Part III
The International Connection

The benefits and problems of trade are now felt in virtually every production network. Even sectors that now appear to be insulated from trade, such as residential construction, are likely to find themselves closely tied to international production systems by the turn of the century.

In principle, trade can improve the living standards of Americans and their trading partners. A nation that is able to profit from ingenuity, invention, and inspiration in other countries is more likely to prosper and improve the productivity of its own enterprises than one limited to discoveries and research within its own borders. Even when the poorest nation trades with the richest, trade should improve living standards in both nations by making least-cost products available to both. Trade permits U.S. employment to grow in areas where the United States is relatively productive and has a competitive advantage, and it provides U.S. consumers with access to products at the lowest possible price. Political impediments to trade can retard the development of efficient international production networks by lowering productivity worldwide, and can frustrate development in less affluent nations—robbing US. producers of potential sales and possibly creating political instability.

In practice, of course. the benefits of trade are unevenly distributed. Trade creates income for certain businesses, occupations, and regions while reducing income for others. Trade can disrupt lives and communities on a massive scale. The costs of continual readjustment are difficult to measure, but can be high. Improperly managed, trade can undermine the technical leadership of U.S. firms in key areas and even threaten U.S. security interests. The challenge of public policy is to find a way to exploit the clear opportunities of trade while ensuring that the costs and benefits are equitably managed.

The Organization of Part III

Chapter 7 extends the analysis of Part II to include international components of production networks. This discussion shows how trade reshapes domestic production recipes, the scale and scope of domestic business operations, and the geography of production. Building on methods described in chapter 4, it provides a set of tools for understanding how exports generate employment throughout the economy, and how imports are integrated into production networks as substitutes for domestic value-added. The methods can be used to show, for example, how imports of manufactured products lead not only to direct declines in the value-added of manufacturing businesses, but indirectly to declining business for firms tied to manufacturing in production networks.

Chapter 8 examines national trends in trade volume and composition during the past several decades, looking closely at changes in the comparative advantage of US. producers. It indicates areas where the United States is gaining advantage (an odd assortment, including a variety of services and products involving heavy use of raw materials) and areas where the United States appears to be losing advantage (many involve products with high technology content). It expands on this analysis to show how trade affects different occupations. Craftsmen, machine operators, and laborers are particularly affected because so much trade involves manufactured products. The chapter also shows, for example, that the United States appears to have become a large net importer of scientific and engineering talent.

The chapter concludes by constructing three views of the future of U.S. trade: one built on the presumption that U.S. comparative advantage will continue to move away from sophisticated manufacturing and toward products with value dependent on natural resources; one built on the assumption that the United States can regain its dominance of world trade in manufactured products of all kinds; and one built on the assumption that technology may lead to a decline in the significance of trade in products generally, due to declining economies of scale in production worldwide and to decreased reliance on scarce materials.

Chapter 9 focuses on the impact of trade on specific sectors of the U.S. economy. Among other topics, it explores shrinking surpluses in U.S. agricultural trade, huge fluctuations in world petroleum markets. and declining U.S. exports in services and “high-technology” products.

Chapter 7

How Trade Enters U.S. Production Recipes

CONTENTS

Chapter 7

How Trade Enters U.S. Production Recipes

TRADE AND U.S. BUSINESS STRUCTURE

Trade affects U.S. business structure in all of the dimensions of change examined in Part 11. Trade alters the share that different domestic industries contribute to America's gross national product (GNP), the scale and scope of enterprises, and the geography of production.

Trade alters America's production and consumption recipes in many ways:

- The forces driving structural change in the domestic economy are magnified by the effects of international trade. Increased consumer demand for specialized products has opened up more opportunities for market niche penetration by foreign producers. Niches such as efficient automobiles or video-tape recorders have often proved to be a crucial entry point into U.S. markets.
- The growing complexity of production networks has allowed more points of entry for foreign firms in domestic networks. The complex business networks described in Part 11 have grown rapidly across international borders. Forces that decrease economies of scale have made domestic producers vulnerable in areas where foreign firms have been able to make better use of new production technology.
- The declining significance of natural resources in emerging production recipes has meant that foreign producers without access to inexpensive energy and materials can compete in U.S. markets—often for the first time. U.S. advantages stemming from vast fertile agricultural lands or inexpensive mineral and energy resources have all but vanished. It is possible that the comparatively high transactional costs associated with U.S. production may place U.S. products at a comparative disadvantage.
- Technology has reduced demands for natural resources, decreased the scale of efficient plants, and led to products where the ratio of value to weight is so high that transportation costs—even overseas transportation costs—can be a comparatively small fraction of total costs.[1] Knowledge and information, perhaps the most important ingredients of successful competition, flow rapidly across borders. Most of the flow cannot even be measured. Efficient, reliable, and comparatively inexpensive communications systems make it easier to coordinate production networks that reach around the globe. All of this makes it easier to form production networks that span large regions.
- Perhaps most importantly, keen international competition has made a capacity for making and marketing products from new technologies critical to survival. Success often hinges on an ability to react quickly, to provide consistent quality, or to tailor products to highly specific applications.

Recipe and Linkages

The increased complexity of linkages connecting different parts of the economy has contradictory effects on trade. On the one hand, the separation of once unified production facilities into networks of component and service enterprises permits more points of entry for both domestic and foreign producers. Telephone equipment installed and maintained in Chicago may have been designed in Palo Alto, California, using parts produced in Japan and Korea. On the other hand, an increased need for coordination between production, sales, and servicing operations, and the increased integration of services and production, can make international coordination cumbersome.

At a minimum, success in international markets now depends on skillful management of both production and service functions. The Japanese, for example, succeeded in penetrating U.S. automobile markets in part because of their heavy investment in U.S. sales and servicing facilities, their skillful use

[1] Sam Cole, "The Global Impact of Information Technology, " *World Development, vol. 14, No. 10/1* 1, 1986.

of advertising, and their patience and perseverance in learning about U.S. markets. Sales of advanced PBX (private branch exchange) telephone systems abroad will clearly require a good infrastructure for sales and maintenance. Mastery of banking, insurance, advertising, and other service industries abroad will be of increasing importance for both service exports and exports of manufactured products.[2]

Changes in Scale and Scope

Trade has an uncertain effect on the scale and scope of businesses operating in the U.S. economy. Anecdotes suggest that trade can present problems in both large, highly concentrated production sectors and sectors characterized by small, entrepreneurial firms.

Competitive problems faced in highly concentrated sectors, like textile machinery, steel, and automobiles, apparently resulted in part from inadequate flexibility in the face of unanticipated competition.[3] Concentrating on price reductions and efficiency achievable from mass economies of scale, such producers failed to see the dangers of having aggressive foreign companies invest heavily in new production techniques and search out market niches world-wide. In time, these niches have grown to encompass large sections of the industry. Foreign firms have all but eliminated U.S. producers of advanced textile equipment, and the U.S. steel and auto industries survive in part because of U.S. trade protection policies. Small U.S. farms have difficulty competing with foreign producers in products other than bulk commodities marketed by major trading companies (in part because foreign governments give major assistance to domestic producers wishing to market a wide variety of products abroad).[4]

On the other end of the production spectrum, such highly entrepreneurial enterprises as the U.S. merchant semiconductor industry-which lives off venture capital in California's "Silicon Valley"—and the U.S. machine tool industry have also faced major competitive problems. They proved vulnerable to the patience and planning of large, integrated Japanese firms which demonstrated a superior ability to transfer learning and resources from one part of their business to another, and to build loyal teams of highly skilled employees. In some cases, U.S. industries have also been vulnerable to foreign practices of limiting access to markets, selling products at "below cost" prices (dumping), and receiving government subsidies.[5]

Geography

In a sense, trade is an extreme reflection of the geographic mobility of production described in the last part of chapter 5. The forces behind shifts in the international location of production are much the same as those that led to greater mobility within the United States. What has changed is that the economic, political, and psychological barriers that once kept most U.S. firms isolated from the international marketplace have all but vanished. The change appears to be irreversible. Once a firm has demonstrated that a manufacturing enterprise can operate successfully from, South Korea, making use of indigenous labor skills, local port facilities and other physical infrastructure, and enjoying government support for its profitable operation, it is easier for the next firm to enter. Once Taiwan established itself as a reliable producer of high-quality, low-cost components in one field, it could build on that reputation and encourage multinational firms to consider the country as a site for other production facilities. The removal of investment uncertainty is thus an important and usually irreversible process, barring a major domestic upheaval.

Trade has clearly helped reshape the landscape of production. As in the case of domestic geographic movement, however, the theoretical possibility of locating production facilities more evenly around the world has not necessarily resulted in even rates of post-war economic development. Conflicting forces

[2]U.S. Congress, Office of Technology Assessment, International COmpetition in Services, OTA-ITE-328 (Washington, DC: U.S. Government Printing Office, July 1987).

[3]See the thesis of Michael Piore and Charles Sable, *The Second Industrial Divide* (New York, NY: Basic Books, 1984).

[4]U.S. Congress, Office of Technology Assessment, *A Review of U.S. Competitiveness* in Agricultural Trade—A Technical Memorandum, OTA-TM-TET-29 (Washington, DC: U.S. Government Printing Office, October 1986).

[5]For an example, see Andrew S. Grove, "Regain Leadership by Working Together," *The New York Times,* Dec. 13, 1987.

are at work. Much of the world seems unable to join what is called the "convergence club"-a group of nations whose economies have become much more similar during the past century.[6] Members of this "club" seem to be able to learn from each other. While relative positions may change, all have enjoyed real growth while the gap separating these nations from the rest of the world has not narrowed.

Technology makes it comparatively easy for businesses to base decisions on factors such as the availability of an educated and trainable work force, the availability of beneficial tax policies, and other factors that might influence business climate. Indeed, there is reason to believe that the striking success enjoyed by the Pacific Rim nations during the last decade depended heavily on their ability to provide workers with comparatively good high school training at comparatively low wages.[7]

Interestingly, the fast-moving production networks emerging in the world economy may work to increase the advantage of being close to markets, because successful participation in tightly integrated networks depends heavily on a firm's ability to respond quickly with new products and production systems.[8] Many of the new service professions are necessarily disaggregate, since they depend entirely on proximity to clients. The maintenance of complex telephone systems, the installation of software, and the provision of health services all demand close association with clients. Improved transportation networks and inventory control systems permit retailers to offer a wider range of products; at the same time, retailers attempting to keep a large range of products in stock without large inventories need suppliers located where they can deliver quickly and reliably. Auto assembly relying on "just in time" inventories similarly benefits from close proximity. Chapter 6 gave several other examples of technology capable of identifying and reaching niche markets throughout the Nation.

There are other strong links with location, however, that are more difficult to measure in standard statistical terms. In spite of the theoretical advantages of communication in displacing travel, there appears to be no good substitute for real physical proximity in many advanced transactional services. The expanded legal, accounting, financial, insurance, and other services gaining a large fraction of national employment appear to require the undisputed benefits of casual meetings, the reading of a face, or a handshake. These are businesses where perceptions are often as important as anything measurable. The result of this has been significant concentration of many advanced services in a few centers, such as New York, Tokyo, London, and Los Angeles.

There has been a marked change in the geography of U.S. trade. A number of Asian nations have become major markets for U.S. exports and major suppliers of U.S. imports. In 1975, Asia accounted for one-quarter of both U.S. imports and exports. By 1984 the Asian share of U.S. exports had risen to 30 percent while 37 percent of all U.S. imports came from Asia, making it the largest supplier of goods to the U.S. market. Trade with Asia now accounts for more than 50 percent of the total U.S. merchandise trade deficit. The countries involved are mainly Japan, Taiwan, South Korea, Hong Kong, and Singapore.

Table 7-1 shows how rapid change has been during the past decade. In 1975, 50 percent of the net trade surplus with non-OPEC countries was used to finance oil imports, resulting in an enormous trade deficit with the oil producers. By 1986, imports from OPEC nations accounted for only 6 percent of the U.S. trade deficit. 0PEC's share of US. exports fell from 9 percent in 1975 to 5 percent in 1986. However, the collapse of U.S. exports occurred because nations that formerly purchased U.S. exports reduced their purchases in real terms.

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[6] William 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.

[7] Harold M, Stevenson, "Mathematics Achievement of Chinese, Japanese, and American Children," *Science, vol.* 231, No. 4739, Feb. 14, 1986, p. 693.

[8] For further elaboration of this point see Peter Drucker, "The Changed World Economy," *Foreign Affairs, vol. 64, No. 4,* pp. 768-791, spring 1986; and James Brian Quinn, "The Impact of Technology in the Services Sector," Bruce R. Guile and Harvey Brooks (eds.), *Technology and Global Industry* (Washington, DC: National Academy Press, 1987), pp. 119-159.

Table 7.1.—The Geography of U.S. Merchandise Trade (billions of dollars)

Location	1975 Exports (from U.S.)	1975 Imports (to U.S.)	1975 Balance	1986 Exports (from U. S.)	1986 Imports (to U.S.)	1986 Balance
Total	107.1	98.2	8.9	221.8	369.5	– 147.7
Western Europe	29.9	20.8	9.1	60.7	89.3	–28.6
European Community	22.9	16.5	6.3	52.2	74.5	–22.3
Others	7.0	4.3	2.8	8.5	14.8	–6.3
Canada	23.5	21.9	1.7	54.2	70.3	–16.0
Japan	9.6	11.3	–1.7	26.4	81.0	–54.6
Australia, New Zealand, South Africa	3.5	2.2	1.3	7.1	6.0	1.2
Eastern Europe	3.2	0.7	2.5	2.0	2.0	0.0
Latin America	17.1	16.2	0.9	30.9	41.5	–10.6
Asia& Africa	20.2	25.2	–4.9	40.4	79.4	–39.0
Hong Kong, Singapore, South Korea, Taiwan	N.A.	N.A.	N.A.	17.3	46.1	–28.8
OPEC [a]	7.3	14.7	–7.4	6.8	12.7	–5.9
Other	12.9	10.4	2.5	16.3	20.6	–4.3

[a]Organization of Petroleum Exporting Countries. Total shown does not include Venezuela, Ecuador
N.A. = not available

SOURCE: U.S. Department of Commerce, *Survey of Current Business, vol. 66, No.* 6) June 1986, pp. 48-50; vol.67, No.3, March 1987, pp. 45-46.

FOLLOWING TRADE THROUGH DOMESTIC PRODUCTION NETWORKS

Between 1972 and 1984, trade's effect on the GNP share of several production sectors was as large as the effect of domestic demand. One of the difficulties in evaluating the effect of trade on the U.S. economy, however, is that the beneficiaries of trade are difficult to identify, while those adversely affected by imports are vigorous in making their presence known. A plant closed because imported clothing has underpriced the domestic product is a tragedy because the pain is concentrated on relatively few individuals. Consumers **as a whole,** however, may benefit from less expensive clothing due to these imports. Taken collectively, the advantages derived from trade may outweigh the costs, though the costs and benefits are not distributed equally.

Unfortunately, national statistics are virtually useless in making a detailed calculation of the ways trade affects U.S. production networks to the benefit of U.S. consumers. There is no way, for example, to look at the National Income and Product Accounts or the input-output accounts to determine whether the steel purchased by an automobile company is imported or produced by a domestic firm.

Even given this information, it is not easy to determine how the US. economy would operate in the absence of trade. Many products and services simply cannot be produced domestically at any price, such as a trip to Paris. There are other areas where expanding domestic production to replace imports would be prohibitively expensive—displacing imports, for example, would require doubling domestic petroleum production. Moreover, products are imported with prices and characteristics that cannot easily be matched by domestic production; if imports were not available, the prices of many products in the U.S. economy would be radically changed. Consumption and production recipes would be altered as a result. It is extraordinary difficult to anticipate these shifts given available information. At this writing, consistent deflator series are not available for all imports.

International trade statistics are becoming less reliable as an indicator of real movement of value. For example, measuring the value of technology moving across international borders has always been difficult, but its significance has grown as its value has increased. The value of technology that flows freely in the form of open technical literature, scientific meetings, educational training, and products undoubtedly dwarfs the recorded flow of patents, licenses, and the like. Barter-like trade, not easily included in official estimates, may amount to 30 percent of world trade.[9] Official estimates of U.S. serv-

[9]Stephen **Cohen and John Zysman,** "Countertrade, **Offsets, Barter, and Buy backs,"** *California Management Review,* **vol. 28, No, 2, winter 1986, pp. 41-56.**

ice exports and imports may be 50 to 70 percent too low.[10] In addition, the value of drugs illegally imported to the United States in 1985 could, if measured, increase the U.S. trade deficit by 10 to 50 percent.

Because of these limitations, the discussion that follows can provide only a very dim light on the way trade has insinuated itself into U.S. production networks. Even this dim light can be useful.

Direct Effects

It is useful to begin by examing the direct effects of trade, following the vocabulary of chapter 4. Leaving doubts about the data aside, table 7-2 shows that nearly one-quarter of merchandise trade appears in categories not closely linked to U.S. producing sectors. Of the remaining trade in goods and services, the most dramatic changes are found in manufacturing. Medium Wage Manufacturing shows an increased share of both imports and exports, primarily because of growing trade in electronics, while High Wage enterprises fall as a share of both imports and exports in spite of the surge in imports of steel, automobiles, and other products of High Wage Manufacturing. In contrast, Transactional Activities have gained in their share of imports, and their share of exports rose to 7.6 percent in 1984—more than a 50 percent increase from 1972.

Indirect Effects

Making the assumption that products made for export are produced in the same way as products made for domestic sales, the methods discussed in chapter 4 can also be used to estimate the domestic business generated by foreign purchases of products and services. Table 7-3 indicates that in 1984, exports generated $38 to $49 billion of value-added in each of the following sectors: Natural Resources, High Wage Manufacturing, Medium Wage Manufacturing, Transportation & Trade, and Transactional Activities. In percentage terms, exports gave the greatest boost to High and Medium Wage Manufacturing and Natural Resources; value-added was between 14 and 19 percent in all three sectors, demonstrating the extent to which U.S. enterprises are involved in

[10] U.S. Congress, Office of Technology Assessment, *Trade In Services: Exports and Foreign Revenues—Special Report,* OTA-ITE-316 (Washington, DC: U.S. Government Printing Office, September 1986).

Table 7-2.—Composition of Trade in 1972 and 1984 (in 1980 dollars)

	Percent of all trade in "producing industries"[a]			
	Imports		Exports	
Production sector	1972	1984b	1972	1984b
Natural Resources	22.30/o	20.50/o	12.80/o	14.90/0
Construction	0.0	0.0	0.0	0.0
Low Wage Manufacturing	14.3	16.4	5.3	4.6
Medium Wage Manufacturing	19.3	27.1	21.4	27.7
High Wage Manufacturing	46.1	39.7	39.9	31.2
Transportation & Trade[c]	–2.2	–4.1	14.7	13.4
Transactional Activities	0.2	0.4	5.0	7.6
Personal Services	0.0	0.0	0.6	0.4
Social Services	0.0	0.0	0.3	0.2
Total	100.0	100.0	100.0	100.0
In billions of 1980 dollars:				
Value of trade in "producing industries"[a]	$138.8	$306.5	$117.7	$231.0
Value of trade in "special industries"[a]	59.4	106.1	40.3	83.1
Total	198.2	412.6	157.9	314.1

[a] "Producing" industries differ from "special industries" in that the latter are not linked to the rest Of the economy generating no intermediate inputs and, with minor exceptions, no domestic jobs. The "special industries" that contribute to trade include scrap, "non-comparable" imports, and "rest of the world" industry. An import is "noncomparable" if (1) there is no significant domestic production (e.g., bananas); (2) the item is purchased and Wed outside the United States (e.g., foreign travel); or (3) it is one of several miscellaneous items that are not easily assigned to a U.S. production category (e.g., antiques or fossils). The "rest of the world" trade includes income on foreign investments, compensation of U.S. residents working abroad, and private payments on foreign assets

[b] Bureau of Labor Statistics estimates rebased into 1980 dollars.

[c] Includes duties on imported products.

NOTE: *Totals may not* equal 100 due to rounding.

SOURCE: Office of Technology Assessment, based on US. Department of Commerce, Bureau of Economic Analysis, Survey of *Current Business,* "Dollar Value Tables for the 1972 Input-Output Study," April 1979; U.S. Department of Labor, Bureau of Labor Statistics, 1984 trade estimates, unpublished.

Table 7.3.—Domestic Value-Added Generated by Exports in 1984

Production sector	Billions of 1980 dollars	Percent of value-added in sector
Natural Resources	**$39.2**	14.60/o
Construction	**8.0**	4.4
Low Wage Manufacturing	**9.2**	9.6
Medium Wage Manufacturing	**46.6**	16.0
High Wage Manufacturing	**48.5**	18.5
Transportation & Trade	**45.4**	8.0
Transactional Activities	**38.5**	5.6
Personal Services	**3.6**	3.3
Social Services	**2.7**	0.6
Total	241.8	8.2

NOTE: The value-added includes all transactions associated directly and indirectly with trade, including domestic production of capital equipment needed to produce exports.

SOURCE: Office of Technology Assessment, based on 1984 U.S. Department of Commerce, Bureau of Economic Analysis, "National Income and Products Accounts," historical diskettes with adjustments made to the 1980 Commerce Department Input/Output tables for capital flows and the U.S. Department of Labor, Bureau of Labor Statistics, "Employment Requirements," unpublished, and 1984 trade estimates rebased into 1980 dollars, unpublished.

world trade. Measured in terms of absolute value generated by exports, $104 billion ends up as value--added in manufacturing sectors (44 percent of the total) while nearly $84 billion appears as value-added in Transportation & Trade and Transactional Activities.

The effects of imports are much more difficult to estimate for reasons already discussed. It is possible to obtain a rough estimate about the effects of imports, presented in table 7-4, by making three admittedly heroic assumptions:

1. domestically produced commodities can be used as direct replacements for all "comparable" imports, and can be produced at the same price as imported products (import price plus tariffs);
2. the ratio of imported commodities to domestically produced commodities consumed is the same for households, government, and businesses purchasing ("intermediate demand"); and
3. the ratio of imported commodities to domestically produced commodities consumed is the same for all businesses (e.g., if imports represent 10 percent of all steel consumed in the United States, the automobile industry imports 10 percent of the steel it consumes).

Once changes in the output of industries resulting from the direct and indirect effects of trade have been calculated, the impact of trade on jobs can be computed with the assumption that employment in

Table 7-4.—Domestic Value-added Theoretically Offset by Imports in 1984

Production sector	Billions of 1980 dollars	Percent of value-added in sector
Natural Resources	$95.5	35.5 "/0
Construction	15.2	8.4
Low Wage Manufacturing	34.3	35.9
Medium Wage Manufacturing	70.6	24.3
High Wage Manufacturing	81.4	31.0
Transportation & Trade	34.6	6.1
Transactional Activities	34.1	5.0
Personal Services	3.7	3.5
Social services	3.4	0.7
Total	373.0	12.7

NOTE: The value-added Includes all transactions associated directly and indirectly with trade, including domestic production of capital equipment needed to Produce exports. Duties collected on imported products have been excluded from the calculations.

SOURCE: Off Ice of Technology Assessment, baaed on 1984 U.S. Department of Commerce, Bureau of Economic Analysis, "National Income and Products Accounts," historical diskettes with adjustments made to the 1980 Commerce Department Input/Output tables for capital flows and the U.S. Department of Labor, Bureau of Labor Statistics, '{Employment Requirements," unpublished, and 1984 trade estimates rebased into 1980 dollars, unpublished.

an industry changes in proportion to industry output (see table 7-5). Given the large trade imbalance of 1984, the methods just described indicate that imports resulted in a loss of over 9 million jobs, while exports only generated 6.5 million jobs.

As could be expected, jobs in manufacturing were most heavily affected by both imports and exports. In percentage terms, the Medium and High Wage Manufacturing sectors taken together were the most affected by imports but also benefited the most from exports. While nearly 13 percent of employment in the Transactional Activities sector is attributable to exports (directly from this sector and indirectly from others), the Personal and Social Services sectors were not as heavily affected by either imports or exports.

Methods similar to those used to estimate net effects on employment in different businesses can be used to show how trade influences demand for people with different skills (see tables 7-6 and 7-7). Trade has clearly benefited some groups at the expense of others. As expected, export jobs are heavily dominated by manufacturing professions and agriculture. A large fraction of all technical professionals(14 percent of all engineers, 12 percent of all engineering technicians, and 8 percent of all scientists) owe their jobs to exports. Social service occupations (teaching, health, and other areas) are among those affected least.

While the calculations about the employment effects of imports lack precision, they do suggest that trade has deeply penetrated most U.S. production networks that involve manufactured products, including those that rely heavily on engineering and scientific personnel. Indeed, technical professions are among the most heavily affected by both imports and exports, as are skilled and unskilled employees in manufacturing.

It is possible, of course, that the statistics overstate the loss of domestic scientific and engineering research. Many foreign designs incorporate U.S. engineering. U.S. research may well continue in spite of the loss of some domestic production, although it seems unlikely that U.S. firms can continue to maintain vigorous research programs without an ability to recapture the investment through production. On the other hand, the statistics presented later in this chapter will show that the United States is importing a great deal of engineering talent. The Japanese appear to expend much more engineering talent in some areas of production than U.S. firms.

Taken as a whole, the United States appears to export products requiring relatively large amounts

Table 7-5.—The Impact of 1984 Trade on Domestic Employment by Industry Group

Production sector	Percent of jobs in sector: Lost to imports	Gained from exports	Jobs in sector as percent of all U.S. jobs in 1984
Natural Resources	8.20/o	8.1 0/0	3.50/0
Construction	3.9	2.9	4.5
Low Wage Manufacturing	16.9	5.6	4.6
Medium Wage Manufacturing	25.9	23.7	9.6
High Wage Manufacturing	18.6	15.8	5.9
Transportation & Trade	15.2	27.6	26.3
Transactional Activities	8.7	12.9	13.0
Personal Services	1.5	2.1	5.5
Social Services	1.0	1.3	27.2
Total	100.0	100.0	100.0
Millions **of jobs**	**9.3**	**6.5**	**96.9**

How To Read This Table: in 1984, 3.5% of the 96.9 million wage and salary jobs in the U.S. were in Natural Resource industries. Exports of Natural Resource products accounted for 8.1 °/0 of the 6.5 million jobs generated by all U.S. exports. Of the 9.3 million jobs hypothetically displaced by imports, 8.2°/0 were in Natural Resource industries.

NOTES:

- **Totals may not equal 100 due to rounding.**
- **. Includes both direct and indirect trade effects and the effects on capital purchases.**
- **Uses 1980 input/output and 1984 occupation by industry matrix.**
- **Duties collected on imported products have been excluded from the calculations.**
- **Job totals represent only wage and salary earners i n 1984 (self-employed not included).**

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 1984 trade estimates rebased into 1980 dollars, unpublished.**

Table 7-6.—Jobs *(Wage* and Salary) Lost Directly and Indirectly to Imports of Comparable Products in 1964 (ranked with the occupations iosing most employment at the top)

Occupation category	Jobs lost as percent of all jobs in the occupation in 1984	Jobs lost as percent of all jobs lost to imports in 1984
Extractive and related workers	53.9	1.0
Hand working occupations	31.9	8.7
Machine setters, set-up operators, operators	27.0	15.8
Precision production occupations	22.7	6.4
Blue collar worker supervisors	21.8	3.1
Engineers	21.1	3.0
Engineering and science technicians	17.2	2.4
Helpers, laborers, and material movers	14.5	6.4
Plant and system occupations	13.5	0.4
Natural, computer, and mathematical scientists	12.0	0.8
Material records, scheduling, dispatching	11.9	3.1
Mechanics, installers, and repairers	11.0	4.7
Transportation and material moving operators	10.6	4.9
Technicians, except health and engineering	10.6	0.6
Computer operators and peripheral equipment	10.0	0.3
Management support occupations	9.8	2.3
Construction trades	9.8	2.7
Average of all occupations	9.6	100.0
Agriculture, forestry, fishing	9.2	1.8
Architects and surveyors	8.5	0.1
Managerial and administrative occupations	8.4	7.1
Financial records processing occupations	8,3	2.1
Duplicating, mail, and other office machines	7.7	0.1
Records processing occupations, except finance	7.4	0.7
Secretaries, stenographers, and typists	7.2	3.0
Mail and message distribution workers	7.2	0.6
Writers, artists, entertainers, and athletes	7.0	0.6
Marketing and sales occupations	6.4	6.4
Communications equipment operators	6.3	0.3
Other clerical and administrative support	6.2	3.8
Lawyers and judges	6.1	0.2
Cleaning and building service occupations	5.3	1.6
All other professional, paraprofessional, and technical information clerks	5.3 5.1	0.4 0.4
All other service occupations	4.7	0.4
Adjusters and investigators	3.9	0.2
Protective service occupations	3.3	0.7
Food and beverage preparers	2.8	2.0
Personal service occupations	2.6	0.2
Social scientists	2.3	0.0
Health technicians and technologists	1.0	0.1
Health diagnosing and treating occupations	0.8	0.2
Health service and related occupations	0.4	0.1
Social, recreational, and religious workers	0.3	0.0
Teachers, librarians, and counselors	0.2	0.1
Private household workers	0.0	0.0

How To Read This Table: Of the 9.3 million jobs replaced by trade in 1984, 8.7°/0 were in "hand working occupations." imports substituted for 31.9% of all 1984 hand working jobs.

NOTE: Duties collected on imported products have been excluded from the calculations.

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 1984 trade estimates adjusted into **1960 dollars, unpublished.**

Table 7-7.—Jobs (Wage and Salary) Gained Directly and Indirectly by Exports in 1984
(ranked with the occupations gaining most employment at the top)

Occupation category	Jobs gained as percent of all jobs in the occupation in 1984	Jobs gained as percent of all jobs gained from exports in 1984
Hand working occupations	16.7	6.5
Agriculture, forestry, fishing	15.8	4.3
Engineers	14.3	2.9
Extractive and related workers	13.0	0.3
Precision production occupations	12.4	5.0
Blue collar worker supervisors	12.1	2.5
Engineering and science technicians and technologists.	11.8	2.3
Machine setters, set-up operators, operators.	11.5	9.6
Material records, scheduling, dispatching	9.2	3.4
Transportation and material moving operators	9.1	6.0
Plant and system occupations	8.7	0.4
Architects and surveyors	8.6	0.1
Technicians, except health and engineering	8.3	0.7
Mechanics, installers, and repairers	8.1	4.9
Natural, computer, and mathematical scientists	7.9	0.8
Computer operators and peripheral equipment	7.7	0.4
Management support occupations.	7.3	2.5
Marketing and sales occupations.	7.1	10.1
Writers, artists, entertainers, and athletes	6.8	0.8
Duplicating, mail, and other office machines	6.7	0.2
Average of all occupations	6.7	100.0
Financial records processing occupations	**6.5**	2.4
Managerial and administrative occupations	**6.5**	7.8
Communications equipment operators	**6.3**	0.5
Mail and message distribution workers	**6.3**	0.8
Lawyers and judges	**6.1**	0.3
Records processing occupations, except finance.	**5.7**	0.8
Secretaries, stenographers, and typists	**5.6**	3.3
Construction trades	**5.5**	2.1
Other clerical and administrative support.	**5.1**	4.5
Information clerks	**5.1**	0.5
All other professional, paraprofessional, and technical	**4.5**	0.5
Cleaning and building service occupations	**4.4**	1.9
All other service occupations	**3.9**	0.5
Adjusters and investigators.	**3.8**	0.3
Personal service occupations	**3.1**	0.4
Protective service occupations.	**3,1**	0.9
Food and beverage preparers and service occupations	**2.5**	2.5
Social scientists	2.0	0.1
Health diagnosing and treating occupations	0.9	0.3
Health technicians and technologists	0.9	0.2
Health service and related occupations	0.4	0.1
Social, recreational, and religious workers.	0.3	0.0
Teachers, librarians, and counselors	0.2	0.1
Private household workers	0.0	0.0

How To Read This Table: Of the jobs gained by exports in **1984, 6.5% were in "hand working occupations."** Exports were responsible for 16.7°/0 of all hand working jobs.

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 1984 trade estimates rebased into 1980 dollars, unpublished.**

of labor and relatively small capital inputs compared to U.S. imports. This paradoxical result, first identified by Wassily Leontief in 1953,[11] exhibits relative stability over time (see table 7-8).[12]

The higher capital to labor ratio of imports is due in part to the fact that exports include a significant amount of sales and related employment not included in import accounts; sales workers represented 7.1 percent of all jobs gained by exports and 6.4 percent of jobs lost to imports. It is also possible that U.S. exports embody an unusually large amount of associated service employment when they consist of relatively advanced products, while U.S. firms threatened by imports tend to compete with heavy capitalization to offset higher foreign labor costs.[13] On the other hand, it could also mean that foreign firms have successfully penetrated the most capital-intensive and productive parts of U.S. manufacturing.

Another way to explore this issue is to examine the effect of trade on employment using measures other than occupation descriptions. The result is difficult to interpret. In spite of large differences in the kinds of jobs created and lost by trade, the average wages (calculated by weighting average occupation wages by the number of jobs gained or lost in the occupation) of jobs gained and lost are virtually identical (see table 7-9).[14] Individuals losing jobs because of imports are slightly more likely to be males who are not well educated. Not surprisingly, they are much more likely to be in an occupation with high levels of unemployment.

Because of the large trade deficit in 1984, the United States was actually a net importer of almost every class of worker in that year. In 1972, a year in which the value of exports and imports was close to being in balance, the United States was a net exporter of work by the college-educated in spite of considerable displacement of technical personnel. Given balanced trade, the United States would also be a net exporter of female employment.[15]

Linkages

While manufactured products represent the bulk of direct imports (again see table 7-2), imports lead to significant declines in value-added and employment in non-manufacturing sectors as well because of the extensive linkages connecting manufacturing to the rest of the economy. Loss of domestic automobile production translates directly into losses for the firms that provide marketing, financing, and other services to domestic automobile producers.

The linkages connecting the fate of different parts of the economy are shown in particularly vivid terms when imports substitute for domestic production. These links are examined directly in table 7-10, which separates trade into three components: trade in natural resource and construction goods, trade in manufactured products, and trade in services. The table indicates that while 89 percent of all jobs lost to imports in 1984 resulted from imports of manufactured products, only two-thirds of these lost jobs were manufacturing jobs. Imports of manufactured goods resulted indirectly in the loss of over 2 million service jobs, primarily in the Transportation& Trade and Transactional Activities sectors. In other words, for every 15 jobs lost due to imported manufactured products, 10 were jobs lost in manufac-

[11] Wassily Leontief, "Domestic Production and Foreign Trade: The American Capital Position Reexamined," Proceedings of the American Philosophical Society, September 1953.

[12] Wassily Leontief and Faye Duchin, "Automation, the Changing Pattern of U.S. Exports and Imports, and Their Implications for Employment," Final Report for the National Science Foundation, March 1985, p. 22.

13 See U.S. Congress, Office of Technology Assessment, Technology *and Structural Unemployment: Reemploying Displaced Adults,* OTA-ITE-250 (Washington, DC: U.S. Government Printing Office, February 1986).

Table 7-8.—Capital/Labor Ratios of U.S. Exports and Imports (capital per unit of labor in 1979 dollars per person year of competitive imports and exports)

Year	Export ratio	Import ratio	Ratio (E/I
1963	37.5	49.2	0.76
1967 .., ...	40.7	48.9	0.83
1972	53.0	59.6	0.89
1977	56.0	74.6	0.75

NOTE: Technical matrices apply to the year indicated.

SOURCE: W. Leontief and F. Duchin, "Automation, the Changing Pattern of U.S. Exports and Imports, and their Implications for Employment," National Science Foundation, (PRA 83-11407), March 1965, pp. 2.26-2.27,

[14] Weighting wages by *industry,* however, can yield a result where higher paid jobs are being lost to imports as opposed to those generated by exports. See Lester Thurow, "A Surge in Inequality," *Scientific American, vol. 256, No, 5,* May 1987, pp. 237.

[15] See Charles F. Stone and Isabel V. Sawhill, "Labor Market Implication of the Growing Internationalization of the U.S. Economy," contract report for the National Commission for Employment Policy, Washington, DC, February 1986.

Table 7-9.—Characteristics of Jobs in 1984, Using 1972 and 1984 Trade Patterns

Category	1984 trade patterns			1972 trade patterns		
	Average (all jobs)	Lost to imports	Gained by exports	Average (all jobs)	Lost to imports	Gained by exports
Workers (millions)	96.9	9.3	6.5	98.7	5.0	4.7
Weekly earnings	$330	$329	$328	$330	$329	$330
% unemployed	6.6	7.6	7.1	6.6	7.6	7.2
Demographics:						
% female	46.0	38.4	40.1	45.8	37.8	40.1
% black	13.2	12.5	12.4	13.2	12.5	12.4
Education:						
% no diploma	18.2	22.3	20.5	18.4	22.3	20.5
% high school graduate	61.2	63.2	63.2	61.2	63.3	63.3
% college graduate	20.6	14.5	16.3	20.4	14.4	16.2
Age:						
% age 16-24	20.2	19.6	19.9	20.2	19.7	19.8
% age 25-54	69.0	69.7	69.3	69.0	69.5	69.4
% age 55+	10.8	10.8	10.9	10.8	10.8	10.8

NOTE: Job totals do not Include self-employed workers.

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

turing industries, 4 were in services, and 1 was in the natural resource sector.

A similar interdependence between sectors is evident in the case of natural resource imports. For every 10 jobs lost due to imports of these goods, 5 were lost in the natural resource and construction sector, 3 service sector jobs were eliminated, and 2 manufacturing jobs were lost.

Service sector imports did not appreciably affect the other two sectors. Although the absolute loss of

Table 7-10.—The Linkage Effect of Trade on U.S. Employment in 1984
(wage and salary jobs created or lost by production sector, in percent)

Production sector	Jobs lost by imports of:			Jobs gained by exports of:		
	NRC	Manufact.	Services	NRC	Manufact.	Services
Natural Resources and Construction (NRC)	**50.5%**	**6.5%**	**1.8%**	**45.7%**	**6.5%**	**4.0%**
Natural Resources	36.9	4.0	0.7	40.2	4.0	1.5
Construction	13.6	2.5	1.1	5.5	2.5	2.5
Manufacturing	**18.9**	65.9	**8.8**	**18.5**	64.2	10.5
Low Wage Manufacturing	2.7	18.6	1.0	**2.6**	7.9	1.4
Medium Wage Manufacturing	10.1	27.4	6.2	9.1	33.7	**6.0**
High Wage Manufacturing	6.1	19.9	1.6	**6.8**	22.6	3.1
Services	30.6	27.7	89.4	**35.8**	29.3	85.6
Transportation & Trade	17.1	17.2	6.3	**22.3**	17.9	55.3
Transactional Activities	10.8	8.0	75.7	**11.0**	8.7	24.6
Personal Services	1.4	1.5	5.5	1.5	1.7	3.6
Social Services	1.3	1.0	1.9	1.0	1.0	2.0
Total (percent)	100.0	100.0	100.0	100.0	100.0	100.0
Total (000s of jobs)	(997.5)	(8,290.0)	(50.2)	848.3	4,082.1	1,611.4

Read the table as follows: Of the **8.29 million jobs lost due to importing manufacturing products in 1984, 27.7** percent were lost in service industries through indirect linkages. Of the 848,300 jobs gained due to natural resource and construction exports, 40.2 percent were gained in the Natural Resource sector itself,

NOTES:
- Brackets denote job loss.
- Totals may not equal 100 due to rounding.

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 in 1980 dollars, unpublished.**

jobs attributed to service imports was small, over 89 percent of the losses were contained to the service sectors—76 percent in the Transactional Activities sector alone. The largest non-service impact was felt in Medium Wage Manufacturing, presumably because it produces service industry equipment like computers, photocopiers, and typewriters.

While linkages spread the losses resulting from imports, they also spread the wealth resulting from exports. In 1984, the export of manufactured goods was responsible for 62 percent of all jobs created by exports. Services played a much larger role on the export side than was the case with imports, generating 1.6 million jobs—nearly one-quarter of all the jobs created by exports. Nevertheless, of all the service sector jobs created through exports, over a million jobs (41 percent) were attributable to manufacturing exports. Ten percent resulted from natural resource and construction exports. As was the case in imports, the export of service products generates few jobs outside the service sector.

Although these calculations are based on limited data, they can provide a rough idea of the relative impact of trade and how it ripples through the economy. It underscores the interdependence of the U.S. production sectors, revealing that the health of one industry is dependent on the success of the others. This is especially true for trade-related service sector jobs, which are tightly connected to the manufacturing sector.

The calculations, of course, may not show some of the most important aspects of trade linkages.[16] Domestic production may be essential for earning profits needed to maintain the momentum of research. Proximity to production facilities maybe needed to manage an effective research and development program. Research and development teams that are widely separated from production systems, or located in firms no longer producing products, appear less likely to keep abreast of the most relevant engineering products and less likely to find inspiration in the practical difficulties of the work place.[17]

[16]Stephen Cohen and John Zysman, *Manufacturing Matters: The Myth of a Post-Industrial Economy* (New York, NY: Basic Books, 1987).

[17]OTA is currently studying this issue in greater depth. See *Technology, innovation,* and *U.S. Trade,* forthcoming.

Trade and the Amenities

Using the techniques just described, it is also possible to trace the effect of trade through both consumption and production networks to show how the provision of different amenities (as outlined in Part I) is affected by trade. Table 7-11 shows to what degree Americans depend on imported products for different amenities, The U.S. Transportation system benefits heavily from imports, both because of heavy imports of fuel needed to power vehicles and because a large proportion of the vehicles themselves are imported. Heavy dependence on imports can, of course, be a mixed blessing. It is an indication that consumers may be enjoying lower prices or more choice in goods and services as a result of trade, but it can also mean that the amenity based on the imported commodity is vulnerable to manipulation by foreign producers.

Clothing and Personal Care is heavily affected by trade, primarily because of rapidly growing imports of labor-intensive clothing. Imports represented 12 percent of Recreation and Leisure spending even though the accounts shown do not include foreign travel (a "non-comparable" item). Purchases of imported home electronics, foreign recreational vehicles, toys, and other items have obviously improved

Table 7.11 .—Imports as a Percent of Domestic Spending by Amenity in 1984[a]

Amenity	Percent
Transportation	21.2
Clothing and Personal Care	18.7
Federal Defense	12.5
Exports	12.2
Recreation and Leisure	11.6
Food	9.6
Housing	8.1
Government (N. E. C.)	7.0
Health	6.3
Personal Business and Communication	6.2
Education	4.9
National average	10.7

[a]Does not include noncomparable imports.

N.E.C. = Not elsewhere classified.

NOTE: These estimates include all direct and indirect imports required to meet each class of amenity. They include imports of capital goods needed for domestic producers to satisfy the amenity. They also Include transportation, trade, and transaction costs associated with imports, less costs that would have been incurred whether or not the item was imported. This means that only the incremental cost of transportation and handling is associated with an import.

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 1984 trade estimates rebased into 1980 dollars, unpublished.

the quality of leisure for many Americans. Virtually all Food imports involve what agricultural traders call "high-value" products—those other than bulk grains. Imports of fruits, vegetables, and foods that reflect foreign tastes (i.e., Italian tomatoes or Dutch beer) have grown so large that they equal U.S. exports of grains.[18]

In Housing, direct imports are largely limited to purchased energy (primarily oil) needed for heating, a large variety of home appliances, and building components. In the future, however, it is possible that imports will grow to include a much wider variety of housing components—possibly entire house sections. These issues are discussed in greater detail in chapter 9.

Table 7-11 also includes the indirect effects of imports, such as the sophisticated machines that produce domestic fabrics (virtually all imported), food processing equipment (heavily imported), machine tools that increase the productivity of domestic automobile manufacturing, and other items in the complex production networks serving U.S. consumers.

Under the assumptions made here, even 12.5 percent of Federal Defense spending results directly or indirectly from imported items. This may overstate vulnerability since DoD tries to select "domestic" products but many "domestic" products have foreign components. A recent Defense Science Board analysis found that defense purchases are often faced with a choice between buying the best item and buying a domestically produced item.[19]

The growth of production networks across international borders is apparent from the fact that fully 12 percent of the value of U.S. exports results from imported products. If nothing else, the competitive position of U.S. exported products is heavily dependent on the price and availability of imported products. Connections become apparent during events such as the recent attempt to block Japanese semiconductor imports through high tariffs. One immediate result was concern about an increase in the cost of U.S. products containing imported semiconductors.

[18] *A Review of U.S. Competitiveness in Agricultural Trade—A Technical Memorandum,* op. cit., footnote 4.

[19] Defense Science Board, **"Task Force on Defense Semiconductor Dependency," Washington, DC, December 1986.**

A FINAL ASSESSMENT: WEIGHING THE COSTS AND BENEFITS OF TRADE

Given the complex way that trade has insinuated itself into the Nation's production networks, its net effect is obviously difficult to measure with precision. While the advantages of trade can be clearly demonstrated in a world where prices and products are comparatively predictable, it is possible that trade can lead to real hardship during periods of rapid change. Comparative advantage in today's international markets depends heavily on a producer's ability to capture the "rents" of innovation when marketing products that embody new technology, in order to recover investment in research and development.

It is entirely possible that if foreign firms prove more adroit in exploiting technical opportunities, and if this results in a situation where industries with the potential for rapid productivity growth fail in the United States, the United States could find itself specializing in comparatively poorly paid industries while importing technically sophisticated products from abroad. The *comparative* position of the U.S. economy could fall if the United States fails to manage trade effectively in a dynamic environment. It is even possible that the *absolute* level of U.S. living standards could decline if trade, in effect, reversed the comparative positions of the United States and trading partners that were formerly less affluent.

Rapid loss of markets in a fast-moving area like consumer electronics can rob a firm of profits needed for research and new investment. Even worse, it can break critical links in the chain connecting production and engineering innovation. American companies that maintained comparative advantage in highly productive manufacturing sectors may be forced out of the market altogether.

The converse of this argument is the difficulty of building comparative advantage in a new area when the pressure of trade makes it difficult for investors

to take a chance on an "infant" enterprise. This has been a point of contention in U.S. policy since Alexander Hamilton made the case in his *Report on the Subject of Manufactures.*

It certainly appears that Japan and other nations have been able to make skillful use of trade protection in an overt policy designed to create areas where they will have comparative advantage. The question at issue is whether they could have done better using other means to stimulate development. A critical problem is determining when an enterprise no longer requires protection from trade, since politics invariably plays a large role in creating the answer.

The issue would be largely irrelevant if the United States had succeeded in maintaining a position of leadership in the product cycle. It gains importance when the United States must regain lost markets. The problem becomes all the more vexing in an environment where virtually every enterprise has become an infant in terms of continual rebuilding through innovation. The discussion of Part 11 suggests that successful enterprises in the emerging economy will, in essence, be perpetual "infants" in the sense that their products and production are in the process of almost continuous change. Even a mature business sector like apparel may be about to embark on a bold venture into new technology. Their case for protection from international competition and trade may be at least as valid as the case made by producers of advanced electronics.

Currency issues present a separate problem. In principle, market forces can lead to adjustments in world wage rates and currency exchange rates over the long term; however, many factors prevent these adjustments from being made rapidly. A nation with rapidly rising productivity, for example, is likely to have a work force whose wages have not risen as rapidly as productivity either because workers fail to capture the higher wages that they might eventually be able to command as a result of productivity growth, or because domestic policies block wage increases as a conscious element of growth policy. During the time it takes for local wages to catch up with productivity growth, the nation can have an important, albeit perhaps only temporary, comparative advantage in crucial areas of production.

Employees of U.S. firms that suddenly find themselves at a comparative disadvantage in international markets can face massive problems of adjustment. Constant turmoil can lead not only to personal hardship but lead to enormous inefficiencies. Trade has left entire communities in areas of the rust belt and textile production regions of the South with no major employer and little time to adjust. Adjustment costs can be so large that they overwhelm the long-term benefits.

While the costs of rapid transformation do not undermine the clear benefits of expanding trade, they do provide a justification for developing a trade policy that can ensure a graceful transformation. investments in retraining, and other programs designed to give individuals and communities an opportunity to benefit from transformation, can play a key role in ensuring that the theoretical benefits of expanded trade become real benefits.

Rapidly expanding trade can lead to a variety of other problems not easily measured in economic terms:

- **Loss of Control Over the Domestic Economy.** The sheer volume of U.S. trade in relation to the size of the domestic economy severely constrains the ability of the United States to use standard macroeconomic tools unilaterally to manage the economy. Attempts to stimulate growth through domestic spending may serve only to stimulate imports. Unilateral efforts to change or to control the exchange rate are also extremely difficult. The extent to which this loss of control translates into disruption depends heavily on the degree of cooperation among major trading partners, or lack thereof.

  In an economy without foreign trade, increased domestic spending can only be met through expanded domestic production. The regulating system is automatic: consumption increases until labor shortages drive up prices. The government can intervene to "fine tune" the economy by adjusting its spending. In an open international economy, however, increased spending can be achieved through increased imports. The regulating system becomes international in scope and options for unilateral government control become much more limited.

  The volume of international commerce in fields like banking and telecommunications

mean that decisions that were once made primarily for domestic reasons here and abroad now have a significant influence on international trade. With billions of dollars flowing daily through international financial markets, inappropriate coordination of international regulation can be dangerous as well as inefficient.

The limits of unilateral control may be particularly great in times of crisis, as the international stock market crash of October 1987 proved with disturbing clarity. Such factors as a sudden loss of confidence in the U.S. economy leading to capital flight, a precipitous decline in the value of the dollar, or sudden changes in a major nation's attitude toward free trade could precipitate an acrimonious chain reaction of retaliation and panic unless sound measures are in place to coordinate domestic reactions.

- **Problems of Equity.** For reasons just discussed, it is entirely possible that while trade could increase average wealth in the United States, it can have a strong effect on the distribution of wealth and income. Evidence presented in chapter 8 suggests, for example, that in recent years trade has disadvantaged male workers with craft skills, while advantaging managers and scientists.
- National Security. A productive and innovative domestic economy is essential for the maintenance of American defenses. Recent evidence of declining U.S. capabilities in microelectronics, advanced materials, and other strategic areas calls into question America's ability to rely on domestic suppliers for state-of-the-art technology. Military procurement is forced to make the difficult choice between buying an American product or buying the best product. Decisions of this kind also cast doubt on U.S. ability to use technology to offset East Block advantages in manpower and other resources. (Comfort perhaps can be taken from the fact that the East is probably even less efficient than the United States in exploiting new technology, but this is scarcely a sound basis for security.) This issue is explored in greater detail in chapter 14.

  Trade may also affect security by creating such high levels of dependence on foreign suppliers that overall U.S. flexibility in foreign affairs can be compromised. U.S. dependence on imported oil proved disastrous this past decade, and could well be disastrous again. A $50 billion increase in oil imports (measured in constant 1982 dollars) is likely by the turn of the century. A case can be made that loss of domestic capacity in steel and other materials can also lead to difficulties in periods of high international stress.

It is necessary to distinguish problems actually caused by imperfect trade policy from problems simply revealed by free trade. A nation unable to discipline domestic consumption, or losing the ability to innovate because of excessive shortsightedness and self-interest, is unlikely to find its problems easily corrected by changes in exchange rates or explicit manipulation of imports. Indeed, sheltered from the pressures of trade, a nation losing its ability to innovate may simply find itself falling more rapidly behind the world state-of-the-art.

There is no simple formula for ensuring that free trade works to the advantage of the United States, while avoiding the many problems that trade can create. Fiscal policy and strategies for supporting research may affect trading patterns as powerfully as measures affecting trade more directly. Chapter 14 explores options in a variety of different areas.