



## Productivity in industry and government: 1973–91

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The focus in the past year on economic developments—particularly stagnating American living standards and the ability of U.S. industries to compete successfully in an increasingly global economy—has led to a great deal of discussion about productivity. Productivity growth provides the primary means to higher income levels and is an important indicator of the ability by U.S. industries to compete worldwide. As part of the industry productivity program of the Bureau of Labor Statistics, annual measures for government and industry productivity have been updated to the most current year possible with the available data, which in most cases is 1991 or 1990.<sup>1</sup>

Five industries were added to the list of those already published: dairy products, Standard Industrial Classification (SIC) 202; natural and processed cheese, SIC 2022; prepared fresh or frozen fish and seafoods, SIC 2092; wood containers, SIC 244; and bolts, nuts, rivets, and washers, SIC 3452. In addition, two previously published industries, pharmaceutical preparations, SIC 2834, and semiconductors and related devices, SIC 3674, have been suspended from publication because of potential limits in some of the data. The BLS industry productivity program is assessing these data reliability questions, while also examining alternative sources of data. Following this assessment, BLS may resume publication of productivity measures for these industries.

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This report summarizes the trends observed from this update. Labor productivity movements, as measured by output divided by employee hours and average annual percent changes in labor productivity for selected industries covering four periods between 1973 and 1991, are presented in table 1; average annual percent changes in multifactor productivity and related data for selected industries covering three periods between 1973 and 1990 appear in table 2; and average annual percent changes in productivity for three periods between 1973 and 1990 in the Federal Government are shown in table 3.<sup>2</sup> Finally, table 46 in the “Current Labor Statistics” section in each issue of *Monthly Labor Review* provides indexes for most of the industry labor productivity measures for selected years between 1973 and 1991.

### Labor productivity trends

*Current trends.* Data availability allows for 93 labor productivity measures published by BLS to be updated to 1991. One of the most notable aspects of productivity change for the selected industries that BLS updated to 1991 was the difference between the number of industries posting productivity gains and the number recording output growth.

Labor productivity rose in 66 percent of these 93 selected industries,<sup>3</sup> an increase from 57 percent in 1990, and from 54 percent in 1989. However, output gains in 1991 were recorded only among 32 percent of the industries. By comparison, in 1987, the same number of industries registered productivity growth as in 1991, but 73 percent of the industries reported output increases.

Many manufacturers were forced to streamline and cut total employee hours, which is one reason why so many industries recorded productivity growth in 1991 despite falling output. Eighty-four percent of the industries recorded de-

clines in employee hours in 1991, compared with 47 percent in 1987. The only year since 1973 in which more of these industries registered a drop in recorded hours was 1982, a recession year. Fewer than 20 percent reported output gains, and productivity rose in just 55 percent of those industries.

*Long-term trends.* In the long term—the 1973–90 period—84 percent of the industries recorded productivity growth, while 64 percent recorded gains in output. However, productivity and output gains are different when the period is divided into two subperiods covering 1973–79 and 1979–90.<sup>4</sup>

Between 1973 and 1979, 76 percent of the industries recorded gains in productivity, and 75 percent showed gains in output; between 1979 and 1990, 87 percent recorded gains in productivity and 59 percent registered output growth.

The fewer number of industries showing productivity growth in the 1973–79 period corresponds to the widely discussed productivity slowdown in the 1970’s. The 1973–79 period also appears to have fewer industries showing productivity growth than the preceding period. Comparisons between the 1973–79 period and earlier years are not exact because BLS has fewer measures that begin before 1973. Yet, among industries where the measures are available for the business cycle peak of 1960, nearly 99 percent recorded productivity gains.

*Service sector trends.* In recent years, public interest in the productivity performance of service industries has been rising. This is partly because the service sector, defined broadly as transportation, utilities, communications, trade, finance, insurance, real estate, and service industries has become the fastest growing segment of the U.S. economy. In 1967 service industries (excluding nonprofit and government establishments) employed

32 million employees, while manufacturing industries employed 19.7 million workers. By 1990, the number of employees in the service industries had more than doubled to 67.1 million, while the number in the manufacturing industries had dropped to 19.5 million. The biggest source of employment growth was in retail trade industries, which grew by 10 million, and the personal and business service industries, which increased by more than 15 million. These two industry groups combined accounted for more than 75 percent of the employment growth in service industries and 70 percent of the employment growth in the private business sector of the economy between 1967 and 1990.

In response, the BLS industry productivity program is developing additional service sector productivity measures. BLS currently measures productivity for 32 mutually exclusive service industries, providing at least one published measure for every major industry division in the service sector, and accounting for more than 40 percent of all the workers employed in service industries. In the case of the rapidly growing retail trade sector, BLS publishes measures covering more than 80 percent of the workers.

Current productivity and output trends among service sector industries were characteristic of the overall trends of 1991. More than 63 percent of the measured trade industries registered gains in productivity at the same time that less than 37 percent experienced output growth. Among the nontrade service industries, 60 percent also recorded productivity growth, while only 40 percent showed an increase in output. Nearly 80 percent of the measured service sector industries recorded declines in hours in 1991.

Retail bakeries (sic 546) posted the greatest 1991 productivity gain of any published industry, rising 13.6 percent over the previous year, while another trade industry, scrap and waste material wholesalers (sic 5093), recorded an 8.5 percent gain, the third highest in 1991.

In the long term, the percent of the measured service sector industries showing productivity gains was somewhat lower than in the manufacturing sector. During the period between 1973 and 1990, 89 percent of the measured industries in the manufacturing sector re-

Table 1. Average annual rates of change in output per employee hour in selected industries, various periods, 1973 to 1991

SIC code	Industry	Average annual percent change in output per hour <sup>1</sup>			
		1973-90	1973-79	1979-90	1990-91
<b>Mining</b>					
1011	Iron mining, crude ore .....	4.3	1.3	5.9	—
1011	Iron mining, usable ore .....	3.4	.0	5.3	—
1021	Copper mining, crude ore .....	4.4	2.9	5.3	3.8
1021	Copper mining, recoverable metal .....	5.5	2.3	7.2	-3.7
12	Coal mining .....	3.2	-3.9	7.3	3.3
122	Bituminous coal and lignite mining .....	3.2	-3.9	7.3	3.3
1311	Crude petroleum and natural gas .....	-3.4	-7.3	-1.2	1.3
14	Nonmetallic minerals, except fuels .....	1.4	.9	1.7	-4.1
142	Crushed and broken stone .....	2.0	2.2	1.8	-11.0
<b>Manufacturing</b>					
2011,13	Red meat products .....	1.8	3.5	.9	—
2011	Meat packing plants .....	1.8	2.8	1.3	1.8
2013	Sausages and other prepared meats .....	1.9	5.5	.0	—
2015	Poultry dressing and processing .....	3.7	5.4	2.8	—
202	Dairy products .....	3.2	3.4	3.1	.7
2022	Cheese, natural and processed .....	2.3	.9	3.1	—
2026	Fluid milk .....	4.2	4.6	4.0	2.6
203	Preserved fruits and vegetables .....	1.4	1.0	1.6	—
2033	Canned fruits and vegetables .....	1.8	1.3	2.1	—
2037	Frozen fruits and vegetables .....	1.0	1.3	.8	—
204	Grain mill products .....	3.9	3.6	4.0	—
2041,45	Flour (including flour mixes) and other grains .....	2.8	1.6	3.4	—
2041	Flour and other grain mill products .....	3.2	3.2	3.3	—
2043	Cereal breakfast foods .....	2.4	1.7	2.7	—
2044	Rice milling .....	3.2	2.8	3.5	—
2046	Wet corn milling .....	8.7	10.8	7.6	—
2047,48	Prepared feeds for animals and fowls .....	3.8	3.6	4.0	—
2051,52	Bakery products .....	.8	.3	1.2	.2
2061,62,63	Sugar .....	.8	1.1	.7	4.2
2061,62	Raw and refined cane sugar .....	.6	1.4	.2	4.4
2063	Beet sugar .....	1.2	.8	1.4	3.6
2082	Malt beverages .....	5.6	6.9	5.0	-.6
2086	Bottled and canned soft drinks .....	5.7	4.6	6.3	5.1
2092	Prepared fresh or frozen fish and seafoods .....	-.5	.5	-1.0	—
2111,21,31	Tobacco products .....	2.3	2.2	2.4	.0
2111,31	Cigarettes, chewing and smoking tobacco .....	2.3	2.4	2.2	.4
2121	Cigars .....	3.3	2.1	3.9	-6.3
2211,21	Cotton and synthetic broadwoven fabrics .....	3.7	4.7	3.1	3.3
2251,52	Hosiery .....	2.9	6.3	1.1	5.9
2281	Yarn spinning mills .....	4.0	3.4	4.4	5.9
2311	Men's and boys' suits and coats .....	1.6	2.4	1.2	—
2421	Sawmills and planing mills, general .....	2.3	1.0	3.0	2.1
2431	Millwork .....	-.5	-1.7	.2	5.6
2434	Wood kitchen cabinets .....	1.0	1.7	.6	—
2435,36	Veneer and plywood .....	3.0	1.3	4.0	—
2435	Hardwood veneer and plywood .....	2.7	3.3	2.3	—
2436	Softwood veneer and plywood .....	3.3	.2	5.0	3.9
244	Wood containers .....	2.2	—	3.7	—
251	Household furniture .....	1.2	.7	1.5	3.2
2511,17	Wood household furniture .....	.4	-.4	.8	3.6
2512	Upholstered household furniture .....	1.8	2.4	1.6	4.3
2514	Metal household furniture .....	1.8	-.8	3.3	4.3
2515	Mattresses and bedsprings .....	2.5	2.5	2.5	-.6
252	Office furniture .....	1.3	2.8	.5	4.0
2521	Wood office furniture .....	1.0	6.0	-1.6	—
2522	Office furniture, except wood .....	1.5	1.1	1.7	—
2611,21,31	Pulp, paper, and paperboard mills .....	2.6	2.4	2.8	.3
2653	Corrugated and solid fiber boxes .....	2.1	3.7	1.3	.5
2657	Folding paperboard boxes .....	1.3	2.0	.9	-.6

See footnotes at end of table.

Table 1. Continued—Average annual rates of change in output per employee hour in selected industries, various periods, 1973 to 1991

SIC code	Industry	Average annual percent change in output per hour <sup>1</sup>			
		1973-90	1973-79	1979-90	1990-91
2673,74	Paper and plastic bags . . . . .	.7	.7	.7	—
281	Industrial inorganic chemicals . . . . .	.6	1.6	.1	—
2812	Alkalies and chlorine . . . . .	3.6	.9	5.1	—
2816	Inorganic pigments . . . . .	1.7	-1.4	3.4	—
2819 (part)	Industrial inorganic chemicals, n.e.c. . . . .	.0	2.5	-1.3	—
2823,24	Synthetic fibers . . . . .	4.0	6.3	2.8	3.5
2841	Soaps and detergents . . . . .	2.4	.6	3.3	—
2844	Cosmetics and other toiletries . . . . .	.7	1.2	.5	—
2851	Paints and allied products . . . . .	3.2	4.1	2.8	.6
2869	Industrial organic chemicals, n.e.c. . . . .	2.1	3.9	1.1	-4.2
287	Agricultural chemicals . . . . .	2.5	2.7	2.4	—
2873	Nitrogenous fertilizers . . . . .	3.7	3.0	4.0	—
2874	Phosphatic fertilizers . . . . .	2.4	1.0	3.1	—
2875	Fertilizers, mixing only . . . . .	1.6	4.1	.3	—
2879	Agricultural chemicals, n.e.c. . . . .	2.2	3.1	1.7	—
2911	Petroleum refining . . . . .	1.7	.2	2.5	-1.3
3011	Tires and inner tubes . . . . .	4.1	2.0	5.2	.9
3052	Rubber and plastics hose and belting . . . . .	1.2	.4	1.6	—
308	Miscellaneous plastics products, n.e.c. . . . .	1.9	.2	2.9	-.1
314	Footwear . . . . .	.0	.3	-1	-2.3
3221	Glass containers . . . . .	2.4	1.7	2.8	.6
3241	Cement, hydraulic . . . . .	2.7	-.6	4.5	-9.8
325	Structural clay products . . . . .	1.7	.8	2.2	-8.2
3251,53,59	Clay construction products . . . . .	1.7	.2	2.5	-11.2
3251	Brick and structural clay tile . . . . .	.2	-.9	.8	-7.9
3253	Ceramic wall and floor tile . . . . .	2.5	3.3	2.1	—
3255	Clay refractories . . . . .	1.6	2.8	1.0	6.3
3271,72	Concrete products . . . . .	1.0	.0	1.6	6.2
3273	Ready-mixed concrete . . . . .	.0	-.6	.4	3.1
331	Steel . . . . .	2.7	.0	4.2	-4.0
3321	Gray and ductile iron foundries . . . . .	1.0	.4	1.3	-6.9
3324,25	Steel foundries . . . . .	-.6	-.2	-.8	-7.9
3325	Steel foundries, n.e.c. . . . .	.3	-.1	.5	-4.9
3331	Primary copper . . . . .	5.8	3.8	7.0	2.5
3334	Primary aluminum . . . . .	2.1	.0	3.3	4.0
3351	Copper rolling and drawing . . . . .	1.9	.9	2.4	-.6
3353,54,55	Aluminum rolling and drawing . . . . .	1.3	1.1	1.5	—
3411	Metal cans . . . . .	3.7	4.1	3.5	6.0
3423	Hand and edge tools, n.e.c. . . . .	-.5	.4	-1.0	—
3433	Heating equipment, except electric . . . . .	2.0	2.0	2.0	—
3441	Fabricated structural metal . . . . .	.1	-1.7	1.2	—
3442	Metal doors, sash, and trim . . . . .	.6	.1	.9	—
3452	Bolts, nuts, rivets, and washers . . . . .	1.4	1.1	1.6	—
3465,66,69	Metal stampings . . . . .	.9	.8	.9	—
3465	Automotive stampings . . . . .	1.8	1.4	2.0	—
3469	Metal stampings, n.e.c. . . . .	.0	.3	-.2	—
3491,92,94	Valves and pipe fittings . . . . .	.6	.3	.7	—
3498	Fabricated pipe and fittings . . . . .	-1.9	-3.3	-1.1	—
3519	Internal combustion engines, n.e.c. . . . .	1.5	1.3	1.6	-6.9
352	Farm and garden machinery . . . . .	1.7	1.0	2.1	7.0
3523	Farm machinery and equipment . . . . .	1.7	.4	2.3	7.5
3524	Lawn and garden equipment . . . . .	2.2	4.0	1.2	—
3531	Construction machinery . . . . .	1.7	1.1	2.0	—
3532	Mining machinery . . . . .	.1	-2.1	1.3	6.7
3533	Oil and gas field machinery . . . . .	-1.6	.0	-2.4	1.0
3541,42	Machine tools . . . . .	.3	-.8	.9	.2
3541	Metal cutting machine tools . . . . .	.5	-.4	1.0	3.8
3542	Metal forming machine tools . . . . .	-.3	-2.3	.8	-12.3
3545	Machine tool accessories . . . . .	.1	-.8	.6	—
3561,63,94	Pumps and compressors . . . . .	1.6	.8	2.1	—
3561,94	Pumps and pumping equipment . . . . .	1.7	1.2	2.0	—
3562	Ball and roller bearings . . . . .	-.6	.5	-1.2	1.4
3563	Air and gas compressors . . . . .	1.3	-.1	2.2	—
3585	Refrigeration and heating equipment . . . . .	.5	-.3	.9	—

See footnotes at end of table.

corded gains in productivity, while 69 percent registered increases in the service sector. From 1973 to 1979, 80 percent of manufacturing industries in the BLS measurement program recorded productivity gains, while productivity rose in 68 percent of the measured service sector industries. In the 1979-90 period, 90 percent of the manufacturing industries recorded productivity gains at the same time that productivity increased in nearly 80 percent of the service sector industries.

Demonstrating similarities between the two sectors, fewer industries in the service sector recorded productivity gains in the 1973-79 period than during 1979 and 1990. Similarly, productivity gains also were registered in more measured industries in the preceding period. All service sector measures with data extending to 1960 had productivity growth.

### New industry measures

As mentioned earlier, five new industry measures are included in this update. Three—dairy products, natural or processed cheese, and prepared fresh or frozen fish and seafoods—are from the food products group as defined in the Standard Industrial Classification Manual. The wood containers industry is in the lumber and wood products group, and the bolts, nuts, rivets, and washers industry (sic 3452) is in the fabricated metal products group.<sup>5</sup>

*Natural and processed cheese.* Labor productivity advanced at an average annual rate of 2.3 percent from 1973 to 1990 in the natural and processed cheese industry. Output rose 4.7 percent and employee hours increased 2.3 percent. This growth in productivity over the period is associated with the industry's integrated use of computers and the mechanization of cheese making systems.

Many of these new systems were introduced in the 1970's just as demand for cheese was on the rise. Technological advances such as enclosed vat systems and machines that mill, salt, and hoop the cheese in a continuous stream increased yields and improved production flow. At first, little was gained in productivity, which grew at just 0.9 percent per year during the 1973-79 period. But in the

1980's, sustained modernization of the industry resulted in increasing productivity. From 1979 to 1990, productivity gained at an annual rate of 3.1 percent, as output rose 5.0 percent.

*Dairy products.* The dairy products industry, which is a three-digit designation at a higher level of aggregation than the natural and processed cheese industry, includes the natural and processed cheese industry, the dry, condensed, and evaporated dairy products industry, the ice cream and frozen desserts industry, and the fluid milk industry.

Productivity in the dairy products industry advanced at an annual average rate of 3.2 percent between 1973 and 1990. Output grew at an average annual rate of 1.5 percent, while employee hours declined 1.7 percent. From 1973 to 1979, productivity gained at an average annual rate of 3.4 percent, output rose at a 0.9-percent rate, and employee hours fell, on average, 2.4 percent. In the next period, productivity rose an average of 3.1 percent per year, while output gained at a 1.8-percent rate and employee hours fell 1.3 percent annually.

*Prepared fresh or frozen fish and seafoods.* The per capita consumption of fresh and frozen seafood has been rising in recent years, helping output to grow at an average annual rate of 2.7 percent over the period between 1973 and 1990. Productivity, however, has declined over the period at an average annual rate of 0.5 percent.

Limited technological diffusion in the industry seems to be a primary reason for the productivity decline. Automation technology is somewhat constrained by the processing difficulties associated with handling the many kinds of fish and seafood. As a partial result, there is a reluctance by some firms in the industry to purchase labor-saving technology. Many plant owners are discouraged by the costs of automating, not only because of the expense of buying and operating equipment, but also because of the difficulties associated with obtaining spare parts and service, and finding personnel capable of operating and maintaining the equipment. As a result, portions of the industry remain fairly labor intensive.

Both subperiods reflect this. While output grew 6.3 percent per year be-

Table 1. Continued—Average annual rates of change in output per employee hour in selected industries, various periods, 1973 to 1991

SIC code	Industry	Average annual percent change in output per hour <sup>1</sup>			
		1973-90	1973-79	1979-90	1990-91
3592	Carburetors, pistons, rings, and valves . . . . .	.7	-3.9	3.3	—
3612	Transformers, except electronic . . . . .	1.1	1.9	.6	3.4
3613	Switchgear and switchboard apparatus . . . . .	1.3	.2	1.9	.6
3621	Motors and generators . . . . .	.8	-2	1.4	1.2
3631,32,33,39	Major household appliances . . . . .	2.6	3.3	2.2	4.4
3631	Household cooking equipment . . . . .	3.3	4.2	2.8	3.4
3632	Household refrigerators and freezers . . . . .	2.3	2.7	2.1	6.4
3633	Household laundry equipment . . . . .	2.4	3.4	1.9	-8
3639	Household appliances, n.e.c. . . . .	2.0	3.1	1.4	8.3
3641	Electric lamps . . . . .	3.8	2.6	4.4	12.3
3645,46,47,48	Lighting fixtures and equipment . . . . .	.7	.1	1.0	-2.3
3651	Household audio and video equipment . . . . .	9.0	5.1	11.2	1.9
371	Motor vehicles and equipment . . . . .	2.4	2.2	2.5	-4.2
3825	Instruments to measure electricity . . . . .	2.7	1.7	3.3	—
3861	Photographic equipment and supplies . . . . .	2.8	4.9	1.7	—
<b>Transportation</b>					
4011	Railroad transportation, revenue traffic . . . . .	5.8	1.4	8.3	8.3
4011	Railroad transportation, car miles . . . . .	3.9	0.3	6.0	3.3
411,13,14 (parts)	Bus carriers, class 1 . . . . .	-7	-1.3	2.3	—
4213	Trucking, except local <sup>2</sup> . . . . .	2.9	3.2	2.7	—
4213 (part)	Trucking, except local, general freight <sup>2</sup> . . . . .	3.4	4.0	3.0	—
4512,13,22 (parts)	Air transportation <sup>3</sup> . . . . .	2.5	4.8	1.3	1.4
4612,13	Petroleum pipelines . . . . .	.6	.6	.6	-3.3
<b>Communications and utilities</b>					
481	Telephone communications . . . . .	5.5	6.9	4.7	5.6
491,2,3	Gas and electric utilities . . . . .	.4	.9	.1	1.7
491,3 (part)	Electric utilities . . . . .	1.3	1.3	1.4	2.7
492,3 (part)	Gas utilities . . . . .	-2.5	-2	-3.7	-1.3
<b>Trade<sup>4</sup></b>					
5093	Scrap and waste materials . . . . .	3.0	—	2.5	8.5
5251	Hardware stores . . . . .	1.6	2.6	1.1	-7.6
5311	Department stores . . . . .	2.5	3.1	2.2	5.3
5331	Variety stores . . . . .	-3	-2.7	1.1	-1.3
54	Food stores . . . . .	-8	-6	-9	.2
5411	Grocery stores . . . . .	-8	-3	-1.1	.1
546	Retail bakeries . . . . .	-8	-1.9	-3	13.6
5511	New and used car dealers . . . . .	1.4	.3	2.0	-2
5531	Auto and home supply stores . . . . .	2.4	2.3	2.5	.6
5541	Gasoline service stations . . . . .	2.9	3.7	2.5	-4
56	Apparel and accessory stores . . . . .	2.2	2.1	2.3	-3
5611	Men's and boys' clothing stores . . . . .	1.3	.8	1.6	-4
5621	Women's clothing stores . . . . .	3.2	3.6	3.1	1.6
5651	Family clothing stores . . . . .	1.7	-1	2.7	.9
5661	Shoe stores . . . . .	1.5	2.0	1.3	-6
57	Home furniture, furnishings, and equipment stores . . . . .	2.9	2.1	3.4	-1.3
571	Furniture and home furnishings stores . . . . .	1.4	1.5	1.3	-4.8
572,3	Appliance, radio, tv, and computer stores . . . . .	5.2	3.0	6.4	3.0
5722	Household appliance stores . . . . .	3.4	3.4	3.4	1.3
573	Radio, television, and computer stores . . . . .	5.6	2.4	7.3	2.7
581	Eating and drinking places . . . . .	-5	-7	-5	3.5
5912	Drug stores and proprietary stores . . . . .	.7	1.1	.5	4.7
5921	Liquor stores . . . . .	-2	-7	.2	.2

See footnotes at end of table.

Table 1. **Continued—Average annual rates of change in output per employee hour in selected industries, various periods, 1973 to 1991**

SIC code	Industry	Average annual percent change in output per hour <sup>1</sup>			
		1973-90	1973-79	1979-90	1990-91
<b>Finance and services<sup>4</sup></b>					
602	Commercial banks .....	1.6	.6	2.2	—
7011	Hotels and motels .....	-.9	1.1	-2.0	1.3
721	Laundry, cleaning, and garment services .....	-.7	-.2	-1.0	-2.3
7231,41	Beauty and barber shops .....	1.0	1.1	1.0	.5
7231	Beauty shops .....	.9	.3	1.2	-1.1
753	Automotive repair shops .....	-.2	-.7	.1	-6.0

<sup>1</sup> Average annual percent change using compound rate formula.  
<sup>2</sup> 1979-89.  
<sup>3</sup> Output per employee is used for sic 4213, sic 4213 (part), and sic 4512,13,22 (parts).  
<sup>4</sup> Output per hour of all persons is used for all trade and service industries, except sic 5311, sic 5511, and sic 602.

Note: n.e.c. = not elsewhere classified. Dash indicates data not available

tween 1973 and 1979, productivity was virtually stagnant, rising just 0.5 percent annually. When output rates reached a plateau in the 1979-90 period, growing just 0.8 percent per year, productivity fell at about 1 percent per year.

**Wood containers.** The wood containers industry also is measured at the three-digit level. During the 1979-90 period (the measure begins in 1977), output and labor productivity each grew at a rate of 3.7 percent per year. Productivity growth in the industry has been affected greatly by the technological changes in the wood pallets and skids segment, its largest component. Mechanization of pallet manufacturing and the introduction of computers have been keys to the growth of total industry productivity. Before the 1970's, a common belief held that the cost of transporting new pallets to distant customers would offset any productivity gains made by automation and increased production rates. The idea began to give way in the 1970's, and now even small producers are using highly automated systems. Computers are now widely used to custom design pallets, making them more attractive to many customers.

**Bolts, nuts, rivets, and washers.** Labor productivity in the bolts, nuts, rivets, and washers industry increased at a rate of 1.4 percent annually between 1973 and 1990. Output grew by 0.4 percent over the same period.

Although the long-term rate in productivity growth is relatively low, it has been increasing gradually over the two subperiods. Between 1973 and 1979, it was gaining at an average annual rate of 1.1 percent. In the latest period, 1979 to 1990, it grew at a 1.6-percent rate. By contrast, output has been moving in the opposite direction, growing at an average annual rate of 1.5 percent between 1973 and 1979, and falling 0.2 percent annually between 1979 and 1990. Over the period measured, many large establishments, particularly those employing more than 500 workers, have gone out of business. The number of establishments employing fewer than 100 workers more than doubled between 1958 and 1987, while the number employing 500 workers or more fell by two-thirds.

#### Multifactor productivity trends

Multifactor productivity measures differ from labor productivity measures by relating output to the combined inputs of labor, capital, and intermediate purchases; labor productivity measures relate output only to labor. Multifactor productivity measures can be considered a broader gauge of efficiency because the measures exclude the effects of changes in other inputs relative to labor. The challenge in multifactor measurement is the immense and detailed data requirements for the completion of a measure. This limits the number of industries for

which multifactor measures can be developed.

The BLS industry productivity program currently publishes multifactor measures for six industries: tires and inner 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. Labor productivity measures also are published for these industries.

**Current trends.** Multifactor productivity increased in three of these six industries in 1990, the last year for which data are available. (See table 2.) The tire and inner tube industry, the steel industry, and farm and garden machinery industry gained, while productivity declined in the footwear, motor vehicles, and railroad transportation industries.

Of the three industries with positive multifactor productivity growth, the farm and garden machinery industry gained the most. Productivity in this industry jumped 5.6 percent in 1990. This was fueled by a 7.9-percent surge in output, coupled with a 2.5-percent gain in employee hours, a 5.3-percent increase in intermediate purchases, and a decrease of 3.6 percent in capital input.

In tires and inner tubes, a 1.6-percent productivity increase was registered. This occurred, even as output dropped 1.5 percent, because of a 3.0-percent decline in combined inputs. Capital input rose 3.6 percent, but employee hours and intermediate purchases fell by rates of 2.5 percent and 5.8 percent, respectively.

In the steel industry, output rose 0.8 percent, and productivity gained 1.3 percent, largely due to a 2.5-percent cut in the availability of capital and a 1.1-percent drop in the number of employee hours. Intermediate purchases rose slightly at 0.4 percent.

Of the industries in which multifactor productivity slipped in 1990, the footwear industry fell the most, at 10.4 percent. The primary cause was an unprecedented 14-percent decline in output. All the inputs were cut—employee hours declined 6.3 percent, capital dropped 3.6 percent, and intermediate purchases dropped 3.2 percent—but weighted together, they amounted to just a 4.0-percent decline in combined inputs.

Multifactor productivity also dropped

in the motor vehicles and equipment industry, falling 5.2 percent in 1990. Here, too, output fell 7.9 percent. Employee hours declined 7.4 percent, nearly as much as output, but intermediate purchases fell only 2.6 percent and capital input rose by 1.1 percent, leading to a 2.9-percent decrease in combined inputs.

Similarly, the slight 0.2-percent drop in railroad transportation productivity was the result of a 2.6-percent decline in output that was not quite matched by a 2.4-percent decrease in combined inputs. Capital fell 2.1 percent, employee hours dropped 2.2 percent, and intermediate purchases shrunk 2.8 percent.

*Long-term trends.* Productivity in the tires and inner tubes industry and in the railroad industry improved at an annual average rate of 3.2 percent over the 1973-90 period. Steel gained at 1.9 percent. The motor vehicles industry posted an average annual 0.4 percent increase, and the farm and garden machinery industry gained at 0.3 percent. Footwear was the only industry recording a productivity decline during the period, falling 1.5 percent per year. In comparison to labor productivity growth rates in the same industries, the multifactor productivity rates are generally slower. Multifactor productivity growth is usually slower than labor productivity growth because nonlabor inputs in most industries grow faster than labor.

Similar to the labor productivity measures, some of the multifactor measures showed a dip in productivity performance in the 1973-79 period. In the steel industry, multifactor productivity rose at an average annual rate of 1.6 percent per year from 1960 to 1973. Between 1973 and 1979, it slowed to an average of no change. But from 1979 to 1990, it rebounded to 2.9 percent per year. Multifactor productivity in farm and garden machinery rose 0.9 percent per year from 1960 to 1973. It fell off to a declining average annual rate of 0.1 percent between 1973 and 1979. After 1979, it returned to a positive growth rate of 0.5 percent per year.

Multifactor productivity growth showed a similar pattern in railroad transportation.<sup>6</sup> Multifactor productivity grew at a 4.7-percent rate in the 1960-73 period, slowed to a 1.2-percent average gain between 1973 and 1979, and increased at

an average annual growth rate of 4.3 percent in the 1979-90 period.

The other industries showed different trends. In tires and inner tubes, multifactor productivity gradually increased from a 1.1-percent annual growth rate in the first period to 2.2 percent in the second, continuing to a 3.8-percent rate in the third. Productivity improved in footwear at a 1.0-percent rate in the 1960-73

period, fell off to a 0.7-percent rate of increase between 1973 and 1979, and registered a declining productivity performance in the 1979-90 period, dropping 2.7 percent annually. In motor vehicles, the multifactor productivity rate slowed from an average 1.7-percent rise in the period before 1973, to a 1.2-percent rise in the 1973-79 period, to no growth in the 1979-90 period.

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

SIC code <sup>1</sup>	Industry and measure	Average annual percent change <sup>2</sup>			
		1973-90	1973-79	1979-90	1989-90
3011	<b>Tires and tubes</b>				
	Multifactor productivity . . . . .	3.2	2.2	3.8	1.6
	Output . . . . .	.4	.1	.6	-1.5
	Combined inputs . . . . .	-2.7	-2.1	-3.1	-3.0
	Capital . . . . .	-2.2	-1.5	-2.6	3.6
	Employee hours . . . . .	-3.4	-2.1	-4.1	-2.5
	Intermediate purchases . . . . .	-2.5	-2.3	-2.6	-5.8
314	<b>Footwear</b>				
	Multifactor productivity . . . . .	-1.5	.7	-2.7	-10.4
	Output . . . . .	-5.6	-3.2	-6.9	-14.0
	Combined inputs . . . . .	-4.1	-3.8	-4.3	-4.0
	Capital . . . . .	-2.2	-1.7	-2.5	-3.6
	Employee hours . . . . .	-5.8	-4.0	-6.7	-6.3
	Intermediate purchases . . . . .	-3.8	-4.2	-3.6	-3.2
331	<b>Steel</b>				
	Multifactor productivity . . . . .	1.9	.0	2.9	1.3
	Output . . . . .	-1.2	-.7	-1.4	.8
	Combined inputs . . . . .	-3.0	-.8	-4.2	-.4
	Capital . . . . .	-2.7	-.9	-3.6	-2.5
	Employee hours . . . . .	-4.3	-1.1	-5.9	-1.1
	Intermediate purchases . . . . .	-2.1	-.7	-2.8	.4
352	<b>Farm and garden machinery</b>				
	Multifactor productivity . . . . .	.3	-.1	.5	5.6
	Output . . . . .	-1.9	2.2	-4.0	7.9
	Combined inputs . . . . .	-2.2	2.3	-4.5	2.2
	Capital . . . . .	-1.1	3.5	-3.5	-3.6
	Employee hours . . . . .	-2.8	2.0	-5.3	2.5
	Intermediate purchases . . . . .	-2.1	2.1	-4.2	5.3
371	<b>Motor vehicles and equipment</b>				
	Multifactor productivity . . . . .	.4	1.2	.0	-5.2
	Output . . . . .	1.1	1.5	.9	-7.9
	Combined inputs . . . . .	.7	.3	.9	-2.9
	Capital . . . . .	.3	1.5	-.4	1.1
	Employee hours . . . . .	-1.2	-.6	-1.6	-7.4
	Intermediate purchases . . . . .	1.5	.3	2.2	-2.6
4011	<b>Railroad transportation</b>				
	Multifactor productivity . . . . .	3.2	1.2	4.3	-.2
	Output . . . . .	.2	.3	.2	-2.6
	Combined inputs . . . . .	-2.9	-.9	-3.9	-2.4
	Capital . . . . .	-1.6	-1.3	-1.8	-2.1
	Employee hours . . . . .	-4.9	-2.3	-6.3	-2.2
	Intermediate purchases . . . . .	-.5	1.5	-1.5	-2.8

<sup>1</sup> As defined in the Standard Industrial Classification Manual, 1987, published by the Office of Management and Budget.

<sup>2</sup> Based on the compound rate formula.

**Government productivity trends**

Since 1970, the BLS industry productivity division also has measured productivity trends in the Federal Government. Data currently covering 299 organizations in 61 Federal agencies representing 64 percent of the Federal executive branch civilian work force have been updated to 1991. The measured organizations are grouped into 28 functional groups such as transportation, communications, and personnel management, which reflect common activities found in most government agencies. Federal government productivity is derived by dividing a weighted output index of the 299 organizations by an aggregate input index of employee years (an employee year equals 2,087 hours).<sup>7</sup>

*Current trends.* Productivity among the measured government organizations decreased in 1991. (See table 3.) Overall, output per employee year fell 2.3 percent, as output slipped 1.7 percent and employee years grew 0.6 percent. One reason for the declining productivity was the impact of Operation Desert Storm on output and employee years. For example, the education and training function experienced a 13.6-percent decline in productivity. Several large military organizations have the function of training and educating personnel. Because the emphasis during Operation Desert Storm was more on the movement of military equipment than on training activities, training output dropped 17.6 percent. Facilities and training staff had to be maintained, making it difficult to cut employee years. In another example, employee years for Armed Forces and veterans medical services increased 4.1 percent in 1991, while output fell 2.4 percent as personnel braced for potential casualties.

Desert Storm also had the effect of boosting productivity for some functions. Output surged 87.7 percent for traffic management, leading to an 88.5-percent gain in productivity in that function. This was because of the movement of military equipment. However, this was not enough to offset the drop in training and medical services, which cover a much greater portion of government workers.

Other functions with falling productivity in 1991 included buildings and

Table 3. **Percent changes in productivity for the Federal Government, various periods**

Function	Average annual percent change in output per employee year <sup>1</sup>			
	1973-90	1973-79	1979-90	1990-91
Total measured portion . . . . .	1.2	1.3	1.2	- 2.3
Audit of operations . . . . .	.6	2.1	-.2	10.5
Buildings and grounds . . . . .	2.8	6.0	1.1	- 1.3
Communications . . . . .	6.2	8.3	5.1	25.0
Education and training . . . . .	1.9	3.6	1.0	- 13.6
Electric power production and distribution . . . . .	- 3.8	- 3.5	- 3.9	4.2
Equipment maintenance . . . . .	1.6	1.1	1.8	- 5.7
Finance and accounting . . . . .	4.8	4.5	5.0	9.0
General support services . . . . .	2.1	1.8	2.3	- 1.5
Information services . . . . .	2.2	1.4	2.7	5.4
Legal and judicial activities . . . . .	-.3	- 1.8	.6	- 3.8
Library services . . . . .	4.6	6.3	3.6	- 6.1
Loans and grants . . . . .	2.3	3.8	1.4	- 3.6
Medical services . . . . .	.6	.2	.8	- 6.3
Military base services . . . . .	1.0	2.1	.3	6.0
Natural resources and environmental management . . . . .	1.4	.2	2.0	- 1.2
Personnel investigations . . . . .	2.7	5.2	1.4	- 1.5
Personnel management . . . . .	-.1	2.6	- 1.5	- 4.7
Postal service . . . . .	1.0	.6	1.1	-.4
Printing and duplication . . . . .	1.4	.1	2.1	- 10.3
Procurement . . . . .	1.0	4.7	-.9	- 2
Records management . . . . .	3.0	5.0	1.9	- 2.7
Regulation—compliance and enforcement . . . . .	2.0	1.6	2.2	- 2.6
Regulation—rulemaking and licensing . . . . .	2.9	.0	4.5	1.9
Social services and benefits . . . . .	2.0	1.9	2.0	- 1.8
Specialized manufacturing . . . . .	2.7	3.9	2.1	- 1.6
Supply and inventory control . . . . .	1.5	1.5	1.5	5.8
Traffic management . . . . .	2.1	3.0	1.7	88.5
Transportation . . . . .	1.5	2.9	.7	-.6

<sup>1</sup> Based on the compound rate formula.

grounds, equipment maintenance, general support services, legal and judicial activities, and library services. Some functions that recorded rising productivity were audits of operations, communications, electric power production, military base services, and traffic management.

*Long-term trends.* Peak periods in the business cycle are not necessarily as meaningful for analysis in government productivity measurement as in industry productivity measurement. Between 1967 and 1991—the period covered by the BLS Federal Government productivity measures—output per employee year grew at an average rate of 1.1 percent in the measured portion of the Federal Government. This rate reflected an average rise of 1.5 percent in output and an increase of 0.4 percent in the labor input.

For purposes of comparison to the industry trends, however, it can be noted that productivity for the measured portion of the Federal Government rose at

an average annual rate of 1.2 percent during the 1973-90 period. Productivity increased 1.3 percent per year during the 1973-79 period, and it grew at an average rate of 1.2 percent during the 1979-90 period. Among the 28 functions, the largest average annual increase in productivity in the 1973-90 period was in communications, growing on average 6.2 percent per year, while electric power production and distribution showed the largest decline, falling an average of 3.8 percent per year between 1973 and 1990. □

**Footnotes**

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

<sup>1</sup> The Office of Productivity and Technology is the primary source of data on trends in industry productivity in the United States. BLS maintains measures of labor or multifactor productivity for

177 industries and portions of Federal, State and local governments.

<sup>2</sup> For more details, see *Productivity Measures for Selected Industries and Government Services*, Bulletin 2421 (Bureau of Labor Statistics, 1993), available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC, 20402, or from the Bureau of Labor Statistics, Publications Sales Center, P.O. Box 2145 Chicago, IL 60690.

<sup>3</sup> Industries examined in this section do not necessarily represent all U.S. industries.

<sup>4</sup> These periods were selected because 1973, 1979, and 1990 were peak years of the business cycles, as determined by the National Bureau of Economic Research. The two periods are comparable because they begin and end at the same stage of the business cycle.

<sup>5</sup> Full reports on productivity in the prepared fresh or frozen fish and seafoods industry, the wood containers industry, and the bolts, nuts, rivets and washers industry are in the October 1992 issue of *Monthly Labor Review*. An article on the natural and processed cheese industry appears in the April 1993 *Review*.

<sup>6</sup> *Monthly Labor Review*, August 1992, p. 49.

<sup>7</sup> The overall series do not represent Federal productivity as a whole but rather the productivity of the combined organizations.