# High-Technology Electronics Trade and the U.S.-Japan Relationship

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*In the fifteenth and sixteenth centuries the spice trade brought the Orient and the Occident together in a relationship which has served as the foundation of modern international trade. Today, that relationship is colored by a new commodity which is equally important to its traders: high-technology electronics. In this article, Dr. Calder focuses on the increasingly important role of high-technology trade in the potentially volatile U.S.-Japanese trade relationship. He explores the forces generating tension in the relationship and examines the impact of the clash between government policy and corporate planning in both countries.*

Changes in electronic technology, with major implications for politics and social organization, are sweeping the industrialized world. New applications for computers and their semiconductor components are developing rapidly as miniaturization of electronic devices proceeds and price-performance ratios improve. The growing ability of telecommunications systems to transmit large amounts of complex data rapidly over long distances magnifies still further the prospective economic and strategic consequences of the Electronics Revolution. In 1979, the total worldwide annual production value of electronic products, of which semiconductors were a substantial element, reached roughly $200 billion.[1]

High technology electronics[2] has been among the premier growth industries of the past decade, and could well remain so for the balance of this century. In 1979, for example, world demand for integrated circuits (ICs), the linchpin of high-technology electronics, reached $7 billion, having risen 29 percent from the previous year. (Demand for semiconductors, a broader category of components including both ICs and discrete devices, was over $12 billion). By

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1. U.S. Department of Commerce, *The U.S. Semiconductor Industry,* Washington, D.C.: The Government Printing Office, 1979 p. 1.
2. For the purposes of this research, "high-technology electronics" is taken to include: a) computers, including both mainframe and peripheral equipment; b) high speed telecommunications equipment, including micro-wave relay and facsimile transmission devices and interconnect telecommunications equipment; and c) semiconductors, including both discrete and integrated circuits.

1983, world demand for ICs should double again, reaching $100 billion by the year 2000, according to forecasts by the Electronic Industries Association of Japan.[3] World markets in mini- and micro-computers, peripheral devices, and certain areas of telecommunications also seem likely to grow extremely rapidly. This prospect for buoyance in high-technology electronics stands in sharp contrast to the much lower growth anticipated in most other parts of the world economy over the years immediately ahead.

The Electronics Revolution has profound implications for international relations throughout the world; Europeans have been thinking about these in discussing technological dimensions of *Le Defi Americain* (the American Challenge) for nearly fifteen years.[4] But evidence suggests at first glance that rapid change in electronic technology has more potential for introducing tension and volatility into the U.S.-Japan relationship than into virtually any other major bilateral econo-political linkage in the world aside from that between the U.S. and the Soviet Union. The major reason for this prospective volatility is that in most sectors of high-technology electronics and precision machinery (including robotics, microwave relay and facsimile transmission, central-exchange and interconnect telecommunications equipment, semiconductors, and main frame computers) the U.S. and Japan are each other's only major rival for world commercial technical supremacy. The only major areas of high-technology electronics where Japan has not yet emerged as the primary rival of the United States are sectors relating to the aerospace and nuclear power industries, where substantial European military expenditures have yielded certain technical advantages over the Japanese. Yet even in areas such as aerospace, prospects are strong that Japan will emerge as a primary challenger to the United States by the end of the current decade.[5]

This paper is pre-eminently a study of the surging forces generating tension in the U.S.-Japan relationship coming from the high-technology trade sector, and an assessment of their likely impact on the broader U.S.-Japan relationship. The general argument presented here is that while the U.S. and Japan, conceived as unified rational actors, appear to have ample reason for serious conflict over high-technology issues, more complex analysis of their domestic economic and political processes suggests that overt conflict is less probable than is usually thought, and is likely to be narrow in scope when it does occur. The reason for this is that intra-sectoral market segmentation and supply shortages reduce the "zero-sum" character of U.S.-Japan trade competition,

3. Electronic Industries Association of Japan, *The Integrated Circuit Industry,* Tokyo: Electronic Industries Association of Japan, 1980, p. 6.
4. See, for example Jean Jacques Servan Schreiber, *The American Challenge,* New York: Atheneum, 1968.
5. On prospective developments in the aircraft industry, see "Survey on Aerospace," *The Economist,* 30 August 1980.

especially in semiconductors. This effect is further enhanced by evolving patterns of foreign investment which cause both corporate and government interests to transcend national boundaries. However, as high-technology industries develop stronger political support bases, and as industrial concentration trends proceed, the U.S. and Japanese political systems may face escalated demands for protection from smaller, non-multinational firms. These demands may be especially strong if and when excess capacity and the prospect of unemployment appear. Generally speaking, however, industry pressures on government in the foreseeable future will likely take the form of requests for expanded government support to aid international competitiveness rather than for protection, especially in the United States.

### *Forces Generating Tension in the U.S.-Japan High-Technology Trade Relationship*

From the American perspective, high-technology trade issues intrude persistently and gallingly into the U.S.-Japan relationship due to the rapid erosion of the U.S. trade balance with Japan in this sector during the latter half of the 1970s, and the prospect that such erosion might continue, or even accelerate, during the 1980s. This contrasts strikingly with a persistent and substantial U.S. surplus in high-technology trade with Europe, whose effects are reinforced by the substantial scope of manufacturing operations by U.S. multinationals like ITT and IBM there. In telecommunications, for example, in 1977 the U.S. had a $4.5 million surplus with the four key European nations of France, Germany, Italy, and Sweden, while it ran nearly a $33 million deficit with Japan, up 32.5 percent from the previous year.[6] In office machinery and computers, the U.S. ran a $580 million deficit with Japan in 1978, and a $487 million deficit in 1979.[7] The proportion of imports from Japan in total U.S. computer imports was rising sharply — from three percent of the total in 1975 to 29 percent in 1978.[8] *Vis-à-vis* Europe, the U.S. was running, once again, a consistent surplus, and the European proportion of computer imports into the U.S. was declining.

In integrated circuits, the dynamics were similar, and the speed of Japanese advance even more rapid than in computers or telecommunications. Although the U.S. managed to sustain an overall surplus in bilateral IC trade with Japan,

6. Korea, with whom trade in telecommunications equipment was minimal, was included in the 1977 figures for Japan, which indicated a $33 million deficit. See Comptroller General of the United States, *United States-Japan Trade: Issues and Problems,* Washington, D.C.: Government Printing Office, 1979, p. 78.
7. United States-Japan Trade Council, *Yearbook of U.S.-Japan Economic Relations,* 1979, Washington, D.C.: U.S.-Japan Trade Council, 1980, pp. 131-132.
8. U.S. Bureau of the Census, *Imports: Commodity by Country, 1979,* Washington, D.C.: Government Printing Office, 1979.

that surplus was shrinking rapidly — from roughly $112 million in 1978 to $16 million in 1979. In mid-1980, Japanese firms only had about a five percent share of the total U.S. market for integrated circuits,[9] while U.S. firms (including on-shore production in Japan by Texas Instruments' Japan subsidiary) had over 15 percent of the Japanese market.[10] But for advanced metal-oxide silicon (MOS) integrated circuits, the Japanese share of the U.S. market was over 10 percent. In 16K random access memories (RAMs),[11] a leading-edge $400 million market segment in 1979 expected to grow to $700 million in 1980, Japanese firms had well over 40 percent of the U.S. domestic market.[12]

This whole situation of imminent threat from Japan in ICs contrasted strongly with a persistent and large U.S. surplus with Europe — $131.6 million in 1974, and still $139.3 million in 1977.[13] In 1978, 23.5 percent of the U.S. industry's total sales were in Western Europe compared with 66.3 percent in the U.S. and only 5.7 percent in Japan.[14] In no major sectors of the IC market did European firms at any point during the 1970s pose a major, dynamic challenge to their U.S. counterparts.

The relative strength of the Japanese in relation to the U.S. in integrated circuits, and the relative weakness of the Europeans, stems from the global market shares and accumulated production experience which these groups hold, and the relative cost positions which derive therefrom. At the end of 1979, the U.S. still dominated the $7 billion world IC market, with $4.8 billion of total production, roughly $1 billion of which was consumed in Europe (over half Europe's total consumption). As a result of U.S. dominance of European integrated circuit markets, European firms in 1979 only held eight percent of the world market for ICs. Japanese producers, while late-comers to integrated cir-

9. These figures, however, do not include the substantial number of ICs and discrete device semiconductors exported to the U.S. as elements in Japanese consumer products such as microwave ovens, sewing machines, TV sets, and automobiles. 34 percent of Japanese IC production in 1978 was consumed by the Japanese consumer electronics industry, and 69 percent of all Japanese consumer electronics products (by value) were exported. See U.S. International Trade Commission, *Competitive Factors Influencing World Trade in Integrated Circuits,* Washington, D.C.: Government Printing Office, 1979, p. 46.
10. In 1977 U.S. firms had 16 percent of the Japanese IC market. In 1978 the U.S. company import share of Japanese domestic consumption was 19 percent in value terms, and consisted mainly of state-of-the-art specialty chips. See *ibid.,* pp. 113-115, and Shimura Yukio, *IC Sangyo Dai Senso* (The Great IC War), Tokyo: Diamondo Sha, 1979, p. 159.
11. Random access memories (RAMs) are capable of storing 16,000 bits of information at any one time. These are the standard metal oxide semiconductor "memory chips" used in mainframe computers and applied widely in micro-computers.
12. See *Business Week,* 3 December 1979, p. 85.
13. United States International Trade Commission, *Competitive Factors Influencing World Trade in Integrated Circuits,* Washington, D.C.: Government Printing Office, 1979, p. 121 and 123. Japan's trade surplus in ICs with the European Community was extremely small and static by contrast — $650,000 in 1974 and still only $11.3 million in 1977.
14. Semiconductor Industry Association, *World Semiconductor Forecast, 1977-1981.* Cupertino: Semiconductor Industry Association, 1978.

cuit production, expanded capacity rapidly, encouraged development of industries which consumed large quantities of ICs, and were spared major U.S. intrusions into their home markets during crucial early stages of development. By 1980, Japan's domestic IC market was as large as that of all Western Europe combined, and was supplied almost 90 percent by domestic firms. Consequently, these firms, including Nippon Electric, Hitachi, Toshiba, and Fujitsu, held a highly favorable cumulative experience and cost position. In 1979, Japanese firms held 23 percent of the world market for ICs, with production valued at $1.6 billion annually.

For Japan, as for the United States, trans-Pacific high-technology trade, and high-technology industries more generally, are matters of considerable strategic and balance of payments significance. Since Japan's Industrial Structure Deliberation Council first elaborated a policy of emphasis on structural transformation toward "knowledge-intensive" industries in 1971, the development of computer and information-processing industries, together with their parts suppliers, has been given top priority in national industrial policy. These sectors are seen, by Ministry of International Trade and Industry (MITI) officials at least, as central to the industrial structure of the 1980s and beyond, both because of their intrinsic growth potential as strategic "core industries," and because they are keys to the development of ancillary finished goods sectors with growth prospects, such as aeronautics and nuclear power.[15] Structural transformation toward these "core" high-technology sectors holds potential for (1) enhancing growth, (2) reducing the pollution dangers and high energy consumption accruing in more traditional industries like chemicals and steel, and (3) helping to strengthen the competitiveness of low-productivity sectors such as distribution. Gaps between high-productivity and low-productivity sectors have throughout the postwar period been substantially greater in Japan than elsewhere in the industrialized world, due to the so-called "dual structure" of the Japanese economy. According to a recent study, in Japan's most productive industries, automobiles, for example, output per man is 88 times that of the nation's least productive sectors, vs. a ration of 41 to 1 in West Germany and 14 to 1 in the U.S.[16] Thus, the prospective gains possible through production of machinery suitable for introduction in less productive sectors, such as distribution, have been particularly great in Japan.

Economies of scale, growing domestic market saturation, and rising international competitiveness create micro-economic incentives in Japanese industry not only to produce, but also to export, in ever increasing proportion to total

15. On MITI's industrial strategy for the 1980s, see Sangyo Kozo Shingikai (Industrial Structure Deliberation Council), editor, *Hachi Jyu Nendai no Tsusan Seisaku Vision* (A Vision of the Industrial Policy of the 1980s). Tokyo: Tsusho Sangyo Chosa Kai, 1980.
16. *The Economist*, 23 February 1980, p. 33.

production. In steel, shipbuilding, cameras, watches, and a host of other product areas, there has been a consistent tendency in Japan for export ratios, as a proportion of total production, to rise inexhorably in industrial sectors as those sectors mature. This tendency has prevailed since the early postwar period, and appears to be operating in current high-technology industries as it did in growth sectors of the past. Between 1950 and 1974, for example, the proportion of Japanese steel exported rose from 10.6 percent to 30.2 percent.[17] In numerically controlled lathes, the export ratio rose from 7 percent in 1973 to 53 percent in 1978.[18] Similarly, MITI projects that the export ration of mainframe computers will rise from 2.5 percent in 1973 to 15.8 percent or higher in 1985, and that the export ratio of integrated circuits will follow a similar pattern.[19] Because of the sophistication of the U.S. industrial structure and the high proportion of world markets for high-technology products which it provides, a substantial portion of the growing stream of Japanese high-technology exports must inevitably be directed toward the U.S.

In the United States, as in Japan, strong national incentives also dictate aggressive competition in high-technology markets which could generate tension in the broader U.S.-Japan economic and political relationship. The most important of these incentives is national security which is particularly pressing as warfare becomes more electronics-intensive.[20] Market developments in all three of the core high-technology electronics sectors (telecommunications, semiconductors, and computers) include significant applications in aerospace, electronic warfare, and military communications. U.S. market dominance in such militarily relevant technologies would increase the cost effectiveness of the U.S. defense industry, and prevent other nations from manipulating such industries to the detriment of U.S. interests.

Concern for the overall U.S. balance of trade also dictates a priority effort to compete aggressively in high-technology sectors, especially as dollar stability becomes linked to improvement in the U.S. multilateral trade balance. High-technology goods are among the few manufacturing sectors with major growth potential in which the U.S. still continues to hold strong market positions and comparative advantage *vis-à-vis* the rest of the world. This is particularly true in

17. See Shigeto Tsuru, *The Mainsprings of Japanese Growth: A Turning Point?* Paris: The Atlantic Institute, 1977, p. 25.
18. James Abegglen, *Japan, the United States, and Asia's Newly Industrializing Countries,* New York: East Asia Institute, Columbia University, 1980, p. 51.
19. See Nihon Joho Shori Kaihatsu Kyokai (Japan Information Processing Development Association), *Conputa Hakusho* (Computer White Paper) *1979.* Tokyo: Nihon Denshi Kogyo Kai, 1979.
20. Recent estimates suggest that technical imperatives relating to this greater electronics intensivity will raise the proportion of U.S. defense research and development spending devoted to electronics from 39 percent to 46 percent of total defense research and development spending during the 1980s. See *The Economist,* 12 January 1980.

the Japanese market, where over $2.9 billion in U.S. high-technology exports constituted 54.5 percent of all U.S. manufactured exports to Japan in 1979.[21] As the 1979 report by the U.S. House Ways and Means Committee Task Force on U.S.-Japan Trade (the so-called Jones Report) put it: "If . . . Japan assumes leadership in these high-level technologies, the disturbing question will be raised, 'What industrial goods will America produce for export?' "[22]

U.S. competitiveness with Japan in high-technology sectors has profound implications for U.S. domestic growth as well as for the balance of payments. In a U.S. economy growing at well under four percent annually over the 1960-1977 period, domestic integrated circuit output rose an average of 13 percent, compounded annually.[23] Thus, rising foreign inroads in high-technology electronics fields could stall one of the few engines of growth still propelling the domestic U.S. economy.

The national incentives of both the United States and Japan to compete vigorously with one another in high-technology sectors, even at the cost of potential friction in their bilateral relationship, are being enhanced considerably by two major international economic trends likely to continue for some time. One trend is the supply and price instability in international oil markets. Oil price increases tend to affect the Japanese economy especially seriously because 88 percent of Japan's energy requirements, and virtually all its oil, are imported. Such oil price increases thus tend to weaken the yen and to facilitate Japanese export offensives in the U.S. market and elsewhere.[24] High oil prices simultaneously reduce U.S. tolerance for bilateral deficits with Japan, due to the energy-import induced increase in the overall U.S. payments deficit, and aggravate Japanese deficits.

The second major trend is the increase in Newly Industrializing Country (NIC) competitiveness with the advanced nations in manufactured goods. While Japan's economic incentives (and, to a lesser degree, those of the U.S.) to export have been strengthened by rising oil prices, Japan's range of competitiveness in traditional market segments has narrowed due to competition from emerging NICs, especially Taiwan and Korea. In steel, for example, Taiwan's exports to the U.S. increased 391 percent during 1978, while Korea's

21. This figure included totals for aircraft, computers, electrical machinery, medical equipment, measuring and controlling instruments, and telecommunications equipment. See U.S.-Japan Trade Council, *Yearbook of U.S.-Japan Economic Relations,* 1979. Washington, D.C.: U.S.-Japan Trade Council, 1980, p. 131.
22. Sub-Committee on Trade, Committee on Ways and Means, *Task Force Report on U.S.-Japan Trade,* Washington, D.C.: Government Printing Office, 1979, p. 52.
23. U.S. Department of Commerce, *The U.S. Semiconductor Industry,* Washington, D.C.: Government Printing Office, 1979, p. 34.
24. During 1979-1980 such price increases were the major factor in increasing Japan's current account deficit from $1.84 billion during the first half of 1979 to $11.6 billion a year later. See *Wall Street Journal,* 9 October 1980.

rose 24 percent and Japanese exports fell 17 percent.[25] Similar patterns of NIC penetration of traditional Japanese overseas markets occurred early in the 1970s for textiles, and later in the decade for less technically sophisticated machine tools and industrial plant exports. NIC development is forcing Japan to concentrate its export activities in high-technology sectors where those nations are incapable of competing, and to offset growing NIC penetration of Japanese domestic markets for low-technology manufactured goods[26] with even more intensive export drives in high-technology sectors. The U.S. is in a somewhat similar situation, albeit a less pressing one due to its considerable natural resource base and concomitant competitive advantages in the export of raw materials and foodstuffs.

## *High-Technology Trade and Investment in an Institutional Context*

The imperatives of industrial strategy and national military security, reinforced by balance of payments considerations, may well thrust the United States and Japan into an age of accelerating conflict over high-technology trade. Such conflict could gravely strain the overall trans-Pacific relationship, and become one of the central concerns of both U.S. and Japanese diplomacy and domestic politics.

In analyzing the political economy of protectionsim, or of other forms of conflict in U.S.-Japan relations, it is important to distinguish between policy outcomes based on 1) the strategic calculations of decisionmakers, without regard to political context, and 2) pressure from the political environment, particularly from interest groups. Nowhere is this distinction more important than with regard to trade in high-technology goods such as semiconductors, computers, and telecommunications equipment. In these rapidly growing sectors of major military and industrial significance, "strategic protectionism" often appears as an attractive alternative to policymakers who act solely on the basis of abstract "national interest." Because of their relative newness, low unemployment, and patterns of geographical distribution, such industries generally fail to place substantial grass-roots protectionist demands upon the political system — in sharp contrast to patterns in less strategic industries like textiles, for example.

25. *Financial Times*, 6 June 1979.
26. Between 1970 and 1978, for example, Japan's annual trade balance in textiles with Korea shifted over $880 million in favor of Korea, from an annual surplus of $58.2 million to an annual deficit of $823.8 million. See Sangyo Kozo Shingikai (Industrial Structure Deliberation Council), *op. cit.*, p. 232.

### *The Political Dynamics of Strategic Protectionism*

Aside from the Congressional debates on restraint of Japanese steel imports during 1968, there has been surprisingly little consideration in the United States of the strategic implications of rapid increases of foreign imports in basic industries, particularly those of considerable importance to the industrial structure of the future. This nation's leading position in high-technology industries, and its federal programs to assist military-related industry, have made confronting the question unnecessary.

Japan, a follower nation with less sophisticated technology, has confronted the issue much more often. Throughout the 1960s and early 1970s, Japan's Ministry of International Trade and Industry staged a protracted struggle against liberalization of its infant computer and electronic component industries. In the late 1970s and early 1980s overt Japanese politics of strategic protection have grown increasingly untenable in light of foreign, especially American, pressure. Japan has been particularly vulnerable to this pressure due to the growing dependence of much of the most sophisticated segment of its high-technology electronics industry on the U.S. market. In computers, for example, the proportion of exports to the U.S. in total exports rose from 16 percent in 1974 to 44 percent in 1978.[27] Even so, policies of extensive assistance to "target" high-technology industries, including depreciation allowances and assured access to credit, have continued, if not accelerated. These policies reflect the strategic national objectives of Japanese policymakers.

The analogue in the United States of the infant industry protection issue is the question of access to Japanese markets. It has recently become an issue with respect to autos, color TVs, and in the high-technology sector, ICs, computers and particularly telecommunications. As in Japan, most of the initiative on these strategically important issues has been taken by the bureaucracy rather than by private-sector groups.

### *Interest Group Pressures and Protectionism in High-Technology Trade*

Despite the strategic importance of the high-technology industries, conventional protectionist forces within those industries are weak. Strong industry and union pressure triggered a three-year struggle over U.S.-Japan textile trade when Japanese imports held less than 3 percent of the U.S. market for textiles. By 1979, Japanese producers held over 5 percent of the U.S. semiconductor market, and more than 40 percent of the "leading-edge" 16K random access memory sub-market. However demand for import restrictions was relatively

27. Comptroller General of the United States, *op. cit.*, p. 33.

weak, with the largest producer of ICs, Texas Instruments, refusing consistently to endorse such action.

Protectionist fervor reached its height at the May, 1979 International Trade Commission hearings on the U.S.-Japan semi-conductor trade, and October, 1979 Congressional Joint Economic Committee hearings. On the latter occasion, Mostek President L. K. Sevin, representing the semiconductor industry, accused the Japanese of dumping and called for the application of an equivalency standard to limit Japanese access to the U.S. market to levels attained by U.S. firms in Japan.[28] Yet before the end of 1979 the originally protection-oriented Semiconductor Industry Association, founded in April, 1977, dropped its demands for dumping investigations and import quotas, despite inexhorable increases in the Japanese share of the U.S. integrated circuit market. In the vital computer, telecommunications, and machine tools areas, protectionist pressure has been even more restrained, despite rapid increases in imports from Japan.

In Japan, a pervasive sense of the importance of strategic protection for high-technology industry has prevailed throughout the bureaucracy and throughout much of private industry (within Nippon Telephone and Telegraph's (NTT) "family" of telecommunications equipment makers, for example). Yet this strategic protectionism has been mingled with a surprising amount of pragmatism in the private sector in its willingness to affiliate with and purchase from foreign firms. Even the bureaucracy, under the threat of foreign protectionist retaliation, has moved away from adherence to protectionist principles in an effort to forestall U.S.-Japan trade confrontation. MITI's positive attitude toward the establishment of Fairchild's IC testing centers in Tokyo and Intel's IC production facility near Tsukuba, Ibaraki Perfecture, is an example of this phenomenon.

Considering the intensity of the basic conflict in strategic goals of the U.S. and Japan in high-technology electronics trade, and the recent sharp shifts in the U.S.-Japan trade balance in certain high-technology areas, the lack of political turbulence over high-technology trade is striking. One sharp, brief clash over telecommunications was papered over in May-June, 1979, and telecommunications-procurement issues were once again ambiguously, yet peacefully, resolved in late 1980. Tension over semiconductors, which mounted during the 1977-1979 period, was at least temporarily defused without severe damage to U.S.-Japan relations during late 1979. Computer-related issues have never seriously strained trans-Pacific ties in the way less strategically important textile, steel, color TV, citrus and beef-related issues have, despite the fact that computers have been a major trans-Pacific trade item for nearly a generation.

28. See the statement of L. J. Sevin before the joint Economic Committee of the United States Congress on behalf of the Semiconductor Industry Association, 10 October 1979.

### *The Political Economy of Keeping Politics Out of Trade*

One key factor militating in favor of relatively conflict-free, non-politicized U.S.-Japan high-technology trade has been prevailing *supply-demand relationships*. In all three of the major high-technology electronics industries (semiconductors, computers, and telecommunications) growth has been extremely rapid, and virtually all producers have been consistently operating near full capacity. (In 16K RAM memories, demand has exceeded supply in the U.S. during 1980 by roughly 40 percent, despite a 75 percent increase in production levels). Under conditions of capacity shortage, unemployment, with the attendant political pressures it generates, has rarely been a problem. Furthermore, firms have been able to sell whatever they can produce at favorable prices, and to diversify out of standardized products into higher value-added specialized applications. The desire of U.S. firms to move toward such applications has meshed neatly with the capability and desire of Japanese makers to supply high-quality standardized products such as the 16K RAM memories. Japanese firms such as Hitachi and Nippon Electric (NEC) during 1979-1980 consequently became major suppliers of integrated circuits to major vertically integrated U.S. electronics firms such as IBM, Intel,[29] and Hewlett Packard.[30] Supply shortages, in other words, have helped make relationships between U.S. and Japanese producers complementary rather than competitive at crucial stages in Japanese penetration of U.S. high-technology electronics markets.

The effects of supply shortages in moderating tensions in high-technology trade are reinforced by patterns of *market segmentation,* which have a similar impact. Contrary to popular conception, the major high-technology product areas, such as semidconductors or computers, are not undifferentiated markets like color TVs or crude steel. Semiconductors, for example, are sub-divided into the discrete device and IC categories,[31] while ICs are in turn divided into the CMOS, NMOS, and bipolar types of devices.[32] Bipolar and MOS ICs are sharply distinct technically from one another, and have different commercial applications. Japan's growing market share in MOS integrated circuits (especially in the standardized varieties used heavily in consumer electronics) does not translate into favorable cost positions in producing the faster bipolar ICs, which

29. Intel during 1979-1980 fell from #2 to #7 in 16K RAM production, out of a conscious strategic decision to purchase from Japanese producers, rather than compete with them in this product area. See *Business Week,* 3 December 1979, p. 85.
30. A 1980 study by Hewlett Packard of 16K RAM chips supplied by three Japanese and three U.S. firms suggested that the best American models had failure rates nine times higher than those of the best Japanese products, giving U.S. firms incentives other than availability and price for buying from Japan. See *Computer World,* 26 May 1980, p. 107.
31. See Department of Commerce, *op. cit.,* pp. 105-132 for a full, technically oriented explanation of the distinctions among types of semiconductors.
32. *Ibid.*

are a major input into computer production, and in which U.S. firms are dominant.

There is a second major form of market segmentation in microelectronics between standardized products (so-called "black boxes") and customized applications. "Black boxes," such as the 16K RAM memory in which Japanese producers are increasingly dominant, are high-volume products generating strategically important cash flows for producer firms. But their market segment is likely to grow significantly less rapidly during the 1980s in value terms than are customized applications with which U.S. firms have had more experience, and which they tend to deal with flexibly and creatively. By 1985 one third of the world's ICs will be built or designed by users — not by suppliers.

Since a relatively high proportion of ICs produced in Japan are consumed in-house or by affiliated consumers, Japanese firms should adjust smoothly to this new technical development within their native land. But without extensive sales and service networks in the United States, with instability in some joint-venture relationships with U.S. partners (Fujitsu-Amdahl and Hitachi-Itel, for example) and with manufacturing and research facilities in the U.S. just being established, Japanese firms should face difficulties battling for the "customized one third" of the IC market.

In computers, markets are to some extent segmented in terms of scale of central processing units (CPUS). U.S. firms are strong in large and very large systems; in the latter category IBM alone had a 45 percent market share in Japan during 1979, and U.S. firms as a group held a total share of 65 percent.[33] Conversely, in small-sized computers, IBM held only a 9 percent market share in Japan, less than one-third the 33 percent share of its major rival Fujitsu.[34] Market dominance in one product area has not led directly to favorable positions in other sectors, and need not necessarily do so in the future.

Japanese firms will also probably be impeded in commercial efforts in the U.S. by exclusion from the significant military procurement portion of the electronics market.[35] Although this proportion of the total market has declined sharply since the late 1960s, military procurement in the U.S. is still important as a source of support for technically advanced products which have not yet achieved sufficient economies of scale to be commercially marketable. Government procurement practices, including the controversial NTT procurement practices in telecommunications, fill an analogous function in Japan. In both

33. *Computopia*, January 1980, p. 23.
34. *Ibid.*
35. Department of Defense (DOD) purchases represented 7 percent of total U.S. demand for ICs in 1978. This proportion ranged from 50-65 percent during 1955-1968, but has declined as the range of civilian applications of ICs has expanded. See *Military Electronics/Countermeasures*, January 1979, p. 51.

nations, such practices segment markets and place limits on foreign penetration of them.

*Patterns of geographical distribution* of production facilities appear to have relevance generally in determining the extent to which trade relations in a given industry become politicized. In the case of textiles, for example, Destler, Fukui, and Sato suggest that the combination of (1) broad geographical spread of plants in a large number of Congressional districts, and (2) concentration of the industry in a region (southern U.S.) with substantial political influence was important in making textiles a major issue in U.S.-Japan relations.[36]

In high-technology electronics, production has traditionally been highly concentrated geographically in Santa Clara County, California, otherwise known as "Silicon Valley" and its environs. This area has produced well over half of all American integrated circuits manufactured since the inception of the industry. A substantial additional portion of U.S. micro-electronics is concentrated in Massachusetts' Route 128 high-technology industrial area. Japan also has its functional analogue to "Silicon Valley" in its "Silicon Island" — the southern island of Kyushu. In Kyushu are located Nippon Electric Kumamoto integrated-circuit fabrication facility, largest and most advanced of its kind in the world, and other plants jointly turning out the largest portion of Japanese ICs.[37] Other large concentrations of high-technology electronics production facilities are located in the western and southern suburbs of Tokyo (Tamagawa, Sagami Ono, Tachikawa, and so on), and in Ibaraki Prefecture, near the new science town of Tsukuba.

In the U.S. and Japan the geographical concentration of high-technology electronics is declining — since 1974-1975 in Japan and since 1978-1979 in the United States. Government financial inducements have played a major role in both nations. In Japan these have included low-interest loans for the relocation of industrial plants to rural areas as part of a systematic program for reducing geographical concentration of industry. In the United States, local government competition for attractive new industrial facilities has had a similar effect. Market forces, such as rising land prices and wage levels in areas of growth concentration, have also been important. Diverse areas such as Oregon, Utah, and Colorado in the U.S., and Nagano, Oita, and Kanagawa Prefectures in Japan have been acquiring computer factories and IC wafer fabrication facilities. But high-technology electronics is not yet an industry with a broad geographical base, unlike textiles or steel, and probably will not become so until much later in the 1980s.

36. I. M. Destler, Haruhiro Fukui, and Hideo Sato, *The Textile Wrangle,* Ithaca: Cornell University Press, 1979, p. 58.
37. See Shimura Yukio, *IC Sangyo Dai Senso* (The Great War in Integrated Circuits), Tokyo: Diamondo Sha, 1979, p. 124.

In partial exception to this pattern of relative geographical concentration of high-technology electronics is the Japanese telecommunications industry, with its extensive sub-contracting network spread throughout Japan. As the foregoing analysis would suggest, telecommunications is the high-technology industry whose trade dynamics have become the most highly politicized, especially on the Japanese side.

U.S.-Japan high-technology trade holds a surprisingly precarious position within both political systems. These sectors often enjoy bureaucratic backing on strategic grounds, as was noted earlier. But they are generally much weaker in terms of legislative and interest-group support, and have relatively few ongoing political backers. (This generalization is more valid for semiconductors than for other high-technology product lines, and is subject to qualifications which will be outlined below.) In Japan the only prominent, consistent supporter of the computer industry in the Diet was Hashimoto Tomisaburo, one-time Secretary General of the ruling Liberal Democratic Party (1972-1974) under Kakuei Tanaka, and a defendant in the Lockheed Scandal. Hashimoto was consistently involved in aiding the computer industry, mainly because a major Hitachi plant is located in his electoral district in Ibaraki Prefecture. Hashimoto was defeated in the 1979 general election, in part because of the Lockheed Scandal, and no similarly consistent and clearly identifiable major backer of computers has come forward in the Diet to take his place.

Broadly speaking, the Tanaka and former Mizuta factions have been most supportive of high technology, in part because of their lack of strength in established industries, and their traditional roles in controlling the "subgovernment" surrounding the Ministry of Posts and Telecommunications. But these two factions combined comprise less than 20 percent of Diet membership. The only high-technology field in which a "Dietmen's Support League" (*Giin Renmei*) has been formed has been telecommunications, though even this league has been dwarfed in size and scale of activities by such groups as the agricultural and coal lobbies.

The relative political weakness of high-technology industry in Japan is reinforced by (1) the generally lukewarm and marginal involvement of such firms in "business world" (*zaikai*) activities, and (2) the marginal role of high-technology products like ICs and computers in the overall sales and profitability pictures of most Japanese firms producing such goods. Until mid-1980, when a Hitachi representative became one of five Keidanren Vice Chairmen, the advanced electronics industry (excepting the special case of Toshiba) had never had a powerful representative in the Federation of Business Organization's inner circles. Even within key high-technology firms such as Hitachi and Nippon Electric, the highest proportion of sales (and the locus of much intra-firm influence) lie with consumer products like color television, or heavy industrial products, such as turbines, rather than with telecommunications, semiconduc-

tors, or computers. Only at Fujitsu are high-technology items the major element of sales.

Due to the relatively weak political leverage of Japanese high-technology firms and of a relatively weak corporate insistence on aggressive development of high-technology the industry has occasionally lost in struggles over the thrust of Japanese industrial policy. In 1971, for example, MITI's Industrial Structure Deliberation Council declared the urgency of rapid transformation toward a "knowledge-intensive society." But in 1974-1975 Keidanren re-emphasized the "central role of basic established industries" (steel in particular) in the Japanese industrial structure.

In U.S. politics as well, high-technology firms, with the exception of IBM and a few other computer mainframers, have generally been outside the mainstream, despite substantial contact with the Department of Defense. This situation is particularly pronounced in integrated circuits. "Silicon Valley's" senior Congressman, Paul McCloskey, is a Republican maverick with innovative ideas but relatively little influence on major committees. The area's major interest group, the Semiconductor Industry Association, was founded only in April, 1977. Not surprisingly, the major political concerns of this group, such as tax credits for research and development expenditures, have received lower priority than those of industries like steel and automobiles, as is evident in the construction of the Jones-Conable 10-5-3 depreciation proposal, for example.[38]

Perhaps the most important institutional development in the U.S.-Japan high-technology area over the past generation has been the emergence of complex *transnational relationships.*[39] These generally appear to moderate conflict and to decrease the leverage of the U.S. and Japanese governments in dealing with the transnational actors. Key relationships include:

(1) Ties between major U.S. high-technology firms and the Japanese government, primarily in relation to regulation of U.S. investment in Japan;
(2) Complementary private-sector ties between independent U.S. and Japanese firms, in the form of joint ventures, marketing tie-ups, and supplier-client relations;
(3) Japanese ties to various government and private groups in the United States, acquired through direct investment in this country, and through lobbying.

The intricate, mutually beneficial relationship between U.S. high-technology firms operating in Japan and the Japanese government lies at the

38. Formally known as the Capital Cost Recovery Act, the Jones-Conable Bill proposes a simpler depreciation schedule for tax purposes. It proposes that buildings could be depreciated fully in ten years, machinery and equipment in five, and light vehicles in three.
39. On the role of transnational ties in influencing patterns of international conflict, see Robert Keohane and Joseph Nye, *The Politics of Interdependence,* Boston: Little, Brown, and Company, 1977.

heart of the surprisingly stable political economy of high-technology trans-Pacific trade and investment. U.S. firms just breaking into the Japanese market, such as ITT and AT & T in telecommunications during the early 1980s, or IBM in computers a generation earlier, have had substantial difficulties dealing with MITI, NTT and other Japanese authorities. But once they have entered the web of mutual compensation and long-term relationships that marks the essence of Japanese government-business relations, and as their profitability has improved, U.S. firms operating in Japan have generally moved into much more cooperative relations with government.

Two major examples of U.S. firms effectively developing symbiotic relationships with the Japanese government are IBM and Texas Instruments, the dominant American firms in computers and semiconductors respectively. Both firms have developed intricate mechanisms for liaison and mutual accommodation with MITI and other government agencies (NTT being a partial exception) which help to prevent serious tensions from arising.

First, the Japanese subsidiaries of both IBM and Texas Instruments (TI) have Japanese presidents. President Yoshizaki of TI East Asia is a former Deputy Bureau Chief of MITI's International Trade Policy Bureau, who was deeply involved in negotiations with the U.S. in the late 1960s.

Second, both IBM and TI have long traditions of employing former Japanese bureaucrats to maintain liaison with appropriate government ministries and to obtain information from the government. IBM is particularly assiduous in its cultivation of bureaucratic ties. Within its ranks IBM numbers former members of MITI, the Ministry of Finance, the Science and Technology Agency, the Patent Office, and even a former bureau chief from the Bank of Japan — the only individual of his rank from the central bank ever to join a foreign firm. IBM Japan's personnel roster includes more retired senior bureaucrats than any domestic Japanese computer firm, if retired officials of the National Railways and NTT (neither of which are ministries) are excluded from the calculation.

Third, both corporations contribute significantly through their local operations to the Japanese balance of payments, and to improving the technical proficiency of local firms. In 1978, for example, IBM Japan's export sales were $215.7 million, or 43 percent of Japan's total $597.4 million in computer export sales.[40] IBM and TI cross-licensed major patents to Japanese firms when they first set up Japan operations.

Fourth, IBM and TI refuse to involve themselves with overtly protectionist movements in the United States. TI, for example, refused to join the Semiconductor Industry Association (SIA) when it was founded in 1977 to press the U.S. government for restrictions on high-technology imports from Japan.

40. Comptroller General of the United States, *op. cit.*, p. 34.

Fifth, these firms involve themselves in trans-national non-governmental organizations that serve as forums for bilateral dialogue. Mark Shepherd, Chairman of Texas Instruments, served during 1979 as chairman of the Japan-U.S. Businessmen's Conference, for example.

The framework of mutual accommodation built up over the past twenty years between dominant U.S. computer and electronic-component multinationals and the Japanese government serves as a powerful structural impediment to protectionist actions by the United States; it has also seemingly moderated the protectionist impulses of the Japanese government. The framework creates a network of complex relationships which cross-cut national boundaries, and which create "hostages," in the form of the multinationals, against whom the host government can retaliate should protectionism develop, or through whom it can communicate in attempting to influence foreign attitudes.

For years the symbiotic relationship between U.S. electronics firms and the Japanese government was largely limited to IBM, TI, National Cash Register, and the small number of other U.S. firms operating actively in Japan. The Silicon Valley firms had little on-going contact with the Japanese government, and many adopted an overtly confrontationist attitude toward it. This approach was epitomized in many of the positions of the Semiconductor Industry Association between 1977 and 1979, including accusations of Japanese dumping and of massive subsidies to high-technology industry.[41] But toward the end of 1979 numerous SIA affiliated firms, reportedly with the cooperation of MITI, announced plans to set up production facilities in Japan. Intel indicated plans for an IC design center, to be opened in March, 1980, and for a large LSI production center, to go into operation by July, 1981.[42] Motorola announced plans for a design center;[43] in early October, 1980, the firm also announced a joint venture with Toko Inc. to produce ICs in Japan.[44] Mostek and Advanced Micro Devices indicated plans to start production in Japan by 1983.[45] Roughly concurrent with these decisions to establish facilities in Japan, the Semiconductor Industry Association, perhaps coincidentally, began de-emphasizing Japanese trade practices and stressing inadequacies in American public-policy as the key factors undermining the ability of U.S. high-technology industry to compete with Japan.[46]

Japanese high-technology investment in the United States, like its analogue in Japan, plays a role in undercutting tensions in the U.S.-Japan relationship,

41. See, for example, L. J. Spevin, *op. cit.*
42. *Nikkan Kogyo Shimbun,* 26 November 1979.
43. *Nihon Keizai Shimbun,* 27 November 1980.
44. *Wall Street Journal,* 9 October 1980.
45. *Nihon Keizai Shimbun,* 27 November 1979.
46. See, for example, the testimony of Charles Sporck, President, National Semiconductor Corporation, before the U.S. House Committee on Ways and Means, 31 July 1980.

even as it generates some unique problems of its own. Top Japanese IC producer Nippon Electric in 1978 purchased a Silicon Valley IC manufacturer (Electronic Arrays) and plans to use it as a U.S. production base for 16K and 64K random access memories. Four other major electronics firms (Hitachi, Fujitsu, Toshiba, and Seiko) also announced plans during 1979-1980 to build ICs in the U.S. In sharp contrast to patterns in color television during the early 1970s and in autos during the late 1970s, Japanese producers of integrated circuits have anticipated patterns of rising opposition to Japanese imports, and pre-empted such opposition by setting up U.S. production facilities.

Marketing ties in which U.S. firms serve as distributors for Japanese high-technology products in the U.S. are becoming rapidly more important for the parties involved. Hewlett Packard began buying standard varieties of Japanese integrated circuits in 1977, and was joined during 1979-1980 by such major firms, including IBM, Intel, American Micro Devices. (In 1980 15 percent of IBM's consumption of 16K RAMs was purchased from outside sources, and much of this portion came from Japan). Virtually all large mainframe Japanese computers are also marketed through American distributors. As Japanese exports of such products to the U.S. grow, the stake of American distributors in trade with Japan will probably also grow.

In computers Japanese firms mollify protectionist sentiment, and solidify their marketing base, by operating through a maze of joint venture agreements with American firms. The first of these, concluded between Amdahl and Fujitsu in 1974 for the marketing of plug-compatible mainframe computers, was followed by Hitachi-National Semiconductor (OEM agreement), Fujitsu-TRW (medium-scale computers), and other arrangements, such as NEC's and Mitsubishi's sales corporations in the United States.

Another important factor militating in favor of peaceful settlement of disputes in U.S.-Japan high-technology trade is Japan's growing reliance on the U.S. market in several critical sectors. This pattern contrasts sharply with Japan's growing diversification away from the U.S. market in non-high-technology sectors. In 1974, for example, only 16 percent of Japan's computer exports went to the United States, while by 1978 that fraction had risen to 44 percent, as has been noted. Regardless of how such ratios evolve in the future, Japanese reliance on U.S. markets in high-technology fields will be substantial — much more so than in other product areas such as textiles. Such dependence should help foster a relatively great sensitivity to U.S. desires, and a willingness born of necessity to accommodate them. This sensitivity has already been shown in Japanese responses to the 1977-1979 tension in bilateral integrated circuit trade, including Japanese corporate efforts to invest in the U.S. and in Japanese government receptiveness to U.S. investment in Japan.

A final area of prospective cooperation in the high-technology sphere is the multi-national joint venture in technology development. In late October,

1980, the Japanese government announced the agreement in principle of the U.S., British, French, and West German governments to a Japanese proposal for joint long-term research toward development of a new fifth-generation computer for use in the 1990s, with initial planning for the research to take place in Tokyo during 1981.[47] The massive and rapidly increasing scale of research and development expenditures required in the development of new computer systems and software makes international cooperation increasingly logical. However such cooperation seems less rational for IBM, due to its strong market position (over 60 percent of world computer sales), its enormous fund of experience in software and its considerable financial resources.

Yet problem areas do exist, and there is potential for tension in the near term.[48] One example is the telecommunications field, where webs of transnational relationships have not yet evolved. Over the longer term, several factors contribute to an underlying current of tension in U.S.-Japan high-technology electronics trade.

Industry concentration periodically has led to financial difficulties for small firms. For example, as IC production grows more capital-intensive the industry is becoming more highly concentrated: The cost of a basic IC chip-making facility was $2 million in the late 1960s, and had reached $50 million by 1980. Furthermore, U.S. integrated circuit producers are experiencing a relatively low rate of return on their investments: 7 percent annually on invested capital during 1970-1980, vs. 12 percent for electronics firms as a whole.

During the late 1970s, the political consequences of rising concentration ratios, in the form of protectionist political action by smaller firms, were modified by the great interest of foreigners in buying up distressed smaller firms, often at prices favorable to the owners. By 1980, 15 percent of U.S. domestic semiconductor production capacity was owned by foreigners, and 12 of the 21 major acquisitions during 1977-1979 were by foreigners.[49] However, if foreigners were at some point to curtail such purchases, and were concentration trends to continue, many small firms would be badly hurt, and might seek political recourse.

Tension also may result from patterns of rapid capacity expansion in a market where consumer demand is volatile and difficult to predict. During 1978, capital investment in the U.S. integrated circuit industry rose 42 percent;[50] in

47. *Nihon Keizai Shimbun,* 21 October 1980.
48. Even in this area, however, numerous options are open to both sides, particularly the Japanese, to moderate the dimensions of conflict. The Japanese government can, and is, using expanded support for sales of Japanese telecommunications equipment in the Third World to mute opposition of small domestic firms to expansion of government procurement opportunities for foreign firms (mainly American) in Japan.
49. See*B usiness Week,* 3 December 1980.
50. See *Forbes,* 26 November 1979.

the Japanese IC industry investment rose 81 percent during 1977-1979.[51] In the recent past, demand has outstripped supply, and the IC industry, together with other high-technology electronics industries, has grown rapidly with at least marginal profitability. However, if a sharp downturn in demand or over-optimistic expansion programs lead to excess capacity, corporate red ink and the protectionist pressures often associated with it might develop.

A third factor which might create tension is the rising profile of the electronics industry in the Japanese and American political economies. As the high-technology electronics industry in both countries broadens its geographic scope of operations and acquires greater political influence, government support will be mobilized more easily to anticipate and prevent future conflict.

### *Politics and Markets in the U.S.-Japan High Technology Electronics Relationship*

For much of the half century since Japan first rose to international economic prominence by displacing Great Britain as the world's largest textile exporter, one of the key issues in trans-Pacific relations has been: To what extent should political restraints supplant market mechanisms in ordering U.S.-Japan trade and investment? For two generations the issue was actively posed mainly in relation to textiles. But over the past decade of rising Japanese industrial competitiveness and growing American alarm at burgeoning trade deficits with Japan, the question has been successively posed with respect to steel, soybeans, color television, beef, oranges, automobiles, and a myriad of other product lines. It has already been asked in the sharp, brief confrontation over telecommunications in the spring of 1979. It may well continue to be asked, with growing frequency, in relation to the development of high-technology electronics industries as the 1980s wear on.[52]

Politics have historically often played a major role in shaping the domestic evolution of strategic "core" industries throughout the world — particularly in "follower" nations such as France, Germany, and Japan. Steel and transportation, for example, have frequently been state monopolies because of their fundamental importance in determining military capabilities and economic com-

51. Semiconductor Industry Association, *State of the Semiconductor Industry* (mimeo). Special report prepared for Luther H. Hodges, Jr., Undersecretary Designate, Department of Commerce, 13 June 1979, Enclosure 9.

52. For additional information concerning the role of politics and markets in East-West trade policy making, see Samual P. Huntington, "Trade, Technology and Leverage: Economic Diplomacy," *Foreign Policy*, Fall 1978, pp. 63-80; Raymond Vernon, "The Fragile Foundations of East-West Trade," *Foreign Affairs*, Summer 1979, pp. 1035-1051; Angela Stent Yergin, *East-West Technology Transfer: European Perspectives*, Beverly Hills, Sage Publications, 1980; and Steven Sternheimer, *East-West Technology Transfer: Japan and the Communist Powers*, Beverly Hills: Sage Publications, 1980.

petitiveness in a wide range of ancillary sectors. Where private ownership has prevailed, these industries have commonly received preferential access to government loans, subsidies, tax incentives, and procurement contracts.

In dealing analytically with the political economy of international trade, it is useful to distinguish between two forms of political intervention in the functioning of markets. These include: (1) direct restraints on trade, through import quotas, orderly marketing agreements (OMAs), tariffs, and so on; (2) indirect influences on trade patterns, operating through domestic policies relating to subsidies, research cartels, and government procurement. As the foregoing pages have suggested, the supply-demand connections and institutional ties prevailing in the U.S.-Japan high-technology electronics relationship operate strongly to inhibit overt political barriers to high-technology trade of the former type. Political intervention of the latter variety, however, has traditionally been quite substantial, and may well become more so in future, as the electronics industries of the U.S. and Japan become progressively more influential within their respective domestic political systems.

A similar pattern prevails in the industries currently constituting the heart of the high-technology sector — computers, telecommunications, aircraft, robots, and integrated circuits. In the United States, government assistance to these sectors has taken the form mainly of research and development and procurement contracts for military and NASA programs. In Europe government intervention in high-technology sectors has taken the form more of state ownership (especially in telecommunications), political manipulation of government procurement contracts, and direct subsidies, as well as support through military programs. In Japan, where the small scale of defense spending has made public support for civilian R and D efforts strategically very important, government support has characteristically been more market-oriented, less intrusive into the behavior of individual firms, and less reliant on the actions of state corporations than has been true in Europe. Three major tools of policy have been government procurement policy, the joint government-business research cartel (such as the VLSI electronic component cartel of 1976-1980 and the software cartel of 1979-1983) and finely tuned accelerated depreciation policy. Tight links between banks (mainly private) and manufacturing firms have also made it possible for Japanese high-technology firms to finance rapid expansions of capacity to exploit the latest technology.

In view of the strategic imperative throughout the industrialized world to support high-technology industry, and the constraints on doing so through direct restrictions on international trade, an accelerating scramble within domestic political systems, led by bureaucrats and emerging high-technology pressure groups, to improve incentives for domestic development of high-technology electronics seems in prospect. This "internalized" rivalry between nations already appears well advanced, with major nation-state actors respond-

ing in terms of their characteristic traditional approaches to industrial policy. In Europe, new public corporations, such as INMOS in Britain, have been established to encourage high-technology, and subsidies have been increased. In Japan a major tax reduction for high-technology industry is being deliberated, and more research cartels organized. In the United States, most support efforts, including the VHSI project for the development of new microelectronic components, are taking place within the context of the national defense program.

As has been noted, the forces militating against overt protectionism in U.S.-Japan high-technology trade are powerful. But there is an undercurrent of tension, given force by strategic considerations, volatility of supply-demand relationships, the growing domestic political strength of advanced electronics in both nations, and growing concentration trends accompanying the rising capital intensivity of these industries. Managing the U.S.-Japan alliance in the high-technology electronics sector will probably involve creating some degree of balance between the two nations in levels of domestic support for computer, semiconductor, and telecommunications manufacturers, in order to minimize protectionist pressure on the direct bilateral trade relationship.