Comparative manufacturing productivity and unit labor costs

The U.S. labor productivity growth rate over the 1979–93 period was matched or exceeded by 8 of 12 countries compared; however, U.S. unit labor costs rose less than the trade-weighted average for competitor economies

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In 1993, the U.S. manufacturing sector turned in its best labor productivity performance in 6 years. But in a comparison of 12 industrial countries—the United States, Canada, Japan, and 9 Western European nations—productivity in 4 countries grew faster than in the United States. In the 1979–93 period, U.S. manufacturing productivity growth was matched or exceeded by 8 of the 12 countries.

Also in 1993, U.S. manufacturing unit labor costs recorded their best performance in 6 years, holding to their 1992 level. In a comparison of 14 economies—a group that includes Korea and Taiwan in addition to the 12 countries mentioned above—unit labor costs declined in 4 nations in 1993. Over the 1979–93 period, all the economies recorded increases in unit labor costs. Only three economies had lower average increases in this period than the United States. However, when measured on a U.S. dollar basis—to account for relative changes in exchange rates—8 of the 14 economies had average increases that were smaller or about as small as the U.S. increase.

This article examines comparative trends in manufacturing output per hour, unit labor costs, and related measures in 1993, the most recent year for which comparative data are available, and in the overall 1979–93 period. The United States, Canada, Japan, Belgium, Denmark, France, Germany, Italy, the Netherlands, Norway, Sweden, and the United Kingdom are examined.

Trends in unit labor costs in Korea and Taiwan also are discussed. The Bureau of Labor Statistics has not computed productivity measures for Korea and Taiwan because adequate labor input measures have not been developed. Korea and Taiwan are included in the analysis of comparative developments in unit labor costs because, of the economies covered, only Canada, Japan, Germany, and the United Kingdom account for higher proportions of U.S. trade in manufactured goods than Korea or Taiwan. (Data for Germany relate to the former West Germany. For a description of the country measures, see the appendix.)

The analysis also includes relative trade-weighted measures of productivity and unit labor costs—that is, the U.S. measure relative to a trade-weighted average for the other economies or selected economies.

This article introduces the use of more comprehensive labor input measures for several countries. In previous reports, the data for the United States and Canada have been based on the number of persons employed in the manufacturing sector and hours worked by employed persons; the employment and hours worked data for the other economies have referred to employees only.

Employed persons include the self-employed, unpaid family workers, and employees who are paid wages or salaries. Beginning with this article, the employment, hours worked, and com-

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pensation measures for Japan, France, Germany, Norway, and Sweden also refer to employed persons. (See the box below for an overview of the effect of this change on the measures.) Employment, hours worked, and compensation for the remaining economies continue to be on an employees-only basis. BLS plans to soon complete the conversion to employed-persons-based measures for the remaining economies.

Comparative trends, 1992–93

Productivity. U.S. manufacturing labor productivity (output per hour) grew 3.2 percent in 1993, the largest increase since 1987. All 11 foreign countries also recorded manufacturing productivity increases in 1993. (See table 1.) In most cases, productivity growth improved in 1993 from 1992; only Canada, Belgium, and France posted lower growth rates in 1993.

The U.S. productivity increase in 1993 was about in the middle of the range of growth rates of the other countries. The U.S. performance was exceeded by Denmark, Italy, Sweden, and the United Kingdom, which experienced productivity gains of about 5 percent to 6–1/2 percent. The remaining countries, except Japan, had increases between 1 percent and 3 percent. Japan posted a slight productivity increase of less than 1/2 percent. (See table 1.)

The U.S. productivity increase in 1993 resulted from output growth of 4.1 percent coupled with a less than 1-percent increase in labor input (as measured by hours worked). Only Canada and the United States recorded increases in output and hours worked over the year. Productivity

Change of employment basis

Beginning with this article, BLS has changed the labor input measures for Japan, France, Germany, Norway, and Sweden from an employee (wage and salary worker) basis to an "all-employed-person" basis. The category of employed persons, which includes self-employed and unpaid family workers in addition to employees, has always been used as the labor input measures for the United States and Canada.

BLS hopes to convert the labor input measures for Belgium, Denmark, Italy, the Netherlands, and the United Kingdom to an employed person basis in the future. The output measures for each economy include the output produced by employees, unpaid family workers, and the self-employed. Thus, the development of employment, hours, and compensation series for all employed persons makes these series more consistent with each country's output measures.

Employees comprise the bulk of employment in the manufacturing sector. In 1993, employees made up 90 percent of manufacturing employment in Norway, 92 percent in Japan, 95–1/2 percent in France and Germany, and 96–1/2 percent in Sweden. Except for Japan, the ratios of employees to total manufacturing employment have remained relatively stable since 1979. Therefore, switching to an all-employed-persons basis has little effect on the 1979–93 productivity and unit labor cost trends in France, Germany, Norway, and Sweden. In Japan, the number of self-employed persons declined between 1979 and 1993, while the number of employees rose, increasing the proportion of Japanese manufacturing workers who are employees from 86 percent to 92 percent. Thus, Japanese employment and total hours on an all-employed-persons basis rose more slowly than on an employees-only basis.

Following are the 1979–93 rates of change in productivity, hours, and unit labor costs on an all-employed-persons basis and on an employees-only basis:

	All-employed-persons	*Employees-only*
Output per hour:		
Japan	4.3	3.8
France	2.8	2.8
Germany	1.9	1.9
Norway	2.4	2.3
Sweden	2.9	3.0
Total hours:		
Japan	.3	.7
France	–2.4	–2.4
Germany	–1.4	–1.4
Norway	–2.1	–2.1
Sweden	–1.9	–2.0
Unit labor costs:		
Japan	.3	.8
France	4.9	4.9
Germany	3.7	3.7
Norway	5.2	5.2
Sweden	4.9	4.8

This change to an employed-persons basis has no effect on hourly compensation costs, because, as with the United States and Canada, hourly compensation costs of employed persons are assumed to be the same as for employees.

Table 1. **Annual percent changes in manufacturing productivity, unit labor costs, and related measures, 14 countries or areas, 1992–93**

Country or area	Output per hour	Output	Total Hours	Employment	Hourly compensation	Unit labor costs		Exchange rate
						National currency	U.S. dollars	
United States	3.2	4.1	.8	–.3	3.3	.1	.1	—
Canada	2.3	5.0	2.6	.6	.5	–1.7	–7.9	–6.3
Japan	.3	–4.2	–4.4	–2.1	2.7	2.4	16.9	14.1
Korea	([1])	5.0	([1])	([1])	([1])	1.4	–1.3	–2.7
Taiwan	([1])	2.8	([1])	([1])	([1])	3.2	–1.7	–4.8
Belgium	2.9	–4.2	–6.9	–5.4	3.8	.9	–6.2	–7.0
Denmark	5.7	.6	–4.8	–4.1	2.5	–3.0	–9.7	–6.9
France	1.1	–3.2	–4.2	–3.9	3.3	2.2	–4.5	–6.6
Germany	1.6	–7.7	–9.1	–5.9	7.4	5.7	–.2	–5.6
Italy	5.6	–2.1	–7.3	–5.4	6.6	.9	–21.0	–21.7
Netherlands	1.2	–2.5	–3.6	–3.6	2.9	1.7	–3.8	–5.4
Norway	2.1	1.7	–.4	–.7	1.0	–1.1	–13.4	–12.5
Sweden	6.6	1.6	–4.7	–7.3	–1.5	–7.6	–30.9	–25.3
United Kingdom	4.8	1.4	–3.3	–2.6	7.5	2.5	–12.8	–15.0

[1] Data not available.

increases in Denmark, Norway, Sweden, and the United Kingdom resulted from rising output and declining labor input, with falling hours accounting for approximately two-thirds or more of the gains in each of the countries except Norway. Although output declined in Japan, Belgium, France, Germany, Italy, and the Netherlands, these countries were able to achieve productivity gains by cutting hours worked more than output fell.

Output and employment. The United States, Canada, and Korea had the largest manufacturing output increases in 1993, at 4 to 5 percent. Taiwan, the Scandinavian countries, and the United Kingdom had smaller increases—less than 3 percent. Output fell about 2 percent to 4 percent in Japan, Belgium, France, Italy, and the Netherlands, while the sharpest drop, nearly 8 percent, occurred in Germany.

Canada was the only country to record an increase in manufacturing employment in 1993, but its less than 1-percent increase followed 3 consecutive years in which employment fell 4 percent or more. Japan, with an employment reduction of 2 percent, experienced its first employment decline since 1987. Manufacturing employment has declined overall in the United States and Italy since about 1980 and in all of the other European countries since the mid–1970's or earlier. This trend continued in 1993.

The United States had only a small decline in employment in 1993—less than 1/2 percent—but several other countries had severe declines. The steepest reductions were in Belgium and Italy, 5–1/2 percent, Germany, 6 percent, and Sweden, more than 7 percent for the second consecutive year.

Except for the United States, where labor input increased nearly 1 percent, all countries with declines in manufacturing employment in 1993 also experienced reductions in total hours. Average hours were down 2 percent or more in Japan, Germany, and Italy. These reductions, compounded by declining employment, led to large decreases in labor input. Total hours plunged 7 percent in Belgium and in Italy and 9 percent in Germany. Japan, with a more modest decline in employment, nevertheless experienced a drop in total hours of 4–1/2 percent. Total hours in the remaining European countries, except Norway, fell between 3 percent and 5 percent. Hours in Norway fell about 1/2 percent. Canada increased labor input by 2–1/2 percent.

Hourly compensation costs. U.S. manufacturing hourly compensation costs, which comprise wages and salaries, supplements, and employer Social Security and other employer-financed benefit plans, increased about 3–1/2 percent in 1993. Costs increased at a similar rate in Belgium and France, while costs were up less in Canada, Japan, Denmark, the Netherlands, and Norway. Increases in hourly compensation costs were greater in Germany, Italy, and the United Kingdom—6–1/2 percent to 7–1/2 percent. In Sweden, costs declined 1–1/2 percent in 1993, the first decline ever in the annual series dating from 1950. This decline resulted from a substantial cut in employer social security contributions and a reduction of 2 days in the annual leave entitlement.

In nine countries, including the United States, the changes in hourly compensation in 1993 represent the second or third consecutive year of lower rates of gain compared with the preceding year. In France, hourly compensation costs rose in 1993 at about the same rate as in the preceding year, after falling in 1991 and 1992. Only Germany showed an increase in the growth rate of hourly compensation, with a 7–1/2 percent increase in 1993 following a 5-percent increase in 1992.

Unit labor costs. Unit labor costs remained essentially flat in 1993 in the United States, 1 of 5 economies where unit labor costs declined or were unchanged. Canada, Denmark, and Norway each reported a decrease of 1 percent to 3 percent. The most dramatic decline was in Sweden, which not only reported a 7–1/2 percent drop in 1993, but was the only country to report 2 consecutive years of decreasing unit labor costs. The largest increase, 5–1/2 percent, was in Germany, which also had among the largest increases in 1992.

Unit labor costs in U.S. dollars. The competitive position of the United States deteriorated relative to virtually all other economies when measured by unit labor costs adjusted for changes in exchange rates. The change in the U.S. position reflected a stronger U.S. dollar relative to the currencies of all economies with the exception of Japan, where the yen appreciated 14 percent against the dollar. All other currencies fell against the dollar in 1993, with the Swedish krona and the Italian lira declining more than 20 percent and the Norwegian krone and the British pound declining by more than 10 percent. The smallest decline was less than 3 percent in Korea; the seven remaining currencies depreciated in the range of 5 percent to 7 percent.

Japan, the only economy with an appreciating currency against the dollar in 1993, had a unit labor cost increase of 17 percent on a U.S. dollar basis. In contrast, unit labor costs in U.S. dollars declined in all of the other foreign economies due in large part to the strength of the U.S. dollar relative to the other currencies.

U.S. dollar-based unit labor costs fell more than 30 percent in Sweden, as national-currency-based unit labor costs fell 7–1/2 percent and the value of the Swedish krona fell 25 percent. Weaknesses in other national currencies accounted for sharp declines in dollar-based unit labor costs: 21 percent in Italy and 13 percent in Norway and the United Kingdom.

Dollar-based unit labor costs hardly changed in Germany, which had the largest national-currency-based increase in unit labor costs and among the smaller currency depreciations. Korea and Taiwan experienced modest declines of between 1 percent and 2 percent; the other economies had dollar-based decreases ranging from about 4 percent in the Netherlands to 10 percent in Denmark.

Comparative trends, 1979–93

Comparable U.S. manufacturing output data currently are not available before 1977. (See note on the U.S. output measures, page 33.) Therefore, the analysis of long-term trends is restricted to, at most, the period from 1977 on. However, it is more useful to begin with 1979, a peak year for U.S. manufacturing output. That year also provides a good starting point to analyze the foreign economies, because most also recorded manufacturing output peaks in 1979 or 1980. Japan, where output did not decline until 1986, is the exception to this pattern.

It also is useful for purposes of analysis to divide the 1979–93 period into three subperiods, 1979 to 1985, 1985 to 1990, and 1990 to 1993. These periods are particularly relevant for the analysis of shifts in competitiveness stemming from changes in unit labor costs and currency exchange rates. The trade-weighted value of the dollar rose strongly between 1979 and 1985, then reversed and fell even further between 1985 and 1990. Since 1990, the dollar has continued to depreciate against the Japanese yen, but has rebounded against the European currencies; the trade-weighted value of the dollar remained essentially flat across the 1990–93 period. In addition, U.S. manufacturing output peaked in the third quarter of 1990; all the other economies, except Korea, had manufacturing output peaks in the 1989–91 period.

Productivity. Between 1979 and 1993, U.S. manufacturing productivity increased at an annual rate of 2–1/2 percent. Productivity increases were the largest in Japan, Belgium, Italy, and the United Kingdom, between 4 percent and 4–1/2 percent. Productivity increased the least, at average rates of about 1–1/2 percent, in Canada and Denmark. The other economies had productivity growth rates in the range of 2 percent to 3 percent. (See table 2.)

Between 1979 and 1985, U.S. manufacturing productivity grew only 2 percent annually, the lowest rate of increase among the 12 economies, although growth rates were only marginally higher in Denmark and Germany. Belgium's 6–1/2 percent annual increase made it the productivity leader during this period. Productivity grew by 5 percent annually in Italy, 4–1/2 percent per year in Japan, and about 2–1/2 percent to 4 percent in the other countries during the 1979–85 period.

Table 2. **Annual percent changes in manufacturing productivity, unit labor costs, and related measures, 14 countries or areas, selected periods, 1979–93**

Country or area	Output per hour	Output	Total Hours	Employment	Hourly compensation	Unit labor costs		Exchange rate
						National currency	U.S. dollars	
United States:								
1979–93	2.4	1.5	–0.8	–1.1	5.3	2.8	2.8	—
1979–85	2.0	.7	–1.2	–1.4	6.9	4.9	4.9	—
1985–90	2.7	2.8	.0	–.1	3.9	1.1	1.1	—
1990–93	2.5	1.2	–1.3	–1.9	4.3	1.7	1.7	—
Canada:								
1979–93	1.7	1.1	–.6	–.8	5.9	4.2	3.5	–.7
1979–85	2.4	1.5	–.9	–.8	8.7	6.1	3.4	–2.5
1985–90	.4	1.5	1.1	1.1	4.1	3.7	7.1	3.2
1990–93	2.4	–.5	–2.8	–3.7	3.6	1.2	–2.1	–3.3
Japan:								
1979–93	4.3	4.5	.3	.9	4.6	.3	5.3	4.9
1979–85	4.6	5.8	1.1	1.2	4.7	.1	–1.4	–1.5
1985–90	5.4	5.8	.4	.8	4.7	–.7	9.7	10.5
1990–93	1.8	.0	–1.7	.8	4.3	2.5	12.0	9.3
Korea:								
1979–93	(1)	10.0	(1)	(1)	(1)	7.5	3.6	–3.5
1979–85	(1)	9.1	(1)	(1)	(1)	8.2	–1.9	–9.3
1985–90	(1)	13.2	(1)	(1)	(1)	8.3	12.9	4.2
1990–93	(1)	6.4	(1)	(1)	(1)	4.6	.3	–4.1
Taiwan:								
1979–93	(1)	6.9	(1)	(1)	(1)	4.9	7.3	2.2
1979–85	(1)	8.3	(1)	(1)	(1)	7.1	5.3	–1.7
1985–90	(1)	7.0	(1)	(1)	(1)	3.5	12.0	8.2
1990–93	(1)	4.3	(1)	(1)	(1)	3.0	3.7	.6
Belgium:								
1979–93	4.3	1.8	–2.3	–2.1	5.8	1.5	.3	–1.2
1979–85	6.6	3.1	–3.3	–2.7	7.8	1.1	–10.1	–11.1
1985–90	2.3	2.5	.2	–.5	3.9	1.5	13.9	12.2
1990–93	3.0	–1.6	–4.4	–3.4	5.1	2.1	.9	–1.1
Denmark:								
1979–93	1.5	1.1	–.4	–.1	6.0	4.5	2.9	–1.5
1979–85	2.1	2.9	.8	1.0	8.1	5.9	–5.8	–11.0
1985–90	.1	–.5	–.6	–.1	5.4	5.2	17.2	11.4
1990–93	2.6	.2	–2.3	–2.2	3.1	.5	–1.1	–1.5
France:								
1979–93	2.8	.3	–2.4	–1.9	7.8	4.9	2.7	–2.0
1979–85	3.0	–.4	–3.3	–2.3	12.7	9.5	–3.4	–11.7
1985–90	3.4	2.6	–.8	–.9	4.5	1.0	11.6	10.5
1990–93	1.2	–1.8	–3.0	–2.9	3.7	2.5	1.1	–1.3
Germany:								
1979–93	1.9	.4	–1.4	–.5	5.7	3.7	4.5	.7
1979–85	2.1	.2	–1.8	–1.1	5.9	3.8	–4.1	–7.6
1985–90	2.1	2.3	.3	1.1	4.9	2.8	15.9	12.7
1990–93	1.2	–2.2	–3.3	–2.1	6.3	5.1	4.3	–.8
Italy:								
1979–93	4.1	2.0	–2.0	–2.0	11.3	6.9	2.1	–4.5
1979–85	5.0	1.8	–3.1	–2.9	16.7	11.1	–3.3	–12.9
1985–90	2.6	4.0	1.3	.3	6.9	4.2	14.3	9.8
1990–93	4.6	–.7	–5.0	–4.0	8.1	3.4	–5.6	–8.7
Netherlands:								
1979–93	2.6	1.6	–1.0	–.8	3.7	1.1	1.6	.5
1979–85	4.2	1.6	–2.5	–2.1	4.8	.6	–7.5	–8.0
1985–90	1.9	3.1	1.2	1.4	2.0	.2	12.9	12.7
1990–93	.9	–.9	–1.8	–1.7	4.5	3.5	2.8	–.7
Norway:								
1979–93	2.4	.2	–2.1	–2.1	7.7	5.2	2.7	–2.4
1979–85	2.9	1.0	–1.9	–1.8	10.0	6.9	–2.1	–8.4
1985–90	2.2	–.8	–3.0	–2.7	7.9	5.6	12.5	6.6
1990–93	1.5	.4	–1.1	–1.6	2.8	1.3	–2.9	–4.1
Sweden:								
1979–93	2.9	.9	–1.9	–2.4	7.9	4.9	.5	–4.2
1979–85	3.0	2.1	–.8	–1.2	9.6	6.4	–5.2	–11.0
1985–90	1.9	1.4	–.5	–.8	8.4	6.4	14.6	7.8
1990–93	4.2	–2.5	–6.5	–7.5	3.9	–.3	–9.0	–8.7
United Kingdom:								
1979–93	4.1	.4	–3.5	–3.2	9.6	5.4	2.8	–2.4
1979–85	4.1	–1.2	–5.0	–4.6	11.5	7.1	–1.3	–7.9
1985–90	3.8	3.4	–.3	–.4	7.6	3.7	10.5	6.6
1990–93	4.5	–1.6	–5.8	–5.0	9.3	4.7	–1.2	–5.6

[1] Data not available.

During the 1985–90 period, U.S. productivity growth was up about three-quarters of a percentage point, from 2 percent to 2.7 percent, compared with the previous period. Japan, where productivity growth increased from 4–1/2 percent to 5–1/2 percent, France and the United States were the only countries to post improvements in productivity growth in the 1985–90 period. Productivity growth declined substantially in most of the other countries in the second period. The largest drops occurred in Canada, Belgium, Denmark, Italy and the Netherlands.

In the 1990–93 period, U.S. productivity rose 2–1/2 percent per year and several other countries rebounded to post higher productivity gains than in the previous period, but several countries recorded much lower productivity gains. Italy, Sweden, and the United Kingdom raised their productivity growth rates to the 4 percent to 4–1/2 percent range and Canada and Denmark raised their rates from less than 1 percent per year to 2–1/2 percent annually. Japan and France suffered the most severe declines in their growth rates, compared with the previous period—from 5–1/2 percent to less than 2 percent annually in Japan, because of almost no productivity growth in 1992 and 1993, and, in France, from nearly 3–1/2 percent to about 1 percent per year. Productivity growth also slowed in Germany, the Netherlands, and Norway.

Productivity gains recorded in the 1979–93 period resulted from a combination of increasing output and decreasing labor input in all of the economies except Japan. Japan had a small overall increase in labor hours; consequently, Japan's productivity gains were due entirely to rising output. Productivity growth in the United States, Canada, Denmark, and the Netherlands was due more to output growth than reductions in labor input while reductions in labor input played the more important role in Belgium, France, Germany, Norway, Sweden, and the United Kingdom. Output growth of less than 1/2 percent a year in France, Germany, Norway, and the United Kingdom contributed very little toward increasing productivity. In Italy, rising output and reductions in labor input were of equal importance in increasing productivity.

During the 1990's, the composition of productivity growth in manufacturing has become much more heavily weighted toward reducing labor input, rather than increasing output. Between 1990 and 1993, the United States was the only country in which an overall rise in output contributed as much to productivity growth as reductions in labor input. In the 11 other countries, virtually all productivity growth was accomplished by reducing the number of hours worked. Only Denmark and Norway increased manufacturing output during this period, and only by less than 1/2 percent per year. In contrast, between 1985 and 1990, Denmark and Norway were the only countries where output fell. The remaining countries all boosted productivity during 1985–90, mostly by increasing output.

Output. Manufacturing output in the United States increased at a rate of 1–1/2 percent annually between 1979 and 1993, one of the higher rates among the European and North American economies being compared. Manufacturing output grew rapidly in the three Asian economies. Korea led the way with an average annual increase in output of 10 percent, while output rose on average 7 percent in Taiwan, and 4–1/2 percent in Japan. Japan's rate of growth was 5–1/2 percent from 1979 to 1991, but output declined in 1992 and 1993. Outside Asia, the highest output growth was about 2 percent in Belgium and Italy. The lowest growth occurred in France, Germany, Norway, and the United Kingdom, where, as noted, output rose less than 1/2 percent per year.

Between 1979 and 1985, U.S. manufacturing output grew at an average annual rate of only 0.7 percent. Output fell in France and the United Kingdom and was little changed in Germany. All the other economies posted higher output growth rates than the United States, led by the Asian economies.

Manufacturing output in the United States picked up to a 2.8-percent growth rate in the 1985–90 period. This was still well below output growth rates of the three Asian economies. Only three of the other 10 economies—Italy, the Netherlands, and the United Kingdom—had higher growth rates than had the United States.

Between 1990 and 1993, U.S. manufacturing output growth slowed to an annual average rate of 1.2 percent, due largely to the recession of late 1990 and 1991. In all of the other economies with positive output growth between 1985 and 1990, output fell or growth rates slowed in the 1990–93 period. Due to declines in 1992 and 1993, output growth was flat in Japan over the full period. Growth in Korea was cut in half, from nearly 13 percent annually to 6–1/2 percent. Output was lower in 1993 than in 1990 in Canada and all of the European countries except Denmark and Norway, the two countries in which output declined over the 1985–90 period; average annual output gains in Denmark and Norway were less than 1/2 percent.

Employment and total hours. Employment in manufacturing declined between 1979 and 1993 in all the economies studied except Japan, where it increased at a rate of about 1 percent annu-

ally.[1] U.S. manufacturing employment declined at a rate of 1 percent annually, but six European countries had sharper rates of decline, including Sweden, 2–1/2 percent per year, and the United Kingdom, more than 3 percent per year. The smallest declines were in Denmark, down marginally, and Germany, down 1/2 percent per year.

Most of the economies studied, other than Japan, followed a similar pattern in employment growth over the 1979–85, 1985–90, and 1990–93 periods. Between 1979 and 1985, employment declined in most countries by about 1 percent to 3 percent. During the 1985–90 period, employment rose or the decrease in employment slowed to less than 1 percent, except in Norway. Employment levels dropped again between 1990 and 1993, in most cases at somewhat faster rates than during the 1979–85 period. The U.S. experience is typical of this pattern: employment in the United States fell 1–1/2 percent annually during the 1979–85 period, was about unchanged between 1985 and 1990, and decreased about 2 percent annually from 1990 to 1993. The major exception to this pattern was Japan, where employment increased by about 1 percent per year in each of the three periods.

Japan also was the only country in which total hours worked rose between 1979 and 1993. The average annual increase was less than 1/2 percent as average hours worked were reduced more than 1/2 percent per year. Total hours worked were reduced in the remaining countries at rates from 1/2 percent per year in Canada and Denmark to 3–1/2 percent per year in the United Kingdom. Average hours, however, rose slightly or remained flat in five of the countries studied—the United States, Canada, Italy, Norway, and Sweden.

The following tabulation shows employment and total hours in 1993 as percentages of their 1979 levels:

	Employment	*Hours worked*
United States	86.2	89.4
Canada	89.9	92.2
Japan	113.9	103.6
Belgium	74.6	72.1
Denmark	98.8	94.9
France	76.3	71.7
Germany	92.9	82.2
Italy	75.0	75.7
Netherlands	89.7	86.5
Norway	74.7	74.4
Sweden	70.8	76.0
United Kingdom	63.5	60.3

Hourly compensation costs. Relatively modest growth in hourly compensation costs has been a significant factor in improving the U.S. manufacturing sector's competitiveness in the 1979–93 period. Hourly compensation costs in U.S. manufacturing rose at an average rate of 5.3 percent per year in the period. Only Japan, with hourly compensation growth of 4–1/2 percent annually, and the Netherlands, with growth of less than 4 percent per year, had smaller average increases. Several European countries experienced substantial increases, averaging between 6 percent and 8 percent per year. The most rapid increases were in the United Kingdom, with an annual average increase of 9–1/2 percent, and Italy, where hourly compensation costs rose at an annual average rate of nearly 11–1/2 percent.

Annual hourly compensation increases generally moderated during the period studied. With the exception of Germany and Japan, every country had lower hourly compensation growth rates in the 1985–90 and 1990–93 periods than in the 1979–85 period. In 1979–85, the lowest growth rates, approximately 5 percent to 6 percent, occurred in Japan, Germany, and the Netherlands. The remaining countries all had annual average growth rates above the U.S. rate of 7 percent, including rates of 12 percent in the United Kingdom and nearly 17 percent in Italy.

All countries had lower rates of increase in hourly compensation costs in the 1985–90 period except Japan, where the rate remained the same. Only the Netherlands, at 2 percent, had lower hourly compensation growth during this period than the United States, where compensation rose at a 4-percent rate. Italy, Norway, Sweden, and the United Kingdom had the highest growth rates, between 7 percent and 8–1/2 percent, but these rates nonetheless were lower than in the preceding period in each of these countries.

Although hourly compensation costs increased at higher rates in six of the countries over the 1990–93 period, compared with the 1985–90 period, only Germany had a higher rate of increase compared with the 1979–85 period. Germany, Italy, and the United Kingdom had average annual increases higher than 6 percent. Eight countries, including the United States, had average increases of 4–1/2 percent or less.

Unit labor costs. Unit labor cost growth rates in the 1979–93 period tended to mirror the hourly compensation increases discussed earlier. Japan and the Netherlands, the economies with the smallest hourly compensation increases, turned in the best unit labor cost performances between 1979 and 1993. In Japan, strong productivity growth almost completely offset hourly compensation increases, resulting in unit labor costs that were nearly flat over the period. Unit labor costs in the Netherlands grew just 1 percent per year and unit labor costs in Belgium rose 1–1/2 percent per year. The next lowest rate of increase

U.S. output measures

The 1979–92 real manufacturing output data for the United States are the 1987 fixed-price-weighted measures prepared by the Bureau of Economic Analysis of the U.S. Department of Commerce for gross product originating. Comparable manufacturing output data currently are not available before 1977. The 1992–93 percent change in manufacturing output is based on the trend shown by the industrial production indexes published by the U.S. Federal Reserve Board for the durable and nondurable goods sectors, weighted by their shares in gross product originating.

The U.S. real output measures typically constructed by the Bureau of Economic Analysis are based on fixed-price weights of a single year. Fixed-weighted real output series have several advantages, but if relative prices change significantly in the period covered, the change in real output becomes sensitive to the choice of price weights. This issue is discussed in Robert P. Parker, "Gross Product by Industry, 1977–90," *Survey of Current Business*, May 1993. The Parker article shows alternative measures of real output growth, using "benchmark-years-weighted quantity index" numbers for total gross domestic product and for manufacturing for the years 1977–87. The annual growth rate for manufacturing output is 2–1/2 percent over the 1977–87 period; the growth rate based on the 1987 fixed-weighted measure is 1.7 percent. BLS is considering introducing manufacturing output measures based on changing price weights for use in its productivity calculations.

Most of the foreign economies link fixed-weighted measures covering various periods, but some also produce annual chain-weighted indexes. The output measures used in this article are fixed weighted, with one exception: the measures for Norway for 1987–92 are based on relative prices of the preceding year (the 1993 measure is currently based on 1991 prices).

was in the United States, with average unit labor cost growth of less than 3 percent annually. Most of the remaining economies recorded average unit labor cost increases of about 4 percent to 5 percent, but increases in Italy came in at 7 percent annually, and Korean unit labor costs increased by 7–1/2 percent per year.

Unit labor cost growth rates between 1979 and 1985 were dispersed over a wide range. Japan, Belgium, and the Netherlands each had growth rates of about 1 percent or less, while unit labor costs in France increased 9–1/2 percent per year and Italy's average rate of increase was 11 percent. Unit labor costs rose at average annual rates of 4 percent in Germany, 5 percent in the United States, and about 6 percent to 8 percent in the remaining seven economies.

In most countries, unit labor costs rose at lower rates in the 1985–90 period, reflecting the lower rates of increase in hourly compensation costs. Unit labor cost growth in the United States dropped from 5 percent per year to only 1 percent annually. The biggest improvements among the other economies were in Italy, where unit labor cost growth dropped from 11 percent to 4 percent per year, France, where growth fell from 9–1/2 percent to 1 percent annually, and the United Kingdom, where unit labor cost growth was reduced from 7 percent to 3–1/2 percent per year. Costs in the Netherlands remained approximately unchanged over the period and Japanese unit labor costs fell by more than 1/2 percent per year.

The rate of increase in U.S. unit labor costs rose to 1.7 percent per year in the 1990–93 period. Unit labor costs in Japan fell in the 1980's, but rose 2–1/2 percent per year from 1990 to 1993. Unit labor costs in the Netherlands increased less than 1 percent per year in the 1980's, but rose at a 3–1/2-percent rate over the 1990–93 period. In contrast, Canada, Denmark, and Norway reduced their rates of increase to about 1 percent or less. The improvement in this period that stands out most, however, occurred in Sweden; following a decade in which unit labor costs grew at a 6–1/2-percent rate, unit labor costs fell slightly between 1990 and 1993.

Unit labor costs in U.S. dollars. Changes in the value of an economy's currency relative to those of competitor economies must be taken into account when considering the competitiveness of an economy's goods in international markets. Changes in unit labor costs measured in U.S. dollars—to adjust for relative changes in currency exchange rates—are a better indicator of changes in competitiveness than are changes in unit labor costs measured on a national currency basis.

The pattern of exchange rate movements in the 1979–93 period is a major factor driving changes in unit labor costs measured on a U.S. dollar basis. The dollar appreciated sharply relative to the currencies of most of the economies studied in the first half of the 1980's. This widespread dollar appreciation peaked in 1985 and

the dollar began a similarly sharp decline throughout much of the last half of the 1980's. Between 1990 and 1993, the trade-weighted value of the dollar relative to the currencies of the other economies remained mostly unchanged, primarily because of the strength of the Japanese yen: the dollar appreciated overall relative to all of the other currencies except the Taiwanese dollar.

These volatile exchange rate swings dominate the movements in exchange-rate-adjusted unit labor costs. Between 1979 and 1985, unit labor costs measured in national currencies increased for all the foreign economies studied. Nine of the twelve foreign economies recording increases had growth rates exceeding the U.S. increase of 5 percent annually. Measured on a U.S. dollar basis, however, unit labor costs declined in all the foreign economies except Canada and Taiwan. The average yearly declines ranged from 1–1/2 percent in the United Kingdom to 10 percent in Belgium.

Between 1985 and 1990, U.S. unit labor costs increased by only 1 percent annually. After adjusting for relative changes in exchange rates, none of the foreign economies had unit labor cost growth rates of less than 7 percent per year. Omitting Canada and Japan, all of the remaining foreign economies had double-digit unit labor cost growth rates. Denmark, at 17 percent, and Germany, at 16 percent, had the highest annual average increases.

While the U.S. competitive position measured by unit labor costs deteriorated relative to most competitors between 1979 and 1985 and improved relative to all competitors between 1985 and 1990, the results for the 1990–93 period were mixed. U.S. unit labor costs between 1990 and 1993 increased only 1.7 percent per year. However, helped by depreciating currencies, U.S. dollar-based unit labor costs declined in Canada, Denmark, Italy, Norway, Sweden, and the United Kingdom, remained unchanged in Korea, and rose only about 1 percent per year in Belgium and France. In contrast, unit labor costs in Japan increased at a rate of 12 percent per year, primarily because the yen appreciated by more than 9 percent per year. U.S. dollar-based unit labor costs in Germany and the Netherlands, whose currencies depreciated by less than 1 percent per year, increased at rates greater than in the United States. These costs also increased at a greater rate in Taiwan.

Relative unit labor costs

The economies covered by these comparative measures differ greatly in their relative importance to U.S. trade in manufactured products. Therefore, BLS constructs trade-weighted measures that take account of these differences. The trade weights used were derived by rescaling a series covering 21 economies that was developed by the International Monetary Fund. These weights are based on disaggregated 1980 trade data for manufactured goods, and take account of bilateral trade and the relative importance of "third country" markets.[2] The following are the rescaled weights in percent:

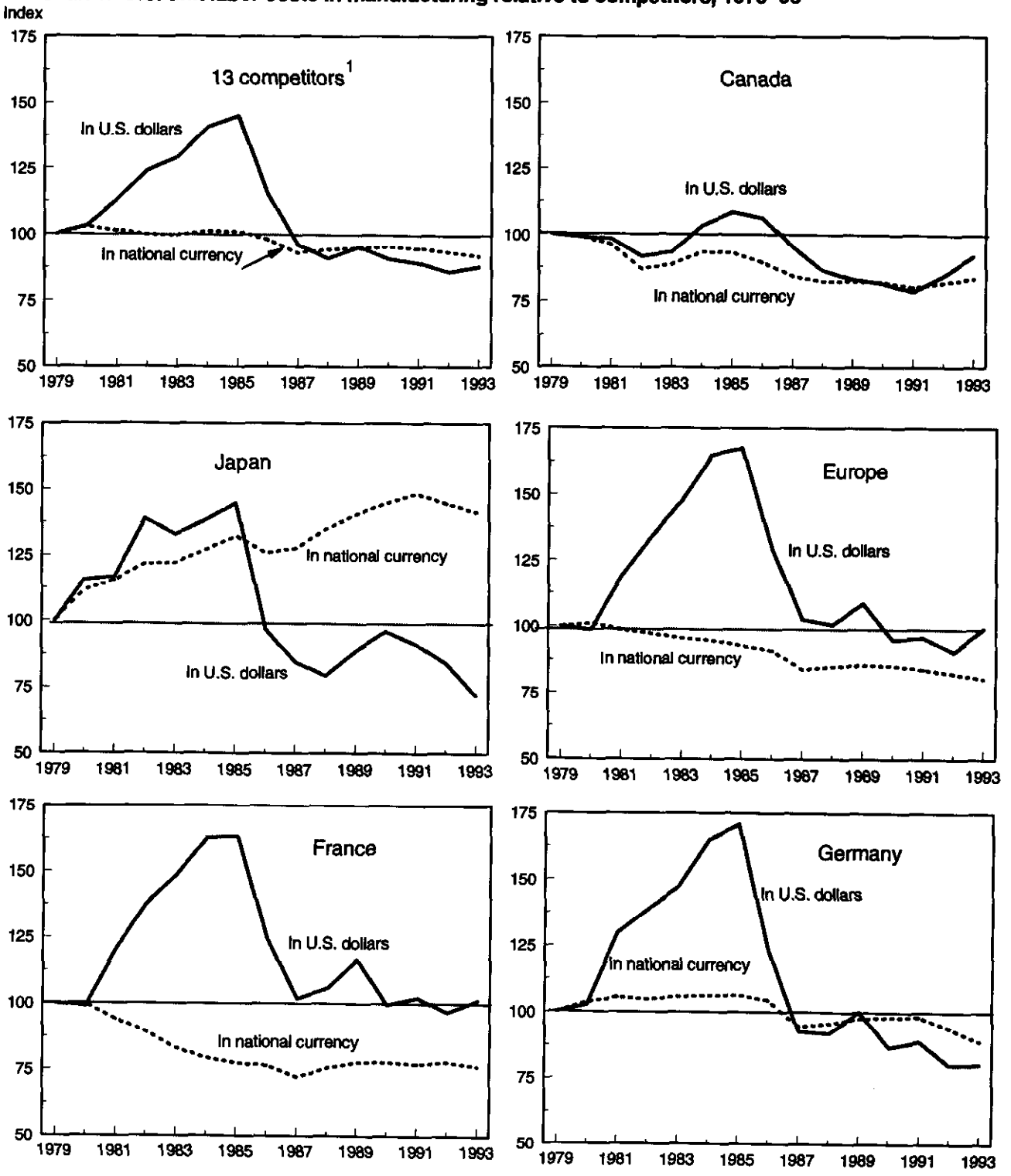
Recent exchange rate changes

Average 1994 currency values in most of the economies studied were within 3–1/2 percent of their average 1993 values. Japan and Canada were the exceptions. The Japanese yen appreciated sharply, up by nearly 9 percent. The Canadian dollar was the only currency to fall significantly in value relative to the U.S. dollar, down more than 5 percent.

The values of the European currencies began 1994 at 1/2 percent to 7 percent below their average 1993 levels. During the year, the European currencies appreciated nearly steadily each month to October, before falling back somewhat in November and December. Following this retrenchment, the average 1994 currency values for the European countries, except Italy, were about 1 percent to 3–1/2 percent higher relative to the dollar than their average 1993 values. The Korean won and New Taiwan dollar hardly fluctuated at all in 1994; average 1994 values were essentially the same as their average 1993 values. The Italian lira was down about 2 percent relative to the dollar in 1994.

Changes in exchange rates influence the increase or decrease of U.S. dollar-denominated unit costs relative to other economies. Consequently, exchange rate changes play an important role in determining the competitiveness of U.S. manufacturing. In the first three quarters of 1994, U.S. unit labor costs were down about 2 percent relative to the same period in 1993, according to data available in late January. The exchange rate changes in 1994 suggest that U.S. competitiveness is likely to have improved relative to Japan, but could have deteriorated somewhat relative to Canada.

Chart 1. **U.S. unit labor costs in manufacturing relative to competitors, 1979–93**



NOTE: 1979 = 100

1 The 13 competitors are Belgium, Canada, Denmark, France, Germany, Italy, Japan, Korea, the Netherlands, Norway, Sweden, Taiwan, and the United Kingdom

Table 3. **Average annual percent changes in U.S. unit labor costs in manufacturing relative to 13 competitors, selected periods, 1979–93**

	National Currency				U.S. Dollars			
	1979–93	1979–85	1985–90	1990–93	1979–93	1979–85	1985–90	1990–93
13 competitors	–0.6	.1	–1.2	–1.2	–0.9	6.4	–9.0	–1.0
Canada	–1.3	–1.2	–2.5	.5	–.6	1.4	–5.5	3.9
Japan	2.5	4.8	1.8	–.8	–2.3	6.3	–7.8	–9.2
Korea	–4.3	–3.1	–6.6	–2.8	–.8	6.9	–10.4	1.4
Taiwan	–2.0	–2.1	–2.3	–1.3	–4.1	–.4	–9.7	–1.9
Europe	–1.6	–1.3	–1.7	–2.0	–.1	9.0	–10.7	1.5
Belgium	1.4	3.7	–.4	–.3	2.6	16.6	–11.2	.8
Denmark	–1.6	–1.0	–3.9	1.2	–.1	11.3	–13.7	2.8
France	–1.9	–4.2	.1	–.7	.1	8.5	–9.4	.6
Germany	–.8	1.0	–1.6	–3.2	–1.6	9.3	–12.7	–2.5
Italy	–3.8	–5.6	–2.9	–1.6	.7	8.4	–11.5	7.7
Netherlands	1.7	4.2	1.0	–1.7	1.2	13.3	–10.4	–1.1
Norway	–2.2	–1.9	–4.3	.5	.1	7.1	–10.2	4.8
Sweden	–2.0	–1.5	–4.9	2.0	2.3	10.6	–11.7	11.8
United Kingdom	–2.4	–2.1	–2.5	–2.8	.1	6.3	–8.5	2.9

Country	*Weights*
Japan	24.9
Canada	18.9
Germany	14.3
United Kingdom	11.9
France	8.2
Italy	5.5
Taiwan	4.4
Korea	3.2
Belgium	2.8
Netherlands	2.7
Sweden	2.0
Denmark	.6
Norway	.6

Two summary measures are constructed: "competitors" indexes, which are the trade-weighted geometric averages of the indexes for competitor economies; and relative indexes, which are the ratio of the U.S. index to the "competitors" index. Chart 1 shows the U.S. unit labor cost index relative to all 13 foreign economies on a national currency and a U.S.-dollar basis in the 1979–93 period. The chart also shows the U.S. index relative to the trade-weighted index for Europe and the indexes for selected countries—Canada, Japan, France, and Germany. Table 3 shows average annual percent changes in U.S. unit labor costs relative to all 13 foreign economies, the 9 European economies, and each of the economies for 1979 to 1993 and the three subperiods analyzed.

In national currency. Between 1979 and 1993, with each country's unit labor costs measured on a national currency basis, U.S. unit labor costs rose by about 2 percent per year relative to Japan and the Netherlands, somewhat less relative to Belgium, and fell relative to each of the remaining economies. Relative to the 13 competitor countries combined, U.S. unit labor costs dropped, on average, a little more than 1/2 percent per year. (See chart 1 and table 3.)

During 1979–85, unit labor costs in the United States rose sharply relative to those in Japan, Belgium, and the Netherlands, and to a smaller extent relative to Germany, but declined relative to the remaining economies. Unit labor costs in the United States remained flat relative to the combined 13 economies because the performance of the United States relative to Germany and Japan, which, with Canada, have the largest trade weights, offset the unit labor cost advantage the United States experienced relative to most of the other economies in this period.

The growth rate of unit labor costs in the United States decelerated from about 5 percent between 1979 and 1985 to about 1 percent between 1985 and 1990, improving the U.S. unit labor cost performance relative to the other 13 economies by an average of about 1 percent annually. During this period, Japan and the Netherlands were the only countries where unit labor cost growth rates were lower than in the United States.

In the 1990–93 period, when U.S. unit labor costs rose 1.7 percent per year, U.S. unit labor costs relative to the trade-weighted average for the 13 foreign economies also improved at an average rate of 1 percent per year, in large part because of Germany's much higher unit labor cost growth.

In U.S. dollars. U.S. competitiveness, as measured by unit labor costs adjusted for changes in the value of the U.S. dollar, improved at a rate of about 1 percent annually relative to the 13 competitors between 1979 and 1993. Although the U.S. competitive position deteriorated or remained the same relative to all the European countries except Germany, the U.S. position improved relative to Canada, Japan, and Germany, which have a combined trade weight of 58 percent of competitor economies. U.S. competitiveness also improved relative to Korea and Taiwan.

However, looking at the 1979–93 period as a whole masks three distinct movements in U.S. relative unit labor costs that occurred during the 14 years because of changes in relative currency values. Due to the sharp appreciation of the dollar in the first half of the 1980's, the competitive position of the U.S. relative to the 13 competitors deteriorated at a rate of more than 6 percent per year between 1979 and 1985. U.S. unit labor costs rose by 6 percent annually relative to Japan, and 9 percent per year relative to the European economies. Taiwan's economy was the only one against which the U.S. competitive position improved.

The trend of rising U.S. unit labor costs relative to the 13 competitors was reversed in the 1985–90 period. Unit labor costs in the United States fell 9 percent per year relative to all 13 economies, with the biggest declines—nearly 11 percent annually—occurring relative to the European economies.

In 1991, the European currencies started to weaken against the U.S. dollar. Following a recovery in 1992, European currency values dropped sharply in 1993. As a result, in the 1990–93 period, U.S. competitiveness declined relative to Europe as a whole. However, the strong yen pushed Japanese unit labor costs up at a rate of 12 percent per year, improving U.S. competitiveness relative to Japan and offsetting the deteriorating U.S. competitive position relative to Europe. The net result was that U.S. competitiveness improved at a rate of 1 percent per year between 1990 and 1993 relative to all 13 foreign economies. □

Footnotes

[1] According to their household surveys, employment increased 2.9 percent per year in Korea and 1.3 percent per year in Taiwan over the 1979–93 period.

[2] See Ann K. McGuirk, "Measuring Price Competitiveness for Industrial Country Trade in Manufacturers," working paper (International Monetary Fund, April 28, 1986). This paper relates to 17 industrial countries. McGuirk subsequently recalculated the trade weights to include Hong Kong, Korea, Singapore, and Taiwan. The weights given to Korea and Taiwan would be larger based on a more current year.

APPENDIX: Manufacturing productivity and unit labor costs

BLS constructs trend indexes of manufacturing labor productivity (output per hour), hourly compensation costs, and unit labor costs from three aggregative measures—output, total labor hours, and total compensation. The hours and compensation measures refer to all employed persons, including self-employed persons, in the United States, Canada, Japan, France, Germany, Norway, and Sweden and to all employees (wage and salary workers) in the other economies. Hours refer to hours worked in all economies. (The figures for Canada are the official measures prepared by Statistics Canada.)

In general, the measures relate to total manufacturing as defined by the International Standard Industrial Classification. However, the measures for France and Italy refer to mining and manufacturing, excluding energy-related products.

Output: In general, the output measures are value added in manufacturing (gross product originating) in constant prices from the national accounts of each country. However, the national accounts measures for the United Kingdom are essentially identical to their indexes of industrial production. While methods of deriving national accounts measures differ substantially among countries, the use of different procedures does not, in itself, connote lack of comparability—rather, it reflects differences among countries in the availability and reliability of underlying data series.

Country differences in the price-base years used to measure real output, and in the frequency and method of changing price weights, also can lead to differences in real output growth rates. The real manufacturing output data currently being used for the United States are 1987 fixed-price-weighted measures. Until the past few years, the effect of using one year's prices rather than another in measuring real output growth had been considered small enough to ignore. Consequently, the U.S. Department of Commerce's Bureau of Economic Analysis, which prepares the national accounts, used the same price-base year for all years from the beginning of the series. However, if relative prices change significantly in the period covered, the change in real output becomes sensitive to the choice of price weights.

Changes in the prices and quantities of computers, in particular, have been large enough since the late 1970's to make the measurement of real output quite sensitive to the choice of price weights, especially for manufacturing output. (See the box on the U.S. output measures, page 33.)

Except for Japan, which uses fixed-weighted measures for long time periods, economies covered in BLS's series link fixed-weighted measures covering various periods, although the methods differ. Most change their weights at about 5-year intervals and extend back by linking to data for previous years that are based on earlier price weights. The method used by Germany is to use fixed weights at the level of detail it publishes and changing weights at more detailed levels. The measures for Norway for 1987–92 are annual chain-linked measures based on relative prices of the preceding year.

Labor input: The total hours measures are developed from statistics of manufacturing employment and average hours. The series used for France, Norway, and Sweden are official series published with the national accounts. Where official total hours series are not available, the measures are developed by BLS using employment figures published with the national accounts, or other comprehensive employment series, and estimates of annual hours worked. For Germany, BLS uses estimates of average hours worked developed by a research institute connected with the Ministry of Labor for use with the national accounts employment figures. For the other countries, BLS constructs its own estimates of average hours.

With this article, the labor input series for Japan, France, Germany, Norway, and Sweden were converted from an employee to an all-employed-persons basis. The Japanese series on all employed persons is from the Japanese national accounts, as was the previous employment series. Average employee hours for Japan are from an establishment survey covering establishments employing 5 or more workers. Average hours worked for the self employed are from Japan's monthly household labor force survey. All of the necessary data for the other 4 countries were available from the sources listed above.

For the Republic of Korea and Taiwan, BLS publishes only measures of unit labor costs and its components, output and total compensation. Total hours, and consequently productivity, are not computed for Korea and Taiwan because BLS has not yet developed adequate labor input series.

Compensation (labor cost): The compensation measures are from the national accounts except those for Belgium, which are developed by BLS using statistics on employment, average hours, and hourly compensation. Compensation includes employer expenditures for legally required insurance programs and contractual and private benefit plans, in addition to all payments made in cash or in-kind directly to employees. For France and Sweden, compensation is increased to account for other significant taxes on payroll or employment. For the United Kingdom, compensation is reduced to account for subsidies. Self-employed workers are included in the all-employed-persons measures by assuming that their hourly compensation is equal to the average for wage and salary employees.

Current indicators: The measures for some recent years may be based on current indicators of manufacturing output (such as industrial production indexes), employment, average hours, and hourly compensation until national accounts and other statistics used for the long-term measures become available.

Level comparisons: BLS measures are limited to trend comparisons. BLS does not prepare level comparisons of manufacturing productivity and unit labor costs because of data limitations and technical problems comparing the levels of manufacturing output among countries. Each country measures manufacturing output in its own currency units. To compare outputs among countries, a common unit of measure—such as the U.S. dollar—is needed. Market exchange rates are not suitable as a basis for comparing output levels. What are needed are purchasing power parities, which are the number of foreign currency units required to buy goods and services equivalent to what can be bought with one unit of U.S. currency.

These purchasing power parities are available for total gross domestic product. However, the purchasing power parities are derived from the expenditure side of the national accounts (consumer, business, and government final expenditures for goods and services) and not from the output side of the accounts (gross product originating by industry, or value added). Therefore, purchasing power parities are not available by industry. The purchasing power parities for total GDP are not suitable for each component industry, such as manufacturing.