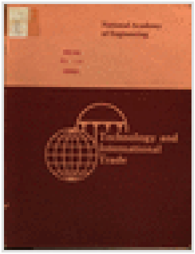

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2. To explore means for promoting cooperation in engineering in the United States and abroad, with a view to securing concentration on problems significant to society and encouraging research and development aimed at meeting them.

3. To advise the Congress and the executive branch of the government, whenever called upon by any department or agency thereof, on matters of national import pertinent to engineering.

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TECHNOLOGY AND INTERNATIONAL TRADE

John R. Pierce and Eugene G. Fubini

Foreword

How and why the National Academy of Engineering came to present a Symposium on Technology and International Trade is recounted briefly in the Introductory Remarks of John R. Pierce. The principal motive for the selection of this topic was growing concern for the welfare of America.

In Sputnik, Americans saw a Soviet challenge in science and technology. They responded magnificently, and America won succeeding laps of the space race. Today, the writers feel and the symposium confirmed, that we face a greater and more serious technological challenge. Sputnik was as catastrophically visible as a hailstorm on a sunny day. The challenge that we face today is less easily perceptible. It can be likened to the gradual transition from summer to winter. Hard to observe as it happens, the change from summer to winter is far more serious than a sudden storm.

How is America's welfare threatened by the gradual changes with which the symposium concerned itself? America has about 6 percent of the world's population but consumes from 25 percent to 50 percent of the world's resources. To pay for the raw materials it needs—fuel, metals, and chemicals—our country must export. Michael Boretsky's paper eloquently expounds the hazards that he has seen. Figure 1, drawn from his data, shows that our imports are creeping up on our exports. The rate of increase of imports fell off slightly from 1968 to 1969 because of unfavorable economic conditions in this country, but the long-range trend is clear.

Boretsky's data point to trade deteriorations in minerals, feeds, and the like, in nontechnologically intensive manufactures, and in technologically intensive manufactures. He finds that the most effective contribution to our balance of trade is in technology-intensive products, including aircraft, computers, and other electronics. However, technology-intensive exports create a favorable balance of trade chiefly in trade with nontechnological nations. Figure 2 shows that imports from Japan have outstripped exports to Japan since 1965.

In analyzing the factors at work, Boretsky finds that inflation in the sense of rising prices cannot be responsible; prices have risen

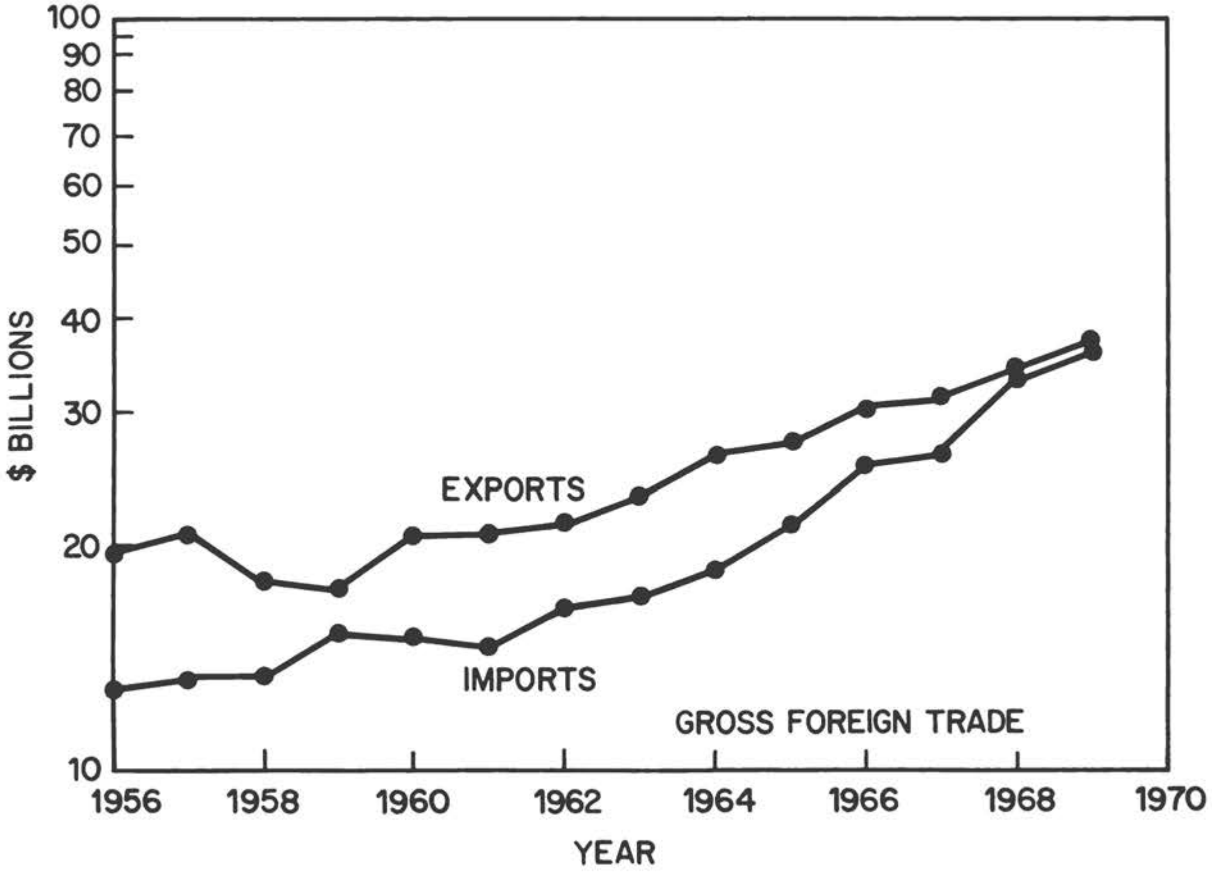

FIGURE 1 Comparison of the Rates of Increase for U.S. Exports and Imports

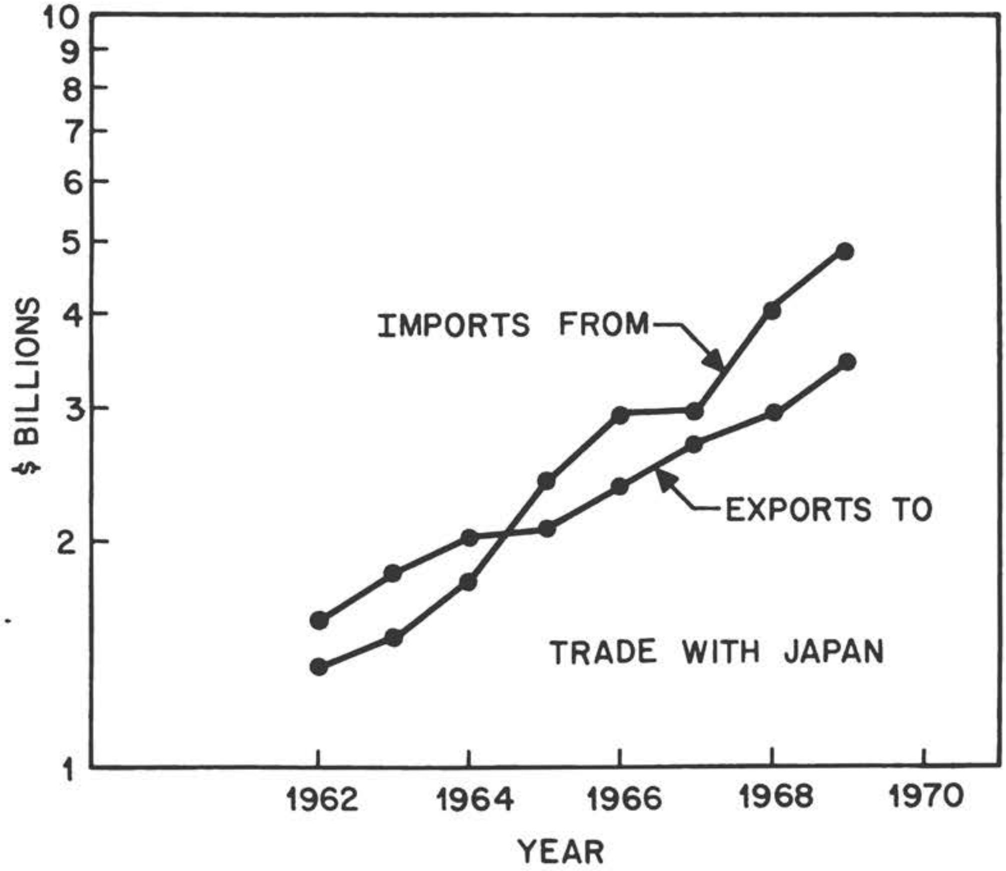

FIGURE 2 Comparison of U.S. Exports to and Imports from Japan

more rapidly in competing nations, and especially in Japan, with which we have an increasingly unfavorable balance of trade.

Concern with balance of trade is an old one. Richard N. Cooper's paper gives a clear and relevant picture of the past. Cooper distinguishes between technology that enables a nation to produce standard products more cheaply and the technological creation of new and profitable exports. He discusses efforts to control the export of technology, which can give a temporary but not permanent advantage. He points to social acceptance of and desire for change as a necessary condition for the success of innovative technology. He makes a very important point: The time between innovation in one country and its successful imitation in another has drastically shortened. A nation can no longer comfortably enjoy the fruits of past innovation; if it is to compete, it must continually use innovation to cut costs as well as to produce new products.

Cooper divided the technological history of the United States into various stages. Until 1850, Great Britain had a clear lead in technology, in agriculture as well as industry. From then to the 1940's, the United States gradually overtook British applied technology, but continued to rely on Europe for basic scientific advances. Since the 1940's, basic science and applied technology have originated largely but never wholly in the United States. We may be entering a phase in which the United States retains scientific leadership but increasingly shares pride of place in applied technology with five or six other countries.

Cooper concludes that the United States should not allow a monetary environment that puts American firms at a disadvantage in the world market, and that American technology must become more conscious of costs.

Speakers from four widely differing industries took part in the symposium. Figures 3-6 give data concerning these industries.

Our computer industry leads the world and is a profitable source of exports. Unhappily, the present Department of Commerce industrial classifications do not make it possible to obtain very good data concerning this industry. In 1969, domestic production classified as business machines was $6.8 billion. Figure 3 shows exports and imports as a fraction of domestic production for the period 1964-1969. The figure shows large exports with a continued commanding lead over imports.

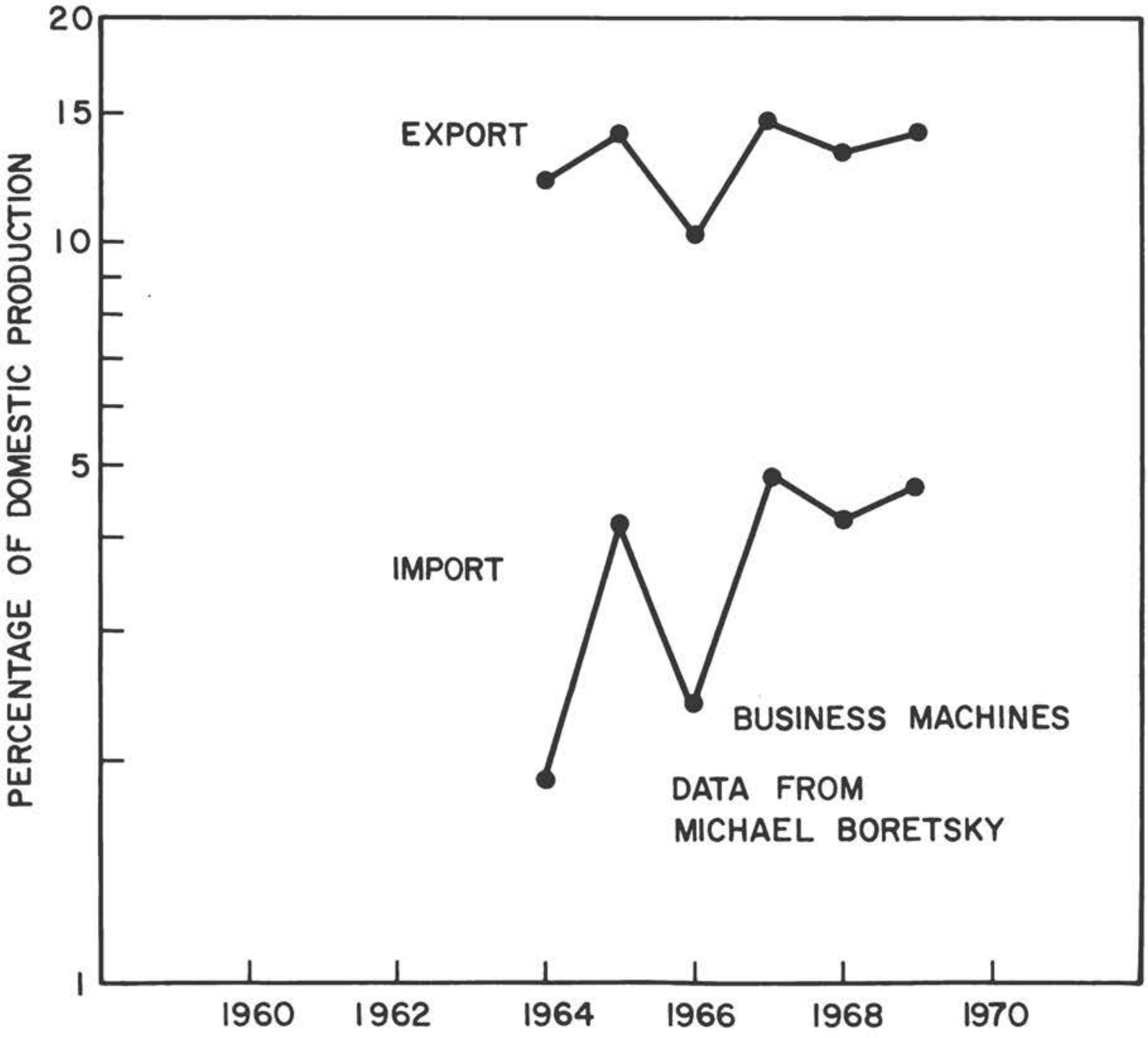

FIGURE 3 Comparison of U. S. Exports and Imports of Business Machines

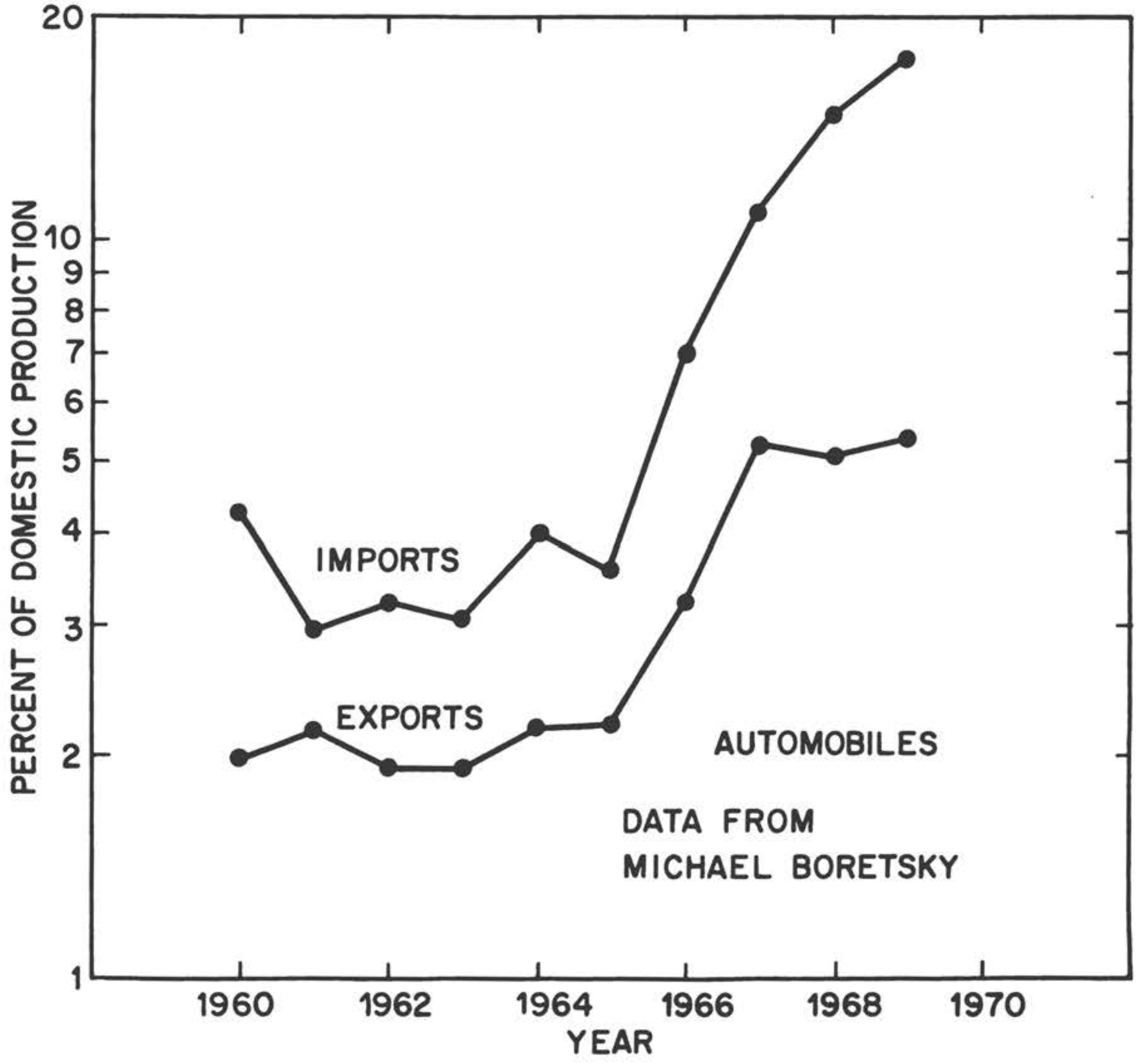

FIGURE 4 Comparison of U.S. Exports and Imports of Automobiles

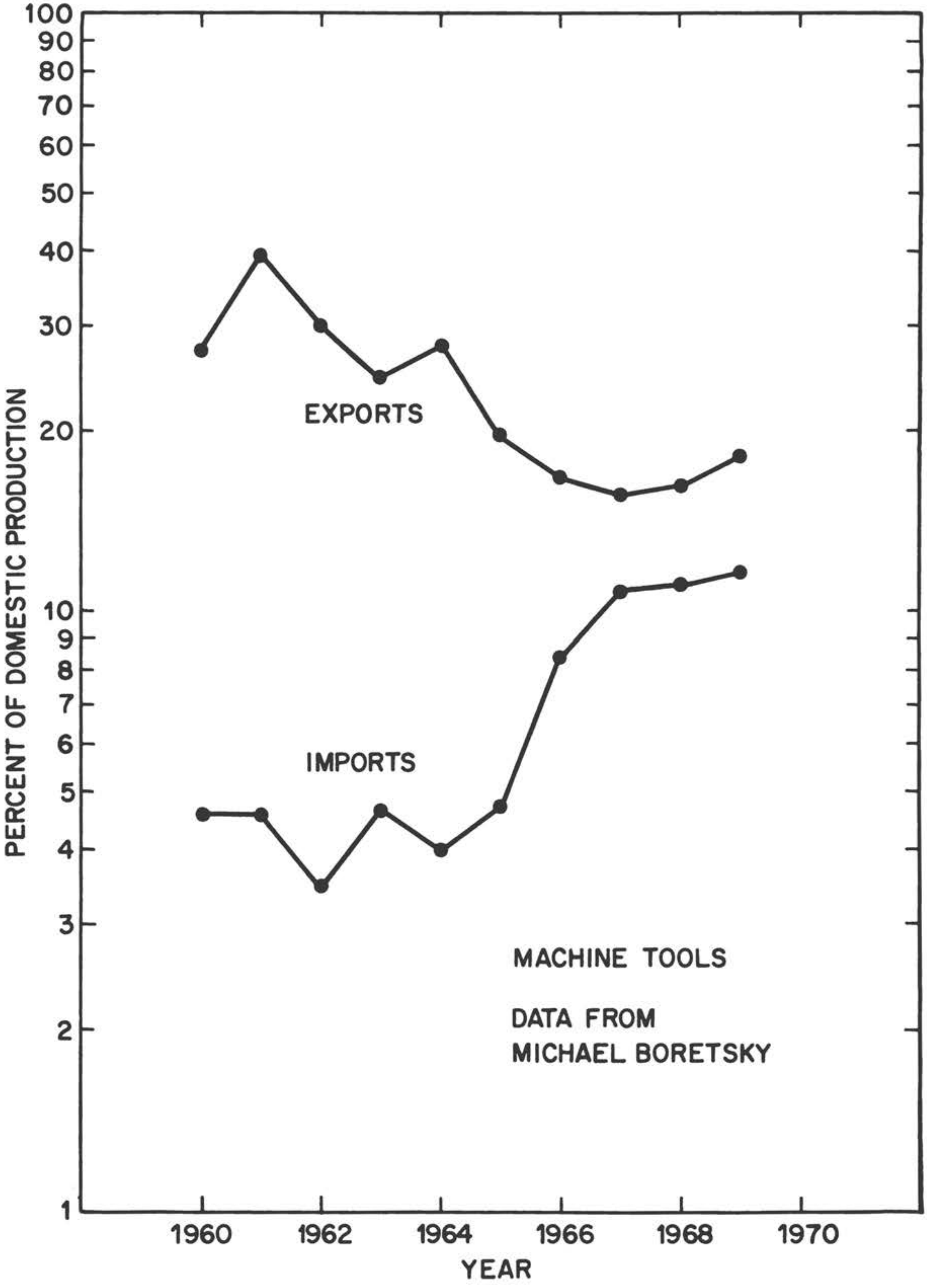

FIGURE 5 Comparison of U.S. Exports and Imports of Machine Tools

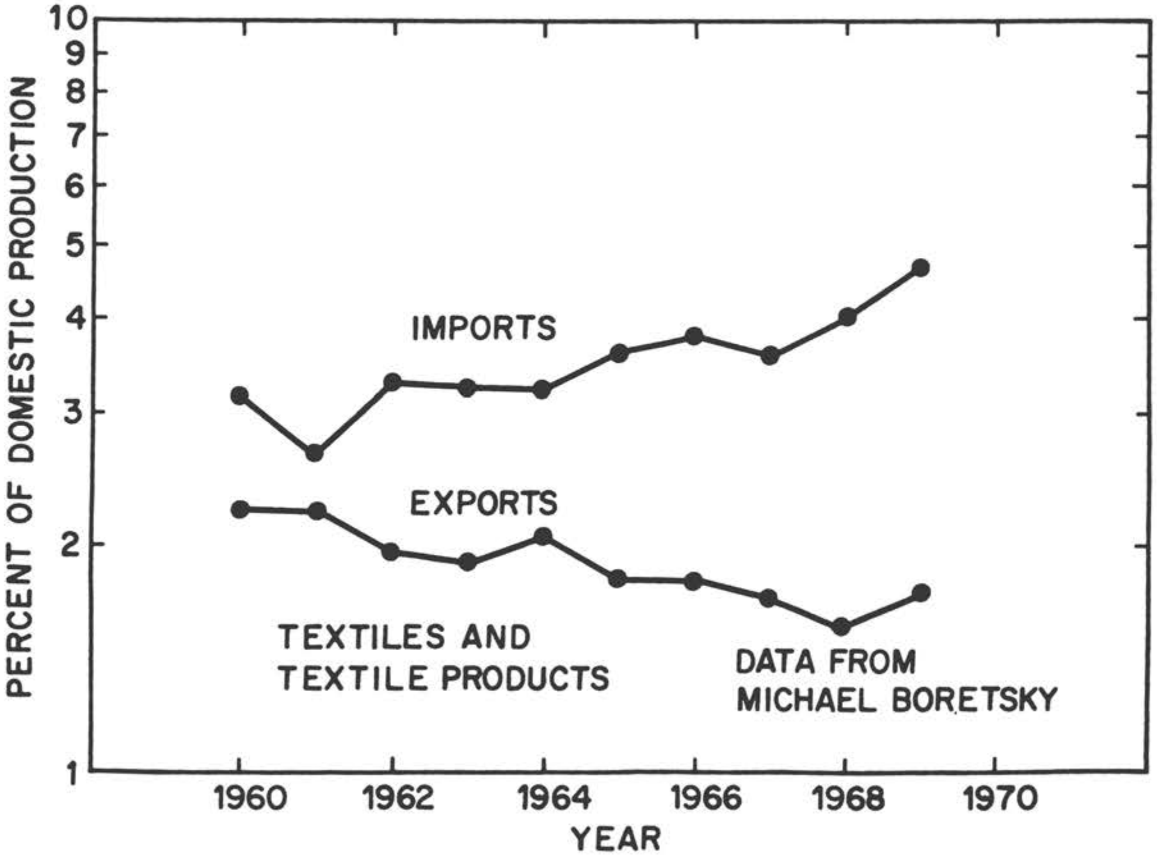

FIGURE 6 Comparison of U.S. Exports and Imports of Textiles

Domestic production of new cars was $18. 6 billion in 1969. Automobile manufacturing is a large and prosperous industry. Nonetheless, Figure 4 shows that imports have exceeded exports during the whole period shown (since 1960) and that, since about 1965, imports have been climbing rapidly as a fraction of domestic production.

The machine tool industry is of moderate size but great importance. In 1969, domestic production was $1. 6 billion. As Figure 5 shows, exports of machine tools have been and are a considerable fraction of domestic production. Imports were small in the past, but have been rising rapidly.

Our textile industry is very large. In 1969, production was $44. 8 billion. Figure 6 shows that imports, which exceed exports, are a moderate fraction of domestic production. However, imports have been gradually rising and exports gradually declining for the entire period shown.

Today, America's lead is clear in certain innovative products, such as aircraft and computers. Jacques G. Maisonrouge, President of IBM World Trade Corporation, eloquently recounts additional developments and their implications: for example, the impact of data processing on the speed and complexity of world trade, the part of the multinational corporation in world trade, and the impact of computers in the automation of the production process.

As an example of the effects of automation, Maisonrouge cites a steel production of 200 tons per worker per year for a Japanese firm, 150 for ARBED in Luxembourg, 130 for Thyssen in Germany, and less than 100 for British Steel.

Maisonrouge observes that in 1969 U.S. companies realized $7 billion on their investments abroad. Multinational companies create markets abroad and also take advantage of research that can be performed abroad. Sometimes, these companies export parts and finished goods.

It is clear from Maisonrouge's paper that multinational companies contribute much to this country and to the world—including the rapid diffusion of technology.

Strong as our automobile industry is, it does not contribute to a favorable balance of trade. Richard C. Gerstenberg, Vice President of the Board of General Motors, noted that the technological gap is closing. In the face of growing foreign competition, a rise in American labor costs that outstrips productivity, and rising absenteeism, the American automobile industry is making heroic efforts through automation to make the productivity of labor rise as fast as wages. We can only hope that these efforts will succeed, for Gerstenberg sees a growing world market for automobiles. Like Maisonrouge, Gerstenberg looks toward sales on a growing world market. He is against trade barriers.

Henry D. Sharpe, Jr., President of Brown and Sharpe Manufacturing Company, characterizes machine tools as the master tools of industry, on which manufacturing industries depend. Sharpe describes our postwar efforts to finance and rebuild the machine tool industries in West Germany. American technology flowed to Western Europe and Japan. American capital went abroad. The result was a warm feeling and a reduction of the technological gap. Today, the American machine tool industry is hard pressed on both the domestic and the foreign market.

Sharpe sees remedies, not in multinational corporations or in freer trade, but rather, in obtaining for American industry as favorable treatment, here and abroad, as foreign governments provide for their industries. Such treatment could include support for innovation, financial and tax policies favorable for innovation, and support in all matters relating to foreign trade.

Frederick B. Dent, President of Mayfair Mills, indicates that even the high productivity of labor in American textile manufacture has not been enough to meet the wage differential. He says: "Today the U.S. textile industry faces a crisis." He regards pending trade legislation as necessary to achieve support of American industry comparable to that provided by other governments as well as to save our textile industry.

Thus, the tenor of the symposium was that American industry has been increasingly troubled in both foreign and domestic markets by the rapidly increasing technology in Western Europe, and even more so by that of Japan.

If these developments present a clear and present danger to our country and our way of life, how can we prevent our technological leadership from slipping away? How can we maintain and widen a technological gap? For only in this way can we assure ourselves of the raw materials we need. Only in this way can we maintain a standard of living preeminent in the world.

Clearly, the general answer must lie in a lead either in innovative products or productivity of labor. It is not easy to see how to encourage either. Research and development, new science, and new technology, are needed.

Almarin Phillips' paper shows the thought that economists have expended on understanding how science is related to and integrated into industry. There is no clear agreement in this important area.

Perhaps remedial action should lie only partly in the direct manipulation of technology. In addition, government tax and other policies that will encourage industries to modernize their plants and to operate efficiently and other government actions that favor exports may be needed. A number of such approaches are discussed in the papers by Sharpe and Dent. These include tax treatment of capital gains favorable to innovative industries, fast write-offs, investment credit, a value added tax to encourage efficiency instead of inefficiency, quotas, tariffs, encouragement and support of activities abroad, and other matters.

Another avenue to technological advance is direct government support of research in government laboratories, universities, and industry.

It appears that in general other governments act in ways more conducive to the advance and fostering of successful and innovative industries than our government does.

Not only were these various approaches (discussed in the preceding paragraphs) treated in detail in the various papers, but these and other matters also were discussed at length among the speakers and the audience in a two-hour afternoon session.

During this discussion, Richard N. Cooper suggested that imports rose more swiftly than exports after 1965 because of inflation, in the sense of demand in excess of supply (not in Boretsky's sense of rising prices). The other speakers judged the primary cause to be technological, though they acknowledged an inflationary effect.

Although the speakers from industry denied that new technology could be withheld from other countries, informed members of the audience did not entirely agree and stated that the release of useful technology in some fields, including nuclear energy, has been sensibly and profitably controlled.

No clear agreement was reached on ways of maintaining a technological lead. All were concerned because wages have been rising faster than productivity in this country. Maisonrouge of IBM, and Gerstenberg of GM, praised free trade, multinational corporations, automation, and growing world markets. Sharpe (machine tools) and Dent (textiles) looked to favorable actions by the government. In particular, they advocated treatment at least as favorable as favorable as that given in other countries.

There was little enthusiasm for research in government laboratories. Effective government support of research and development in industry is hampered by the unattractiveness of government contracting procedures and regulations compared with work for the nongovernment market. The effectiveness of government supported university research was questioned, and there was some suggestion that present engineering education does not fit students for the problems and challenges of technology in industry.

In all, the symposium confirmed that the nation faces a very serious challenge in the field of foreign trade. The technology gap is narrowing; in some cases it has reversed. Reasons can be found, and remedies have been suggested, but none is as certain as the fact that the situation is worsening.

America's physical and social well-being depend on a powerful technology and healthy industries. These give us the means for a good life and for social action. There is every reason to believe that a strong, progressive industry can do more for us, and can do more to rectify ills, than a faltering, unprofitable industry. For more than a quarter of a century we have taken technological preeminence and our industrial strength for granted, as if no action, domestic or foreign, could threaten them. Now they are threatened, and so is our power to do the things that would make our world better.

We face a challenge far more serious than Sputnik, but it is not one that can be met by establishing a National Aeronautics and Space Administration and appropriating billions of dollars. It is difficult to develop courses of action the success of which is relatively assured.

Clearly, our attitude must be one to foster success; we must not pamper or support or try to pay for the consequences of failure but reinvigorate and inspire progress. We must correct remediable weaknesses, not subsidize irremediable failures. We can work directly toward the advancement of technology, or indirectly toward encouraging industries toward technological advances and increased exports.

The challenge is to all Americans—to government, industry, and the American public—and especially, we believe, to institutions such as the National Academy of Engineering.

INTRODUCTORY REMARKS

John R. Pierce

Over a decade ago the American people saw a great challenge in Sputnik. Apollo was one response that our nation made to this challenge. After a late start and with all the world watching, we won decisively in the next phase of the space race. American technology proved best. We made other responses as well, such as increased interest in and education in science and engineering and lavish government support of research.

Today we are facing a technological challenge far more important to us and far more difficult to meet than the challenge of Sputnik. As much as five years ago I became concerned about America's economy. In an article in Science (1), I expressed fear that, "By government support we are inadvertently alienating engineering education from the civilian economy." By 1968 I was worried by an unfavorable trend in our balance of trade, especially with such technologically competent nations as Japan and West Germany. I communicated my concern to the National Academy of Engineering's Committee on Public Engineering Policy, of which I was at that time vice chairman.

My concern was shared by Chauncey Starr, chairman of that committee, and by other members of the committee and of the Academy. Especially, Patrick Haggerty and Eugene Fubini, who had similar concerns, believed that a meeting should be held to explore the matter, and they and I set out to organize such a meeting. Henri Busignies, chairman of the Projects Committee, and the members of that committee agreed. Thus, this Symposium on Technology and International Trade became the program of the 1970 Sixth Autumn Meeting of the National Academy of Engineering.

Our success in competing in international trade both at home and abroad is of great importance in itself. Further, it may give us an indication of the health of our technology.

Our standard of living has long led the world. Our prosperity has come from within. The American economy has produced more goods and services per person than have the economies of other nations. With what we exported, we were able to buy what we needed from other lands. Partly, nature favored us. Surely, however, effective science and technology have been responsible in a large measure for our high productivity.

Today, our productivity per man-hour appears to be increasing slowly, if at all, and our standard of living appears to be stationary or declining. At the same time, the productivities and standards of living of some other nations are rising rapidly. We might blame our troubles on unrest and disorder, but it would be as plausible to blame unrest and disorder on the poor prospects many Americans see for substantially bettering their lot.

Today we have with us as guests of the National Academy of Engineering a number of distinguished men outside the field of engineering. These seven men, distinguished in the fields of economics and industry, will discuss America's role in international trade, some present problems and concerns, and the relation of technology to industry. They will tell us about the current success of American industry in international trade. They will give us their reasons for any difficulties that they are aware of. They will discuss possible remedies. Finally, in a panel discussion, through a process of comments and questions, among themselves and with the rest of us, they will further illuminate the subject.

It is our problem to decide whether we see in the conditions they describe a serious challenge to America and a serious threat to our way of life. If we do recognize this challenge, we must decide whether it is addressed to America's engineers and America's technology.

What is the appropriate action for us to take, as members of the National Academy of Engineering, as engineers, and as citizens?

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TECHNOLOGY AND U.S. TRADE: A HISTORICAL REVIEW

Richard N. Cooper

In recent years we have heard two contrasting though not mutually contradictory views regarding the impact of technical change on American trade. The first, from the eastern side of the Atlantic, marvels at, envies, and resents the yawning technological gap between the United States and Europe, enabling American producers to outdistance European firms even on their own home ground. The second, coming largely from the western side of the Atlantic, expresses alarm at the loss of a technological lead by the United States and points to this as a major cause of the recent deterioration in the U.S. trade position.

Both viewpoints have a long history; both also have undergone periods of quiescence. We heard little about the loss of U.S. technological leadership in the early 1950's, during the period of world dollar shortage. The U.S. Government was then concerned with the problem of transmitting American know-how to the rest of the world through such vehicles as President Truman's Point Four Program and the Organization for European Economic Cooperation (OEEC) Productivity Teams sent from Europe under the auspices of the Marshall Plan to study U.S. techniques. The absence of the second argument during the period of dollar shortage, and its reappearance in the late 1950's following the emergence of a U.S. payments deficit—in short, a link to monetary developments—is not an accidental one, as I shall attempt to show.

In this presentation, I shall offer a brief historical survey of the role of technology in American foreign trade. I shall then step out of the historian's role and offer a few remarks about the current situation.

The earliest trade was based largely on resource availability. Salt was traded for wine, because salt was not available where the wine grapes grew, and the wine could not be made where the salt was mined. Special skills played some role in this early trade, particularly in connection with jewelry and simple tools. This role was based largely on craftsmanship rather than technology, although to be sure the line between the two is not always easy to draw. However, technical knowledge played some role in trade even over two thousand years ago, for example, in the case of the famous Phoenician dye, Tyrian purple, the secret of which was so closely guarded that it was eventually lost.

Resource availability has continued to provide an important basis for trade. Technology also began to play a key role with the advent of the mechanical age in the eighteenth and nineteenth centuries. We must not suppose that the impact of technology on trade is confined to the visible, tradable, technologically based product, such as the telephone or the jet aircraft. Technology can affect trade through at least three important channels:

1. Improvements in production processes, based on technological developments, will influence trade by reducing the costs of production of some goods relative to others and, at least for a time, of some locations relative to others. Examples of these process innovations are the electrolytic refinement of aluminum and the fixation of nitrogen from the atmosphere. This category might also include genetic improvements in plants to resist disease or to respond to fertilizer.

2. New products enter trade directly. Product innovations include most of the celebrated inventions; for example, the telephone, the diesel engine, and the jet aircraft.

3. Some new products, however, lead to a reduction in costs by improving processes. This category includes a long list of agricultural machinery and machinery for spinning and weaving. It also includes, not least for long distance trade, improvements in inland and oceanic shipping, the locomotive, the steel hull, the ship-to-shore radio.

The first and third channels have undoubtedly been far more important than the second, even if sometimes less conspicuous to the public. Indeed, for many years in the early period of the industrial revolution, Great Britain, the source of most early mechanical innovations, sought to ensure that the main impact of new inventions on trade would be through the third rather than the second channel. Prohibiting the export of machinery, especially textile machinery, in which substantial advances were then being made, was the means adopted to achieve this goal.

These various channels by which technology may affect trade make it difficult to trace accurately the impact of technology on trade, since the most important effect of a given change may be on the very traditional commodities. It is not always the glamorous new product that provides a strong export performance. Nonetheless, because of its visibility, hence its ability to provide at least some quantitative information, I will focus on the machinery industry, which has long been an important source of technical change and in the nineteenth century is clearly the most important source.

Great Britain took an early lead in the development and commercial exploitation of machinery, both for the production of power and for the manipulation of materials. Its earliest impact on trade was in the area of textiles, and Great Britain quickly became the world's leading source of low-cost, machine-made textile products. Later coal (for which mechanical pumps and hauling were important) and iron and steel products became important British exports. Machinery directly accounted for a negligible part of Great Britain's exports, amounting in 1830 to less than one percent of the total. Indeed, Great Britain was very conscious of the advantage for exports of its technological lead and prohibited the exportation of machinery, models, and even drawings on the grounds that such exports would lay the basis for foreign competition. These controls were gradually relaxed and finally removed in 1843, as it became clear that these prohibitions would not prevent the spread of technical knowledge; instead, they would impede British exports and encourage the development of machinery industries abroad. A considerable amount of smuggling, especially of drawings and models, occurred, but the principal means of transmission was through emigration of skilled workmen. For example, an Englishman, William Slater, in 1790 built the first spinning mill in the United States; he had memorized the design of a British mill. By the early nineteenth century hundreds of English craftsmen in the United States, Belgium, France, Saxony, Prussia, and elsewhere were laying the foundations of the machinery industries in those countries.

Americans built an extensive machinery industry relatively early, and by 1840 were exporting machinery to Russia, Prussia, Latin America, and even some to Great Britain. Some observers in Great Britain were concerned about the loss of markets to British products. However, a Parliamentary Report in 1841 concluded that British machinery still had a commanding lead both in quality and price after making allowance for quality, although it recognized the mechanical ingenuity of Americans and their proclivity to invention.

Fifteen years later, the British public was shocked when the Enfield Arms Establishment in Great Britain found it necessary to import machinery from the United States for the manufacture of small arms. A new Parliamentary committee found that on the whole American machinery was still behind that made in England. The committee issued the observation and warning that "in the adaptation of special apparatus to a single operation in almost all branches of industry, the Americans display an amount of ingenuity, combined with undaunted energy, which as a nation we would do well to imitate, if we mean to hold our present position in the great market of the world" (1). The committee found a U.S. lead in a number of types of machinery, and thereafter technological leadership, as distinguished from craftsmanship and from scientific advancement, passed increasingly to the United States. Americans were ahead in two quite different senses: (a) they became the major source of new mechanical and, later, electrical innovations; and (b) they were quick to adopt and apply inventions and discoveries made elsewhere. However, the American lead was not a universal one. Germany, for example, early established its leadership in the chemical industry and, in 1900, German exports of chemical products were about three times the value of American exports of similar products. Even in the areas in which Americans did excel, the impact on trade was largely of the indirect type, reflected, for example, in the rapid increase in grain exports to Europe in the late nineteenth century. These exports were boosted by mechanical improvements in planting and harvesting, inland transportation, and ocean shipping—notably the perfection of the steamship, the steel hull, and the screw propeller—these last improvements coming largely from Great Britain. Exports of finished manufactures accounted for only 10 percent of U.S. exports as late as 1840, and by 1900 were still under one fourth of U.S. exports. Exports of machinery accounted for only 2 percent of the total in 1880, 6 percent in 1900, and 8 percent in 1913. These figures compare with 64 percent and 28 percent, respectively, in 1969. Machinery imports into the United States in the mid-nineteenth century were also low, although iron and steel manufactures from Great Britain, the quality of which was generally superior to corresponding American products, amounted to about 10 percent of total imports. Finished manufactures accounted for over half of the total.

Why did the United States early capture the technological lead? The answer is partly psychological, and partly economic. Americans had a frontier psychology under which novelty and change were taken for granted, accepted, approved, and encouraged. Compared with other countries there was relatively little social resistance to economic innovation and its consequences, which resulted in an atmosphere in which innovation was encouraged. The importance of receptivity is illustrated by the case of the sewing machine, which in primitive but effective form was invented by a Frenchman, Thimonnier, 16 years before Elias Howe constructed his machine in the United States. It was actually used to mass produce uniforms for the French army, an early example of government support for innovation. But Parisian tailors formed mobs, smashed the machines, and forced Thimonnier to flee from Paris.

On the economic side, two related factors were at play. The first was the higher average incomes in the United States than other countries, even in the early nineteenth century. The second was the higher labor costs, resulting from a shortage of labor relative to resources, particularly arable land. The higher incomes put Americans on the frontiers of consumption spending, with more income to spend on products beyond the bare necessities of life, thus providing a mass market for new products. This feature has been especially important in this century, but it already played some role in the late nineteenth century in, for example, the rapid extension of telephones and household electrical apparatus. The higher labor costs meant that businessmen and their suppliers were constantly searching for techniques to conserve on labor, and most innovations in nineteenth century America, such as the sewing machine, the linotype, and the typewriter, were of the labor-saving type. This search was so intensive that labor-saving devices were introduced even when they required modifying the finished product, thus requiring and presupposing customer acceptance, which depends on the psychological attitude toward change.*

Alexis de Tocqueville marveled at the technical ingenuity of Americans as early as 1835 ("...no people in the world have made such rapid progress in trade and manufactures..."), a British Parliamentary committee expressed mingled admiration and anxiety at American inventiveness in 1855, and still later this anxiety turned to alarm about the economic viability of Europe:

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*The importance of customer acceptance has been emphasized by Nathan Rosenberg in, The International Transfer of Technology: Some Historical Perspectives (1970 mimeo.). He contrasts American attitudes with those in Britain, where most innovations were initiated by the customer rather than the machine-builder, the latter being regarded much like a custom tailor, a craftsman working under instruction.

"Europe has...reached a turning-point in her development. The solving of the great problem of the material well-being of nations...is no longer a distant Utopia. It is near at hand. The disastrous competition which, in all domains of human activity, we have to submit to from over the seas, and which we will also have to encounter in the future, must be resisted if the vital interests of Europe are not to suffer, and if Europe is not to fall into gradual decay...the twentieth century of struggle for existence in the domain of economics. The nations of Europe must unite in order to defend their very means of existence" (2).

Except for some slight archaisms, this could be Servan-Schreiber writing in 1968. In fact it is the Austrian Foreign Minister, Count Goluchowski, speaking to the Austro-Hungarian Parliament in 1897. He does not specify the danger as being technological, but he is clearly concerned with powerful competition from North America, and the base of that competition was technological.

However, the turning point was near at hand, and not exactly of the character envisaged by the Austrian Count, at least as seen from the American side of the Atlantic. In summarizing contemporary views, Frank Taussig wrote in 1915:

"The more machinery becomes automatic, the more readily can it be transplanted. Is there not a likelihood that apparatus which is almost self-acting will be carried off to countries of low wages, and there used for producing articles at lower price than is possible in the country of high wages where the apparatus originated? In hearings before our congressional committees a fear is often expressed that American investors and tool-makers will find themselves in such a plight. An American firm, it is said, will devise a new machine, and an export of the machine itself or of its products will set in. Then some German will buy a specimen and reproduce the machine in his own country (the Germans have been usually complained of as the arch plagiarists; very recently the Japanese also are held up in terrorem). Soon not only will the exports cease, but the machine itself will be operated in Germany by low-paid labor, and the articles made by its aid will be sent back to the

United States. Shoe machinery and knitting machinery have been cited in the illustration" (3).

This argument, too, has a familiar ring.

High technology products increasingly have entered directly into trade, to the point, for example, at which machinery (including electrical machinery but excluding vehicles) now accounts for over 25 percent of American exports, 30 percent of German exports, and 35 percent of British exports (the three largest exporting nations).

Some machinery, of course, has become quite conventional and no longer represents advanced technology. But recent research has shown that American export strength relies to a considerable extent on the continuing flow of new technology (as measured, imperfectly, by industrywide expenditures on research and development). Not only are the most rapidly growing components of U.S. exports in high technology fields, such as aircraft, technical instruments, and office machinery, but the U.S. share of world exports is disproportionately higher in industries with a high technological input. The first factor is due mainly to the characteristics of world demand, which grows more rapidly for new, technologically advanced products. The second factor suggests that the competitive strength of American exports in world markets depends to a considerable extent on continuing technological leadership, at least under existing monetary conditions, and that the comparative advantage of the United States is in high technology products (4).

Recently the U.S. lead in the export of technologically advanced products has been reduced, although it is still far from being overtaken. Several continental European countries and Japan have begun increasingly to export advanced products and, coming from behind, their exports of such products have grown more rapidly than those of the United during the past 10 to 15 years. The U.S. share in world exports of research-intensive products fell from over 35 percent in 1955 to just under 30 percent in 1965, although the U.S. share seems to have stabilized there between 1965 and 1969. Research-intensive products are here defined, somewhat arbitrarily, as products of industries whose expenditures on research and development in the United States in 1962 exceed 4 percent of sales or those in which scientists and engineers employed in research and development exceeded 2 percent of total employment. By this standard, aircraft instruments, agricultural machinery, office machinery, electrical machinery, and chemicals (including drugs) were research-intensive.* European exports of these products rose by over 200 percent between 1955 and 1965; American exports of the same products rose only 130 percent.

But figures such as these can be deceptive and lead to quite erroneous interpretations. During the same period, European exports of all manufactured products, conventional as well as advanced, increased more rapidly than did American exports; the United States experienced a general decline in its share of world trade in manufactures. It is true that European exports of research-intensive products grew more rapidly than did other European exports, but the same was true for the United States. Specifically, U.S. exports of research-intensive products did not suffer more than did other U.S. exports. Indeed, in the last few years the U.S. share in world exports of research-intensive products seems to have stabilized (due in part to large sales of aircraft), whereas the U.S. share in total exports of manufactures has continued to decline.

These facts suggest that a loss of technological lead may not be the most important explanation for recent U.S. trade performance. It is not difficult to find competing explanations. During the late 1950's, U.S. export prices rose relative to those of this nation's major competitors. In the early 1960's, U.S. price competitiveness improved, but American goods encountered greater competition in Europe following the formation of Europe's two trading blocs, the European Economic Community and the European Free Trade Association. Both of these organizations eliminated tariff duties among members by 1968 but retained duties on American (and other nonmember) products. In the late 1960's exceptionally strong pressures of demand in the United States, largely resulting from expenditures associated with the war in Vietnam, resulted in unprecedented increases in imports from other industrial countries, including imports of research-intensive goods. Consequently, American firms may be more conscious today of European and

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*Quite apart from the arbitrariness of the two criteria, the system for classifying industries means that a number of quite conventional products are accidentally considered "research-intensive" here, whereas some research-intensive products are inadvertently excluded because they fall in industries that as a whole fail to meet the criteria.

Japanese competition, even in their home market, than was true before 1966. Furthermore, the recent inflation of costs and prices in the United States suggests that some of these inroads will be durable, for even in research-intensive products cost considerations are far from irrelevant. Aggressive new product development can compensate to some extent for inflated costs, but the higher costs become, relative to those of foreign competitors, the more aggressive innovation will have to be. By the same token, some loss of innovative lead to competitors can be compensated, as far as its effects on foreign trade are concerned, by holding the line on prices. Thus, the general monetary and exchange-rate policies of each country have an important role to play in determining the impact of product or process innovations on foreign trade, in particular, in determining how long the innovating country will retain its initial trade advantage.

Even allowing for over-all monetary considerations, there is little reason to doubt that the capacity of European and Japanese firms to innovate successfully, and to imitate quickly the innovations of others, has increased and will continue to increase in the near future. Concomitantly, innovation will continue at full pace in the United States. Several reasons account for this trend toward innovation. First, incomes in the other industrial countries are growing very rapidly—more rapidly than in the United States*—and the share of income available for discretionary spending, beyond the bare necessities of food and shelter, is growing even more swiftly. This means a rapidly growing demand for new products and new designs.

Second, European and Japanese attitudes have become much more receptive to change, much less tradition-oriented, than they once were. The progressive-minded individuals among these populations have an admiration for the technological process in the United States, a concern for the direction it may take, and a desire for preservation of European and Japanese independence. This greater desire to do things in the modern way was perhaps unwittingly fostered

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*However, the starting level is much lower. Average European income per capita increased from 29 percent of that in the United States in 1953 to 38 percent in 1968; the corresponding ratios for per capita income in Japan were 10 percent and 32 percent; and the per capita income in the six member countries of the European Economic Community were 31 percent and 47 percent.

by the havoc and destruction of World War II, after which some decision regarding the future shape of production processes, as well as of cities, had to be taken. It was no longer feasible to let patterns of growth and development proceed without plan or direction.

Third, today new ideas and products are much more rapidly diffused across boundaries, with the result that an innovating country will enjoy the export advantages of innovation for a much shorter interval than has been true in the past. Very quickly its new products will be produced abroad and perhaps exported back to the country of origin. The claim that imitation of new products takes place more rapidly today is difficult to document comprehensively because of paucity of information about the past, but there is much anecdotal information that supports it. During the nineteenth century, it was not unusual for 20 or even 30 years to elapse between the first commercial development of a new product in one country and its commercial production in another. For example, it was 20 years after their introduction in the United States that the sewing machine and the rotary printing press were first produced in Great Britain. The case of the typewriter provides another example. It was invented in the United States in 1868 and by the mid-1880's had quite a large domestic market. It first appears as a separate entry in U.S. export statistics in 1897, when exports of $1.4 billion were recorded. By 1908 there was modest competition from one German and two British firms, with British exports amounting to $90,000, a negligible amount compared with American exports of $6.5 million in that year. Broadly speaking, it took 20 years from the time of heavy marketing in the United States to the time of modest exports by a few leading competitors. The imitation lag was generally less than this when the innovation occurred in Europe and Americans were the imitators, but it was still substantial.

Let us compare this with more recent developments. Within a year of the introduction of stainless steel razor blades by Wilkinson Sword, a British firm, several American firms had competing blades on the market. This response was defensive and rapid. Float glass was produced in the United States only four years after the pioneering production began in England. Several computers have been produced in Europe a relatively few years after they were first marketed in the United States.

Table 1 shows the rate of diffusion for a number of innovations in three industries. Most of these innovations in the plastics industry and in the synthetic rubber and synthetic fibers industries occurred in the period 1920-1950. The innovations in the semiconductor

TABLE 1 International Diffusion of Technology. Average Imitation Lags Following Important Innovations

Industry Where Innovations Occurred	Average Number of Years Between First Production in Innovating Country and Production				
	United States	France	Germany	Japan	United Kingdom
Synthetic rubber and synthetic fibers 1897-1949 (15 innovations)	8.8	10.3	7.4	14.7	8.3
Plastics 1870-1957 (20 innovations)	5.2	8.7	6.1	14.0	8.7
Semiconductors					
1951-1957 (8 innovations)	1.0	3.0	2.4	3.9	2.6
1958-1963 (5 innovations)	[a]	2.6	2.6	1.2	1.6

[a] All these innovations were in the United States

Sources: G. C. Hufbauer, Synthetic Materials and the Theory of International Trade (Gerald Duckworth, London, 1966), pp. 131-132.
John E. Tilton, The Semi-Conductor Industry (The Brookings Institution, mimeo., 1970), Table 3.1.

industry occurred in the period 1951-1963. The figures represent the average number of years between first production in the innovating country and first production in the country indicated. Although the comparison of different industries precludes hard conclusions, the table suggests that, as compared with a period of some 20 years during the nineteenth century, the imitation lag had generally been reduced to less than 10 years in the second quarter of this century, and to less than three years by the 1960's—in short, a sharp reduction in the period required for new, commercially successful ideas to be imitated abroad.

There are various reasons for this acceleration in international diffusion. It results in part from technological changes in transportation and communication, which make international transmission of new ideas much easier. It also is due to the attitudinal changes discussed above, which make Europeans much more receptive to new products and processes than they once were. Finally, the very rapid growth of American investment in Europe during the past decade fostered international diffusion of new ideas and techniques. Very often subsidiaries of American firms are the first to introduce innovations to European countries. Direct business investment abroad is an important conveyor of management and technical skill, which is often more significant in its effects than the movement of capital. In a sense, it represents a return to reliance on migration for the international transmission of technical knowledge, although here the migrants are mobile employees of multinational corporations rather than independent entrepreneurs and craftsmen who hope to settle where they can use their knowledge to best advantage.

To summarize the historical relationship between technology and U.S. trade, it is helpful to identify four stages. During the first period, from the Colonial era in the United States until around 1850, Great Britain had a clear lead in technology, agricultural as well as industrial. However, the impact on trade was felt largely through the export of manufactured goods, other than machinery, from Great Britain. Thereafter the United States gradually overtook the British in applied technology, especially in the areas of machinery and electrical apparatus, but it continued to rely heavily on Europe for basic scientific advances. This second period lasted from 1850 to the 1940's. In the 1940's, we entered a third stage, in which basic scientific advance as well as applied technology has originated largely, although never wholly, in the United States. We may be entering a fourth stage now, in which the United States retains its scientific lead but increasingly shares pride of place in applied technology with five or six other countries or at least finds those countries adopting U.S. innovations so rapidly that any trade advantage accruing to the innovating country will be very short-lived. There is no sign, however, that Americans are losing their capacity for innovation.

It is interesting to speculate on the reasons for Great Britain's loss of technological leadership to the United States in the last century. A key factor seems to have been British preoccupation with quality engineering and inadequate attention to economics. Professional pride understandably leads to a desire to do the best job technically possible. The search for ways to cut corners, to give up technical quality for financial saving, was not congenial to the British engineer, who was very much a craftsman. Americans generally did not share that attitude. For the reasons already given, Americans were always looking for ways to cut costs, especially labor costs; the answer typically lay in product standardization and interchangeable parts, so that long production runs could be achieved and components could be subcontracted to specialist firms. Both practices began early in the history of the United States but were adopted only recently in Europe, where the tradition of hand-tailored manufactures was deeply rooted.

There may be a lesson here for the present. Technological lead can be lost, in particular its advantages for trade, by preoccupation with quality without regard to cost. In this connection, the heavy concentration of American engineering talent in the defense and aerospace industries, where performance specifications are established on the basis of military or space program requirements and are only casually examined for economics, and where contractors also have an incentive to regard cost considerations as secondary to performance, may damage the commercial interests of the United States. The American machinery industry, unlike that in Britain, has a history of taking the initiative with new machines and persuading customers to adopt them, even when some change in the final product is required (e.g., for reasons of standardization). The defense industry is customer-oriented rather than production-oriented, which may inhibit commercially useful innovation. This is not to argue that the customer should be ignored, but rather that the final product should reflect cost considerations as well as customer requirements.

Although the United States should be alert to the possibility that its own innovative capacity could diminish, it should not lament the growing innovative capacity abroad. There is a great deal of scope for commercial diversity, and specialization is mutually beneficial even—or perhaps especially—in invention.

In conclusion, I would offer two injunctions. First, the United States should not allow a monetary environment to develop that places innovative American firms at a competitive disadvantage in world markets. If these firms cannot reap the commercial rewards of innovation, they will cease to innovate. And if they cannot reap those rewards by producing in the United States, they will shift their production to foreign locations, to the detriment of other Americans. These considerations suggest that the government should pursue overall monetary and fiscal policies that permit American industries (though not, of course, each product, for that would stifle the basis for trade) to compete effectively in world markets. It might even adopt a strategy whereby this is achieved more or less automatically, such as through greater flexibility in exchange rates. If this is not done, it may be necessary to restrict the activities of American firms abroad, that is, to exploit what remaining immobility of technical knowledge there is. But that is distinctly a second-best solution.

Second, in continuing to seek new and better ways of doing things, American engineers and technicians should be more conscious of costs. They should have more explicitly in mind than they did in the recent past the need to find economical ways of making old as well as new products. In this connection, they should apply their considerable talent to adapting American innovations to the frequently different requirements of foreign markets rather than being exclusively occupied with the domestic market.

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CONCERNS ABOUT THE PRESENT AMERICAN POSITION IN INTERNATIONAL TRADE

Michael Boretsky*

Introduction

After many, many years of highly comfortable merchandise trade surpluses, ranging in the last ten years or so from $3 billion to nearly $8 billion a year, in 1968 all U.S. merchandise transactions with foreign countries, including noncommercial ones (grants, aid, etc.), yielded a gross surplus of only about $1.4 billion. Strictly commercial transactions yielded a deficit of almost the same magnitude. In 1969 the gross surplus increased slightly but continued to be far below the prevailing level of the past, and the commercial balance remained in the red. In view of the tremendous role that the favorable trade surpluses have played in the U.S. balance of payments position as well as in the U.S. over-all economic and political posture abroad, this development caused concern on the part of some students and government officials dealing with U.S. international economic relations. The deterioration generally was interpreted as the result of the "overheated economy" of the United States, and firm belief that the comfortable trade surpluses would be restored once the economy "cooled off" was expressed. The improvements in the U.S. trade balances reported monthly in the press throughout most of 1970 made this explanation quite sensible if not totally convincing.

In this presentation, I will demonstrate that in all probability the recent "overheat" in the economy contributed to this deterioration only in a marginal way. The true causes of this deterioration are much more complex and have been at work for a long time. The apparent improvement in 1970 is an illusion; there are virtually no indications that the kind of surpluses prevailing in the past will

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*The views expressed in this presentation, based on a study of interest to and sponsored by the Department of Commerce, are those of the author and do not necessarily represent the views of the Department or any other agency of the government. In the study the author was assisted by Robert McKibben.

be automatically restored once the economy "cools off." These views give ample reason for very serious concern.

The analysis will consist of five parts. The first part will outline briefly the theoretical framework of the analysis. The second will sketch the trends in U.S. trade from 1951 through 1969 and delineate the commodity and regional areas in which the U.S. balances deteriorated over this time span. In the third part, I will trace the principal forces at work, hence, the causes of the deterioration. Part four will analyze the extent and nature of the apparent improvement in the balances that took place in 1970. Part five, finally, will summarize the conclusions derived from the preceding sections and discuss some of the major implications—the reasons for concern.

Analytical Framework

Introduction

Analytically, the concern of this presentation is with U.S. foreign trade prospects for some years hence. The standard approach for analyzing any country's trade prospects is to project its exports and imports into the future and then to speculate about development that might alter the projections. Most trade projections are based on other projections that are considered to be determinants of foreign trade, such as the Gross National Product (GNP), population, investment, industrial production, and the like, and anticipated changes in comparative cost and/or prices consistent with the comparative cost doctrine initially developed by Ricardo some 150 years ago and later refined by Haberler (1). Some analysts might consider also changes of the country's endowment of scarce resources as suggested in theories advanced by Ohlin and Heckshher (2). Others might consider some of the "product cycle" and other technology-oriented ideas advanced by Posner (3), Hufbauer (4), Keesing (5), and Vernon et al (6).

The disadvantages of this approach are well known: the number of variables that a sensibly conscientious projection must take into account is almost unmanageable, the quality of shortcuts is unpredictable, and the theoretical guidance is either unrealistic or not readily quantifiable.

Essence of the Approach Used in this Presentation

The approach pursued in the present analysis does not require projections and is otherwise different from the standard one.

In essence it constitutes a description of the areas and extent of deterioration in the U.S. trade situation that has occurred and the principal forces that have caused this deterioration. The possibility that the forces causing the deterioration (if any) will cease to operate in the future and the likelihood that policy actions may be needed also are explored. The basic reasoning of the analysis rests on three assumptions about the factors that determine a country's foreign trade. These assumptions appear to offer a more comprehensive and operational (in the sense of applicability for policy judgments) theory of international trade than has been used before.

Determinants of Foreign Trade

In this analysis it is assumed that any country's international trade is determined by:

1. The country's endowment with natural resources relative to its needs. Other things being equal, the more abundant the country's resources relative to its needs, the more of these resources it is likely to export and the fewer it will import.

2. The price levels of its products relative to such price levels in other countries, all valued in currency commonly used in international trade transactions (currently, this is usually the U.S. dollar, even in the Eastern Bloc countries). Other things being equal, the lower the country's relative price levels, the more products it will be able to export and the fewer of them it will import.*

3. The comparative quality and scope of the country's technological know-how embodied in its manufactured products (excluding those aspects that affect the relative cost and pricing of these products).

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*Following Ricardo, economists usually think of relative costs rather than relative prices as determinants of trade. (In text books, the standard term is comparative cost and it refers to differences between costs of different commodities within the same country rather than differences between costs of the same commodities in different countries.) In some cases relative costs might be similar or even identical to relative prices, but in many cases they might be substantially different, due to such factors as the artificiality of exchange rates, differences in tax rates or tax systems, and countless others.

Other things being equal, the higher the quality and broader the scope of a country's technological expertise compared to that of other countries, the greater its exports of manufactured goods are likely to be and the smaller the imports of such goods.

The principal novelty of this approach is found in the third assumption. Therefore, its rationale should be understood as thoroughly as possible. The kind of know-how in question is embodied in large U.S.-manufactured commercial aircraft. The United States enjoys substantial surpluses in the trade related to this aircraft because the quality of U.S. know-how in this product line is superior to that possessed by other countries. The scope of this know-how is probably equally or more important than its quality. For example, Japan's know-how in electronics and the manufacture of automobiles was hardly in evidence in 1957, but now appears to be second to none (or second only to that of the United States). This change has resulted in tremendous gains for Japan's foreign trade.

Technology, or technological progress in general, appears to affect a country's foreign trade in two ways.

1. When technological improvements take the form of new or better production techniques as such, the use of these techniques improves productivity, which might reduce the cost of products, thus making the country's products more competitive price wise. However, because these kinds of technological improvements work through productivity and/or cost only, the advantage that a country derives from them can be nullified not only by similar improvements in other countries but also by any development affecting relative prices, such as the failure of prices to decline with decline in cost, tariffs, taxes, and subsidies, or changes in exchange rates. Therefore, such technological improvements are not considered here as a distinct determinant of foreign trade, although they might be crucial in maintaining or improving a country's price competitiveness.

2. When technological improvements take the form of new or better equipment, industrial materials, or even farm products, the country has something new or better to export and/or will be in a better position to compete with imports. Both economic (carrying price tag) and noneconomic (price free) improvements are of course important (with respect to the latter, some U.S. export-oriented businessmen maintain that greater reliability of some American-made industrial equipment alone is frequently offsetting a price disadvantage of 20 percent or more). The foreign trade advantages that a country derives from such technological improvements are

generally of a monopolistic nature (they can rarely be nullified by measures other than similar improvements) and, hence, are considered as a distinct determinant of its foreign trade.

Frequently a specific technological innovation can benefit a country's foreign trade in both ways (e.g., a new or better piece of industrial equipment may be exported and its use at home may result in a more efficient production technique). Frequently also such an innovation may lead to but one of these kinds of benefits (e.g., a new or better camera or piece of pollution-control equipment would generally benefit a country's foreign trade in only the second way). However, to be a distinct factor in international (merchandise) trade, innovations must be embodied in manufactured products, that is to say, they must be exportable.

Statistical Grouping of Commodities

Consistent with the three determinants of trade outlined above, the statistical analysis in this presentation uses a five-way classification of commodities traded.

1. Agricultural products. Trade in these products is presumed to be a function of the relative endowment with agricultural land and climate and the relative prices of these products. In the international trade in these products relative technological know-how rarely affects the quality of the exported products,* only their cost. Consequently, it is not considered as a separate factor.

2. Minerals, unprocessed fuels, and other raw materials (products of nature other than agricultural land and climate). Trade in these products is largely a function of the relative endowment with natural resources and relative prices. The quality of technology, as in agricultural products, is not an independent factor (because it rarely affects the quality of the products).

3. Manufactured products regarded as nontechnology-intensive products. This group includes all manufactured products not specified in the fourth group described below. The most important commodities in the group are textiles, steel, and nonferrous metals.

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*Only when new hybrids of grains for seed are involved, but these are rarely important in terms of the over-all value of trade.

Trade in these products is assumed to be largely a function of relative prices. The quality of technological know-how embodied in these products other than that working through comparative prices might be of importance, but in the present analysis the effect is regarded more as potential than actual, because with some exceptions noted below, this know-how is much the same in all industrialized countries.

4. Technology-intensive manufactured products. This group includes chemicals; nonelectrical machinery; electrical machinery and apparatus, including electronics; all types of transportation equipment, including aircraft and automobiles; and scientific and professional instruments and controls. The chief criterion in designating these products as technology-intensive is the intensity of the new-technology-generating inputs used in their production—scientific and engineering manpower, research and development (R and D), and relative level of skill of workers. In the United States, the value added by the industries manufacturing these products represents only 14 percent of the GNP, but they employ about 60 percent of all the scientific and engineering manpower working in manufacturing (with the exception of the ordnance industry), they perform over 80 percent of all nondefense industrial R and D; and the relative hourly earnings of the production workers employed in these industries, which are usually assumed to be largely a function of relative skill levels, are about 23 percent higher than in all other manufacturing industries. In terms of the actual output of new technology, the industries manufacturing these products are unquestionably the primary domestic originators of technological innovations, not only for their own use but also for all other sectors of the economy through the equipment, instruments, and synthetic materials embodying innovations that they supply. The disparities in technological prowess among the industrialized countries are largely concentrated in these industries. International trade in these products is largely a function of the quality of technological know-how embodied in them, the scope of this know-how, and the relative prices of the products.

Following the new-technology-originating input criteria, it would be desirable to include ordnance products (mainly ammunition, tanks, and missiles) in the technology-intensive category (these products are included in the third group), but this is not practical on statistical grounds. The statistics on U.S. exports of these products are not sufficiently consistent over time, the exports are not very large, and the imports are negligible. It should be noted, however, that today ordnance products cannot be equated with military hardware. From the international-trade point of view, the most important products in the military-hardware category are aircraft and electronic control devices, which are included in the group of technology-intensive products.

5. All commodities, consisting of the sum of the four groups and, in the case of U.S. exports, reexports of foreign merchandise. These reexports consist of all types of commodities. Ideally, one would want to adjust the data for the four preceding groups, either on the import side or export side, by the value of these reexports. Unfortunately, the commodity detail on these reexports is not available. However, the inaccuracies in the analysis of U.S. trade performance by the defined commodity group arising from this inconsistency in the data are inconsequential because the over-all value of these reexports is still quite small (1.5 percent of total exports in 1969).

Other Features of the Analytical Framework

It is instructive to analyze the trends in U.S. trade in the defined commodity groups not only with all countries in the world but also with at least four regions that are subject to diverse forces affecting their trade with the United States. Consequently, the analysis uses also a fourfold regional breakdown of trade. The regions, assumed to be roughly homogeneous in regard to the forces affecting the trade with the United States, are: Western Europe, Japan, Canada, and the "Rest of the World" (which includes all developing countries New Zealand, Australia, Union of South Africa, Israel, Eastern Europe, and the Union of Socialist Soviet Republics [U.S.S.R.].

There is also a need to distinguish, whenever feasible, between commercial and noncommercial transactions. All U.S. imports are commercial, but U.S. exports include not only commercial exports (sales of merchandise to foreign countries for convertible currencies, i.e., foreign exchange) but also shipments that do not bring foreign exchange—notably U.S. grants and aid to foreign countries of equipment and materials for military purposes; exports of various products, largely machinery and equipment, financed by U.S. foreign aid funds; and "sales" of agricultural commodities for nonconvertible currencies under the auspices of Public Law 480.

Using this framework, the analysis of trends in U.S. trade with all countries in the world can be extended as far back as the early 1950's (and with less accuracy to the beginning of this century). In the analysis by regions, due to the lack of consistent data, trends can be depicted only from 1962 to the present time.

Trends in U.S. Trade, 1951-1955 to 1969

For the analysis of what occurred in U.S. trade in the 1950's and 1960's, which focuses on the five commodity groups and four regions defined in the preceding section,, reference is made to Tables 1 and 2 and Figure 1. Table 1 provides data on U.S. exports, imports, and the trade balances by the defined commodity group in trade with all countries in the world for selected years from 1951-1955 to 1969 and the implicit growth rates in exports and imports for the periods 1951-1955 to 1962 and 1962-1969. Graphical representation of export and import trends for the four commodity groups appear in Figure 1. Table 2 gives the regional breakdown of this trade for 1962 to 1969 (the commodity breakdown by region is not available for the years prior to 1962).

The data contained in these two tables and the graph show clearly that, although the U.S. trade situation varies from one commodity group to another and from region to region, the over-all picture is that of a long-term and drastic deterioration of the U.S. position.

In the trade in agricultural products (Item 1 in Tables 1 and 2 and Figure 1), the situation is not entirely clear but hardly promising. In the early 1950's, the United States ran deficits in both gross and commercial balances. Toward the end of the 1950's and through 1962, exports began to exceed imports, but the balance of commercial transactions remained in the red. In the 1963-1967 period, U.S. trade in agricultural products yielded increasing surpluses, but in 1969 the commercial transactions again yielded a small ($36 million) deficit.

In view of such fluctuations, any attempt to assess the prospects for U.S. trade in these (agricultural) commodities in the future, especially for any specific point in time, is at best hazardous. Great optimism for the not-too-distant future is hardly warranted merely on the grounds that in the 1962-1969 period the value of U.S. exports (unadjusted for price changes) grew, on the average, by 2 percent per year, whereas imports (largely "tropicals" and processed foods, including delicatessen items from Europe) grew by 4 percent per year. In addition, there is ample evidence of growing competition from other developed countries rich in agricultural resources (such as the wheat price wars of the 1960's), the protectionistic agricultural policies of the common market countries, and, of course, the rapid spread of the "green revolution" in developing countries.

TABLE 1 Trends in U.S. Trade with All Countries in the World by Defined Commodity Group

	Transactions, $ Millions						Average Annual Growth, Percent	
	Average For 1951-1955	1957	1962	1964	1968	1969	1951-1955 to 1962	1962 to 1969
1. Agricultural Products:								
U.S. Exports (Gross)	3,247	4,643	5,034	6,348	6,227	5,936	5.0	2.0
U.S. Imports	4,450	3,872	3,869	4,143	5,054	4,954	-1.6	4.0
Gross Balance	-1,203	771	1,165	2,205	1,173	982	...	...
Noncommercial Exports	n.a.	n.a.	1,446	1,619	1,178	1,018	...	- 5.0
Commercial Balance	n.a.	n.a.	- 281	586	- 5	- 36	...	...
2. Minerals, Unprocessed Fuels, and Other Raw Materials:								
U.S. Exports (Gross)	1,611	3,252	2,742	3,420	4,154	4,741	5.3	6.7
U.S. Imports	3,660	4,978	4,946	5,500	7,548	8,077	3.4	7.2
Gross Balance	-2,049	-1,726	-2,204	-2,080	-3,394	-3,336	...	...
Noncommercial Exports	...	...	...	...	...	...	...	...
Commercial Balance	-2,049	-1,726	-2,204	-2,080	-3,394	-3,336	...	...
3. Manufactured Products Nontechnology-Intensive:								
U.S. Exports (Gross)	3,711	4,045	3,452	4,419	5,419	6,210	-0.8	8.8
U.S. Imports	1,884	2,900	5,107	6,038	11,220	11,689	11.5	12.6
Gross Balance	1,827	1,145	-1,655	-1,619	-5,801	-5,479	...	...
Noncommercial Exports	n.a.	n.a.	246	211	90	92	...	-17.0
Commercial Balance	n.a.	n.a.	-1,901	-1,408	-5,891	-5,571	...	...

... = Nil   n.a. = not available

TABLE 1 (Continued)

	Transactions, $ Millions						Average Annual Growth, Percent	
	Average For 1951-1955	1957	1962	1964	1968	1969	1951-1955 to 1962	1962 to 1969
4. Technology-Intensive Manufactured Products:								
U.S. Exports (Gross)	6, 630	8, 752	10, 216	12, 110	18, 399	20, 575	5. 0	10. 0
U.S. Imports	897	1, 570	2, 542	3, 068	9, 404	11 323	12. 3	24. 0
Gross Balance	5, 733	7, 182	7, 674	9, 042	8, 995	9, 252	...	...
Noncommercial Exports	n. a.	n. a.	1, 816	1, 922	1, 420	1, 440	...	- 4. 0
Commercial Balance	n. a.	n. a.	5, 858	7, 120	7, 575	7, 812	...	...
5. All Commodities:								
U.S. Exports, Including Reexports[a] (Gross)	15, 336	20, 871	21, 713	26, 650	34, 636	38, 006	3. 9	8. 4
U.S. Imports	10, 961	13, 418	16, 464	18, 749	33, 252	36, 043	4. 7	12. 0
Gross Balance	4, 375	7, 453	5, 249	7, 901	1, 384	1, 968	...	...
Noncommercial Exports	n. a.	n. a.	3, 508	3, 752	2, 688	2, 550	...	- 8. 0
Commercial Balance	n. a.	n. a.	1, 741	4, 149	-1, 304	- 582	...	...

[a]The value of all commodities consists of the value of the four specified commodity groups, plus the small value (1. 2 to 1. 5 percent of the total) of reexports not reported by commodity group. The value of these reexports to all countries in the world was as follows ($ Millions):

1951-1955 = 137	1964 = 353
1957 = 180	1968 = 437
1962 = 269	1969 = 544

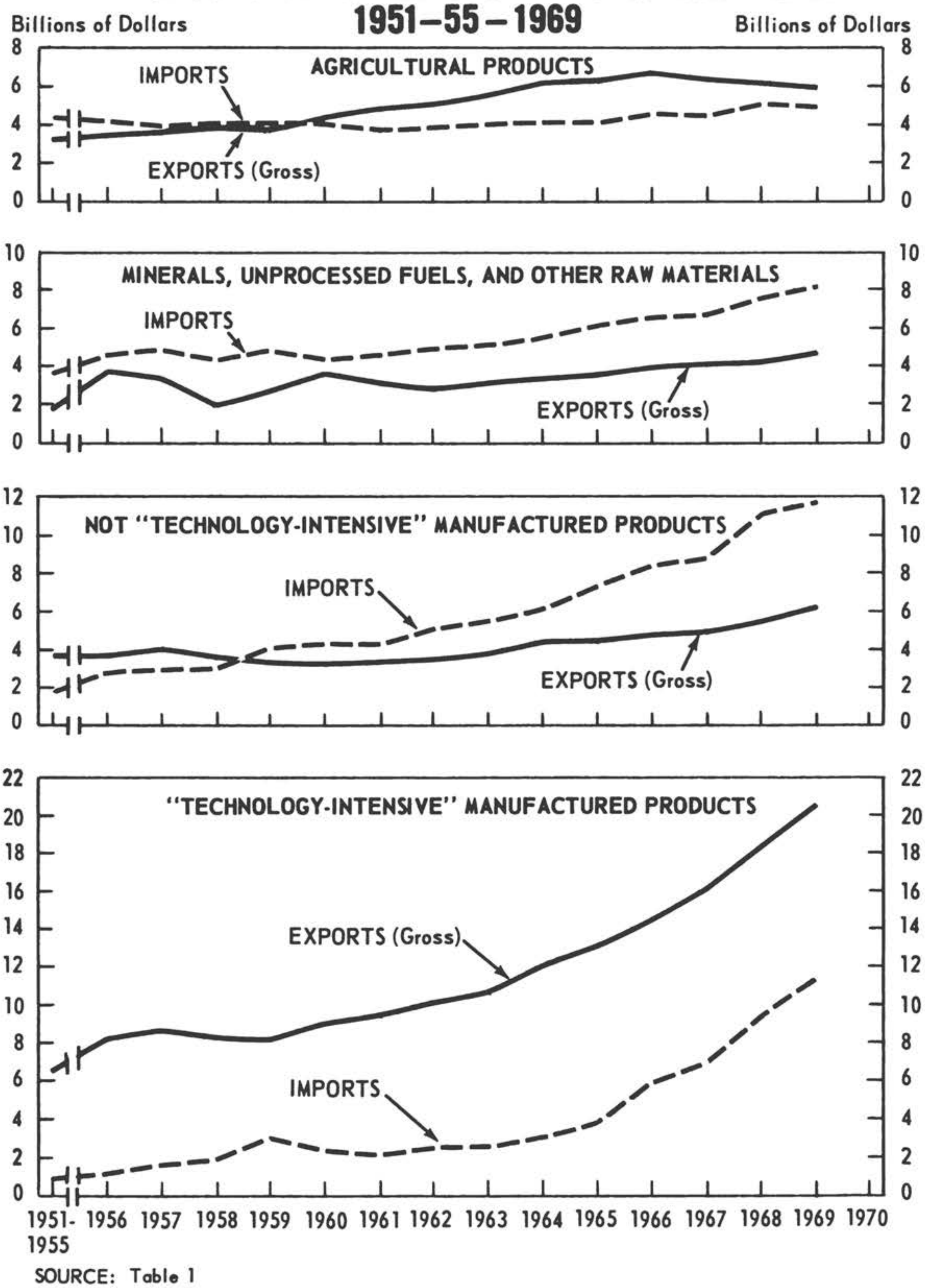
TABLE 1 (Continued)

Sources:

All Transactions: 1951-1955 - 1962—Computed from the data on U.S. merchandise exports and imports by class of commodity, rearranged to fit the classification of commodities used in this table, as reported by the Bureau of the Census in *Historical Statistics of the United States*, Colonial Times to 1957 and Continuation to 1962 (Series U51 through U72), and *Statistical Abstract of the United States*, editions for 1960 (tables 1182 and 1183), 1963 (tables 1205 and 1206) and 1965 (tables 1238 and 1239). 1962-1968—Bureau of the Census, excerpted and checked for inter-temporal consistency by BIC, International Trade Analysis Division, U.S. Department of Commerce.

Noncommercial Transactions (Military grant/aid shipments, exports financed by U.S. foreign aid programs and sales of agricultural products for nonconvertible currencies under Public Law 480) - estimated from data of Department of Defense, Agency for International Development, and the Department of Agriculture.

Fig. 1 TRENDS IN U.S. TRADE IN FOUR DEFINED COMMODITY GROUPS WITH ALL COUNTRIES IN THE WORLD 1951–55–1969



SOURCE: Table 1

TABLE 2 Trends in U.S. Trade by Region and Defined Commodity Group

A. Trade with Western Europe	Transactions, $ Millions								Average Annual Growth, Percent
	1962	1963	1964	1965	1966	1967	1968	1969	
1. Agricultural Products:									
U.S. Exports (Gross)	2,158	2,203	2,442	2,508	2,770	2,450	2,231	2,136	0
U.S. Imports	510	523	533	586	697	785	854	816	7
Balance (Gross)	1,648	1,680	1,909	1,922	2,073	1,665	1,377	1,320	...
2. Minerals, Unprocessed Fuels and Other Raw Materials:									
U.S. Exports (Gross)	1,369	1,526	1,586	1,535	1,437	1,659	1,834	2,203	7
U.S. Imports	629	681	728	797	972	997	1,182	1,159	9
Balance (Gross)	740	845	858	738	465	662	652	1,044	...
3. Manufactured Products Nontechnology-Intensive:									
U.S. Exports (Gross)	969	1,154	1,494	1,377	1,524	1,486	1,786	2,077	9
U.S. Imports	1,998	2,050	2,235	2,705	3,065	3,236	4,216	4,065	12
Balance (Gross)	-1,029	- 896	- 741	-1,328	-1,541	-1,750	-2,430	-1,988	...
4. Technology-Intensive Manufactured Products:									
U.S. Exports (Gross)	3,055	3,210	3,563	3,708	4,011	4,454	5,104	5,765	10
U.S. Imports	1,415	1,477	1,713	2,067	2,945	3,034	3,887	4,098	16
Balance (Gross)	1,640	1,733	1,850	1,641	1,066	1,420	1,217	1,667	...
5. All Commodities:									
U.S. Exports (Gross)[a]	7,637	8,198	9,222	9,257	9,891	10,187	11,132	12,392	7
U.S. Imports	4,552	4,731	5,209	6,155	7,679	8,052	10,139	10,138	12
Balance (Gross)	3,085	3,467	4,013	3,102	2,212	2,135	933	2,254	...

[a] Exports of all commodities include the sum of the four commodity groups and reexports. The value of reexports to Western Europe was as follows ($ Millions): 1962=86; 1963=105; 1964=137; 1965=129; 1966=149; 1967=138; 1968=177; and 1969=211.

TABLE 2 (continued)

B. Trade with Japan	1962	1963	1964	1965	1966	1967	1968	1969	Average Annual Growth, Percent
	Transactions, $ Millions								
1. Agricultural Products:									
U.S. Exports (Gross)	481	651	720	876	943	865	933	934	10
U.S. Imports	46	46	40	37	37	32	37	37	- 3
Balance (Gross)	435	605	680	839	906	833	896	897	...
2. Minerals, Unprocessed Fuels and Other Raw Materials:									
U.S. Exports (Gross)	416	495	535	471	576	801	820	990	13
U.S. Imports	123	116	126	157	190	169	213	202	7
Balance (Gross)	293	379	409	314	386	632	607	788	...
3. Manufactured Products Nontechnology-Intensive:									
U.S. Exports (Gross)	79	94	128	130	170	234	246	360	23
U.S. Imports	895	993	1,146	1,543	1,746	1,748	2,364	2,640	17
Balance (Gross)	- 816	- 899	-1,018	-1,413	-1,576	-1,514	-2,118	-2,284	...
4. Technology-Intensive Manufactured Products:									
U.S. Exports (Gross)	592	595	620	590	660	768	929	1,178	10
U.S. Imports	294	343	456	677	990	1,050	1,440	2,005	32
Balance (Gross)	298	252	164	- 87	- 330	- 282	- 511	- 827	...
5. All Commodities:									
U.S. Exports (Gross)[b]	1,574	1,847	2,018	2,083	2,370	2,669	2,954	3,490	12
U.S. Imports	1,358	1,498	1,768	2,414	2,963	2,999	4,054	4,888	21
Balance (Gross)	216	349	250	- 331	- 593	- 330	-1,100	-1,398	...

[b] Exports of all commodities include the sum of the four commodity groups and reexports. The value of reexports to Japan was as follows ($ Millions): 1962=6; 1963=12; 1964=15; 1965=16; 1966=21; 1967=31; 1968=26; and 1969=28.

TABLE 2 (continued)

C. Trade with Canada	Transactions, $ Millions 1962	1963	1964	1965	1966	1967	1968	1969	Average Annual Growth, Percent
1. Agricultural Products:									
U.S. Exports (Gross)	512	597	615	620	626	556	595	710	5
U.S. Imports	188	174	176	234	240	201	226	244	4
Balance (Gross)	324	423	439	386	386	355	369	466	...
2. Minerals, Unprocessed Fuels and Other Raw Materials:									
U.S. Exports (Gross)	539	502	559	654	638	666	708	744	5
U.S. Imports	1,653	1,797	2,011	2,164	2,396	2,534	2,995	3,362	11
Balance (Gross)	-1,114	-1,295	-1,452	-1,510	-1,758	-1,868	-2,287	-2,618	...
3. Manufactured Products Nontechnology-Intensive:									
U.S. Exports (Gross)	888	882	1,055	1,172	1,328	1,323	1,408	1,609	9
U.S. Imports	1,233	1,265	1,388	1,544	1,789	1,865	2,194	2,255	9
Balance (Gross)	- 345	- 383	- 333	- 372	- 461	- 542	- 786	- 646	...
4. Technology-Intensive Manufactured Products:									
U.S. Exports (Gross)	2,022	2,198	2,598	3,111	3,938	4,515	5,239	5,892	16
U.S. Imports	610	615	590	916	1,727	2,540	3,590	4,523	34
Balance (Gross)	1,412	1,583	1,903	2,195	2,211	1,975	1,649	1,369	...
5. All Commodities:									
U.S. Exports (Gross)[c]	4,052	4,261	4,921	5,658	6,679	7,172	8,072	9,137	12
U.S. Imports	3,684	3,851	4,265	4,858	6,152	7,140	9,005	10,384	16
Balance (Gross)	368	410	656	800	527	32	- 933	-1,247	...

[c] Exports of all commodities include the sum of the four commodity groups and reexports. The value of reexports to Canada was as follows ($ Millions): 1962=91; 1963=82; 1964=99; 1965=101; 1966=149; 1967=112; 1968=122; and 1969=182.

TABLE 2 (continued)

D. Trade with "Rest of the World"	Transactions, $ Millions								Average Annual Growth, Percent
	1962	1963	1964	1965	1966	1967	1968	1969	
1. Agricultural Products:									
U.S. Exports (Gross)	1,883	2,133	2,571	2,225	2,536	2,509	2,468	2,156	2
U.S. Imports	3,125	3,277	3,394	3,225	3,556	3,454	3,937	3,857	3
Balance (Gross)	-1,242	-1,144	- 823	-1,000	-1,020	- 945	-1,469	-1,701	...
2. Minerals, Unprocessed Fuels and Other Raw Materials:									
U.S. Exports (Gross)	418	698	740	849	1,250	888	792	804	10
U.S. Imports	2,541	2,553	2,635	2,984	3,084	2,961	3,158	3,354	4
Balance (Gross)	-2,123	-1,855	-1,895	-2,135	-1,834	-2,073	-2,366	-2,550	...
3. Manufactured Products Nontechnology-Intensive:									
U.S. Exports (Gross)	1,516	1,581	1,742	1,730	1,800	1,799	1,979	2,164	5
U.S. Imports	981	1,125	1,269	1,558	1,854	1,919	2,446	2,725	16
Balance (Gross)	535	456	473	172	- 54	- 120	- 467	- 561	...
4. Technology-Intensive Manufactured Products:									
U.S. Exports (Gross)	4,547	4,583	5,334	5,621	5,787	6,265	7,127	7,740	8
U.S. Imports	223	202	209	235	330	364	487	697	18
Balance (Gross)	4,324	4,381	5,125	5,386	5,457	5,901	6,640	7,043	...
5. All Commodities:									
U.S. Exports (Gross)[d]	8,450	9,081	10,489	10,531	11,490	11,564	12,478	12,987	6
U.S. Imports	6,870	7,127	7,507	8,002	8,824	8,698	10,028	10,633	6
Balance (Gross)	1,580	1,954	2,982	2,529	2,666	2,866	2,450	2,354	...

[d] Exports of all commodities include the sum of the four commodity groups and reexports. The value of reexports to "Rest of the World" was as follows ($ Millions): 1962=86; 1963=86; 1964=102; 1965=106; 1966=117; 1967=103; 1968=112; and 1969=123.

In trade with minerals, processed fuels, and other raw materials (Item 2 in Tables 1 and 2, and Figure 1), the United States already had deficits in most of the years between 1910 and 1920 and every year since 1921. In the time span covered in Table 1, the annual deficit in the trade with these commodities grew from about $1.9 billion in 1951-1955 to about $3.3 billion in 1969—almost proportionate with the real growth of the GNP over the same period. There can be no doubt that this deterioration is due to inadequate natural resources in the United States relative to the economy's needs and that it is likely to continue with the continued growth of the GNP.

In trade with manufactured products nontechnology-intensive (Item 3 in Tables 1 and 2 and Figure 1), the United States was a net exporter (had a net surplus) until about 1959. In that year it became a net importer of these products, and by 1969 the excess of U.S. imports over exports grew to $5.5 billion. The deterioration of the U.S. trade position in this commodity group started in the early 1950's—the time when the reconstruction of Western Europe's and Japan's war-damaged economies was completed.

In view of the large deficit that the United States has in trade in these commodities with the world and the four specific regions (Item 3 in Table 2), it would hardly be realistic to hope for much improvement in this area in the not-too-distant future. Indeed, the continued disparity between the over-all growth in imports of these products (11.5 percent in 1951-1955 to 1962 and 14 percent in the 1962-1969 periods) and the growth in export of these products from a decline of 0.8 percent per year in 1951-1955 to 1962 to 7 percent growth in the 1962-1969 period and the nature of the products involved (textiles, steel nonferrous metals, etc.) suggest that this deficit will grow, probably very substantially.

U.S. trade in technology-intensive manufactured products (Item 4 in Tables 1 and 2 and Figure 1) is the most voluminous and this commodity group is the only one that has consistently yielded surpluses that have covered the deficits in trade with other commodity groups as well as the deficits arising from other U.S. financial transactions with foreign countries. This trade has been the principal booster of the U.S. balance of payments position with the world. The gross surplus yielded by trade in this commodity group averaged $5.7 billion in 1951-1955 and about $9 billion from 1964-1969.

However, as is apparent in the Tables, even the surpluses in this commodity group are becoming vulnerable. The reasons for this are the persistent and much higher growth rates in U.S. imports of these products than in exports in trade with the world (Table 1) as well as the four regions (Table 2), and the relative closeness of the aggregate value of imports versus that of exports. Throughout the period included in Table 1, the growth of U.S. imports of these products was almost 2.5 times as rapid as that of exports (exactly 2.46 times as rapid in 1951-1955 to 1962 and 2.4 times as rapid in the 1962-1969 period) and the ratio of the aggregate dollar value of imports to that of exports advanced from only about 14 percent in 1951-1955 to 55 percent in 1969. Due to the disparities between the growth of imports versus exports and the relative level of imports versus exports, only in trade with the "Rest of the World" group can the U.S. surplus in trade with these products be regarded as safe for some time to come. The continuation of surpluses in trade with Western Europe and Canada is highly uncertain, and in trade with Japan, the United States has had deficits in relation to these (technology-intensive) products since 1965 ($87 million in 1965 and $828 million in 1969).

Data on U.S. trade in all commodities (Item 5 in Tables 1 and 2 and Figure 1) represent the aggregate of the four commodity groups and U.S. reexports. These reexports, as indicated in the footnote in Table 1, are very small and hardly influence the over-all trends. As a result of the lack of an apparent deterioration in trade with agricultural products, which, as noted, might be deceiving, the over-all deterioration so far does not appear dramatic, but it is unmistakably in evidence. The most meaningful indicator of this deterioration is an almost 180° turn of the over-all commercial trade balance in only six years: from a surplus of $1.7 billion in 1962 to a deficit of $1.3 billion in 1968. The last time the United States had a commercial merchandise trade deficit was in 1875, that is, 93 years before 1968. This turn, in itself, would not be disturbing if it were of a temporary nature, as it is generally believed to be, but this is clearly not the case. The turn is unquestionably the result of the persistently higher growth of imports than of exports since the early 1950's. Because of the relatively low volume of U.S. imports for a long period of time, the effects of this disparity in the growth rates were not readily noticeable, but the process of deterioration obviously proceeded. As shown in Table 1, Item 5, the rate of growth of all U.S. imports was faster than that of exports by about 21 percent ($4.7 \div 3.9 = 1.21$) in 1951-1955 to 1962, and by 75 percent ($14.0 \div 8.0 = 1.75$) in the 1962-1969 period.

The data in Table 2 also show that in the more recent period the growth of U.S. imports exceeded the growth of exports and, hence, at least some deterioration of U.S. trade position took place, not only in trade with the world but also in trade with all the defined regions except the "Rest of the World." The deterioration with Western Europe was not dramatic, but with Canada and Japan it could hardly have been more dramatic. In the trade with the "Rest of the World" the U.S. neither lost nor gained (over the last five years, but most other countries considered in this analysis gained).

In summary, then, what the United States has in the area of foreign trade is:

1. Rapidly deteriorating, and by now very large, trade deficits in trade with minerals, fuels, and the like, and nontechnology-intensive products, and a rapidly deteriorating trade position in the technology-intensive products. The situation in trade with agricultural products is unclear but not promising.

2. A rapidly deteriorating trade position with practically all the developed world and a dramatically deteriorating one with Japan and Canada.

3. All these deteriorations reflect long-term trends rather than cyclical developments.

These data imply a rather bleak trade-balance situation in the years to come. With this in mind, let us now turn to the analysis of the forces at work.

Forces at Work

Many of the reasons for the deterioration in the U.S. trade position can be inferred from the preceding analysis. However, to define most or all of the forces at work requires a systematic analysis. The best way to proceed with this is to start with a formal analysis of the role of the overheated economy in recent years, which, as noted earlier, is generally believed to have been the principal cause of the deterioration. That this proposition is untenable is strongly suggested by the fact, demonstrated in the preceding analysis, that the process of deterioration started in the early 1950's and continued throughout that decade—a time hardly marked by an overheated economy. A formal analysis also is fruitful. Such an analysis represents a highly effective shortcut to determine the causes of deterioration.

Any systematic analysis of the role of the overheated economy in the deterioration of the U.S. trade position must, first of all, clearly define what overheated means. In general, the term is usually associated with rapid growth of the economy coupled with inflation. Some writers have labeled it "demand inflation." Statistically, the demand inflation might be measured by the growth in the GNP in current prices.

However, some economists would argue that, for changes in a country's trade position, what matters is not the growth of the economy per se (this frequently is a function of growth of exports) but the overheat in terms of price increases or genuine inflation. The latter is, of course, measurable by changes in price indexes relevant for international trade.

It is worthwhile to ascertain the role of the overhead in both senses.

Judgments about the role of the overheat in either sense must take account not only of the relevant developments in the United States but also such developments in the countries with which the United States trades, and especially such developments in the countries relative to which the U.S. trade position has deteriorated. Changes in the trade position of individual countries result not only from internal developments but also from developments in the countries with which they trade as well as in other countries. It would make no sense to argue that inflation has been the cause of the U.S. trade position, no matter how bad inflation might have been in the United States, if it was less than was true of the countries relative to which the U.S. trade position deteriorated. The emphasis on this rather elementary point may seem unduly strong, but in many hastily reasoned analyses this basic prerequisite frequently is ignored.

The Role of U.S. Demand Inflation

To assess the role of the recent U.S. demand inflation in the deterioration of the U.S. trade position, reference is made to Tables 3 and 4 and Figure 2. Table 3 gives data on the comparative growth of the GNP in current prices versus growth of imports and exports in the United States, major European countries, Japan, and Canada in 1962-1969, that is, the time period in which the bulk of the deterioration in the U.S. trade position took place. For the United States, the data on imports also provide the breakdown by the four commodity groups. Table 4, in turn, gives explicit estimates of the comparative propensities to export and to import, which are only implicit in Table 3 but are generally believed to reveal the comparative disparities in trade performance much more subtly than any

TABLE 3 Comparative Growth of GNP in Current Prices Versus Growth of Imports and Exports: United States, Selected European Countries, Japan, and Canada

Item and Country	1962=100 1962	1963	1964	1965	1966	1967	1968	1969	Average Annual Growth, Percent
A. Growth of GNP (in Current Prices):									
United States	100	105	113	122	133	141	154	166	7.5
United Kingdom	100	106	115	124	131	137	145	152	6.7
France	100	111	122	130	142	152	160	184	9.1
West Germany	100	107	117	127	135	138	153	170	7.9
Italy	100	115	126	135	146	159	169	184	9.1
Japan	100	113	133	146	168	199	236	277	15.7
Canada	100	107	117	128	143	153	166	183	9.0
B. Growth of Merchandise Imports:									
United States	100	105	114	131	156	165	202	219	14.0
United Kingdom	100	107	122	123	128	139	149	157	6.7
France	100	119	137	141	161	170	192	234	12.9
West Germany	100	108	120	144	149	143	166	205	10.8
Italy	100	125	118	117	138	157	163	198	10.3
Japan	100	125	142	144	165	203	229	266	15.0
Canada	100	106	122	139	163	176	198	228	12.5

TABLE 3 (continued)

Item and Country	1962=100 1962	1963	1964	1965	1966	1967	1968	1969	Average Annual Growth, Percent
C. Growth of U.S. Merchandise Imports by the Defined Commodity Group:									
1. Agricultural Products	100	104	107	106	117	116	131	128	3.6
2. Minerals, Unprocessed Fuels, and Other Raw Materials	100	104	111	123	134	135	153	164	7.3
3. Manufactured Products Nontechnology-Intensive	100	106	118	144	166	172	220	229	12.6
4. Technology-Intensive Manufactured Products	100	104	121	153	236	275	370	446	24.0
D. Growth of Merchandise Exports:									
United States	100	108	123	127	140	146	159	175	8.3
United Kingdom	100	107	112	121	129	128	137	156	6.6
France	100	111	123	138	149	157	176	208	11.0
West Germany	100	110	123	135	151	163	186	218	11.8
Italy	100	108	128	155	173	187	220	253	14.2
Japan	100	111	138	171	198	210	262	323	18.3
Canada	100	111	129	137	162	178	213	233	12.8

TABLE 3 (continued)

Item and Country	1962	1963	1964	1965	1966	1967	1968	1969	Average Annual Growth, Percent
	1962=100								
E. Growth of Total Merchandise Imports Relative to Growth of GNP:									
United States	100	100	101	107	117	117	131	132	4.0
United Kingdom	100	101	106	99	98	101	103	103	0.4
France	100	107	112	108	113	112	120	127	3.5
West Germany	100	101	103	113	110	104	108	118	2.4
Italy	100	109	94	87	95	99	96	108	1.1
Japan	100	110	107	99	98	102	97	96	-0.6
Canada	100	99	104	109	114	115	119	125	3.2
F. Growth of U.S. Merchandise Imports by Commodity Group Relative to Growth of GNP:									
1. Agricultural Products	100	99	95	87	88	82	85	77	-3.6
2. Minerals, Unprocessed Fuels, and Other Raw Materials	100	99	98	101	101	96	99	99	-0.1
3. Manufactured Products Nontechnology-Intensive	100	101	104	118	125	122	143	138	4.7
4. Technology-Intensive Manufactured Products	100	99	107	125	177	195	240	269	15.2

TABLE 3 (continued)

Item and Country	1962=100 1962	1963	1964	1965	1966	1967	1968	1969	Average Annual Growth, Percent
G. Growth of Merchandise Exports Relative to Growth of GNP:									
United States	100	101	109	107	111	113	116	118	2.4
United Kingdom	100	101	97	98	98	93	94	103	0.4
France	100	100	101	106	105	103	110	113	1.8
West Germany	100	103	105	106	112	118	122	128	3.6
Italy	100	94	102	115	118	118	130	138	4.7
Japan	100	98	104	117	118	106	111	117	2.3
Canada	100	104	110	107	113	116	128	127	3.5

Sources:

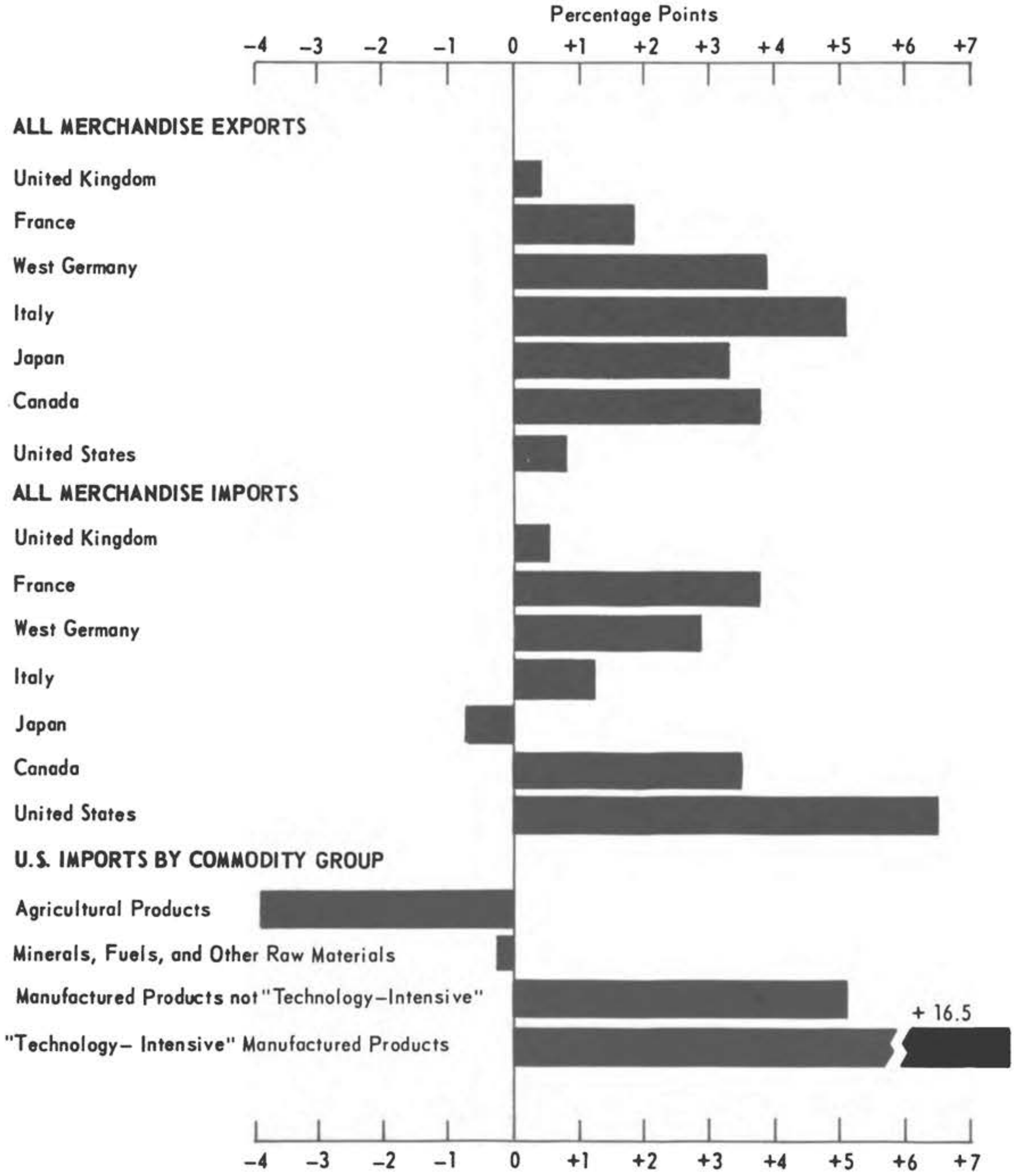
Organization of Economic Cooperation and Development, National Accounts of OECD Countries, 1950-1968; Idem. Historical Statistics 1959-1969; Idem. Main Economic Indicators, December 1970; and Table 1 above.

TABLE 4 Comparative Propensities to Export and Import

Item	Ratios of Average Annual Percentage Growth in Exports and Imports to Percentage Growth in GNP in Current Prices in 1962-1969	
	Exports	Imports
All Merchandise Exports and Imports:		
United Kingdom	1.06	1.08
France	1.21	1.42
West Germany	1.49	1.37
Italy	1.56	1.13
Japan	1.17	0.96
Canada	1.42	1.39
United States	1.11	1.87
U.S. Exports and Imports by Defined Commodity Group:		
Agricultural Products	0.32	0.48
Minerals, Unprocessed Fuels, and other Raw Materials	0.89	0.97
Manufactured Products Non-technology-Intensive	1.17	1.68
Technology-Intensive Manufactured Products	1.40	3.20

Source: Tables 1 and 3

Fig. 2 AVERAGE ANNUAL GROWTH OF EXPORTS AND IMPORTS IN EXCESS OF AVERAGE GROWTH OF GNP IN 1963-69 (CURRENT PRICES)



other estimates. These propensitites are defined simply as ratios of the countries' average (1962-1969) percentage growths in exports and imports, respectively, to their average percentage growth in GNP (in current prices). And Figure 2 demonstrates these disparities in still another way, namely, the countries' growth in exports and imports in excess of the growth in GNP.

At least theoretically, the only way in which demand inflation could cause deterioration in a country's trade position is by inducing a rapid growth of imports and diversion of productive facilities from the production for export to the production for domestic market and, hence, reducing the growth of exports. In analyzing the data in Tables 3 and 4 and Figure 2 to determine whether demand inflation could have been the decisive factor in the deterioration of the U. S. trade position, we make the following assumptions. If demand inflation is the decisive factor, then:

1. Other countries that have had similarly high or higher growth of GNP in current prices as the United States also should have experienced at least similar, and probably worse, deterioration in their trade positions than the United States, because the economies of all these countries are substantially less balanced than the U. S. economy. Consequently, equally rapid growth would produce many more import-generating and export-restricting bottlenecks than in the United States.

2. In such a technologically developed economy as that of the United States, the greatest impact on imports would have been in the area of minerals, fuels, and raw materials, which are essential for expanding economic activity, and next—in that order—on agricultural products, nontechnology-intensive manufactured products, and technology-intensive manufactured products.

As is evident in Table 3, Section A, all the foreign countries except the United Kingdom had higher rates of growth of GNP in current prices but substantially lower rates of growth in imports (Section B) and substantially higher rates of exports (Section D). Relative to each percentage point growth of GNP in the period, as shown in Section E, U. S. total merchandise imports grew by 4 percent as compared with 3. 5 percent in France, 2. 4 percent in West Germany, 1. 1 percent in Italy, 3. 2 percent in Canada, and -0. 6 percent in Japan.

Nor has the pattern of the actual growth of imports by commodity group been the kind that one would expect had demand inflation been the decisive factor in the deterioration. Relative to average percentage-point growth in GNP over the period, as shown in Section F, imports of minerals, fuels, and the like grew about 0.1 percent less and imports of agricultural products 3.6 percent less; imports of nontechnology-intensive manufactured products grew 4.7 percent faster, and imports of technology-intensive products 15.2 percent faster.

Table 4 and Figure 2 lead to the same conclusions.

In the light of this evidence, the only way one could assume that demand inflation could have been anything more than a marginal factor in the deterioration is by assuming that the U.S. economy is much less balanced, or much less accustomed to rapid growth, than that of other economies. Neither of these assumptions can be accepted.

The Role of Genuine Inflation

Data provided in Table 5 assist in determining whether the genuine inflation in the United States could have been the decisive factor in the trade deterioration. Table 5 lists two basic and commonly used indicators of inflation—changes in consumer prices and wholesale prices of manufactured goods—for the United States, major European countries, Japan, and Canada for the 1960-1969 period. These indicators, it should be noted, include many factors that are irrelevant to international trade but there is no valid reason to believe that the indexes defined for items relevant to international trade should show radically different relative rates of inflation than those apparent in the given indicators. Two other indicators frequently used in international comparisons of inflationary trends do not appear in Table 5, namely, indexes of unit labor cost to manufacturing and the price indexes of export goods, both of which are readily available. The first of these indicators, indexes of unit labor cost, is excluded on the grounds that changes in unit labor cost do not necessarily lead to changes in prices and, whenever they do, their impact on price changes is rarely uniform. The second, price indexes of export goods, is excluded on the grounds that these indexes are derived from changes in the average unit value of exported goods—a meaningless basis for comparative price analysis.*

* If the United States, while losing international competitiveness in standard commodities, shifts its export mix to increasingly sophisticated products, such as alloyed steel priced at $1,000 per ton instead of carbon steel priced at $150 (continued on page 47)

TABLE 5 Comparative Rates of Inflation: United States versus Selected European Countries, Japan, and Canada

Item and Country	1962=100									Average Annual Rate of Change, Percent
	1960	1962	1963	1964	1965	1966	1967	1968	1969	
1. Consumer Price Index (All Goods):										
United States	98	100	101	103	104	107	110	115	121	2.4
United Kingdom	93	100	102	105	110	115	118	123	130	3.8
France	92	100	105	108	111	114	117	123	130	3.9
West Germany	95	100	103	105	109	113	114	116	120	2.6
Italy	94	100	107	114	119	122	126	127	129	3.6
Japan	89	100	108	112	119	125	130	137	144	5.5
Canada	98	100	102	104	106	110	114	119	124	3.8
2. Index of Wholesale Prices of Finished Manufactured Goods:										
United States	100	100	100	100	102	105	106	109	113	1.4
United Kingdom	95	100	101	104	110	113	114	118	122	2.8
France[a]	96	100	103	106	106	110	108	106	118	2.3
West Germany	95	100	101	102	104	107	107	102	104[b]	1.0
Italy	96	100	105	109	108	110	109	110	115	2.1
Japan	100	100	101	101	103	106	108	111	113	1.4
Canada	97	100	102	103	105	108	110	113	118	2.2

[a] Intermediate Goods

[b] Through 1967 West Germany's wholesale prices of finished manufactured goods advanced faster than those of the United States. From an international competitiveness point of view the slower rate in 1968-1969 was entirely offset by the revaluation of the Deutsche Mark in 1969 (9.3%).

Sources: Organization of Economic Cooperation and Development, Main Economic Indicators and individual countries' data.

As is evident in Table 5, in terms of consumer prices, the record of inflation in the United States was considerably better than that of any of the other six major countries listed in the Table throughout the period in which deterioration in the U.S. trade position began to be apparent. In terms of the prices of manufactured goods, which have the greatest direct relevance to the area of U.S. trade in which deterioration was greatest, the U.S. record was excelled only by West Germany; this resulted from opposite changes in 1968—a deterioration in the United States and an improvement in West Germany—and a smaller advance in West Germany in 1969. The divergences between the West German and U.S. indexes in these two years could not have affected greatly either the over-all trend or the 1968-1969 developments.

It can be readily demonstrated that in the 1950's the rate of inflation was even more favorable for the United States than in the 1960-1969 period, but, as was shown in Table 1, deterioration of the U.S. position nonetheless developed and proceeded rapidly.

Hence, the overheating of the U.S. economy in the sense of rapid price increases (genuine inflation) can hardly be recognized as the principal cause of the deterioration in the U.S. trade position. However, such inflation is not completely irrelevant. Any price increase is usually detrimental to foreign trade. But the most that one can reasonably attribute to it is a marginal significance, in the sense that with no inflation in the United States, or a smaller degree than was present, deterioration might have been slower.

The Principal Causes of Deterioration

Concluding that the overheat in the U.S. economy, whether in the sense of demand inflation or genuine inflation, has not been the cause of deterioration, one must also conclude:

1. Since the U.S. trade position in the area of manufactured goods deteriorated despite a lower rate of inflation in the United States, the industrial and technological capabilities of Western Europe, Japan, and Canada must have grown at rates faster than

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*(continued from page 45) per ton, and numerically controlled machine tools priced at $50,000 to $250,000 apiece instead of standard types of machine tools priced between $10,000 and $20,000, the U.S. unit value index (price index of exported goods) would show a rapid increase without any genuine inflation.

those of the United States. The term, capabilities, refers here to the quality of the know-how as well as its scope. The important factor is the comparative rate of growth in technological and industrial capabilities, not the level of these capabilities. For U.S. trade balances to deteriorate because of the faster rate of growth in the capabilities of foreign countries indicates that foreign countries are narrowing the gap in capabilities. However, there is no evidence that the level of technological and industrial capabilities in these countries has surpassed the level of capability in the United States in any important product line.

2. That Western Europe, Japan, and Canada penetrated U.S. markets for manufactured goods though lacking industrial and technological superiority also implies that these countries have the ability to supply competitive manufactured products for home and export markets at prices lower than those prevailing in the United States in spite of their higher rate of inflation over long periods of time.

3. That the U.S. deficit in trade with minerals, unprocessed fuels, and other raw materials has grown almost proportionately with the growth in GNP, as shown in Table 1, indicates that the deterioration is also caused by the deficiency of natural resources in the United States relative to the economy's needs.

In short, the deterioration in the U.S. trade position has been caused primarily by three forces: (a) U.S. industry's gradual loss of industrial and technological superiority (or narrowing of the gap); (b) the weak international price competitiveness of U.S. industry; and (c) inadequate natural resources in the United States relative to the economy's needs.

Some of the data bearing on the faster growth rate of industrial and technological capabilities in the most important foreign countries than in the United States appear in Table 6. The accelerating development of technological expertise in foreign countries is regarded as the most important cause of the deterioration of U.S. trade position. Table 6 lists the comparative growth rates in the domestic output of all manufactured goods and of technology-intensive manufactured products, comparative gains or losses in world exports of the latter products, and the comparative growth rates in GNP between 1955 and 1967 (i.e., most of the period included in this analysis). These data show that the domestic output of manufactured goods in general (column 1), and of technology-intensive products in particular (column 2), both bearing directly on the comparative growth of the respective capabilities, was vastly greater in all the foreign countries,

TABLE 6 Selected Estimates Bearing on Comparative Growth in the Capability to Supply Manufactured Goods for Domestic and Foreign Markets, 1955-1967

	Average Annual Growth in Output of all Manufactured Goods, Percent	Average Annual Growth in Output of Technology-Intensive Products, Percent	Average Annual Gain in the Share of Total World[a] Exports of Technology-Intensive Products, Percent[b]	Average Annual Growth in GNP, Percent
United States	3.7	4.9	-10.7	3.8
United Kingdom	2.7	3.7	- 7.3	2.8
West Germany	6.4	7.7	+ 3.1	5.0
France	6.3	5.1	+ 1.0	5.2
Italy	7.7	10.1	+ 3.6	5.5
Japan	15.7	19.7	+ 6.1	9.8
Canada	5.2	n.a.	+ 2.2	4.5

[a] Strictly - Share in the total exports of 14 industrialized countries which approach total world exports.

[b] From 1954 to 1967

Sources:

Manufacturing Industries and GNP - Organization of Economic Cooperation and Development, National Accounts Statistics, 1950-1968; Technology Intensive Products - Estimates based on each country's data on shipments of engineering goods net of multiple counting (machinery and related products) and chemicals in current prices deflated with the appropriate prices indexes as reported in OECD's The Engineering Industries (Paris, 1961, 1965, and 1967) and The Chemical Industry in Europe (Paris, 1954 and 1959), OECD's The Chemical Industry 1964-1965 and 1966-1967, as well as statistical reference material (usually annual "handbooks") of the individual countries.

with the exception of the United Kingdom, than in the United States. The industrial and technological capabilities in these countries also grew substantially faster than their relative over-all economic advance, as is apparent from the comparison of their growth rates in columns 1 and 2 with the growth rates in GNP in column 4. Therefore, that these countries were able to penetrate U.S. markets is not surprising. In trade with technology-intensive manufactured products, these countries not only gained relative to the United States in U.S. markets but also worldwide, as is evident from column 3.

For some of the most important corroborating data bearing on the weak international price competitiveness of U.S. industry reference is made to Tables 7 and 8. Table 7 gives selected German and Japanese estimates bearing on the competitive price levels that prevailed in 1963-1964 in the area of consumer goods and services. Table 8 summarizes the (preliminary) results of the National Bureau of Economic Research (NBER) five-year study (not yet fully published) of comparative price levels in selected areas of producer durables as of 1964. All these data show that although there might be some question as to the precise degree to which U.S. price levels exceed those of foreign countries, there seems to be little doubt that, as of 1963-1964, the over-all West European price levels in the area of consumer goods were about 15 percent lower and those of Japan, about 30 percent lower. In the area of producer durables the over-all (average) gap was probably smaller, but not less than 10 percent for Western Europe and some 20 percent for Japan. Although some of these gaps have narrowed recently, they have not entirely disappeared.

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* In his testimony before the Joint Economic Committee of the U.S. Congress on February 17, 1971, the Secretary of the Department of Housing and Urban Development, George Romney, provided some insight into the current international price competitiveness of the U.S. automobile industry, which is of interest to this analysis. He maintained that Ford's Pinto is almost wholly from the company's foreign plants, largely from Europe. These foreign plants employ usual technology. General Motors' Vega is made in the most modern (especially built for the purpose) facilities in the United States. Both cars are priced to meet the tough foreign and domestic competition. The Vega is $200 more expensive, or about 10 percent, than the Pinto. He did not comment on how much more expensive the Vega would have been had it been built with GM's usual technology, nor how much the Pinto would have cost had the parts been imported from Japan rather than Europe. One might presume that in both cases a U.S.-made car would have been even less competitive.

TABLE 7 Selected Indicators of Broad Comparative Price Levels by Type of Purchases in Selected European Countries and Japan Relative to the United States, 1963-1964

U.S. Price Levels = 100

Country	Comparative Price Levels of All Consumer Goods and Services in 1964 Implicit in the German Statistisches Bundesamt's Estimates of The International Cost of Living	Comparative Price Levels in 1963 Implicit in Japanese Estimates of The International Cost of Living		
		All (Private) Consumer Goods and Services	Food	Clothing
	1	2	3	4
United States	100	100	100	100
United Kingdom	80- 85	n. a.	n. a.	n. a.
France	76- 81	67	89	73
West Germany	81	69	110	74
Italy	66- 73	65	104	74
Netherlands	91-102	62	85	66
Belgium	79- 84	74	73	78
Norway	77- 82	n. a.	n. a.	n. a.
Sweden	71- 73	68	147	71
Japan	59	45	97	51

n. a. = not available

Sources:

Column 1: Derived from Internationaler Vergleich der Preise für die Lebenshaltung (International Comparison of the Cost of Living), Statistisches Jahrbuch für die Bundesrepublik Deutschland, 1967 pp. 136-137. The left side of the range refers to the implicit relative prices based on average U.S. and German quantity weights and the right side to the implicit relative prices based on German and respective country's weights. (Continued on page 52)

TABLE 7 (Continued from page 51).

Columns 2, 3, and 4: Derived from Office of the Prime Minister, Bureau of Statistics, Kokumiu Seikatsu Hakusko (National Life White Paper, in Japanese), Tokyo, 1965, Section I-2, Table 2 (translation of selected parts was provided by the Department of State's Language Service). Estimates of the comparative price levels of the individual countries in the source are relative to Japan rather than to the U.S. The source provides no detail as to the composition of the observations used in the comparison or the methodology, except that the comparisons employed geometrically averaged quantity weights of the respective country and Japan. Systematic use of the average of U.S. and respective country's quantity weights might have resulted in somewhat higher relative prices but, judging by the German comparisons, not very much.

TABLE 8 National Bureau of Economic Research Estimates of Comparative International Price Levels for Selected Major Product Groups, 1964

U.S. = 100

Commodity Class	U.S.	U.K.	EEC	Japan
Nonelectric Machinery (Average)	100	92	96	n.a.
Office Machines	100	97	97	n.a.
Textile and Leather	100	n.a.	87	n.a.
Agricultural	100	84	89	n.a.
Mechanical Handling Equipment	100	91	85	80
Construction and Mining	100	107	114[a]	97
Printing and Bookbinding	100	94	96	n.a.
Heating and Cooling Equipment	100	93	102	n.a.
Powered Tools	100	88	99	n.a.
Machine Tools	100	86	84	n.a.[d]
Transport Equipment (Excluding Road Motor Vehicles)	100	91	92	n.a.
RR Vehicles and Parts	100	107[b]	125	119[c]
Aircraft	100	111	n.a.	n.a.
Ships	100	n.a.	55	46
Iron and Steel	100	81	80	n.a.
Nonferrous Metals	100	98	98	n.a.

[a] Germany

[b] 1963

[c] Diesel Locomotives

[d] Based on a sample of 13 comparisons compiled by the National Machine Tool Builders Association, it appears that Japan's machine tool prices are at a level about 35 percent lower than the U.S. level.

n.a. = not available

Source: National Bureau of Economic Research (NBER) (Preliminary)

With respect to the inadequacy of U.S. natural resources relative to the needs of the economy, it should suffice merely to mention that by now the United States is not self-sufficient in some 26 types of raw materials of which the economy consumes more than $100 million worth per year (among them are iron ore, copper, lead, zinc, tin, nickel, mercury, chromium, bauxite, petroleum, and natural gas) and the list is growing (7).

Two Other Factors

In trade with Western Europe, the U.S. trade balances in recent years have also been unfavorably affected by at least two other price-equivalent disadvantages that should be noted, because their impact is likely to continue and to increase in strength.

The first of these is the shift of France, West Germany, and The Netherlands from sales taxes to value-added taxes. This policy entails the imposition of border taxes on U.S. products imported into these countries and the refunding of the value-added taxes to those who export like products to the United States. This measure is justified as a cost equalization of their products entering foreign trade, since the United States does not impose either sales or value-added taxes on exported products. Income taxes, which are more important in the United States than in Europe, are considered to be neutral for the level of prices. This justification is not tenable. The reason is that it fails to recognize the institutional differences in the social cost structure of products that have evolved on the two sides of the Atlantic. The differences arise chiefly from different methods of financing social programs, notably pension plans, education, health care, humanitarian foundations, and the like. In the United States, such programs are prevailingly financed privately, whereas in Europe they are most often financed by taxes, including value-added taxes. A greater U.S. share of such expenditures being privately financed obviously requires relatively higher wages and profits, and this tends to make the private cost of U.S.-made products, and their prices, relatively higher than those produced in Europe. Consequently, the imposition of border taxes on U.S. products entering these countries is but another instance of a non-tariff trade barrier. Conversely, refunding the value-added taxes to European exporters represents an export subsidy device.

The second disadvantage that U.S. trade with Western Europe has experienced in recent years is connected with the creation of the European Common Market. From the point of view of U.S.-European trade, the Common Market represents the elimination of tariffs among member countries and the maintenance of tariffs against outsiders, including the United States. The import preferences of the member countries would change as a result of the relative price changes (involving the choice of an item only in terms of price versus the price-plus import duties). Such changes would not be to the advantage of the United States. The prospect of this disadvantage served as an immensely potent force in the movement of U.S. direct investments to Europe and the accompanying outflow of advanced technology in a "naked" form that, in many instances, represented a substitute for U.S. exports. These might have been offset, in part, by the increase in U.S. exports resulting from increased income in European Economic Community (EEC) member countries.

All of the preceding analysis has been based on data through 1969. As noted in the Introduction, the United States experienced some improvement in the trade balances in 1970 that was widely interpreted as a reversal of the deterioration. Therefore, it is necessary to take a careful look at the extent and nature of this improvement to determine whether it represents a reversal of the outlined long-term trend or is merely an aberration of this trend.

Extent and Nature of the Improvement In the U.S. Trade Situation in 1970

The developments in U.S. trade in 1970 and the apparent reasons for these developments are described in Tables 9 through 12. Table 9 compares the data on U.S. trade in 1970 by region and defined commodity group with 1969 and 1962-1969 trends; Table 10 amplifies Table 9 with selected specific commodity detail; Table 11 gives the data on that year's comparative changes in prices and over-all economic growth—the principal determinants of short-term trade developments; and Table 12 compares that year's growth of U.S. imports, total and by group and selected specific commodities, relative to growth of the GNP with such estimates for the 1962-1969 period. This vast amount of information can be summarized as follows:

1. In 1970 all U.S. foreign merchandise trade yielded an over-all gross surplus of about \$3.2 billion, or \$1.3 billion more than in 1969 (Table 9, Item A/5). The comprehensive data on the value of U.S. noncommercial exports (largely military grants and aid shipments, exports financed by U.S. foreign aid programs, and sales of agricultural products under Public Law 480) are not yet available. Assuming that these data do not differ greatly from those for 1969,

TABLE 9 U.S. Trade in 1970 by Region and Commodity Group Compared with 1969 and the 1962-1969 Trends

Region and Commodity Group	I. Transactions, $ Millions: 1969 Exports	1969 Imports	1969 Balance	1970 Exports	1970 Imports	1970 Balance	II. Comparison of Growth Rates: Exports 1970 Over 1969, Percent	Exports Average Annual Growth in 1962-1969, Percent	Imports 1970 Over 1969, Percent	Imports Average Annual Growth in 1962-1969, Percent
Trade with All Countries in the World										
1. Agricultural Products	5,936	4,954	982	7,174	5,665	1,509	21	2	14	4
2. Minerals, Unprocessed Fuels, and Other Raw Materials	4,741	8,077	-3,336	6,079	8,395	-2,316	28	7	4	7
3. Manufactured Products Nontechnology-Intensive	6,210	11,689	-5,479	6,781	12,926	-6,145	9	9	11	13
4. Technology-Intensive Manufactured Products	20,575	11,323	9,252	22,559	12,977	9,582	10	10	15	24
5. All Commodities[a]	38,006	36,043	1,963	43,226	39,963	3,263	14	8	11	12
Trade with Western Europe										
1. Agricultural Products	2,136	816	1,320	2,566	929	1,637	20	0	14	7
2. Minerals, Unprocessed Fuels, and Other Raw Materials	2,203	1,159	1,044	2,224	1,202	1,022	1	8	4	9
3. Manufactured Products Nontechnology-Intensive	2,077	4,065	-1,988	2,398	4,343	-1,945	16	9	7	12
4. Technology-Intensive Manufactured Products	5,765	4,098	1,667	7,070	4,701	2,369	23	10	15	16
5. All Commodities[a]	12,392	10,138	2,254	14,465	11,175	3,290	17	7	10	12
Trade with Japan										
1. Agricultural Products	934	37	897	1,214	37	1,177	30	10	0	-3
2. Minerals, Unprocessed Fuels, and Other Raw Materials	990	202	788	1,444	246	1,198	46	14	22	7
3. Manufactured Products Nontechnology-Intensive	360	2,644	-2,284	408	3,014	-2,606	13	23	14	17
4. Technology-Intensive Manufactured Products	1,178	2,005	- 827	1,544	2,578	-1,034	31	10	29	32
5. All Commodities[a]	3,490	4,888	-1,398	4,652	5,875	-1,223	33	12	20	21
Trade with Canada										
1. Agricultural Products	710	244	466	810	308	502	14	5	26	4
2. Minerals, Unprocessed Fuels, and Other Raw Materials	744	3,362	-2,618	860	3,512	-2,652	16	6	5	11
3. Manufactured Products Nontechnology-Intensive	1,609	2,255	- 646	1,527	2,483	- 956	-5	9	10	9
4. Technology-Intensive Manufactured Products	5,892	4,523	1,369	5,609	4,788	821	-5	16	6	34
5. All Commodities[a]	9,137	10,384	-1,247	9,084	11,091	-2,007	-1	12	7	16
Trade with "Rest of the World"										
1. Agricultural Products	2,156	3,857	-1,701	2,584	4,391	-1,807	20	2	14	3
2. Minerals, Unprocessed Fuels, and Other Raw Materials	804	3,354	-2,550	1,550	3,435	-1,885	93	9	2	4
3. Manufactured Products Nontechnology-Intensive	2,164	2,725	- 561	2,448	3,086	- 638	13	5	13	16
4. Technology-Intensive Manufactured Products	7,740	697	7,043	8,336	910	7,426	8	8	30	18
5. All Commodities[a]	12,987	10,633	2,354	15,025	11,822	3,203	16	6	11	6

[a] All commodities include the value of the four commodity groups and reexports. The values of reexports were as follows ($ Millions): to all countries, 544 in 1969 and 633 in 1970; to Western Europe, 211 and 207, respectively; to Japan, 28 and 42; to Canada, 182 and 278; and to the "Rest of the World," 123 and 106.

Source: See Table 1

TABLE 10 U.S. Trade with all Countries in the World in Selected Specific Commodities, 1970 Compared with 1969 and 1962-1969 Trends

Commodity	Transactions $ Millions		Comparison of Growth Rates	
	1969	1970	1970 Over 1969, Percent	Average Per Year in 1962-1969, Percent
U.S. Exports:				
Grains and Preparations	2,127	2,588	22	0
Soybeans	822	1,216	48	11
Feed for Animals	405	497	23	14
Coal, Coke and Briquettes	636	1,044	64	5
Iron and Steel Scrap	303	447	48	7
*Textiles and Textile Products	785	804	2	4
*Iron, Steel, and Iron and Steel Products	941	1,190	26	6
*Nonferrous Metal Products	861	964	12	11
*Chemicals (All Types)	3,383	3,826	13	9
*Nonelectrical Machinery	7,460	8,677	16	9
*—Metalworking Machine Tools	253	305	21	-3
*Electrical Machinery and Electronics	2,677	3,000	12	10
*Scientific and Professional Instruments and Controls	789	857	9	15
*Aircraft and Parts	2,423	2,658	10	17
*Motor Vehicles and Parts	3,514	3,244	- 8	15

*Designates commodities for which trade balances might be derived by subtracting the value of imports from exports.

TABLE 10 (continued)

Commodity	Transactions $ Millions 1969	1970	Comparison of Growth Rates 1970 Over 1969, Percent	Average Per Year in 1962-1969, Percent
U.S. Imports:				
*Textiles and Textile Products	2,124	2,402	13	11
*Iron, Steel, and Iron and Steel Products	1,724	1,954	13	20
*Nonferrous Metal Products	1,534	1,653	8	11
*Chemicals (All Types)	1,228	1,450	18	9
*Nonelectrical Machinery	2,622	3,102	18	27
*—Metalworking Machine Tools	157	135	-14	31
*Electrical Machinery and Electronics	1,948	2,272	17	28
*Scientific and Professional Instruments and Controls	333	356	7	18
*Aircraft and Parts	283	274	- 5	20
*Motor Vehicles and Parts	4,796	5,394	12	39

*Designates commodities for which trade balances might be derived by subtracting the value of imports from exports.

Source: See Table 1

TABLE 11 Comparative Changes in Prices and Economic Growth in 1970 Over 1969

Country	Price Changes			Growth in GNP				(Real) Growth of Industrial Production	
	Increase in Consumer Prices in 3 Qtrs. 1970 Over 3 Qtrs. of 1969, Percent	Increase in Wholesale Prices of Manufactured Goods[a], 3 Qtrs. 1970 Over 3 Qtrs. 1969, Percent	Increase in OECD-Projected GNP Deflator for 1970 Over 1969[b], Percent	2 Qtr. 1970 Over 2 Qtr. 1969, Percent: Current Prices	2 Qtr. 1970 Over 2 Qtr. 1969, Percent: Real	OECD-Projected for Whole 1970 Over 1969[b], Percent, Real	Average Annual Growth in 1962-1969, Percent, Real	3 Qtrs. 1970 Over 3 Qtrs. 1969, Percent	Average Annual in 1962-1969, Percent
United States	5.7	3.9[c]	5.25	4.9[e]	0.4[e]	-.25	4.6	-3.0[e]	5.6
United Kingdom	6.3	6.5	6.0	7.1	2.2	1.75	2.9	2.4	3.5[f]
France	5.7	10.5	5.5	n.a.	n.a.	5.75	5.6	5.9	6.1
West Germany	3.7	7.2	7.0	12.7	n.a.	4.5	4.8	7.0	5.8
Italy	4.7	9.8	6.25	n.a.	n.a.	6.5	5.0	4.0	6.2
Japan	7.5	2.0	5.75	21.1[d]	13.4[d]	11.5	11.1	18.0	14.2[f]
Canada	3.8	1.3	4.0	7.1	3.8	2.75	5.4	2.3	6.3

[a] Intermediate manufactured goods only

[b] Based on information available to OECD at the end of 1970

[c] Finished manufactured goods

[d] First quarter 1970 over first quarter 1969

[e] Preliminary estimates for the year

[f] 1963-1969

Sources: OECD, Main Economic Indicators, 1959-1969 and December 1970; Idem, Economic Outlook, December 1970; and Economic Report of the President, February 1971.

TABLE 12 U.S. Propensity to Import in 1970 Compared to 1962-1969

Commodity	Ratio of Percentage Growth of Imports to Percentage Growth of GNP in Current Prices: 1970	1962-1969 Average
Agricultural Products, Total	2.94	0.53
Minerals, Unprocessed Fuels, etc., Total	0.80	0.93
Nontechnology-Intensive Manufactured Products, Total	2.16	1.60
- Textiles and Textile Products	2.65	1.47
- Iron, Steel, and Iron and Steel Products	2.65	2.67
- Nonferrous Metal Products	1.63	1.46
Technology Intensive Manufactured Products, Total	2.98	3.20
- Chemicals	3.67	1.20
- Nonelectrical Machinery	3.67	3.60
--Metalworking Machine Tools	-14.0/4.9	4.13
- Electrical Machines & Apparatus	3.47	3.73
- Scientific and Professional Instruments and Controls	1.43	2.40
- Transportation Equipment	2.39	4.93
--Aircraft and Parts	-5.0/4.9	2.67
--Motor Vehicles and Parts	2.45	5.20
All Commodities	2.22	1.87

Sources: Tables 1, 3, 8, 9, and 10

this over-all gross surplus would imply a net commercial surplus of about $800 million, compared with a net commercial deficit of about $600 million in 1969. This improvement in the over-all balances was derived from improvements in the balances of all four major commodity groups except nontechnology-intensive manufactured products (Table 9, Section A) and the balances of trade with all regions except Canada (Table 9, Sections B-E).

2. The gross balance in trade with agricultural products reached $1.5 billion, about $500 million more than in 1969 (Table 9, Item A/1). This improvement is the net result of a greater surplus in trade with Western Europe (up by $300 million, Table 9, Item B/1), a greater surplus in trade with Japan (up by almost $300 million, Table 9, Item C/1), a slightly greater surplus in trade with Canada (up about $36 million), and a greater deficit in trade with the "Rest of the World" (deficit up by about $100 million, Table 9, Item E/1).

3. In trade with minerals, unprocessed fuels, and the like, the U.S. deficit (traditional since about 1910) was reduced to about $2.3 billion, down from about $3.3 billion in 1969, with the improvement being largely the result of a phenomenal increase in U.S. exports to Japan (up by about $454 million) and to the "Rest of the World" (up by $746 million from 1969), coupled with a very modest over-all growth in imports of these products (only 4 percent, Table 9, Item A/2).

4. The U.S. deficit in trade with nontechnology-intensive manufactured products, traditional since 1959, increased by another $666 million from the 1969 level of roughly $5.5 billion. This further deterioration resulted from an increase of the deficit in trade with Japan (from about $2,284 million in 1969 to $2,606 million in 1970), Canada (from $646 million in 1969 to $956 million in 1970), and the "Rest of the World" (from $561 million in 1969 to about $638 million in 1970).

5. The traditional U.S. surplus in the over-all trade with technology-intensive manufactured products increased by another $330 million, from $9.3 billion in 1969 to $9.6 billion in 1970, with the gain largely accounted for by an increase in the surplus in trade with Western Europe (an increase in the U.S. surplus from about $1.7 billion in 1969 to $2.4 billion in 1970) and with the "Rest of the World" (an increase in the U.S. surplus from roughly $7.0 billion in 1969 to $7.4 billion in 1970) and a further decline in the surplus of trade in these commodities with Canada (from about $1.4 billion in 1969 to

$821 billion in 1970). The deficit in trade with Japan also increased (from $827 million in 1969 to about $1 billion in 1970).

6. On a regional basis the approximately $1.3 billion over-all gain in the U.S. gross surplus is accounted for by a sizable increase in the over-all surplus with Western Europe (up from about $2.3 billion in 1969 to $3.3 billion in 1970) and the "Rest of the World" (from $2.4 billion in 1969 to $3.3 billion in 1970) and a decrease in the over-all trade deficit with Japan (from about $1.4 billion in 1969 to about $1.2 billion in 1970). An increase in the over-all deficit in trade with Canada (from about $1.2 billion in 1969 to $2.0 billion in 1970) also occurred.

7. Statistically, the reason for the improvement is that U.S. imports of all commodities increased by 11 percent, whereas exports increased by 14 percent. However, the growth of U.S. exports exceeded the growth of imports only in agricultural products (21 percent compared with 14 percent) and minerals, fuels and the like (28 percent compared with 4 percent). Exports of manufactured products nontechnology-intensive continued to grow less than imports (9 percent compared with 11 percent). The same trend characterized exports of technology-intensive manufactured products (10 percent compared with 15 percent). On a regional basis, the growth of U.S. exports in 1970 exceeded the growth of imports in trade with all regions except Canada. In the 1962-1969 period (as well as in 1951-1962), the growth of U.S. exports was smaller than the growth of imports in trade with all commodity groups except minerals, fuels, and the like (in which both were about the same) and in trade with all regions except the "Rest of the World" (in which both were about the same).

8. The principal substantive reason for the improvement may be ascertained from the information given in Table 11. This Table shows that U.S. price changes in 1970 did not differ greatly from those in most other countries (with the possible exception of Canada and Japan) and would not have caused U.S. imports to grow more slowly than exports. However, the drastic differences in the U.S. growth in 1970 compared with that of other countries could have been the significant factor. In 1970 there was a decline in real GNP and the level of industrial production in the United States, but the economies of other countries (except Canada) continued to grow, and some of the Western European countries experienced accelerated growth. These disparities in growth rates must have curbed the growth of U.S. imports and stimulated exports. The curbing of U.S. imports is most evident in the trade with minerals, fuels, and the like

(in which the traditional U.S. deficit was reduced by about $1 billion), and the stimulus to exports is most evident in the U.S. trade with steel and machine tools, where U.S. exports increased dramatically (Table 10), in spite of the generally weak price competitiveness of these U.S. products.

9. The phenomenal increases in U.S. exports of agricultural products and, especially, of minerals, fuels, and the like (21 percent and 28 percent, respectively) suggest that there might have been other factors involved, such as the stockpiling of storable commodities by foreign countries (e.g., grains, soybeans, coal, and iron and steel scrap). If so, these increases can hardly be expected to continue in the future.

10. The observations stated in points 8 and 9 imply that it would be imprudent to consider the 1970 improvement in U.S. trade balances as anything more than a temporary and a rather inconspicuous interruption (or cyclical aberration) of the long-term trend in the deterioration of the U.S. trade position that has been under way since the early 1950's and especially since 1962. In fact, comparisons of the growth of U.S. imports with the growth of the GNP given in Table 12 imply a reinforcement of the long-term trend rather than an interruption, since in 1970 the growth of imports relative to the growth of the GNP, which defines trends in the U.S. propensity to import, became substantially higher than in the past. Were this propensity to continue to grow as rapidly when the U.S. economy resumes normal GNP growth, the $3.3 billion gross surplus of 1970 would soon turn into a sizable deficit.

11. The threat of large U.S. trade deficits in the oncoming normal times is most apparent in the context of technology-intensive products. The United States has enjoyed sizable surpluses in trade with these products since the beginning of this century. As Table 9 shows, U.S. imports of these products in 1970 continued to grow faster than exports in spite of the negative real growth of the U.S. economy and the phenomenal growth in Western Europe and Japan. How rapidly these imports would grow, were the rapid over-all economic growth to take place in the United States and the slump to occur in Western Europe and Japan, is uncertain.

12. The commodity detail in Table 10 also provides considerable insight into the principal areas of U.S. strength as well as weakness. Of the 15 narrowly defined product classes listed in the Table, the most troublesome in terms of deficits are textiles and textile products and motor vehicles and parts. The difficulties of the U.S. government

with textiles are well known. A rather superficial analysis of the developments in motor vehicles and parts suggests, however, that the difficulties with textiles might prove to be trifling compared with what might occur in regard to motor vehicles should U.S. industry fail in its current attempt to introduce products that will compete effectively against imports. In 1970 the U.S. deficit in trade with automobiles and parts exceeded $2 billion. As late as 1964 the U.S. surplus in trade with these products was in excess of $1 billion. In the 1962-1969 period, U.S. imports of these products grew at the rate 2.6 times that of exports. In 1970 imports increased by 15 percent, whereas U.S. exports declined by 8 percent and domestic sales decreased by 15 percent.

Conclusions

Based on a rather extensive analysis of a great variety of statistical data on the 1950's and 1960's, it was concluded that the seemingly sudden and drastic deterioration in the U.S. merchandise trade balances in 1968 and 1969 (from a $3 billion to $8 billion gross surplus to gross surpluses of $1.4 billion in 1968 and $2 billion in 1969, and from $1.7 billion to $4.1 billion net commercial surplus to a net surplus of $1.3 billion in 1968 and a deficit of nearly $600 million in 1969) was, contrary to the general belief, not a cyclical development but the result of the long-term deterioration of the U.S. trade position that began early in the 1950's and continued through the 1960's. Equally extensive analysis of the developments in 1970 leads to the conclusion that the apparent improvement in the over-all balance in that year was cyclical, thus an aberration rather than a reversal of the long-term trends. Therefore, this deterioration continues. Its principal features are:

1. A gradually growing deficit in trade with minerals, fuels, and the like (from, e.g., $1.7 billion in 1957 to $3.3 billion in 1969)

2. A dramatically growing deficit in trade with nontechnology-intensive manufactured products (from a surplus of about $1.1 billion in 1957 to a deficit of $5.6 billion in 1969)

3. A rapidly deteriorating trade situation in the technology-intensive manufactured products, the only commodity group still yielding sizeable surpluses, with imports persistently growing at a rate about 2.5 times as fast as exports and about 3.2 times as fast as the growth of the GNP (in current prices)

4. A rapidly deteriorating trade situation with nearly all the developed world and a dramatic deterioration with Japan and Canada

The principal causes of this deterioration have been:

1. The gradual loss of industrial and technological superiority by U.S. industry (narrowing of the gap)

2. Weak international price competitiveness of U.S. industry

3. Inadequate natural resources in the United States relative to the economy's needs

The creation of the European Common Market and the shift by some of its members to value-added taxation have exerted significant effects.

In assessing the probable operation of all these forces in the near future, it would appear that time will be working in favor of the United States only in the area of price competitiveness. However, for at least two reasons its impact is not likely to be great. First, the United States still has far to go to catch up with the price levels of the most important competitors, especially Japan and West Germany. Second, all the foreign countries have the advantage of being able to devalue whenever their price competitiveness excessively decreases, an advantage that the United States does not have.

All these conclusions have serious implications, not only in regard to the future U.S. balance of payments, the international monetary system, and the over-all U.S. posture abroad but also in domestic matters such as level of interest rates, control of inflation, exploration of domestic natural resources, and the scientific and technological state of the civilian economy. To discuss all these implications in detail obviously would take another paper or more. But even without this detail it should be quite clear that the situation gives ample reason for very serious concern.

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TECHNOLOGY AND INDUSTRY STRUCTURE*

Almarin Phillips

Introduction

Until quite recently, there was little in the core of economic theory that dealt with science and changes in technology, on the one hand, and the functioning of an economic system, on the other. There are now a number of macroeconomic models that explicitly include technological change in aggregate production functions (1). And in microeconomics, there have been numerous theoretical and empirical attempts to relate science and technology to the functioning markets (2).

However, the problems of blending scientific activities into the framework of economic theory are hardly solved. Indeed, there are radically different and still evolving views of basic relationships. One of these regards science and science-related activities as exogeneous to economic processes. Macroeconomic models typically—though not universally—view science as producing technological alternatives that are costlessly developed to yield new parameters in the economy's production function. That is to say, new technology seems to flow like manna from heaven—sometimes at constant annual rates—in a way unrelated to economic variables. The recent microeconomic work, on the contrary, typically treats technological development as functionally related to economic variables, particularly market structures, thus incorporating as endogenous factors some of the world of science.

The nature of the relationship between scientific and economic processes and the effects of these processes on industry structures are the topics primarily addressed in this paper. The conclusions suggest possible applications of the main arguments to problems of international trade.

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*Adapted and expanded, with permission, from materials in Phillips, A. Technology and Market Structure: A Study of the Aircraft Industry. (Heath Lexington Books, Lexington, Mass., 1971).

The Theories of Schumpeter and Galbraith

It is not difficult to explain why only a few of the studies of technology and industry structures conducted by economists in recent years have paid explicit attention to possibly exogenous effects of science and technology on economic processes.* Understandably, economists interested in industry structures and their effects on economic performance have sought to explain the scientific and technological world in terms of economic variables. However, this has not always been the case. Joseph A. Schumpeter stressed the historical importance of the emergence of capitalism—viewed generally—on scientific developments (3). According to Schumpeter, in the sweep of modern history, the sociological and political counterparts of Western European capitalism were essential to the creation of an intellectual environment conducive to scientific discovery and progress. But Schumpeter did not use this broad view of history to argue that it was the structure and performance of markets that governed technology in the microcosmic aspects of the capitalist process. Quite the reverse is true.

The Theory of Economic Development (4) and the closely related work, Business Cycles (5), view particular developments and directions of science and technology as largely independent of particular markets in a capitalist society. The Theory, in a manner somewhat akin to recent models of growth, and without attempting historical or empirical tests, pays little attention to either the scientific source of inventions or the motivation of the inventor. Whatever the source and motivation, it is implicitly assumed that a discontinuous stream of more or less significant inventions occurs over time.

From the stream of inventions, ostensibly made for reasons independent of particular markets, and from entrepreneurs dipping into this stream for innovations, Schumpeter fashioned his theory of economic development. The aggregative aspects of the theory consist of generalizations drawn from the impact of a new technology on a

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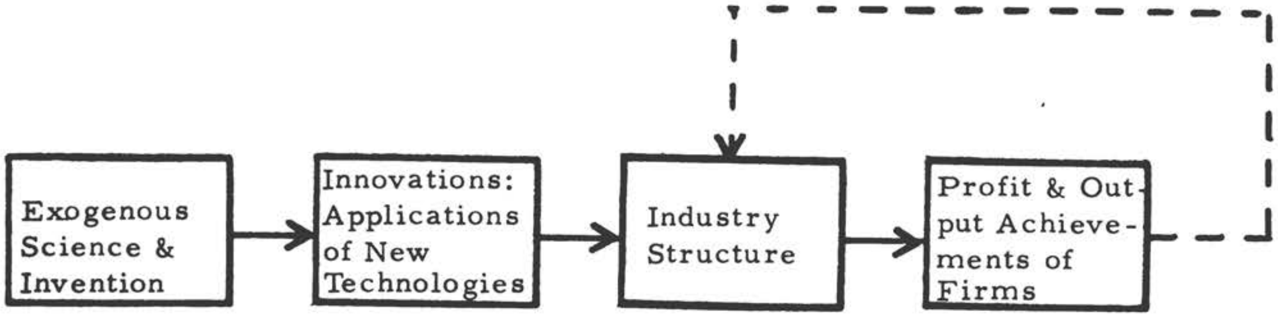
*Some exceptions are Nelson, R.R., M. J. Peck and E. D. Kalachek, Technology, Economic Growth and Public Policy (The Brookings Institution, Washington, 1967), pp. 34-43; Comanor, W. S. Market Structure, Product Differentiation, and Industrial Research. Quarterly Journal of Economics (November 1967); Scherer, F.M. Firm Size, Market Structure, Opportunity and the Output of Potential Inventions. American Economic Review (December 1965).

particular market. Utilizing the initial assumptions of a static, circular flow equilibrium for aggregate economic activity and the conditions of long-run competitive equilibrium for the individual product markets, Schumpeter followed with an analysis of the unbalancing effects of innovation and of the subsequent balancing effects exerted by the market forces inherent in his system. Briefly, the successful innovator created a monopoly in a particular market, only to have that monopoly successively whittled away by the entry of swarming, secondary innovators. The swarming tended to reproduce the initial conditions of competitive equilibrium in particular markets. At the same time, technical and economic interrelations among markets led to cyclical investment behavior and higher levels of real income. These higher income levels were the principal variables of Schumpeter's interest, though not the ones of greatest relevance here. Interestingly, a similar argument has been advanced to explain the changing mix of exports of technologically advancing nations (6).

The point to be emphasized about The Theory is the direction of causation. The milieu of the capitalist process fostered science and technology. Science and technology stimulated invention, a necessary ingredient for innovation. Given invention, the spirit of the entrepreneur provided a sufficient condition for innovation. The innovation then directly influenced the structure of particular markets; that is to say, innovation made some of them ephemerally monopolistic. With some change from Schumpeter's terminology, the system of The Theory is shown in Figure 1. The dashed feedback loop from the profits and output achievements of the firms to market structure represents the swarming of secondary innovators and the demise of firms utilizing the old technology. Thus, market structure is affected by the entry of new firms and the failure of old ones as the process of technological change occurs.

At this stage in his career, the argument that market structure determines the research, development, and innovative behavior of firms and their contributions to technology and science was neglected by Schumpeter. Two or three decades later, the Schumpeter of Capitalism, Socialism and Democracy offered a different view, perhaps because of the different historical context in which this later work was written. In the 1930's, Schumpeter foresaw the demise of entrepreneurial capitalism. Invention remained an important part of his system, but the role of an inventor who is independent of market processes was cut from the plot. Enterprises remain, especially "giant industrial units," but the individual entrepreneur is ousted. Invention and, as the topic is not treated separately, presumably the necessary increments to science that underlie the inventions, in this

FIGURE 1 Relations Between Science, Technology and Industry Structure in Schumpeter's Theory of Economic Development



later view, are routinized by managers and trained specialists in ways that satisfy the bureaucratically set goals of large firms.

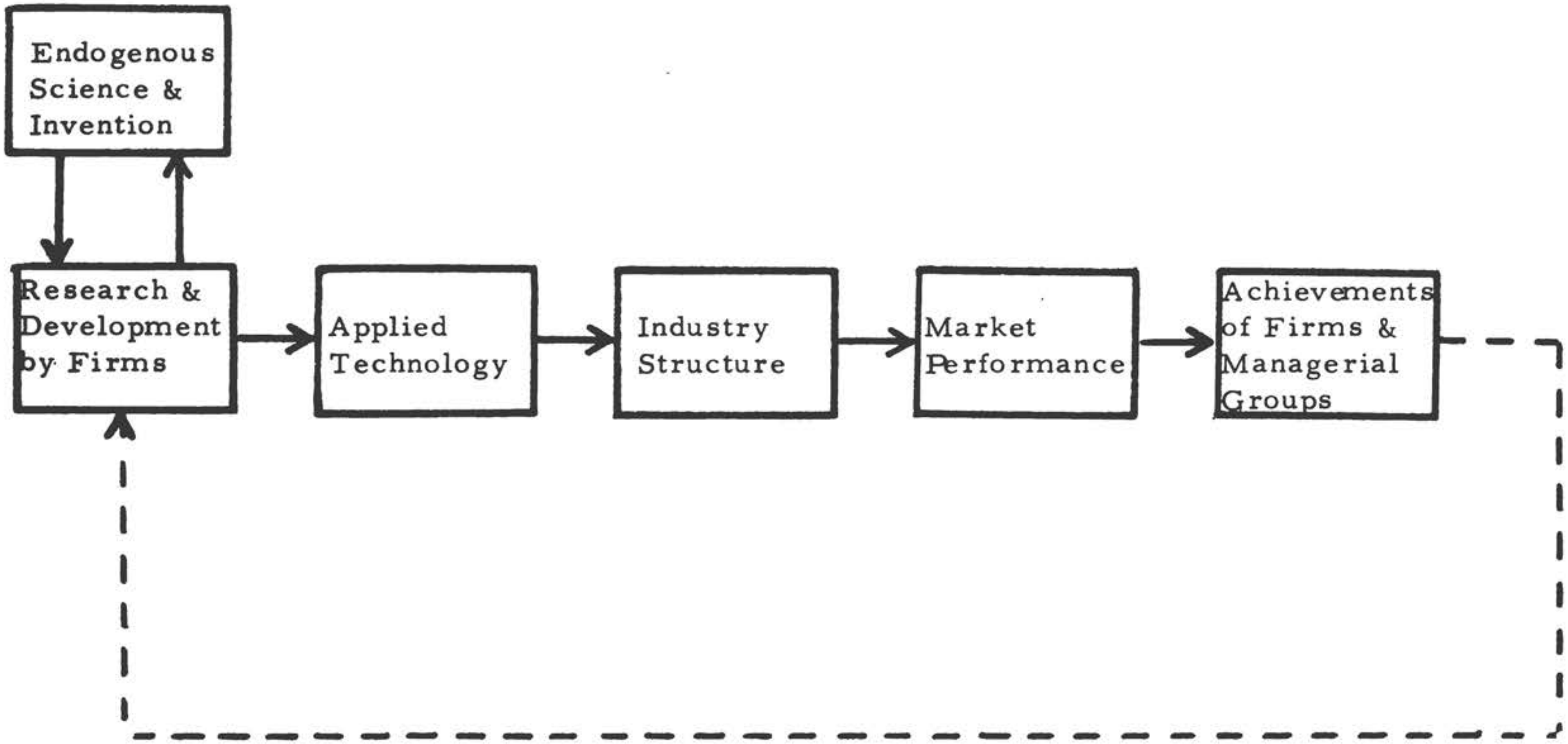
Industry structure continues to be determined by technological change. Technological success and market success are generally identical, however, and they result in increased concentration as small and medium-sized firms are excluded from markets by their larger, more successful rivals. Price competition generally is supplanted by technological, innovative competition and, once concentrated, market structures are threatened only through long-run forces of "creative destruction," in which a new, technically progressive firm supplants an older, less progressive, monopolistic firm.

The market structure-technological change system in Schumpeter's Capitalism, Socialism and Democracy is a short, closed-loop scheme, as shown in Figure 2. Successful technical change leads to, or is identical with, market success and increased concentration. The rewards to the managerial groups that are associated with technological and market success give rise to additional research, development, and scientific effort. These, in turn, lead to further technical development and continued market success. Science and technology, it seems, become the handmaidens of managers and applied technicians until the fruits of the process result in the full elimination of the entrepreneurial class. Eventually, Schumpeter felt, scientific socialism would emerge.

The popular version of relations between technical change and markets fashioned by John Kenneth Galbraith (7) opened the system again, but with a direction of causation just the opposite from that presented by Schumpeter in The Theory of Economic Development. Differences and changes in market structure are acknowledged, but they are not explained by differences and changes in the technologies related to the markets. Market structures are simply assumed. Aspects of science and technology other than those developed by or for market-oriented firms or market-oriented purposes are not considered important in the explanation of market performances. That is to say, there is no discussion of developments in science and technology that are exogenous to the market process.

In the Galbraith system, oligopolistic firms—ostensibly viewed as a homogeneous subset—are able to carry on research, development, and innovative activities because of the financial achievements deriving from their protected market positions. The stimulus that accounts for their use of resources in technological activities rather than for other purposes is not detailed, but it seems to originate from some

FIGURE 2 Relations Between Science, Technology, and Industry Structure in Schumpeter's Capitalism, Socialism and Democracy



characteristics of market-share and technical rivalry that Galbraith feels are likely to prevail among oligopolistic firms.

Firms in more atomistically structured markets, in contrast, are just consumers of technical changes created by oligopolistic firms from whom purchases are made and/or created by government and quasi-government research and development agencies. The latter activities are viewed as public efforts to overcome the shortcomings in the performance of atomistic markets and, in this sense, are also indirectly market determined. In both the oligopolistic and atomistic cases, the chain of causation, shown in Figure 3, runs from industry structure to firm behavior, and from this, to changes in applied technology, market performance, and the achievements of firms and their managers. In neither the atomistic nor the oligopolistic case is the entry of new firms or the failure of old ones regarded as a source of change in industry structure.

Inadequacies of the Schumpeterian and Galbraithian Theories

If the later Schumpeterian or the Galbraithian theory were correct, large firms in concentrated markets would generally display more technological progressiveness than do others. More accurately, if either theory is correct, differences in measures of technical progressiveness between firms such as these and other firms should be more than proportional to the differences in the sizes of the firms.

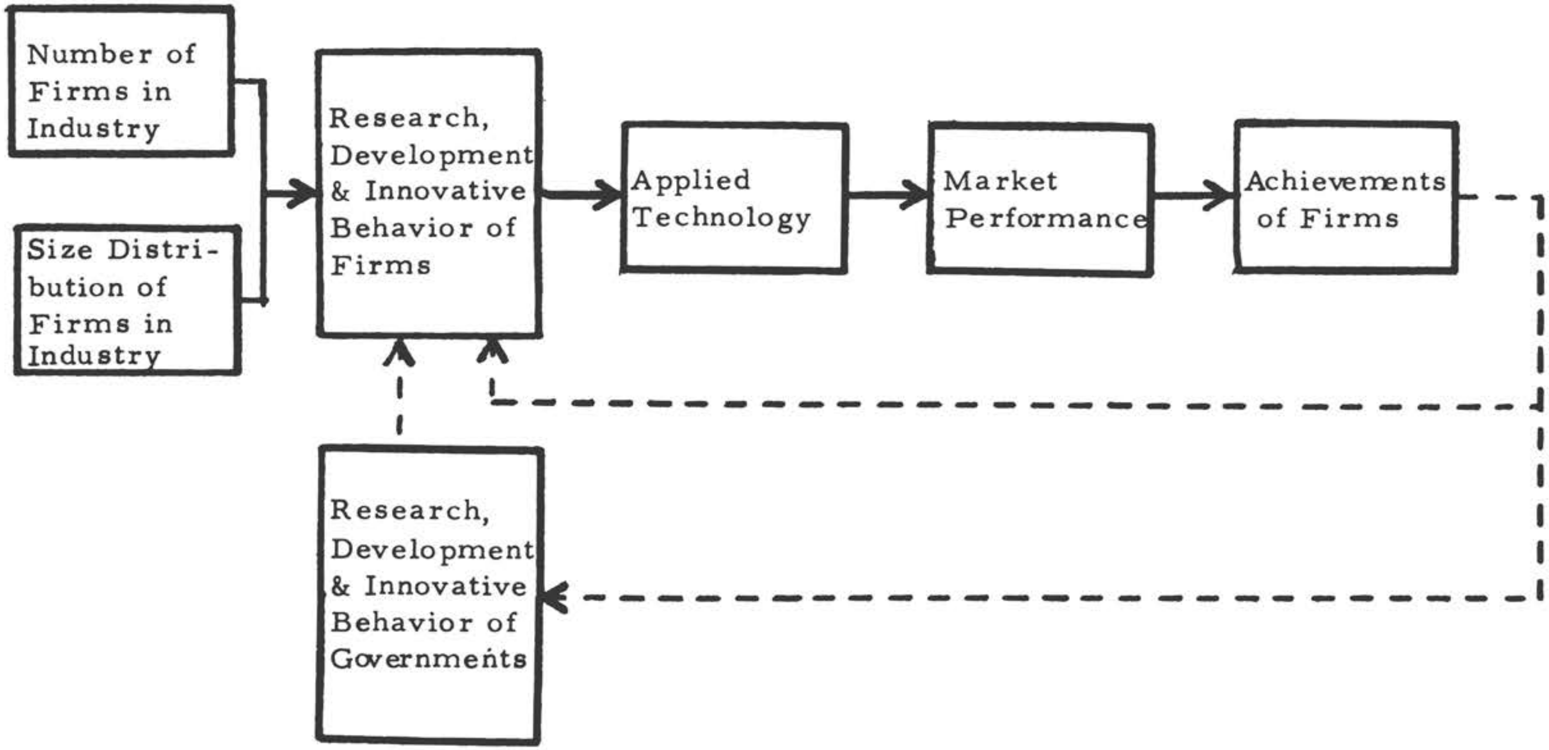
Edwin Mansfield has demonstrated conclusively that there is little empirical support for such broad generalizations. Summarizing the results of recent research, much of which comes from his own contributions, Mansfield finds that:

1. "[T]here is usually no tendency for the ratio of R and D expenditures to sales to be higher among the giants than among their somewhat smaller competitors" in a given industry. Nonetheless, "firm size often must exceed a certain minimum for R and D to be profitable."

2. "[I]n most industries, the limited data that are available do not seem to indicate that only the largest firms can support effective R and D programs; there is generally no indication that the largest programs have any marked advantage over somewhat smaller ones."

3. "[I]n most industries for which we have information... when the size of R and D expenditures is held constant, increases in size of firms are associated with decreases in inventive output."

FIGURE 3 Relations Between Technolog; and Industry Structure in Galbraith's *American Capitalism*.



4. "[I]f [the types of innovations] require very large amounts of capital, it appears that the substitution of fewer large firms for more smaller ones may lead to more rapid introduction [of new processes and products]; if they require small amounts of capital, this may not be the case."

5. "[T]he very small amount of evidence...bearing on [the] question seems to suggest that greater concentration in an industry may be associated with a slower rate of diffusion."

In sum, Mansfield holds that, "Contrary to the allegations of Galbraith, Schumpeter and others, there is little evidence that industrial giants are needed in all or even most industries to ensure rapid technological change and rapid utilization of new techniques" (8).

In a sense, detailed statistical studies are unnecessary to indicate the inadequacies of the Schumpeterian and Galbraithian hypotheses. Even when we view each as the broadest of generalities, we still find far too many instances in which the gross facts of technological change and of market operations are not in accord with the theories. Galbraith, of course, is correct that industries engaging in substantial amounts of research and development and characterized by a seemingly high rate of technological progress tend to be oligopolistic. One need only cite the relevant data for the aerospace, computer machinery, chemical products, electrical machinery, or ethical pharmaceutical industries to demonstrate that research and development is heavily concentrated in oligopolistically structured industries and that these industries, by any quantifiable standards, have been relatively innovative. Galbraith is also correct that less concentrated industries such as bituminous coal and agriculture, which have been technologically progressive in the sense of having high rates of increase in output per unit of factor input, have utilized the results of research and development carried out under government auspices and have used as inputs articles that were themselves product innovations coming from oligopolistically structured industries.

However, as Markham has noted, there are on the other hand some "spectacular examples of highly concentrated industries...that rank low in research and development" activities and whose record of technological change is less impressive (9). Beyond tobacco products and steel, which he mentions, there are industries such as distilled liquors, shipbuilding, meat packing, glass containers, plate glass, newspapers, lead and copper, which, although highly concentrated on a national or regional basis, would not likely be cited by anyone seeking to defend the Galbraith view. It is clear from this as well as from the works reviewed by Mansfield that oligopoly is not uniquely related to and should not be considered a cause of rapid technological change.

The neglect of the question of causation appears to me to be basic in the failure of economics to erect satisfactory generalizations concerning industry structure and technological change. The bulk of the evidence of empirical studies indicates that Galbraith and Schumpeter were wrong, but none of these studies has suggested an alternative explanation at nearly the same level of generality. And, more important, the bulk of these studies have been carried out in ways that explicitly or implicitly treat technological change as endogenous to an economically motivated system describing the operation of markets. That is, most of the empirical studies as well as the Galbraithian and the later of the Schumpeterian generalizations fail to consider any effects on market processes from a generally exogenous science or technology.

That there are such exogenous effects seems reasonably clear. They derive largely from firms conducting additional development after seminal research performed elsewhere. The earlier theory of Schumpeter, it was noted, gave a prominent role to such exogenous events. But beyond mere assumptions made for theoretical convenience, there are histories (10) and statistical studies (11) indicating the existence of the effects. For every case of freon, LP records, nylon, tetraethyl lead, and the transistor, the origins of which trace quite directly to the commercial interest of firms, there are other innovations such as the fluorescent lamp, television, wireless telephony, streptomycin, penicillin, catalytic cracking, cinerama, and synthetic light polarization, the scientific origins of which trace at least as directly to the research of individuals.

On a more general level, there are obvious research and development activities conducted by nonprofit organizations and active scientific disciplines closely related to the technologies of the aerospace, computer, chemical products, electrical machinery, and pharmaceutical industries. It is more difficult to find analogous activities in the cases of distilled liquors, shipbuilding, meat packing, glass containers, plate glass, and other, less technically progressive industries. It could be true that profit-motivated and nonprofit research and development spring from common causes. It could also be argued, in the sense of the scheme given in Figure 2, that what are ostensibly scientific activities exogenous to market processes are in fact a sub-loop of these processes. However, the weight of the evidence indicates the continued existence of some substantial amount of scientific and developmental research, the potential commercial purposes of which are so vague that market considerations do not help to explain them.*

To insist on the existence of science and invention exogenous to to microeconomic processes and to suggest that such science and invention may affect these processes is not at all equivalent to a reversion to the Schumpeter scheme of Figure 1. In it, no role is ascribed to the research and development activities of existing firms. Given the records of firms in such industries as computer machinery, chemicals, and ethical pharmaceuticals, it seems plausible that both science and the structures of industries may be affected by the research and development (R and D) activities of firms. And it is possible that some combination of effects from exogenous science and the R and D activities of existing firms influences the ability of new firms to enter markets. What observed reality appears to require is a synthesis of the schemes represented by Figures 1, 2, and 3. The Schumpeterian and Galbraithian views of relations between market structure and technological change are not so much wrong and inconsistent as they are, each viewed alone, incomplete.

An Overview of an Eclectic System

A more nearly complete view of the relationships between industry structure and technological change incorporates features

*Even more broadly, the appearance of nearly contemporary and very similar technological developments in the Soviet Union and the United States can be seen as common products of a science which is to a large degree exogenous to their forms of economic system. I do not know if a Russian was the real inventor of the telephone and incandescent lamp; if so, I would wager the inventions occurred at about the same time as Bell and Edison succeeded in the United States. They and the Russians would have been basing their work on the same general body of science. Similarly, I think it is not accidental that developments such as the transplantation of animal organs, supersonic commercial aircraft, and interplanetary space vehicles are timed so closely. The factor of international rivalry in technical developments obviously is important, but so is ready access to a common and growing scientific base, the details of which to a considerable degree are independent of that rivalry.

from each of the Schumpeterian and Galbraithian hypotheses. From The Theory of Economic Development comes a role for science and technological advances conducted for reasons unrelated to the market goals or achievements of existing firms and to the performance of markets. In the United States, this exogenous science and progress in technology is in part the result of the research of individuals. But it includes also research results from the universities and colleges, government agencies, some nonprofit, nongovernment research institutions, and, although probably not independent of these, basic research performed by firms whose other, more applied research and development activities are an integral part of the market process.*

A great deal of this exogenous science and technical development is of a sort that has no visible use for firms over any foreseeable period of time. The titles of dissertations submitted by doctoral candidates are good evidence of this fact. So too are the grumblings of congressmen about research titles and publications of government agencies. It is not universally true, however, that all exogenous research is unrelated to firms' activities. Some of the scientific and technical developments conducted for reasons independent of the market and of the goals of firms create visible opportunities for firms to develop new products or new production methods.

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*There may be semantic difficulties with respect to the latter. Burton H. Klein, an experienced participant as well as an astute student of research activities, has suggested in conversations that the term "exploratory research" be used to designate investigations carried on by firms when the research, as carried out, has no specific *ex ante* economic goal. Klein argues that the firm nonetheless supports only the general types of research it feels will contribute to its success over a period of time. I have included the possibility of something akin to "pure research" in firms because I feel there is sometimes an organizational need for firms to allow scientific personnel to engage in such research as a necessary concomitant of their employment. I do not disagree with Klein that this research tends to concentrate in areas relating to the technologies of the industry—obviously most scientific personnel will have training and research interests so related. Neither do I dispute that in particular instances great rewards accrue to firms from these activities.

Figure 4, which portrays the eclectic system, shows a link from an element depicting an exogenous science and technological progress to the research and development activities of firms. Where a recognized scientific discipline is related to the technologies and products of existing firms—related in the sense that those managing the firm perceive potential opportunities arising from the findings of the exogenous science—a complementary R and D activity in the firms is likely. The R and D consists of two functions that may be performed more or less well. One is a search of the results produced by the exogenous science.* The other is the development of some aspects of these results into forms that are expected to contribute to the profit, sales, growth, or security goals of the firm and its managers.

The economic reasons for hypothesizing this relationship and for its general functional form are rather conventional. Exogenous scientific or technological activities that have been or promise to be sources of new products and production technologies yield an environment such that failure by a single firm to engage in the R and D function means that it is increasing one type of risk. Other firms that do so engage may successfully develop a new product or process that will ultimately lower the achievements of firms that have not undertaken R and D. But, it is to be emphasized, reductions in this risk through R and D spending may at some point increase other types of risk more than commensurately. There is undoubtedly something analogous to diminishing returns in at least the search function of R and D. Beyond some point, the increasing costs of this activity will increase rather than decrease the risks of financial or organizational failure. And, where there is no exogenous science reasonably related to the activities of a firm, this relation may obtain for all levels of scientific R and D activity.

In this framework, the R and D activity of the firm is in one respect a risk-reducing activity, in which an optimal balance must be sought between risks of two sorts. Given the progress in exogenous science, there is the risk that the firm will fail to achieve its goals because other firms will be first to innovate successfully. This risk is reduced by increasing the R and D activity. On the other hand, R and D requires resources and, again given the progress in exogenous science, the higher the levels of R and D the more likely

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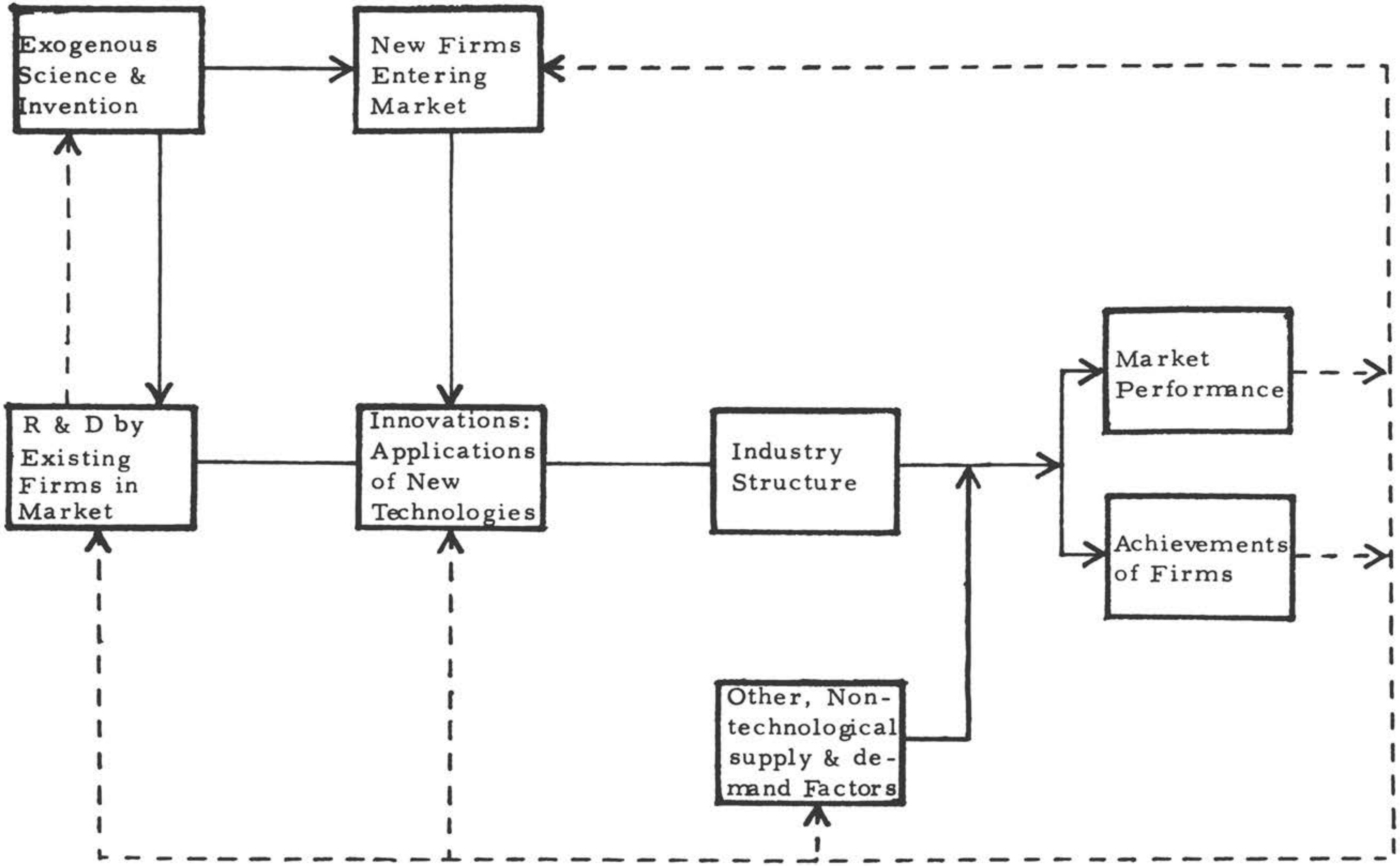
*Indeed, the extent of subscriptions to scientific publications and the frequency of attendance at the meetings of scientific organizations might be used as crude indications of the "relatedness" of science to particular firms.

FIGURE 4 Eclectic System of Relations Between Industry Structure, Market Performance, and Technological Change



it is that, in the conventional sense, the ex post results will show incremental costs to have exceeded incremental returns. This result, too, is in the direction of failure.

Figure 4 also shows a feedback link from the research and development activities of firms to the exogenous science and technology. This is to account for the additions to knowledge emanating from firms. This link is quite different in nature, however, from the connections shown in Figure 2 to depict the theory contained in Capitalism, Socialism and Democracy. In the latter, exogenous technology plays no explicit role. Here, R and D tends to exist only in firms that have products or processes for which there is related, exogenous scientific and technical development. Although firms provide feedback to exogenous and related science and technology, these activities are the sine qua non of market-related R and D in the first instance, and the feedback is something of a serendipitous spillover.

Put alternatively, there are many scientific and technical research areas for which one can find little or no corresponding privately financed R and D carried out by firms. In such cases no relationship is perceived between the exogenous science and the achievement of goals of firms. Not obvious, however, are privately financed R and D efforts by firms for which no corresponding science or other forms of exogenous technical developments exist.

The "creative destruction" of Capitalism, Socialism and Democracy is not denied. Developments in exogenous science that existing firms have failed to utilize may lead, as shown in Figure 4, to perceptions by new firms that goals may be accomplished through innovation.* Presumably, some standard hypotheses relating to barriers to entry help to explain the strength of these tendencies. Thus, economies of scale, customer allegiances to the existing products and firms, advertising advantages, and other possible absolute cost advantages for established firms are usually considered to establish a "limit price" (12). So long as existing firms do not charge more than this price, entry is forestalled.

In the context of the economics of technological change, the same factors give rise to a concept of a "limit rate of technical progress." Some combinations of price and R and D and innovative behavior by existing firms—given scale economies, customer

*Not necessarily newly formed firms. New, in this context, means only entry into markets by firms hitherto not in those markets.

allegiances, cost advantages, and the like—define limits to entry by new firms. The lower the prices of established firms and the more advantage they take of innovations made possible by exogenous scientific and technical developments, the less likely it is that others will enter. With respect to technical developments, the exclusion of newcomers arises when, in the words of Judge Hand in the ALCOA case, established firms "progressively... embrace each new opportunity."

However, other factors also are involved. As Mansfield has shown, the efficient use of particular innovations may be denied to firms below certain sizes (13). In addition, particular innovations may necessitate capital outlays that make them unavailable to smaller firms and to new firms as well. Patents held by established firms impede entry, whereas those held by new firms foster entry.

Unfortunately, no clear and general hypothesis exists concerning the determinants of the behavior of established firms in continuing to explore and to mine the economically feasible resource created by exogenous science. The firm, once successful, has the ability but not necessarily the motivation to continue to be scientifically progressive. The tenacity with which some firms cling to old products and processes is nothing short of amazing.* Yet other cases can be cited, for example, Bell Telephone Laboratories, in which motivation is not readily apparent and technical progress seems to continue, almost as an objective in its own right.

With these caveats about the limited knowledge of the process, it is still the underlying argument of "creative destruction" that explains the links from exogenous science and technology, through either R and D by existing firms or by new entrants, to innovation and to industry structure. The entering, innovating firms, Schumpeter argued, displace the existing firms. But in the same fashion, existing firms that succeed in maintaining R and D activities that enable them to adapt effectively to their scientific environments and that are motivated so to adapt tend to displace those with ineffective R and D or low motivations. Given the inherent uncertainties in technological change and the difficulties of rationally fashioning an

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*An excellent illustration is the entrance in the early 1930's by General Motors into the manufacture of locomotives. Steam locomotive manufacturers showed not just disinterest, but actual disdain for diesel locomotive development. In subsequent chapters, the same sort of behavior appears for numerous manufacturers of aircraft.

effective research and development program, some will be more successful than others. If the resulting innovations are products with relative demands that depend on the timing and nature of the technological change, market structures will be directly affected. Some firms will tend to lose sales and market shares; some will gain. Some firms will experience relatively high costs and low profits; others will encounter lower costs and higher profits.

It is, of course, the resulting dimensions of prices, costs, product differences, and product innovation that define market performance. These factors together with market performance influence business behavior and industry structure, thus partially but not fully closing the system of relationships. Schumpeter, in The Theory of Economic Development, posited that these feedback effects would tend to reproduce a competitive structure. But Schumpeter was dealing with a once-and-for-all sort of innovation. He did not consider the possibility that a series of innovations may affect a particular market, with inadequate time between innovations for the competitive structure to become reestablished, or that other entry barriers may exist. Nor did Schumpeter recognize the possibility that firms may adapt responsively to a changing technology through an R and D activity. It is this responsive adaptation of firms in an environment in which related science creates more-or-less continuous opportunities for innovation that, with other more-or-less effective entry barriers, explains the correlation between market concentration and technological change. With the exception of outside science, which may itself receive spillover contributions from the market-oriented R and D, and numerous significant nontechnological factors that may affect behavior, structure, and performance, the system in Figure 4 is closed. Arbitrarily beginning the description with the R and D component, the hypothesis is that this activity, based on its search of exogenous science, may afford opportunities for further development and innovation. Innovations, as they occur, tend to alter industry structure, with the successfully innovating firms increasing their market shares, profits, and other relevant measures of achievement. The successful achievement is at once the visible result of innovation and the source of "slack" internal to the successful firm.* The "slack" conditions permit—but do not require—

*For extended discussion of the concept of "slack" see Simon and March, Organizations (John Wiley & Sons, New York, 1958) and Cyert and March, A Behavioral Theory of the Firm (Prentice-Hall, Englewood Cliffs, 1963). For our purposes, it denotes a condition in which particular activities in a firm may be increased without decreasing the rewards to others in the organization.

additional R and D, which may in turn lead to further innovation and further market success by the already successful firm.

The firms adversely affected by the innovation have fewer rather than more internal resources. Although the need for additional R and D may be recognized, especially by those so employed in these firms, as the means to market success and eventual reestablishment of "slack" conditions, others in the firm may resist the redistributional aspects of such a behavioral shift. Further, success will not be automatic. The R and D may be undertaken in something of a crisis environment in the firm, which may reduce the probability of a successful outcome. In addition, because of the uncertainty necessarily attaching to attempts to "pull" new innovations from searches of the related science and other nontechnical barriers to the use of the new technology, success cannot be regarded as assured. Failure, with consequent market concentrating effects, is the result for at least some of the firms. *

Conclusions

The view expressed above about relations among sciences, private R and D, and industry structures has rather direct bearing on the Kravis-Vernon explanations of changes in the goods composition of international trade (14). It bears also on points raised by John R. Pierce in his introductory remarks and on at least one facet of the real income gap between the more- and the less-developed countries.

It follows from my interpretation that public support for basic science is likely to continue to produce opportunities for private business profitably to develop new products, new variants of old products, and new processes. One would expect some of these products to find their way into export markets in the manner described by Kravis and Vernon. It is possible that this indirect subsidization of production is often justifiable on a social cost-benefit basis; however, it does not follow that the probably positive effects on the

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*In this context, failure means exit of a firm from the group comprising the supply side of the market. The firm may disappear through bankruptcy, but it also may disappear through merger or withdrawal into a geographic and product market in which it no longer is in rivalry with the successfully innovating firms.

balance of payments alone would socially justify the public support of science. It should be noted also that only those industries whose products and processes are closely related to the developments in science would find stimulation in domestic and export demand because of the public support of science. The effect is unlikely to extend to a large number of industries.

Additional control over the mix of new products could be achieved if public support were extended into the exploratory research, advanced development, and product development phases of R and D. That is to say, a nation could subsidize the development of particular products—the SST is an example—for domestic or foreign trade reasons. When the necessary basic science is not well developed, this product-specific form of public support seems universally to be far more costly in time and money than is originally planned. Again, the SST provides an example. Justification of specific development on the basis of cost and benefits from international trade alone seems to me to be improbable in most cases.

Following seminal work by Gary Becker (15), Harry G. Johnson (16), G. C. Hufbauer (17), and undoubtedly others have stressed that expenditures on science, R and D, general education, vocational training, and the like are, in an economic sense, investments in human capital that orthodox trade theory fails explicitly to consider in weighing comparative advantage. Whether such investment has positive or negative social rates of return over planning horizons of realistic lengths is likely to depend, I fear, on the sort of economic structure to which it is applied. Casual empiricism suggests that the economies of the more developed nations have a mix of industries such that some can profitably develop new products as science progresses. Similarly, expenditures on education and vocational skills may have a good social rate of return because of the sorts of industries to which learning may be applied in these nations.

On the contrary, the less-developed nations, with industries devoted to the production of goods such as staple agricultural items, basic metals, crude oil, and other minerals, may not so easily find ways to apply new science. Their products are of a sort that is generally unamenable to easy change through science, at least through western science, which is the sort transferred to them in today's world. And, although science might more easily yield new production methods, economic and institutional forces mitigate the incentives for their use. In this sense technology transfer among the developed nations may have greater payoffs to them than does transfer between them and the less-developed countries.

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COMPUTERS AND INTERNATIONAL TRADE

Jacques G. Maisonrouge

Some time ago, the New Yorker magazine ran a cartoon showing a sad little man standing between two husky detectives in a police station. One of the detectives is explaining the offense to the desk sergeant in these words: "He's charged with showing contempt for data processing."

I doubt whether such charges could be leveled against anyone today. Some people are suspicious of computers, certainly. Some disapprove of them. There are even some who fear them. But no one, to my knowledge, holds them in contempt. For whether it meets with unanimous approval, an indisputable fact of modern life is that the computer has become an important part of our environment. It affects the way we travel, pay our bills, and receive medical attention. It is helping to increase productivity around the world, both industrial and agricultural. It is aiding science in unraveling some of the deepest mysteries of life. And it has turned man into a space traveler.

Nowhere are its effects more visible today than in the world economy and it is on one special aspect of this subject—the computer's influence on international trade—that I would like to dwell.

Over the past 20 years world trade has grown at an annual rate of more than 8 percent; today some $240 billion worth of goods cross national boundaries annually. The computer has emerged as one of the basic tools for the worldwide development of technology that, in turn, is responsible for much of the goods represented by that $240 billion worth of international trade. The computer's ability to transmit knowledge and data swiftly from city to city, country to country, and continent to continent, is surely known and appreciated by the engineering fraternity.

Without this capability, my company's System/360 line of computers would never have become a reality in 1964. That development was truly a global effort, with IBM scientists and engineers in the United States, Great Britain, France, West Germany, and Sweden exchanging ideas, plans, and blueprints across vast distances.

The Internal Teleprocessing System that we set up in 1964 is geared to serve the data communications needs of the major functional areas of our business—engineering, manufacturing, finance, and the like. It links the major countries in which we do business via some 500 terminals in the United States, Canada, Europe, and Japan, communicating information in the form of telegraph, digital data, and hard copy.

The system, which is really a computer-based, worldwide information system, serves a multitude of purposes. One of its most important jobs is the transmission of engineering data—thousands of product improvements and changes—making it possible for us to tap, on a real time basis, the worldwide engineering know-how of our widely dispersed laboratories.

Then, as you know, the computer has made possible many technological breakthroughs that, in turn, are affecting international trade. An executive of The Boeing Company put it this way:

> "The great coincidence, and a coincidence that is largely not understood, even by many of our own people, is that computers became available just when they were wanted. You see, you can't do the stress analysis for a Boeing 707 or 747 or supersonic transport without a computer. And you can't have a customer-oriented assembly line without one, either. Without the computer, airplane development would have come to a halt.
>
> "There is no going back. We are committed. To build airplanes you need people, buildings, tools, materials—and computers."

And, of course, what holds true for the aviation industry is true of just about every major industry in the world.

Finally, the computer is helping governments to streamline their administration of foreign trade. Over the past four years, for example, Mexico has developed the world's first operating automated system for processing segments of its merchandise entries. Great Britain and France are moving rapidly to get their own systems under way at London and Paris airports. The United States hopes to have a nationwide system in effect by the mid-1970's. And Australia, Italy, West Germany, and Canada are conducting feasibility studies.

There is another sense in which computers are contributing to international trade. Several months ago, for example, the New York Times ran an article headlined, "India Is Feeling Impact of Computers."

The burden of the report was that, with a computer population numbering only a little over 100, India has already realized great benefits in industry, agriculture, and education.

In the case of agriculture, unprecedented yields have made farmers richer, enabling them to use modern implements and the latest technology to increase output further. In turn, this new wealth is being translated into purchases of everything from fertilizers to tractors from such countries as the United States, Australia, and Japan. Here, in microcosmic form, we have some of the effects of computers on international trade demonstrated for us.

And, there is the trade in computers themselves. It is commonly agreed that data processing is the world's fastest growing major industry. Before the year 2000, it is further commonly recognized that this industry will become the world's largest, surpassing in gross revenues the automobile and petroleum industries.

Its annual revenues are already impressive. In the United States alone, total annual computer revenues—which include income from hardware, software, related services, and supplies—grew almost 1,100 percent over the last decade, from $975 million in 1960 to $10.6 billion in 1969. When you also consider that the marketplace for computers outside the United States is growing at the rate of 25 percent annually in value of equipment in use and that foreign markets will account for almost 40 percent of the shipments by U.S.-based manufacturers this year, you get some feeling for the impact and potential of computers in international trade. This record of achievement is particularly impressive in an industry that did not exist 20 years ago.

Yet, despite its brief history, the computer has already deeply affected the world's economy. Japan is probably the most dramatic example of a nation raising its productivity, thus making itself increasingly felt as a competitor in the international marketplace. One of the "secrets" of its success is its advanced use of automation in the production process.

I recently visited the newest steel plant of the Yawata iron and steel group at Kimitsu, southeast of Tokyo. It produces five million tons a year with only 3,600 employees, seven central computers, and hundreds of units of peripheral equipment. The entire Yawata group produced 12,370,000 tons in 1968 with 59,017 employees, that is to say, 209 tons per person. In the same year, British Steel Corporation, the second largest steel manufacturer in the world, manufactured

23,951,000 tons with 254,000 employees—less than 100 tons per worker. In Luxembourg, ARBED reached 150 tons; and August Thyssen-Hütte AG in Germany, 130 tons.

Obviously, no single reason accounts for Japan's higher rate of productivity. Its causes range from technological advances to lower wage scales to increased reliance on automation. However, the use of computers is growing more rapidly in Japan than elsewhere. Last year its computer population surpassed West Germany's and today is second only to that of the United States.

Perhaps even more important than the computer's contribution to productivity is its contribution to the rise of the single most important force in international trade today—the multinational company. Actually, the international business venture is by no means a new phenomenon, nor is it, as is frequently assumed, a special preserve of the Americans. Even before World War I, there were a number of multinational ventures organized under the direction of a single corporation: some oil and mining companies, several dozen manufacturing firms, and a few banks and insurance companies. Most of these were European. American companies were relative latecomers to the international scene, although by 1950 over 400 U.S. corporations had assets of $1 million or more in direct foreign investments.

What is new is the size and scope of the international company's operations and the growing recognition and understanding of the tremendous part it plays, not only in economic development, but in the diffusion of technology and the development of political and social relationships among the countries of the free world.

Only in the last decade, has the multinational corporation, operating within a concept of worldwide planning and strategy, really come of age. The growth of such corporations is a logical response to the economic and political facts of life. Obviously, a larger worldwide market is more attractive than a national one. Since the end of World War II, barriers to international trade have been shrinking rapidly, thanks to such mechanisms as the Common Market and the Organization for Economic Cooperation and Development. That shrinkage has been further accelerated by the great surge of international demand resulting from rapid advances in communications and transportation technologies.

At the same time, there has been a growing need to rely on larger markets. Twenty-five years ago, technologies were simpler and, by today's standards, development costs were relatively modest.

It was possible to bring a product to market with the expectation of a profit within the relatively limited area of national boundaries. That no longer is necessarily true. The burst of technological developments in the last two and one-half decades, with their enormous costs, has frequently required the expansion of markets to justify those costs.

Simultaneously, the necessary advances in technology have made the successful organization and management of multinational companies possible. One example is the jet airplane, which makes feasible both the quick delivery of goods and the swift transport of people across vast distances. A second example is the development of satellite communications. And a third is the computer, which, among other things, has made the jet airplane and satellite possible.

In addition, computer-communications networks help international enterprises to maintain their competitive posture despite wide geographical dispersal by making up-to-date information immediately available over long distances via terminals. The result is that the modern multinational company can respond quickly and efficiently to the fast-changing environment of the "global marketplace."

My company, IBM World Trade Corporation, employs over 100,000 people and uses more than 1,000 computers—about one computer for every 100 employees. Our computers serve many purposes, but one or two examples may give you some idea of the reliance we place on them. In Havant, England, a subsidiary, IBM Information Services, Ltd., was created to help develop a hierarchy of information systems that will service and support field operations, technical staffs, planners, and management. One subsystem, for example, allows customer engineers to enter and retrieve information in real time using the latest technology. It currently serves branch offices in 12 European countries, our European Headquarters, and, via satellite circuit, IBM World Trade Headquarters in New York City. Another provides IBM World Trade Corporation with a single computer file for the order backlog of data processing equipment to make possible more efficient scheduling of individual customer orders. Without computers, we would surely have been buried years ago under mountains of paperwork and been hopelessly behind schedule in all our activities. Certainly, we could not serve the 108 countries in which we currently do business.

What is true of IBM is true of other international businesses. It is no coincidence that virtually all of our major customers also are multinational companies with widely dispersed operations.

Multinational companies have had wide-ranging beneficial effects on international trade. Since the majority of such firms today are U.S.-based, let us consider the benefits America realizes from the activities of its multinational firms. First, there is the direct financial return realized by investors. According to the June 1970 Survey of Current Business of the Department of Commerce, in 1969 U.S. companies realized $7 billion on their investments abroad. These $7 billion substantially improve the balance of payments. Second, markets created abroad produce demand for more products. For example, although IBM manufactures abroad, last year this corporation exported $267 million worth of products and parts from its U.S. plants to its companies overseas.

In addition, there are the nonmonetary but equally important dividends remitted in the form of new knowledge. For example, research and development work in computer hardware and software is conducted by foreign scientists and engineers in IBM's seven laboratories abroad. Although their contributions are only a relatively small part of this organization's total output, their discoveries and inventions are available to IBM in the United States and, eventually, to our American customers. And what is true of IBM is true of other U.S.-based multinational companies.

Less directly, of course, multinational corporations benefit their home country through the over-all results of their worldwide operations. By contributing to employment abroad, acting as agents of technology transfer, paying local taxes, and becoming substantial customers of local vendors and subcontractors, multinational firms help strengthen foreign economies. If our generation has learned anything in the last 30 years, it is that a healthy, vigorous world economy, which is prerequisite for world peace, is in the very best interests of the United States.

Benefits accrue to the host country as well. There are, first, a company's normal economic contributions to the host country's economy, which include the following:

1. As an important employer and a substantial customer of local subcontractors, a multinational corporation is a major generator of salaries.

2. It contributes both directly and indirectly to local tax revenues.

3. It is often a significant exporter of parts and finished goods, thus adding to gross national products and balance of payments.

4. It provides products to meet a wide range of needs. In doing so, it raises living standards and enriches the general quality of life, particularly in the developing countries.

Secondly, a multinational corporation plays a vital role as a "carrier" of technical know-how through such activities as licensing agreements; the training of foreign scientists, engineers, and production personnel; and the establishment of subsidiaries.

Thirdly, the multinational company makes a profound contribution to international understanding. By creating international career opportunities, it brings the people of many nations together to cooperate on common projects and problems.

Yet, despite the demonstrably positive consequences of multinational companies operating in an environment of free trade, there are some in every country who would sever the arteries of commerce and undo what men of good will on both sides of the Atlantic worked 20 years to create—the free flow of goods between Europe and the United States. Because the United States is the acknowledged leader of the free world, it is imperative that it continue to take the initiative. A general problem to consider in this context is that it is impossible for all trading partners to have a favorable balance of payments.

I hope I have not strayed too far afield in my discussion. But, as you know, technological advances invariably have far-reaching consequences. The automobile revolutionized the way we live. The elevator made the modern city possible. And television, at least according to Marshall McLuhan, shaped the thinking processes of an entire generation.

In view of its record, therefore, I do not think that it is claiming too much for the computer to say that it is already well on its way to changing the world's economic patterns. Where economic patterns change, so also do social and political patterns. Consequently, the computer's final effects are yet to be felt and accurately measured.

It is precisely this future—this as yet untapped potential of the computer—that we in the data processing industry find particularly exciting. As Leo Cherne has observed, "The computer is incredibly fast, accurate and stupid. Man is unbelievably slow, inaccurate and brilliant. The marriage of the two is a force beyond calculation." I am convinced that the marriage will be a happy and fruitful one, and nowhere more so than in international trade.

THE AUTOMOBILE AND INTERNATIONAL TRADE

Richard C. Gerstenberg

The American automobile industry has long been acclaimed for its efficiency and ability to compete. Yet today it is seriously challenged in markets at home and abroad. Automobile manufacturers in Western Europe and Japan, with technology that is advanced and labor costs that are lower, have become formidable competitors in world trade.

The level of productivity of the U.S. automotive industry, measured in terms of the value of output per man-hour, is still higher than that of overseas automotive manufacturers. But foreign manufacturers have made and are continuing to make significant gains. The technology gap is closing. Overseas manufacturers are paying the costs of transoceanic shipment. Yet even with this added cost, they are able to offer their products in the United States on a highly competitive basis.

In spite of this rising challenge, I am convinced there is a great potential for the U.S. automobile industry to share in the expanding world markets. We can share through investment in overseas manufacturing and assembly facilities, building cars to sell throughout the world. The competition is already strong. It will become stronger, particularly outside North America where the greatest market growth is expected. To grasp this opportunity will require the maximum utilization of our technological resources and management capabilities. In addition, we must maintain an openminded, flexible approach to ways of participating in these new global opportunities.

The magnitude of our opportunities overseas can be illustrated by comparing automobile ownership in foreign countries with that in the United States. In the United States, there is one car for every 2.4 people. In Europe, there is one car for every 12 people; in South America, one for every 43 people; and in Asia there is only one car for every 240 people.

To better present the character of the worldwide automobile industry, let me review briefly several key trends that have contributed to its development. Let me use the experience of General Motors as an example.

At first, most of our overseas business was in the export of completely assembled vehicles from the United States. Later, in the 1920's, as this volume increased, tariff differentials and transportation costs were advantageous to the shipment of unassembled vehicles. Consequently, there was increasing emphasis on the establishment of assembly plants overseas where parts exported from the United States were assembled into complete cars. Between 1923 and 1928, General Motors opened 19 assembly plants in 15 overseas countries.

Partly as a result of changing consumer tastes, the U.S. and overseas markets for passenger cars began to develop different characteristics. American cars grew larger to satisfy American tastes. Meanwhile, in Europe and elsewhere, cars remained smaller, reflecting different driving conditions and lower income levels. It became apparent that if U.S. producers were going to continue to serve overseas markets, they had to become a part of these markets. As a result, in the late 1920's, American automotive companies began to establish complete manufacturing facilities overseas.

This growth trend was interrupted by the depression of the 1930's and later by World War II. It resumed, at an accelerated rate, after the war.

Two historic developments contributed to this resurgence. The first was the creation of large trade groups, such as the European Economic Community, the European Free Trade Association, and the Latin American Free Trade Association. The second was the rapid emergence of the developing nations with their goals of accelerated industrialization. These developments shaped and enlarged the place of the automobile in world trade.

The rapid growth in overseas since 1950—similar to that which occurred in the United States during the 1920's—encouraged the introduction of improved mass-production facilities and processes in overseas countries. In turn, these more efficient methods lowered prices and stimulated further market growth. As a result, between 1960 and 1969, vehicle production outside North America increased at an average annual rate of 9 percent. This compares with a rate of 3.5 percent in the United States and Canada.

The closing of the technological gap in automotive production and distribution in the more-industrialized countries has had far-reaching consequences. The transition from the bicycle to the motor scooter, to the minicar, and then to the four-seat family car, was most evident in major European countries in the 1950's and 1960's. Not only did this trend bring a higher level of transportation to other countries, it also resulted in automobiles that found a market in the United States.

Most important of all, however, the closing of the technological gap removes whatever excuse the more-industrialized countries may have had for maintaining barriers against the free trade of motor vehicles or the free flow of investment funds. Although we have made great progress, a free world market does not yet exist. The further reciprocal removal of trade and investment barriers should be a constant aim of U.S. policy. Unfortunately, the recent trend has been in the other direction. In fact, the Trade Bill of 1970, now before the Congress, could mark a return to protectionism. It could hamper world economic development.

In recent years, U.S. policy toward automotive trade has moved far toward the goal of free world trade. We place no limitations on the freedom of overseas manufacturers to invest in any part of the U.S. automobile business. They can make, assemble, or distribute products with great freedom here. Nor do we impose quotas or special taxes on imported cars as do most overseas nations.

Traditionally, the United States has had a substantial surplus in automotive trade. Since 1965, however, it has moved to a deficit position. The U.S.-Canadian Trade Agreement and sharply rising imports from overseas have been major factors. As a result, U.S. automotive trade has dropped from a surplus of $1.3 billion in 1965 to a deficit of $767 million in 1969. Thus, the U.S. automotive industry has lost ground as it has moved forward in attempts to achieve free world trade.

Japan has benefited greatly from recent trends toward free trade. Yet today, Japan has the most restrictive and discriminatory trade policies relating to automotive imports. Although Japan has already put into effect the final reduction in tariffs scheduled for 1972, its import duties are still 20 percent for smaller cars and 17.5 percent for larger models. In addition, there is a commodity tax—40 percent for smaller imported vehicles compared with a 15 percent rate on most domestically produced vehicles. Direct foreign investment in vehicle manufacturing in Japan is currently prohibited, although we are told that these restrictions will be modified early next year.

There are other non-tariff barriers that in many overseas countries represent an additional means for discrimination against vehicles built in the United States. These include import quotas, border taxes and discriminatory customs, sales taxes, and registration fees. France, for example, has an annual vehicle tax that rises geometrically with engine size. As this tax is calculated, the Volkswagen with seven horsepower units is assessed only $16, whereas the Chevy II with 18 horsepower units is assessed $180. In other words, The Chevy with 2-1/2 times the horsepower pays 11 times the tax.

Imports into the United States are likely to reach 1.2 million vehicles this year. So it is tempting to consider increasing tariffs and other penalties on imported cars.

We are convinced, however, that protective trade policies are in the long-term interest of neither the consumer nor the nation. When competition is restricted, consumer choice is reduced and costs tend to increase. In addition, such a policy would no doubt provoke retaliatory action against American goods in overseas markets. The first objective of our government should be to work to reduce trade barriers to our products to the low levels we present to others. We should then move toward the complete elimination of all trade barriers. A continuing rise in standards of living throughout the world depends on our ability to stimulate, rather than restrict—to free rather than restrain—the incentives for progress through competition for economic opportunity.

The high cost of American labor is a major problem in our efforts to compete with foreign-built cars. The last ten years provide an interesting contrast. From 1959 to 1965, compensation per man-hour in all U.S. manufacturing increased 25 percent; productivity also increased 25 percent. As a result, unit labor costs remained the same, and industrial prices also remained the same. On the other hand, between 1965 and the end of 1969, compensation per man-hour again increased 25 percent; but productivity increased only 8 percent. Unit labor cost increased 15 percent and industrial prices increased 10 percent. This imbalance between labor costs and productivity has been a major factor in the inflationary spiral experienced in this country during the past five years.

American automobile manufacturers recognize that the invasion of the imports is a major economic threat. Either we meet this threat, or we relinquish by default a growing and important segment of our own market. The new American small cars, introduced last month by U.S. manufacturers, of course, are an important part of our response to the import challenge. But there are other important steps that we as an industry must take to strengthen our competitive position in markets both here and abroad.

Part of our American answer must be to accelerate the pace of technological progress as a fundamental means of improving productivity and efficiency. We must find ways to achieve a better balance between labor cost and productivity. The record of the past demonstrates that it can be done.

Advances in technology must be applied aggressively so that we can bring productivity more in line with labor costs. This is particularly important in the production of cars, such as the new Chevrolet Vega, that are designed to compete against import models. Let me cite just a few examples of advanced methods and equipment that our engineers and manufacturing specialists have developed for the Vega.

To produce this car, we built a completely new plant in Lordstown, Ohio. It is one of the most highly automated automobile assembly operations in the world. This especially applies to welding equipment on the assembly lines. More than 85 percent of assembly-line welding on the Vega is done automatically. New processes are used in rustproofing and soundproofing. The body paint is applied automatically.

Equally important are the contributions made by simplified product design, innovations in use of materials, and reductions of weight. A new aluminum alloy and a new fabricating process were used to produce the engine block.

Beyond the car itself, our engineers made a major contribution to a different design for railroad cars to reduce shipping costs and minimize damage to the car in transit. The automobiles are packed hanging on the inside of a pallet that becomes the side of the rail car. The capacity of each new rail car is increased to 30 Vegas as compared to 18 for conventional rail cars.

Technological innovation was the foundation of our approach to the new Vega. This was essential if we were to achieve our goal of producing a car with American standards of quality, designed to meet the discriminating needs of American motorists, and at a price that made it strongly competitive in value with imported cars. We wanted our new car to be built with American parts and material and by American workers.

But our perspective of improvement through technology obviously extends far beyond one line of cars. It includes every part in every model and every process, every piece of equipment, and every facility in which our cars and trucks are produced. The technological mission of the engineer and scientist is to achieve continuing improvements in over-all performance and, at the same time, lower costs. Here are a few examples of key areas now being explored in the automobile industry:

1. We look to our engineers to provide further automation of manufacturing operations. This is especially true in the assembly area in which we expect to make much greater use of advanced assembly techniques.

2. We expect accelerated progress in both metallic and non-metallic materials and fabrication processes. We must find new ways of working efficiently with better or less expensive materials. Intermediate processing steps can be eliminated to achieve a more direct conversion of raw materials to a useful form.

3. We expect greater use of computer-oriented equipment in design, testing, and production. Progress is already evident in the application of computer graphics and numerical control to car-body tooling. This can cut tooling costs and lead time in addition to improving the quality of car bodies.

4. Advances in machine tools will extend tool life and allow us to produce parts at higher speeds, and with greater precision and more effective monitoring.

5. Current research by our engineers and scientists points the way to more efficient methods of recycling scrap materials and converting the metal in junked cars and other solid wastes into usable raw materials.

All these developments will increase the need for skilled personnel to operate and maintain the more sophisticated equipment that will be required.

These are some of the areas that offer great potential for better products. The attainment of these objectives is necessary to maintain a strong competitive position for the American automobile industry.

The potential of technology is virtually unlimited. Of course, in the final analysis it is not machines from which the greatest progress must flow. Rather it is from people. We improve productivity when we provide better tools for our employees. More important, we improve productivity by the manner in which our employees use these tools. Most important of all is the motivation of our people to encourage the special dedication and ingenuity that each employee applies in seeking ever-higher standards of personal and group accomplishment. This is another area of great opportunity for American industry today.

Unfortunately, during the past ten years, absenteeism and employee turnover in the U.S. automotive industry have risen dramatically—conditions also being experienced by industry in general. For example, absenteeism in General Motors has more than doubled from about 2.4 percent in 1961 to 5.2 percent for the first seven months of 1970. In fact, in several GM plants, it is not uncommon to have over 10 percent of the employees not report for work on certain days such as Mondays or the day after payday.

Absenteeism has serious effects on product quality and also on productivity. In this country today, many people seem to be placing special emphasis on more leisure time both on and off the job.

Management must accept a major responsibility for providing sound leadership, effective communications, and proper incentives, recognition, and stimulation for employees. At the same time, labor unions must assume their share of responsibility for maintaining satisfactory levels of productivity and product quality if they expect their members to prosper.

Beyond the critical fields of technology and people, let me touch briefly on other areas that bear on the competitive capability of the American automobile in international trade.

Much of the success of the automobile business has resulted from our ability to take advantage of mass production techniques and, through the use of options in color and equipment, to tailor the particular car to the needs of the individual buyer. And the tastes of the individual have become more discriminatory over the years. We must be certain that in our desire to produce this variety of products we do not lose the benefits of mass production.

Another factor of major significance is the industry's increased emphasis on highway safety and the control of emissions. We have made considerable progress in both areas. However, we should work toward the objective of uniform standards around the world. There can be only one proper set of standards, especially with respect to air quality. And it is essential that we achieve a meeting of the minds with other nations on this problem.

As we look to the future of the world automotive industry, the view is challenging and exciting. Although today's mass automotive markets will continue to be strong, most experts believe that the most dynamic areas of demand for automobiles over the next 30 years will be those of South America, Asia, and Africa.

Our optimism about the future market conditions in these regions is based on the fact that most of these countries have made a strong commitment to rapid economic growth. As income levels and highway development in these regions increase, so will car ownership.

It is already clear that access to these markets will continue to be severely limited with respect to importing of vehicles or even importing a relatively high percentage of parts and components for local assembly. The overpowering emphasis on industrialization in these countries has placed a high priority on the local manufacture of parts and components.

In such an environment, the multinational business represents an ideal vehicle for both the efficient transfer of advanced technology and the investment of capital, which are vital requirements for the development of automotive operations. The investment resources, technological know-how, management skills, and highly developed manufacturing, personnel, and marketing programs of the multinational business can provide a valuable foundation on which developing nations can build a long-range program of economic growth.

The business challenge of world automotive demand also is reflected in projections of annual sales during the next decade. Worldwide vehicle sales in 1969 were about 28 million. By 1975, we expect these sales to be in the area of 35 million. By 1980, worldwide motor vehicle sales could total more than 40 million—an increase of 50 percent above their 1969 level.

In summary, the world automobile market offers outstanding potential for future growth. To compete aggressively in these expanding business opportunities, the U.S. automotive industry must become even more successful in accelerating the pace of management and technological innovations.

In short, America's position in the markets of the world depends on whether we can improve our productivity. We have to recognize that the rest of the world has caught up with us technologically. Other countries have taken full advantage of American technological innovations. In some cases, their equipment is more modern than ours. The greatest difference between us is that American industry is burdened with a much higher cost base with respect to labor. We are paying at least twice as much as our leading foreign competitors. This situation demands that labor and management work together to improve productivity. If we can't resolve the problem of productivity, the price we must pay is abdication from the world market. For the resolution of this problem, we depend heavily on the engineer. No one has a more important role. The opportunity is there. Let us make the most of it.

TEXTILES AND INTERNATIONAL TRADE

Frederick B. Dent

The textile import problem has been growing apace for more than a decade. It has now reached proportions that threaten the viability of the American fiber-textile-apparel complex, unless reasonable controls over import growth are effected promptly.

Figure 1 depicts the growth in our imports of textiles and apparel made from man-made fibers, cotton, and wool during the decade of the 1960's. The data are in equivalent square yards as computed by the Department of Commerce. You can see that in a ten-year period this volume has grown fourfold from 976 million yards in 1959—then an all-time record—to nearly 3.7 billion yards in 1969. During the first seven months of 1970, in which domestic production languished, the flow rose another 19 percent, reaching an annual rate of nearly 4.4 billion yards. In this context, wool textile imports appear small by comparison, but the next figure puts the volume of our wool imports in better perspective.

For example, in Figure 2 you can see that woolen and worsted imports during 1969 accounted for $410 million. Wool textile imports have captured 25 percent of our domestic market, and, in the case of worsteds, 50 percent. The erosion of woolen and worsted production has been severe.

Since 1962, cotton textile imports have been subject to control under the General Agreement on Tariffs and Trade Long Term Cotton Textile Arrangement (GATT-LTA). When any plan for controlling the flow of shipments fails to cover all textiles regardless of fiber content, it only shifts the burden of imports from one area to another. This has happened under the LTA. It was not geared to the dramatic changes in fiber use occuring since 1962. Since its inauguration early last year, the Nixon Administration has tried diligently but unsuccessfully to negotiate a similar control arrangement for imports of man-made fiber and wool textiles. Imports of textiles and apparel manufactured from man-made fibers increased so rapidly that they now exceed those of cotton products, as shown in Figure 3. They have grown 43 percent between 1969 and 1970. Unless restrained, man-made fiber textile imports can be expected to continue to take ever larger shares of this important market.

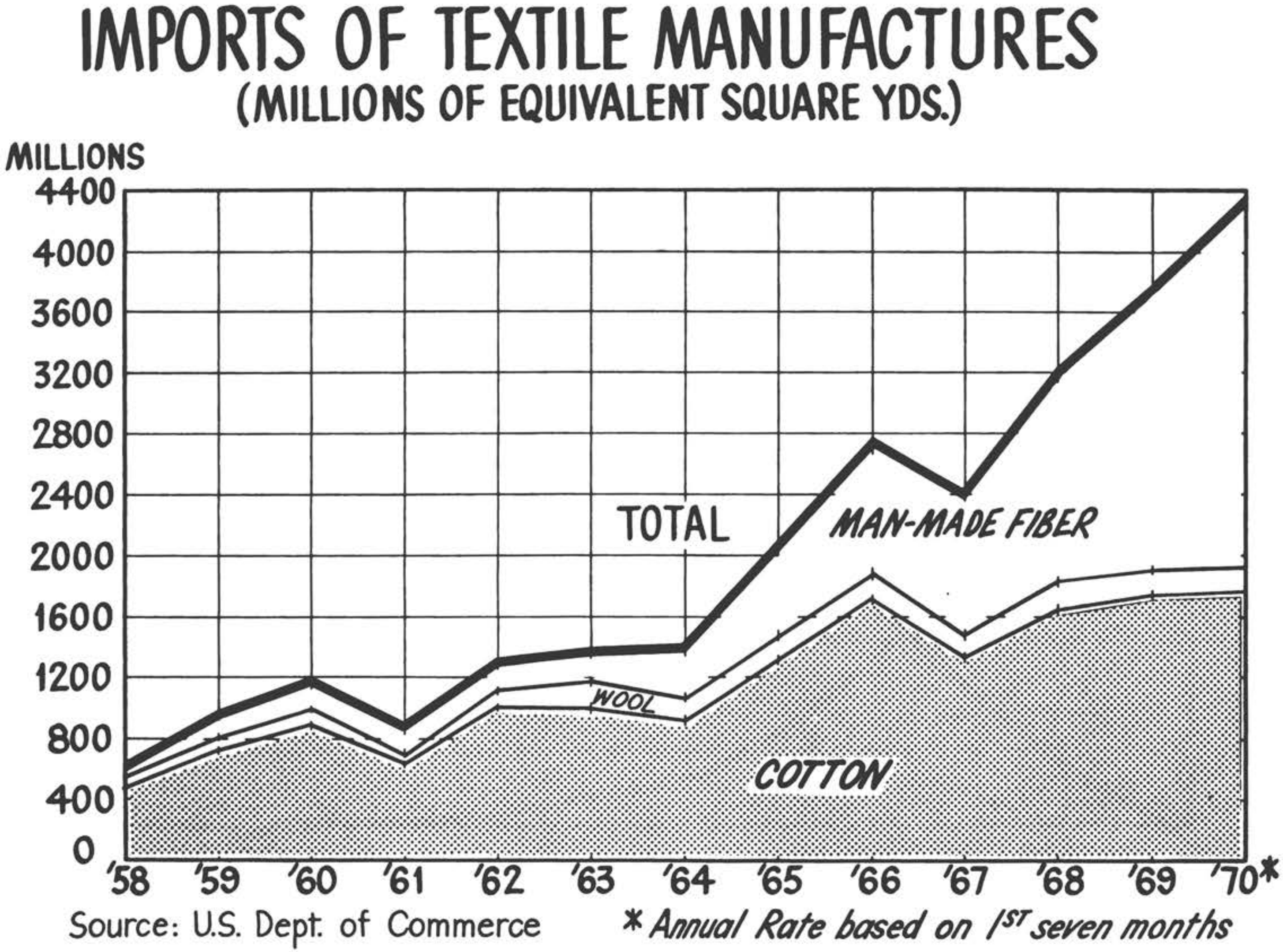

IMPORTS OF TEXTILE MANUFACTURES
(MILLIONS OF EQUIVALENT SQUARE YDS.)
MILLIONS
4400
4000
3600
3200
2800
2400
2000
1600
1200
800
400
0
TOTAL
MAN-MADE FIBER
WOOL
COTTON
'58
'59
'60
'61
'62
'63
'64
'65
'66
'67
'68
'69
'70*
Source: U.S. Dept. of Commerce
* Annual Rate based on 1ST seven months

FIGURE 1

UNITED STATES IMPORTS OF COTTON, WOOL AND MAN-MADE FIBER TEXTILES

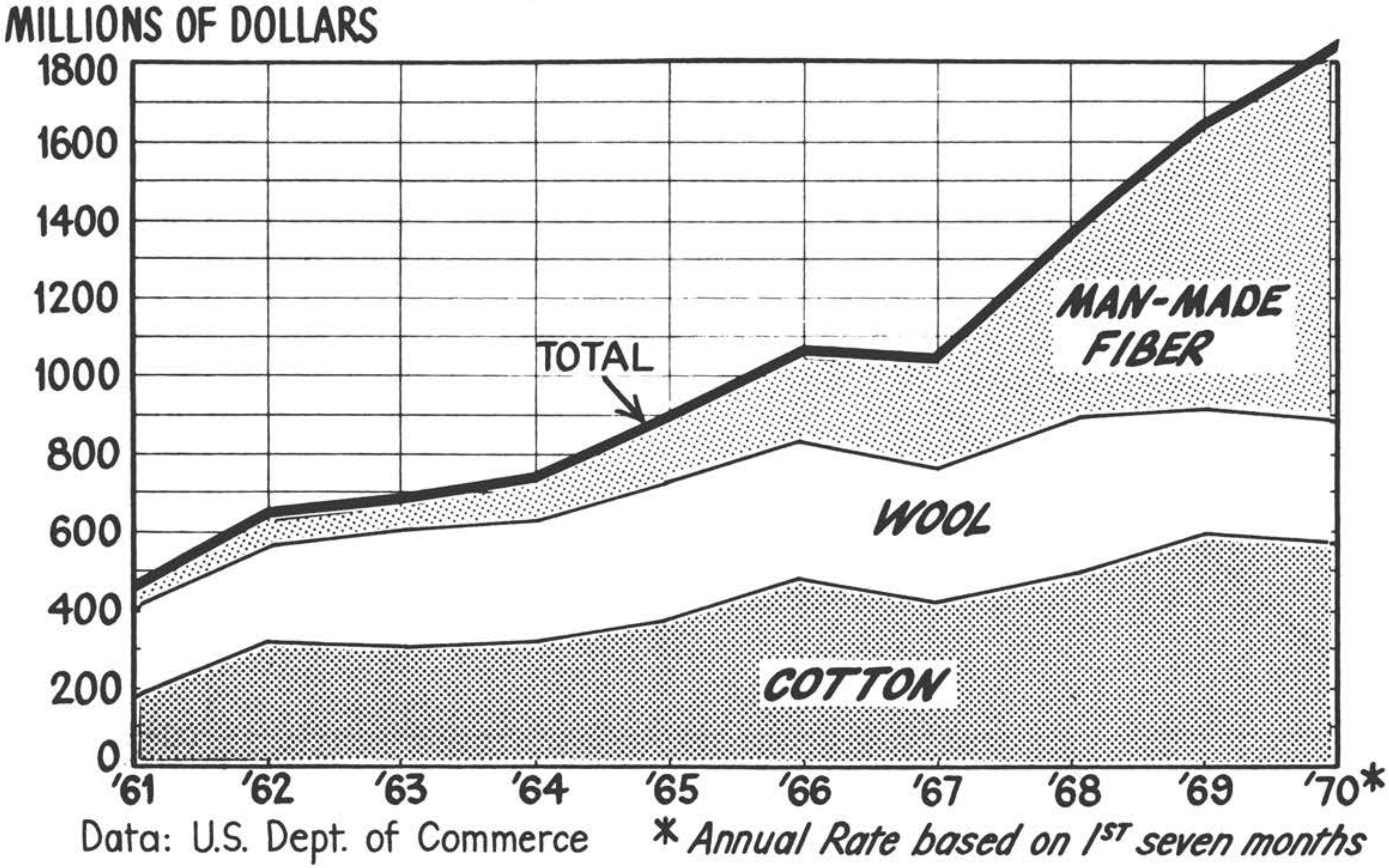
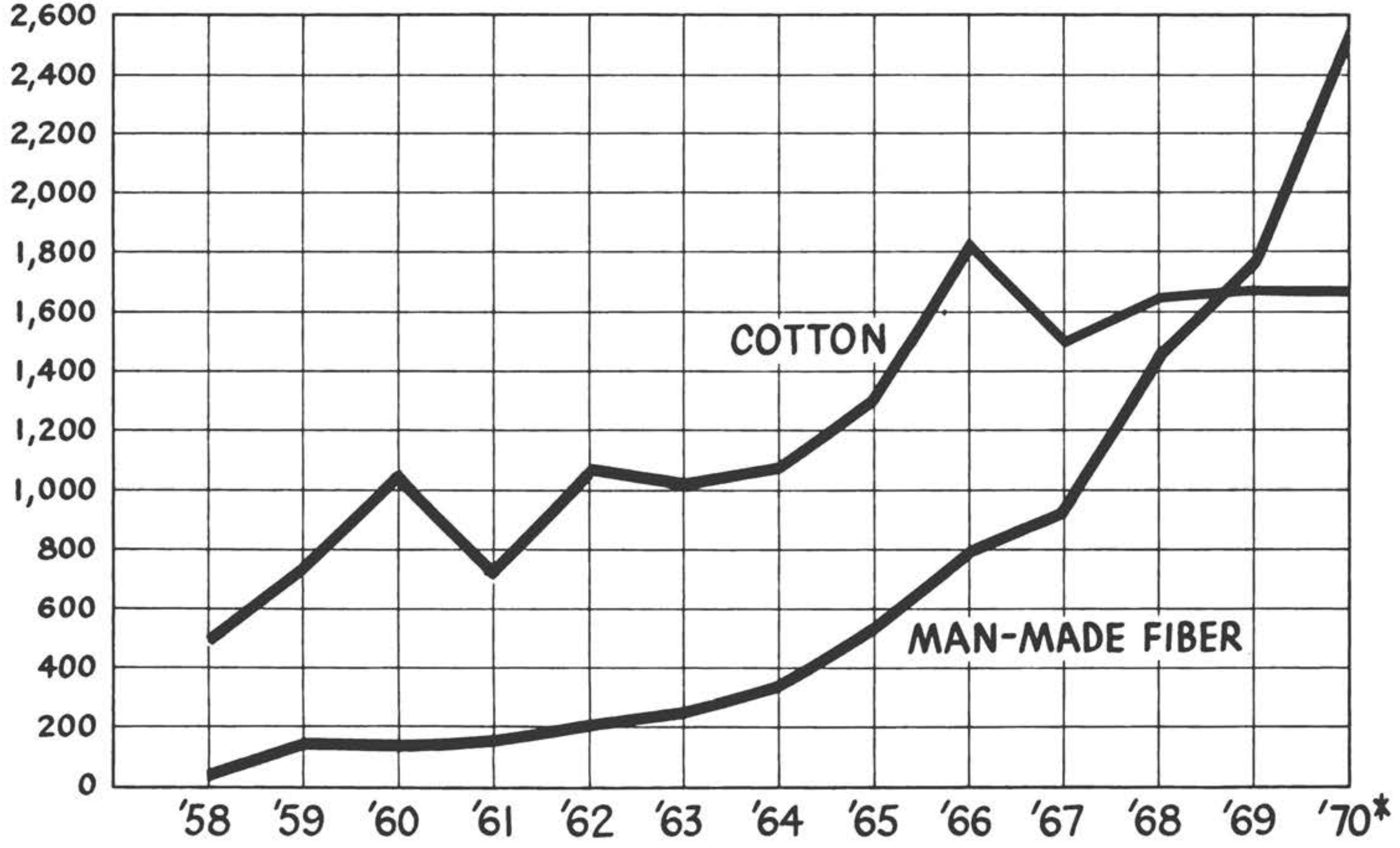


FIGURE 2

IMPORTS OF MAN-MADES EXCEED COTTON
(MILLIONS OF EQUIVALENT SQUARE YARDS OF TEXTILES)



Source: U.S. Department of Commerce *Annual Rate based on 1ST seven months

FIGURE 3

Inefficient U.S. production techniques are not the cause of the import explosion; to the contrary, the American textile industry is the most efficient in the world. The British Textile Council published an exhaustive study last year of the relative productivity in major textile industries around the world. In Figure 4, which presents some of their findings, spinning productivities are compared. The U.S. industry performance is more than twice that of the Japanese and more than three times that of the British.

Figure 5 shows productivity in spinning combined with productivity in weaving, with U.S. performance taken as 100 percent. Again, the American industry is by far the most efficient. The United Kingdom is second, at 37 percent of U.S. productivity, and Japan third, at 32 percent.

Items made abroad, at wages far below the legal U.S. minimum, give foreign producers cost advantages that cannot be overcome even by superior American efficiency. As Figure 6 shows, U.S. wages are five times higher than those in Japan and about eight times greater than those in Hong Kong. Korea, Taiwan, and other Asian countries show a still greater disparity. This factor alone gives appeal to imports. Generally, they are copies of American products made at these lower wages without innovative features.

Contrary to claims often heard, the wage gap between the United States and its major foreign competitors is not narrowing but widening. For example, Figure 7 shows that the gap with Japan in 1960 was $1.44. In 1970, it is $1.98, a 37 percent increase in ten years. Japan's textile wages could have been increased 100 percent or more, but the actual increment was still far less than the increase in wages that occurred in the United States. And, among the Asian nations, Japan pays the highest wage.

In spite of rising costs of wages and materials in this country, the textile industry has managed to keep prices relatively stable. Textile wages have risen 58 percent above the 1957-1959 average and will advance further this month. At the same time, wholesale prices for textile mill products are virtually unchanged (see Figure 8). Few items have held the line against the inflationary spiral as well as textiles.

This point is even more emphatic when the price performance of the textile industry is compared with that of all manufacturing industries in Figure 9. Here you observe that wholesale prices of

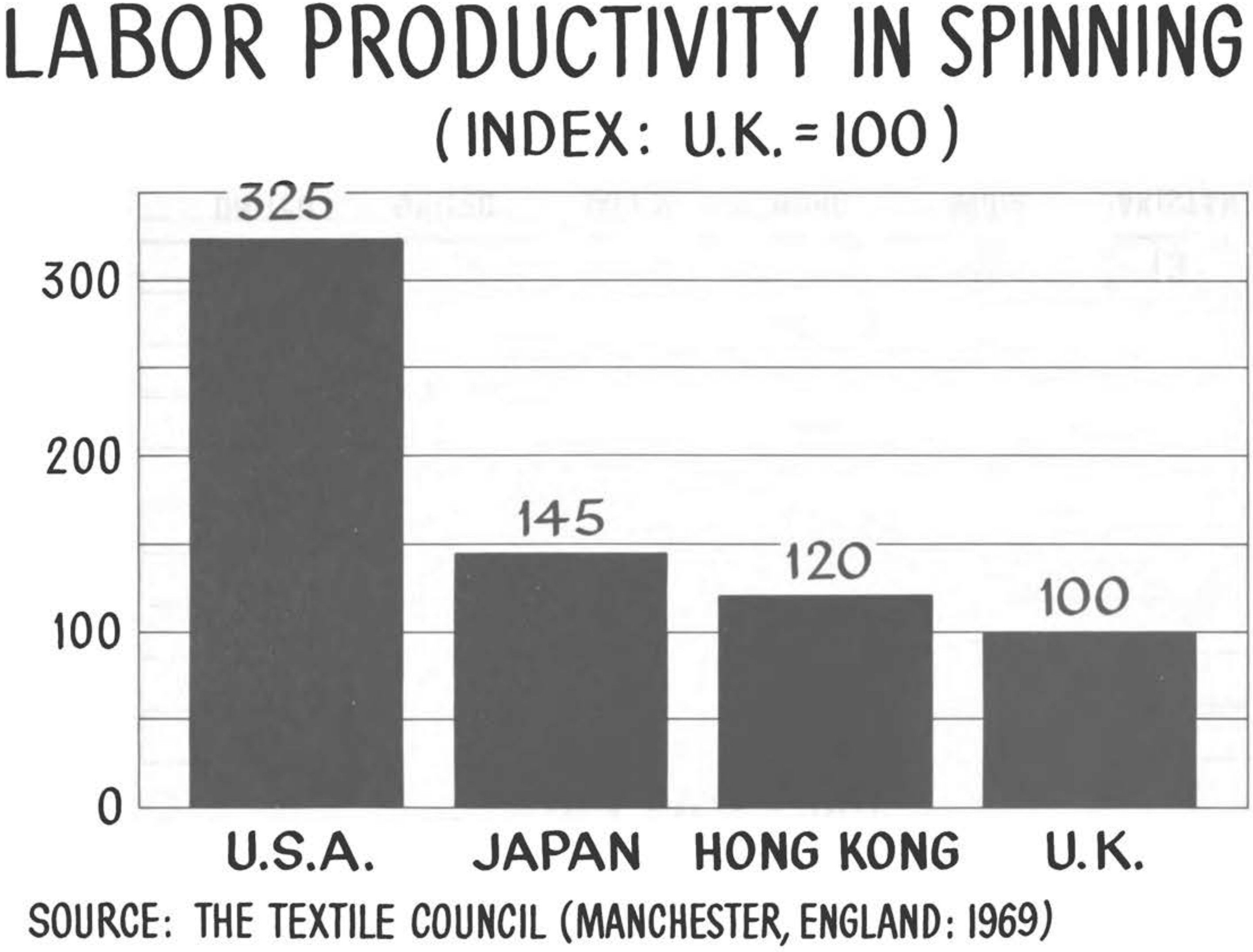
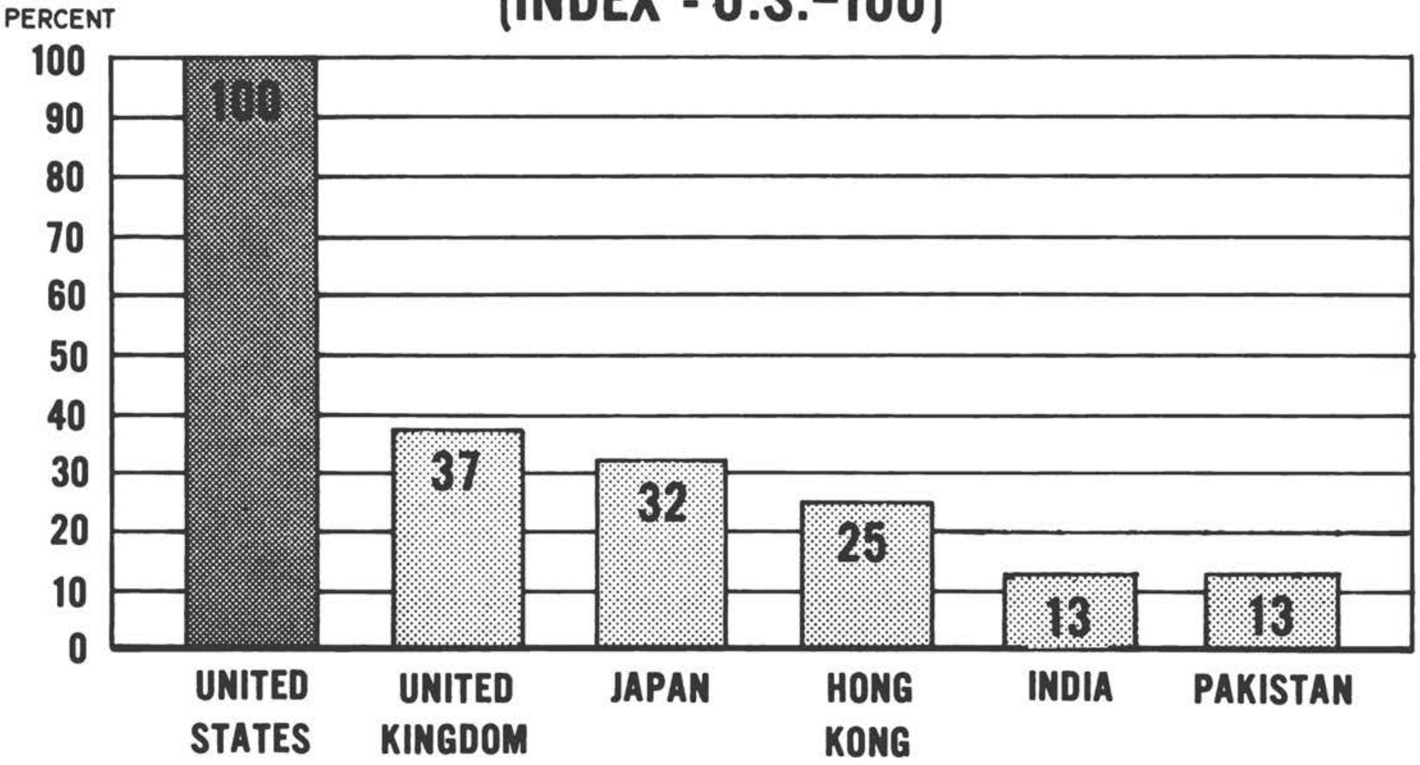

LABOR PRODUCTIVITY IN SPINNING
(INDEX: U.K. = 100)
325
145
120
100
300
200
100
0
U.S.A.
JAPAN
HONG KONG
U.K.
SOURCE: THE TEXTILE COUNCIL (MANCHESTER, ENGLAND: 1969)

FIGURE 4

LABOR PRODUCTIVITY IN TEXTILES 1967

(INDEX - U.S.=100)



SOURCE: TEXTILE COUNCIL (MANCHESTER, ENGLAND 1969)

FIGURE 5

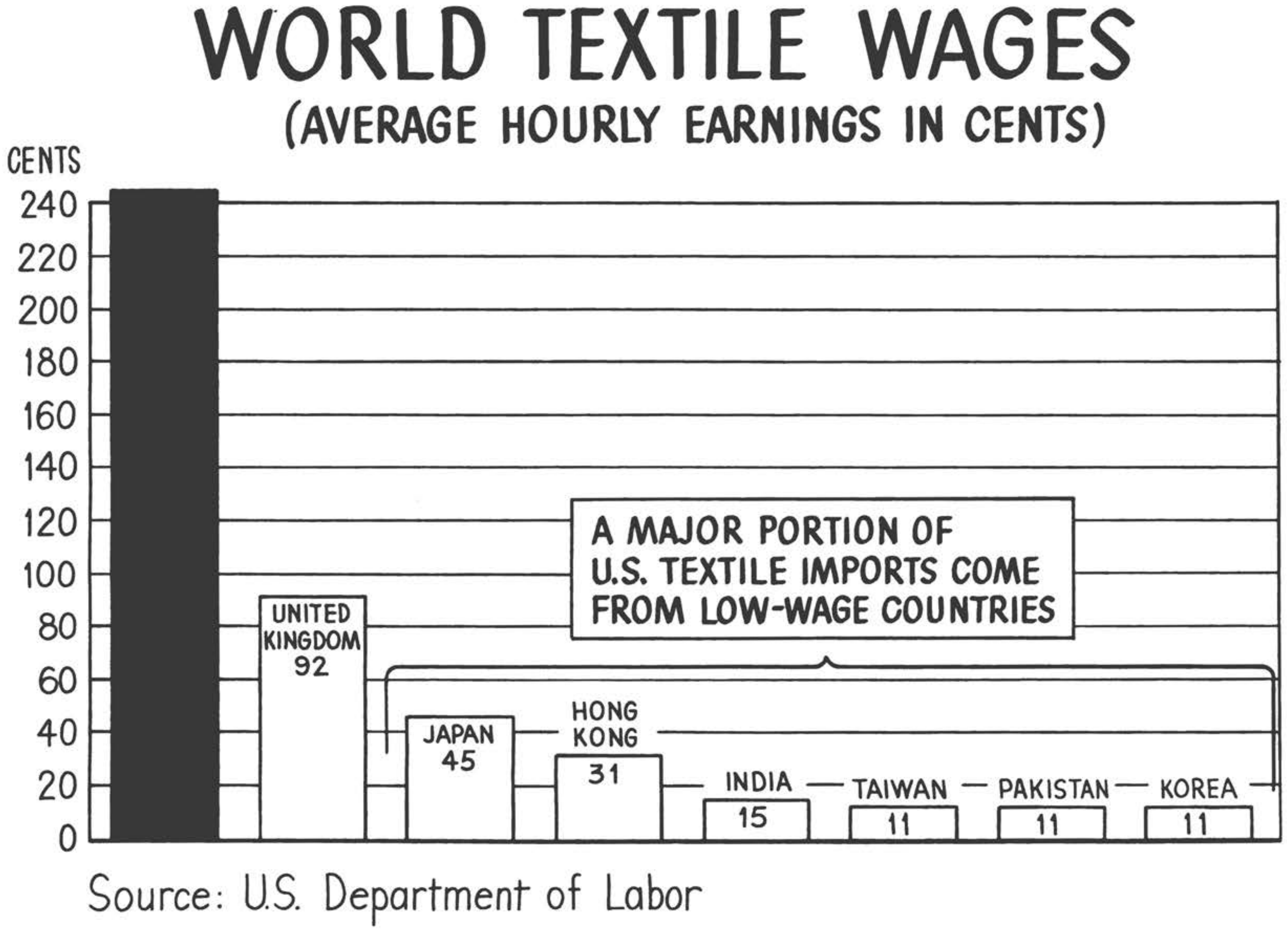
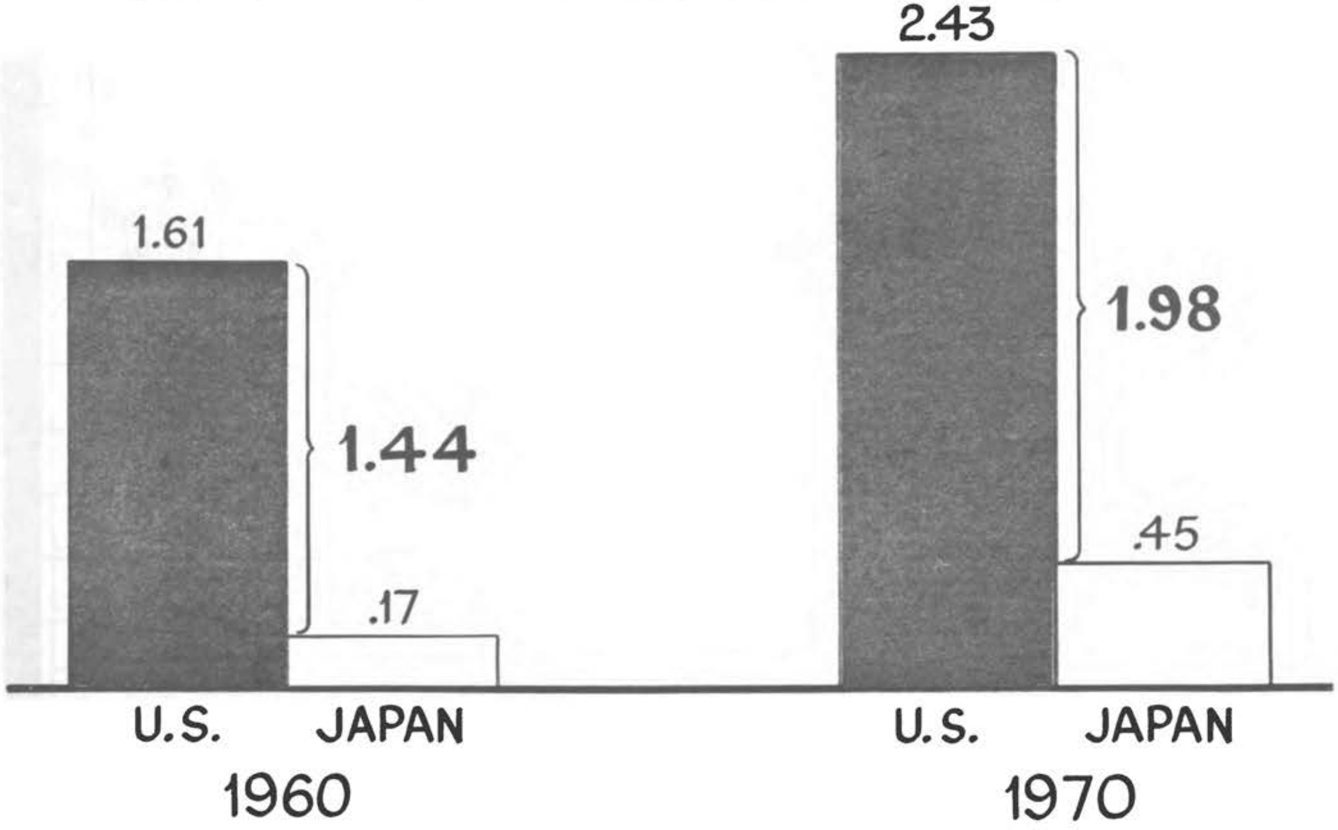

WORLD TEXTILE WAGES
(AVERAGE HOURLY EARNINGS IN CENTS)
CENTS
240
220
200
180
160
140
120
100
80
60
40
20
0
A MAJOR PORTION OF U.S. TEXTILE IMPORTS COME FROM LOW-WAGE COUNTRIES
UNITED KINGDOM 92
JAPAN 45
HONG KONG 31
INDIA 15
TAIWAN 11
PAKISTAN 11
KOREA 11
Source: U.S. Department of Labor

FIGURE 6

U.S.-JAPAN WAGE GAP WIDENING
(HOURLY $ TEXTILE EARNINGS)



Source: U.S. Department of Labor

FIGURE 7


TEXTILE WAGE & PRICE INDEXES
(1957 - 1959 = 100%)
PERCENT
170
160
150
140
130
120
110
1957-
59=100
90
'57
'58
'59
'60
'61
'62
'63
'64
'65
'66
'67
'68
'69
'70
HOURLY
WAGE
INDEX
WHOLESALE
PRICE INDEX
Source: U.S. Department of Labor

FIGURE 8

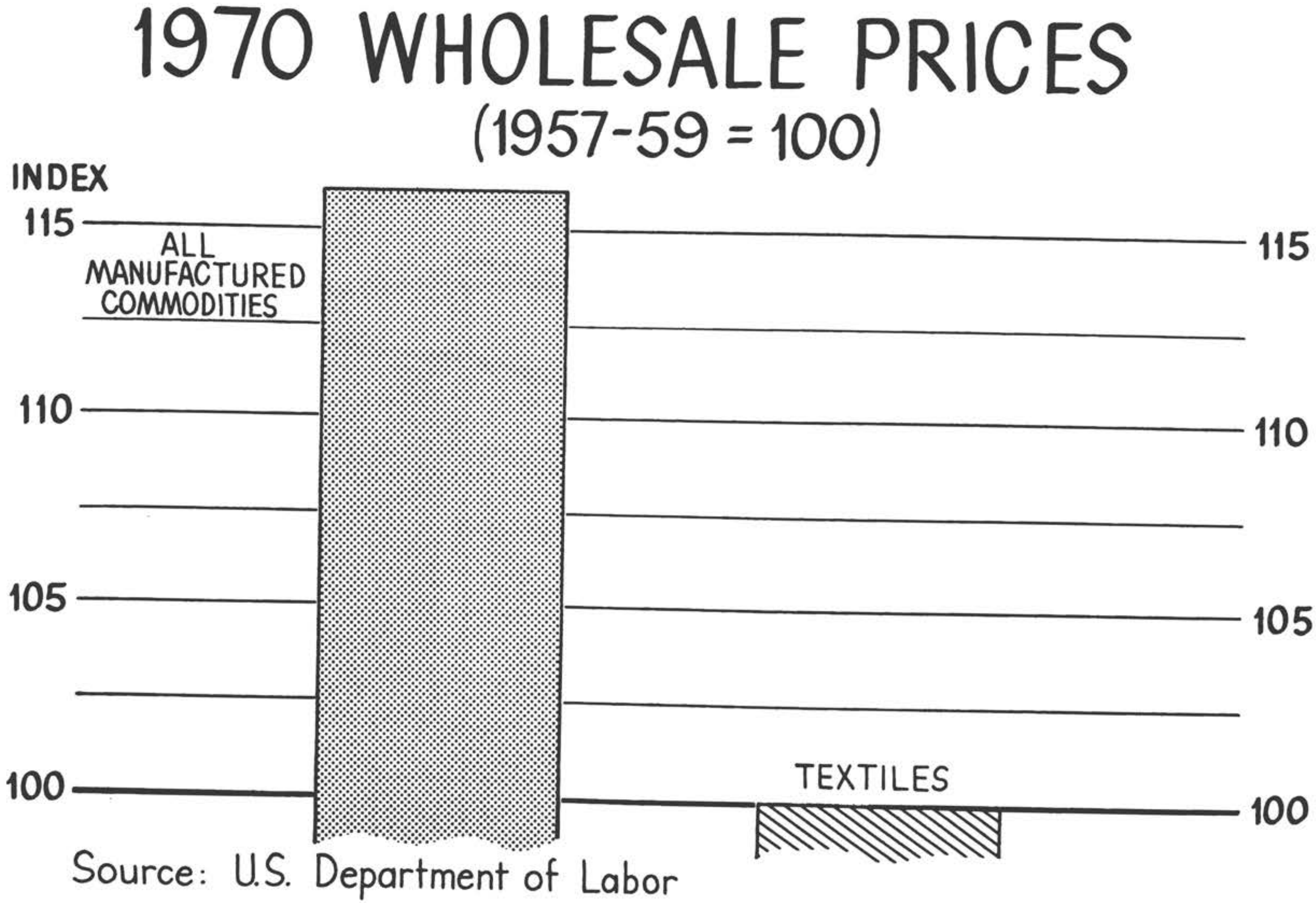

1970 WHOLESALE PRICES
(1957-59 = 100)
INDEX
115
110
105
100
ALL
MANUFACTURED
COMMODITIES
TEXTILES
115
110
105
100
Source: U.S. Department of Labor

FIGURE 9

all manufactured commodities have risen 17 percent above the 1957-1959 base; in sharp contrast, no change occurred in textile prices.

The best way to hold the textile price line for consumers is to encourage healthy competition between the 7,000 textile plants and 27,000 apparel plants in the United States. Once the control over a major part of a product line falls into the hands of foreign interests, provisions of U.S. law for the protection of American consumers and employees—antitrust regulations, prohibitions against price-fixing conspiracies, minimum wage requirements and the like—are ineffectual. No foreign producer has any obligation to feel legal or moral responsibility toward this country's consumers.

Pending legislation to regulate the growth of textile imports will have no significant effect on consumer prices. Imports have been rising faster than domestic production. Although the import legislation should slow this rapid rise, it will still permit importation of large volumes of products from textile producing nations around the world.

Prices are affected by many factors from day to day, including the general business cycle, deflationary or inflationary government monetary policy, and shifts in consumer tastes.

The textile quota provisions of the pending trade bill are so generous that the present "product mix" of the tremendously wide variety of men's, women's, and children's clothing in low, medium, and higher priced brackets will continue to be available at the retail counter. The proposed legislation also provides for annual increases in the already high levels of textile imports.

Approximately half the textile products in use in the United States today are already covered by import restraints. As mentioned earlier, for almost a decade international trade in cotton textiles has been regulated under terms of the GATT-LTA, a multilateral agreement among 30 major cotton textile producing nations, including the United States. During this entire period, there has been no apparent effect on domestic cotton textile prices. Under the pending legislation, which would cover man-made fiber and wool textile articles, the day-to-day prices of hundreds of articles of clothing will be determined by the same supply, demand, and national policy considerations that have influenced prices of cotton textile products. Consumers will still be able to take advantage of any lower import prices that importers and retailers will be willing to pass along. Although import legislation is not expected to have any significant impact on textile prices, it will help to prevent the rapid destruction of textile and apparel jobs in many small U.S. communities.

Some examples may be useful to illustrate that over-all supply, demand, and national policy considerations are the prime determinants of commodity prices in the American market. The U.S. Department of Labor's All-Commodity Wholesale Price Index is a widely used measure of changes in prices of a large composite of basic commodities and products. The Index is currently about 17 percent above its 1957-1959 base of 100.

Similar index measurements for the components of the All-Commodity Index show that petroleum (under import quota) prices have increased about 4 percent, whereas coal (with no import quota) is up 47 percent. Wheat imports are strictly controlled, yet the price of wheat dropped 31 percent in the 20-year period between 1950 and 1970; the price of corn, with no quota protection, dropped only 13 percent. There are many examples of price increases in products that have no import controls.

Maintaining a highly competitive, expanding domestic textile-apparel industry is the consumer's best assurance that he or she will continue to receive quality textiles at reasonable prices. However, when any segment or large part of that market falls under foreign domination, the competitive influence on prices can be lost.

A good example of what happens when a textile product falls under foreign control is silk. Japan and Italy dominate the world's silk textile production. Since 1960, the wholesale price index of silk textiles has increased some 89 percent. During the same period, the price of all textile mill products—operating in the competitive U.S. market—has not increased, and the combined textile and apparel index is up about 9 percent.

We have not yet reached the point at which foreign influence dominates the U.S. textile and apparel markets, but unless prompt control action is taken, that point could soon be reached with respect to many different textile products, and the U.S. consumer will be the loser.

Taken together as a single industrial complex, textile and apparel manufacturing form a key foundation element in America's economic structure. Not only does this industry make products essential to people and vital to national security, but it fills a primary role in providing livelihoods and economic activity for hundreds of communities, large and small, urban and rural, throughout the land.

The textile-apparel industry directly employs some 2.4 million men and women, in a broad range of occupations, as indicated in Figure 10. It pays its employees approximately $11 billion a year. It generates revenues for government—more than $2.5 billion in federal, state, and local tax revenues.

The industry's impact on the economy of the United States goes even further. In a normal year it buys $4 billion worth of fiber, including two thirds of the output of this country's 300,000 cotton farms and all the domestically produced wool; $600 million worth of chemicals and dyestuffs; $630 million in plants and equipment; and millions more for other supplies and services (see Figure 11). Another million workers are employed in producing the raw fiber, machines, chemicals, and the like used by the industry.

Of the 20 million manufacturing employees in this country, the textile-apparel industry directly employs 2.4 million, or one in every eight, as shown in Figure 12. A broad employment base such as this comprises a national asset of major importance, because the United States stands near the head of the list of nations depending on manufacturing activity for employment of its labor force. To accommodate the great numbers of people involved, our country needs more manufacturing occupations, a vigorously expanding industrial employment level.

Figure 13 shows that nonwhite employment in the textile industry has grown from 3.3 percent in 1960 to 14.3 percent currently, whereas the present level for all manufacturing since 1960, and in certain textile areas the percentage of black employees is much more concentrated, running as high as 40 percent.

Another significant aspect of textile-apparel employment is the number of women involved. Women constitute about 45 percent of the textile labor force and 80 percent of the apparel workers. This compares with the all-manufacturing average of 27 percent. In terms of opportunities for people, regardless of race, sex, educational background, or their lines of interest, the textile-apparel industry is unique in what it can offer, provided that it has a reasonable chance to grow and progress with the nation's economy as a whole.

TEXTILE-APPAREL INDUSTRY

A MAJOR FACTOR IN U.S. ECONOMY

- JOBS-2.4 MILLION
- PAYROLL-$10.8 BILLION
- FEDERAL, STATE AND LOCAL TAXES - $2,500,000,000

FIGURE 10

TEXTILE-APPAREL INDUSTRY

A MAJOR FACTOR IN U.S. ECONOMY

PURCHASES ANNUALLY

- FIBERS - $4.0 BILLION
- PLANT AND EQUIPMENT - $630 MILLION
- PACKAGING PRODUCTS - $240 MILLION
- CHEMICALS & DYESTUFFS - $600 MILLION
- POWER AND FUEL - $420 MILLION
- TRUCKING SERVICES - $100 MILLION

FIGURE 11

ONE IN EIGHT OF ALL U.S. MANUFACTURING JOBS IS IN TEXTILES & APPAREL

ALL INDUSTRIES	TEXTILE & APPAREL INDUSTRY
20.1 MILLION	2.4 MILLION

FIGURE 12

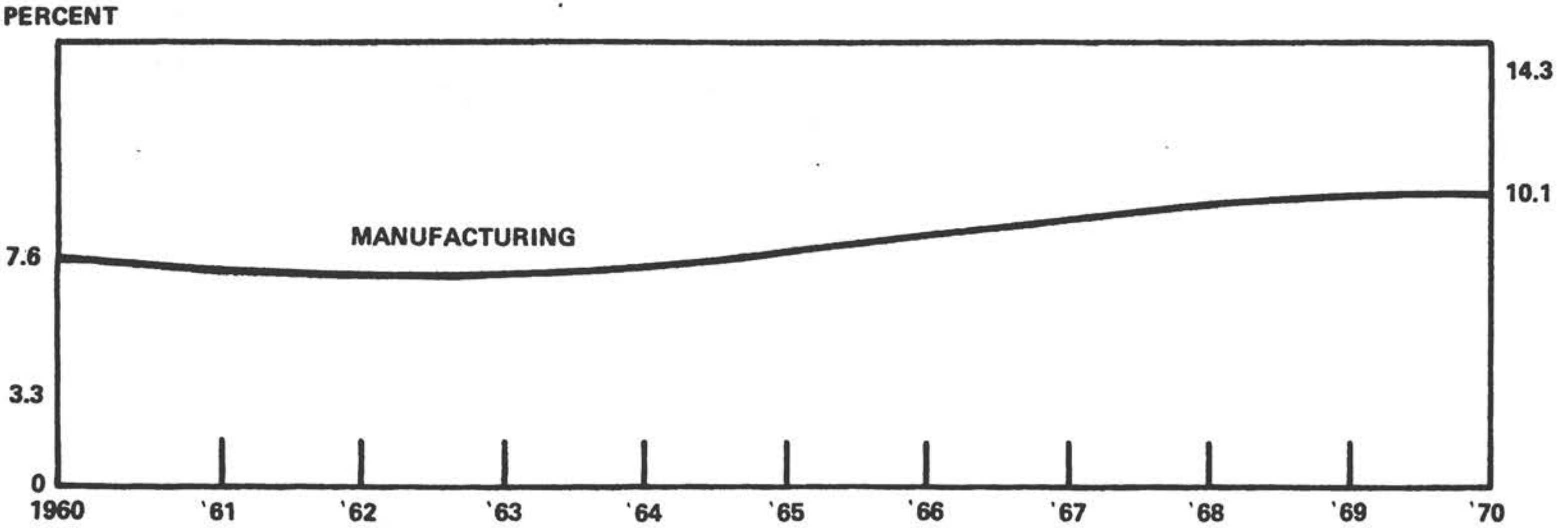

PERCENT
14.3
10.1
MANUFACTURING
7.6
3.3
0
1960
'61
'62
'63
'64
'65
'66
'67
'68
'69
'70

FIGURE 13

These important social contributions of the textile industry are important and significant to our national welfare. They are vital to our national commitment to full employment.

One of the most alarming aspects of this entire import situation is the impact on capital investment. In our dynamic economy, industry must constantly innovate and modernize. No industry can stand still. Currently, it is extremely difficult for U.S. manufacturers to plan ahead with any degree of certainty. In the past, when government actions created confidence, the textile industry invested heavily in the future. As Figure 14 illustrates, outlays for new plant and equipment rose from $380 million in 1962, when the cotton LTA controls went into effect, to $820 million in 1966. After that they began to decline, a situation that cannot be tolerated for very long. These outlays are currently estimated at $580 million for 1970.

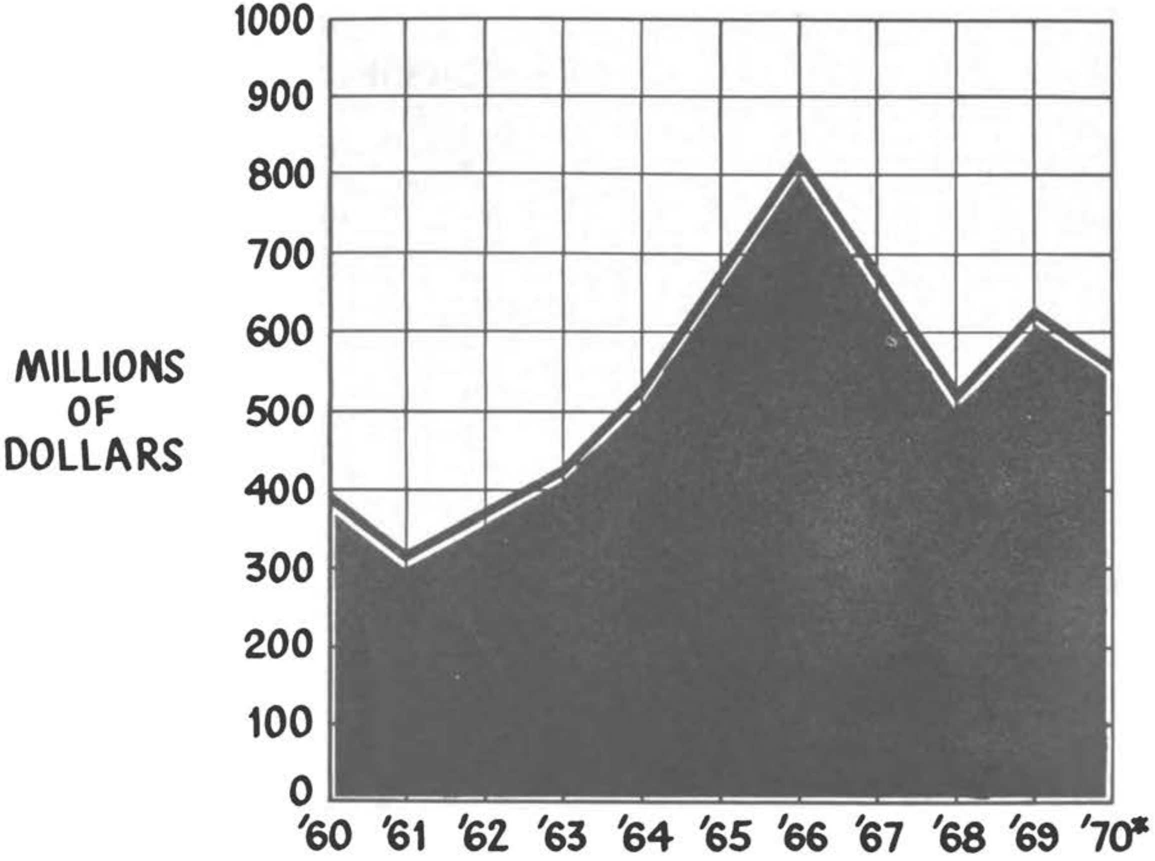
We are concerned by the fact that textile machinery sales on a worldwide basis, as reported by both European and U.S. manufacturers, are very strong except in the United States. This finding, we believe, reflects the depressed economic status of the textile industry in the United States as well as a lack of confidence in the future.

This same trend in the area of research could be equally serious; for innovation, relatively high productivity, and efficiency are the main strengths of the U.S. textile industry.

Profits in the textile industry, whether measured on sales or equity, lag behind other manufacturing industries. Net profits on sales after taxes in the second quarter of 1970 were at an annual rate of 1.8 percent compared with the all-manufacturing average of 4.4 percent. That is a rate of only 41 percent of the average for all U.S. industries. Expressed as a percent of equity, textile profits are 4.8 percent compared to 10.4 percent for all manufacturing. Figure 15 presents these comparisons. (It appears that a further deterioration in textile profits was recorded in the third quarter of 1970.)

Revival of textile investment depends on revival of textile profits and that, in turn, depends in good part on slowing the accelerating import rate. Job growth in the industry will depend on plant expansion here rather than overseas to serve the growing American market.

NEW PLANT AND EQUIPMENT EXPENDITURES



Source: Securities & Exchange Commission and U.S. Dept. of Commerce
*Official Estimate

FIGURE 14

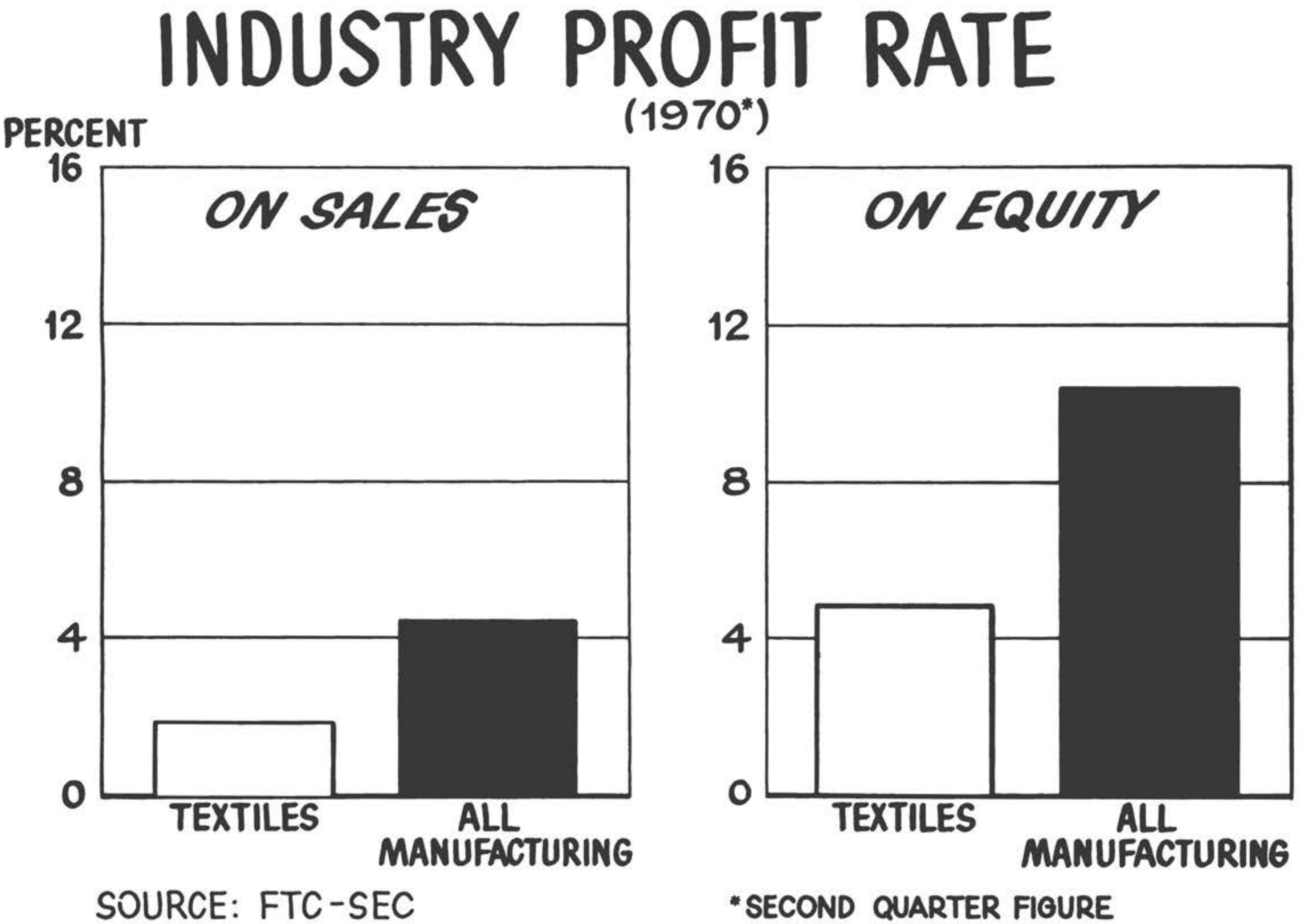

INDUSTRY PROFIT RATE
(1970*)
PERCENT
16
12
8
4
0
ON SALES
TEXTILES
ALL MANUFACTURING
16
12
8
4
0
ON EQUITY
TEXTILES
ALL MANUFACTURING
SOURCE: FTC-SEC
*SECOND QUARTER FIGURE

FIGURE 15

The upper line in Figure 16 shows how imports have been rising. This is shown in terms of dollars. The foreign market price of textiles and apparel has soared to an annual rate of $2.2 billion in 1970. The lower line shows the total dollar value of textile and apparel products exported from the United States to other countries, a 1970 annual rate of $0.8 billion. The current textile trade deficit is at a $1.4 billion annual rate.

The United States has not had a favorable textile trade balance since 1957. The result is a constantly widening textile trade gap. Can the United States afford to let this gap grow indefinitely?

As Figure 17 shows, Japan accounts for much of this trade gap. Japan has some of the most restrictive trade regulations in the world to protect its own market, but at the same time seems to feel that she should have completely free access to our market. In 1968, Japan had a favorable world textile trade balance of $1.7 billion. She sent $478 million worth of textiles to the United States but imported only $11 million from us. (In 1969 we received $540 million worth of textiles from Japan, whereas we exported only $15 million worth to her.) On the other hand, the European Free Trade Association nations received $45 million in textiles from Japan and exported $36 million worth to her. The European Economic Community imported $59 million worth of textiles from Japan and shipped $35 million worth to her.

No other developed nation, nor trading group, provides Japan with the favorable trade balance that we do. It is evident that other countries restrain the quantity of their Oriental imports to the detriment of the United States, which has heeded the GATT rules and maintains virtually the only open textile market in the world.

But these data do not tell the entire story. Included among the LDC's (Economic Class II Countries) are such countries as Hong Kong, Taiwan, and Korea. Much of what they process and export to the United States was originally produced in Japan.

During the first six months of 1970, 67 percent of our textile imports came from five countries. In order of importance these were: Japan, Hong Kong, West Germany, Taiwan, and South Korea. The next five countries shipped in a total of 13 percent bringing the total for the first ten countries to 80 percent. The second five countries were: Italy, United Kingdom, Canada, Mexico, and France.

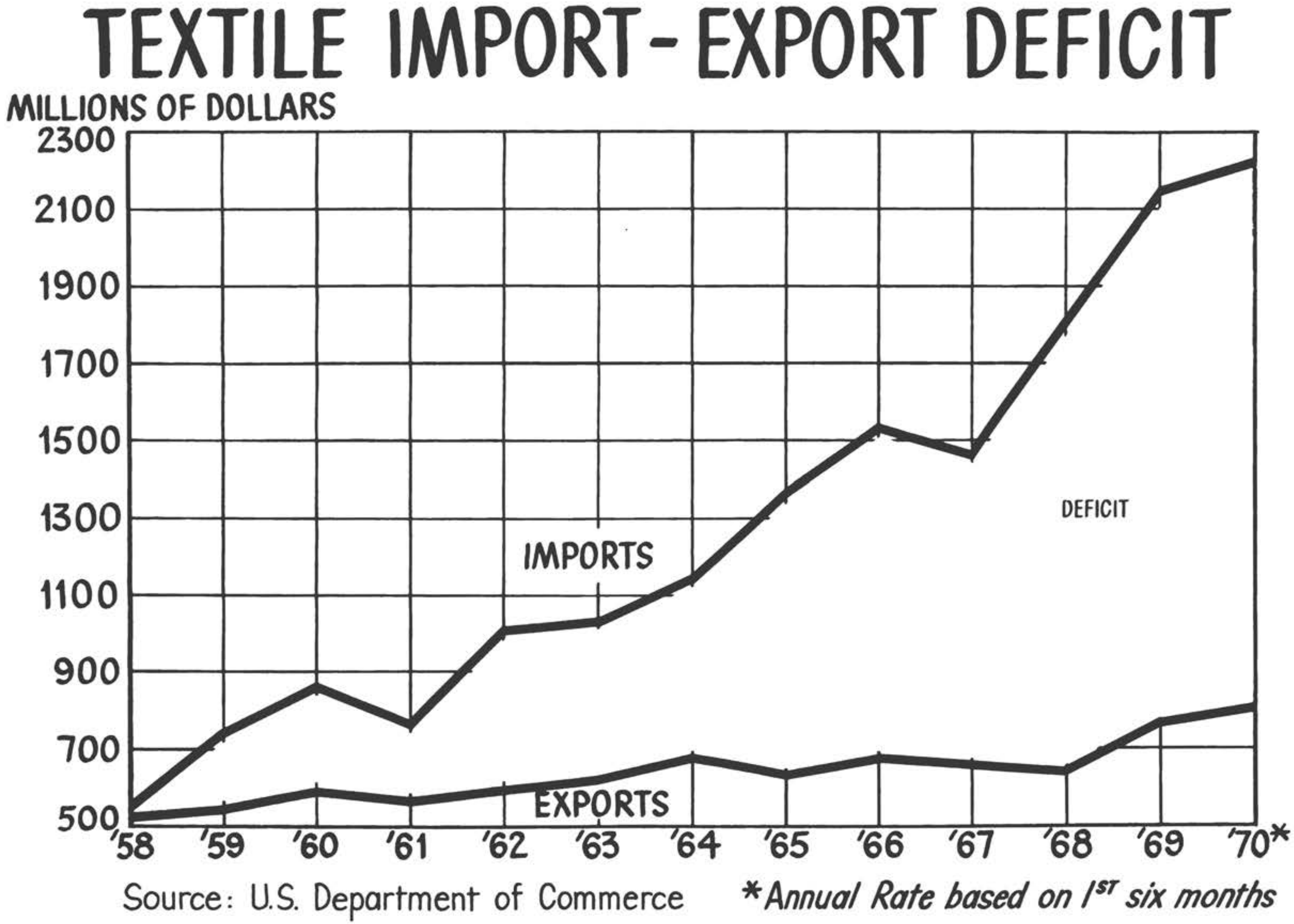
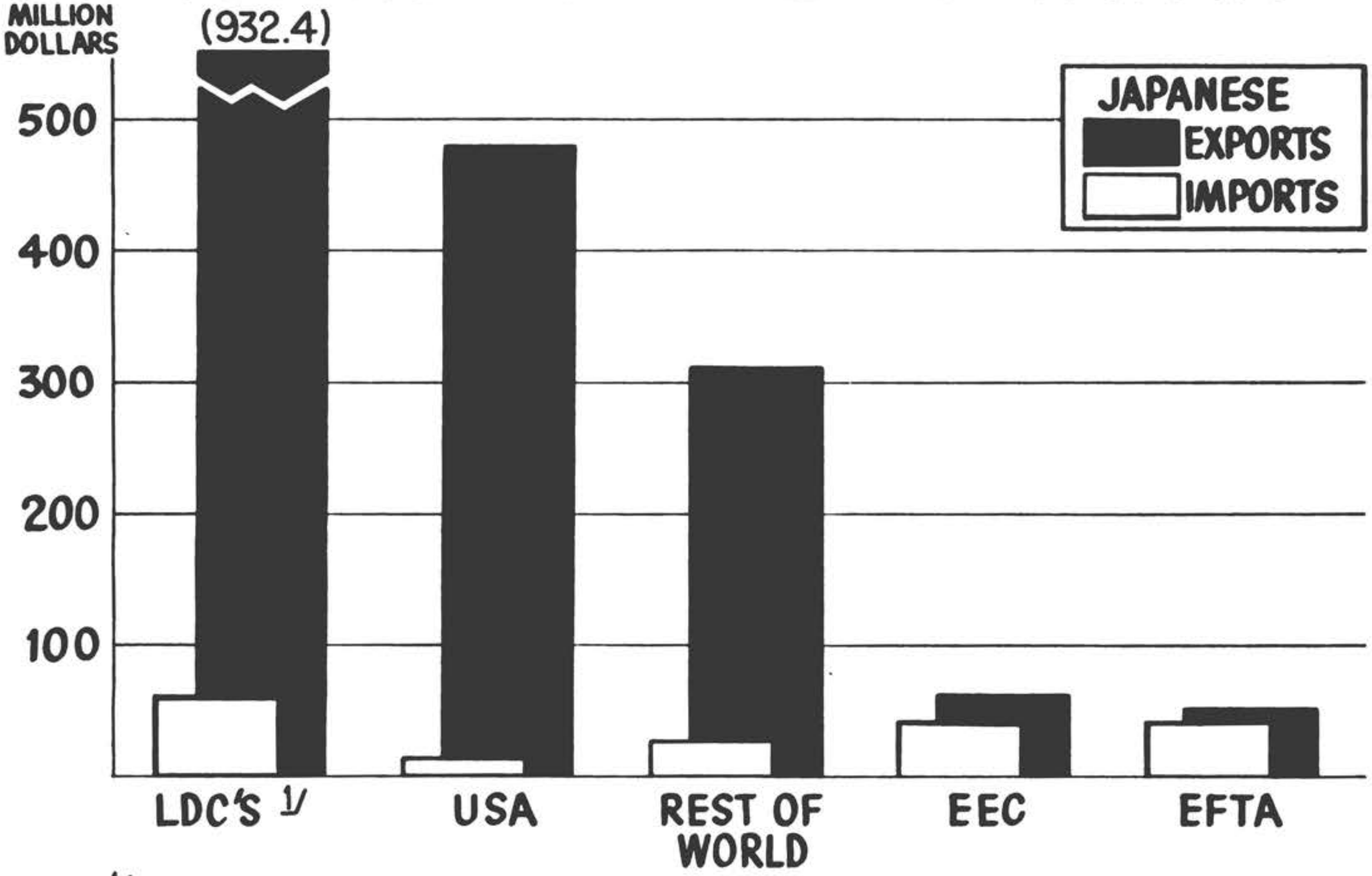

TEXTILE IMPORT-EXPORT DEFICIT
MILLIONS OF DOLLARS
2300
2100
1900
1700
1500
1300
1100
900
700
500
IMPORTS
DEFICIT
EXPORTS
'58 '59 '60 '61 '62 '63 '64 '65 '66 '67 '68 '69 '70*
Source: U.S. Department of Commerce
*Annual Rate based on 1st six months

FIGURE 16

TEXTILE TRADE OF JAPAN



1/ Economic Class II Countries
Source: United Nations

FIGURE 17

More than any other large industry, textile plants are located in small communities. About 60 percent of the industry's workers are employed in nonmetropolitan areas. In some states this figure is as high as 70 percent to 85 percent. Figure 18 depicts this trend.

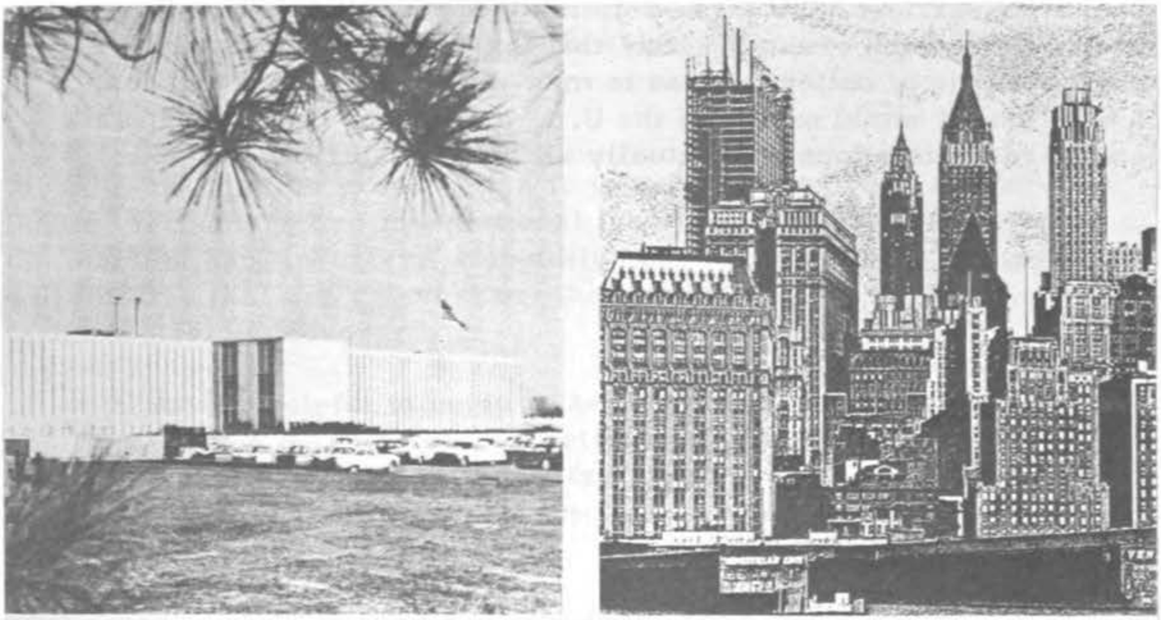
Apparel is more of an urban industry than textiles, with about two thirds of its jobs in cities. Visitors to New York City quickly recognize the importance of the apparel industry to that large city. One of every three manufacturing jobs there is provided by the clothing industry.

In hundreds of small towns and villages throughout the nation, textile and apparel plants are the only employers of significant numbers of people. As a result, these towns and villages are largely dependent on these plant payrolls for their survival. If a company is forced to reduce its work force or, worse, to close its doors, the community suffers a crippling catastrophe.

Today the U.S. textile industry faces a crisis. The growing flood of imports coming primarily from the Oriental countries is being directed to our market by inequities in international trade. The markets of many other developed countries are virtually closed to these goods. World textile trade has become increasingly unbalanced.

Our studies of Far Eastern plans for expansion of textile and apparel production in the early 1970's indicates a compelling need for restraint in the rate of growth of man-made fiber and wool textile exports to the U.S. market. We cannot sacrifice the job-producing potential of this vast industry and the existing 2.4 million jobs in it on the altar of free trade, when in fact free trade does not exist in textiles.

The Nixon Administration sought for the first 17 months of its existence to negotiate multilateral and then bilateral agreements to effect reasonable restraints on man-made fiber and wool products. The intransigence of our trading partners led to the recommendation that legislation be adopted to encourage such voluntary agreements. The pending legislation is very permissive and gives the President wide latitude to accommodate the solution to our national interests. It is mild and reasonable, yet holds the potential of restoring confidence in a major segment of our national economy, a segment that brought the industrial revolution to the United States and today serves the American consumer with such a variety of style and choice that imports are only copies of American products, not overseas innovations.



61% OF ALL TEXTILE JOBS ARE LOCATED IN NON-METROPOLITAN AREAS . . .

79% OF ALL MANUFACTURING JOBS ARE FOUND IN URBAN-METROPOLITAN AREAS

Without Textiles, Communities Hurt

"Textile industry payrolls are of particular importance to economic health of many small communities in non-metropolitan areas. Such communities . . . may be adversely affected to a more marked extent than large areas by significant changes in textile output and employment."

Labor in the Textile and Apparel Industries
U. S. Dept. of Labor, Bureau of Labor Statistics, Bulletin No. 1635

Source: U.S. Dept. of Labor

FIGURE 18

Textiles have been traded among the peoples of the world since mankind's earliest days. The solution today is not unique. It merely involves extension of the practice that exists in the previously predominant area of cotton textiles to man-made and woolen textiles. In addition, it would extend to the U.S. market the bilateral or unilateral restraints found in virtually all other countries.

MACHINE TOOLS, IMPORTS, AND NATIONAL SECURITY

Henry D. Sharpe, Jr.

My objective in this presentation is to explore the broad symposium theme, technology and international trade, in the specific context of the machine tool industry. Hopefully, certain principles and problems will emerge that are relevant to other industries and kinds of technological endeavor.

It may be helpful to begin by telling you briefly about the unique position that the machine tool industry occupies. First, machine tools are the master tools of industry. The production of all manufactured goods is dependent on them, either directly or indirectly. For this reason the machine tool industry is basic to the national economy and national defense.

I do not exaggerate when I say that an indigenous machine tool industry is regarded by virtually all governments as a prized possession, even though at times the actions of some governments, including our own, would seem to belie that fact. This, at times curious, compulsion seems to spring from an intuitive feeling that there is some kind of basic value to a nation in possessing at least some self-sufficiency in machine tool capability. Perhaps this feeling is no more than a legitimate expression of national pride. Often it is obviously well justified, and certainly equally often the whole idea seems irrational. But everywhere you look on the international scene the feeling is there; whether rational or not, it is an international political fact.

As an illustration, the Soviet Union values its machine tool industry so highly that for many years a Minister of Machine Tools had cabinet rank, and perhaps still does. Most of the Soviet Bloc countries have their own machine tool industries, as does Red China.

Every one of the Western European countries has its own machine tool industry, and in some cases these industries are assiduously nurtured financially by their governments. A similar situation exists in Japan. Even semi-industrialized nations are doing their best to establish their own machine tool industries, for example, India, Spain, Mexico, Portugal, Argentina, and Brazil.

As a basis for my discussion of international trade in machine tools, I will outline briefly events occurring since World War II, particularly in the past five years. Under the Marshall Plan in the years immediately following the War, we helped finance the rebuilding of the prostrate West German machine tool industry. At that time, our short-sighted allies, Great Britain and Russia, insisted on dismantling certain important German machine tool plants and shipping them home to be reassembled. The result was not what they had expected. The reassembled plants, bereft of their former owner's skill and enthusiasm, were of little value to either Great Britain or Russia. Apparently no thought had been given to the fact that the Germans, always resourceful and still possessing skill and enthusiasm, would start to rebuild from scratch and thereby create new plants with new equipment—plants that often were financed by Marshall Plan money.

As early as 1952, West Germany had a rehabilitated, thriving machine tool industry that has been in the forefront ever since. Perhaps it is not a coincidence that the West German industry has exported more machine tools by far to this country than any other foreign machine tool industry. Specifically, West German builders have delivered to American customers $204 million worth of machine tools in the past five years.

We as a nation were in a helping mood in those days. We sent government-sponsored productivity teams abroad, and foreign governments dispatched productivity teams to our country, all with the official blessing of Washington and the enthusiastic cooperation of U.S. industry. These cooperative arrangements proved to be largely a one-way affair. The foreigners absorbed a large amount of American expertise and American technology, then took this knowledge back and applied it successfully at home. American industry found quickly that it had little if anything to learn from Europe and Japan. Our quo for this quid was a warm feeling inside.

During the 1950's the great trek to Europe of American machine tool capital, technical and engineering knowledge, and manufacturing know-how began. The Europeans were producing machine tools at spectacularly low prices; the quality of their products was constantly improving.

Foresighted machine tool management in U.S. industry realized that eventual survival in world markets meant establishing wholly or jointly owned subsidiaries abroad, or at least making licensing arrangements through which they could take advantage of low labor rates in particular and more favorable tariff rates.

Our American machine tool top executives, chief engineers, production managers, and various technical and manufacturing personnel commuted across the Atlantic. They spent much of their time helping to establish in the United Kingdom and Western Europe an effective production system for U.S.-designed machine tools, often replacing less efficient European with more efficient American methods.

The U.S. domestic market for machine tools is the biggest and most lucrative in the world. Foreign builders have had their eye on it since the early 1950's. Foreign machines then were not what they are now in quality and performance. They were sold almost entirely on price alone, with a few conspicuous exceptions. These foreign machines were sold to American customers as a logical substitute for used American machines. After all, why not buy a new foreign machine instead of an old U.S. machine?

As time went on, foreign machines were vastly improved in design and performance and began increasingly to compete directly with new American machines. Beyond that, increasing numbers of top-grade American machine tool distributors began to handle foreign lines, partly because of the lure of large commissions and partly because they were deprived of representation of domestic lines by mergers of U.S. builders and were forced by necessity to seek foreign lines to have a full complement of machine tool types to sell.

To show the drastic change that has occurred, only four foreign machine tool builders were represented in the membership of the American Machine Tool Distributors Association (AMTDA) in 1955. Today 148 foreign builders are represented in this organization. In recent years these foreign builders have poured large sums into establishing sizable inventories of replacement parts in this country and maintaining factory-trained service crews here.

If one takes into account all the U.S. sales agents and machinery dealers and distributors, in addition to AMTDA members, selling foreign machine tools in this country, it is conservatively estimated that at least 350 overseas builders are today soliciting business in the American market. This effort is paying off for foreign builders; they have invaded our domestic market in depth and are digging in for a long stay.

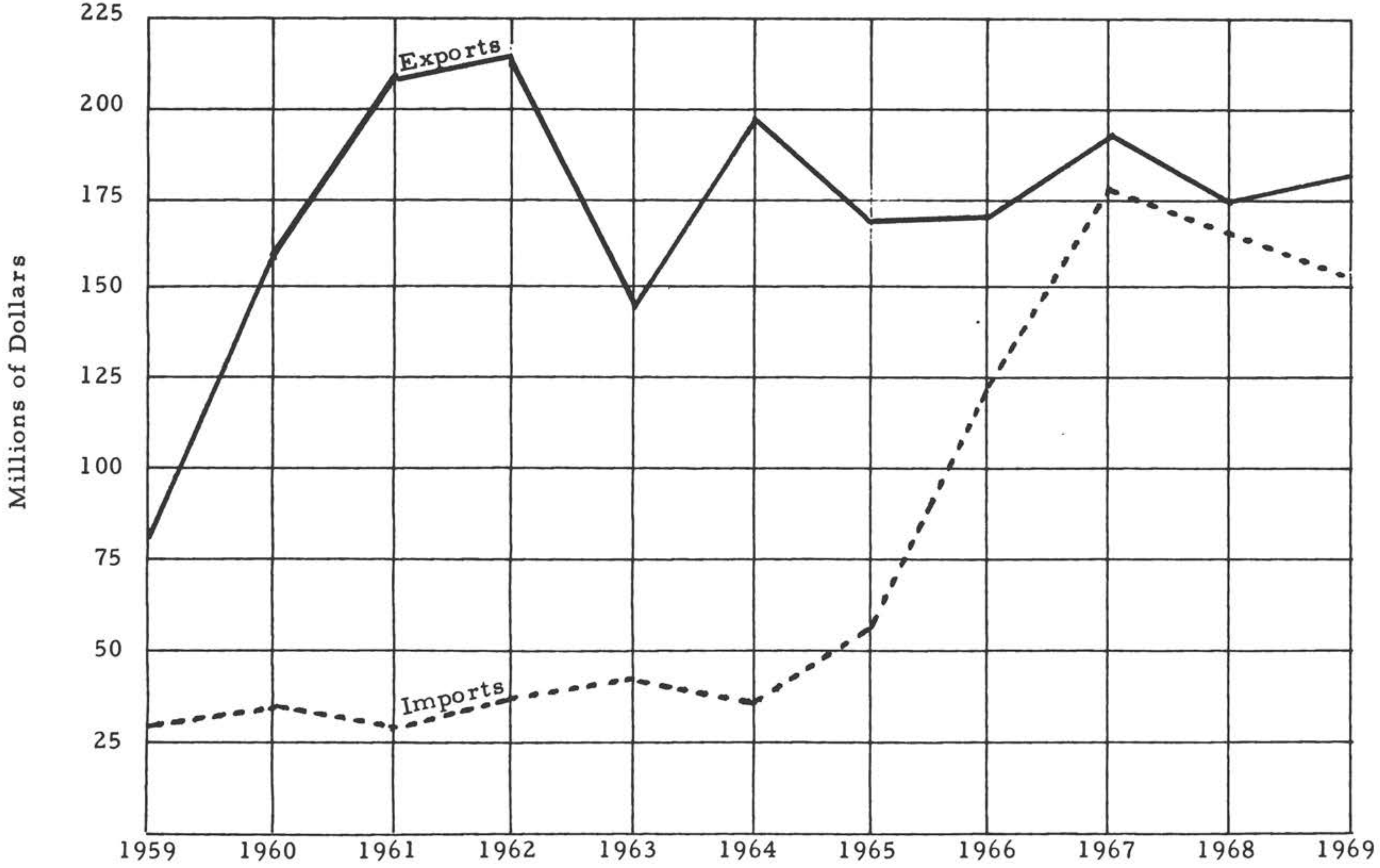
A new aspect to the import situation has recently developed, an aspect that cannot be ignored and promises to be troublesome in the future. Almost all imported machine tools to date have been so-called standard machines, such as engine lathes and milling machines. Recently, however, foreign builders have been developing the more sophisticated types, including numerically controlled machines and machining centers. These sophisticated machines are now being offered to American buyers, thus broadening significantly foreign competition in the U.S. builders' home market. In sophisticated as well as standard machines, foreign builders have an important price differential because of their lower labor costs.

Figure 1 shows exports and imports of machine tools. In the early 1960's we enjoyed a favorable trade balance of almost $200 million; we were benefiting from a boom among European machine tool users. With very long deliveries among European builders, European customers turned to U.S. builders to get machines within a reasonable time.

Note that the wide margin in 1962 shrinks drastically to less than $16 million by 1967, because the import curve zooms from $46 million in 1964 to $178 million in 1967. Imports, as a matter of record, rose from 3.6 percent of the domestic deliveries in 1964, to almost 10 percent in 1969. These figures, it should be stressed, are based on the f.o.b. (free on board) value of the machines; thus freight, insurance, and distributor discounts or commissions are excluded. In addition, the imported machine often sells here for a list price that is about 60 percent to 75 percent of that for a comparable U.S. machine. Putting these several differences together suggests that the Bureau of Census dollar import figures that have been cited above possibly understate the dollar impact of many individual machine tool imports by as much as 50 percent. Therefore, it is reasonable to suppose that what I term the Economic Impact Penetration of total machinery imports may be double the amount indicated by the official figures. In other words, importation by 1969 may well have actually reached an Economic Impact Penetration figure that is more nearly 20 percent than 10 percent. For example, we know that unit penetration in that year reached 39 percent, and this tends to corroborate our suspicions about the true economic penetration of foreign imports.

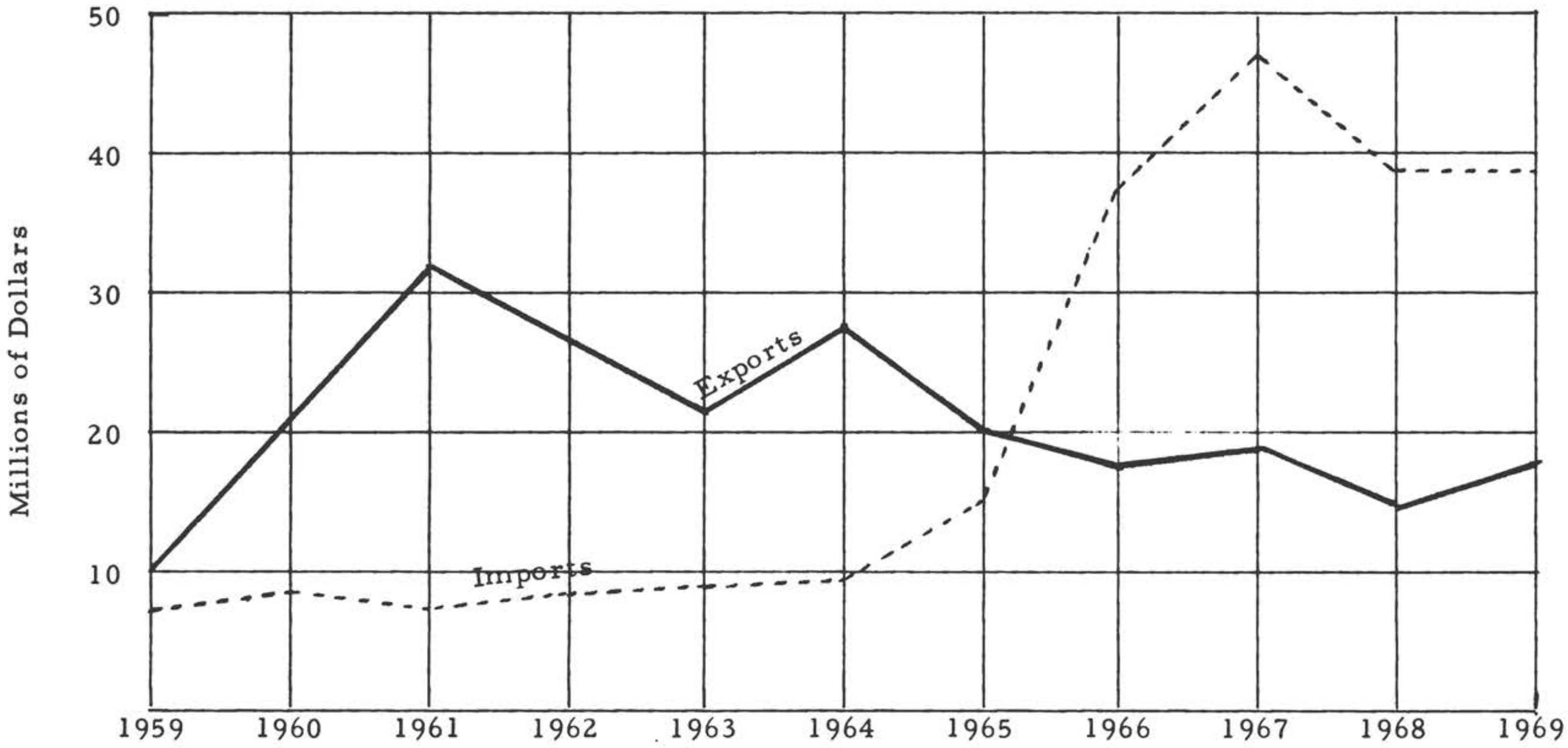
This is only part of the story. The detailed effect of these trends on specific parts of the industry is particularly marked. For example, Figure 2 presents data on lathes, one of the machine tool industry's staples. Note that imports in dollars in 1967 were five times those of

FIGURE 1 U.S. Exports and Imports of All Machine Tools



Source: Bureau of the Census, U.S. Department of Commerce, Imports FT 135; Exports M35W.

FIGURE 2 U.S. Exports and Imports of Lathes



Source: Bureau of the Census, U.S. Department of Commerce, Imports FT 135; Exports M35W.

only three years before in 1964, whereas exports dropped persistently. Note also that we have been running an unfavorable balance in lathes for the past four years. Last year 13,241 lathes, valued at $38 million, were imported. This will give you some idea of the high volume of low-priced lathes that are entering our country. By contrast, 685 U.S. lathes, totaling $17.4 million, were exported.

Data on milling machines tell much the same story, as shown in Figure 3. The number of units coming into the United States last year were more than seven times those in 1964, and the dollar total was eight times higher. The unfavorable dollar balance in milling machines last year amounted to almost $20 million.

The machine tool import story in its entirety is depicted in Figure 4. Last year dollar imports of metal-cutting machine tools as a group, using f.o.b. prices, were 11.1 percent of domestic consumption. Lathes were 12.5 percent, milling machines 12.9 percent, and boring machines 22.1 percent. This year, 1970 (which is not shown in this figure), Census Bureau figures broken down in greater detail than ever before show, for example, that f.o.b. dollar imports of engine lathes were 38 percent of domestic consumption, and f.o.b. dollar imports of radial drills during the first quarter were 43 percent of domestic consumption. The Economic Impact Penetration is obviously far greater than 50 percent in these situations.

In conclusion, one more significant import phenomenon has been the continuing high level of penetration that imports have sustained since the peak year, 1967, in spite of the developing weakness of the U.S. machine tool market. The f.o.b. dollar import totals in 1969 dropped only 13 percent below 1967, when U.S. domestic shipments during the same period dropped 11.9 percent—a negligible variation.

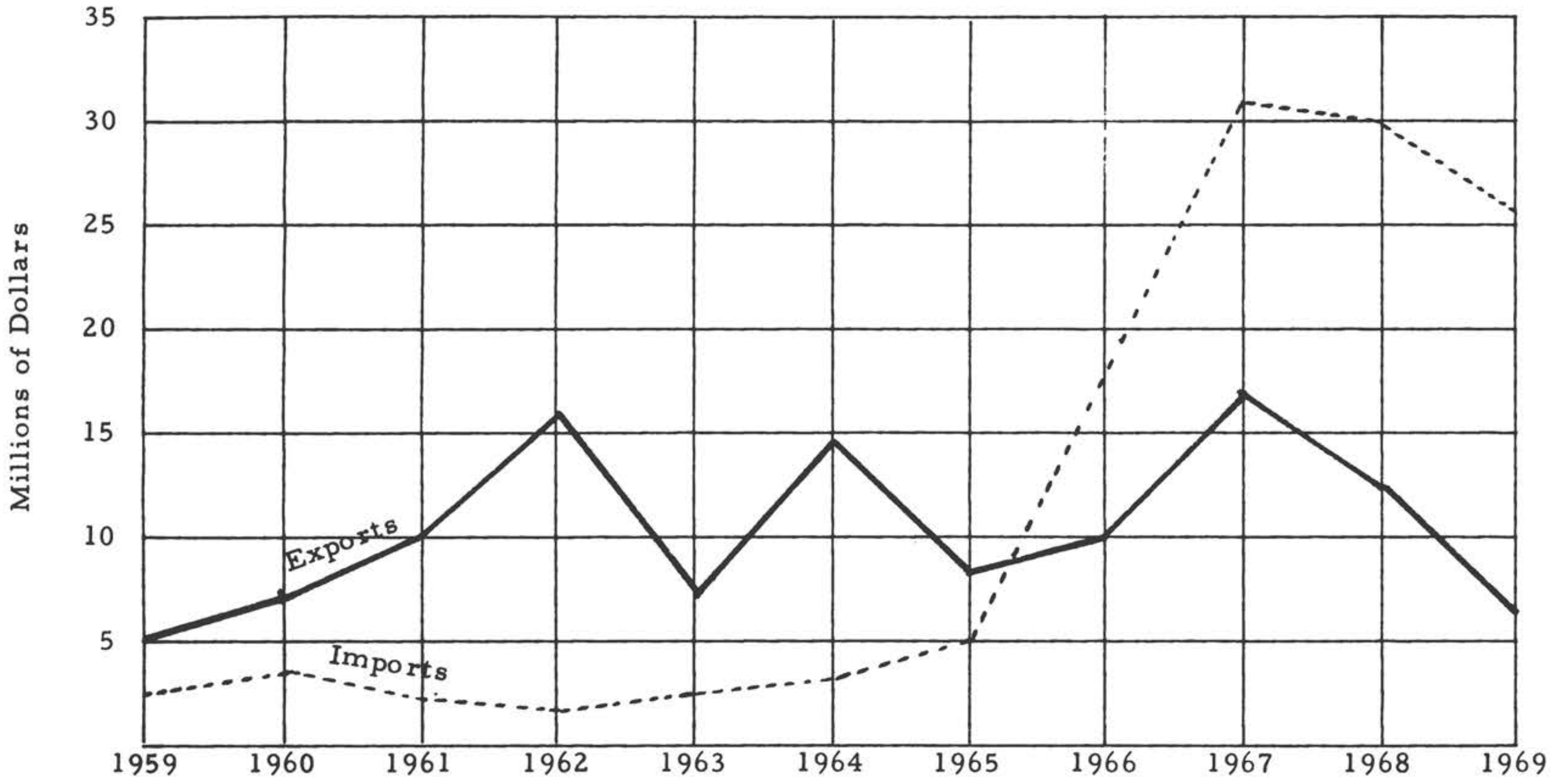
I am putting all these details before you as evidence of the complicated and perplexing situation facing our machine tool industry. Salient points to review are these:

1. During the years following World War II, we gave massive aid to overseas builders to get them back into business.

2. Later, by necessity, we established our own overseas manufacturing and selling bases to preserve our position in world markets.

3. For some years, now, we have been on the brink of losing our export balance altogether, and in relation to some kinds of machines we have already lost it.

FIGURE 3 U.S. Exports and Imports of Milling Machines



Source: Bureau of the Census, U.S. Department of Commerce, Imports FT 135; Exports M35W.

FIGURE 4 U.S. Machine Tool Imports as a Percentage of U.S. Machine Tool Consumption, by Types (Based on Dollar Value), 1964-1969

Type	Percent					
	1964	1965	1966	1967	1968	1969
All Machine Tools	3.6	4.3	7.3	9.9	9.7	9.6
Metal Cutting Types	4.2	5.1	8.9	11.4	11.0	11.1
Metal Forming Types	2.0	2.3	3.0	5.4	5.3	5.3
Gear Cutting and Hobbing Types	4.6	8.1	5.6	9.5	9.2	6.9
Drilling Types	2.5	3.0	5.2	6.6	15.3	10.4
Lathes (excl. Vertical Turret Lathes)	5.1	6.3	12.4	13.3	11.4	12.5
Grinding Machines	3.6	3.6	6.0	7.1	7.9	8.4
Milling Machines[a]	2.9	4.3	8.3	12.6	12.1	12.9
Boring Machines (incl. Vertical Turret Lathes)[a]	5.6	6.5	10.8	15.7	17.8	22.1
Other Metal Cutting Machines	4.6	5.2	8.6	11.4	8.3	7.3

[a]Includes shipments of machine tools with an average value of $1,000 or less. All other categories exclude shipments of machine tools with an average value of under $1,000.

Sources: U.S. Department of Commerce: Shipments - Current Industrial Reports, Metalworking Machinery (M35W); Exports - M35W, Bureau of the Census; Imports - FT 135, Bureau of the Census.

4. Our domestic market has been seriously penetrated by foreign builders who are confidently laying plans for even deeper penetration.

5. Foreign builders are widening their operations to include the most sophisticated as well as the standard types of machine tools.

This background brings us inevitably to two critical questions:

1. Should efforts be made to keep U.S. machine tool imports at a level of penetration lower than that which might naturally be established by the long-term operation of completely free trade?

2. If so, by what means should this be done?

In regard to the first question, there is an argument, and it is certainly not entirely without logic, which states that the quickest way to build national efficiency is by stretching scarce capital-equipment dollars as far as possible and buying as much equipment as is practical at the lowest possible price. This logic relies heavily on the belief that the place to concentrate national efficiency is in the consumer-product industries, because they presumably account for the largest part by far of our exports and contribute most to our balance of payments. In effect, this logic asks the question, What does it really matter whether our little machine tool industry is strong and efficient? Let's stretch our machine tool dollars as far as possible to ensure that our end-product industries are the most efficient in the world, for <u>that</u> is where the foreign exchange is earned, and <u>that</u> is where the battle against inflation is really won or lost.

Is there a weakness in this policy? In all honesty I must admit that probably the greatest weakness (maybe the only weakness) is that of national defense risk—the importance of maintaining within our territorial boundaries a high order of machine tool capability as a resource in time of war.

To estimate the significance of this risk, one has only to recall the recurring vignettes of history that illustrate the classic underestimations of how important the machine tool industry is, which have occurred repeatedly in modern times.

We well recall in our industry the frantic appeals of the French arsenals prior to World War II and during its early days. Many active in the industry today well remember the French Government's financing the construction in our own middle west of extensions on the plant of

U.S. machine tool builders to meet the desperate need in Europe. In our own company, during World War II, they tell of one occasion when an entire shipload of our machinery was sunk by a submarine and replaced in one order by the French Government.

It seems to many of us only yesterday that the United Kingdom, striving mightily to rise from the sands of Dunkirk, was said to be clandestinely flying boring mills from secret air strips by moonlight in Switzerland to meet desperate commitments for crucial parts of the Oerlikon antiaircraft gun, which had to be manufactured in a commandeered London subway carbarn and formed an indispensable element in the protection of Great Britain's wartime convoys.

Additionally, we in the metal-cutting side of the industry, who shipped a total of $1.19 billion last year, recall that at the peak of World War II our same industry produced shipments of $1.32 billion, or what would probably be today, at 1969 prices, not far from three times that amount, possibly almost $4 billion.

And finally, as we consider vignettes of underestimation, most of us remember most recently the frustrations of the industry at the time of the Korean War, after General Harrison made his famous luncheon speech during which he asserted that the industry was due no greater priority than any other industry because, as he said in my recollection, "After all, the manufacture of machine tools is no different from the making of pots and pans." Today, almost 20 years later, the "pots and pans" are still reverberating.

Now, of course, we are in a new era, and we are told that we will never fight a war again, or perhaps more realistically we are told that if we do fight a war, it will be a totally different kind of war from World War II or the Korean crisis. It is probably impossible to debate either of these propositions intelligently, but I would like to suggest that should either of these assertions be in error, it can be predicted with absolute certainty that this nation will once again be on its knees for machine tools in what seems today virtually unimaginable quantities.

We are now, as we saw earlier, at what is effectively estimated to be between an 18 percent and a 22 percent Economic Impact Penetration of our U.S. machine tool market. All signs seem to be "Go" for greater penetration, until we reach, I believe, a natural floating point at which the very nature of the industry will make further foreign competition unrealistic, because of the distances involved and the close coordination necessary between customer, manufacturer, and designer. We met our great World War II machine tool challenge when this country was able to field 95 percent or more of its own needs in normal times. Are we willing to risk a similar situation when we are reduced, perhaps, to an indigenous industry that is capable of taking care of very probably less than 75 percent, perhaps as little as 60 percent, of the customary U.S. market? I believe that we possess in our machine tool industry today a national capacity for initiative that we should not knowingly surrender without the most sober consideration.

If we do attempt to protect ourselves from this surrender, we are brought to the second question: How should the rising tide of imports be stemmed?

An intelligent discussion of this subject, it seems to me, divides itself into three general approaches. Often-discussed factors that potentially affect U.S. machine tool imports and exports fall under three broad headings: "Import Controls"; "Tax and Economic Policies"; and "Various Types of Government Assistance." I will try to discuss each of these very briefly, realizing that a thorough analysis of all the headings makes each almost a career in itself.

First, under "Import Controls," we consider the Peril Point (I use this term interchangeably with the commoner phrase, Escape Clause, which perhaps is more legally accurate).

Because, as we have shown, the onus of imports falls drastically differently on various parts of the industry and it is important to retain in this country representatives of all branches of the industry, it seems reasonable to allow an escape hatch for these various specialties, if and when they should be severely injured. Our National Machine Tool Builders Association (NMBTA) has recently testified before the U.S. House (of Representatives) Ways and Means Committee that it is in favor of making it easier for portions of the U.S. industry to apply for Escape Clause relief.

Presented next are Tariffs (here, again, to be legally accurate, we are talking about legislatively imposed tariffs). The NMTBA has gone on record as advocating consideration at least of a novel approach to such tariff setting in regard to machine tools and has suggested variable ascending or descending tariffs based on the prior year's penetration of the U.S. market.

This approach is out of step with the desires of the current Administration, which is strenuously fostering free trade, and its mere mention, as free trade advocates accurately forecast, has thrown apprehension into the ranks of our foreign competitors. If this apprehension is translated into counteraction, U.S. machine tool companies striving to operate in those countries may find it increasingly difficult or impossible to do so. For these reasons, it is perhaps wise to delay consideration of the possibility of higher legislatively imposed tariff protection.

Next are Quotas, which are frequently linked with tariffs in people's minds. Legislatively imposed quotas are out of favor with our government and foreign governments. They probably should be rejected for the very same reasons as higher tariffs at this time.

The last item in this section is "Tit for Tat" Administration of Non-tariff Barriers. It is often suggested in our industry that we should impose the same restraints that a foreign government exercises when American machine tools enter it and that we establish the administrative machinery to make possible what would inevitably be a rather fast moving checker game within the framework of our import control administration. The Administration has supported such proposals; the U.S. House Ways and Means Committee has proposed them; and the machine tool industry endorses them.

Now, under "Tax and Economic Policies," let us consider Faster Write-offs. Here, in my opinion, lies one of the most fruitful and valuable avenues of exploration. I think that it is an area on which our industry will place a great deal of emphasis in the next 12 months. Capital recovery in the United States has always been a difficult problem, influenced by political beliefs that somehow fast write-offs of productive equipment for tax purposes were a "giveaway" to business. These political views fail to recognize that virtually every leading industrial nation in the world far outstrips us in this regard and that the United States possesses the world's largest stock of overaged machine tools. Admittedly, some short-term federal income sacrifices would result from facing and dealing directly with this challenge, but the long-term benefits in terms of tax income, productivity, and national security are hardly a "giveaway" of anything except U.S. jobs to U.S. citizens that otherwise will go overseas. An interesting variation of this particular challenge relates to the next topic, Tax Credits.

If faster write-offs to make the country competitive with already existing legislation of this sort in other countries are, correctly or incorrectly, considered politically unfeasible at this time, the establishment of a mechanism such as the former 7 percent investment credit would be helpful.

Another approach that is increasingly coming to our attention is the Value Added Tax (VAT)—a substitute for the corporate income tax under which "value added" to materials received would be taxed regardless of the profit or loss resulting. Already in use by several of our Common Market trading partners, VAT has the attribute of being highly stimulative to the economy in general, because it is a tax on inefficiency rather than a tax on efficiency (which, in effect, we have under our present system that reduces taxes on low profit makers). For this reason, value added tax would appear to become a vast indirect incentive to the public in general to purchase efficiency-building equipment in order to save taxes. In addition, the value added tax by its nature requires importers to pay a tax on the values they have added to imports, and conversely provides a mechanism under which U.S. manufacturers could be credited with the value added tax that they have paid if a given machine is exported—just as manufacturers in VAT countries are already receiving refunds and protection. An attractive feature of this policy is the two-way spread between exports and imports that I believe would act as a particular advantage for U.S. tool builders.

Under "Government Assistance" are the various categories of foreign trade stimulation. The first of these is: Financing and Credit Help. Working through such organizations as the Export-Import Bank and others, our government is gradually recognizing that such support has possibilities; we are gradually realizing that competing foreign nations have been doing this sort of thing for many years with devastating results for U.S. builders.

Commercial Shows include trade shows abroad, sponsored by the U.S. Government, trade missions, and the dissemination of various commercial information abroad. All are continuing activities that, under various circumstances, can be effective if properly managed.

The next category is Opening of Eastern Bloc Trade. Perhaps the most important move to assist the American machine tool industry would be government assistance to encourage freer trade with Eastern Bloc countries. This again is an area on which I believe U.S. tool builders will concentrate heavily in the next year or so. We are all acutely aware that our European competitors are permitted to trade freely with East Germany and other Eastern European nations, Russia, and even Red China, whereas we must withhold sale of the very same types of equipment that these countries are purchasing anyway. The rationale for our trade policy is an alleged hindrance to the Communist technological growth.

Government Research Laboratory for Machine Tools constitutes a war cry that is raised repeatedly and that, in widely shared opinion within the industry, is unlikely to be effective, though the concept is extremely tempting. Such laboratories are in operation in Russia, Germany, and England, and probably in other nations. No convincing evidence has yet surfaced to suggest that they have served the machine tool industries of their respective nations with notably dynamic and vital inspiration. In Russia, particularly, the effort is large-scale but seems (from a distance) to react with some ponderousness to the quick moving multifaceted demands of modern machine tool development. Variety is often the spice of life in attacking metalworking problems. A monolithic institution, for all its resources, tends to look at problems in only one way. The diversity of the U.S. approach still seems to yield more solutions to problems more quickly.

When a problem is solved, the next challenge is fostering acceptance and broad application of the solution. Recall, if you will, that it is difficult to get corporate-sponsored research accepted and applied by divisions. Gaining acceptance and application in industry of government-sponsored research is far more difficult.

The support of research within private companies or universities, Subsidized Research, is also a frequently discussed gambit. Organizations receiving research contracts frequently find it necessary to expend far more money than the government allows to explore a problem adequately. Also, because of the acceptance problem, this solution has never had wide support in the industry. I would not urge it as a valid, significant way to assure U.S. machine tool superiority.

Perhaps one of the outstanding things that the government can do to assist and support the industry in its emergency role is to increase recognition of the machine tool industry as a segment of our economy that requires early manpower and materials consideration in any mobilization crisis. Those of us who have watched "pots and pans" kinds of crises consume precious months at the outset of an arms buildup can say only that a permanent willingness of the government to recognize this recurring problem would be of enormous assistance in helping the machine tool industry to fulfill its role of supporting our national defense. Only recently, the Pool Order System, originally erected in World War II and key to our success in organizing for the Korean crisis, has been disbanded, perhaps wisely. We are assured that it has been replaced by other steps to ensure mobilization readiness, but history in this respect has a knack of repeating itself and we in the industry frankly are wary.

In summary, I have presented some of the various often-discussed factors that potentially affect the U.S. machine tool import and export picture. In my opinion, six of these areas, i.e., Peril Point, Faster Write-offs, Tax Credits, Value Added Tax, Eastern Bloc Trade, and Recognition of the Machine Tool Industry as Having a Key Role in Mobilization, are those on which we should concentrate to solve the machine tool import riddle that perplexes us all and poses questions of profound national significance.