	67.1	79.6	52.3	48.7	64.9	49.9	59.6	92.0
1956		74.9	63.6	73.1	62.8	68.6	53.3	64.1	77.3	48.9	46.3	64.3	49.1	56.3	90.0
1955		70.4	60.6	71.0	60.0	66.8	51.9	60.1	75.3	44.2	45.4	61.0	47.1	54.8	88.1
1954		67.6	57.7	70.0	58.2	63.1	50.5	60.3	76.3	43.8	45.9	57.4	43.1	53.2	84.3
1953		62.6	50.4	67.9	52.0	62.5	48.1	60.4	79.7	42.0	44.2	54.9	40.9	51.9	(NA)
1952		61.8	47.5	65.4	50.0	60.8	48.1	61.8	83.6	42.0	45.9	54.9	39.9	49.3	84.6
1951		61.5	48.2	62.7	46.0	60.6	46.5	60.3	83.1	40.4	42.4	55.6	38.4	50.9	82.9
1950		59.7	48.7	62.0	48.8	54.5	46.4	58.1	78.6	39.4	39.7	53.0	36.6	52.6	80.2
1949		54.1	47.2	61.3	45.1	53.2	45.3	53.6	75.2	35.2	38.0	47.4	31.7	47.9	74.1
1948		49.8	(NA)	(NA)	(NA)	(NA)	(NA)	52.2	73.4	34.3	(NA)	(NA)	(NA)	(NA)	(NA)
1947		48.5	49.8	59.6	41.0	53.3	38.6	43.2	68.5	31.4	35.8	44.4	28.6	43.1	69.6
1939		43.7	44.5	(NA)	(NA)	47.6	33.0	38.6	47.7	28.7	(NA)	48.5	29.9	(NA)	(NA)
1947 = 100															
1950	114.3	118.3						119.3	115.6	122.5	115.4	118.9			
1949	107.2	111.5						113.2	111.8	114.3	110.3	106.7			
1948		103.2						106.7	107.9	105.6					
1947	100.0	100.0						100.0	100.0	100.0	100.0	100.0			100.0
1946		106.0						98.1	93.5	102.4	108.5	98.0			109.1
1945		102.5						96.5	86.3	106.9	114.4	95.6			104.4
1944		100.5						89.3	81.8	96.6	109.7	95.0			99.5
1943		92.3						84.9	80.0	89.3	106.1	98.1			101.6
1942		93.2						85.3	80.5	89.8	99.6	109.1			100.4
1941		97.8						84.1	78.7	89.3	95.6	115.9			101.8
1940		99.2						80.8	71.5	90.5	94.9	115.0			97.7
1939	93.2	90.0						80.0	69.6	91.3	87.0	109.2			93.8
1938	85.1	85.8						76.1	67.8	84.5		103.2			92.9
1937	83.6	79.8						73.1	66.6	79.5		101.1			89.8
1936	84.5	74.5						75.0	71.3	78.4		99.9			97.3
1935	84.3	90.4						69.4	62.8	75.8		95.5			91.0
1934	79.8	84.3						60.8	56.7	63.6		90.0			84.0
1933	76.0	88.1						61.3	67.1	57.1		94.9			82.5
1932	72.2	76.5						56.1	60.7	52.9		92.7			74.5
1931	77.5	77.5						58.5	59.0	58.1		93.1			68.9
1930	74.3	68.9						52.7	56.9	49.6		81.3			71.0
1929	72.5	61.6						52.5	55.4	50.4		80.8			72.9
1928	69.7	65.2						45.2	44.1	46.2		80.2			72.8
1927	66.2	60.7						44.5	44.2	44.8		76.1			69.3
1926	64.5	64.1						45.8	45.6	45.9		71.8			64.2
1925	62.8	61.9						41.6	39.6	43.4		70.2			58.9
1924	58.9	65.0						39.3	35.3	43.3		66.5			60.0
1923	55.2	59.1						36.7	32.3	41.4		64.2			59.0
1922	56.2							33.0	26.7	40.8		60.5			63.0
1921	51.3	47.4						30.5	23.6	40.0		51.5			59.3
1920	44.6							27.2	18.2	45.8		51.3			62.5
1919	42.1	48.3						27.4	19.5	41.0		49.0			60.3
1914	42.2														
1909	36.6														

NA Not available.

PRODUCTIVITY INDEXES

W 44-66

Series W 30-54. Indexes of Output Per Man-Hour for Production Workers, Selected Industries: 1909 to 1970—Con.

Year	Glass containers	Cement, hydraulic	Concrete products	Steel	Primary copper, lead, and zinc	Primary aluminum	Metal cans	Year	Steel	Chemicals	Lumber and timber	Motor vehicles	News-papers and periodicals	Blast furnaces	
	44	45	46	47	48	49	49a		47	50	51	52	53	54	
	1967 = 100								1947 = 100		1939 = 100				
1970	105.0	109.3	109.0	102.8	111.4	109.8	106.7	1950	111.9						
1969	109.1	111.9	110.3	104.8	113.8	104.8	107.7	1949	102.8						
1968	106.5	110.2	109.7	104.6	112.8	95.6	104.6	1948	100.4						
1967	100.0	100.0	100.0	100.0	100.0	100.0	100.0	1947	100.0						
1966	97.4	99.4	100.2	101.3	111.6	100.7	96.7	1946							
1965	97.7	94.4	93.5	98.7	113.1	97.0	95.6	1945					88.7		
1964	91.9	91.4	91.0	94.8	110.2	94.4	92.2	1944			98.0		87.5		
1963	89.3	86.8	85.9	92.1	106.4	93.2	89.9	1943			95.1		101.4		
1962	86.5	80.9	75.8	89.6	104.8	90.4	90.3	1942			98.1		105.7		
1961	83.1	78.0	74.5	85.4	99.0	87.5	93.8	1941	87.2		105.5		106.2		
1960	81.8	68.2	72.7	82.3	94.4	83.0	88.8	1940	82.3	95.9	111.7	101.3	103.8	113.9	
1959	83.8	68.2	76.0	87.7	86.7	78.6	86.7	1939	79.3	100.0	100.0	100.0	100.0	100.0	
1958	79.2	64.2	77.4	78.4	91.4	68.2	84.3	1938	67.2	89.6	87.6	99.7	92.8	68.2	
1957	81.4	61.2	77.8	81.6	90.7	59.7	80.0	1937	65.9	91.3	82.4	100.4	93.0	98.7	
1956	81.5	62.5	78.6	82.3	89.1	58.8	81.0	1936	64.7	88.5	84.9	102.1	93.7	101.2	
1955	81.2	59.5	71.9	82.4	88.6	56.3	77.9	1935	62.9	84.1	90.8	99.5	92.1	86.4	
1954	78.5	56.7	68.4	74.1	80.7	50.5	73.7	1934	58.6	76.0	89.5	85.2	85.4	68.7	
1953	79.1	50.7	64.0	76.0	78.6	44.6	71.5	1933	59.5	86.7	86.1	83.8	75.3	67.8	
1952	74.0	45.9	62.1	75.0	79.5	45.6	69.2	1932	55.4	85.7	79.6	69.4	74.4	51.2	
1951	74.6	45.3	58.8	72.8	78.0	46.0	69.4	1931	58.0	81.3	90.6	79.6	75.4	83.3	
1950	77.4	43.6	55.5	72.5	75.8	47.5	70.2	1930	54.7	72.6	78.5	89.1	74.3	98.8	
1949	69.9	43.8	48.0	66.8	69.3	43.0	63.8	1929	57.8	72.1	82.4	84.2	77.3	105.5	
1948	(NA)	(NA)	(NA)	65.1	(NA)	(NA)	(NA)	1928	57.5	65.9	78.2	70.6	78.6	92.5	
1947	77.4	37.8	39.6	64.7	68.4	42.4	60.1	1927	50.9	64.2	79.4	66.8	75.7	80.4	
1939	59.7	39.8	(NA)	(NA)	61.6	(NA)	(NA)	1926	50.3	61.1	76.4	66.1	77.5	82.0	
								1925	48.9	51.2	76.5	62.5	69.0	77.5	
								1924	49.1	45.9	72.7	59.6	65.0	62.0	
								1923	42.4	46.9	71.4	58.8	63.2	67.7	
								1922	43.8	43.5	67.5	51.5	59.4	64.7	
								1921	34.3	43.5	84.4	47.8	51.8	55.1	
								1920	37.7	49.6	75.6	39.1	51.9	59.7	
								1919	29.5	29.9	79.0	35.9	43.8	43.5	

NA Not available.

Series W 55-66. Indexes of Output Per Worker and Output Per Man-Hour in Transportation, Distribution, Gas and Electric Utilities, and Nonfinancial Corporations: 1869 to 1970

Year	Transportation (NBER), output per worker					Distribution (NBER)		Indexes of output (BLS)				
	Transportation	Railroads	Pipelines, etc.	Waterways	Airlines	Output per person	Output per man-hour	Air transportation, output per employee	Petroleum pipelines, output per employee	Railroad transportation, output per man-hour	Gas and electric utilities, output per man-hour	Nonfinancial corporations, output per man-hour
	55	56	57	58	59	60	61	62	63	64	65	66
	1958 = 100							1967 = 100				
1970								109.7	120.7	110.1	117.3	106.7
1969							142.1	107.2	113.5	109.2	113.8	105.5
1968							141.0	104.3	105.4	104.3	107.0	104.3
1967							135.5	100.0	100.0	100.0	100.0	100.0
1966	151.5	170.1	208.9	107.5	188.2	129.8	133.3	93.9	88.1	97.5	95.7	99.0
1965	142.5	158.9	193.1	111.5	170.6	126.1	127.7	83.7	78.6	90.8	89.2	96.5
1964	132.5	147.0	159.7	112.1	150.3	123.1	123.8	75.0	66.2	82.1	85.5	93.0
1963	125.0	136.9	146.0	112.1	136.3	119.1	118.8	68.2	60.3	77.1	79.5	88.8
1962	118.3	127.9	132.1	110.3	124.0	114.7	114.6	61.6	54.6	72.6	74.9	85.7
1961	111.5	119.2	124.8	102.9	110.8	108.4	108.3	55.4	51.9	68.2	69.4	81.1
1960	107.9	111.6	116.7	108.9	106.4	105.8	105.3	52.3	48.7	63.6	65.5	79.2
1959	106.0	107.4	111.8	100.1	109.6	106.0	105.4	51.9	45.7	61.2	61.5	78.1
1958	100.0	100.0	100.0	100.0	100.0	100.0	100.0	48.2	39.7	57.6	56.4	74.8
1957	94.9	96.1	98.5	105.5	98.4	99.0	99.3	46.6	39.0	54.8	53.7	73.8
1956	98.2	95.1	96.7	109.1	96.6	98.1	97.7	45.0	39.6	54.0	51.1	72.0
1955	94.6	89.5	86.6	107.6	96.3	97.9	96.9	43.9	34.8	51.6	47.2	71.5
1954	87.0	79.2	77.8	102.3	87.5	91.8	91.0	38.9	31.2	46.6	42.4	67.8
1953	84.5	77.2	71.5	96.6	78.8	89.9	89.3	35.2	28.4	44.8	39.6	65.6
1952	83.9	77.2	64.2	97.2	72.5	87.7	86.2	32.4	25.9	44.6	37.0	63.6
1951	85.0	78.5	62.9	102.1	71.0	86.8	84.8	31.1	25.0	44.4	34.7	63.3
1950	80.1	75.8	54.4	96.9	61.5	88.9	86.8	27.1	21.7	42.0	31.3	61.5
1949	78.3	71.9	44.1	89.4	51.8	82.3	80.8	23.4	18.0	36.7	28.1	57.2
1948	77.9	77.7	43.7	88.8	45.2	80.2	79.1	20.5	17.5	37.6	27.5	56.1
1947								18.2	16.5	38.3	26.2	
1939										27.9	15.8	

¹ Preliminary.

Series W 55-66. Indexes of Output Per Worker and Output Per Man-Hour in Transportation, Distribution, Gas and Electric Utilities, and Nonfinancial Corporations: 1869 to 1970—Con.

Year	Transportation (NBER), output per worker					Distribution (NBER)		Railroad transportation, output per man-hour (BLS)
	Transportation	Railroads	Pipelines, etc.	Waterways	Airlines	Output per person	Output per man-hour	
	55	56	57	58	59	60	61	
	1929 = 100				1947 = 100	1929 = 100		1947 = 100
1953	255.4	178.6	379.5	206.8	172.5	124.5	157.3	118.0
1952	253.3	179.3	345.0	206.7	160.7			117.3
1951	258.8	181.7	334.5	222.6	157.9			116.7
1950	247.1	172.8	290.7	207.0	142.9			110.5
1949	224.3	160.6	239.6	178.4	123.2			96.9
1948	231.6	174.0	238.5	170.7	108.4	117.1	144.2	98.5
1947	223.8	176.1	221.2	178.1	100.0			100.0
1946	207.3	169.0	211.5		88.2			95.8
1945	225.7	195.5	233.2		95.3			103.6
1944	242.2	211.2	241.6		75.3			110.1
1943	250.7	215.8	216.5		57.2			112.1
1942	231.3	191.0	186.4		60.2			103.7
1941	187.4	151.6	176.8		69.6			85.7
1940	168.7	132.0	159.6	115.7	66.4			78.2
1939	154.2	123.8	157.1	102.0	60.2			74.4
1938	141.0	114.6	148.2	97.5	53.3			70.4
1937	140.5	119.3	141.1	105.9	54.6	99.8	113.5	71.0
1936	132.2	116.7		99.2	57.3			70.0
1935	117.4	103.8		85.8	51.7			66.2
1934	111.5	98.2		84.6	36.4			63.2
1933	104.4	93.5		85.5	33.3			62.7
1932	94.5	83.7		77.2	26.5			55.7
1931	96.8	90.8		85.6	27.3			57.1
1930	97.7	95.3		93.9	37.1			56.7
1929	100.0	100.0	100.0	100.0	22.6	100.0	100.0	56.7
1928	96.1	98.4						55.7
1927	91.4	94.3						53.1
1926	90.6	95.6						53.2
1925	86.2	92.6						51.5
1924	81.1	87.6						48.8
1923	80.3	88.1						47.5
1922	76.0	84.2						46.0
1921	69.3	76.7						44.2
1920	76.2	83.9						43.5
1919	73.6	81.0	40.5	73.8		92.6	89.6	42.9
1918	80.2	88.8						40.4
1917	81.8	91.4						40.9
1916	78.2	87.3		69.7				39.0
1915	72.2	80.6						
1914	65.3	71.2						
1913	65.5	71.2						
1912	64.3	70.2						
1911	61.7	67.2						
1910	62.5	68.2						
1909	62.3	68.2				95.3	85.8	
1908	59.3	64.5						
1907	59.6	64.4						
1906	60.4	65.6		62.9				
1905	59.1	64.1						
1904	56.5	61.2						
1903	56.0	60.5						
1902	56.6	61.4						
1901	56.4	61.7						
1900	56.5	62.2						
1899	55.8	61.5		46.7		90.5	73.7	
1889	42.3	47.5		30.8		82.1	66.0	
1879				18.9		93.0	75.0	
1869				18.1		59.4	47.8	

PRODUCTIVITY INDEXES

W 67-81

Series W 67-81. Index of Farm Production Per Man-Hour: 1910 to 1970

[1967 = 100. Index of farm output (production) divided by index of man-hours used]

Year	All farm work	Livestock and livestock products	Meat animals	Milk cows	Poultry	All crops	Feed grains	Hay and forage	Food grains	Vegetables	Fruits and nuts	Sugar crops	Cotton	Tobacco	Oil crops
	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81
1970	113	119	116	123	120	110	101	148	117	106	107	121	125	104	115
1969	112	112	110	115	112	112	109	145	113	106	109	115	117	98	114
1968	106	105	105	106	105	106	102	102	108	101	98	118	130	98	110
1967	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
1966	94	93	95	93	95	95	93	99	102	99	99	92	101	96	101
1965	91	87	90	87	87	92	92	96	101	99	95	88	101	95	100
1964	83	83	89	81	82	85	78	93	97	96	91	90	87	99	89
1963	80	77	83	74	73	82	77	92	90	97	87	97	78	97	94
1962	73	71	78	70	66	77	70	89	89	92	87	82	71	93	92
1961	70	67	74	65	61	73	64	89	86	93	78	82	61	88	90
1960	67	62	70	60	55	71	58	84	93	89	74	79	56	87	84
1959	62	59	68	57	50	66	52	81	77	88	74	75	52	81	82
1958	59	55	65	53	45	65	47	77	85	82	73	67	48	81	81
1957	53	51	63	49	39	56	40	71	62	80	69	67	44	77	69
1956	50	48	62	46	37	52	35	65	54	76	75	59	41	80	67
1955	47	46	62	43	32	48	31	63	50	70	75	53	39	75	60
1954	43	43	59	40	30	45	29	58	46	67	74	51	35	71	54
1953	41	41	58	39	27	43	27	63	43	64	70	49	33	67	51
1952	39	40	56	37	24	42	26	60	46	63	67	43	30	67	50
1951	36	39	56	36	23	38	23	58	38	59	65	39	28	67	46
1950	35	37	55	35	21	39	23	55	40	57	64	38	25	66	47
1940	21	27	50	25	15	22	10	30	21	40	51	27	17	56	18
1930	17	26	48	25	14	17	8	23	17	34	38	22	12	50	13
1920	15	24	45	22	13	17	8	24	11	32	38	18	12	52	10
1910	14	24	44	21	13	15	7	24	10	30	27	18	11	54	9

Copyrights, Patents, and Trademarks (Series W 82-108)

W 82-95. Copyright registrations, by type, 1870-1970.

Source: Series W 82-91, W 93-95, U.S. Library of Congress, *Annual Report of the Librarian of Congress* and *Annual Report of the Register of Copyrights*, various issues. Series W 92, U.S. Patent Office, 1874-1896, *Annual Report of the Commissioner of Patents*; 1897-1940, unpublished data; 1941-1970, U.S. Library of Congress, *Annual Report of the Librarian of Congress*, various issues.

Additional detail for some series is shown in the source volumes.

Figures are on a calendar-year basis for 1870-1896, and on a fiscal-year basis thereafter. Prior to 1870, copyright claims were entered at Federal District Courts. For additional information on this period, see Martin A. Roberts, *Records in the Copyright Office Deposited by the United States District Courts Covering the Period 1790-1870*, Washington, D.C., 1939.

The term "copyright" may be defined as the right to prevent copying. It has come to mean that body of exclusive rights granted by Federal statute to authors for the protection of their writings. It includes the exclusive right to print, reprint, publish, copy, and vend the copyrighted work; to make other versions of the work; and, with certain limitations, to make recordings of the work and to perform the work in public. The Copyright Office is primarily an office of record, and registers claims if the provisions of the law and the regulations have been complied with. A certificate is issued to the applicant upon completion of each registration.

The first law, 1790, applied only to maps, charts, and books. Subsequent amendments provided for prints (1802); musical compositions (1831); dramatic compositions with the right of public performance (1856); photographs (1865); paintings, drawings, sculpture, and models or designs for works of the fine arts (1870); performance rights in music (1897); motion pictures and photoplays (1912); and performance rights in nondramatic literary works (1952). The original term of copyright was 14 years, with the privilege of renewal for 14 years. In 1831, the first term was increased to 28 years, and in 1909, the renewal term was also increased to 28 years. Before 1891, only citizens or residents of the United States could obtain copyrights. The Act of 1891 extended the privilege to citizens of countries with which the United States had reciprocal copyright agreements. Claims in works by citizens of States adhering to international copyright conventions to which the United States is a party (Mexico City, 1902; Buenos Aires, 1910; and Universal Copyright Convention, 1952) may also be registered, as well as works first published in States adhering to the Universal Copyright Convention.

Detailed information on the various classes of works may be obtained by writing to the Register of Copyrights, Library of Congress, Washington, D.C. 20540.

W 82, total registrations. For 1870-1940, the figures shown in this series exclude commercial prints and labels; see text for series W 92, below.

W 83-85, books, pamphlets, and periodicals. Serial publications issued at regular intervals of less than a year are considered periodicals; otherwise, they are considered books.

W 87, dramatic or dramatico-musical compositions. For 1909 and earlier years, this series pertains only to dramatic compositions.

W 92, commercial prints and labels. Registration of commercial prints and labels in the Patent Office was first authorized by the Act of June 18, 1874. Jurisdiction was transferred to the Register of Copyrights by Public Law 244, 53 Stat. 1142, effective June 30, 1940.

W 94, miscellaneous. Includes lectures, sermons, addresses; reproductions of works of art; drawings or plastic works of a scientific or technical character; and photographs.

W 96-106. General note.

A patent is a grant by the Government to the inventor, his heirs or assigns, of the right to exclude others from making, using, or selling the invention patented. Patents can be obtained for any new and useful machine, manufacture, composition of matter or process, or any new and useful improvement thereof, subject to the requirements and conditions of the law, United States Code, Title 35, Patents. An invention is "useful" if it has lawful purpose and is operative. Since 1946, inventions useful solely in the utilization of fissionable material or atomic energy for atomic weapons have been unpatentable. If the subject matter patented can be used without infringement of the prior rights of others or violation of any applicable statute, the patent, in effect, gives its owner the exclusive right to make, use, or sell the subject of the patent. The subject matter covered by a patent must be sufficiently new as to be not obvious to one skilled in the art to which it relates.

Patents on inventions have been issued by the Federal Government since April 10, 1790. Both the fees charged and the term of patents have been changed occasionally by law. A total fee of \$30 was charged on application in 1793; now (1973) a base fee of \$65 is charged. Whereas no charge was made prior to 1861 when a patent was granted, modern-day applicants pay an additional minimum fee of \$110 at that time. Other smaller fees incidental to the processing of applications may also be charged by the Patent Office.

For 1790-1861, the term of a patent was 14 years. From 1836 until the patents granted in 1861 expired, patents could be extended for an additional 7 years upon application by the patentee and approval of a special board or the Commissioner. About 5 percent of the patents issued during the latter part of this period were extended in this manner. Since 1861, the term of patents on inventions has been fixed at 17 years with extensions possible only by special act of Congress. The number of such extensions has been negligible.

From February 21, 1793, to July 4, 1836, patents were granted on demand of the applicant, upon compliance with the formal requirements, without examination as to novelty and other requirements. Consequently, statistics of patents on inventions issued during this period are more comparable to subsequent statistics of *applications* for patents on inventions (series W 96) than to subsequent statistics of *patents* on inventions. Different sources for patent statistics during this period show minor discrepancies.

Since July 4, 1836, the Patent Office has examined applications for novelty and for compliance with the requirements of the statute and not all applications which are filed become patents. See Department of Commerce, *The Story of the United States Patent Office*, for a brief account of the development of the patent laws; and *General Information Concerning Patents* (revised periodically), for an outline of the patent law.

Other kinds of patents issued are design patents, botanical plant patents, and reissued patents. Reissued patents are patents which are issued to replace another patent to correct some error, and hence have no significance in most uses of patent statistics. They are not shown in this compilation, although reissue applications are included in series W 96 for some years for which they could not be separated. Reissued patents were numbered separately from 1838; the number of the first such patent issued in 1972 is 27,264.

Statistics on various phases of patents on invention are available in various sources. Analyses of aggregate patent statistics appear in Barkev S. Sanders, "The Course of Invention," *Journal of the Patent Office Society*, October 1936; Joseph Rossman and Barkev Sanders, "The Patent Utilization Study," *The Patent, Trademark, and Copyright Journal*, June 1957; Alfred B. Stafford, *Trends of Inven-*

tion in *Material Culture*, Ph.D. thesis, University of Chicago, 1950; Alfred B. Stafford, "Is the Rate of Invention Declining?" *American Journal of Sociology*, May 1952; Jacob Schmookler, *Invention and Economic Growth*, Harvard University Press, 1966. Statistics of patents issued by industry or by field of technology appear in Simon Kuznets, *Secular Movements in Production and Prices*, Boston, 1930; R. K. Merton, "Fluctuations in the Rate of Industrial Invention," *Quarterly Journal of Economics*, May 1935; *Trends of Invention in Material Culture*, cited above; and *Invention and Economic Growth*, cited above. The basic data used in this work, two volumes bound in one, are on file in the Library of the U.S. Patent Office under the title "Statistics of Patents Classified by Industry, United States, 1837-1957".

Statistics of patents issued by State and country of residence of the inventor appear in the Patent Office, *Annual Report of the Commissioner of Patents*, and in the Bureau of the Census, *Statistical Abstract of the United States*. Since 1966, the annual reports have also included applications filed by country of residence, beginning with calendar year 1961.

International patent statistics are given in P. J. Federico, "Historical Patent Statistics, 1791-1961," *Journal of the Patent Office Society*, vol. 46, Feb. 1964, pages 89-171, which also contains a description of the sources of the statistics for various countries, including the United States. *The English Language International Periodical Industrial Property* (World Intellectual Property Organization, Geneva), published since 1960, has an annual statistical supplement in each December issue, which gives data for a large number of countries including, for many, applications filed by and patents granted to residents of other countries, and additional statistics for the United States.

W 96-98. Patent applications filed on inventions, designs, and botanical plants, 1836-1970.

Source: U.S. Patent Office, 1836-1839, *The Story of the United States Patent Office, 1790-1956*; 1840-1925, *Annual Report of the Commissioner of Patents*; 1926-1970, unpublished data.

Series W 96 involves a slight element of double counting prior to 1940. Before a change in the law on August 5, 1939, made it impossible, an applicant could permit his initial application to lapse and then file a new application covering the same invention. Possibly 2 to 4 percent of the applications filed before 1940 were of this character. For years prior to 1880, series W 96 includes design applications, and for years prior to 1877, also includes reissue applications.

W 99. Total patents issued on inventions, 1790-1970.

Source: 1790-1925, U.S. Patent Office, *Annual Report of the Commissioner of Patents*; 1926-1970, unpublished data.

Patents for inventions are numbered serially, the number of the first patent issued in 1972 being 3,631,539. This numbering system, although instituted later, began with the first patent issued after the Patent Act of July 4, 1836. Most sources of patent statistics give, as the annual number of patents issued, the numbers derived by subtracting the serial numbers of the first patent in each year. However, some serial numbers were not used and are blank; that is, there may not be any patent corresponding to a particular number. This may arise when an application scheduled to be patented, with the patent number assigned, is withdrawn for some reason at a time when it is too late to assign that number to some other case. The blank numbers averaged 26 per year for 1939-1955, but only 7.5 per year for 1961-1970. Beginning with the 1970 edition, the Annual Patent Index includes a listing of the blank numbers, for the period 1920-1970. Through 1971 there were 2,998 blank numbers. In the present series the number of blank numbers has been deducted in each year for which it could be ascertained. Therefore, the statistics of patents on inventions issued since 1836 may run a fraction of a percent below those appearing in some issues of the *Annual Report of the Commissioner of Patents* and in *Historical Statistics of the United*

States, 1789-1945. Reissued patents are not shown in this compilation.

Patents granted in a given year cannot be compared with applications filed in the same year since there is a variable lag between the time of applying and the time of issuing a patent. During the last 10 years this lag varied between 2 years and 6 months and 3 years and 3 months as the average time for issuing patents. In addition, variations in the number of patents issued in a given year may be due to administrative problems such as the loss or addition of examining personnel, or rearrangement of printing schedules.

W 100-103. Patents on inventions issued to individuals, to U.S. and foreign corporations, and to the U.S. Government, 1901-1970.

Source: 1901-1935, U.S. Patent Office, unpublished data; 1936-1955, P. J. Federico, *Distribution of Patents Issued to Corporations, 1939-1955*, Washington, D.C., 1957, Study No. 3, table 6 (a report prepared for the Senate Subcommittee on Patents, Trademarks, and Copyrights); 1956-1970, U.S. Patent Office, unpublished data.

Statistics on patents issued to U.S. and foreign corporations are actual counts for 1931-1937, 1955, and 1961-1970; for the other years they are estimates based on samples. Statistics of patents issued to the U.S. Government are based on actual count. This figure does not include patents issued to the Alien Property Custodian during and after World War II. Patents assigned after grant are not included. The patents issued to individuals are obtained by subtraction from the total.

W 104. Patents issued on designs, 1842-1970.

Source: U.S. Patent Office, *Annual Report of the Commissioner of Patents*, and unpublished data.

Designs became patentable in 1842 and relate to the appearance, not to the structure or use, of articles of manufacture. The term for design patents was initially set at 7 years. Since 1861, the term has been 3½, 7, or 14 years, at the discretion of the applicant. Fees payable vary with the term. Design patents are numbered separately. The number of the first design patent issued in 1972 is 222,801.

W 105. Patents issued on botanical plants, 1931-1970.

Source: U.S. Patent Office, unpublished data.

Botanical plants became subject to patents for the first time in 1930. Patentable plants are those which are asexually reproduced—distinct and new varieties of plants other than tuber-propagated plants. The term and fees for plant patents are the same as for patents on inventions. Plant patents are numbered separately from the other patents. The number of the first plant patent issued in 1972 is 3,063.

W 106. Patents issued to residents of foreign countries, 1836-1970.

Source: U.S. Patent Office, *Annual Report of the Commissioner of Patents*, and unpublished data.

The volume of patents issued to citizens of foreign countries was influenced in the early years of the patent system by discriminatory legislation. For 1800-1836, only aliens who had resided in the United States for 2 years and who had declared their intention of becoming citizens could apply for U.S. patents. For 1836-1861, aliens paid higher fees than citizens on a theory of reciprocity. Discrimination based on nationality was eliminated in 1861.

This series is based on residence and not on citizenship. It includes patents on inventions, designs, and botanical plants. Separate statistics on components are not available except for recent years. For the 7 years 1951-1957, foreign residents received 12.6 percent of invention patents, 3.3 percent of design patents, and 12.5 percent of the plant patents. For the period 1964-1970, foreign residents received 22.4 percent of invention patents, 7.0 percent of design patents, and 13.5 percent of the plant patents.

W 107-108. Trademarks registered and renewed, 1870-1970.

Source: U.S. Patent Office, *Annual Report of the Commissioner of Patents*, and unpublished data.

A trademark is a symbol—a picture, word, or phrase—applied by a manufacturer or merchant to distinguish his goods from those of others. Trademark rights are acquired by adoption of a mark and use of it on the goods in trade. The Federal law provides for the registration in the Patent Office of such marks which are used in interstate and foreign commerce. Applications for registration are examined and registration may be refused if the mark is of a character prohibited registration (national emblems, deceptive marks, purely descriptive marks, etc.) or if it conflicts with a prior registered mark. Federal registration does not create ownership, but only gives additional advantages to the owner. See Department of Commerce, *General Information Concerning Trademarks*, (revised periodically), for an outline of the requirements for registering a trademark.

The first Federal trademark law, that of 1870, was based on the

patent and copyright clause of the Constitution instead of the interstate and foreign commerce clause, and was held unconstitutional in 1879. The Trademark Act of 1881 was limited to marks used in foreign commerce. The Act of 1905 included marks used in interstate commerce as well. An Act of 1920 permitted registration of a secondary class of marks not previously registrable. A completely new Act of 1946, effective 1947, provides for a Principal Register on which marks of the type registrable under the Acts of 1881 and 1905 could be registered, and a Supplemental Register on which marks of the type registrable under the Act of 1920 could be registered. Registrations under the Act of 1946 are for a term of 20 years, with renewal possible for successive 20-year terms. Registrations issued under the Acts of 1881 and 1905 remain in force for their unexpired terms and may be renewed in the same manner as registrations under the Act of 1946. Registrations under the Act of 1920 cannot be renewed unless renewal is required to support a Foreign Registration and in such case may be renewed on the Supplemental Register in the same manner as registrations under the Act of 1946.

Series W 82-95. Copyright Registrations, by Type: 1870 to 1970

Year	Total copy-right registrations ¹	Books and pamphlets		Periodicals	Contributions to periodicals ²	Dramatic or dramatico-musical compositions	Musical compositions	Maps	Works of art, models, or designs	Prints and pictorial illustrations	Commercial prints and labels ¹	Motion pictures	Miscellaneous	Renewals, all classes ³
		Total ¹	Printed abroad in foreign language											
1970	316,466	88,432	-----	83,862	1,943	3,352	88,949	1,921	6,807	3,873	5,255	2,545	6,711	23,316
1969	301,258	83,603	-----	80,706	1,676	3,213	83,608	2,024	5,630	2,837	4,798	2,364	5,132	25,667
1968	303,451	85,189	-----	81,773	2,026	3,214	80,479	2,560	5,236	3,109	5,972	2,922	5,197	25,774
1967	294,406	80,910	-----	81,647	1,696	3,371	79,291	2,840	4,855	2,740	5,862	2,696	4,999	23,499
1966	286,866	77,300	-----	77,963	1,717	3,215	76,805	1,933	5,164	3,081	6,285	2,889	5,050	25,464
1965	293,617	76,098	-----	78,307	2,095	3,343	80,881	3,262	5,785	2,927	7,509	3,752	6,188	23,520
1964	278,987	71,618	-----	74,611	2,529	3,039	75,256	1,955	5,915	3,325	7,013	4,107	7,045	22,574
1963	264,845	68,445	-----	69,682	2,535	2,730	72,588	2,002	6,262	2,694	7,318	4,216	6,314	20,164
1962	254,776	66,571	-----	67,523	2,998	2,813	67,612	2,073	6,043	2,889	7,167	3,641	6,177	19,274
1961	247,014	62,415	-----	66,251	3,398	2,762	65,500	2,010	5,557	2,955	7,564	4,654	5,754	18,194
1960	243,926	60,034	-----	64,204	3,306	2,445	65,558	1,812	5,271	3,843	8,142	3,457	4,961	21,393
1959	241,735	55,967	-----	62,246	3,042	2,669	70,707	1,865	4,593	3,186	8,786	3,724	3,417	21,538
1958	238,935	57,242	-----	60,691	3,355	2,754	66,515	1,614	5,019	3,413	8,924	3,199	3,616	22,598
1957	225,807	53,508	2,915	59,724	3,214	2,764	59,614	2,084	4,557	3,409	8,687	3,198	3,580	21,473
1956	224,908	53,942	3,115	58,576	3,490	3,329	58,330	2,242	4,168	3,306	9,491	3,012	4,096	20,926
1955	224,732	54,414	3,694	59,448	3,746	3,498	57,527	2,013	3,456	3,793	10,505	2,650	4,168	19,519
1954	222,665	51,763	3,697	60,667	3,294	3,527	58,213	2,390	3,170	4,103	10,784	2,556	3,690	18,508
1953	218,506	49,059	3,875	59,371	3,288	3,884	59,302	2,541	3,029	3,126	12,025	2,175	3,605	17,101
1952	203,705	46,083	3,382	56,509	3,320	3,766	51,538	2,422	3,305	2,891	11,770	2,079	3,332	16,690
1951	200,354	47,125	3,536	55,129	3,408	3,992	48,319	1,992	3,428	3,590	11,981	2,149	2,869	16,372
1950	210,564	50,456	3,710	55,436	4,438	4,427	52,309	1,638	4,013	4,309	13,320	1,895	3,792	14,581
1949	201,190	47,422	2,644	54,163	4,140	5,159	48,210	2,314	3,281	4,358	13,233	1,763	3,472	13,675
1948	238,121	48,811	2,545	59,699	5,963	6,128	72,339	1,456	3,938	6,686	10,619	1,631	5,035	15,816
1947	230,215	49,525	3,970	58,340	4,400	6,456	68,709	1,779	4,044	6,506	9,674	2,084	5,497	13,201
1946	202,144	42,356	3,513	48,289	5,504	5,356	63,367	1,304	3,094	5,384	7,975	2,024	4,975	12,516
1945	178,848	35,688	111	45,763	4,856	4,714	57,835	857	1,821	2,634	7,403	1,735	4,175	11,367
1944	169,269	35,952	82	44,364	4,730	4,875	52,087	494	1,743	2,426	5,953	1,872	4,526	10,247
1943	160,795	36,889	156	42,995	3,568	3,687	48,348	737	1,649	2,317	5,385	1,767	3,803	9,650
1942	182,232	45,157	651	45,145	5,119	4,803	50,023	1,217	2,110	2,917	7,162	2,219	4,872	11,488
1941	180,647	46,040	1,553	42,207	5,845	5,010	49,135	1,398	2,187	3,058	7,152	1,798	6,475	10,342
1940	176,997	50,125	2,504	40,173	13,926	6,450	37,975	1,622	3,081	4,699	2,470	1,611	7,123	10,207
1939	173,135	49,901	4,086	38,307	9,843	6,800	40,961	1,566	3,419	3,126	2,315	1,757	7,278	10,177
1938	166,248	49,156	3,646	39,249	8,195	7,369	35,334	1,200	3,330	3,010	2,415	1,889	7,576	9,940
1937	154,424	45,504	3,841	38,053	7,551	7,176	31,821	1,198	3,002	3,875	2,506	1,751	5,904	8,589
1936	156,962	47,667	3,853	38,418	7,082	6,569	33,250	1,444	2,977	4,117	2,306	1,708	5,550	8,180
1935	142,081	43,134	3,283	36,351	7,875	6,501	27,459	1,343	3,082	3,120	2,408	1,695	4,810	6,661
1934	139,047	40,658	3,593	35,819	7,740	5,945	27,001	1,250	5,447	2,834	2,170	1,513	3,851	6,989
1933	137,424	40,694	4,232	35,464	9,290	6,359	26,846	1,178	2,667	3,143	1,937	1,607	3,765	6,411
1932	151,735	46,576	4,784	39,177	10,489	6,296	29,264	1,774	2,590	3,354	1,975	1,539	4,788	5,888
1931	164,642	46,855	4,339	42,415	12,698	5,784	31,488	2,940	2,551	5,813	2,465	1,926	6,174	5,998
1930	172,792	47,248	4,664	43,989	14,587	5,734	32,129	2,554	2,734	9,170	2,333	2,195	6,565	5,937
1929	161,959	44,040	3,868	44,161	13,574	4,594	27,023	2,232	2,486	9,873	2,707	2,319	6,709	4,948
1928	193,914	50,095	4,405	47,364	26,986	4,473	26,897	2,862	3,152	14,272	2,801	2,304	10,062	5,447
1927	184,000	47,801	3,777	41,475	29,335	4,475	25,282	2,677	2,575	14,833	2,856	1,915	8,946	4,686
1926	177,635	73,455	3,430	41,169	-----	4,130	25,484	2,647	3,173	13,382	2,544	1,623	8,543	4,029
1925	165,848	65,670	3,266	40,880	-----	4,015	25,548	2,222	2,950	10,827	2,015	1,765	8,662	3,309
1924	162,694	61,982	2,306	39,806	-----	3,409	26,734	2,265	2,873	11,170	2,016	1,473	9,549	3,433
1923	148,946	55,561	2,886	37,104	-----	3,778	24,900	2,042	2,790	10,400	2,141	1,277	8,405	2,689
1922	138,633	46,307	1,309	35,471	-----	3,418	27,381	1,980	2,954	9,139	2,101	1,487	7,820	2,726
1921	135,280	41,245	1,134	34,074	-----	3,217	31,054	1,647	2,762	9,362	1,485	1,721	7,992	2,206

See footnotes at end of table.

Series W 82-95. Copyright Registrations, by Type: 1870 to 1970—Con.

Year	Total copyright registrations ¹	Books and pamphlets		Periodicals	Contributions to periodicals ²	Dramatic or dramatico-musical compositions	Musical compositions	Maps	Works of art, models, or designs	Prints and pictorial illustrations	Commercial prints and labels ¹	Motion pictures	Miscellaneous	Renewals, all classes ³
		Total ²	Printed abroad in foreign language											
		82	83											
1920	126,562	89,090	939	28,935	2,906	29,151	1,498	2,115	10,945	780	1,714	8,096	2,112	
1919	113,003	37,710	855	25,083	2,293	26,209	1,207	1,901	9,997	768	1,429	5,268	1,906	
1918	106,728	33,617	636	25,822	2,711	21,849	1,269	1,858	9,161	708	1,833	6,746	1,857	
1917	111,438	33,552	914	26,467	3,067	20,115	1,529	2,247	11,514	1,123	2,720	8,235	1,992	
1916	115,967	32,897	1,276	26,553	3,223	20,644	1,612	2,220	12,722	1,235	3,240	11,228	1,628	
1915	115,193	31,926	1,843	24,938	3,797	21,406	1,772	2,965	12,935	1,083	2,950	11,178	1,326	
1914	123,154	31,891	2,860	24,134	3,957	28,493	1,950	3,021	15,438	1,059	2,148	10,891	1,231	
1913	119,495	29,572	2,369	23,002	3,700	26,292	2,011	2,871	16,591	918	953	13,438	1,065	
1912	120,931	29,286	2,294	22,580	3,767	26,777	2,158	3,224	17,639	893	1,451	14,151	1,349	
1911	115,198	26,970	1,707	23,393	3,415	25,525	2,318	3,355	14,269	757	1,502	15,025	928	
1910	109,074	24,740	1,351	21,608	3,911	24,345	2,622	4,383	11,925	235	14,533	1,007		
1909	120,131	32,533	2,195	22,409	2,937	26,306	2,392	28,427	915	1,010	935	1,095		
1908	119,742	30,191	2,078	22,114	2,932	28,427	2,114	31,401	935	1,095	1,373	1,301		
1907	123,829	30,879	2,294	23,163	2,932	28,427	2,114	31,401	935	1,095	1,301	1,301		
1906	117,704	29,261	2,294	23,163	2,932	28,427	2,114	31,401	935	1,095	1,301	1,301		
1905	113,374	29,860	2,294	22,591	1,645	24,595	1,645	24,595	1,373	1,373	1,373	1,373		
1904	103,130	27,824	2,294	21,496	1,571	23,110	1,571	23,110	1,301	1,301	1,301	1,301		
1903	97,979	27,466	2,294	22,625	1,608	21,161	1,608	21,161	1,143	1,143	1,143	1,143		
1902	92,978	24,272	2,294	21,071	1,448	19,706	1,448	19,706	913	913	913	913		
1901	92,351	(NA)	(NA)	(NA)	(NA)	(NA)	(NA)	(NA)	948	948	948	948		

Year	Total copyright registrations ¹	Periodicals	Dramatic or dramatico-musical compositions	Musical compositions	Maps	Commercial prints and labels ¹	Year	Total copyright registrations ¹	Periodicals	Dramatic or dramatico-musical compositions	Musical compositions	Commercial prints and labels ¹											
													82	85	87	88	89	92	82	85	87	88	92
													1900	94,798	(NA)	(NA)	(NA)	775	1885	28,411	6,060	625	6,808
1899	80,968	(NA)	(NA)	(NA)	443	1884	26,393	5,670	587	6,241	513												
1898	75,545	(NA)	(NA)	(NA)	89	1883	25,274	5,459	498	6,250	906												
1897	75,000	(NA)	(NA)	(NA)	35	1882	22,918	4,612	458	6,143	304												
1896	72,470	12,892	907	20,951	1,198	1881	21,075	4,339	415	5,578	202												
1895	67,572	12,155	827	18,563	1,432	3	1880	20,686	4,369	496	5,628	203											
1894	62,762	12,149	465	18,460	1,922	4	1879	18,125	3,608	414	4,688	355											
1893	58,956	11,094	580	16,273	1,814	2	1878	15,798	3,424	372	3,772	492											
1892	54,735	10,327	813	14,649	(NA)	6	1877	15,758	3,424	372	3,772	392											
1891	48,908	9,477	746	11,688	1,912	137	1876	14,882	3,424	372	3,772	472											
1890	42,794	8,164	715	9,132	---	304	1875	15,927	---	---	---	232											
1889	40,985	7,646	620	8,958	---	319	1874	16,283	---	---	---	232											
1888	38,225	7,086	589	8,066	---	327	1873	15,352	---	---	---	---											
1887	35,083	6,708	536	7,744	---	380	1872	14,164	---	---	---	---											
1886	31,241	6,089	672	7,514	---	378	1871	12,688	---	---	---	---											
							1870 ⁴	5,600	---	---	---	---											

NA Not available.
¹ Prior to 1941, commercial prints and labels not included in total; jurisdiction moved to copyright office in 1940.
² Prior to 1927, contributions to periodicals included with books and pamphlets.
³ Prior to 1941, excludes renewals of commercial prints and labels.
⁴ July-December.

Series W 96-106. Patent Applications Filed and Patents Issued, by Type and by Patentee: 1790 to 1970

Year	Patent applications filed			Patents issued							
	Inventions	Designs	Botanical plants	Inventions				Designs	Botanical plants	To residents of foreign countries	
				Total ¹	Individuals	Corporations					U. S. Government ²
						U. S.	Foreign				
96	97	98	99	100	101	102	103	104	105	106	
1970	102,868	5,996	188	64,427	13,511	36,896	12,294	1,726	3,214	52	17,872
1969	98,386	5,496	111	67,557	14,772	38,847	12,138	1,750	3,335	103	17,573
1968	93,136	5,171	95	59,102	13,555	34,886	9,172	1,489	3,352	72	13,722
1967	87,872	4,744	103	65,652	15,647	38,353	9,895	1,757	3,165	85	14,711
1966	88,293	4,853	104	68,406	16,018	41,634	9,222	1,532	3,188	114	14,008
1965	94,632	5,413	105	62,857	16,063	37,158	8,096	1,540	3,424	120	12,782
1964	87,597	5,259	120	47,376	12,504	27,836	5,854	1,182	2,686	128	9,168
1963	85,724	4,968	145	45,679	12,525	26,632	5,501	1,021	2,965	129	8,736
1962	85,029	4,897	151	55,691	15,470	32,560	6,380	1,281	2,300	91	10,255
1961	83,100	4,714	107	48,368	13,383	28,351	5,161	1,473	2,487	108	8,384
1960	79,590	4,525	131	47,170	13,069	28,187	4,670	1,244	2,543	116	7,850
1959	78,594	4,879	114	52,408	16,017	29,888	5,081	1,422	2,768	101	8,340
1958	77,495	4,923	134	48,330	15,706	27,116	4,230	1,278	2,374	120	7,395
1957	74,197	4,714	101	42,744	15,154	23,255	3,372	963	2,362	129	6,282
1956	74,906	4,824	104	46,817	16,643	25,502	3,690	982	2,977	101	6,646

See footnotes at end of table.

Series W 96-106. Patent Applications Filed and Patents Issued, by Type and by Patentee: 1790 to 1970—Con.

Year	Patent applications filed			Patents issued								
	Inventions	Designs	Botanical plants	Inventions					U. S. Government ²	Designs	Botanical plants	To residents of foreign countries
				Total ¹	Individuals	Corporations						
						U. S.	Foreign					
96	97	98	99	100	101	102	103	104	105	106		
1955	77 188	5 764	118	30 432	11 914	16 084	1 744	689	2 713	108	4 065	
1954	77 185	5 465	95	33 809	12 531	18 319	2 301	658	2 536	101	4 433	
1953	72 284	5 450	99	40 468	16 284	21 230	2 294	658	2 713	78	4 331	
1952	64 564	4 993	84	43 616	18 538	22 340	2 085	695	2 959	101	5 635	
1951	60 438	4 279	71	44 326	19 192	22 805	2 163	659	4 163	58	4 888	
1950	67 264	6 739	105	43 040	18 960	21 782	1 660	622	4 718	89	4 408	
1949	67 592	6 998	70	35 131	14 957	18 536	1 127	485	4 450	93	3 105	
1948	68 740	7 048	59	23 963	9 812	13 124	628	352	3 968	44	1 984	
1947	75 443	7 644	92	20 139	7 784	11 448	669	155	2 102	52	1 617	
1946	81 056	10 698	72	21 803	7 444	13 486	585	147	2 778	56	1 656	
1945	67 846	8 066	52	25 695	8 981	15 665	580	87	3 524	17	2 112	
1944	54 190	5 063	42	28 053	9 636	16 769	645	106	2 914	38	2 564	
1943	45 493	2 986	41	31 054	11 654	18 022	524	48	2 228	47	2 625	
1942	45 549	4 218	60	38 449	14 534	22 019	1 286	62	3 728	65	3 949	
1941	52 339	7 203	67	41 109	16 322	22 632	2 112	43	6 486	62	5 311	
1940	60 863	8 530	91	42 238	17 627	22 165	2 406	40	6 145	85	6 148	
1939	64 093	7 137	76	43 073	18 583	21 800	2 640	50	5 592	45	6 338	
1938	66 874	8 084	48	38 061	16 304	19 635	2 063	59	5 026	41	5 776	
1937	65 324	7 207	45	37 683	15 995	19 831	1 824	33	5 136	55	5 638	
1936	62 599	6 478	66	39 782	16 639	21 207	1 903	33	4 556	29	5 734	
1935	58 117	5 728	72	40 618	17 757	20 821	2 018	22	3 864	45	5 980	
1934	56 643	4 399	28	44 420	19 731	22 529	2 131	29	2 919	32	6 489	
1933	56 558	3 600	27	48 774	22 713	23 667	2 343	51	2 411	33	7 170	
1932	67 006	4 345	46	53 458	26 274	24 822	2 325	37	2 942	46	7 376	
1931	79 740	4 190	37	51 756	26 618	23 149	1 961	28	2 935	5	6 897	
1930	89 554	4 182	16	45 226	23 726	19 700	1 800	-----	2 710	-----	6 085	
1929	89 752	4 520	-----	45 267	25 367	18 500	1 400	-----	2 905	-----	5 921	
1928	87 603	4 761	-----	42 357	23 357	17 800	1 200	-----	3 182	-----	5 218	
1927	87 219	4 473	-----	41 717	25 417	15 100	1 200	-----	2 387	-----	4 918	
1926	81 365	4 343	-----	44 733	28 633	15 200	900	-----	2 597	-----	5 103	
1925	80 208	4 082	-----	46 432	30 332	14 800	1 300	-----	2 819	-----	5 347	
1924	87 987	3 635	-----	42 574	29 174	12 400	1 000	-----	2 670	-----	4 723	
1923	76 783	3 550	-----	38 616	27 016	10 800	800	-----	1 927	-----	4 133	
1922	83 962	4 763	-----	38 369	27 369	10 300	700	-----	1 609	-----	4 455	
1921	87 467	5 596	-----	37 798	27 098	9 860	840	-----	3 265	-----	3 983	
1920	81 915	4 660	-----	37 060	-----	-----	-----	-----	2 481	-----	3 762	
1919	76 710	3 627	-----	36 797	-----	-----	-----	-----	1 521	-----	3 687	
1918	57 347	2 234	-----	38 452	-----	-----	-----	-----	1 206	-----	2 883	
1917	67 590	2 545	-----	40 935	-----	-----	-----	-----	1 505	-----	3 209	
1916	68 075	2 684	-----	43 892	31 742	11 540	610	-----	1 745	-----	3 767	
1915	67 138	2 734	-----	43 118	-----	-----	-----	-----	1 538	-----	4 334	
1914	67 774	2 454	-----	39 392	-----	-----	-----	-----	1 711	-----	4 595	
1913	68 117	2 060	-----	33 917	-----	-----	-----	-----	1 677	-----	4 212	
1912	68 968	1 856	-----	36 198	-----	-----	-----	-----	1 341	-----	4 489	
1911	67 370	1 534	-----	32 856	24 756	7 580	520	-----	1 004	-----	4 058	
1910	63 293	1 155	-----	35 141	-----	-----	-----	-----	636	-----	3 719	
1909	64 408	1 234	-----	36 561	-----	-----	-----	-----	679	-----	3 812	
1908	60 142	1 131	-----	32 735	-----	-----	-----	-----	755	-----	3 338	
1907	57 679	896	-----	35 859	-----	-----	-----	-----	589	-----	3 866	
1906	55 471	806	-----	31 170	24 750	6 040	380	-----	620	-----	3 471	
1905	54 034	781	-----	29 775	-----	-----	-----	-----	486	-----	3 292	
1904	51 168	818	-----	30 258	-----	-----	-----	-----	553	-----	3 285	
1903	49 289	770	-----	31 029	-----	-----	-----	-----	536	-----	3 763	
1902	48 320	1 170	-----	27 119	-----	-----	-----	-----	639	-----	3 499	
1901	43 973	2 361	-----	25 646	20 896	4 370	280	-----	1 729	-----	3 402	
1900	39 673	2 225	-----	24 644	-----	-----	-----	-----	1 754	-----	3 483	
1899	38 937	2 400	-----	23 278	-----	-----	-----	-----	2 137	-----	2 311	
1898	33 915	1 843	-----	20 377	-----	-----	-----	-----	1 799	-----	2 752	
1897	45 661	2 150	-----	22 067	-----	-----	-----	-----	1 620	-----	2 221	
1896	42 077	1 828	-----	21 822	-----	-----	-----	-----	1 441	-----	2 027	
1895	39 145	1 463	-----	20 856	-----	-----	-----	-----	1 108	-----	2 049	
1894	36 987	1 357	-----	19 855	-----	-----	-----	-----	927	-----	2 156	
1893	37 293	1 060	-----	22 750	-----	-----	-----	-----	899	-----	2 473	
1892	29 514	1 130	-----	22 647	-----	-----	-----	-----	816	-----	2 051	
1891	39 418	1 025	-----	22 312	-----	-----	-----	-----	835	-----	1 928	
1890	39 884	1 046	-----	25 313	-----	-----	-----	-----	886	-----	2 105	
1889	39 607	857	-----	23 324	-----	-----	-----	-----	723	-----	2 003	
1888	34 713	971	-----	19 551	-----	-----	-----	-----	832	-----	1 536	
1887	34 420	1 041	-----	20 403	-----	-----	-----	-----	948	-----	1 466	
1886	35 161	645	-----	21 767	-----	-----	-----	-----	594	-----	1 489	
1885	34 697	862	-----	23 285	-----	-----	-----	-----	769	-----	1 549	
1884	34 192	1 230	-----	19 118	-----	-----	-----	-----	1 150	-----	1 284	
1883	33 073	1 238	-----	21 162	-----	-----	-----	-----	1 017	-----	1 259	
1882	30 270	948	-----	18 091	-----	-----	-----	-----	853	-----	1 135	
1881	24 878	678	-----	15 500	-----	-----	-----	-----	565	-----	995	
1880	21 761	634	-----	12 903	-----	-----	-----	-----	514	-----	786	

See footnotes at end of table.

Series W 96-106. Patent Applications Filed and Patents Issued, by Type and by Patentee: 1790 to 1970—Con.

Year	Inventions, patent applications filed ²	Patents issued			Year	Inventions, patent applications filed ²	Patents issued		
		Inventions	Designs	To residents of foreign countries			Inventions	Designs	To residents of foreign countries
1879	20,059	12,125	591	648	1857	4,771	2,674	113	45
1878	20,260	12,845	590	581	1856	4,960	2,302	107	31
1877	20,308	12,920	699	590	1855	4,435	1,881	70	41
1876	21,425	14,169	802	787	1854	3,323	1,755	57	35
1875	21,638	13,291	915	563	1853	2,673	844	86	26
1874	21,602	12,230	886	547	1852	2,639	885	109	20
1873	20,414	11,616	747	498	1851	2,258	752	90	17
1872	18,246	12,180	884	581	1850	2,193	883	83	20
1871	19,472	11,659	903	522	1849	1,955	984	49	17
1870	19,171	12,137	737	644	1848	1,628	583	46	14
1869	19,271	12,931	506	377	1847	1,531	495	60	21
1868	20,420	12,526	445	337	1846	1,272	566	59	19
1867	21,276	12,277	325	275	1845	1,246	473	17	12
1866	15,269	8,863	294	244	1844	1,045	478	12	20
1865	10,664	6,088	221	181	1843	819	493	14	8
1864	6,932	4,630	139	181	1842	761	488	1	11
1863	6,014	3,773	176	125	1841	847	490	-----	21
1862	5,038	3,214	195	80	1840	765	458	-----	19
1861	4,643	3,020	142	83	1839	800	404	-----	10
1860	7,653	4,357	183	49	1838	900	514	-----	17
1859	6,225	4,160	107	47	1837	650	426	-----	7
1858	5,364	3,455	102	28	1836	400	103	-----	8

Year	Inventions, patents issued	Year	Inventions, patents issued	Year	Inventions, patents issued	Year	Inventions, patents issued	Year	Inventions, patents issued
	99		99		99		99		99
1836	599	1826	323	1816	206	1807	99	1798	28
1835	752	1825	304	1815	173	1806	63	1797	51
1834	630	1824	228	1814	210	1805	57	1796	44
1833	586	1823	173	1813	181	1804	84	1795	12
1832	474	1822	200	1812	238	1803	97	1794	22
1831	573	1821	168	1811	215	1802	65	1793	20
1830	544	1820	155	1810	223	1801	44	1792	11
1829	447	1819	156	1809	203	1800	41	1791	33
1828	368	1818	222	1808	158	1799	44	1790	3
1827	331	1817	174						

¹ Since 1942, includes patents issued to Alien Property Custodian, not shown separately. ² Excludes patents issued to Alien Property Custodian. ³ Applications for reissue included with inventions, 1836-1876; design applications included with inventions, 1836-1879. ⁴ Estimate. ⁵ From July 4 to end of year. ⁶ To July 4.

Series W 107-108. Trademarks Registered and Renewed: 1870 to 1970

Year	Registered	Renewed	Year	Registered	Renewed	Year	Registered	Renewed	Year	Registered	Year	Registered
	107	108		107	108		107	108		107		107
1970	21,745	6,076	1950	16,817	3,564	1930	13,246	1,661	1910	4,239	1890	1,415
1969	20,613	6,176	1949	15,968	3,788	1929	14,514	1,750	1909	4,134	1889	1,229
1968	21,528	4,646	1948	11,472	5,056	1928	14,133	2,049	1908	5,191	1888	1,059
1967	20,036	3,801	1947	8,976	6,139	1927	14,579	3,063	1907	7,878	1887	1,133
1966	20,259	3,585	1946	8,106	5,725	1926	14,955	4,273	1906	10,568	1886	1,029
1965	18,501	3,165	1945	7,490	4,210	1925	13,815	2,278	1905	4,490	1885	1,067
1964	20,087	2,702	1944	6,025	4,052	1924	15,727	227	1904	2,153	1884	1,021
1963	19,740	2,655	1943	5,595	3,835	1923	14,834	251	1903	2,136	1883	902
1962	17,023	2,809	1942	6,795	2,894	1922	12,793	254	1902	2,006	1882	947
1961	16,595	3,358	1941	8,530	2,765	1921	11,636	117	1901	1,928	1881	834
1960	18,434	3,933	1940	9,974	2,547	1920	10,268	73	1900	1,721	1880	349
1959	18,709	3,272	1939	10,521	1,398	1919	4,208	64	1899	1,649	1879	872
1958	15,351	3,070	1938	10,204	1,051	1918	4,061	38	1898	1,238	1878	1,455
1957	17,430	3,488	1937	11,242	1,524	1917	5,339	52	1897	1,671	1877	1,216
1956	20,753	3,756	1936	10,722	1,888	1916	6,791	55	1896	1,813	1876	959
1955	18,207	4,268	1935	10,886	1,874	1915	6,262	57	1895	1,829	1875	1,138
1954	15,946	3,491	1934	11,362	2,445	1914	6,317	48	1894	1,806	1874	559
1953	15,610	3,103	1933	9,130	1,671	1913	5,065	-----	1893	1,677	1873	492
1952	16,172	3,419	1932	9,603	1,587	1912	5,020	-----	1892	1,737	1872	491
1951	17,376	3,350	1931	11,400	1,643	1911	4,205	-----	1891	1,762	1871	486
											1870	121

Research and Development (Series W 109-180)

W 109-180. General note.

Historical statistics on research and development expenditures and employment by various groups in the major sectors of the economy are of comparatively recent origin. Public interest in representing the input of research and development activity in terms of some widely used measure, such as funds expended or personnel employed, has been largely incidental to concern with major national issues. During the depression years of the 1930's this interest stemmed from the role that research played in the recovery of the economy. Groups such as the National Research Project of the Work Projects Administration (formerly the Works Progress Administration) and the National Resources Planning Board engaged in studies of the interrelationships among trends in research and development, technological change, unemployment, education, and other major economic and social factors. Their interest in measuring research and development was generally subsidiary to a larger preoccupation with such broad national issues as economic recovery, re-employment, and national planning. The research and development estimates which they published were intended to serve primarily as illustrative background materials.

The period of World War II and its aftermath dramatized the critical place of research and development in the Nation's military security program. Groups concerned with measuring research and development during this period included the Committee on Science and Public Welfare (Bowman Committee), the President's Scientific Research Board, and the Research and Development Board of the Department of Defense. Like the earlier groups, these organizations supplemented fragmentary data already on hand with special inquiries and analyses in order to develop background estimates on research and development trends.

The National Science Foundation, a Federal agency established in 1950, undertook as one of its functions the development of such factual data and related analyses on research and development. As a first step, the Foundation initiated an annual survey of Federal funds for research and development, starting with data on funds for scientific research and development at nonprofit institutions for fiscal 1951 and 1952 and moving thereafter to annual surveys of the funds comprising the "Federal Research and Development Budget."

In 1954, the National Science Foundation undertook the first

effort to measure the volume of research and development activity, in terms of funds and personnel, through surveys of all major types of organizations in the several sectors of the economy which were known to be performing or financing this activity. Out of this effort grew a continuing Foundation program of surveys designed to facilitate preparation of annual estimates on funds and personnel employed in research and development by the major sectors of the economy. Before the National Science Foundation undertook its first surveys, there was no general agreement on such fundamental matters as the definition of research and development; the distinction between the conduct of research and development and such related activities as academic instruction or industrial production; the distinction between basic and applied research and development; and the major characteristics distinguishing various types of research organizations.

National estimates. National estimates of funds spent on the performance of research and development by the four major sectors of the economy have been made by the National Science Foundation for 1953-70. National estimates of funds received from various sources for the performance of research and development have also been made for 1953-70. These series appear in table B-1 of the National Science Foundation publication, *National Patterns of R&D Resources, 1953-72, Funds and Manpower in the United States, (NSF 72-300)*. An analysis of intersectoral flows of transfers of funds for research and development for 1970 appears in table I, below. This table is based on information obtained in the National Science Foundation surveys of funds for research and development in 1970 as presented in table B-1.

The limitations described below indicate that table I should be considered a general approximation rather than an exact statement of the extent to which the different sectors are participating in the financing and performance of research and development.

Detailed information on the scope and limitations of the various surveys appears in the National Science Foundation publications listed below. Generally speaking, the National Science Foundation surveys seek full enumeration of the various segments. The exceptions are industrial firms and the smaller nonprofit institutions for which sampling procedures are employed.

The data in table I are derived basically from survey responses by performers of research and development as to how much they spent

Table I. Intersectoral Transfers of Funds Used for Performance of Research and Development: 1970
[In millions of dollars, except as indicated. Based on reports by performers]

Sources of funds, by sector	Research and development performers				Total		
	Federal Government agencies	Industry ¹	Universities and colleges ²		Other nonprofit institutions ¹	Amount	Percent
			Total	Associated FFRDC's ³			
Federal Government agencies.....	3,855	7,779	1,648	737	745	14,764	56.7
Industry.....		10,283	61		90	10,434	40.1
Universities and colleges.....			461			461	1.8
Other nonprofit institutions.....			165		223	388	1.5
Total	3,855	18,062	2,335	737	1,058	26,047	100.0
Percent.....	14.8	69.3	9.0	2.8	4.1	100.0	100.0

¹ Expenditures for Federally Funded Research and Development Centers (FFRDC's) administered by both industry and by nonprofit institutions are included in the totals of their respective sectors. FFRDC's are organizations exclusively or substantially financed by the Federal Government to meet a particular requirement or to provide major facilities for research and training purposes.

² Includes agricultural experiment stations.
³ Federally Funded Research and Development Centers (FFRDC's) administered by individual universities and colleges and by university-consortia.
⁴ Includes State and local government funds.

on this activity and where their funds originated. The estimates represent final through-transfers from source organizations financing research and development to performing organizations which ultimately used the funds. Every effort was made to net out intermediate transfers.

Research and development in these series consist of basic and applied research in the sciences (including medical sciences) and in engineering and activities in development, all defined below. In terms of fields, the natural sciences—life, physical, and engineering—as well as the social and psychological sciences are covered in the Federal, universities, and other nonprofit sectors. Industry coverage is limited, at present, to the natural sciences. Research and development excludes routine product testing, quality control, mapping surveys, collection of general-purpose statistics, experimental production, and activities concerned primarily with the dissemination of scientific information and the training of scientific manpower.

Research, which is made up of basic and applied, is systematic, intensive study directed toward fuller scientific knowledge of the subject studied.

Basic research. For three of the sectors—Federal Government, universities and colleges, and other nonprofit institutions—the definition of basic research stresses that it is directed toward increases of knowledge in science with “. . . the primary aim of the investigator being a fuller knowledge or understanding of the subject under study, rather than a practical application thereof.” To take account of an individual industrial company’s commercial goals, the definition for the industry sector is modified to indicate that basic research projects represent “original investigations for the advancement of scientific knowledge . . . which do not have specific commercial objectives, although they may be in fields of present or potential interest to the reporting company.”

Applied research. The core definition in the NSF questionnaire sent to the universities and colleges is: “*Applied research* is directed toward practical application of knowledge.” Here again, the definition for the industry survey takes account of the characteristics of industrial organizations—it covers “. . . research projects which represent investigations directed to discovery of new scientific knowledge and which have specific commercial objectives with respect to either projects or processes.” By this definition, applied research in industry differs from basic research chiefly in terms of objectives of the reporting company.

Development. The NSF survey concept of development may be summarized as “. . . the systematic use of scientific knowledge directed toward the production of useful materials, devices, systems or methods, including design and development of prototypes and processes.”

Funds used for research and development refer to current operating costs, consisting of both direct and indirect costs including depreciation, insofar as this information is available to respondents. Capital expenditures are excluded by definition in both the industry and the other nonprofit sectors. Under the accounting practices of some Federal agencies, particularly the Department of Defense, data on the Federal R&D funds, which are available in detail only in terms of obligations rather than expenditures, do not include an allowance for depreciation but do include some obligations for capital items. A small amount of capital outlays is also included in the universities and colleges sector.

The National Science Foundation surveys include data on research and development by Federally Funded Research and Development Centers (FFRDC’s). These are laboratories or similar research undertakings supported wholly or predominantly by the Federal Government but operated under contract by an industrial, university, or independent organization. Data relating to the performance of research and development at these centers are included within the appropriate sector in the estimates for 1956 and later years.

Several groups of organizations comprise the industry sector as represented in table I. Private industrial firms account for over 95 percent of the total funds for performance of research and development

in this sector. (Data for firms appear in series W 144-160.) The remaining groups are FFRDC’s operated by industrial concerns, independent commercial laboratories, and engineering service firms.

The colleges and universities sector consists of institutions of higher education with substantial research programs and of the FFRDC’s operated under contract by educational institutions. Included in institutions of higher education are their affiliated research organizations, agricultural research centers, graduate and professional schools, and affiliated hospitals.

Other nonprofit institutions include privately endowed philanthropic foundations, nonprofit research institutes, voluntary health agencies, academies of science, professional societies, museums, zoological gardens, and arboretums, as well as several FFRDC’s operated by independent organizations.

The data on transfers of funds were based on estimates from many institutions having somewhat different understandings of costs and expenditures. The estimates for Federal agencies, moreover, were based on obligations rather than expenditures, since information on transfers to the other sectors was available only for obligations. (Additional details appear in series W 126-148.)

For detailed information and trend data on R&D funds and scientific personnel, see the following publications: *National Patterns of R&D Resources, Funds and Manpower in the United States* (annual); *Federal Funds for Research, Development, and Other Scientific Activities* (annual); *Research and Development in Industry* (annual); *Scientific Activities at Universities and Colleges* (biennial); *Scientific Activities of Nonprofit Institutions* (periodic); *American Science Manpower* (biennial); *Scientific, Technical, and Health Personnel in the Federal Government* (annual); and *Employment of Scientists and Engineers in the United States, 1950-66*.

Early major efforts to estimate the volume of research and development. The methodology, scope, and limitations of the various series are often summarized in the publications cited below, and any use of these estimates in descriptive or analytical work should be preceded by a careful review of their limitations. Differences in concepts and scope of these earlier series make comparisons with the later NSF data not generally possible.

George Perazich and Philip M. Field, *Industrial Research and Changing Technology*, Work Projects Administration, National Research Project, Philadelphia, 1940, pp. 5-17 and 52-79. This report presents data on research personnel in industrial laboratories for 1920, 1921, 1927, 1931, 1933, and 1938. The data are based on the six directory listings on industrial research laboratories in the United States published by the National Research Council between 1920 and 1938.

National Resources Committee (later, National Resources Planning Board), *Research, A National Resource*, vol. 1, *Relation of the Federal Government to Research*, Report of the National Resources Planning Board Science Committee, 1938. Section 3, pp. 61-112, of this report presents estimates of Federal expenditures for research in 1937 and 1938. Table D, p. 91, summarizes from other sources a number of earlier estimates of Federal expenditures going back as far as 1901. Section 6, pp. 167-193, contains a discussion of research in American universities and colleges. It also provides a general estimate of the dollar volume of expenditures for research and development for 1935-1936.

National Resources Planning Board, *Research, A National Resource*, vol. II, *Industrial Research*, a report of the National Research Council to the National Resources Planning Board, 1941. Section IV, pp. 173-187 of this report, presents estimates of research personnel in industrial laboratories for 1940; and section II, part 7, pp. 120-123, shows research personnel and expenditures in 31 firms for 1937.

U.S. Senate, Committee on Military Affairs, Subcommittee on War Mobilization (Harley M. Kilgore, Chairman), *Report on the Government’s Wartime Research and Development, 1940-44, 1945*. Part I of this report presents detail, and part II summarizes data on funds for research and development for each of 45 Federal agencies

and bureaus, with detail on the fiscal sources of funds and the major categories of recipients for fiscal years 1940 through 1944.

Vannevar Bush, *Science, The Endless Frontier, A Report to the President*, July 1945, appendix 3, "Report of the Committee on Science and Public Welfare" (Isaiah Bowman, Chairman). The Bowman Committee's report to Dr. Bush presents the first known national estimates of trends in scientific research and development expenditures in table I, p. 80. It also contains series on scientific research expenditures (based largely on performance of research) for the following major groups: (a) Industry—annual expenditures estimates for 1920-1940; (b) nonprofit industrial research institutes—annual expenditures estimates for 1930-1942; (c) Government (Federal and State)—annual estimates for 1923-1932, 1934-1938, and 1940-1944; (d) colleges and universities—biennial estimates, 1930, 1932, 1934, 1936, 1938, 1940, and 1942; (e) research institutes (not connected with any industry nor an integral part of any university)—annual estimates for 1930-1940; and (f) total scientific research expenditures—total of the foregoing five series for 1930, 1932, 1934, 1936, 1938, and 1940.

The President's Scientific Research Board (John R. Steelman, Chairman), *Science and Public Policy, A Report to the President*, vols. I, II, and IV, 1947. Based on data in Vannevar Bush, *Science, The Endless Frontier* (cited above, vol. I, *A Program for the Nation*), presents for the even years of 1930-1940 estimated expenditures by the Federal Government, industry, universities, and others. Estimates are also made of the average annual expenditures by major groups for 1941-1945 and of expenditures for 1947. Vol. II, *The Federal Research Program*, presents estimates of Federal "expenditures for research and development in the physical and biological sciences" in fiscal year 1947 based on project reports from the individual agencies. Vol. IV, *Manpower for Research*, presents annual estimates and forecasts of scientists and engineers in industrial research laboratories for 1929-1956.

Helen Wood, Robert Cain, and Joseph H. Schuster, *Scientific Research and Development in American Industry, A Study of Manpower and Costs*, Bulletin No. 1148, U.S. Bureau of Labor Statistics, prepared in cooperation with the Department of Defense, 1953. Data in this publication are based on the first survey specifically designed to obtain research and development performance costs and personnel for private firms. The report presents estimates of expenditures for research and development performed in 1951 by firms reporting. Personnel data cover research and development scientists and engineers employed by these firms in January 1951 and 1952.

Office of the Secretary of Defense, *The Growth of Scientific Research and Development*, 1953. This publication presents annual estimates on sources of research and development funds and on performance of research and development for 1941-1952 for the Federal Government, industry, and nonprofit institutions including colleges and universities. Estimates of the number of scientists and engineers employed in research and development by these broad sectors are also shown for the same years. No methodological notes accompany the estimates. They are known to be based on materials in Wood, Cain, and Schuster (cited above); U.S. Senate Committee on Military Affairs, Subcommittee on War Mobilization (cited above); and other published and unpublished sources.

Office of Education, *Statistics of Higher Education; Receipts, Expenditures, and Property, 1953-54*, 1957. This report presents biennial estimates on expenditures for performance of "Organized research" by institutions of higher education, 1930-1954. See series H 732 in this volume. This is the oldest known current series on research expenditures.

More recently, beginning with Bureau of the Budget, *The Budget of the United States Government, 1955*, the Federal budget documents have carried a special analysis of "Federal Research and Development Programs" summarizing expenditures and/or obligations for research and development and R&D plant on an agency basis. In *The Budget, 1972*, this was Special Analysis R and covered fiscal years 1970, 1971, and 1972.

W 109-125. Funds expended for performance of research and development and basic research, by sector, and major function, 1953-1970.

Source: U.S. National Science Foundation, *National Patterns of R&D Resources, 1953-72*, Funds and Manpower in the United States (NSF 72-300).

The four-sector division followed by the National Science Foundation attempts to take account of both the legal nature and major functions of organizations active in financing and performing basic research, applied research, and development. However, grouping diverse types of organizations into discrete sectors requires certain arbitrary judgments because of the mixed nature of many organizations, particularly those in the university and other nonprofit sectors.

The *Federal sector* is made up of the agencies of the Federal Government.

The *industry sector* consists of both manufacturing and nonmanufacturing companies. Manufacturing is surveyed in major industry groupings; and nonmanufacturing, which includes organizations such as those in selected service industries, is treated as a unit. Federally Funded Research and Development Centers (FFRDC's) administered by industrial firms are also included.

The *universities and colleges sector* is composed of all institutions of higher education, both public and private. The term "universities and colleges" is used to refer to the academic institutions as a group without the associated FFRDC's administered by the schools for various Federal agencies. The universities and colleges comprise the following:

Colleges of liberal arts; schools of arts and sciences; professional schools, such as engineering and medical schools, including affiliated hospitals; associated research institutions, and similar organizations, which are integral parts of the universities and colleges; agricultural experiment stations and associated schools of agriculture.

Funds used at the universities and attributed to the universities sector as a source consist of: (a) State and local government funds separately budgeted for research and development, (b) the direct or indirect costs of R&D performance sponsored by outside organizations that were defrayed in part by universities and colleges in accordance with cost sharing or other arrangements, and (c) unrestricted or general funds which the institutions themselves have been free to allocate for research either through their instructional or departmental budget or through their own separately budgeted research. Funds from the Federal Government, industry, or other nonprofit institutions, which are supplied in the form of grants or contracts for research or development at a university, are credited to the appropriate source in the performance of research and development by universities and colleges. Thus, research contracts from industry are treated as university performance funded by industry as the source, whereas funds given to the institution by industry for general educational purposes and used by the school, at its discretion, for research, are treated as university performance financed with the university's own funds.

Institutions in the *other nonprofit sector* fall into two general groups: (1) Organizations that are primarily granting in nature, namely private philanthropic foundations and voluntary health agencies, and (2) public and private organizations that are primarily involved in performing research and development, comprising separately incorporated nonprofit research institutes, professional societies, academies of science, museums, zoological gardens, botanical gardens, arboretums, nonprofit hospitals, and FFRDC's administered by nonprofit organizations.

In these series, both the university and the other nonprofit sectors contain private and public institutions—the latter either closely associated with or considered a part of State or local government. A number of organizations in both sectors, as well as in industry, also receive State and local government funds.

In the Foundation's surveys, respondents in all four sectors indicate the amounts they spend on research and development in their own sector and the sources of these funds. The National Science Foundation bases all national totals on data as reported by performers because institutions doing research and development are in the best position to: (a) indicate how much they spent in the actual conduct of research and development in a given year, (b) classify their work as basic, applied, etc. and (c) identify the sector of the economy in which their financing originated. The use of performer reporting throughout also reduces the possibility of double counting. Because the national time series on Federal funds spent in research and development are based on expenditures reported by organizations which have actually performed the research and development, they differ from the series in *Federal Funds for Research, Development, and Other Scientific Activities* on agency obligations for research and development to be performed in the non-Federal sectors. Federal agency obligations are used in the series only for intramural performance in agency laboratories where they are treated as the equivalent of expenditures. Expenses of Federal personnel engaged in planning and administering intramural and extramural R&D programs are also included in the intramural performance total.

W 126-143. Federal funds for research and development, by agency, 1947-1970.

Source: 1947-1951, U.S. Bureau of the Budget (now the Office of Management and Budget), unpublished data; 1952-1970, U.S. National Science Foundation, *Federal Funds for Research, Development, and Other Scientific Activities*, Vol. XXI.

Obligations represent orders placed, contracts awarded, services received, and similar transactions during a given period, regardless of when the funds were appropriated and when future payment of money is required. One of the limitations of these data is that they are two series compiled at different times and on somewhat different bases. The first series, FY 1947-51, was compiled by the Bureau of the Budget. The second series, FY 1952-70, is based on agency submissions to the National Science Foundation for its annual survey on *Federal Funds for Research, Development, and Other Scientific Activities*. Since Government accounting does not use research and development as a uniform bookkeeping category for all agencies, the data represent estimates by informed persons.

Expenditures represent checks issued and cash payments made during a given period, regardless of when the funds were appropriated.

For agencies operating on a cost-type budget, accrued expenditures and costs are reported instead of obligations. Accrued expenditures represent all costs accrued during the reporting period except those subject to reimbursement from other agencies.

The obligations and expenditures reported cover all transactions from all funds available from direct appropriations, trust funds or special account receipts, corporate income, or other sources, including funds appropriated to the President that an agency received or expects to receive. The amounts reported for each year reflect obligations and expenditures for that year regardless of when the funds were originally authorized or received and regardless of whether they were appropriated, received, or identified specifically for research, development, or R&D plant.

Funds reported for research and development reflect full costs. In addition to costs of specific R&D projects, the applicable overhead costs are also included. The amounts reported include the costs of planning and administering R&D programs, laboratory overhead, pay of military personnel, and departmental administration.

R&D plant (or R&D facilities and fixed equipment, such as reactors, wind tunnels, and radio telescopes) includes acquisition of, construction of, major repairs to, or alterations in structures, works, equipment, facilities, or land, for use in R&D activities at Federal or non-Federal installations. Excluded from the R&D plant category are expendable equipment and office furniture and equipment. Obliga-

tions for foreign R&D plant are limited to Federal funds for facilities located abroad and used in support of foreign research and development.

W 144-160. Funds for industrial research and development, by industry, 1956-1970.

Source: U.S. National Science Foundation, *Research and Development in Industry*, annual reports.

The report covering R&D expenditures for 1956 and 1957 follows the general format used in subsequent annual reports. The National Science Foundation also sponsored two industry surveys covering the 1953-56 period, which were conducted by the U.S. Bureau of Labor Statistics (BLS): *Science and Engineering in American Industry, Final Report on a 1953-54 Survey* (NSF 56-16) and *Science and Engineering in American Industry, 1956* (NSF 59-50). Data obtained in the BLS surveys are not directly comparable with U.S. Bureau of the Census figures for 1957-70 because of methodological and other differences in the surveys conducted by the two agencies and have, therefore, been excluded. In addition, the Census surveys, beginning in 1957, have collected data on the R&D activities of Federally Funded Research and Development Centers (FFRDC's) operated by business firms, whereas the earlier BLS surveys did not. To account for the R&D performance of these research centers in 1956, Census adjusted data for that year (collected in the 1957 survey) to provide comparable trend data from 1956 forward.

The surveys in this series have made use of the "shuttle" type questionnaire, permitting respondents to report information for the current year and at the same time make revisions as necessary in figures for the preceding year, which were preentered by the Bureau of the Census.

Research and development as defined in these series, includes basic and applied research in the physical and life sciences (including medicine) and in engineering, and design and development of prototypes and processes. This definition excludes quality control, routine product testing, market exploration, research in the social sciences or psychology, or other nontechnological activities or technical services.

Expenditures, as defined in these series, include salaries of research and development scientists and engineers and their supporting personnel, other direct costs, service and supporting costs, plus attributable overhead expenses incurred in such items as administration, depreciation, and rent. Expenditures also include Federal funds for private industry performance of research and development ranging from about 40 percent of total expenditures in 1953 to about 50 percent in 1970. The totals exclude capital expenditures and patent expenses.

The industry surveys conducted by the Bureau of the Census for the National Science Foundation use the company as the reporting unit. The company is defined as a corporate entity that includes all establishments under common ownership or control. Each company is classified in a single industry on the basis of its primary business activity, although many companies engage in research and development and productive activities outside the industry in which they are classified. Since many firms are active in several diverse product fields, data collected in this survey are not comparable with figures reported elsewhere on an establishment basis.

For the period 1963-70, companies in the survey have been assigned an industry classification based on the 1963 economic censuses conducted by the Bureau of the Census. Similarly, figures for 1958 and earlier years are based on the company classifications resulting from the 1958 economic censuses. To provide a continuous time series, individual industry data for 1959-1962 (previously classified on the 1958 basis) have been adjusted to account for the differences in absolute level resulting from the two classifications. A detailed explanation of the adjustment technique is contained in the Technical Notes section of the industry reports.

RESEARCH AND DEVELOPMENT

W 109-125

Series W 109-125. Funds Expended for Performance of Research and Development and Basic Research, by Sector and Major Function: 1953 to 1970

[Amounts in millions of dollars]

Year	Total funds	Percent Federal as source	By performance sector										By major function				
			Federal Government	Industry		Universities and colleges				FFRDC's ²	Other nonprofit institutions			Defense ⁴	Space ⁴	Other	
				Federal funds	Industry funds	Federal funds	Industry funds	Universities and colleges funds ¹	Other nonprofit institutions funds ¹		Federal funds	Industry funds	Other funds ³			Non-Federal	Federal
RESEARCH AND DEVELOPMENT ⁵																	
1970	26,545	55.6	3,853	7,779	10,283	1,648	61	961	166	737	748	90	220	8,388	2,840	11,786	3,531
1969	26,169	57.0	3,501	8,451	9,867	1,595	60	895	145	725	640	81	209	8,767	2,905	11,253	3,244
1968	25,119	59.5	3,493	8,560	8,869	1,572	55	841	131	719	608	73	198	8,515	3,291	10,173	3,140
1967	23,613	61.1	3,396	8,365	8,020	1,409	48	753	119	673	577	66	187	8,005	3,377	9,209	3,022
1966	22,264	62.8	3,220	8,332	7,216	1,262	42	673	108	630	546	59	176	7,124	4,230	8,260	2,649
1965	20,439	63.8	3,093	7,740	6,445	1,073	41	615	93	629	498	53	159	6,602	4,170	7,397	2,269
1964	19,214	65.3	2,838	7,720	5,792	916	41	555	83	629	450	47	143	6,936	3,555	6,667	2,056
1963	17,371	64.6	2,279	7,270	5,360	760	41	485	73	530	380	48	145	7,053	2,380	6,149	1,789
1962	15,665	63.4	2,098	6,435	5,029	613	40	424	66	470	310	45	135	7,363	1,050	5,749	1,504
1961	14,552	63.7	1,874	6,240	4,668	500	40	371	58	410	240	41	110	7,160	800	5,282	1,310
1960	13,730	63.7	1,726	6,081	4,428	405	40	328	52	360	180	40	90	7,085	426	4,984	1,235
1959	12,540	64.3	1,640	5,635	3,983	306	39	290	47	338	140	35	87	6,684	314	4,477	1,066
1958	10,870	62.5	1,374	4,759	3,630	254	39	257	42	293	111	31	80	5,652	109	4,076	1,033
1957	9,912	61.7	1,220	4,335	3,396	229	34	230	38	240	95	30	65	5,174	99	3,796	843
1956	8,483	57.3	1,040	3,328	3,277	213	29	204	34	194	84	30	50	4,123	76	3,622	662
1955	6,279	55.9	905	2,180	2,460	169	25	185	30	180	75	28	42	2,976	63	2,769	471
1954	5,738	54.7	1,020	1,750	2,320	160	22	167	28	141	67	25	38	2,766	52	2,599	321
1953 ⁶	5,207	53.0	1,010	1,430	2,200	138	19	151	26	121	60	20	32	2,473	42	2,447	245
BASIC RESEARCH																	
1970	3,943	62.6	646	158	471	1,296	40	748	110	269	100	25	80				
1969	3,758	63.5	565	160	458	1,275	39	678	95	275	111	22	80				
1968	3,648	64.3	502	180	462	1,268	36	621	86	276	118	20	79				
1967	3,357	64.7	472	202	427	1,124	31	551	79	250	125	19	77				
1966	3,123	63.6	445	173	451	1,009	27	494	71	227	132	18	76				
1965	2,853	63.7	424	186	406	879	26	445	69	208	120	16	74				
1964	2,559	62.3	364	165	384	767	25	402	67	191	108	15	71				
1963	2,196	59.7	299	147	375	610	25	343	58	159	95	14	71				
1962	1,886	57.8	251	143	345	481	25	293	51	136	80	12	69				
1961	1,543	54.5	206	81	314	382	25	250	44	115	57	11	58				
1960	1,326	52.3	160	79	297	299	24	215	38	97	58	10	49				
1959	1,155	52.7	173	72	248	226	24	185	33	92	46	8	48				
1958	973	47.3	126	43	252	178	24	159	29	78	35	6	43				
1957	857	47.6	122	41	230	155	21	136	25	65	25	5	32				
1956	747	46.2	104	37	216	130	18	116	22	51	23	5	25				
1955	608	47.0	90	27	162	103	16	99	19	49	17	5	21				
1954	548	48.4	102	23	143	90	14	85	17	39	11	4	20				
1953 ⁶	439	47.9	101	19	132	73	12	73	15	33	8	4	19				

¹ Includes State and local government funds received by these institutions and used for research and development.

² Federally Funded Research and Development Centers administered by individual universities and colleges and by university consortia.

³ Includes estimates for independent nonprofit hospitals and voluntary health agencies.

⁴ Defense expenditures consist of all R&D spending by the Department of Defense (DOD) and a portion of Atomic Energy Commission funds. Space R&D expenditures

are those of the National Aeronautics and Space Administration. The space activities of DOD are included as spending on defense. The space activities of other Federal agencies are not included; they are estimated to account for less than 5 percent of all space R&D spending.

⁵ Basic research, applied research, and development.

⁶ Calendar year data for industry and nonprofit institutions combined with Federal and university data for fiscal year 1953 (July 1952-June 1953).

Series W 126-143. Federal Funds for Research and Development, by Agency: 1947 to 1970

[In millions of dollars. For years ending June 30]

Year	Obligations ¹																Expenditures	
	Total	Departments of—															Research and development	R & D plant
		Agriculture	Commerce ²	Defense					Health, Education, and Welfare ⁴		Interior	Atomic Energy Commission	National Aeronautics and Space Administration ⁵	National Science Foundation	Veterans Administration	All other ³		
				Total	Army ³	Navy ³	Air Force ³	Other	Total	National Institutes of Health								
126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	
1970	15,340.3	281.2	121.6	7,360.4	1,659.8	2,257.9	2,990.0	452.7	1,221.0	873.3	157.9	1,346.0	3,799.9	239.0	58.6	704.7	15,157.0	578.9
1969	15,641.1	260.1	72.1	7,696.3	1,643.8	2,124.2	3,498.5	429.6	1,297.4	892.9	207.6	1,405.9	3,963.3	273.8	50.2	414.4	15,695.4	652.2
1968	15,921.4	253.5	83.9	7,709.3	1,563.4	2,024.3	3,621.7	499.3	1,251.8	864.0	190.6	1,369.0	4,429.4	233.5	44.7	305.7	16,333.0	715.9
1967	16,529.3	252.6	74.8	8,049.2	1,661.3	2,108.9	3,794.3	484.6	1,146.6	802.8	170.4	1,257.3	4,867.0	282.4	40.9	408.0	16,073.0	786.1
1966	15,320.4	234.9	55.2	7,023.6	1,585.4	1,601.7	3,342.3	494.2	1,014.4	701.0	143.2	1,212.4	5,050.0	243.7	40.1	303.0	14,970.2	1,047.8
1965	14,614.3	224.6	61.3	6,795.5	1,459.5	1,449.5	3,351.0	536.5	869.4	715.1	113.2	1,240.7	4,951.5	187.2	37.4	132.7	13,811.4	1,077.4
1964	14,225.4	189.0	53.8	7,261.9	1,376.9	1,621.2	3,784.0	479.7	776.9	651.0	106.4	1,238.0	4,288.6	170.2	33.7	110.8	13,758.9	948.1
1963	12,494.7	168.0	52.2	7,285.7	1,297.4	1,597.3	3,944.7	446.3	656.2	566.0	92.1	1,077.9	3,857.4	154.1	29.9	121.1	11,338.5	673.6
1962	10,289.9	157.2	40.1	6,722.9	1,203.5	1,539.1	3,569.3	410.6	576.9	495.1	85.6	1,029.2	3,439.2	113.9	27.5	97.4	9,831.6	555.2
1961	9,058.6	143.4	32.3	6,574.0	1,117.9	1,539.0	3,568.9	328.3	428.5	375.4	73.3	850.2	2,776.9	84.0	22.0	73.9	8,747.9	539.1
1960	7,551.7	125.8	31.4	5,711.5	1,117.0	1,535.5	3,815.5	243.6	319.8	274.3	64.0	761.7	369.3	74.7	15.1	78.5	7,300.4	443.8
1959	6,993.5	120.7	25.6	5,161.6	1,174.2	1,349.5	2,440.0	197.9	242.8	211.7	60.6	699.8	261.7	60.4	12.8	47.5	5,459.3	347.1
1958	4,569.7	110.2	18.3	3,403.3	603.3	867.9	1,858.6	73.5	164.9	157.4	51.1	644.0	77.1	33.6	10.1	37.3	4,648.4	342.2
1957	3,932.0	99.8	17.7	2,985.6	500.6	804.2	1,643.9	36.9	144.2	124.7	45.2	528.0	55.3	30.6	7.7	17.9	4,118.9	342.9
1956	2,988.2	83.0	18.2	2,268.6	408.0	673.3	1,142.8	44.5	86.0	(NA)	36.1	410.7	49.5	16.0	6.5	13.6	3,231.9	214.1
1955	2,532.8	72.2	15.0	1,945.1	419.3	564.8	939.3	21.7	68.0	(NA)	32.4	327.3	43.0	9.7	5.6	14.5	3,100.1	208.2
1954	2,375.0	59.3	7.3	2,320.0	763.3	615.3	941.4	-----	58.2	48.4	37.7	323.4	47.3	4.6	5.3	11.3	2,884.6	263.3
1953	3,106.0	56.0	10.9	2,577.2	899.6	660.7	1,016.9	-----	49.9	38.0	32.1	309.9	48.4	2.3	5.1	14.1	2,825.6	275.4
1952	1,887.3	55.3	10.3	1,508.3	458.8	551.1	498.6	-----	43.6	33.0	30.7	168.9	50.5	9.9	3.9	14.7	1,548.2	268.0
1951	1,481.9	55.1	11.0	1,126.9	307.1	450.2	368.6	-----	37.9	-----	30.4	157.9	45.4	1.1	5.1	13.0	-----	-----
1950	972.6	56.9	22.4	599.7	119.0	257.6	223.1	-----	34.2	-----	28.7	172.2	42.8	-----	3.8	11.8	-----	-----
1949	937.7	53.2	10.3	626.1	114.7	298.0	213.5	-----	25.2	-----	30.2	140.0	33.3	-----	4.3	9.6	-----	-----
1948	776.5	45.7	8.9	485.8	97.7	247.3	140.8	-----	24.3	-----	20.3	145.4	33.0	-----	3.1	10.0	-----	-----
1947	619.5	40.0	5.7	469.3	104.3	262.3	112.7	-----	10.6	-----	16.9	39.9	26.7	-----	1.4	8.9	-----	-----

NA Not available.
¹ Excludes R & D plant.
² Beginning 1966, the Bureau of Public Roads and the Office of Transportation Research and Development, formerly in the Department of Commerce, are included in "All other."
³ Includes pay and allowances of military R & D personnel beginning in fiscal year 1953, and support from procurement appropriations for development, test, and evaluation, starting with fiscal year 1954.
⁴ Federal Security Agency prior to fiscal year 1952.
⁵ National Advisory Committee for Aeronautics prior to fiscal year 1958.

Series W 144-160. Funds for Industrial Research and Development, by Industry: 1956 to 1970

[In millions of dollars]

Year	Total	Food and kindred products	Textiles and apparel	Lumber, wood products and furniture	Paper and allied products	Chemicals and allied products	Petroleum refining and extraction	Rubber products	Stone, clay, and glass products	Primary metals	Fabricated metal products	Machinery	Electrical equipment and communications	Motor vehicles and other transportation equipment	Aircraft and missiles	Professional and scientific instruments	All other industries
1970	18,062	235	58	48	178	1,766	515	220	157	275	200	1,649	4,352	1,582	5,245	745	837
1969	18,318	205	70	15	188	1,659	467	217	159	257	182	1,536	4,401	1,558	5,909	734	762
1968	17,429	187	58	19	144	1,588	437	205	142	251	133	1,477	4,105	1,491	5,776	660	705
1967	16,385	183	57	12	128	1,507	371	182	136	242	163	1,326	3,867	1,354	5,669	542	649
1966	15,548	164	51	12	117	1,407	371	168	117	232	154	1,217	3,626	1,344	5,526	468	574
1965	14,185	157	38	11	94	1,356	397	162	112	213	145	1,065	3,200	1,230	5,148	403	455
1964	13,512	144	32	12	77	1,284	393	158	109	195	148	1,015	2,972	1,182	5,078	331	384
1963	12,630	130	30	11	69	1,239	317	156	100	183	153	958	2,866	1,090	4,712	284	330
1962	11,464	121	28	10	65	1,175	310	141	96	171	146	914	2,639	999	4,042	309	299
1961	10,908	125	30	10	59	1,101	299	138	88	177	136	901	2,433	936	3,829	297	299
1960	10,509	104	38	10	56	980	296	121	88	177	145	949	2,532	889	3,514	329	287
1959	9,618	91	30	12	49	891	278	115	81	152	138	930	2,329	866	3,090	309	257
1958	8,389	83	26	12	42	792	246	89	75	131	162	781	1,969	856	2,609	294	222
1957	7,731	74	15	14	35	705	211	107	69	108	135	669	1,804	707	2,574	249	(¹)
1956	6,605	64	(¹)	(¹)	36	641	182	(¹)	60	90	116	543	1,516	688	2,138	200	(¹)

¹ Not available separately; included in total.

RESEARCH AND DEVELOPMENT

W 161-180

Series W 161-167. Funds for Industrial Research and Development, by Character of Work, and Cost Per Scientist or Engineer: 1953 to 1970

Year	Research and development (mil. dol.)					R & D scientists and engineers ¹	Cost per R & D scientist or engineer	Year	Research and development (mil. dol.)					R & D scientists and engineers ¹	Cost per R & D scientist or engineer
	Total	Research			Development				Total	Research			Development		
		Total	Basic	Applied						Total	Basic	Applied			
		161	162	163						164	165	166			
1970	18,062	4,028	629	3,399	14,034	375,450	\$48,100	1960	10,509	2,405	376	2,029	8,104	302,050	\$34,800
1969	18,318	3,905	618	3,237	14,413	385,600	47,500	1959	9,618	2,311	320	1,991	7,307	280,200	34,300
1968	17,429	3,766	642	3,124	13,663	381,900	45,600	1958	8,389	2,206	295	1,911	6,183	256,100	32,800
1967	16,385	3,544	629	2,915	12,841	371,950	44,100	1957	7,731	1,941	271	1,670	5,790	236,600	32,700
1966	15,548	3,467	624	2,843	12,081	360,200	43,200	1956	6,605	1,521	253	1,268	5,084		
1965	14,185	3,250	592	2,658	10,935	348,400	40,700	1955	4,640	1,117	189	928	3,523		
1964	13,512	3,149	549	2,600	10,363	341,900	39,500	1954	4,070	980	166	814	3,090		
1963	12,630	2,979	522	2,457	9,651	333,750	37,200	1953	3,630	877	151	726	2,753		
1962	11,464	2,937	488	2,449	8,527	319,650	35,900								
1961	10,908	2,372	395	1,977	8,536	312,050	35,000								

¹ For 1957-69, the number of R & D scientists and engineers was derived by using the arithmetic mean of the full-time-equivalent number of R & D scientists and engineers employed in January of two consecutive years; for 1970, man-years were used.

Series W 168-180. Employment of Natural Scientists and Engineers: 1950 to 1970

[In thousands]

Year	Total, scientists and engineers	Scientists, by field of employment									Employed in research and development		
		Total	Chemists	Mathematicians	Physicists	Geologists, etc.	Other physical	Agricultural	Biological	Medical	Total	Engineers	Scientists
		168	169	170	171	172	173	174	175	176	177	178	179
1970	1,595	496	133	74	49	31	36	49	71	53	535	342	194
1969	1,568	483	131	73	48	29	35	48	63	51	549	357	192
1968	1,525	462	127	67	46	29	34	47	66	46	553	359	194
1967	1,477	439	123	62	44	28	30	47	63	42	554	358	195
1966	1,418	418	120	54	42	26	29	47	57	43	526	339	186
1965	1,367	397	117	50	40	26	27	44	56	37	513	331	183
1964	1,327	381	115	47	39	23	26	42	54	35	498	322	176
1963	1,281	359	110	44	36	23	25	39	51	31	478	311	165
1962	1,210	337	107	40	34	21	24	35	49	27	442	284	157
1961	1,152	319	103	36	32	21	24	32	47	24	410	263	146
1960	1,104	303	100	34	30	20	22	30	45	22	386	249	138
1959	1,058	291	95	32	29	21	21	30	43	20	362	233	129
1958	1,001	272	91	29	26	20	21	27	39	19	330	210	120
1957	959	251	85	26	24	20	21	26	35	16	309	198	111
1956	874	228	79	23	21	18	19	24	30	14	271	171	100
1955	813	210	74	21	20	17	17	22	27	12	249	156	93
1954	784	204	72	20	19	16	17	22	26	12	244	153	91
1953	749	194	68	18	18	16	17	22	24	11	228	143	85
1952	686	178	63	16	17	14	15	20	23	10	205	126	79
1951	612	161	57	15	15	13	12	18	21	10	175	106	70
1950	557	149	52	14	14	13	10	17	20	9	158	94	64