



## Productivity in industry and government, 1973-92

Mary Jablonski

The productivity of workers in the non-farm business sector of the U.S. economy jumped by 3.0 percent in 1992. Indeed, productivity growth in the non-farm business sector was so widespread that 80 percent of industries with available data increased productivity in 1992, according to recently released productivity measures from the Bureau of Labor Statistics.

These numbers reflect a substantial improvement in productivity growth compared with the previous year. In 1991, labor productivity increased by 1.1 percent in the nonfarm business sector, which is much below the 1992 change. At the detailed level, labor productivity climbed in 56 percent of the 93 industries in 1991, which is far less than the 1992 percentage.

This report reviews the findings of this update on annual measures of industry and government productivity to the latest year possible; for the majority of the measures the most current year is 1991 or 1992. Each type of productivity statistic in this report compares output, which is the production of goods and services, to one or more inputs of production.<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 the selected 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.<sup>3</sup>

### Labor productivity

The 93 industries updated to 1992 that have been cited are among the 145 distinct industries for which BLS maintains labor productivity measures. Available data allowed 50 of the other 52 nonduplicated industries to be updated to 1991.<sup>4</sup> Additionally, BLS provides 33 measures that represent a higher level of aggregation or a different definition of output relative to one or more of the distinct industries, for a total of 178 industry labor productivity measures. (See table 1.) The analysis in this section refers only to the distinct industry measures.<sup>5</sup>

In 1991, the U.S. economy was slumping; the civilian unemployment rate averaged 6.7 percent, up from 5.5 percent in the previous year; in most parts of the economy employment fell, as did employee hours in 82 percent of the 143 industries updated at least to 1991. In addition, in 71 percent of these industries, production slipped in 1991. Yet despite the numerous dips in output, 55 percent of the industries achieved productivity gains in 1991. These gains were possible in part because of the extensive cutbacks in employee hours.

By 1992, the U.S. economy was emerging from the recession. Employment rose in the service-producing sector, although it declined in the goods-producing sector.<sup>6</sup> Of industries updated to 1992, 34 percent used more hours of labor than in 1991; though a minority of the measured industries boosted employee hours, 74 percent managed to attain higher levels of output in 1992 and 80 percent reached higher levels of

labor productivity. Moreover, in 68 of the 93 industries, the *rate of change* of productivity was greater in 1992 than in 1991. Therefore, not only was productivity increasing in a large majority of measured industries in 1992, it also was accelerating in most industries.

*Current trends in goods-sector.* The recession hit the goods-producing sector hard in 1991, with job losses of more than 1 million. This sector, which includes mining, construction, and manufacturing, now accounts for about one-fourth of private sector employment.<sup>7</sup> Employee hours increased in only 17 percent of the measured industries in the goods sector in 1991, while productivity rose in 53 percent of the industries. Productivity movements in the sector ranged from a low of -12.8 percent in the construction machinery industry (Standard Industrial Classification 3531) to a high of 17.2 percent in the aircraft manufacturing industry (SIC 3721).

In 1992, productivity advanced in 80 percent of the goods-producing industries for which data were available, which is the same percentage as for all the measured industries. Production expanded in 1992 in 77 percent of the industries in this sector, while employee hours were up in 31 percent. Also, most of the productivity gains were sizable: 76 percent of the increases in productivity exceeded 3.0 percent.

Focusing on manufacturing in particular in 1992, 69 percent of the largest industries experienced productivity hikes (where the largest manufacturing industries are those with 1992 employment of more than 100,000).<sup>8</sup> The steel industry (SIC 331) recorded the top productivity growth rate of these industries—9.3 percent—while industrial organic chemicals, not elsewhere classified (SIC 2869) registered a decline of 1.5 percent. Output rose in 10 of the 13 indus-

Mary Jablonski is an economist in the Office of Productivity and Technology, Bureau of Labor Statistics.

tries and employee hours moved up in 5. The changes in output ranged from a drop of 6.1 percent in aircraft to a rise of 11.0 percent in motor vehicles and equipment (SIC 371). Among the 13 industries, the fastest decrease in hours occurred in the aircraft industry, with a 6.6-percent decline. The corrugated and solid fiber boxes industry (SIC 2653) achieved the greatest increase, with a climb of 3.3 percent.

**Long-term trends in goods-sector.** About nine-tenths of the industries in the goods-producing sector realized productivity improvements between 1973 and 1991. Crude petroleum and natural gas production (SIC 1311) was the biggest loser in productivity: output per employee hour deteriorated at an average annual rate of 3.1 percent. The biggest winner was household audio and video equipment (SIC 3651), where output per employee hour soared by an average 8.8 percent annually in the period.

All of the largest manufacturing industries—those with 1992 employment of more than 100,000—showed productivity gains in the 1973–91 period. The advances ranged from a low of 0.3 percent per year in refrigeration and heating equipment (SIC 3585) to a high of 3.9 percent per year in poultry dressing and processing (SIC 2015) and in cotton and synthetic broadwoven fabrics (SIC 2211, 21).

**Current trends in service-sector.** The service-producing sector was not spared from job cuts in 1991, but the reduction in employment was much less severe than in the goods sector. About 100,000 positions disappeared from the service-producing sector in 1991, in contrast to more than 1 million in the goods-producing sector.<sup>9</sup> The service sector comprises transportation, utilities, communications, trade (wholesale and retail), 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 sector, of which the services industry is one component.

Although the service sector did not suffer as much as the goods sector in

Table 1. Employment in 1992 and percent changes in output per hour for various periods, selected industries

SIC code	Industry	Employment (thousands)	1973–91 <sup>1</sup>	1990–91	1991–92
<b>Mining</b>					
1011	Iron mining, crude ore .....	9	3.9	-2.3	0.9
1011	Iron mining, usable ore .....	9	3.0	-3.6	-1.3
1021	Copper mining, crude ore .....	15	4.5	6.5	-8
1021	Copper mining, recoverable metal .....	15	5.1	-1.4	15.9
12	Coal mining .....	126	3.2	3.0	9.7
122	Bituminous coal and lignite mining .....	117	3.2	3.4	9.7
1311	Crude petroleum and natural gas .....	181	-3.1	1.1	4.6
14	Nonmetallic minerals, except fuels .....	102	1.1	-4.5	7.3
142	Crushed and broken stone .....	38	1.2	-10.5	5.7
<b>Manufacturing</b>					
2011,13	Red meat products .....	224	1.8	1.3	—
2011	Meat packing plants .....	135	1.9	3.8	2.9
2013	Sausages and other prepared meats .....	89	1.6	-2.4	—
2015	Poultry dressing and processing .....	209	3.9	6.0	—
202	Dairy products .....	152	3.2	2.2	5.0
2022	Cheese, natural and processed .....	40	2.5	5.7	—
2026	Fluid milk .....	70	4.1	2.6	1.5
203	Preserved fruits and vegetables .....	246	1.4	2.3	—
2033	Canned fruits and vegetables .....	85	2.0	4.1	—
2037	Frozen fruits and vegetables .....	49	1.1	3.6	—
204	Grain mill products .....	124	3.7	.5	—
2041,45	Flour (including flour mixes) and other grains .....	31	2.7	2.6	—
2041	Flour and other grain mill products .....	20	3.0	-1.1	—
2043	Cereal breakfast foods .....	20	2.4	3.2	—
2044	Rice milling .....	5	2.8	-5.4	—
2046	Wet corn milling .....	10	8.0	-3.3	—
2047,48	Prepared feeds for animals and fowls .....	59	3.6	-4	—
2051,52	Bakery products .....	194	.6	-3.5	-7
2061,62,63	Sugar .....	22	1.0	3.3	5.1
2061,62	Raw and refined cane sugar .....	13	.9	7.1	-8
2063	Beet sugar .....	9	1.3	2.5	9.5
2082	Malt beverages .....	40	5.2	-2.1	1.3
2086	Bottled and canned soft drinks .....	93	5.8	6.7	6.2
2092	Prepared fresh or frozen fish and seafoods .....	47	-6	-3.2	—
2111,21,31	Tobacco products .....	41	2.5	6.4	4.7
2111,31	Cigarettes, chewing and smoking tobacco .....	39	2.5	5.8	3.9
2121	Cigars .....	2	3.9	14.8	—
2211,21	Cotton and synthetic broadwoven fabrics .....	155	3.9	7.4	6.0
2251,52	Hosiery .....	69	3.1	5.4	5.6
2281	Yarn spinning mills .....	78	3.8	-2	7.4
2311	Men's and boys' suits and coats .....	45	1.1	-9.5	12.7
2421	Sawmills and planing mills, general .....	144	2.3	2.6	7.4
2431	Millwork .....	100	-5	-2.1	.0
2434	Wood kitchen cabinets .....	66	.8	-1.9	—
2435,36	Veneer and plywood .....	49	3.1	4.2	-9
2435	Hardwood veneer and plywood .....	22	2.7	2.8	—
2436	Softwood veneer and plywood .....	27	3.4	5.7	2.5
244	Wood containers .....	43	2.2	1.6	—
251	Household furniture .....	270	1.3	3.5	1.8
2511,17	Wood household furniture .....	126	.4	1.5	-6
2512	Upholstered household furniture .....	87	2.0	5.0	4.6
2514	Metal household furniture .....	21	1.9	3.6	8.0
2515	Mattresses and bedsprings .....	28	2.7	6.5	3.7
252	Office furniture .....	62	1.2	-6	2.7
2521	Wood office furniture .....	28	1.2	3.3	—
2522	Office furniture, except wood .....	34	1.2	-2.9	—
2611,21,31	Pulp, paper, and paperboard mills .....	239	2.6	1.9	7.3
2653	Corrugated and solid fiber boxes .....	121	2.0	-3	1.1
2657	Folding paperboard boxes .....	50	1.2	-8	.2
2673,74	Paper and plastic bags .....	56	.4	-3.0	—
281	Industrial inorganic chemicals .....	136	.2	-5.4	—

See footnotes at end of table.

Table 1. Continued—Employment in 1992 and percent changes in output per hour for various periods, selected industries

SIC code	Industry	Employment (thousands)	1973-91 <sup>1</sup>	1990-91	1991-92
<b>Manufacturing—continued</b>					
2812	Alkalies and chlorine .....	13	2.9	-8.9	—
2816	Inorganic pigments .....	11	1.2	-5.7	—
2819 (part)	Industrial inorganic chemicals, n.e.c .....	88	-4	-6.0	—
2823,24	Synthetic fibers .....	73	4.0	2.8	6.3
2841	Soaps and detergents .....	42	2.2	.1	—
2844	Cosmetics and other toiletries .....	69	.9	2.2	—
2851	Paints and allied products .....	58	3.0	-3	2.7
2869	Industrial organic chemicals, n.e.c .....	125	1.6	-6.3	-1.5
287	Agricultural chemicals .....	58	2.6	5.4	—
2873	Nitrogenous fertilizers .....	11	3.4	-3	—
2874	Phosphatic fertilizers .....	12	2.7	7.3	—
2875	Fertilizers, mixing only .....	9	1.6	.6	—
2879	Agricultural chemicals, n.e.c .....	27	2.5	8.1	—
2911	Petroleum refining .....	120	1.6	-2.3	3.9
3011	Tires and inner tubes .....	82	3.9	1.4	6.3
3052	Rubber and plastics hose and belting .....	23	.6	-8.2	—
308	Miscellaneous plastics products, n.e.c .....	619	1.8	.7	-3
314	Footwear .....	64	.1	.2	.9
3221	Glass containers .....	36	2.4	2.0	5.0
3241	Cement, hydraulic .....	17	2.2	-5.3	11.1
325	Structural clay products .....	31	1.3	-5.5	4.6
3251,53,59	Clay construction products .....	25	1.3	-5.6	6.6
3251	Brick and structural clay tile .....	14	.5	-1.0	6.8
3253	Ceramic wall and floor tile .....	9	2.4	-11.9	—
3255	Clay refractories .....	6	1.4	-5.8	-3.7
3271,72	Concrete products .....	80	1.0	1.6	2.2
3273	Ready-mixed concrete .....	90	-2	-3.6	1.9
331	Steel .....	250	2.3	-3.7	9.3
3321	Gray and ductile iron foundries .....	75	.7	-4.5	5.6
3324,25	Steel foundries .....	39	-7	-2.6	7.5
3325	Steel foundries, n.e.c .....	24	.2	-1	9.9
3331	Primary copper .....	5	5.4	-1.9	.0
3334	Primary aluminum .....	25	2.2	3.8	-2.6
3351	Copper rolling and drawing .....	23	1.9	2.5	6.9
3353,54,55	Aluminum rolling and drawing .....	54	1.2	-1.9	—
3411	Metal cans .....	36	3.8	5.1	9.3
3423	Hand and edge tools, n.e.c .....	34	-6	-1.3	—
3433	Heating equipment, except electric .....	19	2.2	4.2	—
3441	Fabricated structural metal .....	69	.2	2.4	—
3442	Metal doors, sash, and trim .....	69	.4	-2.3	—
3452	Bolts, nuts, rivets, and washers .....	45	1.5	2.1	—
3465,66,69	Metal stampings .....	180	1.0	2.2	—
3465	Automotive stampings .....	98	1.9	3.4	—
3469	Metal stampings, n.e.c .....	78	.1	1.4	—
3491,92,94	Valves and pipe fittings .....	78	.5	.0	—
3498	Fabricated pipe and fittings .....	25	-1.5	6.4	—
3519	Internal combustion engines, n.e.c .....	59	1.0	-6.9	7.2
352	Farm and garden machinery .....	93	1.4	-4.3	5.5
3523	Farm machinery and equipment .....	69	1.2	-5.7	6.4
3524	Lawn and garden equipment .....	24	2.1	.1	—
3531	Construction machinery .....	73	.8	-12.8	—
3532	Mining machinery .....	16	-4	-8.1	9.3
3533	Oil and gas field machinery .....	39	-1.7	-2.7	—
3541,42	Machine tools .....	53	.1	-4.5	1.4
3541	Metal cutting machine tools .....	38	.3	-2.9	-4.2
3542	Metal forming machine tools .....	15	-7	-7.4	13.4
3545	Machine tool accessories .....	48	.2	1.5	—
3561,63,94	Pumps and compressors .....	84	1.5	.2	—
3561,94	Pumps and pumping equipment .....	58	1.6	-1.2	—
3562	Ball and roller bearings .....	39	-8	-3.0	11.5
3563	Air and gas compressors .....	25	1.4	2.5	—

See footnotes at end of table.

1991, employment losses were distributed widely. Of the measured service-sector industries, a mere 17 percent increased employee hours in 1991, the same percentage as in the goods sector. Labor productivity was higher in 63 percent of the service-sector industries, compared with 53 percent of the goods-sector industries. The range of productivity changes was narrower than in the goods-producing sector, with a low of -7.3 percent in hardware stores (SIC 5251) and a high of 9.6 percent in radio, television, and computer stores (SIC 573).

In 1992, employment in the service sector advanced by approximately half a million, with the gains concentrated primarily in the services industry. Of the four measured industries in the services industry, three added employee hours in 1992. Of all the measured industries in the service-producing sector, 41 percent used more hours of labor in 1992 than in the previous year, while output increased over 1991 in 69 percent.<sup>10</sup> Productivity rose in 79 percent of the industries. Also, as in the goods sector, most of the increases in productivity were considerable: 74 percent of these increases were greater than 3.0 percent.

Among the largest service-sector industries—those with 1992 employment of more than 200,000—labor productivity moved forward in 86 percent in 1992.<sup>11</sup> Productivity growth ranged from a decrease of 1.5 percent in drug stores and proprietary stores (SIC 5912) to an increase of 10 percent in family clothing stores (SIC 5651). Employee hours grew in almost half of these industries (10 of 22), with changes that extended from -6.3 percent in shoe stores (SIC 5661) to 3.1 percent in automotive repair shops (SIC 753). Output increased in 77 percent of the largest industries in the service-producing sector in 1992, with movements ranging from a drop of 3.0 percent in shoe stores to a rise of 11.2 percent in family clothing stores (the industry with the highest productivity growth rate).

*Long-term trends in service-sector.* Nearly three-quarters of the service-sector industries recorded productivity increases between 1973 and 1991. The top gain was in radio, television, and computer stores (SIC 573), where productivity shot up at an average annual rate

Table 1. Continued—Employment in 1992 and percent changes in output per hour for various periods, selected industries

SIC code	Industry	Employment (thousands)	1973 -91 <sup>1</sup>	1990-91	1991-92
<b>Manufacturing—continued</b>					
3585	Refrigeration and heating equipment.....	118	.3	-2.7	—
3592	Carburetors, pistons, rings, and valves.....	21	.7	1.2	—
3612	Transformers, except electronic.....	41	1.2	3.7	7.5
3613	Switchgear and switchboard apparatus.....	42	1.1	-2.6	—
3621	Motors and generators.....	78	.9	2.6	-7
3631,32,33,39	Major household appliances.....	76	2.5	1.9	8.0
3631	Household cooking equipment.....	17	3.3	3.1	13.6
3632	Household refrigerators and freezers.....	27	2.4	4.6	4.4
3633	Household laundry equipment.....	18	2.7	7.3	18.8
3639	Household appliances, n.e.c.....	14	1.3	-10.5	-3.6
3641	Electric lamps.....	21	4.0	8.1	13.4
3645,46,47,48	Lighting fixtures and equipment.....	69	.5	-2.1	.6
3651	Household audio and video equipment.....	59	8.8	5.5	14.7
371	Motor vehicles and equipment.....	809	2.0	-5.6	8.1
3721	Aircraft.....	332	2.3	17.2	.6
3825	Instruments to measure electricity.....	76	2.8	3.3	—
3861	Photographic equipment and supplies.....	95	2.7	1.0	—
<b>Transportation</b>					
4011	Railroad transportation, revenue traffic.....	225	6.0	8.4	5.7
4011	Railroad transportation, car miles.....	225	3.9	3.2	3.2
411,13,14 (parts)	Bus carriers, class I.....	15	-7	—	—
4213	Trucking, except local <sup>3</sup> .....	461	2.9	—	—
4213 (part)	Trucking, except local, general freight <sup>3</sup> .....	283	3.4	—	—
4512,13,22 (parts)	Air transportation <sup>3</sup> .....	631	2.5	1.5	3.5
4612,13	Petroleum pipelines.....	19	.4	-3.4	-8
<b>Utilities</b>					
481	Telephone communications.....	886	5.6	5.0	5.0
491,2,3	Gas and electric utilities.....	797	.5	2.0	1.4
491,3 (part)	Electric utilities.....	596	1.4	3.0	.8
492,3 (part)	Gas utilities.....	201	-2.4	-1.0	1.1
<b>Trade<sup>4</sup></b>					
5093	Scrap and waste materials.....	107	3.3	8.6	—
5251	Hardware stores.....	173	1.1	-7.3	7.3
5311	Department stores.....	2,046	2.6	4.1	4.3
5331	Variety stores.....	171	-5	-1.4	-9.4
54	Food stores.....	3,392	-9	-8	.7
5411	Grocery stores.....	2,980	-8	-7	.2
546	Retail bakeries.....	183	-1.8	6.0	-8.3
5511	New and used car dealers.....	876	1.2	-1.5	.7
5531	Auto and home supply stores.....	364	2.7	.4	-5
5541	Gasoline service stations.....	663	3.1	1.0	4.4
56	Apparel and accessory stores.....	1,217	2.2	.7	6.9
5611	Men's and boys' clothing stores.....	96	1.5	.5	2.0
5621	Women's clothing stores.....	394	3.5	3.6	8.7
5651	Family clothing stores.....	313	1.6	.9	10.0
5661	Shoe stores.....	212	1.5	-8	3.5
57	Home furniture, furnishings, and equipment stores.....	935	3.2	4.1	9.0
571	Furniture and home furnishings stores.....	545	1.3	-3	8.4
572,3	Appliance, radio, TV, and computer stores.....	389	5.9	9.6	9.2
5722	Household appliance stores.....	87	3.9	6.1	18.6
573	Radio, television, and computer stores.....	302	6.2	9.6	6.4
581	Eating and drinking places.....	6,917	-2	1.4	-1.4
5912	Drug stores and proprietary stores.....	624	1.0	2.8	-1.5
5921	Liquor stores.....	138	1.0	1.5	12.7

See footnotes at end of table.

of 6.2 percent. The biggest loss in productivity was in gas utilities (SIC 492, 3 (part)), where it fell by 2.4 percent annually in the period.

Six of the 22 largest service-producing industries registered productivity losses from 1973 to 1991. Among them were the two industries with the highest levels of employment in 1992 of all the measured industries: the eating and drinking places industry (SIC 581), with approximately 7 million employees, and the grocery stores industry (SIC 5411), which employs about 3 million. The department stores industry (SIC 5311), which is the third largest employer (approximately 2 million employees), increased productivity at a solid rate of 2.6 percent per year between 1973 and 1991.

*New measure.* BLS has added a new industry to the list of those for which it publishes labor productivity measures. The measure for aircraft manufacturing (SIC 3721) begins in 1972 and currently extends to 1992. In that span, output per employee hour grew at an average annual rate of 3.1 percent. Output advanced by 3.9 percent annually in the aircraft industry, while employee hours moved up by 0.8 percent per year.<sup>12</sup>

After achieving productivity increases averaging 6.0 percent annually from 1972 to 1979, the aircraft industry tallied much smaller gains in 1979-92, with an average of 1.5 percent per year. The roughest stretch was between 1979 and 1984, during which productivity declined cumulatively by 19 percent. Output took an unexpected downturn during those 5 years and firms were reluctant to lay off workers, many of whom were highly trained. Since 1984, only in one year—1990—has productivity declined in the aircraft industry.

### Multifactor productivity

In a multifactor productivity measure, output is related to the combined inputs of labor, capital, and intermediate purchases.<sup>13</sup> The labor productivity measures discussed in the previous section relate output solely to labor.

Multifactor productivity is preferred to labor productivity as a measure of efficiency because multifactor productivity excludes the effects of changes in the ratios of the two other inputs to la-

bor. 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>14</sup>

Because of the enormous data requirements for the measurement of capital and intermediate purchases, a limited number of industry multifactor productivity measures has been published. (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.) For most of the 178 industries in table 1, labor productivity is the only type of productivity measure currently available.

BLS continues to develop multifactor productivity measures for additional industries and will report on these measures in future publications. Multifactor productivity measures are now published for the following seven industries: household furniture (SIC 251), tires and tubes (SIC 3011), footwear (SIC 314), steel (SIC 331), farm and garden machinery (SIC 352), motor vehicles and equipment (SIC 371), and railroad transportation (SIC 4011).

*Current trends.* Multifactor productivity declined in five of the seven industries in 1991, the most recent year for which data are available. (See table 2.) The steepest decline was in the steel industry, where multifactor productivity dropped by 6.1 percent. Other industries where declines were recorded were farm and garden machinery (4.7 percent), motor vehicles and equipment (1.2 percent), tires and tubes (1.1 percent), and household furniture (0.8 percent). Increases in multifactor productivity were recorded in 1991 in footwear

**Table 1. Continued—Employment in 1992 and percent changes in output per hour for various periods, selected industries**

SIC code	Industry	Employment (thousands)	1973-91 <sup>1</sup>	1990-91	1991-92
<b>Finance and services<sup>5</sup></b>					
602	Commercial banks .....	1,488	1.8	3.5	4.5
7011	Hotels and motels .....	1,552	-.7	.8	7.1
721	Laundry, cleaning, and garment services ...	499	-1.0	-2.4	.5
7231,41	Beauty and barber shops .....	392	.2	-4.1	5.0
7231	Beauty shops .....	379	.0	-4.2	3.3
753	Automotive repair shops .....	834	-.5	-6.1	3.3

<sup>1</sup> The 1973-91 rates are average annual percent changes based on the compound rate formula.  
<sup>2</sup> 1977-91.  
<sup>3</sup> Output per employee is used for sic 4213, sic 4213 (part), and sic 4512, 13, 22 (parts).  
<sup>4</sup> 1973-89.  
<sup>5</sup> Output per hour of all persons is used for all trade and service industries except sic 5311, sic 5511, and sic 602.  
NOTE: The sic codes are defined in the *Standard Industrial Classification Manual, 1987*, published by the U.S. Office of Management and Budget.  
Dash indicates data are not available.  
n.e.c. = not elsewhere classified.

(2.1 percent) and railroad transportation (3.3 percent).

In the steel industry, output was down in 1991, as it was in all seven industries. The reduction of 9.4 percent in steel output was coupled with a fall of 3.4 percent in combined inputs, to yield the sharpest drop in multifactor productivity for 1991. Of the combined inputs, employee hours were reduced the most (6.3 percent), while capital and intermediate purchases were cut somewhat less (2.1 percent and 2.4 percent).

Of all the industries, output dropped the fastest in farm and garden machinery (12.2 percent) in 1991. With combined inputs receding by 7.9 percent, a decrease in multifactor productivity of 4.7 percent resulted—the biggest downturn in multifactor productivity in the industry since 1975. Capital was down by 4.5 percent, hours of labor by 8.9 percent, and intermediate purchases by 9.2 percent.

U.S. production of motor vehicles and equipment declined by 8.8 percent in 1991, after falling by 8.0 percent in 1990. Intermediate purchases were slashed by 11.6 percent, while hours of labor were curtailed by 3.5 percent. In contrast, capital input was boosted in 1991, by 2.1 percent. This rise in capital was the only increase in an input observed among the seven industries in 1991. Together, combined inputs turned down by 7.7 percent in motor vehicles

and equipment, leading to a fall in multifactor productivity of 1.2 percent.

Multifactor productivity ebbed by about the same percentage in tires and tubes (1.1 percent) as it did in motor vehicles and equipment, reflecting a decrease in output of 4.7 percent and a drop in combined inputs of 3.7 percent. The falloff in output was the largest in the tires and tubes industry since the recession year of 1982. Labor hours contracted by more than output (5.9 percent), while intermediate purchases were down by 4.1 percent and capital was off by a mere 0.6 percent.

Of the five industries with multifactor productivity declines in 1991, output fell the least in household furniture (4.4 percent), as did multifactor productivity (0.8 percent). The reduction in combined inputs (3.7 percent) was slightly smaller than the reduction in output, with employee hours decreasing by 6.6 percent, intermediate purchases by 2.9 percent, and capital by 0.8 percent.

Of the industries in which multifactor productivity fell in 1991, household furniture and tires and tubes registered increases in output per employee hour. It turns out that the ratio of capital to labor and the ratio of intermediate purchases to labor rose in both industries, allowing labor productivity to rise despite the drop in multifactor productivity.

Production in footwear was scaled back by 9.2 percent in 1991, and combined inputs were cut even more (by 11.1 percent). As a result, multifactor productivity climbed by 2.1 percent in the industry, after 2 years of deteriorating productivity. Intermediate purchases plunged by 13.4 percent, while the drops in labor (9.5 percent) and capital (4.7 percent) were less severe.

In railroad transportation, the decline in output in 1991 was the smallest by far of the seven industries (0.7 percent) and the performance of multifactor productivity was the best (an increase of 3.3 percent). This was the 10th consecutive year in which multifactor productivity was up in railroad transportation. The productivity gain was possible in 1991 because combined inputs were trimmed by 3.9 percent, with hours of labor down by 7.7 percent, capital by 1.9 percent, and intermediate purchases by 0.1 percent.

*Long-term trends.* Between 1973 and 1991, multifactor productivity grew in five of the seven industries studied. The changes ranged from an average decrease of 1.3 percent annually in footwear to an average annual increase of 3.4 percent in railroad transportation. Multifactor productivity in farm and garden machinery did not change from 1973 to 1991, while average annual rates of growth were greater than zero in the remaining industries: household furniture (0.1 percent), motor vehicles and equipment (0.3 percent), steel (1.4 percent), and tires and tubes (3.0 percent).

In footwear, output declined more rapidly—by an average 5.8 percent annually—than in any other industry between 1973 and 1991. (The two other industries with output declines in the 1973–91 period were farm and garden machinery [2.5 percent per year] and steel [1.6 percent per year]). The rate of decline in the footwear industry was so rapid that by 1991, production was about one-third of its 1973 level. Combined inputs also dropped at the fastest rate in the footwear industry. The net result was that multifactor productivity fell by 1.3 percent per year, making footwear the one industry of the seven to experience a long-term decline in multifactor productivity.

Railroad transportation, which had the highest rate of multifactor produc-

tivity growth from 1973 to 1991, is the sole industry of those studied that is outside manufacturing. Output increased in railroad transportation in the period (at an average annual rate of 0.4 percent), despite the rising use of high-

ways and of air transportation. However, this was not the top rate of output growth in that timespan; production of motor vehicles and equipment expanded at a slightly faster rate (0.5 percent per year). In railroad transportation, com-

Table 2. Percent changes in multifactor productivity and related data for selected industries, various periods, 1973–91

SIC code	Industry and measure	Percent change <sup>1</sup>		
		1973–91	1989–90	1990–91
251	<b>Household furniture</b>			
	Multifactor productivity	0.1	-0.5	-0.8
	Output	.0	-2.3	-4.4
	Combined inputs	-1	-1.8	-3.7
	Employee hours	-1.5	-2.7	-6.6
	Capital	.6	-4	-8
314	<b>Footwear</b>			
	Multifactor productivity	-1.3	-10.3	2.1
	Output	-5.8	-14.1	-9.2
	Combined inputs	-4.5	-4.2	-11.1
	Employee hours	-6.0	-6.3	-9.5
	Capital	-2.4	-3.5	-4.7
3011	<b>Tires and tubes</b>			
	Multifactor productivity	3.0	1.4	-1.1
	Output	.1	-1.5	-4.7
	Combined inputs	-2.8	-2.8	-3.7
	Employee hours	-3.5	-2.4	-5.9
	Capital	-2.1	4.2	-6
331	<b>Steel</b>			
	Multifactor productivity	1.4	1.8	-6.1
	Output	-1.6	.7	-9.4
	Combined inputs	-3.1	-1.1	-3.4
	Employee hours	-4.4	-1.1	-6.3
	Capital	-2.6	-2.3	-2.1
352	<b>Farm and garden machinery</b>			
	Multifactor productivity	.0	5.6	-4.7
	Output	-2.5	7.9	-12.2
	Combined inputs	-2.5	2.2	-7.9
	Employee hours	-3.1	2.5	-8.9
	Capital	-1.3	-3.6	-4.5
371	<b>Motor vehicles and equipment</b>			
	Multifactor productivity	.3	-5.3	-1.2
	Output	.5	-8.0	-8.8
	Combined inputs	.2	-2.9	-7.7
	Employee hours	-1.4	-7.4	-3.5
	Capital	.4	1.2	2.1
4011	<b>Railroad transportation</b>			
	Multifactor productivity	3.4	3.6	3.3
	Output	.4	1.1	-7
	Combined inputs	-2.9	-2.4	-3.9
	Employee hours	-5.1	-2.2	-7.7
	Capital	-1.6	-2.1	-1.9
		-4	-2.8	-1

<sup>1</sup> The 1973–91 rates are average annual percent changes based on the compound rate formula.

NOTE: The SIC codes are defined in the *Standard Industrial Classification Manual, 1987*, published by the U.S. Office of Management and Budget.

bined inputs were reduced by an average 2.9 percent per year between 1973 and 1991, for a cumulative decline of more than 40 percent in total input use.

**New measure.** This year, household furniture (SIC 251) became the seventh industry for which BLS maintains a multifactor productivity measure. Like the other multifactor productivity measures, the series for household furniture extends back to 1958. From 1958 to 1991, multifactor productivity increased at an average annual rate of 0.5 percent in household furniture. This was the result of production rising by an annual average of 2.1 percent and combined inputs climbing at the somewhat slower rate of 1.5 percent per year. Of the combined inputs, capital recorded the highest average annual growth rate (2.3 percent), with intermediate purchases at 2.0 percent annually and labor at just 0.2 percent per year.<sup>15</sup>

Most of the improvement in multifactor productivity in the study period occurred between 1958 and 1973, during which productivity rose at an average annual rate of 1.0 percent. In the following period, 1973–91, multifactor productivity in household furniture moved up by just 0.1 percent annually. The increase was small despite advances in technology, such as computer-aided design and computer-aided manufacturing (CAD/CAM). (Such technological advances have not spread widely or quickly through the industry.) Output increased at a rapid clip in the industry in the earlier timespan, with an average gain of 4.7 percent per year, while combined inputs went up by an annual average of 3.6 percent. In the subsequent period, output was stagnant, with a growth rate of 0.0 percent per year, while combined inputs fell marginally, by 0.1 percent per year.

### 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 276 organizations in 60 Federal agencies, has been updated to fiscal year 1992, which began on October 1, 1991, and ended on September 30, 1992. These organizations, which employ 64 percent of the

total Federal executive branch civilian labor force, are grouped into 28 functions, such as communications and procurement.<sup>16</sup> Overall Federal Government productivity is computed by dividing a weighted output index of the 276 organizations by an aggregate labor index of employee years (an employee year equals 2,087 hours).

**Current trends.** Productivity in the total measured portion of the Federal Government increased by 0.7 percent in 1992, following a decline of 2.8 percent in 1991. (See table 3.) Output was up by 1.2 percent in 1992, after slipping by 1.9 percent in the previous year. Employee years rose by 0.5 percent, which was below the 1991 growth rate of 0.8 percent.

Of the 26 functions updated to 1992, output per employee year advanced in 15 and receded in 11.<sup>17</sup> In comparison, productivity was up in only 8 of those functions in 1991 and was down in 18.

The productivity changes in 1992 ranged from a decrease of 9.7 percent in audit of operations to an increase of 45.3 percent in communications.

The huge jump in productivity in communications was due to a hefty rise in output of 36.8 percent and a drop in labor of 5.9 percent. The communications function includes organizations responsible for processing messages and performing telecommunications services for Federal organizations. This was the second straight year of outstanding productivity performance in the communications function. In 1991, output per employee year in communications surged by 27.9 percent.

Library services was another function with a double-digit percent increase in productivity—14.3 percent—in 1992. This rise resulted from an increase in output of 4.2 percent and a decline in employee years of 8.8 percent. Organizations classified in library services provide re-

Table 3. Percent changes in productivity for the Federal Government, various periods, 1973–92

Function	Percent change in output per employee year <sup>1</sup>		
	1973–92	1990–91	1991–92
Total measured portion .....	1.0	-2.8	0.7
Audit of operations .....	.5	10.4	-9.7
Buildings and grounds .....	2.5	-1.2	2.6
Communications .....	9.0	27.9	45.3
Education and training .....	.7	-13.6	-3.2
Electric power production and distribution .....	-3.0	4.2	3.1
Equipment maintenance .....	<sup>2</sup> 1.2	-5.7	...
Finance and accounting .....	4.8	5.7	5.3
General support services .....	1.7	-1.5	-2.7
Information services .....	2.2	5.0	-5
Legal and judicial activities .....	-5	-3.5	-7
Library services .....	4.5	-5.6	14.3
Loans and grants .....	1.0	-11.8	3.6
Medical services .....	.1	-6.3	-5
Military base services .....	1.2	6.0	.6
Natural resources and environmental management .....	1.0	-2.5	-2.1
Personnel investigations .....	2.8	-1.5	8.6
Personnel management .....	-3	-5.2	1.0
Postal service .....	.9	-4	.9
Printing and duplication .....	1.1	-10.2	9.1
Procurement .....	.8	-7	-1.7
Records management .....	2.5	-8	-2.5
Regulation — compliance and enforcement .....	1.5	-4.7	1.5
Regulation — rulemaking and licensing .....	2.8	1.6	3.5
Social services and benefits .....	2.0	-2.3	7.1
Specialized manufacturing .....	2.1	-2.6	-2.5
Supply and inventory control .....	2.0	5.9	6.4
Traffic management .....	<sup>2</sup> 5.7	88.5	—
Transportation .....	1.3	-6	-2

<sup>1</sup> The 1973–92 rates are average annual percent changes based on the compound rate formula.

<sup>2</sup> 1973–91

NOTE: Dash indicates data are not available.

search and reference services to Federal agencies, Congress, or the public.

The largest decrease in productivity in 1992 occurred in audit of operations, which also experienced the biggest drop in output—15.6 percent. The corresponding reduction in employee years was much smaller (6.5 percent), leading to a sharp downturn of 9.7 percent in productivity. This function includes organizations responsible for reviewing, evaluating, and analyzing Federal programs and operations. The substantial decline in output in audit of operations followed increases during the previous 4 years in which output rose by one-third.

Of the 28 functions, the U.S. Postal Service accounts for the most employees. Productivity improved by 0.9 percent in 1992, as output increased by 0.4 percent and labor decreased by 0.5 percent due to tighter controls on the use of overtime.

*Long-term trends.* From 1973 to 1992, productivity in the measured portion of the Federal Government moved up at an average annual rate of 1.0 percent. During this period, output registered an average annual gain of 1.4 percent while employee years recorded an average annual increase of 0.4 percent.

Output per employee year was higher in 1992 than in 1973 in 23 of the 26 functions updated to 1992. Communications was the leader in productivity growth by far, with an average annual increase of 9.0 percent between 1973 and 1992. As a result of this growth, the level of productivity in communications in 1992 was 5 times as high as in 1973. This exceptional progress was due primarily to the adoption of up-to-date equipment (such as fax machines) that permits high-speed transmission of messages.

Of the three functions with productivity decreases between 1973 and 1992, electric power production and distribution had the biggest drop (3.0 percent

per year). Reasons for the decline include extended periods of dry weather that have affected power production in hydroelectric plants, and delays in nuclear power production associated with regulatory problems.

In the function with the most workers, the Postal Service, productivity rose at an average annual rate of 0.9 percent from 1973 to 1992, which is about the same as the growth rate for the total measured portion of the Federal Government. Output climbed by 1.9 percent per year on average, while employee years increased at an average annual rate of 1.0 percent. □

### Footnotes

NOTE: Additional information on industry and government productivity is available from the Office of Productivity and Technology, Bureau of Labor Statistics, Washington, DC, 20212, telephone: (202) 606-5600.

<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 characteristics and effort of the work force.

<sup>3</sup> For more details, see *Productivity Measures for Selected Industries and Government Services*, Bulletin 2440 (Bureau of Labor Statistics, 1994), available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC, 20402, or from BLS.

<sup>4</sup> Most of the industries that have not yet been updated to 1992 are in the manufacturing sector. Because a Census of Manufactures collected data for 1992, the manufacturing data from the Census Bureau were not available as early as they usually are; certain manufacturing industries could not be updated to 1992. (The productivity measures in manufacturing that were updated used data from other sources.)

<sup>5</sup> Industries examined in this section do not necessarily represent all U.S. industries. The total employment of the 145 distinct industries covers nearly 40 percent of the total U.S. non-farm business sector.

<sup>6</sup> Although the unemployment rate crept up to 7.4 percent in 1992, total employment actually increased as measured by the BLS household and payroll surveys. The unemployment rate rose because the increase in jobs was outstripped by the increase in the number of people looking for work.

<sup>7</sup> BLS does not currently publish any productivity statistics for the construction sector, because the data currently available for this sector are inadequate for productivity measurement.

<sup>8</sup> Fifteen manufacturing industries registered 1992 employment of more than 100,000 among the 145 distinct industries; productivity measures for 13 have been updated to 1992.

<sup>9</sup> Recall that the labor productivity section of this research summary concerns industries in the private sector. Therefore, discussion of the service-producing sector applies only to the private portion (excluding government organizations).

<sup>10</sup> Of the 30 service-sector industries updated to 1991, 29 also have been updated to 1992.

<sup>11</sup> A higher cutoff point is used to define the largest industries in the service sector compared with manufacturing, because the Standard Industrial Classification system is more detailed for manufacturing than for the service sector and because total employment in that sector is much greater than in manufacturing.

<sup>12</sup> For more information, see Alexander Kronemer and J. Edwin Henneberger, "Productivity in aircraft manufacturing," *Monthly Labor Review*, June 1993, pp. 24-33.

<sup>13</sup> The inputs are combined using the inputs' shares of total input cost as weights.

<sup>14</sup> Although multifactor productivity is sometimes interpreted as measuring technological change, it also is influenced by changes in the scale of operations, capacity utilization, managerial skill, and the characteristics and effort of the work force.

<sup>15</sup> For more information, see Thomas M. Muth II and Edna Thea Falk, "Multifactor productivity in household furniture," *Monthly Labor Review*, June 1994, pp. 35-46.

<sup>16</sup> The overall productivity series does not represent Federal productivity as a whole, but rather the productivity of the combined organizations.

<sup>17</sup> Due to insufficient data, two of the functions, equipment maintenance and traffic management, were not updated to 1992.