

### Productivity in industry and government, 1973-94

Alexander Kronemer

The productivity of workers in the nonfarm business sector of the U.S. economy rose by just half a percent in 1994, marking the second year in a row that productivity grew by less than 1 percent. Labor productivity data at the industry level reflect this trend by recording no change from the previous year in the proportion of measured industries registering productivity growth. In 1994, as in 1993, 70 percent of the industries for which data were available recorded labor productivity gains in their production processes.

The underlying trends in output and hours between the 2 years were somewhat different, however. The proportion of measured industries showing growing output and employee hours increased between 1993 and 1994. Output grew in 79 percent of the measured industries in 1994, up from 72 percent in the previous year, while hours rose in 62 percent of them, up from 53 percent in 1993.

This report summarizes these and other findings from a recent BLS update of industry and government productivity statistics. The updated measures are published to the most recent year allowed by the availability of current data which, in most cases, is 1994. The productivity statistics in this report compare output (the production of goods and services) to one or more inputs of production (such as labor hours).<sup>1</sup>

The first section examines labor productivity in selected industries of the private sector. For these industries, labor productivity is calculated as the ratio of output to employee hours.<sup>2</sup> In the second section, the report examines

growth rates of multifactor productivity for a subset of industries. Multifactor productivity relates output to the combined inputs of labor, capital, and intermediate purchases. Finally, productivity statistics for a variety of Federal Government functions are reviewed. They measure the relationship between the output of government organizations and the corresponding labor input computed in employee years. Due to budget reductions, the productivity measurement program for the Federal sector has been terminated; statistics presented here represent the final results of the program. BLS Report 906 discusses the history and trends in Federal productivity between 1967 and 1994.

#### Labor productivity

BLS currently measures labor productivity for 148 specific industries. In addition, BLS also publishes data on 30 measures defined at higher levels of aggregation, for a total of 178 published series. The analysis in this section refers only to the specific industry measures. Available data allowed 143 of them to be updated to 1994. Together, the total employment of the measured industries covers nearly 40 percent of the total U.S. nonfarm business sector. (The nonfarm business sector accounts for about 75 percent of gross domestic product and excludes the output of general government, nonprofit institutions, private household workers, and the rental value of owner-occupied dwellings.)

The developments in industry productivity in 1994 occurred during the fourth year of the current business cycle recovery.<sup>3</sup> It is possible to chart the trends in productivity, output, and employee hours during these 4 years, and put 1994 into context. (See chart 1.) As can be seen in the chart, during the current business cycle recovery to date, the proportion of published industries that registered productivity growth was high-

est in 1992. The proportion then declined and has remained steady for 2 years. The percentages of industries recording increases in output and hours have risen constantly during the entire period.

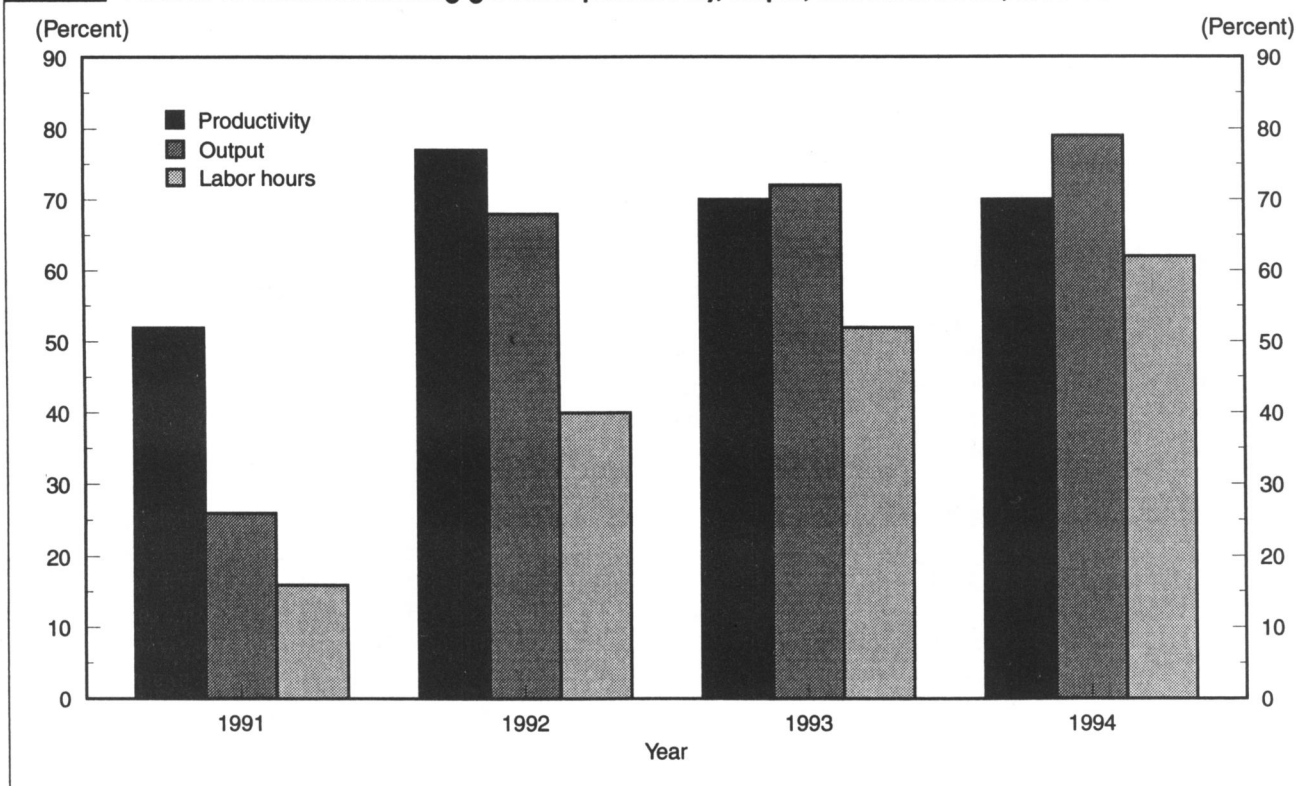
Corresponding trends are found for productivity growth in the overall nonfarm business sector. For the nonfarm business sector, the peak year for productivity improvement was also 1992, when a 3.4-percent growth rate was recorded, while the peak year for growth in output and employee hours was in 1994.

Data to construct industry productivity measures for specific industries in 1995 are not yet available. However, statistics for the nonfarm business sector are available and show that, for the third straight year, productivity growth remained at less than 1 percent. Output and hours both continued to grow, though more slowly than in 1994. Measures of 1995 productivity at the detailed industry level are expected to be available in the spring of 1997.

*Goods-producing sector.* Sixty-nine percent of the measured industries in the goods-producing sector recorded productivity growth in 1994. This was down slightly from 71 percent in 1993. Output grew in 77 percent of the goods-producing industries, up from 72 percent in 1993, and employee hours increased in 63 percent, up from 50 percent. The goods-producing sector comprises the manufacturing, mining, and construction industries.<sup>4</sup> The measured industries in this sector account for about 40 percent of all employment in the sector.

Twenty of these industries employ 100,000 or more workers. Seventeen of these large employers recorded productivity growth in 1994, and most posted rates well above the 0.5-percent average of the nonfarm business sector. Five had productivity increases of greater than 6 percent. These five industries, which included steel and crude petroleum and natural gas production, were among the top quarter of all the mea-

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**Chart 1. Percent of industries showing growth in productivity, output, and labor hours, 1991–94**

sured goods-producing industries in terms of productivity growth in 1994. Aircraft manufacturing had the worst productivity performance among the large industries. It was also the only large industry to experience a drop in output.<sup>5</sup> (See table 1.)

**Service-producing sector.** The proportion of measured service-producing industries showing productivity growth climbed to 72 percent in 1994, up from 63 percent in 1993. This gave the service-producing sector a slightly greater percentage of measured industries showing productivity improvement than the goods-producing sector. The service-producing sector also had a greater proportion of industries showing output growth, and fewer registering increases in employee hours than the goods-producing sector. Output growth was recorded in 86 percent of the service-producing industries, up from 70 percent in 1993, while

increases in employee hours were registered by 55 percent, down from 62 percent in 1993. Although a higher proportion of service-producing industries recorded productivity improvement in 1994 than in 1993, this was not a high for the 1990–94 period. As with the goods-producing sector, 1992 remains the highest year in the period for the proportion of service sector industries recording productivity gains (77 percent).

The service-producing sector comprises transportation, utilities, communications, wholesale and retail trade, finance, insurance, real estate, and the services industry. (Note the distinction between the *services* industry, which includes personal, business, health, legal, and educational services, and the much broader *service-producing* sector.) As was the case for goods producers, the measured industries in this sector account for about 40 percent of all employment in the sector.

The service-producing sector includes some of the largest industries in the U.S. nonfarm business economy. Many of these are found in retail and wholesale trade. Eating and drinking places, with more than 7 million employees, is the largest industry for which BLS measures productivity. It posted a productivity increase of 0.7 percent in 1994, as output increased by 4.9 percent and employee hours rose 4.2 percent. Among the largest service-producing industries, radio, television, and computers stores, with 364,000 employees, posted the highest productivity growth rate in 1994—15.1 percent. (See table 2.)

As was the case among the goods-producing industries, most of the service sector industries with employment greater than 100,000 recorded higher output in 1994. Output for the nonfarm business sector rose 4.2 percent in 1994, and almost half of the large service-pro-

**Table 1. Measured goods-producing industries with employment greater than 100,000, from highest to lowest productivity rates, 1994**

[Percent change]

SIC code	Industry	1994 employment (thousands)	Productivity	Output	Hours
2869	Industrial organic chemicals, n.e.c. ...	115	9.2	3.6	-5.1
261,2,3	Pulp, paper, and paperboard mills ....	232	6.6	6.0	-6
221,2	Cotton and synthetic broadwoven fabrics .....	149	6.4	4.3	-1.9
331	Steel .....	239	6.3	7.2	.8
131	Crude petroleum and natural gas production .....	162	6.2	.3	-5.5
2653	Corrugated and solid fiber boxes .....	125	4.8	7.9	3.0
3465	Automotive stampings .....	106	3.1	10.2	6.9
14	Nonmetallic minerals, except fuels ...	103	3.7	6.6	2.9
3585	Refrigeration and heating equipment .....	129	3.6	13.9	10.0
12	Coal mining .....	112	3.4	8.9	5.4
291	Petroleum refining .....	109	3.1	.0	-3.0
308	Miscellaneous plastics products, n.e.c. ....	690	3.0	9.7	6.5
371	Motor vehicles and equipment .....	899	3.0	14.3	10.9
2421	Sawmills and planing mills, general .....	150	1.1	5.8	4.7
205	Bakery products .....	213	.8	3.3	2.5
2511,17	Wood household furniture .....	132	.2	3.0	2.8
2015	Poultry dressing and processing .....	224	.1	4.6	4.5
2431	Millwork .....	110	-3.1	4.1	7.4
2011	Meat packing plants .....	138	-3.7	.3	4.2
3721	Aircraft manufacturing .....	271	-7.5	-16.9	-10.1

NOTE: n.e.c. = not elsewhere classified.

**Table 2. Measured service-producing industries with employment greater than 100,000, from highest to lowest productivity rates, 1994**

[Percent change]

SIC code	Industry	1994 employment (thousands)	Productivity	Output	Hours
573	Radio, television, and computer stores .....	364	15.1	24.8	8.5
753	Automotive repair shops .....	543	7.6	7.0	-.5
525	Hardware stores .....	175	6.9	5.7	-1.3
566	Shoe stores .....	211	6.3	1.0	-5.0
491,3 (pt.)	Electric utilities .....	564	5.9	3.0	-2.8
565	Family clothing stores .....	337	4.6	6.6	2.0
723	Beauty shops .....	385	4.3	1.1	-3.1
531	Department stores .....	212	3.3	8.2	4.7
701	Hotels and motels .....	1,566	3.3	4.2	.9
553	Auto and home supply stores .....	392	2.5	6.1	3.6
554	Gasoline service stations .....	662	2.3	2.4	.0
546	Retail bakeries .....	190	2.1	5.4	3.2
721	Laundry, cleaning, and garment services .....	423	2.0	1.1	-.9
4512,13,22 (pts.)	Air transportation .....	584	1.8	3.4	1.5
594	Miscellaneous shopping goods stores .....	1,058	1.6	4.1	2.5
551	New and used car dealers .....	964	1.4	6.8	5.3
481	Telephone communications .....	903	.9	4.0	2.9
58	Eating and drinking places .....	7,354	.7	4.9	4.2
571	Furniture and homefurnishing stores .....	563	-.2	5.2	5.5
562	Women's clothing stores .....	361	-.3	-3.8	-3.6
591	Drug stores and proprietary stores ...	611	-1.0	.2	1.0
541	Grocery stores .....	3,047	-1.1	.3	1.5
5093	Scrap and waste materials .....	142	-2.6	8.3	11.3
592	Liquor stores .....	148	-3.8	.9	4.9
492,3 (pt.)	Gas utilities .....	190	-4.5	-6.0	-1.5
533	Variety stores .....	149	-8.9	-13.6	-5.1

ducing industries had output gains equal to or greater than that.

Of the large service-producing industries that registered the 10 strongest productivity increases in 1994, all recorded output gains and half experienced reductions in hours. This was particularly striking in several industries, such as automotive repair shops and hardware stores, which achieved solid output increases with fewer hours input.

*Long-term trends, 1973-94.* Productivity increased in 89 percent of the 139 industries with data available for the period 1973 to 1994. Average annual changes in productivity ranged from a low of -2.0 percent per year in crude petroleum and natural gas production to a high of 10.3 percent per year in household audio and video equipment. Output rose in 67 percent of the industries and hours in 33 percent.

When the industries are divided according to whether they are in the goods-producing or service-producing sectors, differences are evident. (See chart 2.) Among the measured goods-producing industries, 91 percent recorded productivity gains, 63 percent had growing output, and 24 percent increased labor hours from 1973-94. In the service-producing sector, only 81 percent recorded productivity gains over the period. Output rose for 81 percent and labor hours increased for fully 70 percent.

Among the largest measured industries, most experienced long-term productivity growth, although again there were differences between the two sectors. In the entire nonfarm business sector, productivity grew at an average annual rate of 1.2 percent over the period. Most of the large goods-producing industries recorded growth rates above that. Just six had productivity rates below the annual average for the nonfarm business sector, and only two actually had decreasing productivity over the period.

In contrast, 11 of the large industries in the service-producing sector recorded

annual rates of productivity less than 1.2 percent between 1973–94. Five of these had falling productivity, including the two largest measured industries, eating and drinking places and grocery stores. During the period, productivity for those two industries slipped –0.3 percent and –0.8 percent per year, respectively.

### Multifactor productivity

The labor productivity measures discussed in the previous section relate output solely to the labor input. In multifactor productivity measures, output is related to the combined inputs of labor, capital, and intermediate purchases. Multifactor productivity is equal to output per hour minus the effects of changes in capital per hour and intermediate purchases per hour.<sup>6</sup>

Changes in overall economic efficiency are more nearly reflected in multifactor productivity measures than in labor productivity data because they account for the effects of changes in the ratios of the two other inputs to labor. For example, suppose that a decline in the price of capital induces an industry to purchase more of that input. The capital-labor ratio rises and the industry can produce more output with the same amount of labor. Output per employee hour will increase but the multifactor productivity measure may be unchanged (assuming that nothing else affecting multifactor productivity, such as the type of technology used, has changed). Therefore, while the movement of the labor productivity measure suggests that there has been an efficiency gain, the multifactor productivity statistic may indicate that there has not been a change in the overall efficiency of input use in the industry.<sup>7</sup>

Because of the enormous amount of data required to measure capital and intermediate purchases, only a limited number of industry multifactor productivity measures has been published.<sup>8</sup> BLS continues to develop multifactor productivity measures, and a new industry—

refrigeration and heating equipment—appears for the first time in this report. This brings the total number of multifactor productivity measures to ten, nine of which are goods-producing industries, while one is a service-producing industry. They are:

- Cotton and synthetic broadwoven fabrics
- Metal stampings
- Household furniture
- Farm and garden machinery
- Tires and inner tubes
- Refrigeration and heating equipment
- Footwear
- Motor vehicles and equipment
- Steel
- Railroad transportation

(data available through 1993 only)

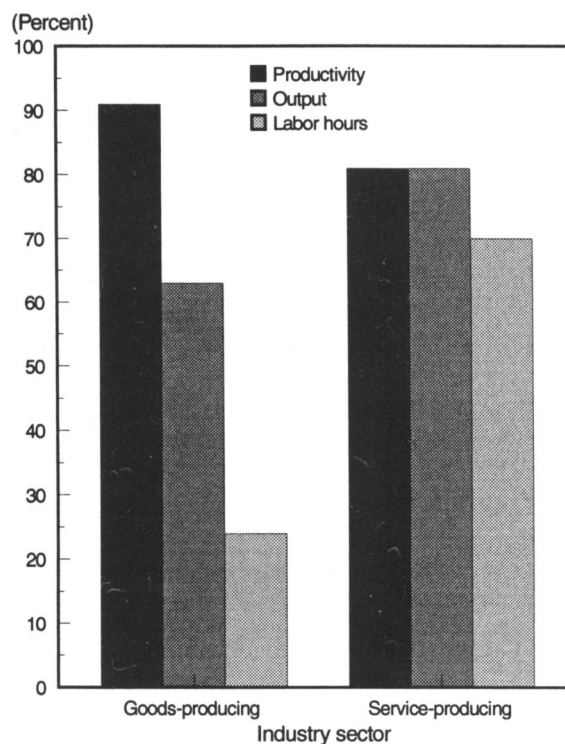
**Current trends.** In 1994, multifactor productivity rose in all nine of the measured goods-producing industries, ranging from a high of 7.5 percent in the cotton and synthetic broadwoven fabrics industry to a low of 0.1 percent in the household furniture industry. In 1993, eight of the nine measured goods-producing industries recorded increases in multifactor productivity. The one declining industry was motor vehicles and equipment. Within the service-producing sector, multifactor productivity for railroad transportation increased 3.3 percent in 1993, the latest year available for that industry.

Among the largest industries for

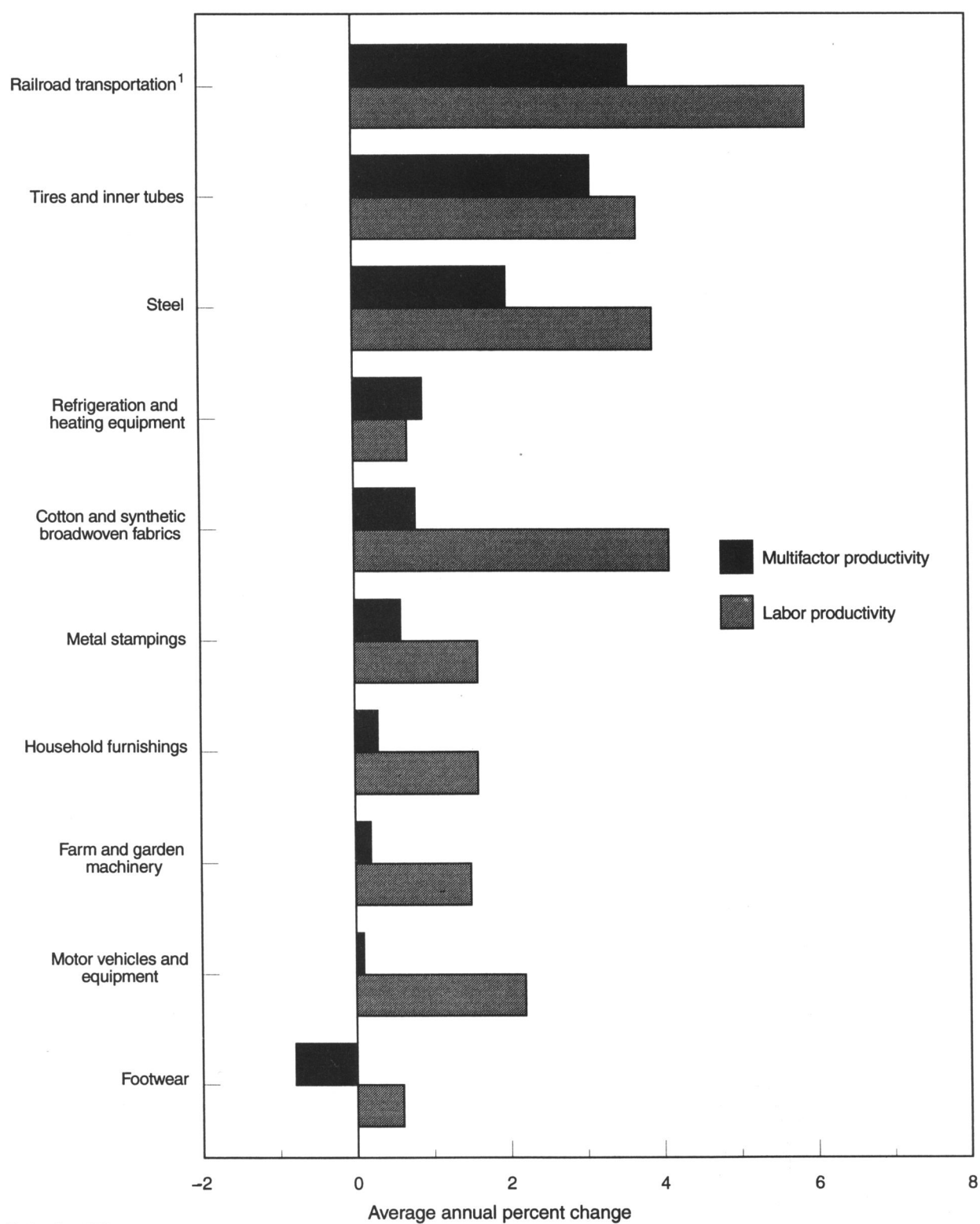
which multifactor productivity is calculated, motor vehicles and steel both recorded only slight increases in multifactor productivity in 1994 of 0.5 percent and 1.0 percent, respectively. For both industries the multifactor growth rate in 1994 was significantly lower than the corresponding labor productivity growth rate. The strong increases in output that these industries posted in 1994 were accompanied by similarly strong increases in combined inputs, led by intermediate purchases. The substitution of intermediate purchases (materials, fuel, electricity, and purchased services) for labor accounted for most of the increase in labor productivity for the two industries in 1994.

In cotton and synthetic broadwovens, which posted the highest multifactor productivity increase in 1994, multifactor productivity growth exceeded labor productivity growth in 1994. In contrast to steel and motor vehicles, labor was sub-

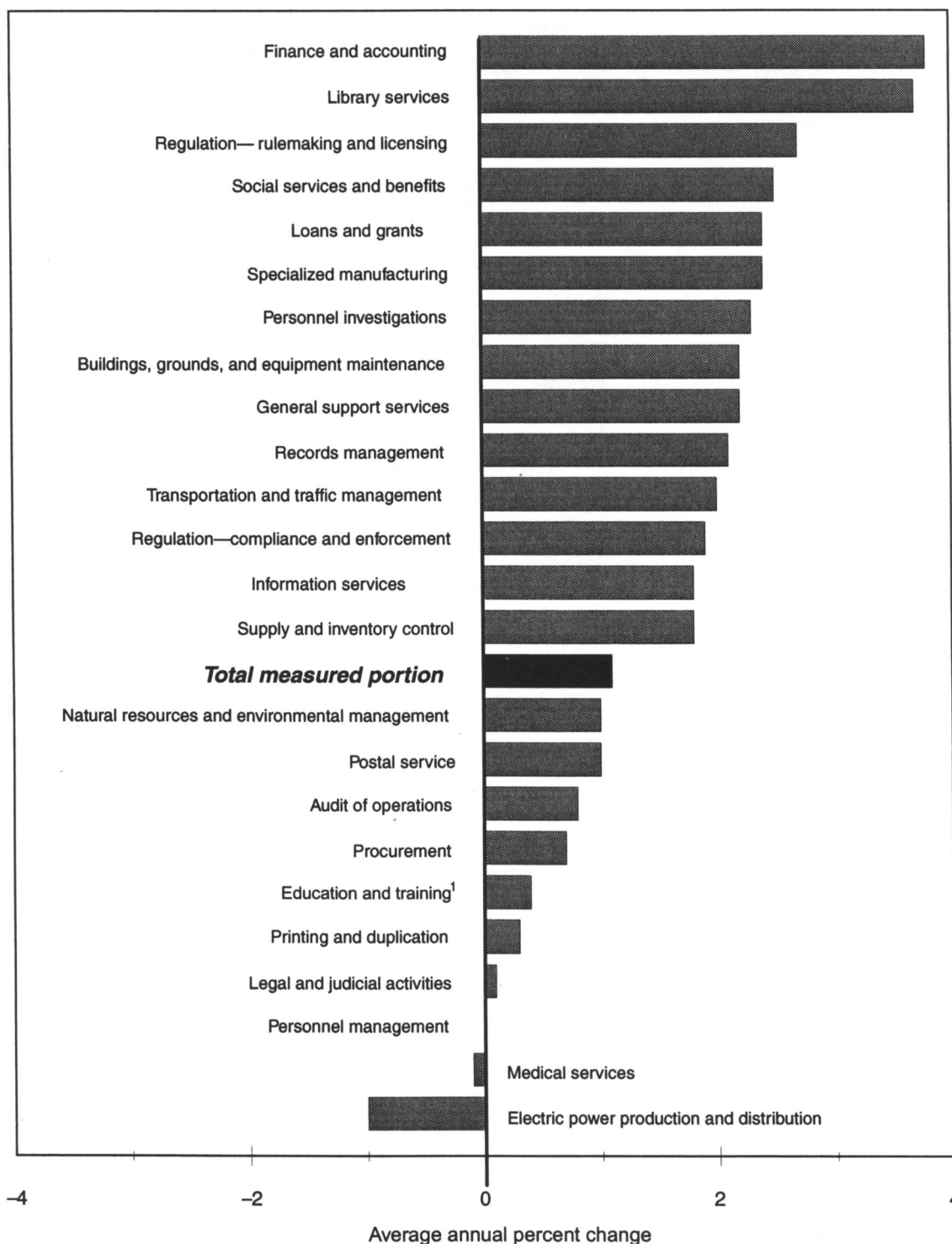
Chart 2. Percent of industries showing growth in productivity and related variables, by industry sector, 1973–94



**Chart 3. Multifactor productivity and labor productivity in 10 industries, 1973-94**



**Chart 4. Output per employee year in the Federal Government, by function and for the total measured portion, fiscal years 1967-94**



<sup>1</sup>Measure begins in 1968.

NOTE: Average annual percent change using compound rate formula.



stituted for intermediate purchases in this industry, thus lowering measures of labor productivity growth.

*Long term trends.* From 1973 to 1994, multifactor productivity increased in 9 of the 10 measured industries. In most, labor productivity growth exceeded multifactor productivity growth, as capital and/or intermediate purchases were substituted for labor hours in the long run. These substitutions sometimes account for more than half of the improvement in an industry's labor productivity. (See chart 3.)

## Government productivity

Labor productivity in the Federal Government is measured as output per employee year, rather than output per employee hour. The overall productivity measure for the Federal Government, which includes data from 255 organizations in 60 Federal agencies, has been updated to fiscal year 1994. These organizations employ 69 percent of the total Federal executive branch civilian workforce. They are grouped into 24 functions based on similarity of tasks performed, such as auditing, communications, personnel, or regulation.<sup>9</sup>

Output per employee year for the measured portion of the Federal Government in fiscal year 1994 was unchanged. This reflected an increase of 1 percent in output and an increase of 0.9 percent in employee years. While employment in the Federal Government has been shrinking overall, several large organizations measured by BLS, such as the Department of Justice, the U.S. courts, and the U.S. Postal Service, showed slight employment increases in 1994.

Among the 24 measured Federal Government functions, 14 experienced productivity increases in 1994. Productivity changes ranged from an increase of 11.8 percent in finance and accounting to a decrease of 5.6 percent in personnel management.

*Long-term trends.* Between 1967 and

1994, productivity in the measured portion of the Federal Government rose at an average annual rate of 1.1 percent. This reflects an average annual increase in output of 1.4 percent and an annual increase in employee years of 0.3 percent.

Among the 24 measured Federal Government functions, finance and accounting experienced the largest average annual increase in productivity over the long term, 3.8 percent, while electric power showed the greatest decline, -1.0 percent (see chart 4). This decline was due to a small average increase in output of 0.4 percent and an annual increase in employee years of 1.4 percent. Regulatory problems associated with delays in nuclear power production and dry weather conditions affecting the production of power for hydroelectric plants have contributed to the decline in productivity.

Medical services was the only other function to experience a long-term decline. Fourteen functions showed productivity increases above the overall average of 1.1 percent. The U.S. Postal Service was just under that average. Postal Service productivity rose 1.0 percent annually, the result of an average annual increase of 1.9 percent in output and an annual increase of 0.9 percent in employee years.

## Additional information

Further analysis and detailed historical data for all the published industries can be found in the BLS Bulletin, *Productivity Measures for Selected Industries and Government Services*, Bulletin 2480 (Bureau of Labor Statistics, 1996). It is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC, 20402, or may be obtained from BLS as long as supplies last. Also, table 41 in every issue of the *Monthly Labor Review* gives annual indexes of industry labor productivity from 1990 forward and selected earlier years. Answers to questions on productivity and productivity measurement and

additional information are available from the Office of Productivity and Technology, Bureau of Labor Statistics, Washington, DC, 20212, telephone: (202) 606-5600, World Wide Web (<http://stats.BLS.gov>). □

## Footnotes

<sup>1</sup> The Division of Industry Productivity Studies of the Office of Productivity and Technology is the primary source of data on trends in industry productivity in the United States. BLS currently maintains measures of labor or multifactor productivity for 178 industries and for a substantial portion of the Federal Government.

<sup>2</sup> Although these labor productivity measures relate output to hours of labor, they do not measure the specific contribution of labor to production. Instead, they reflect the joint effects of many influences, including changes in technology; capital investment; the scale of operations; utilization of capacity, energy, and materials; managerial skill; and the skill, education, and experience of the work force.

<sup>3</sup> Based on data from the National Bureau of Economic Research, there have been four business cycle periods between 1973 and 1994. They are 1973-79, 1979-81, 1981-90, and 1990-94. The 1990-94 period is not a complete business cycle, as this latter business cycle has continued into 1996.

<sup>4</sup> The Bureau does not produce any productivity measures for the construction industry due to lack of data.

<sup>5</sup> For more information on productivity in aircraft manufacturing, see Alexander Kronemer and J. Edwin Henneberger, "Productivity in aircraft manufacturing," *Monthly Labor Review*, June 1993, pp. 24-33.

<sup>6</sup> These effects are measured as the change in the ratio of nonlabor inputs, weighted by the nonlabor input's share in the total cost of output.

<sup>7</sup> Although multifactor productivity is sometimes interpreted as measuring technological change, it also is influenced by such factors as changes in the scale of operations; capacity utilization; managerial skill; and the skill, education, and experience of the work force.

<sup>8</sup> For purposes of multifactor productivity measurement, capital includes equipment, structures, land, and inventories. Financial capital is not included. Intermediate purchases are composed of materials, fuel, electricity, and purchased services.

<sup>9</sup> The overall productivity series does not represent Federal productivity as a whole, but rather the productivity of the combined organizations. The series is computed by dividing a weighted output index of the 255 organizations by the aggregate labor index of employee years (an employee year equals 2,087 hours).