

Silicon Valley Cries Foul

by Ralph Hughes

Red Alert! The Japanese are attacking the U.S. again. First they destroyed the American radio and TV industry; then they drove our auto and steel companies out of business; now they are blitzing our semiconductor industry by pricing below cost and using a lot of other dirty tricks. Man your battle stations! Our economic future is about to be destroyed.

That is the gist of the testimony that Silicon Valley's (Santa Clara County, California) independent semiconductor firms have presented to Congress. The alarm began in the late seventies when Japanese electronic firms first mass produced advanced integrated circuits. The sudden Japanese advance and the subsequent capture of a large portion of the U.S. market for certain advanced devices frightened the Bay Area's merchant IC makers, who bear the brunt of the new competition. In response, merchant chip makers formed the Semiconductor Industry Association (SIA) in 1977. SIA has relentlessly petitioned Congress for help, claiming that the Japanese are competing unfairly. According to Charles Sporck, president of National Semiconductor and a member of SIA's board of directors, the Japanese:

... intend to dominate the U.S. semiconductor industry just as their similar efforts have overtaken many other American industries. Unless the Federal Government of the United States institutes and enforces free-trade rules for Japanese-made products now, the semiconductor industry here will be overrun and destroyed within ten years.¹

Such an event, SIA warns, will leave the U.S. without a domestic supply of the increasingly crucial silicon chip and thus as vulnerable to Japan as to OPEC.

SIA says that this disaster can be averted, but only if Congress quickly provides tax law changes, subsidies, and increased funding of university research to help small semiconductor firms. As crucial as integrated circuits will be in the future world economy, however, SIA's assertions must be considered cautiously. Careful consideration of the history of semiconductor industries in both America and Japan, the structural differences of their economic settings, and the terms of international competition itself is crucial in both evaluating SIA's proposal to Congress and in determining whether the Japanese are competing fairly.

The charge: unfair competition

SIA asserts that the Japanese are being quite sly in their assault. Although the Japanese are now proficient at producing a wide range of IC's, they have focused deliberately on capturing the markets of certain devices that are crucial to the American firms' financing. The device most frequently mentioned by SIA members in this context is the 16 kilobit random access memory (16K RAM), which is widely used in the latest versions of computers. By resorting to "unfair" competition, SIA claims, the Japanese have captured 42 percent of the 16K RAM market.²

According to SIA, the high volume sales of 16K RAM's support its members' essential research and development programs. These R and D programs produce the constant stream of new devices that allow the SIA firms to survive in the competitive semiconductor industry. Without new devices to market, these firms would be driven out of the market by larger companies that could produce standardized circuits with greater economies of scale. SIA warns Congress that because the small, independent semiconductor firm has been the major source of IC innovation, the U.S. electronics industry will be entirely dependent on Japan for state-of-the-art devices if SIA members are allowed to be driven under.

SIA is careful to point out that it is not the foreign competition per se that upsets them. Rather, it charges that the Japanese have not restricted themselves to free enterprise, and it lists several "infractions." First of all, the Americans are extremely bitter about the special aid the Japanese government has given the Japanese semiconductor firms. The government has organized and partially funded a four-year R&D program in Very Large Scale Integration (VLSI) techniques in which select electronics firms participated. The VLSI program, completed in 1979, helped give the Japanese the ability to mass produce the 16K RAM. In this program the government encouraged the participating firms to share development efforts, an action which SIA claims is forbidden in the U.S. by antitrust laws. The government also arranged for additional financing for the program from the major Japanese banks at very low interest rates. Furthermore, the government granted the firms involved tax breaks, duty exemptions, and tariff protection. Such government aid has freed the Japanese companies from the constraints of the free market and thus, SIA claims, given them an unfair advantage over their American competitors.

SIA warns that with this advantage the Japanese will conduct superior R&D efforts and surpass the U.S. in innovation. Because innovation has typically reduced IC production costs by 25 percent a year, the Japanese firms may price the Americans entirely out of the market if they can use this government aid to move ahead in technology.

Secondly, SIA accuses the Japanese with "dumping" their circuits on the U.S. market. SIA believes that the government aid has given the Japanese firms the financial durability to price their exports below costs to capture the American market.

Third, SIA claims that despite the free Japanese access to the U.S. IC market, Japan has brazenly excluded the Americans from its domestic market. The Japanese government has rarely allowed an American electronics firm to operate independently in Japan. In addition, SIA charges that the Japanese government and electronics firms have collaborated on a "buy Japanese" policy which has severely hampered American competition in the Japanese market. In fact, SIA accuses the Japanese of such practices as "customs uplifting" (where the customs officials arbitrarily over-appraise incoming American

circuits) and tariff levels much higher than the U.S. imposes on Japanese circuits. SIA asserts that only by employing such unfair trade practices can the Japanese firms challenge the Americans so ruthlessly.

The Japanese government appears as a central villain in the scenario SIA has presented to Congress. This view is distorted, however, and even hypocritical for SIA to suggest. First of all, there are limits to the government's involvement. The VLSI program which it organized involved only five of Japan's electronics firms.³ SIA condemns this program as a government-run attempt to surpass the technology of U.S. producers and steal their markets. Other observers, however, are more reserved and describe the program as only a well planned attempt to improve Japan's basic integrating skills so that its producers could enter the market for advanced electronics devices and diminish Japan's trade deficit with the U.S. for state-of-the-art circuits. Whatever the case may be, the

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Japanese government payed for only 40 percent of the program's total cost of \$30 million, making the firms responsible for financing the rest.⁴

Although the government also arranged for the semiconductor firms' easy loans from the banking system, SIA should not begrudge this help. Throughout the history of integrated circuits the U.S. government provided essential funds for American producers. Ever since Bell Labs developed the transistor in 1947, the American government has lavishly supported semiconductor development with both massive purchases of components and federal grants to fund further research. The Federal purchases peaked in the '60s when the military was assembling several major weapons systems and NASA was building computers to guide spacecraft. When IC's were still too crude and expensive to be commercially applicable, sales to the government allowed the producers to turn a profit and "move down the learning curve" so that the chips eventually became inexpensive enough to be used in civilian products. All told, the government purchases plus the \$350 million in direct federal aid for R&D equalled close to \$700 million of federal support from '58 to '78. This equals 30 percent of all semiconductor research and development for this period.⁵

The bulk of this federal support occurred in the first fifteen years of this period. Add the generous federal funds paid to the country's universities to subsidize the training of engineers and scientists, and it is clear that the U.S. government was at times financing much more than 30 percent of the American producers' development, probably surpassing the Japanese government's 40 percent aid to the VLSI program. Whatever the case may be, the U.S. government's \$700 million subsidy to its IC industry is more than five times the \$120 million that the Japanese government provided for the VLSI program.

Japan, Incorporated

This perspective is not included in SIA members' testimony to Congress. They express instead resentment that the Japanese government has freed their competitors from the

market constraints that SIA members, like all small, independent firms, must overcome. But unlike SIA members, the Japanese semiconductor firms are not independent companies, and they belong to a very different economic structure which traditionally includes direct government involvement. The Japanese semiconductor firms are simply branches of the large electronics companies who are themselves members of huge industrial groups—the keiretsu⁶—thirteen of which are so large and powerful that they comprise the substance of the Japanese economy and thus dominate the society and its government. The keiretsu are each centered around, and thus controlled by, one or more of the major Japanese banks. Though they compete against each other in the market place, the keiretsu are linked financially and personally. On policy issues they act and think with a great degree of consensus. This cooperation, teamed with the keiretsu's extensive control of the government, is the true meaning of "Japan Incorporated."

There exists, however, a division of labor between the government and the keiretsu in planning and production. In the Japanese system, the government's role is as coordinator, trusted by the keiretsu to plan and preserve the long-term vitality of the economy. It uses its fiscal powers to persuade the keiretsu to focus their productive activity in industries that it believes have the greatest potential benefits for the system. This is the government's practice of "targeting" certain industries for accelerated development. The keiretsu, however, have the power to reverse government policies, such as certain pollution regulations.

Thus, SIA cannot prove unfair government practices because the thorough integration of the Japanese economy makes it ambiguous whether the public or private sector is targeting the semiconductor industry. Furthermore, to claim that Japanese targeting is unfair assumes that the U.S. economic system is somehow ethically superior and that all nations should operate in a similar manner. Targeting, however, is a normal, traditional characteristic of the Japanese system. SIA's analysis presents the U.S.-Japanese semiconductor competition as a struggle between two national private sectors that should remain independent of their respective governments, but a more accurate analysis would focus upon the dynamics of trade between two contrasting economic systems without regard to ethical questions.

SIA is right, however, in suggesting that Japanese electronics firms would not be producing 16K RAMs today if the government had not helped. During the early seventies, government planners determined that specializing in high-technology, knowledge-intensive products such as computers and circuitry would be crucial to the success of their over-polluted, resource-poor island's future economic performance. Even the traditional neo-classical economic theory of comparative advantage concurs that Japan's scarcity of land, energy and raw materials, and its large pool of skilled labor make it wiser to specialize in light manufacturing rather than heavy industry. It was also painfully clear to the Japanese government that Japan's electronics equipment industry was not going to be able to compete well in the future world market without greater proficiency in the leading semiconductor technologies. IBM's introduction of the 360 series computer in 1964, the first computer to be based on IC's, devastated the market for Japan's own transistor-based computer, which had just gone into mass production after great expense. The Americans have dominated the computer market ever since.

The Japanese can license and copy American advances in IC's, but only with a substantial delay. This lag is important because it not only gives the U.S. a crucial price advantage in

IC's and chip-based hardware, but it only allows the Japanese to compete in well established product lines where a significant number of other producers have eroded the profit margins.

At the time the government realized the need for Japan to match the Americans' technological lead, the electronics firms were unwilling to undertake the awesome R&D expense that would be required. Unlike America, Japan has neither a large weapons program to subsidize technological advancement nor a comparable university system to provide scientists and engineers trained in the frontiers of technology. Thus the government initiated the VLSI program. Only by providing subsidies, encouraging collusion, and backing loans could the government lower the risks enough to persuade the private firms to commit themselves. Indeed, the electronics firms made good use of the opportunity, catching up to the state of the art in four years and even achieving some degree of innovation.

Dumping

SIA's bitterness over the Japanese government's involvement, however, has been surpassed by the fury with which it accuses the Japanese of "dumping" their IC's in the U.S. As SIA describes it to Congress, the Japanese are selling at a loss in the U.S. to underprice the Americans and steal their market. The Japanese can afford to do this because they recoup their losses by selling at higher prices in the Japanese market, which is only possible because Japan, unlike the U.S., has excluded foreign electronics firms from their domestic market. According to SIA, if the Americans were allowed into Japan, their competition would equalize the prices in both countries and give all firms an equal chance in a world market. But by excluding U.S. firms, the Japanese are forcing SIA members to sell at a loss at home and preventing them from regaining their profits in Japan. SIA wants Congress to act immediately to correct this unfair situation.

There are two issues involved here, pricing and exclusion. To begin with the topic of pricing, it must be emphasized that "dumping" means selling at a loss, and SIA has not proven that the Japanese are doing this. The best evidence comes from Mostek Corporation, a founding member of SIA, which shows five particular instances in which the Japanese chose to sell their chips in the U.S. when they could have gotten double the price in Japan.⁷ This evidence is shaky because it demonstrates only that the Japanese could have earned more. It does not show that they sold at a loss.

In addition, the greater reliability of Japanese chips may be as responsible for their competitiveness as their lower price. Similar to their strategy in other industries, the Japanese have focused upon obtaining a consistent, high quality output from their semiconductor production lines instead of relying upon inspection of the final product to spot defects. In a 1980 study, Hewlett-Packard, a respected U.S. buyer of circuits, determined that Japanese chips had a significantly lower defect rate than comparable American circuits.⁸ The American firms claim that they can make chips of equal reliability, but that they would have to charge more than the Japanese.⁹

The Japanese semiconductor firms' participation in the keiretsu explains much of their ability to provide better quality chips for less. Their close connections with financial institutions allow them to finance a major portion of their operations through debt. Whereas an independent American semiconductor firm usually sells \$80 of equity capital to every \$20 it borrows, a Japanese firm's financing is typically the reverse.¹⁰ Although the Americans draw funds to update their equip-

ment largely from depreciation allowances for the old machines, their funds for growth and R&D come from retained earnings. These earnings are taxable, so that if the tax rate on profits is, say, 50 percent, an American company must earn twice as much as it plans to spend on expansion.¹¹ On the other hand, because Japanese firms finance themselves through debt which is not taxed, they need much less earnings than the Americans to fund the same increment of growth. Thus Japanese firms do not need as high a profit on sales and can afford more expensive production techniques and still price lower.

In addition, the high debt position makes Japanese firms much more inclined to slash prices than American firms for two reasons. First, the substantial, regularly due bank payments teamed with the Japanese firms' custom of providing life-time employment for many workers gives them much higher fixed costs than their American counterparts. With greater fixed costs they are impelled to keep production and sales at the highest level possible, even if the price of the circuits must be lowered. The American firms' production, in contrast, is comprised of much greater variable costs (non-union labor and materials). Thus they prefer to cut costs during slow periods by lowering production levels instead of prices so that they can maintain the highest profit margin possible.

Second, the Japanese firms are free to lower their profit margin because of the small number of independent stockholders they must worry about. This is especially true because in the Japanese system the bank financing a particular firm usually holds a decisive proportion of the small amount of stocks in the company. The Americans, on the other hand, are forced to maintain their profit margins because of their dependence on equity capital. The Japanese companies' freedom from stockholder reaction to low earnings per share and their access to the keiretsu's vast pool of capital allow firms to concentrate

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on establishing, through underpricing, a long-term market share rather than on maximizing short-term profits, as the Americans are forced to do.

The Japanese are indeed trying to break into the advanced IC market, long the private bastion of U.S. companies. Underpricing a competitor, even pricing at a loss, is a traditional strategy for cracking a market, even in the U.S. Production costs per circuit for new devices, including the 16K RAM, typically follow a downward curve — the "learning curve" — where production gets cheaper as the firms learn better ways of making the same product. Learning curves are universally expected in innovating industries, and it has been a common practice among semiconductor producers to price below the learning curve in the early stages of a product's history. This pumps up demand, and the firms recoup their early losses by later holding prices above cost levels. The Japanese, having just entered the market for advanced devices, are in the early stages of their learning curve. Thus they are comfortable in pricing below costs if they must, whereas the American firms, being now much further down their curve, wish to keep prices much higher.

Exclusion

SIA's charge that U.S. companies are excluded from the Japanese market has several shortcomings. First, American semiconductor makers simply have not made an attempt to crack the Japanese market equal to the one the Japanese made to break into the American economy. Years ago Japanese electronics firms, forced by the small potential of their internal market to focus on exporting, devoted considerable energy to acquaint themselves with American business customs, the English language, and overlooked U.S. markets. Indeed, this effort was worthwhile because American was the largest consumer market in the world, making the potential returns quite inviting. American producers, however, rested on their technological lead to encourage Japanese purchases.

The Japanese, in their efforts to sell in the U.S., could take advantage of American cultural heterogeneity. With business protocols as diverse as the racial makeup of the country, idiosyncrasies of Japanese business style have been viewed as simply one among many ways of doing business. The Japanese society, however, is extremely homogeneous, and American business styles stand out as alien. Again and again, American sales efforts have failed in Japan despite fine offers of price and quality, because Americans usually want to complete in a few days business matters that Japanese settle in several weeks of informal negotiations.¹²

Second, while it is true that procurement practices exclude American semiconductor firms from portions of the Japanese market, Japanese producers are excluded from an equally significant share of the American market. In both countries, major consumers of semiconductor components supply much of their need in house, in "captive" production facilities. U.S. firms with captive production include communications firms such as AT&T and Zenith, computer makers such as IBM and Control Data, instrument manufacturers such as Hewlett-Packard and Tektronix, military systems producers such as Boeing, Hughes, Watkins-Johnson, and other firms including General Motors, Xerox, and Eastman-Kodak. In addition, several U.S. merchant semiconductor firms, led by Texas Instruments, supply portions of their output to equipment-producing divisions.

SIA complains that the top Japanese merchant producers — Fujitsu, Hitachi, Matsushita, Nippon Electric, and Toshiba — are also the top Japanese users of semiconductors. They may prefer to buy circuits in house, but that is hardly unfair competition.

SIA wants the U.S. government to force Japan to open to foreign bids the purchasing of quasi-public Nippon Telephone and Telegraph, and it appears to have won some concessions. But the Japanese counter that equal treatment would mean that privately held AT&T, which obtains most of its semiconductors from Western Electric, its manufacturing subsidiary, would also seek competitive bids on the international market.

Third, Japan's historically protectionist policies have been justified by its inferior economic position. Japan has imposed significantly higher tariffs on semiconductors than the U.S. to enable it to develop its own industry. At the end of World War II, the Japanese economy was devastated, while the U.S. was booming. The U.S. used its economic strength to dominate the economies of friend and foe alike in Europe, but for political reasons it allowed Japan's industrial elite to rebuild the keiretsu — although in a more decentralized form — and establish nationalist economic policies.

Now that Japan's electronics industry is virtually on par with its older American counterpart, the U.S. has negotiated a

gradual tariff reduction. Japanese duties on semiconductor imports will equal the American in 1987.

Fourth, despite the numerous formal and informal barriers, whether justified or not, U.S. firms have been selling to the Japanese market. Japan actually imports more semiconductors from the U.S. than it sells there. From 1973 to 1979 the annual trade deficit averaged \$92 million, reaching \$133 million in 1979. In that year the U.S. held 14 percent of the Japanese market, up from 11 percent in 1978, whereas Japan had only 5 percent of the U.S. market.¹³

The technology race

Why then, are SIA members complaining? Perhaps they fear a repeat of Japan's successful domination of the U.S. consumer electronics market. After all, the volume of Japanese semiconductor exports to the U.S. is growing rapidly. Their 1979 market share represented a 20 percent increase over 1978.¹⁴ In the important 16K RAM market, Japan enlarged its market share from 35 percent in 1979 to 42 percent in 1980.¹⁵

SIA claims that the speed of technological advancement indicated by the Japanese "invasion" may allow Japanese semiconductor firms to soon surpass the Americans in innovation, with disastrous results.

The issue of "unfair" competition, then, is perhaps only a device with which the SIA hopes to sway Congress to accept the proposal.

SIA's alarm, however, must be put into perspective. The Japanese have not captured the entire semiconductor market, only a chunk of the 16K RAM segment. American firms still hold a big lead in other segments, especially in the production of advanced devices such as microprocessors, which is predicted to be an increasingly important market in the near future. Although Japan's VLSI Program allowed Japanese firms to produce the 16K RAM, it did not result in any major technological breakthroughs. Furthermore, the participants made all but 30 of the resulting 1000 patents immediately available to U.S. firms through licensing. The remaining 30 were later released by the government, but only covered minor advances.¹⁶ According to Franklin Weinstein of Stanford University's research project in U.S.-Japan semiconductor competition, the VLSI program gave the Japanese technical ability comparable to the Americans only in the production of circuits based on extensive, regular repetition of simple design units, which includes memory circuits.¹⁷ It did not give them, however, the American's proficiency in making circuits of higher complexity logic designs, such as microprocessors and special function chips. Thus there are entire fields of IC production in which the Japanese cannot effectively compete.

SIA members themselves are partially responsible for the Japanese gains in the 16K RAM market. For more than two years, there was a severe shortage of this device, largely because SIA members were reluctant to expand their capacity to keep pace with growing demand. They feared a repeat of major losses they experienced during the recession of 1974-75. By 1974, they had invested heavily in equipment and inventories to meet an apparently insatiable demand for their circuits. When the recession hit, they were forced to liquidate these inventories by cutting prices, devastating their profit margins. Those firms which had financed their expansion through

heavy borrowing were stuck with large fixed payments. Thus, late in the decade, when there was talk of another recession in the early 1980's, SIA members were careful not to risk over-production.

However, the Japanese semiconductor firms, structured to seek long-term market shares, were undaunted by the gloomy short-term outlook. Unlike the Americans, they were rapidly expanding capacity. They were more willing than the Americans to risk short-term losses because their different style of financing frees them from stockholders' reaction to temporary dips in yearly earnings. As it turned out, demand for circuits skyrocketed through the turn of the decade, despite the recession. SIA hesitancy to expand thus left a widening supply gap for the Japanese, especially in the 16K RAM market, when IBM unexpectedly decided to buy large amounts of these crucial circuits from merchant firms instead of its own subsidiaries. SIA members themselves were swamped with more orders than they could fill. To avoid disappointing important customers, they filled these orders with their own circuits and imported Japanese circuits for assembly into their electronic

ing \$10 million to set up today will cost \$34 million by the mid-1980s. The companies' mask aligners for Large Scale Integration, costing \$40,000 just three years ago, have been made obsolete by the advent of Very Large Scale Integration. They have been replaced by devices costing \$500,000.¹⁹ In addition, innovation costs have increased as circuit designs have become more intricate.

Independent SIA members have had difficulty raising funds to meet these new requirements. Fierce competition among themselves has kept sales prices low and profit margins small, limiting both internal financing and prospects for equity sales. SIA blames the Japanese for forcing prices down, but intense competition among American firms developed long before the Japanese onslaught, which has only added competition to a few segments of the market. This explains why SIA is not petitioning Congress for a tariff or quota protection, which it would seek if Japanese competition were the real problem. Instead, they have requested greater depreciation allowances and changes in the capital gains tax laws, both designed to ease their financing. SIA members recognize that they would sim-

Even the traditional neo-classical economic theory of comparative advantage concurs that Japan's scarcity of land, energy and raw materials, and its large pool of skilled labor, make it wiser to specialize in light manufacturing rather than heavy industry.

equipment products, directly adding to the increase in Japanese sales.

SIA members would like to gain a larger share of the Japanese market, but at least until the end of 1980 they could not even meet the demand at home. It is nonsense for them to say that the Japanese have stolen their market when they were able to sell as much as they could produce for more than two years. They have not been forced to sell at a loss because Japanese and American supplies, taken together, still have not been enough to supply the entire market. 16K RAM prices, for example, have hovered around \$10 apiece, although the typical price before the shortage was between \$5 and \$6.

In practice, individual SIA companies are clearly not afraid of the Japanese. Not only do they purchase imported circuits, but SIA member National Semiconductor actually markets Hitachi's computers in the U.S.¹⁸ Other members, such as Fairchild, sold to the Japanese the production and test equipment they needed for their VLSI program. If the Japanese are now a technological threat, SIA has itself to blame.

Capital shortage

SIA members' real concern is not Japanese competition, but a lack of investment capital. The rapid pace of technological change forces competing American IC makers to frequently update their production lines and support continuing R&D programs, while growing markets invite new production capacity. Until recently, the independent firms that comprised the core of SIA were able to raise enough money through high volume sales and stock issues, without having to borrow much.

But equipment costs skyrocketed as the production process became more complex. For example, a wafer fabrication module, which sold for \$2 million five years ago, now costs \$10 million. Motorola estimates that a wafer fabrication plant cost-

ply lose too much if they were to destroy their present interdependence with the Japanese electronics industry by touching off a semiconductor trade war between the two countries. Not only do they buy Japanese chips and export equipment to Japan, but several U.S. companies reap substantial royalties for the patents they have licensed to their overseas competitors. Texas Instruments and Fairchild, for example, received \$5 million and \$3.5 million respectively in the last five years for technology they have leased to the Japanese. Nevertheless, the U.S. uses the threat of protectionism in trade negotiations, to win concessions, such as those designed to open up NTT purchases.

America, Incorporated

If financing has become such a problem for SIA members, why do they not copy the high debt strategy of the Japanese firms? First, the managers of SIA firms are very wary of high debt, not only because of the restrictions such a large fixed cost would place on their output levels, but also because they have been trained in American business schools whose philosophies are based on a much more turbulent business environment than found in Japan. Second, the American economy is characterized by varying levels of antagonism between corporations, labor unions, and the government, whereas in Japan the keiretsu dominate both the government and many labor organizations. Although strikes are rare in the semiconductor industry, SIA managers are still conscious of turmoil in other industries they must depend on, such as transportation. Third, and most important, SIA members are unwilling to accept control by crediting institutions, which necessarily accompanies major loans. The independent semiconductor firms which are the core of SIA are the personal creations of their top managers, many of whom broke away

from larger electronic corporations to establish their own companies. They feel possessive of these firms and are accustomed to the managerial autonomy they enjoy, so they fear the outside control that the Japanese welcome.

Indeed, SIA members have deliberately not pursued the Japanese model of business and innovation because they believe the industry's present organization not only allows for managerial autonomy, but also gives these firms a technological advantage over the Japanese. SIA representatives claim that these small-and-medium-sized semiconductor firms have produced the substantial portion of advancements in IC's. This is largely true. While large organizations such as Bell Labs made the initial breakthroughs in semiconductor technology, smaller firms have pioneered the commercial applications of these breakthroughs and developed them further. These firms have depended upon innovation for survival in the American market and they plan to use their ability to innovate to stay ahead of the Japanese. For example, although Intel's president Robert Noyce told Congress that the Japanese had stolen the 16K RAM market, his firm had in fact deliberately decided to cut production of its current version of 16K RAMs and buy them instead from the Japanese. Intel is focussing its energy on developing the next generation of this circuit, the single power source 16K RAM, which may recapture for the company a profitable chunk of the market.²⁰

SIA members have an additional competitive advantage in innovative ability that the Japanese will need many years to overcome. According to SRI International's president William Miller, the U.S. university system produces a superior grade of graduates capable of "algorithmic approaches to problem solving."²¹ He believes this gives the U.S. the competitive edge in those industries depending on software. This has important implications for SIA members because in the future, as they move further into microprocessor production, the Japanese may be unable to match the Americans in the algorithms that must be programmed into these devices.

Thus SIA members feel that the present structure of the American semiconductor industry is capable of competing with Japanese technology. But because of their financial difficulties, this structure is beginning to disappear. In their desperate need for capital, many of these firms have been acquired, all or in part, by larger corporations. Altogether, some 14 of Silicon Valley's IC makers have been bought, often by European firms that are looking for a quick way to break into microelectronics.²² Loss of control to larger corporations, regardless of national origin, is what SIA members fear most. Unless they can find a quick way to spring some money from the government, the days of the independent semiconductor firm may be over.

In Whose Interest?

The issue of "unfair" Japanese competition, then, is perhaps only a device with which the SIA hopes to sway Congress to accept its proposals. It is a device that has worked for other industries in the past, and it may be much more persuasive than if SIA were to simply say its members are going broke. Congress should realize, as it considers SIA's proposals, that it is being asked to shape the semiconductor industry, which should not be done without a good deal of sober thought. First, the legislators should question SIA's claim that independent firms are an essential source of future semiconductor technology. Texas Instruments, IBM, and Bell Labs are all large corporations that have full command of integrating techniques and continually achieve advancements. Bell Labs is currently working on bubble memory systems which may soon outperform anything that SIA firms have on their drawing boards.

Second, Congress must realize that although American businessmen present SIA's proposal, many SIA firms are not exactly American companies. For example, is Advanced Micro Devices, a vocal member, truly an American firm when it employs over 60 percent of its workers overseas, mostly in Southeast Asia?²³ Furthermore, should Fairchild be considered American when it is entirely owned by a French company, Schlumberger? Indeed, over the past several years, SIA's members have increasingly become less "American," measured by both employment and ownership. They are "American" only because they are headquartered in the U.S., have their R&D and most of their wafer fabrication plants in the U.S., and pay enormous salaries to American managers and engineers. What is good for the SIA may not necessarily be what's good for the U.S.

Finally, we must consider the Japanese position and determine whether they are competing fairly. First of all, what is the meaning of "fair" competition in the anarchy of world capitalism? Fairness might possibly be defined within a single system, but the Japanese-American conflict is a confrontation between systems not contained within a higher system of ethics that can serve as a reference. Neither system can be

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considered free enterprise, for both governments support their respective private sectors. Because the Japanese system is more closely knit, is it unfair? The Japanese are competing the best that they can against an industry that not too long ago controlled the entire world market for advanced I.C.'s. This foreign (U.S.) industry has used its technological lead in the past to devastate important Japanese markets. Americans did not talk of "fairness," however, when IBM overwhelmed the Japanese market with the 360 series computer. Viewed from the Far East, the Americans can still competitively produce a wider range of advanced circuits and are by far more experienced in innovation. Thus the Americans have the potential to claim the cream of the future world electronics market for years to come, if they can cure their temporary financial problems. And there is no reason for the Japanese to assume that SIA will fail to do so, now that it assiduously petitions a federal government which has been so benevolent to semiconductor firms in the past.

1. Charles Sporck, "Courteous Destruction," National Semiconductor Corporation pamphlet.
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4. "Perilous Times for U.S. Microcircuit Makers," *Science*, May 9, 1980, p. 583.
5. "Perilous Times," p. 584.
6. The term *keiretsu* refers to oligopolistic industrial groups that exist in Japan, that is, to both the bank-centered *zaibatsu* and the industrial *konzerns*. For a detailed discussion of the *keiretsu* and their control of the government see Terutomo Ozawa, "Japan's Industrial Groups," *MSU Business Topics*, Autumn, 1980; *1972 Handbook of Japanese Financial/Industrial Combines*, Pacific Basin Reports, San Francisco; and Jon Halliday, *A Political History of Japanese Capitalism*, Monthly Review Press, chapters 8 and 10.
7. "SIA Claims Japanese Semiconductor Firms Are Buying Into U.S. 16-K RAM Market," *Electronics*, October 25, 1979.
8. "Perilous Times," p. 585.
9. Interview with Franklin Weinstein of Stanford University's research project on U.S.-Japanese semiconductor competition.
10. See *U.S.-Japan Trade in the 1970's*, Boston Consulting Group before the Committee on Finance, United States Senate, 1971, pp. 1013-1055.
11. We use a hypothetical 50 percent corporate profit tax rate here to simplify the exposition of this difficult point. This is not to imply, however, that the U.S. tax rate on profits is a simple, flat rate. The base rate is currently 46 percent, but business write-offs, loopholes and shrewd accounting practices considerably lower the effective tax rate for most corporations. Empirically, we observe that the larger the firm, the lower the effective tax rate because larger firms can put more resources into cutting their tax liability (See Richard Barnett, *The Crisis of the Corporation*, Institute for Policy Studies, Wash., D.C., 1975, Chapter 1). The members of SIA, however, are quite small in comparison to the major American corporations and thus find themselves on the high end of the tax rate spectrum. As long as the effective tax rate is significantly higher than the trend interest rate, financing expansion through debt will allow the firms to expand with lower profit margins on sales. See *U.S.-Japan Trade in the 1970's*, pp. 1039-1041.
12. "Will You Take Your Japanese Wet or Dry?" *Electronics*, December 22, 1977.
13. Derived by comparing statistics on trade volume from chart in *Business Week*, December 3, 1979, to figures on the size of total markets found in *Electronics*, January 3, 1980.
14. The literature on the semiconductor industry is plagued by unstandardized and thus highly incongruent statistics on trade and market shares. The increase in the Japanese share of the American domestic market cited here was derived in the same manner as those in footnote 14, and are very conservative. Estimates for the increase in the Japanese market share from 1979 to 1980 range up to 150 percent.
15. Figures for 1979 found in *Electronics*, June 21, 1979; 1980 figures found in testimony by Robert Noyce, cited above.
16. See "Seek 1000 patents in Japan Government VLSI program," *Electronics News*, April 21, 1980; and "Japan Opens VLSI technology to Foreign Firms," in *Asia Record*, June, 1980.
17. Interview with Franklin Weinstein, cited above.
18. See "National Semiconductor to Sign Pact to Market Hitachi CPUs," *Electronics News*, December 24, 1979; and "National Semiconductor Inherits Intel Computer Business," *Peninsula Times Tribune*, September 25, 1979.
19. Statement by Frederick T. Knickerbocker, Deputy Assistant Secretary for Industry Policy, Department of Commerce, before the subcommittee on Banking, Housing and Urban Affairs, January 15, 1980.
20. "Surprise! 16K RAM prices Firm as Seller's Market Emerges" in *Electronics News*, May 14, 1980.
21. William F. Miller, "Computer Science and Our National Economy," *Campus Report*, Stanford University, June 25, 1980.
22. "Perilous Times," p. 583.
23. Advanced Micro Devices' 1979 form 10-K report to the Securities and Exchange Commission.