Chapter 8

The Framework of U.S. Trade

CONTENTS

Chapter 8

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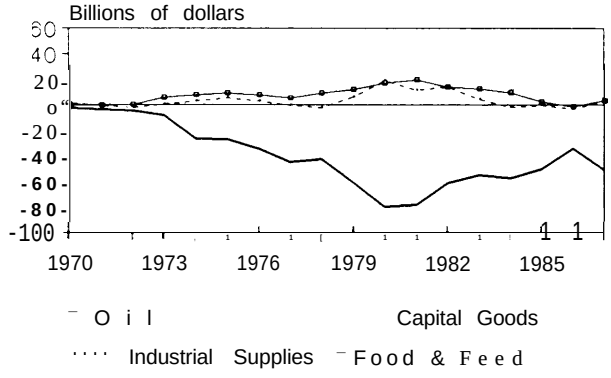
The previous chapter looked closely at how new forces have linked trade into domestic production recipes. The present discussion takes the analysis a step further by tracing national trends in the volume and composition of trade. Trends point to a potentially serious decline in the ability of the United States to compete in the export of highly sophisticated manufactured products.

Both U.S. imports and U.S. exports have grown dramatically during the past 15 years. The oil price shocks, which nearly doubled the value of U.S. imports during the 1970s, simply accelerated a trend that began in the late 1960s and continued after oil prices fell. In 1960, the combined value of imports and exports accounted for 10 percent of the U.S. gross national product (GNP). By 1984, this had risen to 22 percent. Since imports have grown much faster than exports since 1980, the United States now experiences its largest trade deficit since systematic records began in 1929. The Nation consumed 2.7 percent more than it produced in 1987.

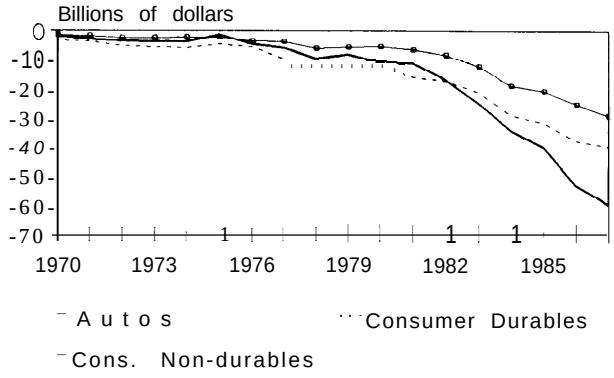
Figures 8-1 and 8-2 indicate that this deterioration is not limited to a single sector of the economy. The problem affects both consumer and industrial goods. In the category of industrial goods, the only improvement in the trade balance is in oil, There has been a trade deficit in oil since the early 1970s, but the value of oil imports declined because of falling oil prices. In the other sectors (capital goods, industrial supplies, and food & feed), healthy trade balances of the 1970s have been sharply eroded since 1980. Similar trends are noticeable in trade in consumer goods. The small deficits of the 1960s in automobiles and other consumer goods have deteriorated into large deficits. A small trade surplus in services reduces, but far from eliminates, the large merchandise trade deficit.

Figure 8-1.-Trade Balance in Industrial Goods (current dollars in billions)



SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis, "National Income and Product Accounts, " historical diskettes, table 4,3.

Figure 8-2.-Trade Balance in Consumer Goods (current dollars in billions)



SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis, "National Income and Product Accounts, " historical diskettes, table 43,

TRADE BALANCES

In principle, economic forces demand that trade between nations be in balance over the long term. An efficient and free system of barter would adjust exchange rates, domestic wages, and/or interest rates to compensate for asymmetric trade flows. The practical world of trade, however, remains dominated by stubborn forces of nationalism, political instability, and wildly varying programs for managing domestic economies and international trade. Simple arithmetic shows that if the U.S. Government

spends more than it takes in as taxes or U.S. firms invest more than they can acquire from U.S. savings—in other words, if U.S. consumption exceeds U.S. production–the difference must be made up by borrowing from abroad (as shown in table 8-1).[1] A nation must either have a current trade account in approximate balance over the long run or find a way to live on perpetually expanding credit.

Heavy U.S. reliance on foreign capital is unexpected given the history of other economic leaders. For example, when England became a "service" economy during the latter part of the 19th century, it did so primarily by lending money to American businesses and other foreign firms rather than by borrowing from the rest of the world.

The United States has been a net debtor to the rest of the world since the spring of 1984, and by 1985 became one of the world's largest borrowers, owing nearly $110 billion. By the end of 1986, the United States owed $263.5 billion.[2] The debt is now increasing at approximately $150 billion per year. By the end of the 1980s, the United States is likely to owe at least $600 billion—a sum larger than all non-defense government expenditures made in 1987. Finding a way to slow the growth of foreign debt, and perhaps even to repay some of the principle, will be a formidable challenge in a period when:

- the United States faces increasing competition in technologically sophisticated products and raw materials (like agricultural products) that once easily earned foreign currency;
- declines in U.S. and non-OPEC (Organization of Petroleum Exporting Countries) petroleum production will require significant increases in the share of petroleum imports from Arab OPEC nations;
- as much as $35 billion per year must be spent simply to repay the interest on foreign capital investment;[3]

Table 8-1.—U.S. Trade Balances and Foreign Investment in the United States, 1986 (billions of dollars)

Total payments to foreigners	–143.9		
Net imports of goods and services.	– 105.5		
–Imports.		–481 .7	
–Exports		376.2	
Of which, net factor income[a] is:			33.8
–Imports			–52.3
–Exports			86.1
Other payments to foreigners	–38.3		
–Transfer payments (net)		–15.7	
–Interest paid by government		–22.6	
Net Foreign Investment in the United States (domestic spending less domestic production)	143.9		
Government deficit	147.8		
Private domestic savings less investment	–8.8		
Of which:			
–Gross private savings		–679.8	
–Gross private domestic investment		671.0	
Statistical discrepancy	4.9		

[a]Direct Investment income, interest income, dividend income, labor income (not including U.S. Government interest payments to foreigners).
NOTE: Numbers may not add due to rounding.
SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis, "National Income and Product Accounts," Survey of *Current Business,* July 1987, Tables 4.1 and 5.1.

- the widespread availability of advanced agricultural technology is reducing world demand for U.S. agricultural products, and many former U.S. customers in developing nations are facing staggering debt problems of their own; and
- key parts of America's production base are increasingly owned by foreign management.

Why is America able to continue borrowing under these conditions? The answer is political as well as economic. Affluent classes in Hong Kong or Latin America choose U.S. investments because of concern about the long-term security of wealth kept at home. The Japanese invest in U.S. manufacturing to escape current and anticipated trade sanctions.

Unlike shifts in the underlying sources of competitive advantage in international product markets, capital flows can change as rapidly as acts of political will. With politics rather than economics at work, self-correcting forces may not operate. A collapse of confidence in the United States as a debtor, for example, could trigger panic in world markets and lead to a catastrophic adjustment rather than a graceful one.

[1] In formal terms:
[Exports – Imports] = [Production – Consumption]
= [Taxes – Government Spending]
+ [Savings – Investment]

[2] Russell B. Scholl, "The International Investment position Of the United States in 1986," Survey of *Current Business, vol. 67, No. 3,* June 1987, pp. *38-45.*

3 Stuart Auerbach, "U.S. Foreign Debt Skyrockets to $263 Billion," *The Washington Post,* June 24, 1987, p. B2.

If U.S. foreign debt expands too rapidly, the logic of investment in the United States must fail. Unless the Nation finds a way to export on the basis of high productivity and innovative products, however, the remedies available (significant increases in interest rates, a continued drop in the value of the dollar, declining U.S. wage rates, or a large reduction in imports) will involve a significant decline in U.S. living standards. Even this course can create problems –barring unexpected growth in world markets, the United States can only restore balanced trade by recapturing markets for manufactured products in areas now held by Japan, West Germany, and even some developing nations. Combined with reduced U.S. imports, this could create economic instability abroad and frustrate development plans at home.[4]

Basic Equations

The value that flows across international borders can be divided into three categories:

1. the "current account," which includes trade in goods and services from "producing industries" and returns on foreign investment (the "invisible" flow of funds);
2. the "capital account," which is the change in a nation's assets abroad and foreign assets in the nation, both direct and indirect, including purchases of bonds, stocks, and parts of firms; and
3. flows of value that do not appear in any account—for example, the value of technology available in the open literature or purchased at low cost through a U.S. education, and the value of illegal shipments.

In 1986, net U.S. payments to foreigners were $143.9 billion (again see table 8-l). This amount was precisely equal to, and thus offset by, foreign investment in the United States. The United States required this amount of investment because net private savings of $8.8 billion were combined with net government borrowing of $147.8 billion.[5] In other words, if Americans consume more than they produce, the difference must be borrowed from foreigners. The inescapable arithmetic of these accounts indicates that balanced trade requires both more U.S. exports relative to imports and more domestic saving relative to expenditures,

Capital Accounts

The capital flowing into the United States has taken a variety of forms, including increases in investments in real assets such as land and buildings, establishment of foreign subsidiaries and joint ventures, and portfolio investments in equities, corporate bonds, and short- and long-term government securities (see table 8-2). Capital flows into the United States continued even through the dollar's rapid decline in value during 1986 and 1987.

International movement of capital has been greatly facilitated by new telecommunications technology, which permits a firm in Japan to examine markets in New York, Frankfurt, Paris, Zurich, Chicago, and Singapore as easily as it examines markets in Tokyo. Gradual movement toward deregulation of financial markets in a variety of nations has contributed to this flexibility. The combination of instantaneous communication, internationally shared financial information, and relatively unregulated markets provides an unprecedented opportunity to increase the productivity of capital throughout the world. It also introduces an unprecedented amount of volatility into capital markets and weakens any single nation's ability to control international financial flows.

Of the change in U.S. investment abroad between 1984 and 1985, 36 percent was in the form of private direct investment. By contrast, only 11 percent of net foreign investment in the United States was direct investment. Nearly 60 percent of the 1985 increase in private foreign investment in the United States was in the form of bank loans, stocks, or treasury bonds. In 1985, $25.5 billion worth of treasury bonds were purchased by foreigners; thus, roughly one-fifth of the U.S. Government's budget deficit in 1985 was directly financed from abroad.

International flows of capital have blurred the distinction between "U. S." and "foreign" firms. As a result, tracing the flow of trade dollars in national accounts may no longer provide a sound guide to changes in economic power. Multinational firms have major holdings in the United States, whose production is not counted as imports. Conversely, for-

[4] Lester C. Thurow and Laura D. Tyson, "The Economic Black Hole," *Foreign Policy*, No 67, summer 1987, pp. 3-21

[5] The National Income and Product Accounts incorporate a statistical discrepancy in calculating net foreign investment of $49 billion. See table 8-1.

eign firms may be partly owned by U.S. multinationals: 40 percent of the "Japanese" firm Isuzu is owned by General Motors.

In 1985, 39 percent of U.S. investment abroad was in Western Europe and Japan, while 76 percent of new (1984 to 1985) foreign investment in the United States was by these nations (see table 8-3). Even the struggling Latin American nations significantly increased their investment in the United States between 1984 and 1985.

Table 8-2.—U.S. Investment Abroad and Foreign Investment in the United States by Type of Investment: 1984 and 1985 (billions of dollars)

	All nations		
Investment type	1985 total	1984-85 increase	Japan 1985 total
U.S. assets	952.4	54.2	56.3
Official assets	130.6	11.0	4.4
Private assets	821.8	43.1	51.6
Direct investment	232.7	19.7	9.1
Bonds	73.4	11.4	1.5
Stocks	40.7	12.8	3.9
Other	474.9	–0.7	37.1
Foreign assets in U.S.	1,059.8	166.0	101.8
Official assets	202.3	3.2	N.A.
Private assets	857.5	162.8	N.A.
Direct investment	183.0	18.4	19.1
U.S. Treasury Bonds	83.8	25.5	N.A.
Private bonds	81.8	49.1	8.6
Stocks	125.9	30.1	1.9
Other	382.9	39.7	N.A.

*Primarily loan from Private banks.
N.A. = Not available,

SOURCE:U.S.Department of Commerce, Bureau of Economic Analysis, "The International Investment Position of the United States in *1985," Survey of Current Business, vol,66, No.6,* **June 1966, p. 27,**

Table 8-3.—U.S. and Foreign Investment by Region, 1984 and 1985 (billions of dollars)

	Western Europe	Canada	Japan	Latin America	Other	Total
7964:						
U.S. assets abroad	272	115	48	267	196	898
Foreign assets in United States	423	58	68	189	156	894
Net	–151	57	–19	78	39	4
1985:						
U.S. assets abroad	317	119	56	266	195	953
Foreign assets in United States	515	66	102	212	165	1,060
Net	–198	53	–46	54	30	–107

NOTE: Numbers may not add due to rounding

SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis, "The international Investment Position of the United States in *1985," Survey of Current Business, vol. 66,* **No. 6, June 1966, p. 27.**

TRADE COMPOSITION

Trends

The change in the *volume* of trade relative to the size of the U.S. economy has also been accompanied by a change in the *composition* of trade—the kinds of goods and services traded. Changes in the composition of trade can be a cause for alarm, since they may reveal changes in the competitive status of the national economy. It now seems clear that the factors driving post-war U.S. dominance in productivity, such as higher levels of education, easier access to capital, and possession of technologically ad-

vanced processes, have eroded. Some part of this loss was inevitable given the fact that it is easier to catch up with a technological leader than it is to forge into untested new areas and succeed. In addition, a technical leader is unable to recover the real value of exported technology or training. To some extent, however, the loss has also been the result of complacency and mismanagement in U.S. industries.[6]

With the advantages of hindsight, the convergence of U.S. and foreign living standards was also predictable given the incentives for post-war recovery and international access to U.S. markets. What was not anticipated, however, was the weakening of the "product cycle," which had once seemed to guarantee that U.S. leadership would be virtually self-perpetuating.[7]

The logic of the product cycle was difficult to challenge. U.S. producers, facing the world's most affluent markets, paying the highest wages, and with access to the largest number of highly skilled workers, had a natural incentive to be the first in the development of sophisticated new products and technologies that substituted capital for comparatively expensive labor. Production systems developed originally for the advanced U.S. economy were eventually perfected to the point where they could be operated by labor available in less affluent economies and transferred as U.S. producers moved to begin yet another cycle.

It is conceivable that the United States could have continued to lead Japan and Europe indefinitely, with new products continually replacing the old in the U.S. export mix. The characteristics of the U.S. market, however, have grown less distinctive over time. The internationalization of financial markets has tended to equalize the cost of capital throughout the world. The traditional product cycle was further weakened by a convergence in wages, and a number of nations may now actually have greater incentives to introduce labor-saving equipment than the United States. U.S. advantages stemming from inexpensive raw materials have also been reduced, by modern production systems requiring lower raw material inputs in the production recipe. Technology has also introduced many options for substituting intellectual resources for scarce or expensive energy, minerals, and other kinds of natural resources.

Large and affluent domestic markets uninhibited by interstate trade restrictions once provided unique advantages for U.S. producers. These advantages are now available to producers throughout the world. Moreover, rising incomes in Europe and Japan have narrowed the huge post-war differences in per capita GNP to the point where innovations designed for European and Japanese markets increasingly resemble those designed for U.S. markets. And new products and production technologies, coupled with growing diversity in American households, have fragmented formerly homogeneous U.S. markets in areas ranging from insurance policies to kitchen appliances. Information technology played a key role in tailoring products to highly specific markets, and in facilitating the production and delivery of large numbers of highly differentiated products without adding significantly to costs. Both of these developments have opened opportunities for foreign entry into U.S. markets.

Stripped of their unique resource and product-cycle advantages, U.S. firms may be at a relative disadvantage in applying complex and fast-moving production and product technologies. Japan and Pacific Rim nations, which have built economic expansion around exports, have developed an impressive ability to identify niche markets and promising new technologies in areas ranging from automobiles to compact-disk electronics. Moreover, they have had longer experience in finding ways to be flexible in the face of volatile world energy and resource costs (an advantage now largely invisible given low world oil prices). By 1984, the exports of U.S. manufacturing firms commonly thought of as "high technology" businesses had declined in relative importance, while gains were posted by most natural resource enterprises.

Although shifts in the composition of U.S. trade indicate that the United States has lost leadership in technological products, they cannot be interpreted to indicate that the United States has now moved to a position of follower in the product cycle. A position of continued leadership would presumably be indicated by trade patterns generating large num-

[6] See interview with Malcolm Baldrige, "Despite Barbs, Baldrige Hopeful on U.S. Business," *Washington Post*, Dec. 7, 1986.

[7] Raymond Vernon, "International Investment and International Trade in the Product Cycle," *Quarterly Journal of Economics,* May 1966,

bers of technologically sophisticated jobs in the United States (engineers, scientists, supporting technical staffs, and highly skilled craftsmen), while tasks that could be reduced to relatively routine labor associated with older types of automation would move abroad. On the other hand, if the United States were reduced to a position on the second tier of the product cycle, the reverse would be true: increasing net exports of semi-skilled production jobs and decreasing net exports of jobs involving technologically sophisticated products. In fact, available data show that what is actually occurring follows neither pattern exactly.

Links in the chain of product development connecting research, production, and marketing prove to be some of the Nation's most fragile assets. Some links, like the connection between producers and supporting services, can be documented using the techniques described in chapter 7. Others are more difficult to follow, since they involve subtle and informal connections between engineering inspiration and familiarity with the daily problems of production.[8] If such links are lost, regaining them will not be easy. The task of rebuilding leadership is much more difficult than maintaining it, and the task of recovering competitive advantage is different than riding comfortably on the crest of a product cycle.

Loss of clear technological leadership does not mean that the United States is necessarily condemned to see its living standards reduced. It does mean that the United States can no longer take markets for granted, depend on inexpensive resources, or rely on a global reputation for making state-of-the-art products. The United States must now compete with many nations on an equal footing—taking advantage where it can by demonstrating a superior ability to make products using new technologies.

The prices of a nation's products and services today depend to a large degree on active choices of private management and the government programs that support them, rather than on traditional price differences derived automatically from natural endowments.[9] This means that the composition of a nation's trade is increasingly a function of the skill and education of its work force, and the success with which its management succeeds in converting new ideas into products and profits. These are areas in which the United States does not have an inherent comparative advantage.

Changing Comparative Advantage

If overall trade balances were restored, there would be no cause for alarm in the static picture of trade composition discussed in the previous sections—but the process by which the Nation restores this balance is of great significance. Will the United States expand exports of technologically sophisticated products and services that result in well-paying domestic jobs, or will the United States be able to compete only by exporting raw materials and comparatively low technology manufacturing? There is concern that the United States has lost critical parts of the technological infrastructure necessary to compete in many areas involving rapidly changing and advancing technologies.[10]

Some consolation can be taken from the fact that recent history provides no case in which loss of trade leadership led to an absolute decline in the living standards of the country concerned. Some countries have, of course, advanced more slowly than the leaders. The United Kingdom provides a highly visible case. Between 1870 and 1910, Britain lost its world economic leadership to Germany and the United States; its share of world manufacturing fell from 32 percent to 14 percent. Yet during this same period, per capita consumption increased 50 percent.[11] Today, England's citizens enjoy a growing standard of living and productivity, and unemployment is not strikingly higher than in more prosperous European nations.[12] Ironically, British interest in welfare grew rather than declined as the economy slowed in relative terms.

The situation could be dramatically different if the United States were forced to readjust to a lower relative status through an international financial crisis. An event such as a disastrous oil crisis, a major default of Latin debtors to U.S. banks, or a loss of con-

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8For greater elaboration of this argument, see Stephen Cohen and John Zysman, *Manufacturing Matters: The Myth of a Post-Industrial Economy* (New York, NY: Basic Books, 1987).

9John Zysman and Laura Tyson eds., *American Industry in International Competition* (Ithaca, NY: Cornell University Press, 1983).

10S. Cohen and J. Zysman, op. cit., footnote 8.

11Robert Gilpin, U.S. *Power and the Multinational Corporation* (New York, NY: Basic Books, 1975).

12William J. Baumol, "Productivity Growth, Convergence and Welfare: What the Long Run Data Show," C.V. Starr Center for Applied Economics, RR#85-27, August 1985.

fidence in fiscal management could trigger a collapse of confidence in the U.S. economy leading to capital flight. A severe domestic recession could set in, leaving the United States without any easy opportunities for stimulating the economy given the enormous budget deficits that already exist and the need to keep interest rates high to attract foreign capital. Such dramatic events could trigger real hardship and lead to drastic steps to protect U.S. markets. If U.S. multinationals were to look abroad for less expensive production opportunities, there would be a reduction in U.S. infrastructure expenditures, reducing investment in programs or institutions designed to enhance domestic productivity.

Comparative Advantage Defined

Since the concept of comparative advantage will be used and critiqued throughout the following discussion, it is useful to begin by stating the basic argument. The central point is obvious and unassailable: trade between nations allows each nation to specialize in those areas where it has the greatest comparative advantage (i.e., lowest cost and/or highest productivity compared to all the other products produced by that nation), By specializing in what it does best and trading for other products and services each nation becomes wealthier than would be the case if no trade took place. Standards of living in each nation increase regardless of the difference in relative living standards before trade (see box 8-A).

Documenting Changes in U.S. Comparative Advantage

Documenting changes in comparative advantage can be difficult even in the best of circumstances. It is particularly difficult when the overall trade balance is undergoing significant changes. For a variety of reasons, trade balances turned negative in virtually every part of the economy between 1980 and 1987. This cannot imply that the United States has lost comparative advantage in every sector. Some sectors suffered more rapid declines than others.

Given the complex networks of enterprises that deliver products to consumers, it is difficult to disentangle competitiveness in one part of the network from that in another. It is also difficult to separate the productivity of one part of a production network from the performance of the network acting as an integrated whole. It is entirely possible that a comparatively low-cost manufacturer has a poor showing in international trade simply because that business is not a part of a network capable of identifying rapidly changing foreign market niches and moving aggressively to exploit advantages. Static measures, therefore, can give a misleading impression.

An index of the comparative advantage of different U.S. industries can be created by dividing the value-added a sector gained through exports in a given year by the value-added lost through exports. Businesses can be ranked by this index in any given year. Changes in the competitive status of the business can be measured by the extent to which industry positions in such a list change from year to year. Changes in competitive ranks between 1972 and 1984 can be measured by taking the ratios between the competitive index for a business in 1984 and the index for 1972. If this ratio is greater than one, the industry became more competitive between 1972 and 1984 while the reverse was true if the ratio is less than one (see table 8-4), The ratio for all industries is less than 1 since total imports grew more rapidly than total exports during the period. Businesses with ratios below the average (0.84) lost in comparative terms while businesses with ratios above the average gained.

Table 8-4 accounts for both direct and indirect effects of trade on the output of each business. It attempts to show only the effects of trade, eliminating changes in value-added in each business that resulted from changes in domestic final demand and in domestic production recipes. The changes shown in the table must be treated with caution since it is based on the same assumptions that led to the creation of tables 7-6 and 7-7 in chapter 7. The results are also very sensitive to the years chosen for comparison.

Almost all manufacturing enterprises in the United States lost ground during this period. Heavy declines and losses were suffered in areas where traditional product leaders should have been gaining advantage: electronic components & accessories; office, computing, & accounting machines; aircraft & parts; and engines & turbines. In addition, automobile manufacturing and apparel lost significant comparative advantage during the past decade.

With the exception of farm equipment (which has undoubtedly lost rank subsequently), only two of the

Box 8-A.–Comparative Advantage

Suppose that U.S. producers can make a radio for $30 and a computer chip for $10, while in Japan both a radio and a computer chip can be made for 600 Yen. Without trade, an American with $60 (or a Japanese with 2400 Yen) could buy one radio and three computer chips. If trade barriers are suddenly lifted, both sides will discover that they gain by specializing in the area where their comparative advantage is highest. In America one radio can be exchanged for three chips, while in Japan the exchange ratio between chips and radios is one to one. Thus, America's comparative advantage lies in chip production, and Japan's comparative advantage lies in radio production.

Suppose that after some haggling it was agreed that the American would exchange three U.S. computer chips for two Japanese radios. The American would then be able to use his $60 to buy six U.S. computer chips and trade three of them for two Japanese radios, while the Japanese would purchase four Japanese radios and trade two of them for three U.S. computer chips. After trade, both the American and the Japanese would be able to buy two radios and three computer chips with the same money that formerly purchased only one radio and three computer chips. By specializing in its area of comparative advantage the wealth of each country has increased.

While the data can be used to show that living standards in both nations would increase with trade, they cannot be used to show which nation has a higher absolute standard of living. Absolute living standards (measured in terms of quantities of goods available per hour worked) depend on the *absolute* levels of output per hour in areas where the nation has comparative advantage. This conclusion does not depend on whether Japanese earned the equivalent of $100 an hour or $0.10 an hour. Suppose that the United States could produce 18 computer chips with 18 hours of work while Japan needed 36 hours to produce 12 radios. The United States would get the same goods (radios and chips) for half as much work as the Japanese. The Japanese would, however, get more per hour worked than they would without trade.

The gap between U.S. and Japanese living standards would close if Japanese productivity approached U.S. levels. If the Japanese achieved nearly the same production costs as the United States in all products, the advantages of trade would shrink. Taking the example a step further, if the Japanese equalled the United States in their productivity of radio production but surpassed the United States in their productivity of chip manufacturing, U.S. workers would again enjoy rising living standards in that 18 hours of work could buy more than three radios and nine chips. Americans would, however, be making radios instead of chips, and the Japanese would have a higher standard of living,

The analysis does not say anything about changes in income distribution that might result from trade. If production wages are lower and working conditions less attractive in the U.S. radio industry than they are in chip production, the shift from chips to radios could benefit owners of capital and a small number of skilled engineers at the expense of production workers. Average U.S. wealth could increase, while the welfare of some groups would decline as the result of trade.

"high technology" enterprises gaining comparative rank involved electrical or metal manufacturing. Instead, gains were posted by manufacturers using chemical processes (chemical products and plastics). Of the 20 industries designated as "high technology," 15 lost rank.[13] Natural resource enterprises, led by agricultural exports that remained strong in 1984,

[13]Virtually all definitions of high-technology rely on one, or both, of two indicators: "large" or above-average R&D expenditures relative to value-added or shipments; and a "high" or above-average proportion of scientists and engineers in the labor force. Examples of definitions using these criteria include New York Stock Exchange, *U.S. International Competitiveness: Perception and Reality* (New York, NY: NYSE, 1984); Michael Aho and Howard F. Rosen, "Trends in Technology-intensive Trade: With Special Reference to U.S. Competitiveness," U.S. Department of Labor, Bureau of International Labor Affairs, Washington, DC, 1980; Regina Kelly, "The Impact of Technological Innovation on International Trade Patterns," Bureau of International Economic Policy and Research, U.S. Department of Commerce, 1977; U.S. Department of Commerce, International Trade Administration, "An Assessment of U.S. Competitiveness in High Technology Industries," 1983; Lester Davis, "Technology Intensity of U.S. Output and Trade," Office of Trade and Investment Analysis, International Trade Administration, U.S. Department of Commerce, 1985; Victoria Hatter, "U.S. High Technology Trade and Competitiveness," Office of Trade and Investment Analysis, International Trade Administration, U.S. Department of Commerce, 1985; Organization for Economic Cooperation and Development (OECD), *OECD Science and Technology Indicators/1: Resources Devoted to R&D, Technological Performance and Industrial Competitiveness* and *Annex, 1985.*

While these techniques can capture some of the linkages between research and the ultimate beneficiary of the research, they are only partially successful. Linkages through capital investment are poorly captured, and the impact of government-sponsored research is not captured at all.

showed consistent gains in rank. Lumber, paper, livestock, and tobacco increased their rank, as well as some Low Wage Manufacturing industries like leather tanning, miscellaneous textiles (non-apparel), and household furniture. In addition, a curious collection of enterprises such as communications, radio & TV broadcasting, and business services gained in rank. U.S. trade in ordnance and associated military equipment also gained sharply in comparative rank.

Table 8-4.—Industries Gaining or Losing Apparent Advantage in Trade (measured by change in the ratio of value-added gained due to exports to value-added lost due to imports between 1972 and 1984)

Industry	1984 index* / 1972 index
Amusements	**0.49**
Miscellaneous manufacturing	**0.50**
Apparel	**0.51**
H Construction and mining machinery	**0.57**
H Electronic components and accessories	**0.59**
H Office, computing, and accounting machinery	**0.61**
Miscellaneous fabricated textile products	**0.61**
H Metalworking machinery and equipment	0.61
H Special industry machinery and equipment	0.63
Broad and narrow fabrics, yarn, and thread mills	0.63
Other furniture and fixtures	0.65
H Aircraft and parts	0.66
Motor vehicles and equipment	0.67
H Materials handling machinary and equipment	0.70
Screw machine products and stampings	0.71
H Engines and turbines	0.71
H Optical, ophthalmic, and photographic equipment	0.71
H Service industry machines	0.71
H Scientific and controlling instruments	0.72
Footwear and other leather products	0.74
H Electric lighting and wiring equipment	0.74
H General industrial machinery and equipment	0.76
Federal Government enterprises	0.78
Primary iron and steel manufacturing	0.80
H Drugs, cleaning and toilet preparations	0.81
Hotels; personal and repair services (excluding auto)	0.81
Paints and allied products	0.81
Other fabricated metal products	0.81
Electric, gas, water and sanitary services	0.82
Wholesale and retail trade	0.82
H Radio, TV and communication equipment	0.83
State and local government enterprises	0.84
Average of all industries	0.84
H Miscellaneous machinery, except electrical	0.84
Heating, plumbing and structural metal products	0.84
H Electric industrial equipment and apparatus	**0.85**
Automobile repair and services	0.86
Eating and drinking places	0.86
Paperboard containers and boxes	0.88
Finance and insurance	0.89
Glass and glass products	0.89
Rubber and miscellaneous plastic products	0.89
Real estate and rental	0.89
Stone and clay products	0.90
Maintenance and repair construction	0.90
H Plastic and synthetic materials	0.91
Primary nonferrous metals manufacturing	0.91
Crude petroleum and natural gas	0.92
Health, education, & social services and nonprofit organizations	0.92
New construction	0.96
Forestry and fishery products	0.96
Coal mining	0.96
Miscellaneous electrical machinery and supplies	0.97
Communications, except radio and tv.	0.97
Business services	0.98
Radio and TV broadcasting	0.98
Tobacco manufacturers	0.99
Chemical and fertilizer mineral mining	1.00
Household appliances	1.00
Transportation and warehousing	1.00
Paper and allied products, except containers	1.01
H Chemicals and selected chemical products	1.05
Wood containers.	1.05
Printing and publishing	1.06
Petroleum refining and related industries	1.07
Metal containers	1.08
Ordnance and accessories	1.12
Lumber and wood products, except containers	1.12
Household furniture	1.14
Nonferrous metal ores mining, except copper	1.15
Miscellaneous textile goods and floor coverings	1.18
H Farm and garden machinery	1.18
Leather tanning and finishing	1.23
Food and Kindred Products	1.29
Stone and clay mining and quarrying	1.32
Livestock and livestock products	1.36
Other transportation equipment	1.37
Agricultural, forestry and fishery services	1.43
Iron and ferroalloy ores mining	1.58
Other agricultural products	1.60

NOTE: An index >1 means export/import ratio increased between 1972 and 1984, an index <1 means that the export/import ratio declined during the same period. * 1984 index = (1984 exports) ÷ (1984 imports)

How To Read This Table: In 1984, the ratio of value-added in "electronic components and accessories" gained from exports to value-added lost from imports was 59 percent of the ratio calculated using 1972 trade patterns.

H = **"high-technology" manufacturing sectors, using the categorization suggested in Robert Z, Lawrence, Can** *America Compete* **(Washington, DC: The Brookings Institution, 1984), p, 148.**

SOURCE: Office of Technology Assessment, based on U.S. Department of Commerce, Bureau of Economic Analysis, Survey of *Current Business,* **Input-Output Tables: 1980, unpublished; and U.S. Department of Labor, Bureau of Labor Statistics, 1984 trade estimates rebased into 1980 dollars, unpublished.**

A different way of viewing the change is to examine the ratios of jobs created to jobs lost by occupation. Table 8-5 shows that, as before, the greatest losses are concentrated in direct manufacturing occupations, while trade seems to work to the advantage of service occupations and other occupations that indirectly support manufacturing. Engineers and engineering technicians appear to be losing ground as rapidly as the craftsmen and laborers that their engineering supports. The data reveal a sharp break between the fate of individuals labeled "engineers" and those labeled "scientists." Trade worked to the advantage of scientific professions more than it worked to the disadvantage of engineering. Computer operators, communication specialists, and a variety of other occupations closely tied to the sophisticated management networks described in Part 11 all appear to be associated with enterprises gaining in comparative advantage.

Numerous studies of U.S. trade argue that technology plays an important role in the determination of U.S. comparative advantage.[14] The analysis presented thus far, however, indicates that technology-intensive firms have lost ground over the past twelve years compared with other U.S. industries. The great-

14 D.B. Keesing, "The Impact of Research and Development on United States Trade," Journal of Political Economy, vol. 75, February, 1967; W.H. Gruber and R. Vernon, "The R&D Factor in a World Trade Matrix," in R. Vernon (cd.) *The Technology Factor in International Trade (New* York, NY: Columbia University Press, 1970); Thomas C. Lowinger, "The Technology Factor and the Export Performance of U.S. Manufacturing Industries," Economic *inquiry, vol.* 13, June 1975; Robert E. Baldwin, "Determinants of Trade and Foreign Investment: Further Evidence, " Review *of Economics* and Statistics, vol. 61, No. 1, 1979; Michael Aho and Howard F. Rosen, op. cit., footnote 13.

Table 8-5.—Occupations Gaining or Losing Apparent Advantage in Trade (measured by change in the ratio of jobs gained due to exports to jobs lost due to imports between 1972 and 1984)

Occupation category	Net 1984 jobs / Net 1972 jobs	Occupation category	Net 1984 jobs / Net 1972 jobs
NOTE: An index >1 means export/import ratio increased between 1972 and 1984, an index <1 means that the export/import ratio declined during the same period. Jobs refer to wage and salary employees only.			
Hand working occupations, including assemblers and fabricators	0.65	Mechanics, installers, and repairers	0.60
Machine setters, set-up operators, operators, and tenders	0.67	Financial records processing occupations	0.80
Engineers	0.68	Other clerical and administrative support workers	0.80
Precision production occupations	0.68	Secretaries, stenographers, and typists	0.80
Engineering and science technicians and technologists	0.71	Extractive and related workers, including blasters	0.60
Personal service occupations	0.73	Natural, computer, and mathematical scientists	0.80
Blue collar worker supervisors	0.73	Social, recreational, and religious workers	0.80
Teachers, librarians, and counselors	0.74	Cleaning and building service occupations, except private household	0.82
Technicians, except health, engineering and science	0.74	Construction trades	0.83
Material records, scheduling, dispatching, and distribution	0.75	Duplicating, mail, and other office machine operators	0.83
Management support occupations	0.76	Marketing and sales occupations	0.85
Mail and message distribution workers	0.77	Protective service occupations	0.85
Average for all occupations	0.77	information clerks	0.86
Writers, artists, entertainers, and athletes	0.78	Adjusters and investigators	0.86
Managerial and administrative occupations	0.78	Transportation and material moving machine and vehicle operators	0.87
Computer operators and peripheral equipment operators	**0.79**	Communications equipment operators	0.87
Records processing occupations, except financial	**0.79**	Health technicians and technologists	0.87
Food and beverage preparers and service occupations	**0.79**	Plant and system occupations	0.88
All other professional, paraprofessional, and technical	**0.79**	Health service and related occupations	0.89
Helpers, laborers, and material movers, hand	**0.80**	Social scientists	0.91
All other service occupations	**0.80**	Lawyers and judges	0.92
		Health diagnosing and treating occupations	0.96
		Architects and serveyors	1.01
		Agriculture, forestry, fishing, and related occupations	1.50

How To Read This Table: In 1984, the ratio of jobs in "hand working occupations" gained from exports to jobs lost from imports was 65 percent of the ratio calculated using 1972 trade patterns.

SOURCE" Office of Technology Assessment, based on U.S. Department of Commerce, Bureau of Economic Analysis, Survey of Current Business, Input-Output Tables" 1980, unpublished, U.S. Department of Labor, Bureau of Labor Statistics, "Employment Requirements," unpublished; and 19S4 trade estimates rebased into 1980 dollars, unpublished.

est loss in value-added was in precisely those areas one would expect to find gains in value-added if the United States were to remain at the head of product cycles in emerging technologies. On the other hand, the United States appears to be gaining advantage in businesses heavily dependent on raw materials and in labor-intensive manufacturing—precisely the areas one would expect to be losing ground to developing nations.

Between 1972 and 1984, the United States lost a significant volume of high-technology exports primarily because of rapidly increasing imports. Overall, the United States still retained a $4 billion trade surplus in technology-intensive businesses in 1985. During the first half of 1986, however, this became a trade deficit of $1.3 billion. [15] A recent study by the U.S. Department of Commerce found that the technology intensity of U.S. exports remained unchanged from 1972 to 1984, while Japan's rose sharply. The U.S. lead was cut in half.[16]

[15] Quick, Finan & Associates, Inc., **"The U.S. Trade Position in High Technology: 1980—1986," Report Prepared for the Joint Economic Committee of the U.S. Congress, Washington, DC, October 1986, p. 8. The U.S. Department of Commerce defines "high technology" as including industrial organic chemicals; plastic materials and synthetic resins; synthetic rubber; synthetic and other manmade fibers, except glass; drugs; ordnance and accessories, except vehicles and guided missiles; engines and turbines; office, computing, and accounting machines; radio and television receiving equipment, except communication types; communication equipment; electronic components and accessories; aircraft and parts; guided missiles and space vehicles and parts; measuring, analyzing, and controlling instruments; photographic, medical, and optical goods; and watches and clocks, except instruments for the measuring and testing of electricity and electric signals.**

[16] Lester A. Davis, **"Technology Intensity of U. S., Canadian, and Japanese Manufactures Output and Exports, " presented at the Industrial Colloquium on Oligopolies, Technological Innovation, and International Trade, October 1987.**

LONG-TERM TRENDS

The Convergence Club

Is it inherent in the nature of things that leaders should sooner or later falter? It seems difficult for any nation to maintain indefinitely a consistently large lead in productivity. In spite of radically different national economic strategies and two world wars, productivity growth rates during the past 100 years are almost perfectly correlated with the degree to which a nation was trailing the most productive nations in 1870. In other words, the further behind in 1870, the more rapidly the nation caught up. [17] Between 1870 and 1979, differences in the productivity of 16 industrial nations fell by more than a factor of 2.[18]

Why Leaders Falter

Leaving aside the role played by national policy in encouraging or discouraging investment and innovation, there are a variety of reasons why an economic leader may fail to grow as rapidly as its followers:

1 An obvious advantage is gained by imitating something that has already been shown to be possible. Even if the imitator is not able to obtain the technology and knowhow required to match the leader, the knowledge that a product or process is possible has already eliminated the need to pursue a variety of dead ends.

The avenues for transferring technology are spectacular, and continue to grow as communication and transportation technologies improve and as multinational corporations become more highly interdependent and familiar with each other's operations. [19] At a minimum, this process means that the opportunity to capture the economic rents due to innovation (and thereby the incentives to undertake innovation) diminish sharply. The innovator's investment in research, therefore, becomes a public good. Indeed, the imitator's concentration on production technology may well result in a second generation product that is higher in quality and less expensive than the original.

[17] Baumol, **op.** cit., **footnote** 12.

[18] Angus Maddison, "Phases of Capitalist Development," **in Baumol, op. cit., footnote 12.**

[19] Raymond Vernon, **"Coping With Technological Change: U.S. Problems and Prospects,"in Bruce R. Guile and Harvey Brooks, cd.,** *Technology and Global Industry* **(Washington, DC: National Academy Press, 1987).**

However, imitation without the help of the group developing the innovation requires an extremely sophisticated research infrastructure. It is apparent that firms conducting their own research are more likely to recognize useful innovations and apply them practically than firms lacking such an infrastructure. The rate of technology flow across borders must increase as more countries develop this ability.

2. It seems to be easier for a rapidly developing nation to take risks with innovations than it is for an established producer facing relatively stagnant markets where any innovation must replace an existing system.[20] Established firms in the United States with a high level of retained earnings face three options for investment: further domestic investment that could saturate markets and drive down profits, product diversification and innovation (a high risk strategy), and movement abroad in an experienced product line—a choice commonly preferred since it is relatively free of risks.[21]

   Leaders attempting to anticipate the direction of consumer demand in areas that require speculation about unknown patterns of consumption are likely to behave more conservatively than firms concentrating on capturing well-understood markets, but "the simple attitude of waiting" can make leaders less aggressive in exploiting new markets and technical innovations.[22]

3. Leaders may simply fail because of complacency –for example, if they assumed that all technology worth paying attention would be developed in the United States, would be freely available for purchase in the United States, and would be published in English. Trade grew rapidly during the 1970s, but on balance this tended to favor U.S. manufacturing exporters; OPEC nations, and Latin American nations expanding through purchases of U.S. capital equipment, created strong markets for U.S. products. The United States was not prepared for the explosion of competition based on sophisticated technology such as the one now occurring in Asia.

   While it is difficult to prove the case, numerous anecdotes suggest that at least part of America's loss of export markets resulted from an assumption that consumers around the world longed to imitate U.S. consumption patterns, and that world markets would largely follow the path led by U.S. consumers. The corollary was that there was no need to tailor products specifically for export or to make a special effort to market them abroad. This argument held that the very superiority of U.S. goods, and their association with U.S. economic leadership, would be adequate to promote sales.

   The United States appears to have been unprepared for a world in which many of the most basic product and process innovations, or at least innovations available at a reasonable cost for producers and consumers, would originate in Japan and elsewhere.

While trading patterns have been changing for years, technological innovations and newly sophisticated international management strategies may have accelerated the process. On-line international data networks already allow global access to current information in some areas, while new telecommunications equipment permits tighter global integration of production and even research and development. More generally, declining communications and transportation costs have contributed to an increase in the knowledge and skill base outside the United States, a development visible in the rapid growth of trained engineers, financial experts, and managers in newly industrializing countries. The result is a more competitive economic environment in which the life cycle of any product has been dramatically shortened.

One study has shown that U.S. firms introduce new products into foreign markets sooner than they have in the past (see table 8-6).[23] Another study examined data on **65** technologies to see whether the proportion of technologies transferred within 5 years of development was greater during 1969-78 than during 1960-68.[24] This study concluded that for tech-

[20] Andrew Sayer, "New Developments in Manufacturing and Their Spatial Implications," working paper No. 49, University of Sussex, Department of Urban and Regional Studies, Sussex, England, October 1985.

[21] A. Maddison, op. cit., footnote 18.

[22] L. L. pasinetti, *Structural Change and Economic Growth: A Theoretical Essay on the Dynamics of the Wealth of Nations* (Cambridge: University Press, 1981).

[23] William H. Davidson, *Experience Effects in International Investment and Technology Transfer* (Ann Arbor, MI: UMI Research Press, 1980).

[24] E. Mansfield and A. Romeo, "Technology Transfer to Overseas Subsidiaries of U.S.-based Firms" *Quarter/y Journal of Economics, vol. 95, 1980, pp. 737-750.*

Table 8-6.—Change in Transfer Rate for 954 Products (by period of U.S. introduction)

Period of U.S. Introduction	Number of products	% First introduced abroad in: 1 year or less	2 to 3 years	4 to 5 years	6 to 9 years	10 or more years
1945-49	174	8.00/0	9.20/o	8.00/0	16.70/o	46.60/o
1950-54	151	8.6	9.3	12.6	25.8	28.4
1955-59	153	8.5	15.7	17.6	23.6	19.6
1960-64	185	23,2	19.4	14,6	13.5	9.9
1965-69	170	28.2	16.5	11.8	7.1	N.A.
1970-75	121	32.2	18.1	N.A.	N.A.	N.A.
Total	954	17.7%	14.1%	11.7%	14.7%	18.1%

How To Read This Table: Between 1945 and 1949, U.S. firms transferred 174 products to foreign countries. 0f these, 8 percent were transferred within a year of their introduction in the United States, while 46.6 percent were introduced ten or more years after they were used in the United States. Between 1970 and 1975, 32.2 percent of the products examined were used abroad within a year of their introduction in the United States.

N.A. = Not available.

SOURCE: William H. Davidson, *Experience Effects in International Investment and Technology Transfer*(Ann Arbor, MI: UMI Research Press, *1980).*

nologies transferred to subsidiaries in developed countries there was a sharp increase in the transfer of recent technologies, from 27 percent in 1960 to 75 percent in 1968-78—suggesting a marked shortening of the product cycle among the states belonging to the Organization for Economic Cooperation and Development (OECD). For technologies transferred to subsidiaries in developing countries or through other channels, including licensing and joint ventures, the sample showed no statistically significant trend toward more rapid diffusion. At a more general level, W.W. Rostow has argued that the disappearance of the technological backlog is one of the most important factors accounting for the rapid growth of "late developers."[25] The "rich," on the other hand, slow down because of the difficulties in continually operating at the technological frontier.

One result of this faster rate of diffusion is that fewer areas of technology are dominated by a small number of firms. It is true that in many high-technology industries, the number of firms found in any one country has probably declined through mergers, creating the impression of growing concentration at the global level. However, this has probably been offset by the process of international diffusion that spurs new entrants. The number of seemingly independent sources of technology in most high-technology industries appears to have grown, which in turn enhances the bargaining power of those firms and of countries seeking effective transfers. This has been demonstrated by a study of the Brazilian petrochemical industry,[26] and in more aggregate data.[27]

[25] W W Rostow, *Why the Poor Get* **Rich and** *the Rich Slow Down* **(Austin, TX: University of Texas Press, 1980).**

[26] Francisco Sercovich, "State **Owned Enterprises and Dynamic** Comparative **Advantages in the** World Retro-Chemical Industry: **The Case of** Commodity Olefins **in Brazil," Harvard Institute for International Development, Discussion Paper 96, Cambridge, MA, May 1980.**

[27] Robert **B.** Stobaugh, **"The Product Life Cycle, U.S. Exports and** International **Investment," PhD Dissertation, Harvard University, Cambridge, MA, 1968.**

FOUR HYPOTHESES ABOUT THE FUTURE

At some point the United States must find a way to get trade imbalances back to manageable levels. [t will need to do so while imports of petroleum increase and while several key areas of past U.S. export surpluses, such as agricultural products, are unlikely to provide the kind of revenue they have in the past. The central issue is whether the trade balance is restored in a way that provides growing opportunities for good jobs in the United States or whether it is restored through acceptance of declining living standards. U.S. ability to assimilate and apply technology to profitable commercial applications will play a key role in determining the Nation's economic future.

Since the future of world trade depends on many choices made here and abroad, it is foolhardy to construct a definite forecast for the future. But it is useful to explore some illustrative possibilities, as outlined below.

All of the future scenarios assume an eventual return to a balance in total trade—imports equaling exports. This is not meant to imply that in the year 2005 merchandise imports will exactly equal exports, but rather that all trade—merchandise, services, and the net payment of income on investments both in this country and abroad—will be in balance.

All of the scenarios make use of U.S. Department of Energy projections for oil imports. What differs in each scenario is the role and importance of different sectors of the economy in contributing to growth. Trade scenarios for both 1.5 percent and 3 percent GNP growth rates are given in tables 8-7a and 8-7b; the scenarios are not meant to be predictions of the future, but to provide a sensitivity analysis of how trade could affect the U.S. economy during the next two decades. Assumptions leading to the 3 percent scenarios are described below (the slower growth rate assumptions can be deduced by analogy):

Table 8-7a.—3 Percent Growth Trade Scenarios

Sector	Caesar scenario Imports	Caesar scenario Exports
Natural resources and construction	16%	14%
Manufacturing	49	51
Services	35	35
Total (percent)	100	100
Total ($ billions)	$980	$980

	Banana scenario Imports	Banana scenario Exports
Natural resources and construction	10%	16%
Manufacturing	55	49
Services	35	35
Total (percent)	100	100
Total ($ billions)	$980	$980

	Drucker scenario Imports	Drucker scenario Exports
Natural resources and construction	18%	6%
Manufacturing	50	41
Services	32	52
Total (percent)	100	100
Total ($ billions)	$510	$510

	Trend scenario Imports	Trend scenario Exports
Natural resources and construction	11%	11%
Manufacturing	64	47
Services	25	43
Total (percent)	100	100
Total ($ billions)	$980	$980

How To Read This Tabie: Under the **Caesar scenario for trade patterns** in the year 2005, imports and exports each total $980 billion. Of these totals, 16 percent of imports and 14 percent of exports are attributable to natural resource and construction industries (see text for more detail).

NOTE: All values calculated in 1980 dollars. Numbers **may not add due to rounding.**

SOURCE: Office of Technology Assessment, 1987, based on data from the U.S. Department of Commerce, Bureau of Economic Analysis, and the U.S. Department of Labor, Bureau of Labor Statistics.

Table 8-7b.—1.5 Percent Growth Trade Scenarios

Sector	Caesar scenario Imports	Caesar scenario Exports
Natural resources and construction	16%	14%
Manufacturing	49	51
Services	35	35
Total (percent)	100	100
Total ($ billions)	$710	$710

	Banana scenario Imports	Banana scenario Exports
Natural resources and construction	10%	16%
Manufacturing	55	49
Services	35	35
Total (percent)	100	100
Total ($ billions)	$710	$710

	Drucker scenario Imports	Drucker scenario Exports
Natural resources and construction	180/0	60/0
Manufacturing	50	41
Services	32	52
Total (percent)	100	100
Total ($ billions)	$370	$370

	Trend scenario Imports	Trend scenario Exports
Natural resources and construction	11%	11%
Manufacturing	64	47
Services	25	43
Total (percent)	100	100
Total ($ billions)	$710	$710

How To Read This Table: Under the **Caesar scenario for trade patterns** in the year 2005, imports and exports each total $710 billion. Of these totals, 16 percent of imports and 14 percent of exports are attributable to natural resource and construction industries (see text for more detail).

NOTE: All values calculated in 1980 dollars. Numbers may not add due to rounding.

SOURCE: Office of Technology Assessment, **1987, based on data from the U.S. Department of Commerce, Bureau of Economic Analysis, and the U.S. Department of Labor, Bureau of Labor Statistics.**

1 The first scenario, called "Caesar" assumes that U.S. exports of manufactured goods and natural resource products grow rapidly, balanced by growing imports of a variety of goods and services. The scenario assumes that trade continues to grow somewhat faster than GNP, but not as fast as it has in recent years. Under the admittedly arbitrary assumptions of this scenario, total trade would increase 150 percent—reaching 30 percent of GNP by 2005. There would be a threefold increase in exports while imports more than double. If the 1974-84 trends continued for the next 20 years, trade would reach 50 percent of GNP.

Exports of natural resource-based products are assumed to rise sharply to help finance imports of raw materials, of which oil is the largest. The division of trade among the three broad groups —natural resources and construction, manufacturing, and services—is patterned after the relationship that held in 1967. These broad groups are then broken down into the individual industries using the 1972 composition of trade. Both traditional U.S. manufacturing concerns and U.S. high-technology firms fared well in international trade during 1972.

2 .The second scenario, "Banana," also envisages a high level of world trade but differs from the first in the composition of U.S. trade. Instead of achieving a balance in manufacturing trade, as in the first scenario, it is assumed that manufacturing trade experiences deficits in high-technology products and gains in comparatively low-wage areas. In addition, there is a large increase in exports of natural resources. The share of trade held by services is retained at the same level as in the Caesar case.

This scenario is an attempt to extrapolate from recent (1977 to 1984) changes in comparative advantage while bringing trade into balance. This scenario plays down the likely effects on trade of the gradual depletion of U.S. petroleum reserves, and of the substitution of advanced (man-made) for traditional materials in many manufacturing processes.

3. A third scenario, named Drucker since Peter Drucker has recently written on the subject,[28] assumes that technological advances in manufacturing processes will lead to a relative decline in global merchandise trade, leaving the trade of ideas and design embodied in services as the prominent focus. This scenario envisages a situation where competition hinges on an ability to tailor products to small local markets, making it increasingly important to manufacture products near their final consumers. Although there is still substantial trade in manufactured goods, countries are linked primarily by trade in services in this scenario.

Advanced communications would allow a network of small-scale production facilities to be managed from a central office located virtually anywhere in the world. Advanced materials and processes would offer such a variety of material substitutions that it would be possible to displace some imported materials. This could be true for energy inputs as well, given high levels of energy efficiency and a variety of resources available for producing electricity and liquid fuels.

Under this scenario, the absolute level of trade would barely increase over current levels (in the 1.5 percent growth case it would decline). It is assumed in the 3 percent growth case that total trade in natural resource products would be less in 2005 than it is now, as technology would lead to greater food self-sufficiency around the world and to reduced oil imports. Trade in manufactured goods is also assumed to be lower than is currently the case, as the decentralization of manufacturing would lead to increased production of tailored products for local markets. On the other hand, trade in services would increase sharply for reasons given above; the balance in services would finance the deficits in trade in manufacturing.

4 The last scenario, "Trend," provides a benchmark for comparing the effects of the other scenarios. Using the same level of trade (30 percent) as Caesar and Banana, Trend uses the 1984 composition of trade, which has been forced to be in balance by scaling down imports. Trade in natural resource products is almost in balance in this scenario. A huge surplus in services is required to balance the deficit in manufacturing.

[28] Peter Drucker, "The Changed World Economy, " *Foreign Affairs*, *vol 64, No. 4,* spring 1986, pp. **68-79.**