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Changes in U.S. Industrial Structure: The Role of Global Forces, Secular Trends and Transitory Cycles

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Introduction

For the first time in postwar history, employment in **U.S.** manufacturing has fallen for three consecutive years. The 10.4 percent decline in the number of workers in **U.S.** manufacturing from 1979 to 1982 is the largest since the wartime economy was demobilized between 1943 and 1946. The current slump is also unusual because international trade has made an important contribution: normally the volume of manufactured goods imports falls steeply in a recession — yet from 1980 to 1982, it rose by 8.3 percent; normally **U.S.** manufactured exports reflect growth in export markets abroad — yet despite a 5.3 percent rise in these markets from 1980 to 1982, the volume of **U.S.** manufactured exports dropped 17.5 percent.

Are these developments the predictable consequences of three years of demand restraint and a strong dollar, or do they result from deep-rooted structural changes?

There are widely held views that the recession has simply dramatized a secular decline in the **U.S.** industrial base. One of these views blames **U.S.** producers for the trend. Americans fail to produce quality goods because managers are myopic and care only about short-term profits, workers lack discipline and are shackled by work rules, and labor and management look on one another as adversaries. Others blame the **U.S.** government. On the one hand are those who fault it for excessive interference — for restrictive regulatory practices

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which have raised production costs, for faulty tax rules which have discouraged investment, savings, and innovation, and for trade protection, which has slowed adjustment to international competition. On the other hand are those who blame government neglect. The U.S. has failed to plan and coordinate its industrial evolution. It ought to have policies to promote industries with potential and to assist those in decline. Finally, there is also the more fatalistic view of the decline in U.S. manufacturing as the inevitable result of the rapid international diffusion of U.S. technology.

While some argue that particular U.S. deficiencies have become worse over time, others point to changes in the environment which have made U.S. structural flaws increasingly costly. As long as competition was primarily domestic, U.S. weaknesses were obscured. As global trade expanded, however, U.S. firms were forced to meet foreign competitors staffed with superior workforces and managers and backed by superior government policies.

Even before the recession and the recent decline in the U.S. manufactured goods trade balance, the erosion of the U.S. international competitiveness had become a national obsession. As an award-winning article in *Business Week* observed in 1980, "U.S. industry's loss of competitiveness has been nothing short of an economic disaster."

The perceived effect of international competition has now grown to the point that it is frequently cited as the major source of structural change in the U.S. economy and the primary reason for the declining share of manufacturing in U.S. employment. This shift of U.S. production away from manufacturing is viewed with some alarm, both because manufacturing activity is considered intrinsically desirable and because of the adjustment costs associated with the shift. In addition, some argue that this decline in comparative advantage does not result from an inevitable process of technological diffusion or from changes in factors of production, but rather from the industrial and trade policies adopted by other nations. Without similar policies, some contend that the United States will eventually become an economy specialized in farm products and services — "a nation of hamburger stands."

Yet, while the role of the deficiencies in U.S. policies and practices in retarding U.S. productivity growth over the past decade remains unresolved, the links between these deficiencies, U.S. trade performance and shifts in our economic structure have not been con-

vincingly demonstrated.

There are several implicit assumptions in the current discussion about U.S. industrial performance that I will show to be inappropriate. First, the policy discussion often presumes that rapid productivity growth will increase the share of resources devoted to an activity, that "higher productivity will create jobs.'' It assumes implicitly the existence of elastic demand. As the experience of U.S. agriculture has demonstrated, however, rapid productivity growth in the face of limited markets may have the opposite effect. Indeed, as I will indicate, the declining employment in Japanese manufacturing in the 1970s and the contrasting rise in U.S. employment suggests manufacturing productivity and employment were negatively associated.

Second, the discussion presumes that a decline in international technological lead in a particular area will reduce the resources devoted to that activity. It assumes implicitly that an erosion in absolute advantage will lead to an erosion in ***comparative*** advantage. Yet, as I will show below, even though foreign productive capacities are converging to those of the United States, the U.S. comparative advantage in high technology products has actually increased.

Third, the discussion presumes implicitly that the trade balance can decline indefinitely. It ignores the automatic adjustment mechanisms that tend to keep the trade balance in goods and services within fairly narrow bounds. An increase in imports eventually leads to an increase in exports. When global demand shifts away from U.S. products, it creates an excess supply of American goods and an excess demand for foreign goods. Since the relative price of U.S. goods may have to fall to restore the trade balance, this will ***increase*** the resources developed to export production, for a decline in the terms of trade entails providing more exports for any given volume of imports. Indeed, as I will argue below, the decline in U.S. terms of trade associated with the real devaluations of the dollar between 1973 and 1980 contributed to the rise in U.S. employment due to trade over that time period.

Fourth, international trade is neither the only nor the most important source of structural change. And, as I will demonstrate, in many cases trade has simply reinforced the effects of demand and technological change. At least five factors have had important effects on the U.S. industrial base. First, the share of manufactured products in consumer spending has declined secularly because of the pattern of demand associated with rising U.S. income levels. Second, some of

the long-run decline in the share of manufacturing in total employment reflects the relatively more rapid productivity growth in this sector. Third, because the demand for manufactured goods is highly sensitive to the overall growth rate of GNP, manufacturing production has been slowed disproportionately by the sluggish overall economic growth in the global economy since 1973. Fourth, shifts in the pattern of U.S. international specialization have arisen from changes in comparative advantage that, in turn, result from changes in relative factor endowments and production capabilities associated with foreign economic growth and policies. And fifth, short-run changes in U.S. international competitiveness have come from changes in exchange rates and cyclical conditions both at home and abroad.

The appropriate choice of policy depends crucially on the relative impacts of these various factors on current U.S. industrial performance. If the slow rate of U.S. industrial growth is the inevitable result of economic development, changes in international comparative advantage, or the post-1973 world economic malaise, policies to assist in the allocation of U.S. resources away from industry may be required. If foreign trade and industrial policies are the reason, the United States may try to change the trade system or its own behavior within it. If exchange rate changes are important, factors such as the monetary-fiscal policy mix or exchange rate intervention policies might merit attention. If transitory cyclical forces are the cause, there might be no need for a new industrial policy, but rather, a change in macroeconomic policies or an acknowledgement that the slump brought about by current policies is the unavoidable cost of reducing inflation.

Given the radical changes in the world economy after 1973, the period from 1973 to 1980 is the most relevant sample for current policy discussions. The data for this period measure performance in the new international environment that is marked by stagnation, volatile exchange rates, and increasing government intervention in trade; and it is during this period, it is alleged, that foreign industrial policies have damaged the U.S. manufacturing base. The data for this period also allow a comparison of U.S. industrial performance with those of other major industrial countries in a period in which comparative performance is less heavily influenced by relative stages of development.

Observations for the 1973-80 period, however, may be unduly influenced by the different cyclical positions prevailing in the end-

point years. Because capacity utilization in manufacturing was similar in 1970 and 1980, U.S. data for the entire decade are used to provide a second, cyclically neutral, measure of structural changes.[1] Observations for 1970-80 are still influenced by changes in the real exchange rate of the dollar in these years. As measured by the International Monetary Fund, relative U.S. export prices for manufactured goods were 13.5 percent lower in 1980 than in 1970. In evaluating the results, therefore, it should be kept in mind that the U.S. trade performance during the 1970s depended in part upon this price-adjustment process.

In this paper I analyze the changing role of manufacturing in the U.S. economy and structural change within U.S. manufacturing. Section I reviews the growth of inputs and outputs in U.S. manufacturing and the myth that the U.S. has been deindustrializing. Section II compares U.S. industrial performance over the 1970s with that of other major industrial nations. Section III examines the impact of trade upon U.S. manufacturing employment over the periods 1970-80 and 1980-82. Section IV measures the extent of structual change within U.S. industry and analyzes some of its determinants. And Section V presents some conclusions and implications for policy.

The myth of U.S. deindustrialization

The contention that declining U.S. international competitiveness has induced the deindustrialization of America is wrong on two counts. First, in the most relevant sense, the United States has not been undergoing a process of deindustrialization; and second, over the period 1973 to 1980; the net impact of international competition on the overall size of the U.S. manufacturing sector has been small and positive.

The term "deindustrialization" requires further elaboration for precise communication. First, what is industry? Does it, for example, include the construction and mining sectors or refer more narrowly, as we will interpret it here (partly for reasons of data availability), to the manufacturing sector alone? Second, does "deindustrialization'.' refer to a drop in the ***output*** of industry, or to the ***inputs*** (e.g., capital and/or labor) devoted to industry? And third, does "deindustrialization" refer to an ***absolute*** decline in the volume

1. Capacity utilization in U.S. manufacturing, measured by the index of the Federal Reserve Board, was 79.3 percent in 1970 and 79.1 percent in 1980.

of output from (or inputs to) manufacturing, or simply a ***relative*** decline in the growth of manufacturing outputs or inputs as compared to outputs or inputs in the rest of the economy?

Since industrial policy is generally concerned with facilitating adjustment, absolute deindustrialization with respect to factors of production would probably be the definition appropriate to current policy concerns about the manufacturing sector as a whole. While a declining ***share*** of output or employment could change the relative power of industrial workers, or the character of a society, an absolute decline in. industrial employment entails much greater adjustment difficulties. Absolute deindustrialization at rates in excess of normal voluntary quits by workers and depreciation of capital requires the reallocation of workers and capital to alternative sectors in the economy with all of the attendant costs associated with such dislocations. Relative deindustrialization, on the other hand, is far less costly to accomplish, for it may entail simply devoting less resources to manufacturing in the future.[2]

As indicated in Table 1, these distinctions are relevant for characterizing U.S. deindustrialization:

Measured by the size of its manufacturing labor force, capital stock and output growth, the U.S. has not experienced absolute deindustrialization over either 1950-73 or 1973-80. Employment in U.S. manufacturing increased from 15.2 million in 1950 to 16.8 million in 1960, 19.4 million in 1970, 20.1 million in 1973 and 20.3 million in 1980.[3] The capital stock in manufacturing grew at an annual rate of 3.3 percent from 1960 to 1973, and 4.5 percent between 1973 and 1980. And output in manufacturing increased at a 3.9 percent annual rate between 1960 and 1973, and a 1.1 percent annual rate from 1973 to 1980.

Judged by the output share of goods, the United States was virtually no more a service economy in 1980 than it was in 1960. In 1960, 1973, and 1980 the ratio of goods to GNP measured in 1972 dollars was 45.6, 45.6, and 45.3 percent respectively. Similarly, the ratio of value added to manufacturing (in 1972 dollars) was actually somewhat higher in 1973 than it was in 1950. Nonetheless, from 1950 to

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2. Of course, as we will show later in this study, absolute declines of employment in individual industries may entail considerable adjustment difficulties, even when offset elsewhere by employment gains in other manufacturing industries.

3. By contrast, the nation has experienced an absolute decline in agricultural employment from 8.6 million in 1945 to 3.3 million in 1980.

1973, the ***shares*** of expenditure, employment, capital stock, and R&D devoted to the manufacturing sector declined. Factors on both the demand and the supply side account for manufacturing's diminishing share. As incomes have risen, Americans have allocated increasing shares of their budgets to items in the service sector such as government services, education, medical care, finance, and real estate services. At the same time, productivity in manufacturing has increased more rapidly than elsewhere in the economy. Although the more rapid growth in manufacturing productivity has resulted in slower increases in manufacturing prices, the demand stimulated by the relative decline of manufacturing goods prices has not been sufficient to offset the fall in the share of resources devoted to value added in manufacturing. As a result, overall real industrial output has

TABLE 1

Share and Size of U.S. Manufacturing Sector

	Total						Shares			
	GNP (1)	IPMAN (2)	EMP (3)	EMPMAN (4)	NCAP (5)	NCAPMAN (6)	Real output	Employment	Capital	Expenditure*
1950	535	131	42.50	15.24	n.a.	n.a.	24.5	35.9	n.a.	29.2
1960	737	172	54.19	16.80	543.2	104.4	23.3	31.0	25.8	28.4
1965	939	237	60.77	18.06	662.9	158.1	25.5	29.7	23.8	28.6
1970	1086	261	70.88	19.37	860.1	202.2	24.0	27.3	23.5	25.4
1973	1255	325	76.79	20.15	971.1	215.3	25.9	26.2	22.2	24.5
1975	1232	290	76.94	18.32	1033.7	232.7	23.5	23.8	22.5	23.1
1979	1479	367	89.82	21.04	1184.6	275.1	24.8	23.4	23.2	23.3
1980	1474	351	90.56	20.3	1226.3	293.6	23.7	22.4	23.9	22.1
1981	1503	359	91.54	20.2	1268.5	311.8	23.7	22.1	24.6	21.9
1982	1477	338	89.62	18.9	n.a.	n.a.	22.9	21.1	n.a.	20.7

Sources: National Income Accounts: Bureau of Economic Analysis; ***Employment and Earnings*** Bureau of Labor Statistics (March 1972); ***Statistical Abstract of the United States,*** 1981, U.S. Department of Census, 1981, p. 562; and ***Survey of Current Business,*** October 1982.

GNP = GNP (in billions of 1972 dollars)
IPMAN = Value-added in manufacturing (in billions of 1972 dollars)
EMP = Employees on nonagricultural payrolls (in millions)
EMPMAN = Employees in nonagricultural payrolls, manufacturing (in millions)
NCAP = Net fixed nonresidential business capital (in billions of 1972 dollars)
NCAPMAN = Net fixed nonresidentialbusiness capital in manufacturing (in billions of 1972 dollars)
* = Ratio of GNP to value-added in manufacturing in current dollars

risen about as rapidly as GNP, but the share of employment and capital in manufactured goods has declined.*

From 1973 to 1982, there was a marked acceleration in the rate at which the share of manufacturing in output and employment has declined. But this should have been expected, given the slow overall growth in GNP and the fact that labor productivity growth (output per man-hour) fell less in manufacturing than in the rest of the economy. (See Table 2.) The demand for manufacturing output is particularly sensitive to fluctuations in income. The demand for goods, particularly durables, is inherently more sensitive to short-run income fluctuations than the demand for services because many such purchases

TABLE 2

Bureau of Labor Statistics Estimates of Average Annual Rates of Growth in Output Per Hour, the Contribution of Capital Services per Hour and Multifactor Productivity 1948 to 1980*

Private Nonfarm Business	(1) 1968 to 1973	(2) 1973 to 1980	(3) Slow down (1)−(2)
Output per hour	2.5	0.5	−2.0
Minus:-Contribution on capital services per hour†	0.8	0.5	−0.3
Equals: Multifactor productivity$	1.7	0	−1.7
Manufacturing: Output per hour of all persons	2.9	1.3	−1.6
Minus: Contribution of capital services†	0.7	1.0	+0.3
Equals: Multifactor‡ productivity	2.2	0.3	−1.9

Source: United States Bureau of Labor Statistics USDL-83-153
* Average annual rates leased on compound rate formula.
† Change in capital per unit of labor weighted by capital share of total output.
‡ Output per unit of combined labor and capital input.

4. There are two measures of manufactured output which provide somewhat different growth rates. The industrial production index of the Federal Reserve Board consistently suggests more rapid increases than the deflated value of manufactured goods output in the GNP accounts.

can be easily postponed. In slack periods the demand for consumer durables and plant and equipment products slumps, while during booms consumers allocate much of the transitory increases in their incomes to the purchase of consumer durables and housing, while producers invest in plant and equipment. Thus the generally slow growth in U.S. GNP from 1973 to 1980 was reflected in disproportionately slow growth in the manufacturing sector.

The relationship between the growth of manufacturing and the overall growth of the economy can be summarized statistically by regressing industrial production on GNP.[5] Such an equation confirms that industrial performance is a magnification of that of the overall economy. If GNP grows at 1.7 percent per year, there will be no increase in manufacturing production. However, for each percentage point increase (decrease) of GNP growth above 1.7 percent, manufacturing output will rise (fall) by 2.2 percentage points. As indicated below, when an equation such as this, fitted using data from 1960 to 1973, is used to forecast industrial production for the period 1973 to 1982 given actual GNP, it does so with remarkable accuracy.[6] Thus, there is no puzzle in explaining aggregate manufacturing production: It is almost exactly what one should have expected given the performance of the total economy.

Factor supplies. While the overall level of manufacturing output has matched its historic relationship with GNP, the relationship between output and input growth has changed. As a result of the

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5. For the 'regression over the period from 1951 to 1981 (annual data), the results were:

$$\%IP = \underset{(4.8)}{-3.42} + \underset{(12.6)}{2.18}\%GNP \quad \ldots\ldots (1)$$

where %IP is the annual percentage growth in industrial production in manufacturing and %GNP the annual growth in real GNP, with t-ratios in parentheses.

From 1960 to 1973 the results were:

$$\%IP = \underset{(5.2)}{-3.84} + \underset{(13.19)}{2.24}\%GNP \quad \ldots\ldots (2)$$

(Numbers in parentheses are t-statistics.)

6. **Forecasts of Annual Average Growth Rates in Industrial Production in Manufacturing*'**

	Actual	Forecast	Error
1973-1980	1.8	1.4	0.4
1979-1982	−3.6	−3.8	0.2

*Using equation (2) above.

NOTE: Regressions of value added in manufacturing against the rest of GNP yield qualitatively similar results.

decline in productivity growth in manufacturing since 1973, given rates of output growth are now associated with somewhat higher rates of employment and capital growth. A regression analysis indicates that, taking manufacturing output as given, manufacturing employment growth has been about 1.36 percent per year higher than it would have been in the absence of the decline in manufacturing productivity. Thus employment has actually held up better than might have been anticipated from past relationships.

Probably the most commonly provided reason for poor U.S. manufacturing performance is the failure of U.S. business to invest in new plant and equipment. Yet, while there has been a marked decline in the growth of the capital-labor ratio in the economy overall since 1973, the measured growth of the net capital stock in manufacturing has been remarkably rapid. (Compare the contribution of capital services to productivity in manufacturing before and after 1973 as reported in Table 2.) Although the ratio of the net capital stock to full time equivalent employees in manufacturing grew at about 2.03 percent per year from 1950 to 1973, it grew at 3.8 percent per year from 1974 to 1980. There is therefore support for the view that automation has accelerated. And, while historically the ratio of the net capital stock in U.S. manufacturing to the net stock in the rest of the economy declined (from 0.30 in the 1950s to 0.26 in the 1960s to 0.237 in 1973), since 1973 the capital stock in manufacturing has actually grown more rapidly than in the rest of the private economy. (See Table 1.)

In the 1970s, there has been a much publicized decline in the growth of real R&D expenditures.' While real R&D spending increased 3.1 percent per year from 1960 to 1973, it fell to a 2.5 percent annual growth rate from 1973 to 1980. But this decline does not reflect a similar drop in real R&D spending in U.S. industry.. Between 1960 and 1972 spending in manufacturing grew 1.9 percent per year. From 1972 to 1979 (the latest data available), it accelerated to 2.4 percent. A similar pattern is evident in industry hirings. While the number of scientists and engineers employed in industry R&D grew at 1.6 percent between 1960 and 1973, from 1973 to 1980

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7. The decline in U.S. growth of R&D spending as a share of GNP was a reflection of the very slow increase in government-financed R&D. Civilian R&D has grown from 1.2 percent of GNP in 1961 to 1.43 percent in 1973 and 1.63 percent in 1980. Source: Science Indicators, Appendix Table 1-4.

growth averaged 3.2 percent per year.[8]

The increased commitment of plant, equipment, and R&D expenditures makes the decline in productivity growth in U.S. manufacturing since 1973 particularly puzzling. One question is whether the capital stock is accurately measured. One reason for mismeasurement could be an increase in capital and R&D devoted to meeting regulatory requirements such as safety and pollution, which do not show up as output. Subtracting Commerce Department estimates of the net capital stock devoted to reducing air and water pollution from the net capital stock in manufacturing lowers the growth in manufacturing capital from 4.5 to 4.2 percent per year.[9] A second reason might be the premature retirement of capital, which has become economically obsolete in changed economic conditions.[10]

Nonetheless, as these data make clear, there has not been an erosion in the U.S. industrial base. The decline in employment shares have been the predictable result of slow demand and relatively more rapid labor productivity growth in manufacturing because of an acceleration in capital formation. Paradoxically, the slow absolute growth in productivity has required unpredictably large increases in employment plant and equipment and R&D.

The myth of inferior U.S. international comparative performance

A comparison of the performance of U.S. manufacturing with that of other major industrial countries should be useful for separating the problems that are shared by other countries, and are therefore reflective of broader global fdrces, from those unique to the United States. A comparison might also assist in gauging comparative U.S. strengths and weaknesses. Proponents of a radical change in industrial policies contrast the ad hoc and laissez-faire policies of the United States with the systematic, interventionist practices abroad. While conceding that there are marked differences in the degree to which foreign practices have succeeded, they argue that the conscious policy of managing the decline of older industries and the rise of new industries has been superior to the U.S. approach, which has

8. All these data are taken from Science Indicators 1980.

9. See Survey of Current Business, November 1982.

10. See, for example, Martin Neil Baily, "Productivity and the Services of Capital and Labor," Brookings Papers on Economic Activity (1981:1), pp. 1-67.

been marked by malign neglect. Similarly, the broader provision of social services in European economies, the more extensive rights to their jobs enjoyed by workers, and the greater restrictions on plant closings have all been held up as worthy of emulation. On the other hand, opponents of such policies argue that they will delay adjustment, for the government is most likely to be captured by forces seeking to preserve the status quo, and strictures on mobility are likely to retard adaptation.

It is particularly important that international comparisons be made on the basis of performance since 1973, for policies that enjoyed success in an environment of strong global growth and economic expansion might not be appropriate for the current era of stagnation.

The 1972-74 commodity boom and the inflation that accompanied it ushered in a new era. All developed countries have been plagued by low rates of investment, slow growth, and inflation. The problems associated with high inflation and energy shocks have destroyed the confidence of investors. They have learned from their experiences in 1973 (and again in 1979) that at any time a political disruption in the Middle East or a sudden increase in domestic inflation may force their governments to adopt policies that bring on a recession, leaving them with excess capacity. As reported in Table 3 the rate of investment has slumped, the growth of the heavy manufactured industries has been cut, and consumption expenditures have risen as a share of GDP. Industries with long gestation periods for investment, such as steel and shipbuilding, have been particularly hard hit by the post-1973 slump. There is insufficient demand for the products of plants that were built on the basis of overoptimistic projections of market growth in the late 1960s.

By a wide variety of indicators, the relative performance of U.S. manufacturing since 1973 has improved. The declines in the growth of manufacturing production, productivity growth, employment, and investment in manufacturing were all smaller in the U.S. than in other industrial nations. In Table **3,** I report rates of growth for GNP and manufacturing production in the major industrial economies. While U.S. growth was among the slowest prior to 1973, since that time U.S. growth has been quite typical for a developed country." From 1973 to 1980, the overall increase in U.S. GDP of 17.3 percent

11. **In fact, according to United Nations data, North American industrial production from 1973 to 1980 grew as rapidly as that in all market economies.**

TABLE 3

Real Growth of Output and Trade in Market Economies, 1960-1979
(1975 prices - average annual rates of change*)

	Gross domestic product	Government final consumption expenditures	Gross fixed capital formation	Private final consumption expenditures	Exports	Imports	Manufacturing: Total manufacturing	Manufacturing: Heavy manufacturing	Manufacturing: Light manufacturing	Manufactured goods traded[b]: Exports	Manufactured goods traded[b]: Imports
Developed countries											
1960-1973	5.0	3.8	6.0	4.9	8.0	8.5	6.0	6.7	4.6	10.9	12.4
1973-1978	2.5	2.8	1 3	3.1	5.3	3.4	2.1'	2.3'	1 6[c]	2.8'	2.1'
Developing countries											
1960-1973	6.1	6.9	7.5	5.0	7.7	5.9	6.9	5.9	8.2	10.1	5.3
1973-1978	5.2	9.1	10.8	4.6	2.3	10.5	4.9'	5.6'	4.0'	6 7[c]	6.2'
United States[d]											
1960-1973	4.1	2.8	4.5	4.2	6.7	7.6	5.3'	5.7'	4.2'	6.4	8.7
1973-1979	2.7	2.1	0.7	3.1	4.0	3.6	3.4	3.4	3.3	5.8	4.8
Japan[f]											
1960-1973	10.4	5.8	14.4	9.4	13.7	14.3	N.A.	N.A.	N.A	16.4	17.3
1973-1979	3.7	4.5	2 1	3.5	10.1	4.3	N.A.	N.A.	N.A.	8.2	4.1
OECD - Europe[g]											
1960-1973	4.8	4.1	2.8	4.8	8.0	8.5	5.5'	6.2'	4.4'	12.1	14.2
1973-1979	2.5	3.2	3.2	2.7	5.0	4.3	2.0	1.6	1.5	4.7	6.0

Sources. *National Accounts, 1951-1980*, Vol. *I*, OECD, *UN Yearbook of Industrial Statistics*, 1977, 1980 editions, *International Economic Indicators*, March 1981, U S Departmentof Commerce; *UN Monthly Bulletin of Statistics*. March 1977, March 1983, *UN Statistical Yearbook*, 1979180: *International Financial Statistics*, Statistical Yearbook, 1982, and *International Trade*. 1960, 1980181, GATT.

N A Not available.

a. Rates of change compounded annually.

b. Estimated using the U.N. manufactured goods export unit value index.

c. 1973-1979.

d. Available data for manufacturing production include Canada.

e. 1962-1973.

f. Revision of Japanese data may make years before 1965 incomparable.

g. Available data for manufacturing production and manufactured goods trade are for European community.

was about the same as that in the rest of the developed countries (up 19.1 percent in the OECD), and U.S. manufacturing production grew at about the same rate as that in the OECD as a whole (13.0 vs. 12.8). Although trailing behind that of Japan, U.S. industrial production grew more rapidly than in Germany, France, or the United Kingdom.

It is in Europe rather than in the United States that employment is undergoing absolute deindustrialization. Compared with historical trends, industrial production in Japan was abnormally strong while industrial production in Europe was unusually weak. Regressions relating industrial production to GNP in European countries from 1960 to 1973 substantially overpredict the level of industrial production in 1980. In the case of Japan, they underpredict industrial production (by 12 percent in 1980).

In Table 5, I report growth rates in industrial output for several industries:

With the exception of basic metals, U.S. output growth from 1973 to 1980 for food, textiles, apparel, chemicals, glass, and fabricated metals products was more rapid than that of either Germany or Japan. Although U.S. growth lagged behind Japan in the various engineering categories, it trailed German growth only in basic metals production and transportation equipment.[12]

Employment. The employment record of the U.S. manufacturing sector may come as an even greater surprise to those concerned about U.S. deindustrialization: From 1973 to 1980, the United States increased its employment in manufacturing more rapidly than any other major industrial country including Japan. (See Table 6.)

Moreover, since, as indicated in Table 6, the average workweek declined more rapidly abroad, the relatively larger growth in U.S. manufacturing employment is even more conspicuous. A comparison between U.S. and Japanese employment growth indicates that from 1973 to 1980, Japanese employment in sectors such as transportation, electrical machinery, iron and steel, non-electrical machinery, chemicals, and nonferrous metals grew less rapidly or declined more than that in the United States (Table 7).

As the case of Japan makes clear, in the current global environ-

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12. 1980 was a recession year in the United States. Comparisons over the period from 1973 to 1979 show U.S. non-electrical growth of 24.2 percent was considerably faster than the 18.7 percent rise recorded in Japan.

ment of relatively slow growth in demand, rapid increases in output do not necessarily increase employment. Indeed, compared with the United States, the faster increases in Japanese productivity have entailed the more rapid process of labor-force deindustrialization. In the case of Europe, employment opportunities in manufacturing have decreased because faster productivity growth has been combined with relatively slower growth in output.

Capital formation. In Table 8, I contrast data for gross fixed investment in manufacturing in the United States with that in industrialized European countries.

The sluggish growth of such investment in Europe is apparent; only in France was it above its 1970 levels in 1979. Compare the ratios of European investment in manufacturing to overall gross fixed investment in those countries: In contrast to the United States, most of the European economies are allocating proportionately less of their new capital formation to industrial production than they did in 1970.

Just as an automobile may be decelerating and yet going faster than another, so one country may have a declining growth rate for investment with a capital stock growing at a relatively faster rate. Thus capital stock measures are required. In Table 9, I report such estimates gathered by the United Nations. They indicate that in contrast to its previous performance, the U.S. capital stock in manufacturing grew as rapidly as those in Europe.

TABLE 4

Growth in Gross Domestic Product and Manufacturing Production in Major Industrial Economies (1960-1980, average annual rates of change)*

Country	Gross Domestic Product†		Manufacturing production‡	
	1960-1973	1973-1980	1960-1973	1973-1980
United States	4.0	2.3	5.4	1.8
Germany	4.5	2.3	5.2	1.1
France	5.6	2.8	5.0	1.3
Japan	9.2	3.8	12.5	2.9
United Kingdom	3.1	0.9	3.0	−2.2
OECD	5.0	2.5	6.0	1.7

Sources: ***National Accounts, 1951-1980,*** Vol. I, OECD; ***Main Economic Indicators — Historical Statistical, 1960-1979,*** OECD; and ***Indicators of Industrial Activity, 1982-IV,*** OECD.

* Rates are annually compounded.

† **GDP** data calculated at **the** 1975 price level.

‡ Industrial production index for manufacturing, 1975 = 100.

TABLE 5

Growth in Industrial Output — Selected Developed Economies

		United States	Japan	Germany	OECD Europe	OECD total
Textiles	63/73	2.7	5.7	1.5	1.7	2.6
	73/80	−0.3	−1.6	−1.7	−1.1	−0.7
Chemicals	63/73	7.9	13.7	9.0	8.8	8.9
	73/80	4.0	2.4	1.4	1.7	2.7
Basic metals	63/73	4.2	14.2	4.8	4.9	5.6
	73/80	−2.9	1.0	−0.7	−0.3	−0.9
Iron and steel	63/73	3.7	14.5	4.9	4.2	5.4
	73/80	−3.9	−0.7	−1.5	−1.4	−1.7
Nonferrous metal	63/73	5.3	13.2	5.8	4.7	6.2
	73/80	−1.6	31.5	1.8	0.9	−0.3
Metal products	63/73	5.4	14.9	4.7	3.7	6.1
	73/80	1.0	−0.1	0.8	0.1	0.5
Non-elec. machinery	63/73	7.0	14.3	3.5	3.4	6.8
	73/80	2.9	3.2	1.8	1.9	2.7
Elec. machinery	63/73	6.5	18.1	8.5	6.8	7.9
	73/80	2.8	8.2	1.9	1.8	3.5
Transp. equipment	63/73	4.6	18.0	5.9	4.6	6.3
	73/80	−0.1	3.5	1.4	1.1	1.2
Professional	63/73	7.4	8.7	4.5	n.a.	n.a.
Scientific equipment	63/73	3.1	19.5	1.1	...	...

Source: OECD ***Industrial Production,*** various issues.

Research and development

Since 1972, the United States has maintained its share in R&D spending among industrial countries, reversing the relative decline in U.S. spending that occurred in the late 1960s and early 1970s, when government-funded R&D was cut back while R&D spending in other major countries advanced rapidly. From 1972 to 1980, the growth in business-funded R&D in the United States has been similar to that of France, Germany, and Japan; and while government-funded R&D in the U.S. has not grown at the Japanese pace, it has exceeded the rise in support provided by the governments of France, Germany, and the United Kingdom.[13]

13. See Rolf Piekarz, Eleanor Thomas, and Donna Jennings, "International Comparisons of Research and Development Expenditures," National Science Foundation (mimeo), 1982.

According to estimates made by the OECD by a wide variety of indicators the U.S. continues to dominate other industrial countries in its commitment to R&D. In 1977, for example, spending on R&D in U.S. manufacturing was equal to about 6.5 percent of the domestic U.S. industrial output. By contrast, spending on manufacturing R&D in Japan, the United Kingdom, and Germany amounted to 3.7, 5, and 4.0 percent of the industrial output. Indeed, privately funded U.S. R&D alone was equal to 4.4 percent of manufacturing product. In absolute terms in 1979, measured at purchasing power parity levels, the U.S. spent about 1.5 times as much as Japan, Germany, France, and the United Kingdom combined and employed about 1.3 times as many scientists and engineers. By contrast, in 1979 manufacturing employment in these countries was 1.5 times that in the U.S. The OECD has also ranked industrial countries according to the percentage of manufacturing output spent on R&D in a variety of industry groups during the 1970s. The U .S. ranked first in manufacturing overall as well as in the electrical, aerospace, machinery, and transportation categories.

As this brief comparison suggests, if U.S. manufacturing performance since 1973 is considered to have been relatively poor, this should not be ascribed to a relative failure to commit resources either to capital formation or to R&D. While the use made by U.S. manufacturers may or may not have been inefficient, the U.S. capital stock and real R&D in manufacturing have grown as rapidly as those abroad.

Productivity. Measured both in terms of the ratio of total output to all inputs and in output per man-hour, U.S. productivity growth in manufacturing, as in the economy as a whole, has slowed down in the period since 1973. Over the same period, however, there has been an even larger slowdown in foreign productivity growth, both in manufacturing and in the whole economy. Careful studies have been unable to provide convincing explanations for these slowdowns.[14] And I will not attempt an investigation of them here. It should, however, be noted that, despite some convergence in the period since 1973, the U.S. productivity growth rate in manufacturing remain the slowest of any major industrial country (Table 10).

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14. See for example, Assar Lindbeck, "The Recent Slowdown of Productivity Growth," a paper presented at the Conference of the Royal Economic Society, London, July 22, 1982, and E.F. Denison, *Accounting for Slower Economic Growth: The United States in the 1970s*, Washington: The Brookings Institution.

TABLE 6

Changes in Employment and Hours in Manufacturing for Seven Countries, 1960-80
(average annual changes, in percent)*

Year	United States	Canada	Japan	France	Germany'	Italy	United Kingdom	Eight European countries†	Ten foreign countries‡
Aggregate hours:									
1960-80	0.9	1.0	0.8	−0.1	−1.3	−0.3	−1.7	−1.1	−0.5
1960-73	1.6	1.7	2.1	0.6	−0.2	−0.1	−1.2	−0.4	0.4
1973-80	0.7	−0.3	−0.7	−2.1	−2.6	−0.1	−2.9	−2.3	−1.7
Employment:									
1960-80	1.0	1.3	1.6	0.6	−0.4	1.2	−0.9	−0.1	0.4
1960-73	1.5	1.9	3.0	1.2	0.5	1.4	−0.5	0.5	1.1
1973-80	0.6	0.3	−0.8	−1.2	−1.8	0.1	−2.2	−1.5	−1.3
Average hours:									
1960-80	0.0	−0.3	−0.8	−0.7	−0.9	−1.5	−0.8	−1.9	−0.8
1960-73	0.1	−0.2	−0.9	−0.5	−0.8	−1.5	−0.7	−0.9	−0.8
1973-80	−0.1	−0.5	−0.1	−0.9	−0.9	−0.3	−0.8	−0.8	−0.5

Source: Bureau of Labor Statistics, *Monthly Labor* Review, December 1981, p. 15.

* **Rates of change computed from the least-squares trend of the logarithms of the index numbers.**

† **France, Germany, Italy, United Kingdom, Belgium, Denmark, the Netherlands, and Sweden.**

‡ **The eight European countries plus Canada and Japan.**

Measured by output per man hour, however, the United States continues to be the world's most productive manufacturing nation. According to Roy, for example, in 1980 output per employed worker-year in United States manufacturing was about 16 percent higher than in Japan, 21.7 percent higher than in Germany, and 31.3 percent higher than in France.[15] To be sure, the United States no longer leads in all industries. According to the 1981 White Paper on International Trade issued by the government of Japan, Japanese productivity levels in 1979 were above those of the United States in steel (108 percent above U.S. levels), general machinery (11 percent higher), electrical machinery (19 percent), transportation equipment (24 percent), and precision machinery and equipment (34 percent).

Accomplishing structural change

The U.S. failure to promote industrial adjustment has been unfavorably contrasted with the explicit adjustment policies followed in Europe and Japan. It is therefore of some interest to compare the shifts in the U.S. industrial structure with those in other major economies to determine whether in fact U.S. industrial adaptation has been lagging. To explore this question I have used the matched set of data collected by the United Nations. These provide fairly disaggregated information on industries at the three-digit ISIC level. First, I selected the group of industries that are generally con'sidered to have high-growth potential. They are characterized by relative intensity in R&D and by rapid rates of technological innovation. The sample includes chemicals, plastic products, machinery, and professional instruments and typically made up to about 35 percent of manufacturing employment in major industrial nations. Next, I calculated the share of total manufacturing employment these industries accounted for in the U.S., Germany, and Japan and compared growth in these shares between 1973 and 1979,.(See Table 11.)

Although employment shares in all three'countries increased, the 8.9 percent rise in the U.S. share far exceeded those of both Japan (up 0.6 percent) and Germany (up 3.0). A similar analysis was performed for a group of slow growers which consisted of a group of labor-intensive industries such as textiles, apparel, leather, footwear,

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15. Overall U.S. GDP per man-year in the U.S. was 49 percent above that in Japan, 13.3 percent above that in Germany, and 7.7 percent above that in France. A.D. Roy, "Labor Productivity in 1980: An International Comparison," *National Institute Economic Review* **No. 101, August 1982, p. 29.**

and furniture, and capital-intensive industries such as metals, metal products, and ship-building. This group also typically accounted for between 30 and 35 percent of total employment. In this case, Germany had the most rapid decline in the share of employment (−9.2 percent), whereas Japan and the U.S. had shifts quite similar in magnitude (−5.9 and −6.4 percent respectively). While the U.S. moved out of labor-intensive industries faster than Japan, the drop in the Japanese share of the capital intensive group exceeded that of the United States.

These results should, of course, be treated with some caution because of the relatively aggregate nature of the industry divisions and possible discrepancies in national classification schemes.[16]

TABLE 7

Employment by Three-Digit ISIC: United States-Japan
(average annual rates of change, compounded annually)

ISIC			1960-1973	1973-1980
321	Textile products	United States	2.1	−2.5
		Japan	−1.1	−4.7
341	Paper	United States	0.9	−0.0
		Japan	0.7	−0.5
342	Printing	United States	1.3	2.2
		Japan	3.7	−0.1
351 and 352	Chemical products	United States	−0.7	0.3
		Japan	−3.0	−1.9
371	Iron and steel	United States	0.4	−2.0
		Japan	1.7	−2.9
372	Nonferrous metal	United States	N.A.	−0.3
		Japan	N.A.	−2.0
381	Metal products	United States	2.1	0.9
		Japan	5.1	−1.5
382	Nonelectrical machinery	United States	3.0	2.7
		Japan	4.5	−1.4
383	Electrical machinery	United States	2.2	1.2
		Japan	5.2	−0.7
384	Transportation	United States	1.0	−0.9
		Japan	4.5	−1.2
3	All manufacturing	United States	1.8	0.3
		Japan	2.6	−1.2

Source: *United Nations Yearbook of Industrial Statistics*, 1967, 1977, 1980, 1981 editions.

16. Nonetheless, the shares in U.S. high tech obtained in this exercise are similar to these of the more detailed analyses described below.

TABLE 8

Gross Fixed Investment in Selected OECD Countries (1973 = 100)

	1963	1970	1973	1978	1979
United States total	**64**	83	100	105	107
manufacturing	63	93	100	133	144
Germany total	**64**	91	**100**	99	107
manufacturing	71	118	100	88	n.a.
France total	46	82	100	102	106
manufacturing*	n.a.	89	100	101	101
Belgium total	62	92	100	110	110
manufacturing	72	103	100	74	72
Netherlands total	54	95	100	102	103
manufacturing†	60	109	**100**	102	105
United Kingdom total	62	92	100	98	97
manufacturing	90	122	100	112	113

Source: *OECD National Accounrs.* **1951-80.**
* **Mining, manufacturing, and utilities.**
† **Mining, manufacturing, and utilities plus construction.**

TABLE 9

Manufacturing Growth Rates of Capital Stocks in Selected Industrial Countries (average annual rates of change)

	Real Capital Stock Growth	
	1960-73	1973-79
United States	**3.1**	**3.8**
Austria	**5.0**	**4.3**
Germany	**6.9**	**2.6***
Sweden	**4.3†**	**3.4***
United Kingdom	**3.5**	**2.4**

Source: Economic Survey of Europe in 1981 United Nations.
* **1973-78.**
† **1963-73.**

TABLE 10

Growth of Productivity and Output in Manufacturing in Seven Countries, 1960-80
(average annual changes, in percent)*

Year	United States	Canada	Japan	France	Germany	Italy	United Kingdom	Eight European countries†	Ten foreign countries‡
Output per hour:									
1960-80	2.7	3.8	9.4	5.6	5.4	5.9	3.6	5.4	5.9
1960-73	3.0	4.5	10.7	6.0	5.5	6.9	4.3	5.9	6.4
1973-80	1.7	2.2	6.8	4.9	4.8	3.6	1.9	4.2	4.7
Output:									
1960-80	3.7	4.9	10.2	5.5	4.0	5.6	1.8	4.2	5.4
1960-73	4.7	6.3	13.0	6.6	5.3	6.8	3.0	5.4	6.8
1973-80	2.5	1.9	6.1	2.7	2.1	3.4	−1.1	1.8	2.9

Source: Bureau of Labor Statistics, *Monthly Labor Review,* **December 1981, p. 15.**
* **Rates of change computed from the least-squares trend of the logarithms of the index numbers.**
† **France, Germany, Italy, United Kingdom, Belgium, Denmark, the Netherlands, and Sweden.**
‡ **The eight European countries plus Canada and Japan.**

Nonetheless, they contradict assertions about the relative failure of the U.S. to shift resources towards high-growth sectors. And they indicate that the United States has been about as successful as Japan in reducing the role of the low-growth group.

Concluding remarks

In this section I have pointed to the marked contrast in European economic performance before and after 1973, a contrast that is particularly evident in data on European industrial performance. European manufacturing production has declined by more than might have been expected, given GNP. Employment has fallen, and productivity growth slowed down. While Germany has been relatively successful in shifting out of slow-growing industries, it has been less successful in moving into new ones. In fact, just as Americans have responded to the slowdown in manufacturing by decrying the short-sighted nature of their decisionmakers, in Europe the concern stems from excessive rigidity.

European governments have assumed much greater responsibility than those in Japan or the United States for providing steady increases in standards of living, and a much greater degree of job tenure is provided in Europe than is common in the United States. In the 1950s and 1960s, these guarantees were relatively costless, for rapid demand growth facilitated job retention, and rising productivity growth made higher wages affordable. With the shocks and slow growth in the 1970s, however, governments were forced to make good on the guarantees. Partly because they were backstopped by generous social payments by schemes such as indexation, growth in European real wages exceed the paced warranted by changes in productivity and the terms of trade. This squeezed profits, discouraged investment, and slowed growth.[17] With slow growth and high wages, firms wished to reduce their work forces. Governments were forced both to support employment by job subsidies, trade protection, schemes for job-sharing, reductions in work hours and early retirement and to provide extensive unemployment benefits. While manufacturing employment declined, the services sectors in Europe were unable to provide employment for new labor force entrants and those displaced from manufacturing.

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17. See, for example, Jeffrey Sachs, "Wages, Profits, and Macroeconomic Adjustment, A Comparative Study," *Brookings Papers on Economic Activity,* 1979:2, pp. 269-319.

Whereas European unemployment rates have been considerably lower than those in the United States for most of the postwar period, by 1982 the average unemployment rates in the United States and the European community (EC9) were 9.7 and 9.5 percent respectively. Although they stand at similar levels, structural unemployment seems much higher in Europe. According to the OECD, in the United States in 1982, about 16.6 percent of the unemployed had been unemployed for more than six months. By contrast, in Germany, France, and the United Kingdom, the long-term unemployed were 38.1, 55.8, and 45.7 of the unemployed.[18] In 1979, males over the age of 45 constituted 36 percent of all unemployed German males, whereas in the United States, older males were 17 percent of all unemployed males. Similarly, older women were 29 percent of the unemployed in Germany, and 15 percent in the United States.

There is, therefore, overwhelming evidence that the structural problems facing European economies far exceed those in the United States. As the Commission of the European Communities noted in a recent report:[19]

> It is in particular apparent that the Japanese and United States examples have in common a positive employment creation record, a more positive record of enterprise profitability, of labor cost adaptability to economic circumstances, and — for reasons linked to social structure — of less onerous labor regulations that place constraints on the use of production capacity. By comparison, enterprise profitability has fallen to much lower levels over the past decade in Europe (especially in the United Kingdom and Belgium, but elsewhere, too, in lesser degree). The adaptability of labor costs to macroeconomic conditions and those of enterprise is less in Europe.

Trade and manufacturing employment

In this section, I estimate the role that manufacturing trade flows have played in aggregate U.S. manufacturing employment. First, I introduce a simple accounting framework and estimate the contribution of trade flows to employment in the 1970s. Next, I extend the analysis to the period from 1980 to 1982. The second part of the analysis accounts for the role of changes in relative U.S. price competi-

18. OECD ***Economic Outlook,*** 1983.

19. European Economy Annual Report 1982-3, No. 14, November 1982.

tiveness in affecting these trade flows. I argue that both the positive record over the 1970s and the declines from 1980 to 1982 were heavily influenced by the relative prices of U.S. manufactured products.

A separation of the effects on the economy of foreign trade and domestic forces begins with the identity $P = U + X - M$, where P = production, U = domestic use (consumption plus investment, including inventories), X = exports, and M = imports.

Given data on total shipments, exports, and imports, any change in overall production can be decomposed into change due to domestic use and a change due to the foreign balance. But the use of raw data on trade flows and output would fail to incorporate the indirect impact of trade. When, for example, an airplane is exported from the United States, it embodies inputs from a wide variety of other industries such as aluminum, tires, and computers. So the ratio of total export shipments to total shipments in manufacturing understates the impact of exports. Similarly, when an import replaces a domestic product, it entails the reduction in demand for the products of domestic manufacturing sectors other than that of the sector competing directly with the import. **A** complete accounting of the impact of trade should incorporate these indirect effects.

The indirect effects of trade were estimated for this study with the aid of the 1972 85-sector input-output table. Data on manufacturing output, exports and imports for 1970, 1972, 1973, and 1980, available at the four-digit SIC code level, were converted into 1972 dollars and arranged to correspond with the industrial coding structure of the 52 manufacturing sectors of I-O table.[20] Next, the input-output table was used to estimate direct and indirect output requirements. Thus for the output, exports, and imports of each manufacturing industry, we obtained an estimate of value-added requirements from the originating industry and from all other industries. These were then used to estimate the proportions of total value added in each industry that could be related to 1) all manufactured goods exports, 2) all manufactured goods assumed to be displaced as a result of manufactured goods imports, and 3) as a residual value-added related to domestic use. Employment effects were estimated under the assumption that productivity growth in the exports and domestic products of each industry was identical, so that employment proportions corresponded

20. The concordance provided by the Department of Commerce was used. See *Origin of Manufactured Exports* 1980 Annual Survey of Manufactures, M80 (AS)-6, Bureau of the Census, January 1982.

to those of value added.

Some caution is necessary in interpreting our results. It should be stressed that this is an exercise with ex post data, rather than a simulation with a full-scale behavioral model. In relating growth to domestic use, exports, and imports, we say nothing about why these configurations should have occurred, nor do we account for the possible interactions between forces resulting in the behavior of these endogenous variables. And the analysis entails making the usual assumptions required for input-output exercises.[21]

In Table 12 we report our estimates of value added and employment related to trade and domestic use in U.S. manufacturing for a number of years in the 1970s.[22]

First compare 1980 with 1970. Since in both these years the capacity utilization levels in manufacturing were similar, the data for these years will be less contaminated by business cycle effects.[23] In 1970, value added related to manufacturing exports amounted to 8.5 percent of overall value added in manufacturing, while the production of manufactured imports at home would have raised value added in manufacturing by 8.3 percent. By 1980, these shares had grown considerably to 15.1 k the case of exports and 14.4 in the case of imports.[24] Thus, over the period from 1970 to 1980, the increase in the 'net value added due to the trade balance raised value added in

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21. For adiscussion of the methodological issues associated with exercises such as this, see Walter Salant, "The Effects of Increase in Imports on Domestic Employment; A Clarification of Concepts," Brookings Institution, and Charles Pearson, "Trade Employment and Adjustment," draft prepared for the Institute for Research on Public Policy, April 1981.

22. There have been a number of studies similar to this with somewhat different emphasis. Krueger estimates, for example, that between 1970 and 1976, the average two-digit industry experienced an annual decline in job opportunities resulting from Increased imports of about 0.37 percent. See Anne O. Krueger, "Protectionist Pressures, Imports, and Employment in the United States," Working Paper No. 461, ***N.B.E.R.,*** p. 20.

Baldwin has decomposed employment by industry into an effect attributable to income elasticities at home and abroad, and a second impact, which he calls a competitiveness effect, attributable tochanges inrelativeprices, etc. See Robert E. Baldwinet. al. ***U.S.Policies in Response to Growing International Trade Competitiveness, Final Phase I Report,*** mimeo, 1972, Appendix A.

23. According to the Federal Reserve Board, capacity utilization in U.S. manufacturing in 1970 and 1980 was 79.3 and 79.6 percent respectively.

24. This is somewhat higher than the 13.7 percent estimate of direct and indirect export related employment of the U.S. Department of Commerce. See ***Origin of Manufactured Exports*** 1980 Annual Survey of Manufactures, M80 (AS)-6, U.S. Department of Commerce, Bureau of the Census, January 1982.

manufacturing (in 1972 dollars) by 0.5 percent.[25] Although net value added due to trade was 0.6 billion dollars in 1970, it amounted to 2.6 billion dollars in 1980 (both figures in 1972 dollars). Because products making up U.S. manufactured imports have lower output per worker when produced in the U.S. than products making up U.S. exports, net jobs relating to trade were negative in each year in Table 12. However, although there was a decline of 10,000 jobs due to trade between 1970 and 1980, the contributions of trade over the periods 1972-80 and 1973-80 were positive. Trade raised job opportunities in U.S. manufacturing by 390,000 from 1972 to 1980, and by 280,000 over the period from 1973 to 1980. This can be compared

TABLE 11

Changes in Employment Shares in Manufacturing of High and Low Growth Sectors: United States, Germany, and Japan

Shares	United States	Germany	Japan
Selected high growth industry*			
(1) 1973	30.4	39.7	31.0
(2) 1979	33.1	40.9	31.2
Percent changes in share†	8.9	3.0	0.6
Low growth industries‡§			
(1) 1973	34.0	32.8	37.5
(2) 1979	32.0	29.8	35.1
Percent change in share	−5.9	−9.2	−6.4
Labor intensive industries*			
(1) 1973	19.2	15.1	21.6
(2) 1979	17.3	13.1	20.4
Percent change in shares	−9.9	−13.2	−5.5
Capital intensive industries§			
(1) 1973	14.8	17.6	15.9
(2) 1979	14.7	16.7	14.7
Percent change in share	−0.7	−5.1	−7.5

Source: *United Nations Yearbook of Industrial Statistics,* 1977 and 1980 editions.

* Industrial chemicals, other chemical products, plastic products, machinery, electrical machinery, and professional goods.

† Percent change in share calculated: $(\frac{1-2}{1}) \times 100$.

‡ Textiles, apparel, leather, footwear, wood products, and furniture.

§ Iron and steel, nonferrous metals, metal products, and shipbuilding.

25. Note in Table 13 that because products making up U.S. manufacturing imports are more labor-intensive (have lower output per worker) when produced in the U.S. than those making up U.S. exports, in 1973 net job opportunities relating to trade were negative even though net value added relating to trade was positive.

TABLE 12

Value Added and Employment in U.S. Manufacturing Due to Foreign Trade and Domestic Use, Selected Years, 1970-80

Item	1970	1972	1973	1980
Value added (billions of 1972 dollars)				
Total	262.7	295.3	318.9	349.5
Foreign trade	0.6	−5.3	−3.3	2.6
Exports	22.4	24.0	30.1	52.9
Imports	−21.8	−29.3	−33.4	−50.4
Domestic use	262.1	300.7	322.2	347.0
Employment (millions)				
Total	19.34	19.10	20.11	20.24
Foreign trade	−0.05	−0.45	−0.34	−0.06
Exports	1.57	1.45	1.78	2.93
Imports	−1.62	−1.91	−2.12	−2.98
Domestic use	19.38	19.56	20.45	20.30
Addenda				
Percentage due to exports				
Value added	8.5	8.1	9.4	15.1
Employment	8.1	7.6	8.8	14.5
Percentage due to imports				
Value added	−8.3	−9.9	−10.5	−14.4
Employment	−8.4	−10.0	−10.5	−14.7

Sources: Author's calculations using data from U.S. Department of Commerce, Bureau of Economic Analysis, input-output tape; Bureau of Industrial Economics, data base for manufacturing output exports, and imports; and U.S. Department of Labor, Bureau of Labor Statistics, employment and earnings tape.

Note: Estimates of direct and indirect requirements based on the input-output table were used to calculate the proportion of value added related to manufactured exports and to manufactured goods displaced by imports. Value added related to domestic use was calculated as a residual and employment allocated to foreign trade and domestic use in proportion to value added in each two-digit I-O industry.

with the corresponding total rise in manufacturing employment over these periods of 1.14 million and 0.13 million respectively.

It is certainly hard to reconcile these findings with the widespread notions that foreign trade was having a major negative effect upon U.S. industrial employment in the 1970s. These perceptions can in part be explained by the inappropriate use of statistics and in part by the particular attention commanded by a few large industries, e.g., steel and automobiles.

As I will show below, several real-dollar devaluations in the 1970s were important in determining these trade flows.

1980 to 1982

A substantial proportion of the decline in U.S. manufacturing employment from 1980 to 1982 was due to changes in trade flows, particularly exports. Between these two years, the volume of **U.S.** manufactured goods exports declined 17.5 percent. The volume of manufactured goods imports rose 8.3 percent. As estimated above, employment due to manufactured exports in 1980 was 2.93 million. Since output per employee in manufacturing was similar in 1980 and 1982, employment and output due to trade most likely declined proportionally. This suggests an employment decline of 513,000 people, or about 34 percent of the total 1.51-million decline in manufacturing employment from 1980 to 1982, was due to the fall in manufactured exports.

The jobs lost to imports can be estimated on two alternative assumptions. As estimated above, imports were displacing 2.9 million U.S. jobs in 1980. If one assumes rising import volumes added proportionately to this job displacement, the 8.3 percent rise in import volume between 1980 and 1982 displaced an additional 240,000 U.S. jobs. Alternatively, if the value of U.S. demand is assumed to rise with domestic prices and the value of U.S. production is reduced by an amount equal to the higher value of imports, the estimated job loss is negligible since import values and domestic prices both rose by about 14 percent.

In the first section, I noted that U.S. industrial production from 1980 to 1982 was quite precisely predicted given **GNP.** A regression fitted through 1980 forecasts a decline of industrial production of −6.8 percent. In fact, the decline was −6.2 percent. This finding creates a puzzle, for given the impact of manufactured trade, a larger decline in manufacturing production might have been expected. Apparently, there are unusually large offsetting sources of strength in the domestic economy. One of these is the production of defense and space equipment, which increased by 11.4 percent from 1980 to 1982 and had a weight of about 0.075 percent in total value added in manufacturing. Thus, industrial production unrelated to either defense or exports declined by 6.0 percent, close to what should have been expected.

Explaining manufactured goods trade

What lies behind the recent erosion of U.S. international competitiveness? No single measure can adequately capture the numerous

factors that determine a country's success in international markets. Some of the factors that complicate the task of explaining performance are the heterogenous nature of the goods entering international trade; differences in marketing, servicing, or reputation for quality; and the availability of trade financing and other forms of government support. Nonetheless, these factors are unlikely to change radically in the short run in which fluctuations in the business cycle and in relative product prices are the major determinants of fluctuations in trade volumes. Accordingly, I have estimated a set of simple econometric equations which explicitly models the major short-run determinants of trade flows and captures the long-run effects in trend variables.

Equations

The volume of U.S. exports is explained in these estimates by a set of variables which capture the growth in overall global economic activity plus the current and lagged values of the relative prices of U.S. manufactured goods exports. Global economic activity is proxied by a time trend, the volume of exports of the major industrial countries besides the United States, and the level of industrial production in the "rest of the world" (Europe, Japan and Canada); The relative price variable is the ratio of the prices of U.S. manufactured goods to the prices of manufactured exports of other major industrial nations as computed by the International Monetary Fund.[26] All variables (aside from the time trend) are entered logrithmically so that the coefficients can be interpreted as elasticities.

The equation tracks U.S. export behavior over the sample period quite precisely (it has a standard error of 3.4 percent), and the coefficients are generally statistically significant with the appropriate signs (Table 13). Trade flows are responsive to both the activity and price variables. With no change in the relative price of U.S. exports, increases in world manufactured goods trade and rest-of-the-world industrial production at their 1973-1980 averages of 4.5 and 1.7 percent entail an annual growth in U.S. exports of 4.0 percent. Over the long run, (three and a half years) each one percent rise (fall) in U.S. export prices (relative to export prices in the other major industrial countries) lowers (raises) the volume of U.S. exports by 1.5 percent. After eighteen months only about half the long-run impact will have

26. An alternative specification using industrial production in other major industrial nations and a cyclical variable was also experimented with but provided poorer results.

occurred. (The absolute values of the price coefficients are largest and most significant between six months and two and a half years, but the effect continues to grow even after three years.)

The import equations relate the volume of U.S. manufactured imports to the growth in U.S. GNP, a proxy for the business cycle (the ratio of actual to potential GNP in the United States), a time trend, and distributed-lagged values of the ratio of import unit values of manufactured goods to the prices of domestic manufactured goods. All variables in the equation are significant, and the specification fits the historical behavior of manufactured import values fairly well (the standard error of the equation is 4.4%). The equation indicates that if the economy grows along its potential path (of about 3.2 percent per year from 1973 to 1982), with no change in relative import prices, manufactured imports will rise at about 9.1 percent per year. For each percent deviation of GNP from this path, imports will deviate by about 1.43 percent in the same direction. The long-run price elasticity of 1.8 for imports is somewhat higher than that for exports. The mean lags are similar. The most powerful effects again come after a year to eighteen months. And imports continue to be affected by price changes three years previously.

When the activity variables take on recent average values, these equations imply annual growth of export and import volumes of 4.0 and 9.1 percent respectively. Starting from a position of balanced trade, the manufactured goods trade balance would decline secularly absent a fall in the relative prices of U.S. manufactured goods. However, an improvement of 2.0 percent per year in relative U.S. prices would suffice to ensure balanced trade in manufactured products.

Over the decade, U.S. relative exports as measured by the IMF declined by 13.8 percent. In the absence of this decline, the equations imply that U.S. export volumes in 1980 would have been about 20.0 percent lower than they actually were. Similarly, without the rise in the relative prices of imports of 22 percent, the dollar value of U.S. manufactured imports in 1980 would have been 21.5 percent higher. Thus the improvements in relative prices of U.S. manufactured products were an important part of the growth in U.S. employment due to trade, particularly from 1973 to 1980. But this adjustment had its costs: Compared with 1970, in 1980 any given volume of imported manufactured products required 13 percent greater volume of manufactured exports to pay for it.

Manufactured goods trade from 1980 to 1982

When the equations are estimated through 1980 and used to forecast trade volumes through 1982, they predict **U.S.** trade flows with reasonable accuracy (Table 12). This suggests that trade flows have retained their previous historical relationships to the variables in the equations, and that the underlying system has not undergone a substantial structural change in the period under consideration. In the second half of 1982, the equation for exports has an error of only 0.7 of one percent; on average, the out-of-sample predictions for exports are no larger than the within-sample standard error. The import equation tracks very accurately until the last quarter of 1982, when it shows that imports were 9.4 lower than might have been expected. This is probably due to unusually large inventory de-stocking that occurred during the trough of the recession.

The equations for the full sample period can also be used to indicate the relative contributions of the independent variables to more recent trade flows. Relative price effects have played the dominant role: From 1980 to 1982, the export equation indicates that the change in **U.S.** relative price competitiveness induced an 18.9 percent fall in **U.S.** export volumes. Trend and seasonal factors and the expansion in world trade and demand added about 2.4 percent to export volumes. The import equation suggests that imports were raised by 8.9 percent because of the relative increase in **U.S.** prices, raised 9.3 percent because of trend factors, and reduced by 7.2 percent because of the drop in the ratio of actual to potential **GNP** (the **U.S.** recession).

1980 to 1982

	Actual change	Forecast Change			
		Prices	Due to Activity	Trend	Error
Exports:	−17.5	−18.9	−0.7	3.1	−1.0
Imports:	+8.7	8.9	−7.2	9.3	**−2.3**

The equations also suggest a somber prognosis: Only about half of the long-run impact of the erosion in the **U.S.** price competitiveness from 1980 to 1982 had been felt by the second half of 1982. In the absence of an improvement in **U.S.** price competitiveness over its levels in the second half of 1982, our equations predict an additional 24.4 percent drop in manufactured export volumes and a 10.7 percent rise in import volumes in 1983 and 1984 due to changes in relative

price factors between 1980 and 1982.

In summary, the recent decline in U.S. exports was primarily the result of the erosion in U.S. price competitiveness and despite its rise U.S. import growth in 1982 remained depressed because of the U.S. recession. Economic recovery in the U.S. and a continuation of 1982 relative prices would induce very substantial further declines in the U.S. trade balance.[27]

In one sense the results of this section, particularly those for the 1970s, confirm the judgment of those who believe U.S. competitiveness declined in that period: A decline in the U.S. terms of trade for manufactured products was part of the adjustment process for maintaining U.S. external equilibrium. The exchange rate system was able to effect this adjustment by channeling resources into U.S. manufacturing to help offset this erosion of competitiveness. But the magnitude required to effect this adjustment was fairly modest.

One interpretation of the recent strength of the dollar is that the U.S. has changed its international role from a net lender to a net borrower, a change that has resulted primarily from the large government deficits. The strength of the exchange rate reflects the need to channel foreign goods into the United States to meet the rise in domestic absorption. In this sense, the growth in the manufactured goods trade deficit is a response to change in economic structure. But it is not a change that has resulted from shifts in U.S. or foreign industrial policies or prowess; it is rather a change that reflects the budgetary decisions of the U.S. government

Myths about the size and sources of structural change

Has there been an increase in the degree of structural change in U.S. manufacturing?

To measure the degree of structural change in the economy over time, I have used an index based upon changes in the employment shares of industries and regions. This index, I, is formed by summing the changes in the shares over the period of comparison. Specifically, I is half the sum of the absolute value of the differences between sector shares; i.e., $I = \frac{0.5}{n} \sum_{i} |a_i1 - a_i2|$ where a_i1 and a_i2 are the percentage shares of sector i in time periods 1 and 2,

27. For similar conclusions, see Robert A. Feldman, "Dollar Appreciation, Foreign Trade, and the U.S. Economy," *Federal Reserve Bank of New York Quarterly Review,* Summer 1982, pp. 1-9.

TABLE 13

Equations for the Volume of U.S. Exports and Imports of Manufactured Goods, 1964-1982
(t-statistics in parentheses)

Estimation period, dependent variable	Constant	Independent variables								Prediction errors				Summary statistics	
		$_{X}$ROW	$_{IP}$ROW	PRPX	T	GNP	GNP*	ΣRPM	DS	8101	8102	8201	8202	SE	DW
I. Isthalf 1964 to	7.5	.41	.40	-1.50	.0071	.	...	...	- 048	...	...	...	...	.034	1 61
1st half 1982, QXM	(7.5)	(2 9)	(1.6)	(-6.3)	(2.5)	...	...	...	(-4.2)	...	..	.	...	...	...
2 Isthalf 1964 to	6.9	.42	.36	-1.4	.0077	...	...	...	- 046	.028	-.047	- 053	-.007	.035	1.64
2nd half 1980, QXM	(5.8)	(2.6)	(1.3)	(-4 4)	(2.0)	..	...	.	(-3.7)	. .	...	.	..	...	.
3. 1st half 1964 to	-75.8	...	...	...	- 163	1 43	11 59	-1 8	...	...	.	...	...	.044	1.64
1st half 1982, QIM	(-5.8)	...	.	...	(4.9)	(3 8)	(5.3)	(-10.1)	.	..	...		...	.	.
4. 1st half 1964 to	72.8	...	...	.	- 155	1.21	11.45	-1.90	...	-.021	.028	-.021	-.094	.047	1.71
2nd half 1980, QIM	(-4.6)	. .	..	..	(-3 9)	(2.7)	(4.7)	(8 1)	...	...		...	...	..	...

Note: Estimation of all equations uses semiannual data. All vanables except T and DX appear as logarithms Price coefficients are estimated as seven-period Almon lags using a two-degree polynomial

Explanation of variables and sources:

QXM: Quantity of U.S. exports of manufactured goods (SITC 5-8) from the Foreign Trade Division of the U.S. Bureau of the Census.

QIM. Quantity of U.S. imports of manufactured goods (SITC 5-8) See QXM for source.

$_{X}$ROW: Total quantity of exports in manufacturing (SITC 5-8) from the "rest of the world" (developed market economies excluding the U.S); from United Nations, *Monthly Bulletin of Statistics*, various March issues.

$_{IP}$ROW: Industrial pmduction in the "rest of the world" (OECD Europe. Canada, and Japan), from OECD, *Main Economic Indicators*.

RPX: Relative price of U.S. exports in manufactunng (price of U S exports divided by the price of foreign competition); from IMF, *International Financial Statistics* (data tape). ΣRPX is the sum effect of RPX lagged over seven penods (the current and the six most recent penods).

T: Trend variable (increasing by I.0 each time period).

GNP: Gross National Product of the U.S. in 1972 dollars; from the Bureau of Economic Analysis, Department of Commerce.

GNP*: Potential GNP of the U.S. in 1972 dollars; from the Council of Economic Advisors.

RPM: Relative price of U.S. imports in manufacturing (unit value index of imports divided by the wholesale price index); from the Foreign Trade Division of the U.S. Bureau of the Census and the Bureau of Labor Statistics HRPM is the sum effect of RPM lagged over seven penods

DS: Seasonal dummy: 0. for the first half and I. for the second half of each year.

8101, 8102, 8201: Out-of-sample prediction errors for the dependent variable (true value minus predicted value) in the first half of 1981, second half of 1981, and first half of 1982, respectively.

SE: Standard error of the equation

DW: Durbin-Watson statistic.

respectively.[28]

For the purposes of making these comparisons, data on U.S. manufacturing in 1960, 1970 and 1980 are particularly suitable because of the similar levels of capacity utilization in these years.[29] When computed across the two-digit industries that make up the manufacturing sector, this index indicates a remarkably similar degree of structural change in the 1960s and 1970s. (See Table 14.) Compositional shifts in the 1970s were less than those in the 1950s. The indices for the overall economy show a slight rise in sectoral employment shifts between the '60s and the '70s and a somewhat greater increase in regional shifts in the 1970s. While the overall shifts in sectoral employment remain below that of the 1950s, there has been a greater rise in regional shifts in the 1970s.[30]

TABLE 14

Measure of Structural Change in U.S. Employment, Average Annual Changes in Structural Change Index*

Period	Total employment	Manufacturing employment	Total regional employment	Manufacturing regional employment
1950-60†	0.77	0.86	0.45	0.60
1960-70	0.54	0.58	0.33	0.49
1970-80	0.60	0.47	0.61	0.70
1973-79	0.67	0.50	0.55	0.64
1974-80	0.51	0.65	0.58	0.75

Total employment measured in full-time equivalent employees in eleven one-digit sectors: agriculture, forestry, and fishery; construction; finance, insurance, and real estate; government and government enterprises; durable manufacturing; mining; nondurable manufacturing; transportation; services; retail trade; and wholesale trade.

Manufacturing employment measured in full-time equivalent employees in 21 two-digit manufacturing industries.

Regional employment measured as number of employees on payrolls of nonagricultural establishments in ten regions.

Manufacturing regional employment measured as number of employees on payrolls of manufacturing establishments in ten regions.

Sources: DRI tape and 1982 ***Employment and Training Report of the President,*** pp. 255-58.

$*I = \frac{0.5}{n} \sum_{i} |ai1 - ai2|$ where ai1 and ai2 are the shares of sector i (region) in period 1 and 2, respectively, and n for the number of years between observations.

† 1952-1960 for regional employment.

28. Absolute values are used to provide equal weight to growing and shrinking sectors. The sum is divided in half so that if there is a total reversal of structure the index will register 100 percent. If there is no change in structure, it will register zero. For the application of similar measures see ***Economic Survey of Europe,*** United Nations, New York, 1981.

29. The manufacturing capacity utilization index of the Federal Reserve Board registered 80.2 in 1960, 79.3 in 1970, and79.1 in 1980.

30. For a discussion of regional shifts in employment, see James Medoff, "U.S. Labor Markets: Imbalance, Wage Growth, and Productivity in the 1970s" Brookings Papers on Economic Activity, 1983:1, pp. 87-128.

A second exercise confirms the stability in the shifts in industrial employment structure over the two decades. A sample of 57 three- and four-digit SIC was assembled. The industries chosen constituted about 85 percent of 1980 employment. For each decade, industries were split into quarters on the basis of employment growth. While the average growth rate declined between the 1960s and 1970s, the dispersion across industries remained the same. In both the '60s and '70s, the range between the first and fourth quarters was about 50 percent. The decline in the mean growth of 11.6 percent from the '60s to the '70s was very close to the decline in each of the quartiles.

	U.S. industrial sectors grouped by growth rate in employment			
Quartile:	I	II	III	IV
1960 to 1970	44%	22%	10%	−5.6%
1970 to 1980	34%	8.2%	−2.8%	−15.4%

Thus, this analysis points to the impact of slow employment growth rather than a speed-up in the pace of structural change as the primary source of the difficulties facing U.S. industry."

Sources of Change. While much of the discussion about U.S. deindustrialization has been couched in terms of the manufacturing sector as a whole, in fact it reflects a concern about a few specific industries. Several of these industries have a number of characteristics which are likely to make employment loss particularly conspicuous: Adjustment in particularly difficult and costly in sectors in which capital investments are long lived, workers earn wage premiums that reflect non-transferable benefits (such as seniority, monopoly rents, and the impact of strong unions), and production occurs in large plants that are important for the economic health of the areas in which they are located.

The erosion of employment has occurred in industries in which it is likely to be most vocally resisted because the industries are likely to be politically powerful and the burdens of adjustment on the workers are likely to be especially great. It has been especially concentrated among unionized workers, in large plants, and in large industries.

In 1980, based on a disaggregation of industries of two-digit SIC codes, 58 percent of U.S. workers were in a two-digit industry which

31. Of course I measure here only ex post structural change. In fact, if the economy has had more ex ante shocks, the lack of change might reflect increased rigidities.

had experienced an overall decline in employment since 1973. In addition, four of the industries with slow employment growth (tobacco, autos, primary metals, and textiles) are among the five industries which have the largest average plant size.

Indeed, a comparison of the features of the industries which grew rapidly in the 1960s with those growing rapidly in the 1970s indicated two important differences. Industries with large plant size and with high concentration ratios were more likely to grow slowly in the 1970s than in the 1960s. Both these variables suggest a declining importance of economies of scale, the predictable result of slow overall market expansion,

To get behind the structural shifts in manufacturing, the 52 industries of the input-output categories have been classified by production process.

In the trade literature it is customary to group goods into three categories: goods that require the relatively intensive use of natural resources (terms Ricardo goods), goods that require high proportions of research and development or employ scientists and engineers fairly intensively (product-cycle or high-technology goods), and goods that use relatively standardized production technologies (Hecksher-Ohlingoods). In this paper, for the process categories I adopt the Ricardo (resource-intensive) and product-cycle (high-technology) groupings and divided the Hecksher-Ohlin group according to relative capital-labor ratios into capital- and labor-intensive categories.[32]

The data in Table 15 highlight the change in the composition of U.S. output and employment in manufacturing. They indicate the long-run shift toward high-technology sectors in both output and employment. The employment shift proceeded at about the same pace between 1970 and 1980 as during the previous decade, although the shift measured by valued added accelerated somewhat. But from 1973 to 1980, the shift toward high technology accelerated by both measures. In the thirteen years from 1960 to 1973, the share of high-technology products in total value added increased from 27 to 32 percent. In the next seven years it rose from 32 to 38 percent. The accel-

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32. The ratio of employment to gross capital stock in 1976 at the three-digit SIC level was used to divided the Hecksher-Ohlin group. The detailed classification scheme used by Sterr and Maskus has been matched with the 52 I-0 categories as indicated in Table A-3 of the Appendix. See Robert M. Stem and Keith E. Maskus. "Determinants of the Structure of U.S. Foreign Trade, 19578-76," *Journal of International Economics, Vol.* 11, May 1981, pp. 207-24.

eration in employment share in high-technology sectors is even more dramatic: After increasing from 27 percent in 1960 to 29 percent in 1973, it rose to 33 percent by 1980.

Table 16 breaks down the striking divergence of the high-technology sector from the rest of manufacturing into the parts accounted for by domestic use and foreign trade. Between 1973 and 1980, output of high-technology products increased by 30.6 percent and employment rose by 15.7 percent; in industries characterized by other production processes, output grew sluggishly and employment declined. The compositional changes were related to growth resulting from both trade and domestic use. Although most of the employment growth in the high-technology sector can be ascribed to the rise in domestic use, growth in employment from foreign trade was greater in this sector than in any other. Foreign trade also raised employment in resource-intensive industries, where domestic demand was sluggish. Stagnant or falling domestic demand, combined with a reinforcing decline in net foreign demand, thwarted growth in both capital- and labor-intensive industries.

TABLE 15

Shares of Value Added and Employment in U.S. Manufacturing, by Production Characteristics of Industries (selected years, 1960-80, by percent)

Item	1960	1970	1972	1973	1980
Value added*					
High-technology	.27	.31	.31	.32	.38
Capital-intensive	.32	.30	.31	.32	.27
Labor-intensive	.13	.13	.14	.13	.12
Resource-intensive	.28	.25	.24	.23	.23
Employment?					
High-technology	.27	.30	.28	.29	.33
Capital-intensive	.29	.30	.30	.30	.28
Labor-intensive	.21	.20	.21	.21	.19
Resource-intensive	.23	.21	.21	.20	.20

Sources: Same as Table 14.

* **Value added computed for each input-output (I-O) industry by multiplying gross output in 1972 dollars by the ratio of value added to output in the 1972 I-O table.**

† **Employment is derived from the Bureau of Labor Statistics series on employment and earnings. The series has been aggregated to the two-digit I-O industry and then to the process categories.**

Despite smaller changes due to trade than those due to domestic use, public perceptions may be exaggerating the role of trade because the effects of trade and domestic use have been positively correlated. For reasons unrelated to international trade, the U.S. manufacturing sector has been undergoing major structural shifts in output and employment because of domestic .demand and technology. The impact of trade has in some cases reinforced these domestic changes; in other cases, industries experiencing employment losses because of domestic use have had only minor offsets as a result of trade. This correspondence between trade and domestic use is apparent at the relatively disaggregated level of the 52 I-O industries. From 1973 to 1980, for example, there was a 0.49 correlation between the contributions to value added of domestic use and those of foreign trade. The correspondence between growth related to domestic use and growth related to trade can be seen clearly when the 52 industries are aggregated according to the nature of the production process.

Patterns of domestic use: Why high-tech?

Explanations of the accelerated shift toward high-technology production since 1972 often cite the influence of foreign trade or a speed-up in the pace of technological change. But neither of these explanations seems sufficient. As shown in Table 16, the accelerated shift is present even when the effects of trade are excluded. Thus trade is certainly not all of the story. As for faster technological change, Table 17 shows that employment, output, and productivity (output per employee) in high-technology industries grew more slowly from 1973 to 1980 than they did in the 1960s. In fact, as measured by the growth in output per employee, the slowdown in productivity growth in the high-technology industries has been quite similar to the productivity slump elsewhere in manufacturing and the value-added deflators for high technology products have not fallen relative to those of manufacturing in general. This makes it doubtful that faster technological change is the explanation.

What other explanations might account for the relatively strong output gains in high-technology products during 1973-80? One might be the relatively high income-elasticity of demand for these products and the low income-elasticity of demand for older commodities. Wealthy consumers devote declining shares of their incomes to basic needs such as clothing, footwear, furniture, and simple electrical appliances. Conversely, they increase the share devoted to com-

TABLE 16

Percentage Change in Value Added and Employment in U.S. Manufacturing Due to Foreign Trade and Domestic Use, by Production Characteristics of Industries (1970-80 and 1973-80)*

Item	1970-1980			1973-1980		
	Total	Domestic use	Foreign trade	Total	Domestic use	Foreign trade
Value Added						
Total	33.1	32.3	0.8	9.6	7.8	1.9
High-technology	61.9	54.7	7.2	30.6	25.2	5.4
Capital-intensive	18.4	22.2	−3.8	−7.3	−6.7	−0.6
Labor-intensive	16.5	20.7	−4.1	−2.1	−0.2	−1.9
Resource-intensive	23.4	22.6	0.8	10.7	8.2	2.5
Employment						
Total	4.7	4.7	0.0	0.7	−0.7	1.3
High-technology	16.4	12.9	3.5	15.7	11.1	4.6
Capital-intensive	0.3	2.3	−1.9	−6.0	−5.9	−0.1
Labor-intensive	−1.8	1.8	−3.6	−8.2	−6.3	−2.0
Resource-intensive	0.5	−0.6	1.1	−1.5	−4.1	2.6

Sources: Same as Table 1.
*** See notes to Tables 14 and 15.**

TABLE 17

Growth of Employment, Value Added, and Productivity in U.S. Manufacturing, High- and Low-Technology Goods, Selected Periods, 1960-82 (average annual growth rates, in percent)

Item	1960-70	1970-80	1973-80	1980-82
Employment				
High-technology	2.5	1.5	2.1	−2.4
Low-technology	1.0	0.0	−0.8	−4.2
Value added*				
High-technology	5.7	4.9	3.9	n.a.
Low-technology	3.2	1.8	0.0	n.a.
Productivity†				
High-technology	3.1	3.4	1.7	n.a.
Low-technology	2.2	1.9	0.8	n.a.

Sources: Same as Table 14.
*** In 1972 dollars.**
† Value added divided by employment.

puters, aircraft, and communications equipment. Thus, with the expansion of income, basic commodities can be expected to have declining shares. But if income elasticities have the dominant effect, the share of high-technology industries increases more rapidly in periods of high rather than low income growth.[33]

Perhaps, however, it is precisely because income effects have been so small during this period that the share of high-technology products has grown. In explaining the demand for a product, it is customary to distinguish between income and substitution effects. In the absence of price declines, since their qualitative nature changes very little, the market for standardized commodities will only expand in the face of income growth. Thus, under depressed cyclical conditions, the demand for the products of U.S. industries such as textiles, iron and steel, other basic metals, fabricated metals products, and automobiles will be particularly sluggish. On the other hand, income growth is likely to be less important as a determinant of the demand for a new product. It might be possible to increase the output of Sony Walkmen in the midst of a recession, for example, whereas it is not possible to raise the output of steel. Substitution effects due to quality changes are likely to dominate income effects. A second source of substitution effects over this period could of course be the demand for more energy-efficient products. The close correspondence between the high-technology and the equipment groupings are suggestive of possibilities along these lines (Table **18).** A third would be the rise in expenditures on defense industries at the end of the sample period.

The other conspicuous shift in the structure of U.S. output from **1973** to **1980** was the decline in the share of capital-intensive goods from **32** percent of value added'in **1973** to **27** percent of value added in **1980.** The decline in the share of automobiles from **8** to **5** percent was the major source of this change. My analysis suggests that of the **19.2** percent decline in employment in the automobile industry over this period, 6.4 percent was due to trade and **12.8** percent to the slump in domestic use. Over the period from **1980** to **1982,** a similar analysis suggests that of the **12.5** percent decline in automobile employment, **10.7** percent was due to domestic use, and **1.9** percent was due to trade. Of the total fall in U.S. automotive employment of

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33. If, for example, income growth rates were infinite, commodities with elasticities of less than 1.0 would tend to have zero shares; if growth were zero, shares would remain constant. Thus the more rapid is the growth rate, the faster the shares of products with high-income elasticities expand.

29.3 percent from 1973 to 1982, therefore, 7.9 percent was due to trade and 21.4 percent to the fall in domestic use. Clearly, even without the problems associated with higher import penetration, the increase in gasoline prices, high real interest rates, and depressed cyclical conditions would have created considerable difficulties for the U.S. automotive industry.

The role of U.S. trade

The growing importance of high-technology trade to the United States is illustrated by Chart 1, which contrasts the U.S. trade balances in R&D and non-R&D-intensive products.[34]

The literature disputes the precise sources of the U.S. advantage in high-technology manufactured goods. Does it result from the relative abundance of engineers and scientists, the relatively large amounts spent on R&D, or the market inducements to innovate a rich economy? The strong interactions among these factors inhibit quantification of the contribution of each.[35] However, it is quite possible to provide a snapshot of the kinds of manufactured goods the United States succeeds in exporting and those in which import penetration has been the greatest.

U.S. export industries have made large investments in R&D and are at the technological frontier.[36] The products are often novel, require specialized production methods, and benefit during their development from being close to the market in which they are sold. Staying ahead requires continual innovation to offset the inevitable standardization of the production process and the international diffusion of technology. Conversely, U.S. imports, especially those from developing countries, are by and large mature and standardized products that can be mass-produced using skills that can be quickly acquired. They may be manufactured products requiring unskilled labor (such as apparel and footwear) or products requiring capital relatively intensively (such as steel).

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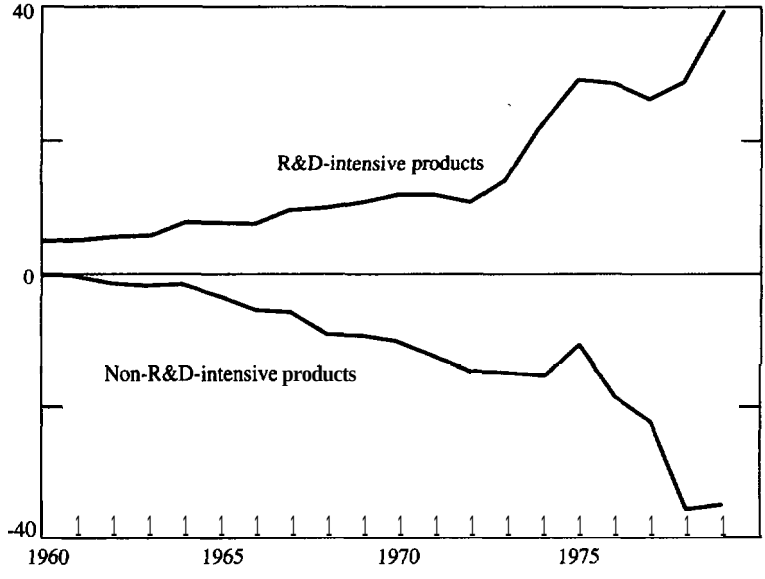
34. The United States has maintained its share in world trade of high-technology products far better than in more routine goods. See Bela Balassa, "U.S. Export Performance: A Trade Share Analysis," Working Papers in Economics, 24, Johns Hopkins University, 1978.

35. On this question, see Thomas C. Lowinger, "The Technology Factor and the Export Performance of U.S. Manufacturing Industries," *Economic Inquiry*, Vol. 3, June 1975, pp. 221-36.

36. The classic generalization among these lines is Vernon's product-cycle theory. See Raymond Vernon, "International Investment and International Trade in the Product Cycle," *Quarterly Journal of Economics*, Vol. 80, May 1966, pp. 190-207.

CHART 1
U.S. Trade Balance in **R&D-Intensive** and **Non-R&D-Intensive** Manufacturing, 1960-79



Source: National Science Foundation. *Science Indicators* **1980 (U.S. Government Printing Office 1961), p. 32**

In summary, therefore, the impact of trade has not been to shrink the U.S. manufacturing sector, and the United States has not lost its comparative advantage in manufacturing as a whole. The United States has been developing a comparative advantage in high-technology (and resource-intensive) products, while its comparative advantage in labor-intensive and capital-intensive products manufactured with standardized technologies has been eroding. There is, therefore, a correspondence between the U.S. industries experiencing slow economic growth because of sluggish domestic use and those experiencing declining comparative advantage.

The direction of structural change in U.S. domestic markets and in U.S. comparative advantage may well be causally linked. The shift toward the demand for high-technology products domestically may be an important source of the growth in comparative advantage of the

TABLE 18

Classification Scheme for the 52 Input-Output Categories in U.S. Manufacturing

End use	*High-technology industries*	*Capital-intensive industries*	*Labor-intensive industries*	*Resource-intensive industries*
Equipment	43. Engines and turbines 44. Farm and garden machinery 45. Construction and mining machinery 46. Materials handling machinery and equipment 47. Metal working machinery and equipment 48. Special machinery 49. General industrial machinery 51. Office, computing, and accounting machines 52. Service industry machines 56. Radio and television equipment 60. Aircraft and parts 62. Scientific instruments		13. Ordnance and accessories 23. Other furniture and fixtures 61. Other transportation equipment	
Consumer durables	63. Optical equipment	54. Household appliances	19. Miscellaneous fabricated textiles 22. Household furniture 64. Miscellaneous manufacturing*	
Consumer nondurables	29. Drugs, cleaning preparations		18. Apparel 34. Footwear 64. Miscellaneous manufacturing*	14. Food and kindred products 15. Tobacco

Intermediate goods	**27.** Chemicals and selected chemical products **28.** Plastics and synthetics **50.** Miscellaneous machinery **53.** Electrical and industrial equipment **55.** Lighting equipment **57.** Electrical components and accessories	**16.** Fabrics, yarn, thread **17.** Miscellaneous textiles **25.** Paperboard containers and boxes **26.** Printing and publishing **30.** Paints and allied products **32.** Rubber products **35.** Glass products **37.** Iron and steel **39.** Metal containers **41.** Screw machine products **42.** Other fabricated metal products	40. Heating and plumbing products **58.** Miscellaneous electrical machinery, equipment, supplies 64. Miscellaneous manufacturing*	**20.** Lumber and wood products **21.** Wood containers **24.** Paper products **31.** Petroleum refining and related industries **33.** Leather products **36.** Stone and clay **38.** Nonferrous metals
Automobiles		**59.** Motor vehicles and equipment		

Sources: Categories for production characteristics of industry are based on Robert M. Stem and Keith E. Maskus, "Determinants of the Structure of U.S. Foreign Trade, 1958-76," *Journal of International Economics.* Vol. 11 (May 1981), pp. 207-24, end-use categories are taken from the 1976 revisions of industrial production by the Board of Governors of the Federal Reserve System. See *Survey of Current Business,* Vol. 59 (February 1979), p. 54, for a complete description of the I-O categories.

* The category "64. Miscellaneous manufacturing" is divided into end-use categories in the following proportions: consumer durables, 0.2; consumer nondurables, 0.4; and intermediate goods, 0.4.

United States in these products; and conversely, the shifts away from older products may have contributed to their relative decline. Burenstam Linder stresses the availability of markets and associated scale-economies rather than of factors of production such as capital or labor as the major determinant of comparative advantage and requests that countries export goods that are demanded in their home markets.[37]

Summary and conclusions

In the 1970s, the share of manufacturing employment in total U.S. employment continued its secular decline as a consequence of the revealed preference of U.S. consumers for services and the more rapid increase of productivity in the manufacturing sector. U.S. industrial growth has been sluggish, but it has been what would have been expected, given the slow growth in GNP. From 1973 to 1980, the share of manufacturing in total employment declined rapidly because GNP grew slowly and labor productivity growth in manufacturing fell less than labor productivity growth in the rest of the economy. Nonetheless, the U.S. did not experience absolute deindustrialization in the 1970s. U.S. employment in manufacturing expanded and, given the growth rate of output, investment and R&D spending in manufacturing were remarkably strong. In contrast to its decline from 1960 to 1973, the share of manufacturing in total U.S. fixed business capital increased from 1973 to 1980. The growth rate of the capital labor ratio in manufacturing actually accelerated.

The finding that capital formation and R&D spending in manufacturing has acceleratedghould give pause to those who believe that channelling additional capital towards manufacturing is an appropriate remedy for our industrial problems. There is no evidence that on average U.S. manufacturers have failed to invest. The evidence points rather to the important role of aggregate demand in constraining manufacturing growth. If growth is resumed, job creation and investment in manufacturing will be stimulated, and reindustrialization will occur automatically. In the absence of demand for particular products, however, policies should facilitate the movement of resources *away* from activities in which they are no longer needed.

The manufacturing slump is a worldwide phenomenon. The increase in U.S. manufacturing output since 1973 has been about the same as the average of all industrial countries. The capital stock in

37. Staffan Burenstam Linder, *An Essay on Trade and Transformation, New* York, *1961.*

manufacturing grew as rapidly in the United States as in Europe, and real R&D spending increased at similar rates here and abroad. Although employment in U.S. manufacturing grew modestly, in other major industrial countries it declined. In fact, in virtually every major industrial sector, employment in the U.S. grew faster than in Japan. Although U.S. labor productivity growth was not as rapid as productivity growth in other industrial countries, U.S. productivity levels in manufacturing overall remain the highest in the world, as does the U.S. share of R&D spending in value-added in manufacturing.

Compared with its postwar track record since 1973, the U.S. manufacturing sector has fared relatively better in comparisons with other industrial countries. This might have been expected given the relative exhaustion of catch-up gains that others could enjoy by adopting U.S. techniques. The U.S. performance may also be ascribed to its greater flexibility in a period marked by external shocks. In particular, U.S. real wage growth has been more adaptable and labor more mobile. The U.S. share of manufacturing employment in high-growth industries has increased more rapidly than those of Germany or Japan. There are, therefore, strengths as well as weaknesses in the U.S. industrial system.

Flexible exchange rates have been important to U.S. trade performance. From 1973 to 1980, partly because of the real devaluation of the dollar, foreign trade provided a net addition to output and jobs in U.S. manufacturing. From 1980 to 1982, the erosion in relative price competitiveness has been the source of the declines in employment due to manufactured goods trade. Changes in the real exchange rate are effective in moving the current account towards equilibrium determined by expenditure patterns. In 1970 and 1980, the current account was a similar percentage of GNP. This stability was accomplished in part by growth in the manufactured goods trade balance because of real devaluation. In the 1980s, the shift towards large full-employment government deficits unmatched by lower private absorption entails a current account deficit as foreign savings help finance the government deficit. This is accomplished in part by a manufactured goods trade deficit achieved through real appreciation. If these trade deficits are viewed as undesirable, policies to lower full-employment government deficits should be considered.

The decline in the manufactured goods trade balance over the past two years is not the result of a sudden erosion in U.S. international

competitiveness brought about by foreign industrial and trade policies. It is predictable given previous trends and current levels of economic activity and relative prices. A continued erosion in the balance is in prospect in **1983** and **1984.**

The evidence does not support the contention that major shifts in **U.S.** industrial and trade policies are required to maintain external equilibrium. Given a continuation of trends in **U.S.** and foreign trade policies and growth patterns, in the absence of relative price changes, the **U.S.** trade balance in manufactured goods would register small annual declines. If required for overall external equilibrium, these declines could be offset by minor improvements in relative **U.S.** prices.

There has not been increased turbulence in the demand for industrial workers across manufacturing industries.

The recent rise in dislocation is principally related to the slow overall growth in employment rather than an increase in structural change at any given growth rate.

The perceptions of an absolute decline in the **U.S.** industrial base and the belief that foreign competition has made a major contribution to that decline stem from the reinforcing effects of U.S. trade and domestic growth and the nature of adjustment difficulties associated with declines in industries adversely affected. The trouble industries are large and highly unionized, and the average plant size is large. Workers displaced from several of these industries face the prospect of considerably lower wages.

The **U.S.** comparative advantage in unskilled-labor and standardized capital-intensive products has been declining secularly. And, because of slow domestic economic growth, the home market for those products has not expanded rapidly. But our comparative advantage in high-technology products has strengthened, while the demand for high-technology products has grown relatively more rapidly in a climate of stagnation. In general, however, structural changes in the **U.S.** economy during this period arose mainly from domestic factors.

I have tried, in this paper, to distinguish the sources of U.S. industrial performance. The conclusion that demand fluctuations and exchange rates have had the dominant effects recently should not be interpreted to imply that this performance has been satisfactory, nor that there is no scope for improvement in **U.S.** structural policies.[38] But if changes in such policies are adopted, they should be made on

the grounds that they improve productivity and stimulate economic growth. They should not be undertaken on the basis of fears, based largely upon confusion about the sources of economic change, that policies which appear inadvisable on domestic grounds are required for the purposes of competing internationally.

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38. For a discussion of the policies I would recommend, see Robert Z. Lawrence, *Can America Compete?* Brookings Institution (forthcoming).