International comparisons of productivity and unit labor cost trends in manufacturing

U.S. manufacturing competitiveness improved in 1987, as measured by relative changes in unit labor costs, because of good productivity growth, a decline in unit labor costs, and large appreciations in foreign currency values

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The manufacturing labor productivity increase in the United States in 1987—about $3\frac{1}{2}$ percent—was more rapid than the gains in 7 of 11 other countries studied. Norway and the United Kingdom had the largest increases (about 7 percent) followed by Japan and Sweden (around 4 percent). Gains recorded in the other countries ranged from about 3 percent in Belgium, France, and Italy; 1 to $2\frac{1}{2}$ percent in Canada, Denmark, and Germany, and less than 1 percent in the Netherlands.[1]

Unit labor costs, which reflect the interplay of productivity and hourly compensation costs, fell by slightly more than 1 percent in the United States in 1987. Belgian unit labor costs decreased at a similar rate and Japan had a larger decline of around $2\frac{1}{2}$ percent for the year. Taiwan, newly added to the unit labor cost comparisons, had a decline of about 2 percent. Unit labor costs were basically unchanged in France; increased less than $\frac{1}{2}$ percent in the United Kingdom; rose between 2 and 3 percent in Canada, Germany, Italy, the Netherlands, Sweden, and South Korea (which was added to the unit labor cost comparisons last year); and increased more than 9 percent in Denmark and Norway.

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The U.S. competitive position was aided for the second consecutive year by exchange rate developments, which resulted in 1987 appreciations of between 5 and 22 percent in foreign currency values relative to the U.S. dollar. Measured in U.S. dollar terms, unit labor costs rose between a low of $7\frac{1}{2}$ percent in Canada and a high of around 30 percent in Denmark.

Our study of developments in Korea and Taiwan is limited to manufacturing output and unit labor costs. Both countries are excluded from the productivity analysis because of unresolved problems in developing labor input measures. However, we have studied Korea and Taiwan to the extent possible as part of our effort to add some of the newly industrializing countries or areas that have become of such great importance to U.S. trade in manufactured goods. Currently, only Canada, Japan, and West Germany account for higher proportions of U.S. trade in manufactured goods (imports plus exports) than Taiwan, and Korea ranks sixth.

Productivity trends

The year 1987 marks the third consecutive year that the United States has been among the productivity leaders. Over this 3-year period, 1984–87, the United States and Japan had about equal average rates of productivity growth, and only the United Kingdom had a higher average rate. In addition, it marks a continuation in the

rebound in U.S. manufacturing productivity growth following the 1973–79 slowdown.[2] As analyzed in previous articles, all 12 industrial countries have had productivity slowdowns since 1973, and only the United States and the United Kingdom have had productivity growth rates since 1979 that match or exceed their pre-1973 trend rates.[3] Most of the other countries have had lower productivity growth rates from 1979 to 1987 than they did in the 1973–79 period. (See table 1.)

Output and labor input

The 1987 productivity gains recorded by the United States, Canada, and Italy resulted from manufacturing output gains that exceeded increases in labor input. The productivity gains registered by all other countries except Denmark resulted from a combination of increases in output and reductions in labor input. In Denmark, output fell, but total labor hours were reduced even more.

The United States, Canada, Italy, and the United Kingdom had the largest output increases among the 12 industrial countries, ranging from nearly 4½ percent in the United States and Italy up to about 5½ percent in Canada and the United Kingdom. The British increase was the largest since 1973, but output was still 4 percent below the historical peak reached that year.

Korea and Taiwan had much larger gains in manufacturing output than any of the industrial countries—around 15 percent. At the other extreme, output fell about 2½ percent in Denmark and rose about 1 percent or less in Belgium, France, Germany, the Netherlands, and Norway. France and Denmark were the only countries other than the United Kingdom where the level of manufacturing output was below a previous year. The peak year for France was 1979; for Denmark, 1986. (See table 2.)

Manufacturing employment rose in the United States, Canada, and the Netherlands in 1987; remained unchanged in Germany and Sweden; and fell about 1 to 2½ percent in the other industrial countries. Canadian employment rose more than 2 percent, whereas the U.S. and Dutch increases were only about ½ of 1 percent. This was the fourth consecutive year in which Canadian employment rose around 2 percent or more. The small U.S. increase followed 2 years of declining manufacturing employment. Dutch employment rose for the third consecutive year, following 14 years of falling employment.

Belgium and France had the largest 1987 employment reductions, marking the 13th consecutive year of declines in both countries. The falloff in British employment was the 12th in the last 13 years.

Total labor hours decreased the most in Denmark and Norway due to both employment cutbacks and reductions in the standard workweek. The Norwegian standard workweek was cut 2½ hours as of January 1, 1987, and the Danish workweek was reduced 1 hour as part of a two-stage working time reduction that will lead to a 37-hour working week in 1990. (See table 2.)

Hourly compensation costs

Hourly compensation costs—which comprise wages and salaries, supplements, and employer payments for Social Security and other employer-financed benefit plans—rose 2.1 percent in the United States in 1987. This was the smallest annual increase since 1965. Nevertheless, Belgium had an equally small rise in hourly compensation and Japan had an even smaller increase. For both countries, these were the smallest annual increases since at least 1961.

Hourly compensation costs rose at moderate rates of between 2½ and 4 percent in France, Germany, and the Netherlands. These were also the smallest increases since at least 1961. Canadian, Italian, Swedish, and British compensation costs rose about 5 to 7 percent. Danish hourly costs rose 12 percent, and Norwegian hourly costs rose 17 percent, in large part reflecting the workweek reductions. (See table 3.)

Unit labor costs

Unit labor costs fell in the United States, Japan, and Belgium as productivity gains in those countries exceeded their small increases in hourly compensation costs. Unit labor costs also fell in Taiwan and were largely unchanged

Table 1. Annual percent changes in manufacturing productivity, 12 countries, 1960–87

Year	United States	Canada	Japan	France	Germany	Italy	United Kingdom	Belgium	Denmark	Netherlands	Norway	Sweden
Output per hour:												
1960–87..	2.8	3.3	7.7	5.0	4.4	5.7	3.7	6.3	4.3	5.7	3.4	4.6
1960–73..	3.2	4.5	10.3	6.4	5.8	7.5	4.2	6.9	6.4	7.4	4.3	6.4
1973–87..	2.5	2.1	5.3	3.7	3.2	4.0	3.2	5.7	2.3	4.2	2.6	2.9
1973–79..	1.4	2.1	5.5	4.6	4.3	3.3	1.2	6.0	4.2	5.5	2.2	2.6
1979–87..	3.3	2.1	5.1	3.0	2.3	4.6	4.7	5.4	1.0	3.3	2.9	3.1
1979–85..	3.4	2.4	5.8	3.0	2.9	5.4	4.7	6.0	1.7	4.4	2.8	3.5
1986	3.3	.3	1.7	3.0	0	.8	2.7	4.0	−3.6	−.5	−.7	0
1987	3.4	2.4	4.1	3.2	1.4	3.2	6.8	3.0	1.3	.5	7.1	4.3

NOTE: Rates of change based on the compound rate method.

Table 2. Annual percent changes in manufacturing output and labor input, 12 countries, 1960–87

Year	United States	Canada	Japan	France	Germany	Italy	United Kingdom	Belgium	Denmark	Netherlands	Norway	Sweden
Output												
1960–87	3.4	4.3	8.7	3.9	3.0	4.9	1.3	4.1	3.4	3.7	2.6	3.1
1960–73	4.8	6.5	12.8	7.2	5.2	7.3	3.0	6.6	5.3	6.0	4.7	5.1
1973–87	2.2	2.3	5.1	1.0	1.1	2.7	-.3	1.8	1.6	1.5	.6	1.2
1973–79	1.9	2.5	3.6	2.6	1.7	3.1	-.7	1.3	1.6	1.7	.2	.5
1979–87	2.4	2.1	6.2	-.2	.6	2.4	.0	2.1	1.7	1.4	.9	1.8
1979–85	2.0	1.5	7.6	-.6	.5	1.9	-.9	2.4	2.6	1.6	1.0	1.8
1986	2.3	2.6	.6	.6	.7	3.3	.2	1.7	.7	1.2	.3	-.5
1987	4.3	5.4	3.4	1.1	.7	4.3	5.4	.9	-2.7	.5	1.3	4.0
Aggregate hours												
1960–87	.6	1.0	1.0	-1.0	-1.4	-.8	-2.3	-2.1	-.9	-1.9	-.8	-1.4
1960–73	1.6	1.9	2.3	.8	-.6	-.2	-1.1	-.3	-1.1	-1.2	.3	-1.2
1973–87	-.3	.2	-.2	-2.6	-2.0	-1.3	-3.4	-3.7	-.7	-2.6	-1.9	-1.6
1973–79	.5	.4	-1.8	-1.9	-2.5	-.2	-1.9	-4.5	-2.5	-3.6	-1.9	-2.0
1979–87	-1.0	0	1.1	-3.2	-1.7	-2.1	-4.5	-3.1	.7	-1.8	-1.9	-1.3
1979–85	-1.3	-.8	1.7	-3.5	-2.3	-3.3	-5.3	-3.4	.9	-2.7	-1.8	-1.6
1986	-1.0	2.3	-1.1	-2.4	.7	2.5	-2.4	-2.1	4.4	1.7	1.1	-.5
1987	.9	3.0	-.6	-2.0	-.7	1.0	-1.4	-2.0	-3.9	.0	-5.4	-.3
Employment												
1960–87	.5	1.1	1.6	-.3	-.4	.1	-1.8	-1.1	.1	-.8	.1	-.4
1960–73	1.4	2.0	3.3	1.3	.4	1.6	-.5	.8	.5	.1	1.3	.1
1973–87	-.4	.4	.0	-1.8	-1.3	-1.3	-3.0	-2.9	-.3	-1.7	-1.0	-.8
1973–79	.8	.8	-1.5	-1.0	-1.6	.3	-1.4	-3.4	-2.0	-2.3	-.2	-.5
1979–87	-1.2	0	1.0	-2.4	-1.0	-2.5	-4.2	-2.5	.9	-1.2	-1.5	-1.1
1979–85	-1.4	-.8	1.6	-2.4	-1.6	-3.0	-4.9	-2.7	1.2	-2.1	-1.9	-1.5
1986	-1.4	2.8	-.3	-2.5	1.6	-1.2	-2.3	-1.5	2.0	2.0	1.2	.4
1987	.4	2.3	-1.1	-2.5	-.1	-.8	-2.0	-2.4	-1.7	.7	-2.0	0

NOTE: Rates of change based on the compound rate method.

in France and the United Kingdom. The gains recorded in the other countries ranged from about 2 to 4 percent in Canada, Korea, Germany, Italy, the Netherlands, and Sweden to more than 9 percent in Denmark and Norway. (See tables 3 and 4.)

Unit labor costs in U.S. dollar terms

The U.S. competitive situation was greatly improved in 1987, as it had been in 1986, by foreign currency appreciations relative to the U.S. dollar. While the 1987 appreciations of the Japanese yen and the European currencies were less than in 1986, they were still very substantial—ranging from 10 to 12 percent for the currencies of Norway, Sweden, and the United Kingdom up to 20 percent for the currencies of Belgium, Germany, and the Netherlands. In addition, the values of the Canadian dollar and Korean won, which fell slightly in 1986, rose 5 to 7 percent, and the Taiwanese dollar rose 19 percent.

Adjusted for these exchange rate changes, unit labor costs rose $7\frac{1}{2}$ percent in Canada and from 10 percent to 30 percent in Japan, Korea, Taiwan, and the European countries. In 1986, unit labor costs rose about 20 percent to 40 percent in the European countries and 46 percent in Japan—amounting to 2-year increases of 32 percent in the United Kingdom; 50 percent to 57 percent in Belgium, Italy, France, Norway, and Sweden; more than 60 percent in Japan; and more than 70 percent in Denmark, Germany, and the Netherlands. The United States had a 1-percent decline in unit labor costs over this 2-year period. (See tables 3 and 4.)

Trade-weighted relative unit labor costs

The countries covered by these comparative measures differ greatly in their relative importance to U.S. trade in manufactured goods. In 1986, Canada and Japan each accounted for 20 percent of total U.S. imports and exports of manufactured goods; Korea, Taiwan, and the four large European countries each accounted for 3 percent to 7 percent; and the five smaller European countries each accounted for 2 percent or less. Therefore, the Bureau constructs trade-weighted measures that take account of these differences. The 11 industrial foreign countries accounted for 63 percent of U.S. manufactured goods trade in 1986. Korea and Taiwan accounted for an additional 8 percent.

Two summary measures are constructed: a "competitors" index, which is the trade-weighted geometric average of the indexes for the 13 other competitors, and a relative index, which is the ratio of the U.S. (or other country) index to the "competitors" index. The trade weights were derived by rescaling an unpublished International Monetary Fund series covering 21 countries or areas that is based on disaggregated 1980 trade data for manufactured

Chart 1. U.S. manufacturing unit labor costs relative to 13 competitors, 1973-87

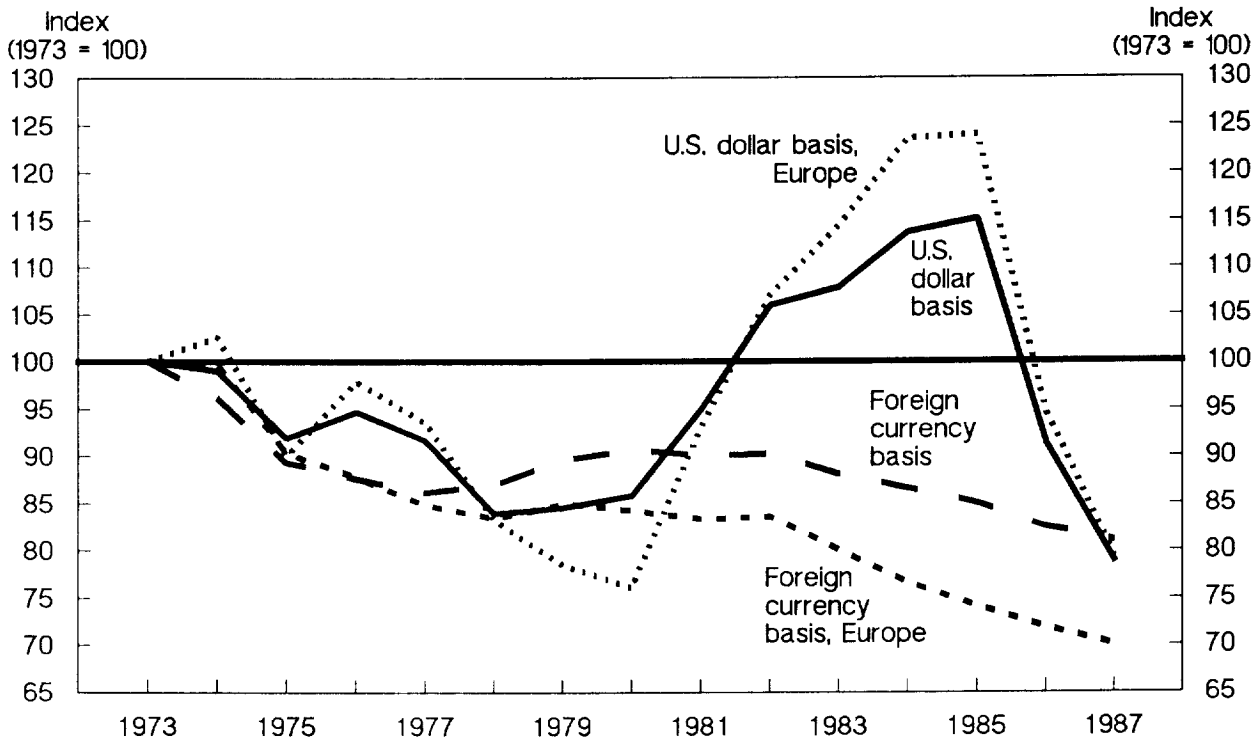

Chart 2. U.S. manufacturing unit labor costs relative to 13 competitors, Canada, and Japan, U.S. dollar basis, 1973-87

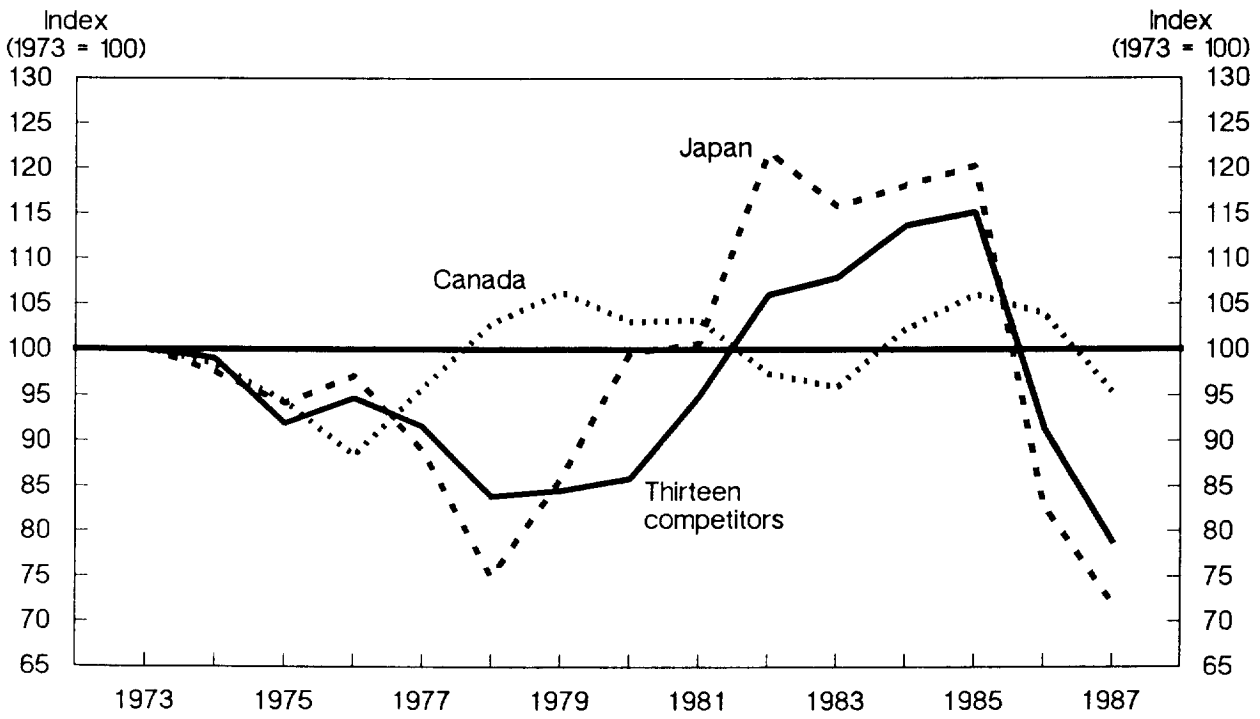

Table 3. Annual percent changes in manufacturing hourly compensation and unit labor costs, 12 countries, 1960–87

Year	United States	Canada	Japan	France	Germany	Italy	United Kingdom	Belgium	Denmark	Netherlands	Norway	Sweden
Hourly compensation												
1960–87	6.2	7.9	11.3	11.5	8.7	15.2	11.6	10.3	11.3	10.1	11.0	11.0
1960–73	5.0	6.2	15.1	10.0	10.3	13.5	9.2	11.0	12.2	12.9	10.0	10.5
1973–87	7.4	9.5	8.0	13.0	7.2	16.7	13.9	9.7	10.5	7.5	11.9	11.4
1973–79	9.5	12.0	12.8	16.3	9.5	20.6	19.4	14.0	14.0	11.6	13.4	14.2
1979–87	5.8	7.7	4.5	10.5	5.5	13.9	10.0	6.5	7.9	4.5	10.8	9.3
1979–85	6.8	8.6	4.9	12.9	6.0	17.2	10.9	7.7	8.1	5.1	9.9	10.0
1986	3.7	4.6	4.9	4.4	4.3	3.3	7.4	3.9	3.3	3.0	9.7	7.7
1987	2.1	5.2	1.4	3.1	4.0	5.9	7.1	1.9	11.6	2.7	17.2	7.0
Unit labor costs												
1960–87	3.3	4.5	3.4	6.2	4.1	9.0	7.7	3.8	6.7	4.1	7.3	6.1
1960–73	1.8	1.6	4.3	3.4	4.3	5.6	4.8	3.8	5.5	5.2	5.4	3.9
1973–87	4.8	7.3	2.6	8.9	3.9	12.2	10.4	3.8	8.0	3.1	9.1	8.2
1973–79	8.0	9.8	6.9	11.2	4.9	16.7	18.0	7.5	9.4	5.8	11.0	11.2
1979–87	2.4	5.4	-.6	7.3	3.1	8.9	5.1	1.1	6.9	1.2	7.6	6.0
1979–85	3.4	6.1	-.8	9.6	3.0	11.1	6.0	1.6	6.3	.6	6.9	6.3
1986	.5	4.3	3.2	1.3	4.3	2.5	4.5	.0	7.1	3.6	10.5	7.7
1987	-1.2	2.7	-2.5	-.1	2.5	2.6	.2	-1.1	10.2	2.2	9.3	2.6
Unit labor costs in U.S. dollars												
1960–87	3.3	3.3	6.9	5.4	7.4	6.0	5.6	4.9	6.8	6.5	7.5	5.3
1960–73	1.8	1.3	6.6	4.2	8.0	6.1	3.7	5.8	6.6	7.7	7.2	5.3
1973–87	4.8	5.1	7.3	6.6	6.8	6.0	7.3	4.1	7.0	5.5	7.8	5.3
1973–79	8.0	6.9	10.8	12.0	11.6	10.0	15.2	12.7	11.9	11.7	13.3	11.5
1979–87	2.4	3.8	4.7	2.7	3.4	3.0	1.7	-1.9	3.4	1.1	3.9	.9
1979–85	3.4	3.4	-2.3	-3.2	-4.8	-3.3	-2.4	-9.6	-5.4	-7.5	-2.1	-5.4
1986	.5	2.5	46.1	31.4	41.3	31.2	18.3	32.8	40.2	40.4	28.4	30.0
1987	-1.2	7.7	13.5	15.1	23.8	18.0	12.0	18.3	30.3	23.5	20.0	15.3

NOTE: Rates of change based on the compound rate method.

goods and which takes account of both bilateral trade and the relative importance of "third country" markets.[4]

Chart 1 shows U.S. relative unit labor cost indexes on both a national currency and U.S. dollar basis over the 1973–87 period. The U.S. indexes are shown relative to all 13 competitors and relative to the 9 European countries. As the chart shows, U.S. relative unit labor costs, unadjusted for exchange rate changes, fell from 1973 to 1977, rose moderately from 1977 to 1982, and then fell again from 1982 to 1987. As of 1987, U.S. relative unit labor costs were down 19 percent from 1973 and 6 percent from 1977 relative to all 13 competitors.

As the chart also shows, these relative changes, measured on a national currency basis, were greatly altered by changes in currency exchange rates, particularly in the period since 1979. Between 1979 and 1985, the trade-weighted value of the U.S. dollar increased 44 percent relative to all 13 competitors. Consequently, U.S. trade-weighted relative unit labor costs rose 36 percent over this period measured on a U.S. dollar basis, compared with a relative decline of 5 percent measured in national currency terms.

Between 1985 and 1987, the trade-weighted value of the U.S. dollar fell 28 percent, which is equivalent to a 39-percent appreciation in foreign currency values. Therefore, on a U.S. dollar basis, U.S. relative unit labor costs fell 31 percent, compared with a 5-percent relative decline on a national currency basis.

As of 1987, the value of the U.S. dollar, relative to the currencies of the other 13 competitors, was 3 percent above its 1979 value, and U.S. relative unit labor costs were down $6\frac{1}{2}$ percent on a U.S. dollar basis, compared with $9\frac{1}{2}$ percent on a national currency basis.

If Canada, Japan, Korea, and Taiwan are excluded from the comparison, and U.S. unit labor costs are compared to a trade-weighted average covering the nine European countries on a U.S. dollar basis, both the 1979–85 relative increase in U.S. unit labor costs and the 1985–87 relative decline are accentuated. The value of the Canadian dollar fell much less relative to the U.S. dollar than did the European currencies between 1979–1985 and rose very little between 1985 and 1987. The Japanese yen also fell much less in the 1979–85 period but rose very strongly in 1986 and 1987. Chart 2 shows U.S. unit labor costs, on a U.S. dollar basis, relative to those of Canada and Japan.

The manufacturing trade deficit

While the trade-weighted value of the U.S. dollar is up only 3 percent over 1979 and trade-weighted unit labor costs are down—relative to the 13 competitors—the United States is still running a large negative trade balance in manufacturing goods. This accounts for most of

the current account deficit. The United States had a positive trade balance in manufactured goods in 1979, 1980, and 1981; the balance turned slightly negative in 1982 and strongly negative by 1983. In 1987, the United States still had a very large deficit in manufactured goods trade, but the deficit was no longer rising. In volume terms, U.S. exports of manufactured goods increased 12 percent in 1987, rising for the first time above the previous peak level in 1981, and import volume fell 2 percent.[5]

With U.S. manufacturing unit labor costs now lower relative to a trade-weighted average for the 13 competitors, it might be expected that the U.S. trade balance in manufactured goods would have been reduced substantially. However, the deficit is no longer rising, and there are other explanations that have been advanced to explain the slow improvement in the U.S. manufacturing trade balance. Among these are: the failure of dollar prices of imports to increase as rapidly or as much as changing currency exchange values would seem to indicate, particularly for goods that have established market shares; a delayed *j*-curve effect; the international debt crisis, especially in respect to Latin American countries; and a higher growth rate in the U.S. economy, stimulating imports.[6] In addition, trade is not based on cost alone, but on such other factors as design, quality, marketing, and services.

Recent exchange rate changes

The value of the U.S. dollar was lower at the end of 1987 relative to all of the other currencies, compared with the annual average 1987 exchange rates used in this article. As of September 1988, the dollar had fallen further against the Canadian dollar and Korean won but was up relative to the yen and the European currencies. Comparing September 1988 exchange rates with 1987' annual averages, the U.S. dollar was down 7 percent to 13 percent against the Canadian dollar and the Asian currencies, down 3 percent against the British pound, and up about 2 percent to 7 percent against the other European currencies.

In the first three quarters of 1988, U.S. manufacturing productivity was about 3 percent higher than in the first three quarters of 1987 and unit labor costs were about unchanged. This, in conjunction with the exchange rate changes, suggests that U.S. manufacturing competitiveness, as measured by comparative changes in unit labor costs on a U.S. dollar basis, has probably improved further relative to Canada, Japan, Korea, and Taiwan, but may not have improved further relative to the European countries. □

Table 4. Annual percent changes in manufacturing output and unit labor costs, Korea and Taiwan, 1973–87

Year	Korea			Taiwan		
	Output	Unit labor costs		Output	Unit labor costs	
		National currency basis	U.S. dollar basis		National currency basis	U.S. dollar basis
1973–87	12.3	12.4	6.8	9.2	7.8	9.3
1973–79	16.5	20.2	16.4	10.2	11.0	12.1
1979–87	9.2	6.9	0	8.5	5.5	7.2
1979–85	6.8	8.3	-1.8	6.6	7.5	5.7
1986	17.4	2.8	1.5	15.5	1.8	7.2
1987	16.4	3.0	10.4	13.5	-2.2	16.5

FOOTNOTES

[1]The data relate to all employed persons, including the self-employed, in the United States and Canada, and to wage and salary employees in the other industrial countries, Korea, and Taiwan. Hours refer to hours paid in the United States and to hours worked in the other countries.

The comparisons are limited to trend measures only because reliable level comparisons of manufacturing productivity and unit labor costs are not available. See Arthur Neef, "International trends in productivity and unit labor costs in manufacturing," *Monthly Labor Review*, December 1986, p. 17, footnote 2.

This article includes some revisions which have not yet been incorporated in "Current Labor Statistics," table 47, this issue.

[2]The U.S. manufacturing productivity measures are based on the national accounts measure of gross product originating in manufacturing. Recently, a number of analysts have suggested that the real growth in manufacturing output since 1973, and particularly since 1979, may have been less than shown by the published measures.

Frank de Leeuw and Robert P. Parker of the Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce, which prepares the U.S. national accounts, responded to some of the criticisms in "Gross Product By Industry: Comments on Recent Criticisms," *Survey of Current Business*, July 1988, pp. 132–33, and plan to reexamine some of the manufacturing data.

There is another factor that affects the manufacturing output measures that has nothing to do with possible errors in measurement. The constant price measures are based on 1982 relative prices, and BEA's price index for the rapidly growing computer industry, part of the nonelectrical machinery industry, has been declining at a rate of about 15 percent per year since 1982. Consequently, as the BEA article states, "recent manufacturing growth expressed in 1982 prices substantially exceeds what it would be in 1987 prices, because the relative price of computers was much higher in 1982 than in 1987."

The output measures for the other countries are, of course, also subject to measurement errors. They will also be affected by the base year used to construct the constant price measures if there are large differences in relative price movements among industries. For example, the Japanese constant price output measures are based on 1980 relative prices and the output deflator for the rapidly growing electrical machinery industry in Japan fell 41 percent between 1979 and 1985, whereas the deflator for all other manufacturing industries fell 4 percent. Therefore, it would appear that the Japanese manufacturing output growth rate over this period would be less measured in current rather than 1980 relative prices.

[3]In comparing U.S. productivity growth rates over time, it is customary to divide the periods analyzed at 1973 and 1979. U.S. output peaked in 1973 and the years since 1973 have been characterized by a productivity growth rate slowdown. U.S. output also peaked in 1979. These periods also work quite well for the other countries. Manufacturing output peaked in 1973 or 1974 in Canada, Japan, and the European countries and those countries also had subsequent productivity growth rate slowdowns. Manufacturing output peaked again around 1979–80 in