**UNITED STATES DEPARTMENT OF COMMERCE**
**International Trade Administration**
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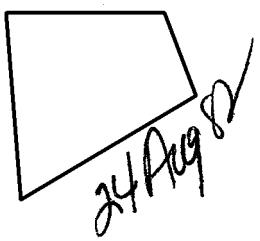

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Special Assistant to the Director
Central Intelligence Agency
Washington, D.C. 20505

Dear [redacted] STAT

Thank you very much for sending me Bill's global assessment. I think it is a very good statement--very well written and, most important, the judgments are sound, at least as far as my understanding of the relevant trends is concerned.

I hope, however, that this assessment is only the first step, or the point of departure, and that the next time around you will substantially deepen as well as broaden this assessment, especially in the direction of why the trends are as they are and what they imply for the country's future. Once you do that, you will discover quite a few opportunities for national policy initiatives and which, as I see it from my "corner," only Bill can undertake. I think he would also enjoy doing so.

Attached is a copy of a synopsis on the threat of U.S. loss of comparative advantage in technology which I prepared on the basis of my analysis for Lionel Olmer's presentation at the meeting of Cabinet Council on Commerce and Trade on June 23. I hope that by the time you start working on the next installment you will have the benefit of a complete report on my analysis of the evolution of the American economic position in the world since World War II.

Sincerely,

Michael Boretsky

Enclosure

Not referred to DOC. Waiver applies.

U.S. DEPARTMENT OF COMMERCE
INTERNATIONAL TRADE ADMINISTRATION
OFFICE OF THE UNDER SECRETARY

# THE THREAT OF U.S. LOSS OF COMPARATIVE ADVANTAGE IN TECHNOLOGY

## A Synopsis

In 1953 Wassily Leontieff, the famous inventor of input-output analysis for which he received the Nobel prize in 1974, challenged the then prevailing belief among economists that the U.S. economy's comparative advantage was based on its abundance of material capital. Were material capital the foundation of U.S. comparative advantage, Leontieff reasoned, in line with the established theory, the United States would be largely exporting capital-intensive commodities, and importing labor-intensive ones. But the evidence Leontieff found was contrary to this a priori expectation--the United States was largely exporting labor-intensive and importing capital-intensive commodities.

This challenge, which the economic literature has labeled as the Leontieff "paradox," initiated an intensive search for the true area of U.S. comparative advantage. By the early 1970's, researchers arrived at what seems to be a general consensus even now--the U.S. comparative advantage is based on an abundance of superior agricultural land, favorable climate, and, even more important, a relative sophistication of industrial technology rather than an abundance of "material capital" as such. The rationale for this consensus is obvious from the figures given in the following table:

COMPOSITION OF U.S. MERCHANDISE TRADE BALANCES BY BASIC COMMODITY GROUP, SELECTED YEARS 1951-1980

$ Billion

| Commodity Group | 1951-1955 Average | 1960 | 1966 | 1971 | 1976 | 1980 |
|---|---|---|---|---|---|---|
| Raw Materials and Energy | -2.0 | -1.7 | -3.1 | -4.1 | -30.6 | -68.3 |
| Not Technology-Intensive Manufactured Products | +1.8 | -0.9 | -3.6 | -8.3 | -13.2 | -21.5 |
| Technology-Intensive Manufactured Products | +5.7 | +6.6 | +8.4 | +8.3 | +25.7 | +42.5 |
| Agricultural Products | -1.2 | +1.0 | +2.3 | +1.9 | +11.8 | +23.8 |
| Total Merchandise Trade[a] | +4.6 | +5.5 | +4.8 | -1.5 | -5.7 | -20.1 |

Notes:

+ denotes trade surplus
- denotes trade deficit

[a]Total merchandise trade includes the four listed groups, commodities not classified by kind and reexport of foreign merchandise

In parallel with this search, however, various students and business observers have been calling attention to a rapid erosion of U.S. agricultural land and, arising therefrom, limitation for further real growth of U.S. exports of agricultural products, on the one hand, and alarming losses of U.S. domestic industries' competitiveness in what became known as "technology-intensive" and "high-technology" products, on the other. The latter, if it is of a secular rather than a temporary nature, would obviously be tantamount to the U.S. loss of comparative advantage in technology. Both of these observations, if true, would obviously be of great concern, but especially the latter, because of its implications for the economic potential and national security of the country.

The Framework of Our Analysis

Since the issue of the erosion of U.S. agricultural land and the problems arising therefrom has been the subject of a long-term study by the Department of Agriculture, our analysis focusses exclusively on the problem of U.S. domestic industries' international competitiveness in trade in advanced-technology-dependent products. This analysis of U.S. domestic industries' comparative performance is made in the context of what we define as either technology-intensive or high-technology prcducts.

The criteria for defining each of these two groups are the relative "normal" use of basic new-technology-generating inputs in their production--expenditures on R & D as a percentage of value added of the industries in question, and employment of scientists, engineers, and technicians (S & T) as percentage of their total employment. As a general proposition,

- Technology-intensive industries are defined as those which normally spend 5 percent or more of gross product (BEA concept of value added) on R & D and/or whose total employment consists of 5 percent or more of "natural" scientists, engineers and technicians. The industries in this category are: chemicals and related products (SIC 28), nonelectrical machinery (SIC 35), electrical and electronic machinery and equipment (SIC 36), transportation equipment and missiles (SIC 37), and professional and scientific instruments and controls (SIC 38);

• High-technology industries are defined as those which normally spend at least 10 percent of their gross product (value added) on R & D and/or at least 10 percent of their total employment consists of "natural" scientists, engineers and technicians. The U.S. manufacturing industries meeting these criteria include drugs and medicinals (SIC 283); office, computing, and accounting equipment (SIC 357); radio, television, communication equipment and electronic components (SIC's 365, 366, and 367); all other electrical apparatus and equipment (SIC 36 minus SIC's 365, 366, and 367); aerospace equipment, missiles, and certain ordnance products (SIC 372 and 376); and professional and scientific instruments and controls.

In addition to these two definitions of industries by the degree of their relative use of new-technology-generating inputs, one might also define and use the concept of not technology-intensive industries. Consistent with the definition of technology-intensive industries, U.S. not technology-intensive industries would be those which spend up to 5 percent of their gross product (value added) on R & D and/or up to 5 percent of their total employment are "natural" scientists, engineers, and technicians. In reality, however, most of the U.S. industries other than those defined as technology-intensive normally spend only between 1 and 2 percent of their gross product on R & D, and only about 2 percent of the persons they employ are scientists, engineers, and technicians.

As for the definitions of technology-intensive and high-technology industries, the latter would most probably be more attractive were we to study the recent contributions of new

technology to the U.S. economy and U.S. national security without any reference to what is going on elsewhere in the rest of the world. For purposes of comparative analysis, however, the concept of technology-intensive industries is more appropriate because the broader spectrum of industries allows us to consider variations in individual countries' objectives and strategies in their pursuit of technological progress and, therefore, it is conducive to a more accurate analysis.[1]

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[1]In the course of the study a suggestion was made to use applied R & D expenditure as a percentage of value of shipments of 3-digit product groupings as a criterion of technological intensity of traded commodities. However, for purposes of a comprehensive analysis the suggested criterion is inferior to the ones adopted in this report for the following reasons:

a. In contrast to the measure of value added, which contains no multiple counting, the measure of commodity shipments contains multiple counting, the amount of which varies from product group to product group and, therefore, any ranking of R & D expenditure as a percentage of such a nonuniform measure is by definition extremely erratic and unreliable;

b. The criterion would not allow taking into account technological improvements achieved by S & T manpower working in functions other than R & D. (Such commodities as nuclear reactors, machine tools and material handling devices, including robots, where the bulk of technological progress is made by production, assembly, and quality testing engineers, would fall into the category of not technology-intensive products);

c. No account can readily be made of purchased R & D via purchase of components (hence, such products as consumer electronics would fall into the not technology-intensive category);

d. The analysis employing this classification of trade data cannot readily extend to analysis of relevant trends in employment, productivity, inflation, Department of Defense procurement, etc., because all of these data are reported in terms of industries and not commodity groups; and

e. Analysis employing the suggested classification cannot be extended to international comparisons because other countries' R & D and most other data are reported in terms of industries and not commodities.

In addition to their critical importance to the country's foreign trade, as noted earlier, the industries in question here are also critically important to the domestic economy in many other respects. Thus, for example:

- In 1970-1980 the real growth in annual output of technology-intensive industries accounted for 32.4 percent of the real growth of the entire U.S. business economy, and that of high-technology industries for 26.2 percent;

- In the same timespan, the technology-intensive industries contributed about 23 percent and high-technology industries 18 percent of the private sector's growth in employment;

- In the same timespan, the technology-intensive industries' growth in real output due to productivity growth accounted for about 45 percent of such growth in the entire private business sector, and that of high-technology industries to 40 percent;

- In the same timespan, the average annual inflation rate originating in the technology-intensive industries was only three-fourths as high as in the entire private business economy, and the average rate in the high-technology industries was less than 40 percent as high, which means that the technology-intensive industries were retardants rather than promoters of inflation in the economy;

- In the 1970's the technology-intensive industries provided between about 84 (1972) and 87 (1979) percent of the Department of Defense total procurement from manufacturing industries, and the high-technology industries between 48 and 50 percent.

In analyzing foreign trade performance, we determine the "comparative performance" of the U.S. domestic industries in question here on the basis of the relative success of these industries in generating positive trade balances and the relative growth or decline in their share of OECD countries' exports to the world and/or certain specified narrower markets. The adjective "comparative" refers to relative performance vis-a-vis the major U.S. competitors--Japan, West Germany, France, Italy, and United Kingdom. The relative sizes of the trade balances of the industries in question at any give time might obviously also be interpreted as measures of the industries' relative strength of comparative advantage in technology among the industries of the five countries.

The Comparative Strength of U.S. Industries' Advantage in Technology Implicit in Their Relative Trade Balances

- In 1980 U.S. technology-intensive industries' trade surplus with all countries in the world amounted to $42.4 billion, up from $10.4 billion or so ten years earlier. This performance is usually cited as proof of an extraordinary and still growing strength of the industries' comparative advantage. However, these figures look much less impressive when the whereabouts of their origin is identified and, especially so, when they are compared with such figures of other countries:

  -- Only about 37 percent of the 1980 U.S. industries' surplus of technology-intensive products came from developed countries and OPEC; about 63 percent came from non-OPEC LDC's which, in most cases, require not only long-term and

frequently unrepayable loans in order to import our industries' products but they also frequently require subsequent loans to pay interest on the preceding loans;

-- Throughout the seventies and in 1980 U.S. trade balances were progressively negative with both West Germany and, especially so, with Japan;

-- The 1980 U.S. trade surplus in technology-intensive products was only about 60 percent as large as the Japanese worldwide surplus in this product group (in trying to fully understand the significance of this disparity, bear in mind that in 1980 the Japanese economy constituted only 34 percent of the U.S. economy, both measured by GNP valued with purchasing power equivalents rather than the official exchange rates), and 66 percent as large as West Germany's surplus (in 1980 the West German economy constituted 21 percent of the U.S. economy);

-- Throughout the 1970's the rates of growth in U.S. trade surpluses in technology-intensive products were also substantially smaller than the growth of French surpluses in this commodity group, although in absolute magnitude the French surpluses were substantially smaller than those of the U.S. (in 1980, the French surplus amounted to $10.0 billion compared to $42.4 billion for the U.S.).

• As of 1980, the relative position of U.S. high-technology industries seems to have been somewhat stronger than that of the entire technology-intensive spectrum, but they were facing equally adverse competitive odds. These industries' 1980 trade surplus amounted to $19.2 billion, up from $4.8 billion in 1970, and the bulk of it, 75 percent, was derived from trade with developed countries and OPEC rather than non-OPEC LDC's. However, even this 1980 surplus of U.S. industries was smaller than Japan's in absolute terms, and its growth was less than one-half of the Japanese growth and one-third smaller than the growth of the French trade surplus in high-technology products.

All of the above implies that although the U.S. industries in question still would seem to have a formidable comparative advantage in technology on the world scene, they are rapidly losing this advantage in favor of other countries, especially in favor of Japan and, to a much lesser extent, in favor of France.

The Extent and Nature of U.S. Industries' Loss of Comparative Advantage in Technology Since the Mid-1950's

• The analysis of changes in U.S. industries' shares in OECD export markets rather than the changes in relative trade balances indicates, however, that at least in the case of U.S. technology-intensive industries the onset of the decline in their comparative advantage in technology goes back to at least the mid-1950's rather than 1970, as the preceding discussion might have implied. Indeed, from

1954 until 1970, the U.S. world export market share in technology-intensive products declined from 35.5 percent to 23.1 percent, or by 35 percent, whereas Japan's share increased at that time from 1.8 to 9.7 percent, or 439 percent; Germany's share increased from 17.6 to 20.4 percent, or 15.9 percent; France's share increased from 6.4 to 7.6 percent, or 18.9 percent; and Italy's share increased from 2.4 to 5.6 percent, or 133 percent. At that time the only major country that lost in its world export market share, other than the United States, was Great Britain. Its export market share in technology-intensive products declined from 19.0 percent in 1954 to 10.1 percent in 1970, or 47 percent of the 1954 level.

- One might obviously argue that all of the countries which have increased their world export shares between 1954 and 1970 did so because of their "low base" in 1954, due to World War II damages still existing in that year. The fact is, however, that at least in the case of Japan, France, and Italy their export market shares in technology-intensive or analogous products in years prior to 1954 had never been as high as in 1954. For this reason, the argument of "low base" is not valid here.

- In the period from 1970 to 1980, the preceding (1954-1970) trends in world export market shares in technology-intensive products continued with only slight modifications:

  -- United States lost an additional 3.2 percentage points of its world export market share, from 23.1 to 19.9 percent, which makes for a loss of 13.9 percent in just ten years;

-- Japan gained an additional 4.8 percentage points, from 9.7 to 14.5 percent, or almost 50 percent in the ten years, and France gained 1.4 percentage points or 18.5 percent;

-- However, in the 1970-1980 period Germany and the United Kingdom each lost 1.1 percentage points, and Italy lost 1/10 of a percentage point.

- The U.S. losses of its market share in 1970-1980 were evidently even more significant than the changes in the worldwide markets indicate (loss of 3.2 percentage points) because the U.S. export share to developed and OPEC countries, that is, the "solid" credit countries, shrank by 4 percentage points, or by 18.9 percent of the 1970 level, and that to the non-OPEC LDC's increased by 1.5 percentage points, or by 5 percent of the 1970 level.

- In the 1970-1980 period the export market shares of U.S. high-technology industries decreased relatively even more than those of the entire spectrum of technology-intensive industries, and the losses were also concentrated in developed and OPEC countries' markets.

Thus, the analysis of both the relative changes in trade balances and the relative changes in export market shares indicates an unmistakable decline in U.S. industries' comparative advantage in technology, and this conclusion holds

whether we base it on the relative developments of technology-intensive or high-technology industries. The decline so far has been quite substantial, to say the least, and the process continues.

In the 1950's and 1960's the gainers of comparative advantage were Japan, West Germany, France, and Italy. In the 1970's, however, the gainers were Japan and, to a much lesser degree, France. Germany and Italy lost some of the ground they gained in the 1960's. The United Kingdom also lost some more ground, but compared with its losses in the 1950's and 1960's, its loss in the 1970's was very small.

By now Japan is clearly the giant of comparative technological advantage, unseating U.S. industries from their former role of technological leadership and evidently hopelessly frustrating the ambitions the German industries might have had in this regard in the recent past.

The above analysis is based solely on the relative developments emanating from individual countries as such. Strictly speaking, therefore, the above conclusion refers to the decline of the comparative advantage of U.S. domestic industries only. Data on the changes in the relative sizes of multinational corporations by their country of origin compiled by the National Planning Association in the last several years imply, however, that this conclusion applies to U.S. business enterprises globally, that is, wherever they operate.

The Causes of U.S. Loss of Comparative Advantage in Technology

The loss has undoubtedly been produced by a great variety of forces. We have identified ten factors which we believe have had a lot to do with this loss.

1. The first to mention is the almost unilateral export of advanced technology in "naked" form by the United States. By export of technology in "naked" form we mean sales or analogous transfers of patent rights and licenses with appropriate instructions, blueprints and other technical assistance on the part of the seller or exporter, which permit the buyer or recipient a quick and full exploitation of the know-how either for a fixed fee, or for "running" royalty payments. The alternative to such exports are exports of commodities embodying the technology in question. Tnere is tremendous controversy regarding the extent and nature of the impact of "naked" exports of technology on the economy, but it is virtually impossible to believe that if you export technology in a "naked" form and this technology is, in turn, used abroad in industrial activity competitive with the United States, such as production of internationally traded goods, such exports will not adversely affect U.S. exports.

We do not have accurate statistics showing how much technology we export and how much we import, but the data on U.S. receipts for and payments of technological royalties and license fees imply that since the late 1950's the United States has been exporting from 8 to 10 times as much as it has been importing. The reverse has been true in Japan, Germany,

France, and Italy. Assuming that the price U.S. companies are getting for their exports of technology averaged about 4 percent of "revelant" sales, this would imply that in 1970 the value of products produced abroad on the basis of U.S. technology amounted to a minimum of some $33 billion and in 1980 to more than $100 billion. Had U.S. industries kept this technology at home and tried to fill the latent foreign demand for the products by exporting from the United States, given appropriate support by the Government, the country would not have any trade problem, and much less of an unemployment problem, even if it exported only one-third of the products the exported technology yields in production and sales abroad.

2. The second in importance, though far from that of export of technology, has been foreign countries' relative increase in R & D effort. In 1964 the aggregate expenditures on industrial R & D of the five foreign countries analyzed in depth in our report amounted to about 32 percent of the U.S. expenditures, but by 1979 this proportion rose to 75 percent. Obviously this increased effort must have produced some competitive gain for these countries vis-a-vis the United States. However, in making this judgment we must bear in mind that there is no one to one relation between R & D effort and export market share (Germany, for example, spends only 20 percent as much on industrial R & D as the United States, but its share of the export market is some 7 percent larger than the United States) and that throughout the

time period the United States continued to do a lot more R & D even than the five foreign countries combined, let alone any individual country.

3. The third in importance has probably been U.S. industries' falling behind the Japanese and Germans in the quality of products they produce. It is generally known that this problem is "big" in the automobile industry, but also in the production of many electrical consumer goods and, especially so, in the production of electronic "chips."

4. Of some importance has also been a relatively lower protection of U.S. domestic markets than is true abroad.

By "protection" we obviously mean not only the use of such traditional tools as tariffs and imports quotas, but also the use of "value-added-tax" gimmicks, government procurement preferences for domestic products, and the entire battery of nontariff trade barriers.

5. In some measure, however small it might have been, the loss must have been caused by a smaller export promotion effort exerted by the United States at large, meaning business plus Government, than is true for most other countries, especially for Japan.

6. In the 1950's and 1960's, the U.S. loss of comparative advantage in technology was also in some measure caused by U.S. industries' price and cost disadvantages. In all probability, however, this factor was not important in the 1970's, although a number of U.S. industries, most notably steel, automobiles, and consumer electronics, have considerable cost disadvantages vis-a-vis the Japanese.

7. In some measure the U.S. export market shares of both technology-intensive and high-technology products have obviously been adversely affected by the U.S. Government's strictly political decision to deny the Soviet Union access to U.S. technology which might have national security implications. However, in all probability this factor has been much smaller than our business community tends to assume.

8. It is conceivable that in some very minute measure the U.S. loss of comparative advantage might have been caused by the less flexible export financing provided by the United States than abroad. In all probability, however, this is more of a latent "force" for the future than a significant one in the past.

9. It is also conceivable that in the most recent years the U.S. loss might have been caused in small measure by a decline in the supply of new scientists and engineers, particularly so if the proportion of U.S.-trained foreign students who stay in the United States after completion of their studies has been smaller than is generally assumed.

10. Finally, the U.S. industries' trade performance in technology-intensive and high-technology products has undoubtedly suffered from the less supportive role the U.S. Government has played in matters of domestic industries' technological progress. Most other governments, especially the French and Japanese,

are much more active in promoting technological progress. By "supportive role" we mean not only export promotion, protection from imports and financial support of industrial R & D, but also such things as strategic planning for industrial-technological development, development strategies for imports of advanced technology from abroad, provision of industrial-technological intelligence to domestic industries, etc. Without a doubt, Japan would not have experienced the phenomenal technological growth which is the envy of the world in the absence of MITI. Nor would France have made her technological advances without the "administrative guidance" of its Ministry of Industry and, lately, its "comité interministériel pour le developpement des investissements et de l' emploi" (CIDISE). There are indications that in the future we shall witness even more active participation on the part of foreign governments in matters of technology than was the case in the past.

The Consequences For the United States Should the Current Trends Continue

There is no doubt whatever that the threat to U.S. industries is real, multidimensional, deep-seated and by now extremely acute. Moreover, what is really threatened is not only the viability of many (and the most advanced) U.S. industries, but the entire economic potential of the country. In a large measure this threat is of our own making and is propagated by our policies pursued even today. There is no chance that this threat might somehow wither away by itself, or by the "invisible hand," nor is it probable that the current economic policies of the Administration might avert it.

Continuation of current trends would result in,

- On the domestic economic front:
  - -- Progressively reduced potential for progress in innovation, productivity growth, and growth in standard of living;
  - -- Progressively reduced potential for real growth of the economy;
  - -- Progressively declining market-induced employment opportunities; and
  - -- Unabatedly growing inflationary pressures.
- On the international economic front:
  - -- Decline in the country's economic and political position in the world;

-- Progressively growing pressures on the external value of the dollar once the interest rates have been brought down to more realistic levels;

-- Progressively worsening of the country's "terms of trade" causing a lowering of the standard of living.

- On the foreign policy and national security front:

-- Progressive weakening of the U.S. leadership position in the Western World;

-- Gradual decay of the progressiveness quality of the industrial and technological base of our military power.

Prepared by
Michael Boretsky
With the assistance of
James Gillula
and
Jane Bardon
ITA
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