> This war–and it is a war–is being fought not with dollars, or oil or steel, or even with modern machines. It is being fought with creative imagination and organizational talent.

This admiring, if slightly defiant, description of a powerful foreign economic challenger is not an American's view of the Japanese competition in the late 1980s. It is a Frenchman's view of America in 1969.[57]

Twenty years later, this description of American industry as all-conquering has come to sound quaintly out of date. American pre-eminence in a great many manufacturing industries is gone. Take consumer electronics. Only one major U. S.-owned company is still making color TV sets, and most of its production takes place in Mexico; no American-owned company makes video cassette recorders or compact disc players. Mass production of automobiles was invented in the United States, but others (especially the Japanese) are now leaders in the technology and management of auto manufacture. Despite the U.S.-Japanese agreement restricting Japanese imports and despite the rise of the yen, 21 percent of the passenger cars sold in the United States in 1987 were Japanese-made (another 6 percent were made by Japanese companies in North America); another 9 percent were imports from other foreign countries.[58] In semiconductors, another native born American product and industry, U.S. companies are still strong, especially in microprocessors and advanced, custom designed chips. Yet, overall, U.S. companies have continually lost market share to Japanese competitors since the late 1970s. By 1987, they had almost ceded dynamic random access memory devices (DRAMs) –a large market segment that has been both cash cow and technology driver for the industry-to the Japanese. In all of these industries, trouble started before the rise of the dollar.

Against the evidence of a decline, some have argued that U.S. manufacturing is faring quite well, that productivity growth has been strong in the 1980s, and that the high dollar – not poor performance by manufacturing — is responsible for the massive manufacturing trade deficits of the decade. The prescription that usually follows from this argument is to do nothing in trade or industrial policy to support U.S. manufacturing. One part of the argument is the statement that manufacturing output, measured in constant dollars, has not declined as a share of gross national product, and that if it eventually does, that alone is not an "omen of decay or loss of competitiveness."[59] Instead, it may simply reflect a natural evolution to a different pattern of demand in a maturing economy, and to the successful economic development of our trading partners.

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57 Jean-Jacques Servan-Schreiber, The American Challenge (New York: Atheneum, 1969), p. xiii.

5a The remaining 64 percent were made in the United States and Canada. Production in both countries is considered "traditional North American' 'because of the U.S.-Canadian agreement establishing free trade in motor vehicles and parts.

59 Molly McUsic, "U.S. Manufacturing: Any Cause for Alarm?" New England Economic Review, January/February 1987. For other examples of this point of view, see Robert Z. Lawrence, Can America Compete? (Washington, DC: The Brookings Institution, 1984); Office of the U.S. Trade Representative, Annual Report of the President of the United States on the Trade Agreements Program, 1985, p. 20.

This argument does not really stand up to scrutiny. The United States is not and gives no sign of becoming a post-industrial economy. But because the question of manufacturing share is closely linked with policy, it is worth examining.

The Share of Manufacturing in the U.S. Economy

Though the record is not entirely clear, there is evidence that the share of manufacturing in gross national product (GNP) is falling. And while it is falling (or at best staying even), the demand for manufactured goods by American consumers, businesses, and government is rising.

In current dollars, the share of manufacturing in GNP fell from 29 percent in 1960 to just under 20 percent in 1986, and the rate of decline has been faster since 1979 than formerly (figure 21). However, this current dollar measure has the defect that it does not take rising productivity into account. Manufacturing has performed better than the economy as whole in raising productivity, and some of that productivity growth has been passed on to consumers in lower-than-average price increases. In fact, Commerce Department data on the constituents of GNP data show the share of manufacturing, in constant 1982 dollars, hovering quite steadily around 21 or 22 percent of total output since the late 1940s (figure 22). This series, prepared by the Department's Bureau of Economic Analysis (BEA), is the only regularly published official set of data on constant dollar shares of GNP. It is the basis for the statement that manufacturing's share of GNP has held steady for many years.

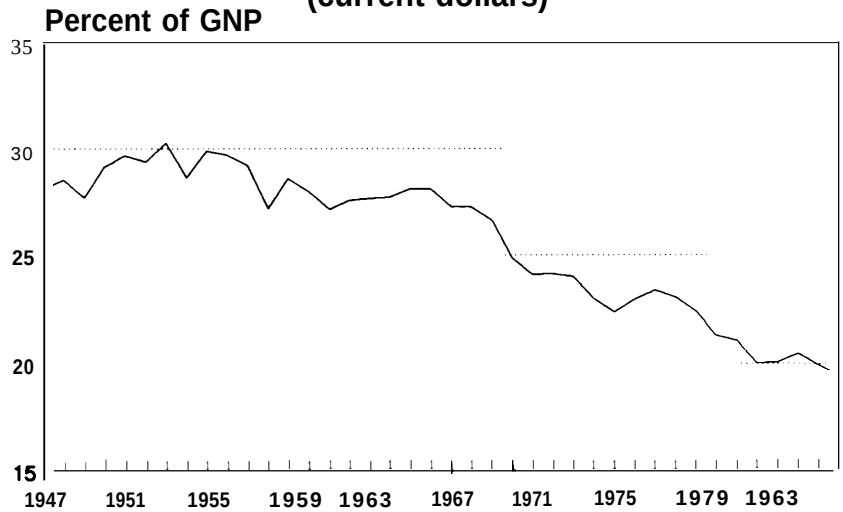
However, estimating the size of various parts of the economy in constant dollars is a difficult task; the uncertainties are great enough to cast doubt on the constant-share conclusion. In the BEA series based on constant 1982 dollars, one difficulty in particular looms large. That is the unique role assigned to the non-electrical machinery industry, which includes computers, in pulling up the whole manufacturing sector.

According to the BEA series, 15 of the 21 major manufacturing industries in the United States experienced a declining share of GNP from 1979 to 1986, while five stayed even or rose only moderately (see table 3) – not enough of a rise to offset the decline in the majority of industries. The only major industry showing a big increase in share was non-electrical machinery; and more than 100 percent of that industry's increase was due to the zooming sales, rapidly improving quality and productivity, and falling real price of computers. By the logic of the numbers, it would appear that computers, which contribute only 2 or 3 percent of manufacturing output, singlehandedly held up the share of the whole manufacturing sector.

Another difficulty is that the choice of base year for constant dollars greatly influences the results.[60] The more recent the base year chosen, the smaller appears the share of manufacturing in past years (see figure 22). For example, when 1958 is used as the base year, the share of manufacturing in real GNP for the year 1948 appears as 29.7 percent; on

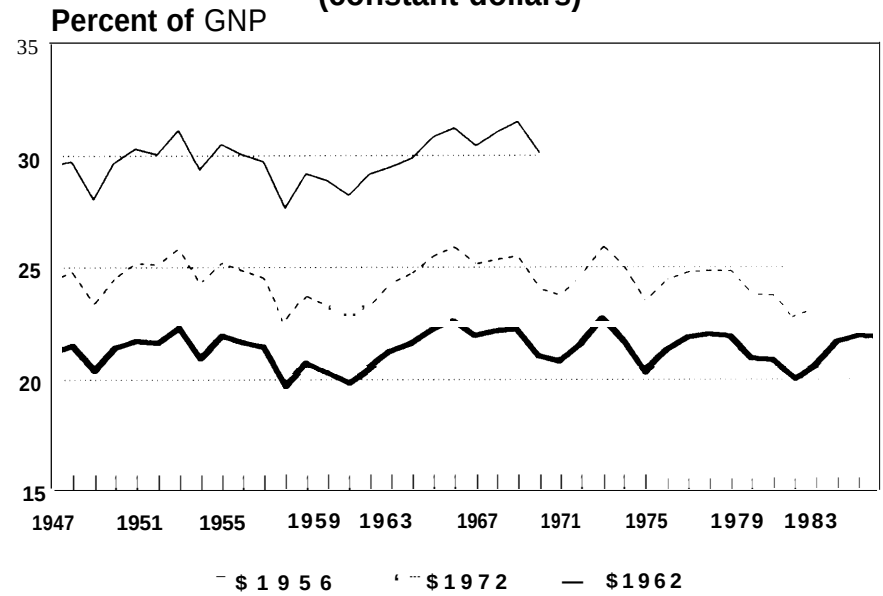
[60] Nicholas S. Pema, "The Shift from Manufacturing to Services: A Concerned View", New England Economic Review, January/February 1987.

Figure 21
Manufacturing Share of U.S. Gross National Product
(current dollars)



SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis, National Income and Product Accounts, electronic data, Table 6.1

Figure 22
Manufacturing Share of Gross National Product
(constant dollars)



SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis, National Income and Product Accounts, electronic data, table 6.2

Table 3.—Manufacturing Share of Gross Nationa Product, 1979–86 (1982 constant dollars)

	1979	1980	1981	1982	1983	1984	1985	1986	Change in share 1979–86	1986 deflator 1982 = 100)
Total GNP (constant 1982 dollars)	$3,192.4	187.1	$3,248.	166.	$3,279.	$3,501.4	$3,607	$3,713.3	–	1 4.[illegible]
GNP implicit deflator 1982 = 100	78.6	85.7	94.0	100.0	103.9	107.7	111.2	114.0		
Manufacturing implicit deflator 1982 = 100	80.6	87.3	95.1	100.0	101.1	101.8	101.1	10[illegible].5		
	Percentage share of total GNP									
Manufacturing	21.84%	20.88%	20. %	20.04%	20.60%	21.65%	21.91%	21.87%	0.2%	101.5%
Machinery, except electrical	2.62	2.65	2.73	2.53	2.65	3.28	3.81	4.06	54.7	57.0
Electric and electronic equipment	1.89	1.97	1.98	1.95	2.02	2.21	2.32	2.29	21.4	103.8
Instruments and related products	0.70	0.68	0.73	0.71	0.71	0.73	0.78	0.80	13.5	105.7
Other transportation equipment	1.17	1.20	1.02	1.02	1.18	1.22	1.26	1.31	12.1	112.0
Rubber and miscellaneous plastic products	0.63	0.59	0.64	0.61	0.66	0.69	0.70	0.70	11.8	104.2
Miscellaneous manufacturing industries	0.38	0.32	0.37	0.35	0.30	0.41	0.41	0.39	1.6	97.9
Paper and allied products	0.85	0.77	0.76	0.84	0.88	0.86	0.85	0.84	-0.7	111.8
Food and kindred products	1.72	1.78	1.79	1.94	1.89	1.74	1.74	1.69	-2.0	113.6
Printing and publishing	1.18	1.16	1.18	1.21	1.22	1.18	1.18	1.14	-3.3	128.6
Chemicals and allied products	1.74	1.57	1.65	1.75	1.82	1.71	1.56	1.60	-7.8	108.4
Furniture and fixtures	0.34	0.32	0.31	0.30	0.32	0.34	0.32	0.31	-9.3	117.5
Textile mill products	0.50	0.51	0.49	0.47	0.51	0.48	0.44	0.46	-9.8	109.5
Lumber and wood products	0.66	0.64	0.58	0.51	0.55	0.58	0.57	0.58	-11.6	114.8
Fabricated metal products	1.72	1.65	1.61	1.46	1.49	1.59	1.55	1.48	-14.2	103.8
Apparel and other textile products	0.61	0.63	0.62	0.60	0.60	0.58	0.54	0.53	-14.5	106.2
Stone, clay, and glass products	0.73	0.66	0.61	0.57	0.60	0.62	0.62	0.60	-18.1	114.0
Motor vehicles and equipment	1.50	1.06	1.04	0.93	1.17	1.37	1.32	1.20	-20.1	111.2
Petroleum and coal products	0.91	0.84	0.78	0.77	0.73	0.71	0.69	0.71	-21.5	147.3
Tobacco manufactures	0.31	0.30	0.30	0.28	0.27	0.25	0.20	0.19	-39.2	181.4
Primary metal industries	1.56	1.46	1.48	1.11	0.91	0.99	0.95	0.94	-39.6	99.4
Leather and leather products	0.13	0.13	0.14	0.13	0.12	0.11	0.10	0.08	-40.0	100.0
	Machinery, except electrical									
Output, billions of current dollars	$70.6	$76.9	$86.2	$80.0	$75.3	$85.4	$88.2	$85.9		
Deflated output, billions of $ 1982	83.8	84.6	88.6	80.[illegible]	86.9	114.8	137.5	150.8		
Implicit deflator 1982 = 100	84.2	90.9	97.3	100.0	.7	74.4	64.1	57.0		
Manufacturing share (%) excluding machinery, except electrical	19.2	18.2	18.1	17.5	17.9	18.4	18.1	17.8		

SOURCE: Bureau of Economic Analysis, National Economic Product Accounts, electronic data, Tables 6 , 6 2.

a 1972 base, the share in 1948 appears as 24.8 percent; with the 1982 base, the 1948 share shrinks to 21.5 percent – just about the same as the 1982 share, which was 21.8 percent. The difficulty with applying an updated constant dollar base to earlier years is that the new base contains new weights for the inputs to industries, and these new weights do not represent the economy as it really was in earlier years. Perna, in discussing this problem, said: "The further one gets from the base period, the less representative it is of the economy's actual structure.

In order to analyze the changing structure of the economy for its assessment *Technology and the American Economic Transition,* OTA independently prepared estimates of various parts of the economy in constant 1980 dollars for selected years.[63] The OTA estimates show manufacturing's share declining by 2.5 percentage points from 1972 to 1984, with an accelerated decline after 1977. The complications and uncertainties of constructing these constant dollar estimates are great; OTA's estimates have their share of flaws. The point is that constant dollar estimates are not graven in stone, but must be taken with a degree of caution.

Suppose it is true that manufacturing is fading as a contributor to the economy as a whole. The next question is: does it matter? It is not ordained that the share of manufacturing in GNP should remain constant. In fact, the current dollar figures show it declining gradually in the 1950s and 1960s, when American manufactured goods were still dominant in the world (however, the decline hastened in the 1970s and 1980s, as American products lost world market share). Moreover, agriculture is often held up as an example of a sector of the economy that grew greatly in output and productivity while declining from a 22 percent share of the national economy at the turn of the century to 2.2 percent in 1986.

A critical difference between manufacturing and agriculture is that the latter has continued to fulfill domestic demand (more precisely, to produce enough that imports are fully covered by exports, and sometimes to generate sizable trade surpluses as well). Over the years, Americans have devoted successively smaller shares of their total purchases to products of farms, forests, and fisheries, and more to other goods and services. The same is not true of manufactured goods. While per capita spending for services has grown greatly in the past 40 years (table 4), it was not at the expense of demand for manufactured products. While consumers spent smaller shares of their growing incomes on food and fuel, they spent more on items such as cars, television sets, and sports gear. Altogether, American consumers, businesses, and government increased their share of spending on manufactured goods other than food and fuel items from 23.4 percent of all their purchases in 1948 to 30.7 percent in 1986. Clearly, the U.S. economy is not passing into a post-industrial state in which demand for manufactured goods is giving way to demand for services.

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61 The weights are used to construct price deflators, which are the basis for constant dollar estimates of GNP and its constituents.

62 Id. For another study that questions BEA's methods for developing the constant-dollar series, and concludes that manufacturing has declined as a share of GNP, see Lawrence R Mishel, Manufacturing Numbers: How Inaccurate Statistics Conceal U.S. Industrial Decline (Washington, DC: Economic Policy Institute, 1988).

63 U.S. Congress, Office of Technology Assessment, Technology and the American Economic Transition: Choices for the Future OTA-TET-283 (Washington, DC: U.S. Government Printing Office, May 1988).

Table 4.– Real per Capita Spending on Goods and Services (1960-86)

	Per capita spending in 1982 dollars					Percent of real apparent consumption				
	1948	1960	1973	1979	1986	1948	1960	1973	1979	1986
Apparent consumption	$7,432	$9,233	$13,099	$14,166	$15,973	100.0%	100.0%	100.0%	100.0%	100.0%
Gross national product	7,563	9,211	12,950	14,182	15,370	1018	998	989	1001	96.2
Goods purchases	3,437	3,966	5,613	6,200	7,250	462	43.0	429	43.8	45.4
Consumer manufactures, except food and fuel	1,038	1,253	2,076	2,320	2,873	140	136	159	164	18.0
Producers' durable equipment	525	461	942	1,150	1,298	71	50	72	81	81
Government goods purchases	181	400	408	461	733	24	43	3.1	3.3	4.6
Consumer food and fuel purchases	1,693	1,851	2,187	2,269	2,346	228	20.1	167	16.0	14.7
Service purchases	2,961	3,956	5,629	6,287	7,041	398	429	43.0	444	441
Consumer services	1,920	2,455	3,710	4,315	4,925	258	266	28.3	305	30.8
Government services	1,042	1,501	1,919	1,972	2,116	140	16.3	14.6	13.9	13.2

NOTE Apparent consumption equals gross national product less exports plus imports

SOURCE: U S Department of Commerce, Bureau of Economic Analysis, National Income and Product Accounts, electronic data, consumer goods and services purchases from Table23, government goods and services spending from Table 3 BB producers' durable equipment spending from Table 57

Until about 1970, U.S. production of manufactured goods generally kept pace with consumption, or stayed ahead; but then output began to dip below consumption, as shown in the recurring manufacturing trade deficits of the decade. In the 1980s, of course, manufacturing output fell far short of consumption, creating the mounting manufacturing trade deficits. Foreign suppliers have filled the ever-widening gap between production and consumption of manufactured goods in the United States in the 1980s.

Manufacturing Employment and Wages

Other measures that may tell us something about the performance of U.S. manufacturing are the number of people working in it and what they get paid. Jobs in manufacturing have declined in the past decade, not just in relative terms, but in absolute numbers. Real wages of production workers in manufacturing (adjusted for inflation) have also dropped, by about 6 percent over the past 10 years. Real compensation per manufacturing worker, including employer-provided benefits, has stayed almost flat – in striking contrast to Japan and major European countries, where manufacturing compensation rose about 20 percent in the same period.[64]

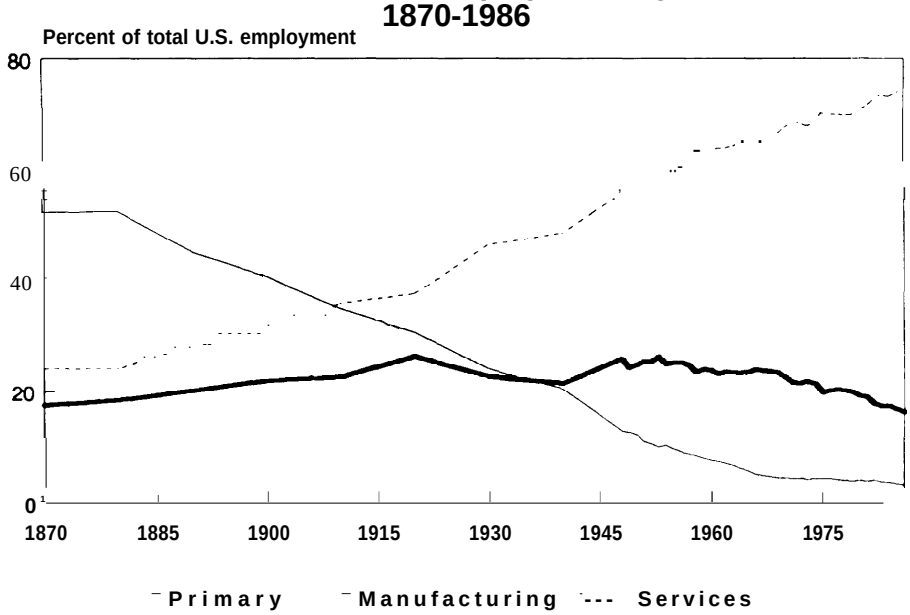
The decline in manufacturing jobs has been hard on millions of displaced workers and their families and scores of communities, but it does not necessarily signify weakness in the manufacturing part of the economy. Since the nineteenth century, and throughout the period of American industrial dominance, the share of employment in services has been larger, and has grown faster, than in manufacturing (figure 23). As the output of manufactured goods grew, employment rose less because of improving labor productivity.

While the *share* of employment in U.S. manufacturing started a gradual decline in the 1950s, the absolute number of manufacturing jobs kept growing until 1979, when manufacturing employment peaked at 21 million. In 1986, it averaged 19.1 million. With the strong expansion of exports and manufacturing output toward the end of 1987, employment recovered to 19.4 million–still 1.6 million below the peak.

An absolute loss of manufacturing jobs is not necessarily a sign of weakness either. Some of the shrinkage in employment was certainly due to rising productivity. Some was also certainly due to the enormous growth in net imports of manufactured goods over the same period. And much of it was due to a combination of the two factors, in which actions to improve productivity – automation, for example, or closure of older, less efficient plants – were forced by foreign competition. If demand for a product is growing fast enough, then imports, productivity, and employment can rise simultaneously. If not, rising net imports are likely to cost jobs. For example, employment in three traditional industries –steel, textiles,

64 U.S. Department of Labor, Bureau of Labor Statistics. The figure for wages is the real hourly wage for production workers, who make up about two-thirds of manufacturing employment. The figure for compensation is real weekly compensation for all persons employed in manufacturing, including wage and salary earners, the Self+ mployed, and unpaid family workers, in the United States, and for all employees in other countries. The Consumer Price Index was used as the basis for calculating real wages and real compensation.

Figure 23
Distribution of U.S. Employment, by Sector
1870-1986



SOURCE:
U.S. Department of Commerce, Bureau of the Census, Historical Statistics of the United States, (Washington, DC: 1975) p. 137, series D127-141

and motor vehicles –dropped by 600,000 from 1979 to 1986. In each of these industries, productivity improved and imports rose; at the same time, demand for the industries' products either declined or grew slowly.

One study, following the ripple effects of imports and exports through the economy by means of an input-output model, concluded that the United States gains 7.5 percent more jobs from a given amount of exports than it loses from the same amount of imports.[65] Every $10 billion of exports generates 193,000 jobs, the study found, while 179,000 jobs are lost with $10 billion of imports. However, the trade deficits have been so big in recent years that job losses due to imports have swamped the job-creating effect of exports. In 1987, for example, exports of goods and services amounted to $428 billion while imports were $547 billion. The deficit of $119 billion spelled a net loss of 1.5 million jobs, according to the analysis.

It has been suggested that the loss of manufacturing jobs in recent years maybe at least partly illusory, because it simply reflects the trend in many manufacturing companies to contract out services that they formerly paid their own employees to perform. For example, if General Motors lays off engineers and contracts with an engineering design firm to do the work once done in-house, that shows up in national employment data as a loss of jobs in manufacturing and a gain in the engineering and architectural services category. In the same way, if firms un-

m Richard S. Belous and Andrew W. Wyckoff, "Trade Has Job Winners, Too," Across the Board, September 1987. The authors used the OTA input-output model for this study.

bundle legal, accounting, auditing, janitorial, or clerical activities, then the employment figures would show a shift from manufacturing to services. A recent analysis, done by a U.S. Department of Labor economist, concludes that unbundling has been a very small factor in the growth of employment in producer services in the last decade.[66] Within manufacturing firms, the proportion of workers in managerial, professional, and technical occupations has actually risen (and the rise is not accounted for by a changing mix of manufacturing industries). While the proportion of clerical and service workers in manufacturing has dropped slightly, these occupations are not very significant in the growth of employment in producer services. Thus, unbundling is not happening industrywide, though it may well be happening in some individual firms. Firms may be buying more services from outside, but not at the expense of already existing jobs in the manufacturing sector.

It is fair to conclude that the job losses in manufacturing are real, not illusory. And though it maybe hard to calculate the exact number of jobs lost to import competition, the number is probably large –above 1 million at the least.

It also seems evident that import competition has been a powerful factor holding down the wages of manufacturing workers. Until the 1970s, wages of manufacturing workers, like wages of American workers generally, rose strongly and steadily. Since then, manufacturing workers have made few lasting gains, and the real wages of production workers (i.e., blue collar workers on the shop floor) had not regained their 1978 peak a decade later. While manufacturing workers in the other advanced industrial nations enjoyed strong growth in real compensation (wages plus benefits) from 1977 to 1986– growth that ranged from 14 percent in Italy, to 19 percent in Japan and Germany, to as much as 24 percent in Britain — Americans employed in manufacturing gained less than 2 percent.

What happened to manufacturing wages has happened to real wages and salaries of all Americans: the long-term, consistent growth of the postwar period came to a halt in 1973, and there has been an unsteady but overall decline since 1978.[68] Part of this change may have been due to demographics; the surge of young people from the baby boom and the increased participation of women in the labor force probably held down wage growth in the 1970s. However, the rate of growth in the work force has been falling since 1978, and is now back to earlier norms. Since 1978, a combination of factors has restrained real wage growth: first, inflation, and then the deep recession of 1981-83, the decline of labor unions and, not least, the loss of manufacturing jobs to foreign competition and the threat of further losses.

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66 John Tschetter, "Producer Services Industries: Why Are They Growing So Rapidly?" Monthly Labor Review, December 1987.

67 Some analysts have argued that the loss of U.S. manufacturing jobs since 1979 simply matches improvement in manufacturing productivity, and draw the conclusion that imports had no effect on job loss. However, rising imports of manufactured goods during the 1980s almost certainly replaced some domestic production of these goods –and the jobs that would have been devoted to producing them. In addition, as discussed in a later section, the official figures may overstate the growth in manufacturing productivity in the 1980s.

68 Weekly earnings of full-time wage and salary earners declined 3 percent from their 1978 peak to 1987; hourly earnings of production and nonsupervisory workers on private nonagricultural payrolls declined 8 percent from 1978 to 1987. Earnings figures are from U.S. Department of Labor, Bureau of Labor Statistics, Employment and Earnings, tables A-73 (published quarterly) and B-1 (published monthly). Real earnings are figured on the basis of the Consumer Price Index for Urban Consumers (CPI-U), 1982= 100.

Productivity Growth: International Comparisons

Another measure of how U.S. manufacturing is doing in comparison with other nations is trends in productivity. The bare figures suggest that, over the past quarter of a century, the United States did not measure up to other nations in raising labor productivity in manufacturing.[69] The U.S. growth rate was less than 3 percent per year, on average, from 1960 to 1986; this compares with nearly 8 percent for Japan, about 5 percent for France, Italy, and Germany, and over 3 percent for Great Britain and Canada (table 5).

Behind these 26-year averages lies a more complex story. Since 1979, the American record has been about as good as Europe's — better than some major countries and not far behind the leaders. But, as noted earlier, America's number one trade competitor, Japan, has continued to excel, achieving higher growth than any other industrialized country in the 1980s, with an average of 5.6 percent growth per year from 1979 to 1986 compared to 3.5 percent for the United States. Another distinction for Japan is that its productivity growth, more than that of any other advanced country, continues to be linked with rising output and employment.

Faster productivity growth in other industrialized countries was in part a catchup phenomenon. From 1960 to 1973, U.S. manufacturing productivity rose at the respectable rate of 3.2 percent per year; but this rate was bettered by nearly all European countries, most of which were repairing war damage and investing in new industrial equipment. Japan, starting from a lower prewar base and suffering more war destruction than most European nations, was advancing even faster, at the remarkable average annual rate of 10.3 percent.[70]

From 1973 to 1979, productivity growth slowed to some degree in all the industrialized countries but (except for Britain's dismal record) the U.S. growth rate dropped to

Table 5.–Annual Percent Changes in Manufacturing Productivity, Seven Countries (1960-86)

Year	United states	Canada	Japan	France	Germany	Italy	United Kingdom
Output per hour:							
1960 86 ., ., ...	2,8	3.3	7.9	5.2	4.6	5 7	3 6
1960 73. .	3.2	4.5	10.3	6.5	5 8	7.5	4 2
1973 79 . . .	1.4	2.1	5.5	4,9	4,3	3 3	1,2
1979 -86..... . . . : : ., .,	3.5	2.3	5.6	3.1	2.7	4.3	4.5

NOTE: Rates of change based on the compound rate method

SOURCE: Arthur Neef and James Thomas, "Productivity in Manufacturing at Home and Abroad,. Monthly Labor Review, Decemer 1987 U S Department of Labor, Bureau of Labor Statistics, Monthly Labor Review, December 1987, Table 47

69 Productivity of other factors of production besides labor, especially capital, is also very important to good manufacturing performance. However, international comparisons are usually limited to labor productivity since data on multifactor productivity are fragmentary.

70 A number of economic historians have discussed the political and social conditions that made it possible for many nations –especially Germany and Japan – to rebuild rapidly and catch up afterword War II; see, for example, Moses Abramovitz, "Catching Up, Forging Ahead, and Falling Behind," Journal of Economic History, June 1986, XLV1 (2), pp. 38 S-406; Mancur Olson, The Rise and Fall of Nations: Economic Growth, Stagflation and Social Rigidities (New Haven, CT: Yale University Press, 1982).

much the lowest of any major country. The U.S. manufacturing productivity growth rate has apparently recovered in the 1980s, both in relation to this nation's own history and to the current experience of European countries. The caveat implied by "apparently" is this: growth rates in manufacturing productivity are based on the BEA (Commerce Department) constant-dollar figures for GNP. As discussed earlier, there are major difficulties in constructing such a series; in particular, since 1982, the real, constant-dollar share of the manufacturing sector in GNP may be overstated because the contribution of computer manufacture may be exaggerated. If this is so, then the rate of productivity growth in manufacturing in recent years is also overstated. Excluding non-electrical machinery (SIC 35, which includes computers), the growth rate for all other manufacturing was 2.2 percent per year for 1979 to 1986, compared to 3.5 percent when the non-electrical machinery segment is included. A realistic estimate for manufacturing productivity growth probably lies between the two figures.

Despite these statistical problems, the picture drawn from productivity growth figures over the past 26 years is reasonably consistent with common sense observations. European countries rebuilt in the 1960s and, except for Britain, continued to grow in the 1970s (although at a rather slower pace) while U.S. growth slowed drastically. In the 1980s, the United States has more or less kept pace with Europe (again except for Britain, which has recently posted the best growth rate among major European countries). On the evidence of the productivity figures, it seems possible that our deteriorating trade balances with Europe in the 1980s were due more to the high dollar than to subpar performance in manufacturing; indeed, the United States maintained a positive trade balance with Europe until 1983, and the balance with Europe was the first to improve as the U.S. trade deficit finally began to decline in 1988. This does not imply that U.S. manufacturing is equal to the Europeans in all sectors or products, but American producers do have areas of strength vis-a-vis the Europeans.

The Japanese challenge is different. Starting from a lower base, the Japanese improved much faster than everyone else until 1973. Relying almost entirely on imported oil to run its industries, Japan was even harder hit by the oil shocks of the 1970s than Europe, and certainly than the United States; yet Japan managed to stay on top in productivity growth throughout the 1970s, and has continued to improve in the 1980s at rates matched by no other advanced industrial country. Impressively, the Japanese have continually raised output and employment while improving productivity. From 1979 to 1986, Japan's manufacturing output grew 60 percent, and employment in manufacturing nearly 10 percent, despite a slight drop in 1986 caused by the rising yen (table 6).[71]

It is quite another story for the European leaders in productivity growth. Britain, which boasted a 4.4 percent annual productivity growth rate from 1979 to 1986, did it, at least in part, by drastic cutbacks in the manufacturing sector in the early 1980s.

71 Manufacturing employment in Japan declined from 1974 to 1979, following the oil shock; it regained the 1974 level in 1986. However, real compensation m manufacturing rose steadily every year, to a level 27 percent higher in 1986 than in 1973. Real compensation in U.S. manufacturing rose 7 percent during the same period, with nearly all the gain occurring before 1978.

Plants were closed, workers were laid off, and unemployment soared to 20 percent and above in the industrial North. Through 1982, Britain's manufacturing output declined sharply; it has since turned backup, showing a moderate overall loss for the 7 years of 4.4 percent. Manufacturing employment fell steadily with no recovery, for a loss of 27.5 percent. France, with a productivity growth rate of 3.1 percent per year, had a 2 percent cut in manufacturing output and lost 16 percent of manufacturing employment. Italy's large rise in productivity went along with a sharp drop in manufacturing employment. Germany and the United States were in the middle, with medium to good productivity growth, rising output, and moderately declining employment.

While jobs in U.S. manufacturing dropped by 10 percent from 1979 to 1986, real output rose over 16 percent (according to the BEA constant dollar series). At least some of the turnaround in American manufacturing productivity was due to shutdown of older, less efficient plants. With this restructuring came some massive worker displacement; an average of 2 million workers per year, half of them in manufacturing, lost jobs due to plant closures or production cutbacks from 1979 to 1985.[72] Steel is an extreme example. Jobs in basic steel numbered 570,000 in 1979 and by the end of 1987 were down to 280,000. The USX company, formerly U.S. Steel, contracted from over 100,000 employees in 1980 to fewer than 20,000 in 1987. But meanwhile, USX productivity improved from 10.8 manhours per ton of steel shipped in 1983 to 3.8 manhours in 1987.[73]

Table 6.– Index of Manufacturing Output and Employment, 1986; and Productivity Growth Rates, 1979-66

	1986		Annual average manufacturing productivity growth 1979-86
	output (1979 = 100)*	Employment (1979 = 100)*	
United States	1165	906	3 5
Canada	114.2	97.1	2.3
West Germany	105.8	92.1	3.1
France	978	84.4	2,7
Italy	1122	825	4.3
J a p a n	159,9	109.5	5 6
United Kingdom	95.7	72.5	4 5

● Adapted from Labor Department data published on a 1977 = 100 basis

SOURCE: Arthur Neef and James Thomas, "Productivityy in Manufacturing at Home and Abroad, Monthly Labor Review, December 1987, U S Department of Labor, Bureau of Labor Statistics, Monthly Labor Review, December 1987, Table 47

In the last half of 1987, as exports finally began to rise briskly in response to the low dollar, manufacturing employment climbed a little (but still remained 8 percent below the 1979 peak) while output grew to 30 percent above the 1979 level. During the expansion, productivity growth held up; the growth rate was 3.7 percent in 1986 and 3.3 percent in 1987. To some degree, this simply reflected greater use of plant capacity, which generally has the effect of raising productivity. But there are some signs that it also reflects more fundamental changes — investment in productive new equipment, more efficient organization of work, and better use of people.

A measure for comparing levels of labor productivity from one country to another (as distinguished from growth rates) is gross

72 These figures are from two surveys of worker displacement, designed and analyzed by the Bureau of Labor Statistics, U.S. Department of Labor, and conducted by the Bureau of the Census, U.S. Department of Commerce, in January 1984 and January 1986.

73 David Ignatius, "What's Left of Big Steel?" The Washington Post, Mar. 20, 1988, p. Cl.

domestic product per employee. This economy-wide measure includes private services and government activities as well as manufacturing. By this measure, the United States was still ahead of most other advanced nations in 1986. Several European countries stood at 80 to 90 percent of the U.S. level and Japan had reached 69 percent.[74] However, the rate of productivity growth in the whole U.S. economy has recovered only slightly from the doldrums of the 1970s. Other major industrialized nations are now improving at much faster rates, Japan the fastest of all (see table 7).

It is a common observation that although agriculture, many kinds of services, and some manufactures are not highly productive in Japan, the Japanese have put prodigious effort into raising productivity in industries such as steel, autos, and electronics that have been central to their export-led growth strategy. It would be helpful, in comparing productivity levels in the United States with Japan, to break out manufacturing, by industry, from the rest of the economy. However, various international comparisons of levels of manufacturing productivity have come to quite inconsistent conclusions; in some, Japanese manufacturing productivity is shown as barely 70 percent of the U.S. level, while in others it is over 90 percent for all manufacturing and well above 100 percent for certain industries.[75]

Several case studies of individual industries have found that Japan has not only caught up with the United States in productivity, but has forged ahead. For example, the International Motor Vehicle Program found that in the mid-1980s it took, on average, 19.1 hours to build a car in Japanese assembly plants

Table 7.-Average Annual Changes in Real Gross Domestic Product per Employed Person, 1960-86

Year	United states	Canada	Japan	France	Germany	Italy	United Kingdom
1960-66	1.2%	1.9%	5.5%	3.6%	3.1%	37%	2.2%
1960-73	1.9	2.6	8.2	4.9	4.1	5.8	2.9
1973-79	0.0	1,3	2 9	2.7	2 9	1.7	1.3
1979-86	08	1,0	2 8	1,9	1.6	1.6	1.7

SOURCE: U S Department of Labor, Bureau of Labor Statistics, Office of Productivity and Technology, unpublished data, mimeo, August 1887

74 These cross country comparisons are based on purchasing power parity (PPP) exchange rates, which show what it costs in one unit of foreign currencies to buy goods and services equivalent to what a dollar will buy. At market exchange rates, rather than PPP exchange rates, Japan's GDP per employee reached 90 percent of the U.S. level in 1986. The market exchange rate for 1986 was 168.5 yen to the dollar; the PPP rate was 220 yen to the dollar. Another measure ofeconomy-wide productivity is GDP per hour worked. Since Japanese workersput in more hours per year than U.S. or European workers, this measure shows Japan at only 58 percent of the U.S. level in 1986, using PPP exchange rates, and 96 percent using market rates.

75 See, for example, Elliot S. Grossman and George E. Sadler, Comparative Productivity Dynamics: Japan and the United States (Houston, TX: American Productivity Center, 1982); George E. Sadler, Update: International Productivity Comparisons (Houston, TX: American Productivety Center, 1986); Elliot S. Grossman, Pace University "Productivity and International Competition: United States and Japanese Industries, "paper prepared for conference on Interindustry Differences in Productivity Growth, Amertcan Enterprise Institute, Washington, DC, October 1984; Martin Baily and Alok Chakrabarti, Innovation and the Productivety Crisis (Washington, DC: The Brocings Institution, 1988); Japan Productivity Center, Productivity Research Institute, International Comparisons of Labor Productivity (Tokyo: Japan Productivity Center, 1983); Molly McUsic, op. cit.; and calculations based on data in Organization for Economic Cooperation and Development, Industrial Structure Statistics, 1985 (Paris: OECD, 1987).

and 19.5 hours in Japanese-managed plants in America. In American-managed plants the average time for assembly was 26.5 hours. The quality of the Japanese autos was better too, judging by the record of defects owners discovered in the first three months of use. The U.S. plants were improving, were generally more productive than European plants, and had about as good a record as the European car makers in freedom from defects; but the Japanese were getting better too.[76] For another example, Japanese productivity and quality is conceded to be superior in parts of the semiconductor industry, especially in the manufacture of 256K dynamic random access memory chips.

The solid conclusion that can be drawn from available data is that Japan remains the leader in productivity growth. It is normal and expected that countries developing from a rural past to an industrialized future should show high rates of productivity growth; witness Japan in the 1950s and 1960s and Korea now. What Japan has accomplished in the past decade is to keep on raising productivity at a rapid rate, *after* becoming world class in many industries, raising output, employment, and wages through times of a rising yen as well as a falling yen.

One element supporting Japan's progress is a high rate of investment in manufacturing. As figure 24 shows, Japan consistently invested more in manufacturing, per dollar or yen of manufacturing output, than the United States did, from 1973 to 1985.[77] As for capital invested each year per manufacturing worker, the Japanese investment (expressed in U.S. dollars) climbed rapidly from 1978 on, and b 1985 was 11 percent above the U.S. level.[78] These figures do not tell the story for the whole economy. For example, taking services together with manufacturing, the Japanese rate of investment in machinery and equipment, per employee, was about on a par with the U.S. rate in 1985. If Japan's rate of capital investment is higher in manufacturing, the U.S. rate is almost certainly higher in many service industries. For example, optical scanners of bar codes and computerized systems for inventory control are now commonplace in American supermarkets and retail stores. Japan has poured most of its investment and management efforts into the manufacturing industries that its leaders see as critical for competing in world markets. Many services have been relatively neglected, though not all; certain services important to international trade, such as banking, do very well.[79]

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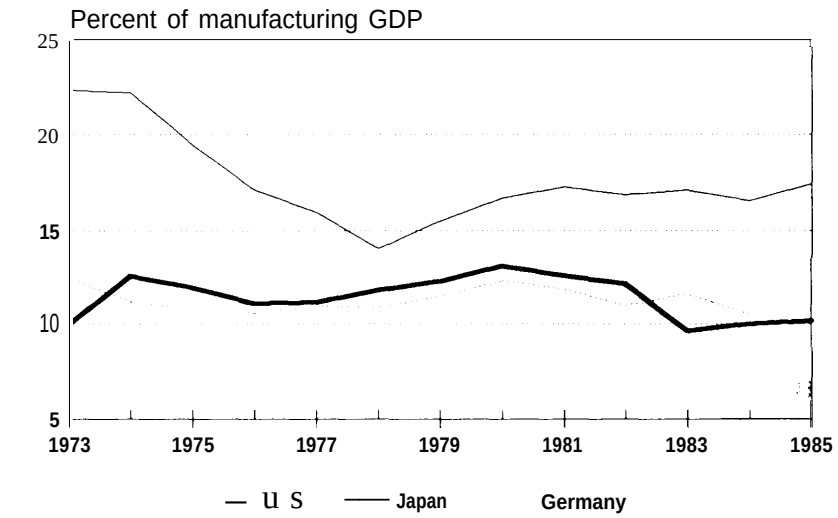
76 Information provided by the International Motor Vehicle Program, Center for Technology, Policy, and Industrial Development, Massachusetts Institute of Technology.

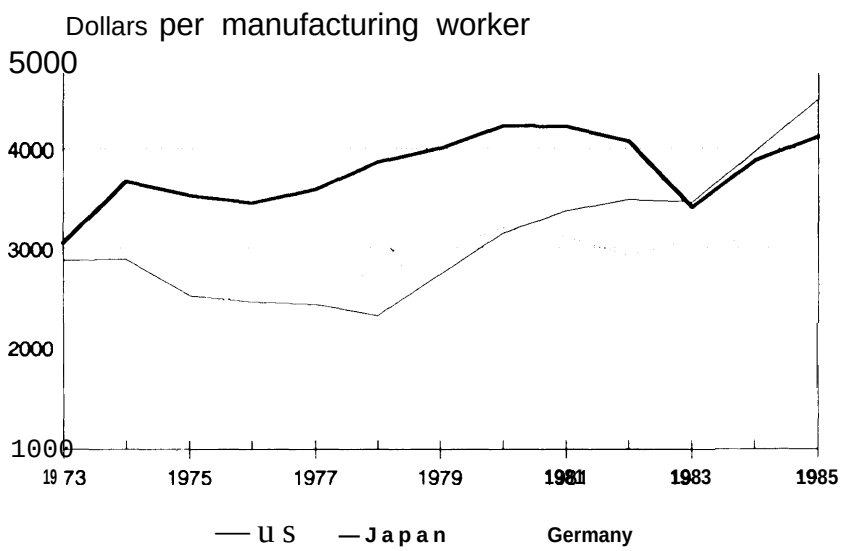
77 The source of this information is the Organization for Economic Cooperation and Development (see figure 24 for source details); 1985 is the latest year for which data are available. Investment in manufacturing means gross capital formation, including buildings and producers' durable equipment. Manufacturing output is the share of manufacturing in gross domestic product, that is value added in manufacturing.

78 How U.S. and Japanese investment per worker compare depends a great deal on what exchange rate is chosen. (This is not i rue of investment as a share of manufacturing output, which can be figured in each country's own currency.) The figures here are in L'. S. doilars, based on 1985 prices and the 198S purchasing-power-parity (PPP) exchange rate for fried capital formation in machinery and equipment, PPP exchange rates are developed by the Organisation for Economic Cooperation and Development (OECD) to show what it costs to buy the same amount of goods and services in different currencies. The PPP exchange rate for machinery and equipment in 1985 was 246 yen to the dollar.

79 U.S. Congress, Office of Technology Assessment, International Competition in Services, (1987), op. cit., see especially chapter 3, "International Corepetition in Banking and Financial Services."

Figure 24
Gross Fixed Capital Formation in Manufacturing, 1973-85





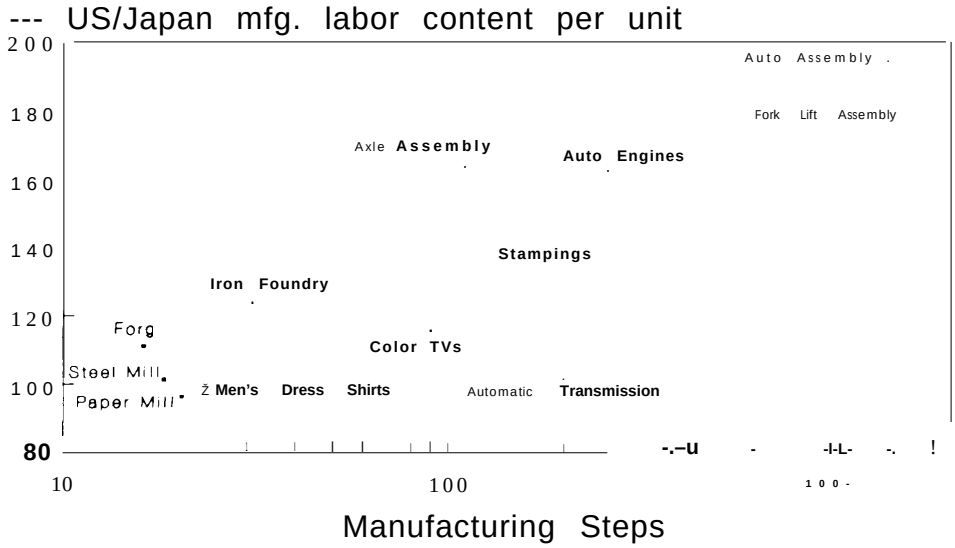
NOTE: Converted to U.S. dollars at 1985 Purchasing Power Parities for Machinery and Equipment Capital Formation

SOURCE: Organization for Economic Cooperation and Development, Flows and Stocks of Fixed Capital, 196085, (Paris: OECD, 1987); OECD, National Accounts, Detailed Tables, 1960-85, Volume 11, (Paris: OECD, 1987)

Large investment in equipment does not by itself assure either productivity growth or good performance in manufacturing; how work is organized and people used with the new equipment make a big difference. Here, the Japanese seem to excel. Managerial competence is an important source of productivity growth in Japan, especially in complex manufacturing where many steps are required and many operations must be coordinated. For example in automobile manufacture, assembly requires over 1,000 independent operations; a report of a few years ago found that Japanese auto assembly plants were twice as productive as in American plants.[80] In engine plants with about 200 operations, Japanese labor productivity was 50 percent higher. In iron foundries, where only about 30 steps are needed, the Japanese advantage disappeared (see figure 25).

Since the turn of the century, America has been in first place in the most generally used economy-wide measure of productivity, GDP per employed person. If others, starting from a lower base, are to catch up and enjoy the same benefits Americans get from

Figure 25.
Manufacturing Productivity in Japan and the United States



NOTE: As the number of steps in manufacture increases, the ratio of total factory labor content per unit of output of U.S. factories increases relative to Japanese factories,

SOURCE: James Albegglen and George Stalks, Jr., Kaisha, Tha Japanese Corporation (New York: Basic Books, 1985)

so James Abegglen and George Stalk, Jr., Kaisha: The Japanese Corporation (New York: Basic Books, 198S). U.S. assembly plants have since improved, according to the International Motor Vehicle Program of the Massachusetts Institute of Technology cited above. The Program's recent survey showed that the average Japanese assembly plant now has a 40 percent advantage in productivity over the average U.S. plant.

rising productivity-economic growth and rising standards of living — their growth rates must be higher, at least for a time. Indeed, it has been suggested that convergence of productivity levels among industrialized nations is all but inevitable, due to the diffusion of technical knowledge all over the world and to the application of that knowledge by those striving to catch up.[81] This idea contains some truth but it does not justify complacency. If U.S. productivity growth were to lag behind that of its trade competitors for long, the consequences would be serious. The example of Great Britain, the former world leader, is cautionary. The U.K. productivity growth rate averaged less than one percentage point below that of the United States from 1870 to 1950, but during that time the output per capita of the British economy dropped to 60 percent, and America eclipsed Britain in standard of living and industrial might.[82]

81 For an exposition of this point of view, see William J. Baumol. "Productivity Growth, Convergence, and Welfare: What the Long-Run Data Show," The American Economic Review, vol. 76, no. 5, December 1986.

82 Angus Maddison, "Growth and Slowdown in Advanced Capitalist Economies: Techniques of Quantitative Assessment," Journal of Economic Literature, vol. xxv, June 1987.