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Abstract

Maintaining Economic Flexibility -- Policies To Revitalize The Semiconductor Industry

COL E. Gordon Hagewood

This paper discusses the competitive challenges facing U.S. semiconductor and electronics companies. It provides an overview of how the current competitive conditions developed and their effect on economic strength and national security. Policy alternatives are provided which suggest changes to existing law or tax codes, as well as trade positions. The areas of tax law, depreciation reforms, trade negotiation, export controls, personal savings, and industrial alliances are included.

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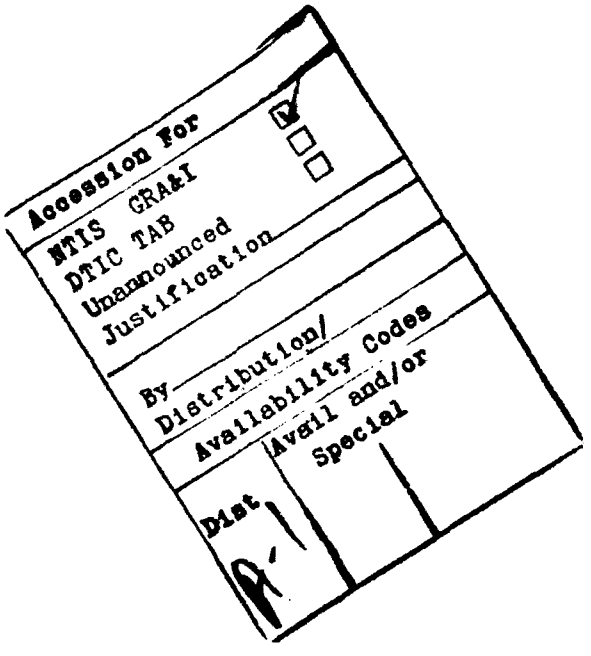

MAINTAINING ECONOMIC FLEXIBILITY -- POLICIES TO REVITALIZE THE SEMICONDUCTOR INDUSTRY

Introduction.

U.S. dependence on foreign (particularly Japanese) electronic components places our long term economic strength in a questionable position. While dialogue continues on this issue, our world position erodes in a variety of electronics related industries. To paraphrase MIT's Charles Ferguson, the endangered species list includes most of the U.S. computer, office equipment, and imaging industries. Ferguson asserts that newcomers (e.g., Apple, Compaq, Conner Peripherals, and Sun Microsystems) and giants (e.g., DEC, Xerox, Hewlett-Packard, and Kodak) are at risk.[1] He further suggests that the "digitization of everything" favors that part of the electronics sector that Japanese industry now dominates: low-cost, mass-produced components that serve as the building blocks for virtually anything related to the information processing industry.[2]

Taking a long term view, this situation may result in a reduction in jobs in our own electronics and semiconductor sector. While this may be offset by growth in other industries, there is no guarantee that these other industries can contribute to national wealth building as does the electronics industry. It seems highly likely that we will experience increased dependence on foreign manufacturers for electronic based systems and components.

Ferguson also points out another development that is often overlooked by those who focus on the semiconductor and electronics industries. Consider the technologies that will be replaced by digital technology. The chemical, mechanical, and optical technologies that formed the basis for a traditional Xerox copier can largely be replaced by a digital laser printer -- with the added advantage that it can communicate with digital computers.[3]

Similar trends are likely to occur with digital cameras replacing the chemical technology based traditional cameras. As the two most costly digital technologies drop in price -- recording media and color laser printers -- the replacement process will accelerate. The competitive advantages of the analog, chemically based, technology that we once dominated will be eclipsed. Moreover, the demand to integrate digital photography with other segments of the information processing industry will favor those who competitively produce the requisite components and interfaces.

With this in mind, consider the implications to national security. The digitization of our high technology weaponry requires components that we either no longer produce or do not produce cost effectively. Semiconductor memory devices, input-output circuits, magnetic and optical disk drives, and flat panel display screens (to identify a few components) are key elements in modern military hardware. Virtually every system that supports our fighting forces, from tactical weapons to strategic command and control, depends on digital electronic

devices to maintain a qualitative advantage over our potential adversaries.

That these devices are not produced here, but rather in Japan or other Asian nations, requires us to examine the implications and to develop polices that will improve our position. As Senator Albert Gore (D., Tenn.) recently stated: "High-technology industries, including electronics, are essential to the economic strength of our nation. If our ability to make advanced products continues to decline, we *risk losing control over our national defense*, and we certainly will lose high-paid manufacturing jobs."[4]

Why are we in this position? What factors do we control? What policy choices do we have? The remainder of this paper will examine these issues and offers public policies for consideration and implementation.

Background.

A detailed, technical, understanding of the factors that have eroded our competitiveness is beyond the scope of this paper. Nevertheless, several important differences between Japanese and American approaches to competitiveness, as well as some insight into our respective governments' involvement, will illustrate some obvious challenges. Having set this backdrop to the competitive stage, I will list a few examples of how relative advantages have reversed in recent years.

- **Hanging Separately:** The hallmark of American business is its individualistic, innovative, approach to the market. Historically, high technology industries have jealously guarded

their proprietary developments in an attempt to ensure market share. Research and development (R&D) agreements, joint manufacturing efforts, and other alliances are only recent, and often poorly targeted, attempts to address foreign competition.

Fundamentally, Americans like to do things on their own terms, be in control, and reap the benefits of this individualistic approach. Roger Levien, Vice President for Xerox Corporation's Strategy Office, views it this way:

> "The idea of shared strategic interests does not seem to be attractive enough ... to overcome the forces of self interest ... that prevent or undo well-meant corporate alliances.[5]

The message from Levien and others is as clear as Pogo's pronouncement that "we have met the enemy and he is us!" Our intense individualism -- especially in cutting edge technologies such as semiconductor design and fabrication -- creates its own set of competitive barriers and is not conducive to risk sharing. We appear to have chosen "hanging separately" over "hanging together."

- **Safety In Numbers:** Contrast this with the situation in Japan. A review of the Japanese approach reveals a more structured partnership philosophy. A small number of large, diversified, vertically integrated corporate complexes dominates the Japanese electronics industry. With revenues ranging from $9 billion to $60 billion each, nine firms control virtually every aspect of the semiconductor, semiconductor equipment,

computer, telecommunications equipment, imaging, office equipment, and consumer electronics sectors.[6]

Most of these companies are linked to at least one of the powerful industrial groups that account for 30% of all Japanese corporate assets, are headed by ten of the world's largest banks, and include the world's seven largest trading companies. These business alliances, known as *keiretsu*, provide both tactical and strategic advantages in the marketplace.[7]

A derivative of the pre-World War II family owned industrial groups, a *keiretsu* is a collection of firms, one from each of a number of industries, usually centered on a lead bank. This lead bank holds equity in, as well as loan claims, on group members. Member firms, in turn, hold equity positions in each other and form strong supply links with group partners.[8] These interlocking arrangements encourage cross-fertilization of R&D, intra-group trading, and protection of group members.[9]

In addition to encouraging the sharing of R&D costs and results, the *keiretsu*, through their equity cross-holdings, form a natural barrier to unfriendly market intrusion or takeover bids. Many *keiretsu* practices would be considered violations of anti-trust laws in the United States and subject to treble damages against an unlucky defendant. The Japanese government, through the Ministry of International Trade and Industry (MITI), supports and encourages the *keiretsu* approach. Ultimately, as Kenichi Ohmae from McKinsey & Co. suggests, "the essence of the *keiretsu* is the strategic alliance, and the fundamental dynamic is risk sharing."[10] This essential difference in structure

between our competing economies, and the underlying philosophy for the *keiretsu* structure, may not appeal to either U.S. business or government, but there is no challenging its historical effectiveness (as we shall see shortly).

- **Brother, Can You Lend Me A Dime?** If the philosophical and structural differences were not enough to secure a competitive advantage, the direct involvement of the Japanese government in funding the computer industry certainly tipped the balance in corporate Japan's favor. From 1961 to 1981, the Japanese government contributed over $6 billion to this single industry.[11] R&D, capital equipment, and working capital pools all benefited from this huge investment. What is particularly striking is its proportion relative to private company investment. The table below shows government investment as a percentage of private computer company investment for three time periods:

Table 1.
Japanese Investment In The Computer Industry[12]

Years	Government Investment As A Percentage Of Private Firm Investment
1960-1969	188%
1970-1975	169%
1976-1981	92%

I can find no parallel in the United States for this proportion or level of funding in any commercial product area. While the Defense Advanced Research Project Agency (DARPA) investment in Very High Speed Integrated Circuits (VHSIC)

amounted to a substantial percentage of what private industry committed, the overall dollar amounts were relatively small. A similar picture emerges when we examine U.S. government investments in R&D "consortia", a topic to be discussed later.

Japanese government investment in computer R&D has declined the last decade. Some argue that investment has merely shifted into related fields, for example digital optics. The enormous increase in private firms' market strength and capital reserves allowed government capital to shift to other industries. Two threads run throughout the readings on this subject: 1) neither private nor public capital availability depends on the promise of short term dividend payments and 2) the Japanese government was committed to underwriting long-term risk.

- **Should We Be Alarmed?:** Have the policies and practices described actually placed our semiconductor and electronics industries in jeopardy? Consider the following:

  - Since 1980, the U.S. semiconductor industry's world market fell from 60% to 35%, and it will probably fall to less than 30% by 1995.[13]

  - By 1987, Japan controlled 80% of the dynamic random access memory (DRAM) market. Japanese firms were willing to sustain $4 billion in losses to buy the market and squeeze out U.S. competition.[14] Only recently has Motorola reentered the DRAM market (in a joint venture with the Japanese giant, Toshiba!).[15]

  - Japanese semiconductor plants now comprise 45 percent of world capacity, up from 15 percent in 1980.[16]

- Flat panel display production (increasingly used in portable command and control equipment, and aircraft fire control displays) is now dominated by Japanese firms. Only IBM is technically competitive -- and its factory is in Japan![17]

- Similar trends emerge in lasers, optical disks, electronic packaging, precision electro-mechanical components, and printed circuit boards.[18]

These components are the essential building blocks for virtually all information technology related products. Moreover, they are vital to our qualitative advantages in military hardware. The cost and technical competitive advantages that the Japanese hold in these areas insure that our semiconductor and electronics industries, as well as our defense industry, will buy Japanese components. To be competitive, a U.S. contractor is forced to take this supply path for both initial procurement and subsequent spares, regardless of whether they are for commercial or military applications.

- **Security Considerations.**

With the Soviet Union no longer the threat that it once was, nations are aligning themselves more regionally than before. This is particularly true in the area of trade. Suppose that some political, moral, or trade dispute develops between the U.S. and Japan (or its Asian trading partners). What policy tools could Japan or other regional powers use to exert leverage against the U.S.? Among other things, they could slow distribution of the high technology components needed for the production or maintenance of our commercial products or

military hardware. Initially, this would affect our second and third tier vendors -- the suppliers to our major commercial products manufacturers and defense contractors. The impact on our supply structure could hamstring our systems integrators and spares providers. Ultimately our commercial sector, and potentially our military operational readiness, would suffer.

The traditional counter argument is that Japan, and Asia in general, values the defense that we provide for the region. The logic continues that our participation in a U.S.-Japanese collective security arrangement is vital to Japan's uninterrupted supply of raw materials and fuel. That may have been more true yesterday than today. With the dissolution of the Soviet Union, how applicable is that logic today? Even if it is true to some extent, will it take less for Japan to become irritated with us given the reduced Soviet threat? How small a dispute would trigger the distribution slowdown described above?

I think that these are the wrong questions. Fundamentally, the question that must be addressed is one of dependence. If we agree that semiconductors, digital electronics, and information related technology comprise a linchpin in our economy and are vital to our national defense, then a more appropriate question becomes: Can we afford to remain so dependent on any nation? I suggest that the answer is no. A utopian world might be guided by Adam Smith's invisible hand and rely on comparative advantage theory to sort out international product mixes. But this is clearly an imperfect economic world.

• **The Laissez Faire Approach:** An alternative exists to today's diverse U.S. semiconductor and electronics industry structure. Howell and his co-authors describe a gradual "consolidation into two or three large vertically integrated firms, such as AT&T and IBM."[19] Howell continues that many believe the "best policy is simply to accept the inevitability of this process and allow it to unfold."[20]

This laissez faire approach to domestic market structure may not produce firms with enough size and clout to compete favorably on an international basis -- especially when we consider the advantages held by our international competitors. Moreover, our strength in the electronics and semiconductor markets may be based as much on the large number of innovative firms that apply leading edge technology on a small scale (the "start-ups") as on the large vertically integrated firms. Howell notes that several countries (including Japan, Korea, and Germany) recognize the unique role that start-up companies play in the process of innovation. These countries are "committing substantial government resources to foster large numbers of start-up companies in microelectronics."[21]

It appears that other governments have recognized the importance of innovative start-ups and are committed to supporting their place in the market. Since the importance of this market segment is a lesson that we in the United States taught our competitors, it is highly unlikely that we would want a market consolidation that resulted in a few giant vertically

integrated firms -- potentially devoid of the leading edge technology developers or slow to respond to innovation.

As Howell suggests, if you accept the notion that foreign government policies have contributed to the relative decline of U.S. competitiveness -- and that a U.S. government response is necessary -- an equally important issue is the type of government policy measures that are needed.[22] This issue has been the subject of much debate -- particularly along the lines of economic philosophy. The philosophical battle lines are drawn even more sharply as we approach a Presidential election year. There are genuine differences among honorable people about the government's role in a process that might pick economic winners and losers. I agree, to a large extent, that this latter role is something our government should not be involved in. However, if you believe that semiconductors and microelectronics components are vital building blocks in our economy -- literally the tools to make tools -- then I suggest that government has a strategic role to play and the tactical tools to support that role.

Policy Discussion

The policy alternatives described in the remainder of this paper are drawn from a variety of sources and include suggestions of my own that expand on them or add specificity. The categories listed below were provided by the National Advisory Committee on Semiconductors (NACS) in their recent February 1992 report to the President and the Congress:

"Attaining Preeminence in Semiconductors." Five major themes dominate the NACS report:[23]

1. Encourage industrial investment
2. Stimulate high volume electronics manufacturing
3. Coordinate precompetitive technology development
4. Promote formation of consortia, alliances, and collaborations
5. Strengthen commitment to high-quality manufacturing skills

I will concentrate on the first of these areas (industrial investment, to include trade policies) with a few comments on the fourth area, consortia and alliances.

- **Industrial Investment:**

NACS suggests a number of policies to attract investment capital to the semiconductor and electronics industries. These include changes to the capital equipment depreciation schedule, an improved and permanent research and development (R&D) tax credit, a move toward a balanced federal budget, a legal and regulatory environment more consistent with foreign competition, and pursuit of fair trade and open world markets.[24]

Depreciation Reforms: Chip and production design technology is estimated to cost between $600 million to $1 billion, with an additional $600 million to $750 million for a commercial scale fabrication plant. Accelerated depreciation of this huge capital investment can go far to make a company an attractive long term investment. By writing off this massive cost in the first two or three years (rather than our current

policy of five or six years, a company's profits would emerge early in the development of its product.

The Japanese recognize this and fully depreciate their costs in three years. This allows them to move into a market share acquisition mode using profits to fund a new generation of products.[25] The NACS report notes the importance of accelerated depreciation and recommends that we adopt the Japanese standard of three years.[26]

As an immediate policy, I would treat semiconductor fabrication plant and equipment capital expenditures as a direct expense. By writing off these costs as they are incurred, a company's taxable income in the first year is reduced, but it is potentially increased in subsequent profitable years. This policy could be implemented for three to nine years (two or three product cycles) and then revert to the Japanese standard -- three years. Investors might be attracted if they know that their return on investment was more realistically aligned with the most potentially profitable portion of a product's life.

Tax Policies - Investment and R&D Tax Credits: The 1986 Tax Reform Act eliminated investment tax credits. As noted earlier, the investment required to build semiconductor fabrication plants is enormous. U.S. firms, despite losses in 1985-86, undertook extensive investments in order to remain competitive in the dynamic ram (DRAM) market.[27] These firms built up ITCs which they could not use in these years because they suffered losses. Unfortunately, the 1986 Act also substantially limited the amount of ITCs that could be carried

forward into subsequent years.[28] Slim profit margins in subsequent years were further narrowed by the limited carry-forward policy. The result in the late 1980s was that many firms could show only marginal (if any) positive return on these massive fabrication plant investments. A substantial contributor to risk-spreading had been eliminated at a time when U.S. semiconductor firms needed help the most. The increasing gap between Japanese and U.S. semiconductor capital spending may be due, in part, to these ITC changes.[29]

The R&D tax credit has historically provided a significant stimulus for R&D. However, this credit is not commensurate with the credits enjoyed by other nations -- particularly Japan.[30] Moreover, the 1986 Act makes this credit a temporary measure and reduces its application from 25% to 20% of the invested amount. The result (as in semiconductor capital spending) is an increasing gap between Japanese and U.S. spending on semiconductor R&D.[31]

Howell, NACS, and others support a return of improved ITCs and R&D tax credits. The limited tax revenue impact of an improved R&D tax credit may be illustrative. Using NACS figures of $1.6B in semiconductor R&D spending (for the top five firms) as a basis, some rather elementary mathematics shows the tax impact of raising R&D credits from 20% to 50%:

20% credit: $1.6B x 20% = $320M in reduced tax revenues.

50% credit: $1.6B x 50% = $800M in reduced tax revenues.

Difference in the plans = $480M in reduced tax revenues.

This $480M reduction in tax revenues is almost insignificant when

compared to a federal budget that requires almost $1.3 *Trillion* in revenues -- *it amounts to less than 4/100ths of 1 percent of required tax revenues*. I believe that the competitive leverage gained by increased R&D spending will ultimately lead to improved profitability and increased corporate taxes -- especially if increased R&D is focused in the area of design and manufacturing technology integration. This area in particular seems to be fundamental to quick-to-market products that are produced with high quality and at low costs -- with competitive levels of productivity.

A similar argument could be made for ITCs on semiconductor capital spending. While the reduction in tax revenues is greater (since the base for capital spending is about $3.2B), the overall impact on tax revenues is still a small percentage of the federal budget. Of interest to us should be that Japan's top five firms are spending almost twice as much as our top five firms in the semiconductor capital investment area. Their dedication to capital investment becomes even more apparent when you realize that their GNP is roughly half of ours. It appears that the Japanese view capital investment as a cornerstone to productivity and wealth building. The almost four to one difference as a percent of GNP is an indicator of this belief.

Tax Policies - Capital Gains Reforms: Mitchell Kertzman (Chairman, American Electronics Association) states that "capital formation is the most serious problem the U.S. electronics industry faces today."[32] With the billion dollar economies of scale required for development and fabrication of semiconductors,

short term thinking will not suffice. The Japanese recognize this and eschew quarterly dividends for the long term returns that only "patient" capital can provide. This, of course, leads to another contentious area: capital-gains reforms.

NACS suggested reduced capital gains taxes in its 1989 report.[33] It is refreshing to see that there is now bipartisan support for reform. Party leaders on both sides support capital-gains tax relief that is targeted toward long-term investors in high-risk, high-technology companies.[34] A recent House of Representatives bill would include a 40% capital-gains exclusion for such investors -- as long as they hold their investment for at least 4 years. Unfortunately, the bill has some rather restrictive conditions: only newly issued stock qualifies; the company must have fewer than 200 employees; it must be a "start-up" company or have a 5 year history of research-intensive business; and R&D spending must be at least 18% of total expenditures.[35]

While the idea is a good one, the restrictions may unnecessarily limit both its attractiveness to investors and its economic impact. I would go much further. At a minimum, I would allow the exclusion to apply to currently held stock on a share-to-share basis with newly acquired stock. For example, I own 200 "old" shares of Delta Electronics. If I purchase 100 "new" shares, then 100 of my "old" shares would qualify for the 40% exclusion if held for at least four years.

The remaining restrictions in the current bill (company size and age) were obviously designed to limit exclusions to investments in small firms. In my opinion, this was a way of showing interest in small business and avoiding the charge of being pro-big business. I would eliminate these qualifiers but would retain the 18% R&D expenditure requirement. While 18% is not a "magic" number, it is almost 6 percentage points above our current R&D investment average of 12.1% -- a 50% increase. As technology cycles become shorter, the need for increased R&D, as well as the money to support it, becomes even more pronounced. Moreover, this high level of R&D expenditures helps identify companies that are committed to our national strengths: innovativeness and risk taking.

Balanced Federal Budget: Our $300 billion federal deficits continue to attract money that could be used for capital investments or R&D. While I agree with NACS that movement toward a balanced budget is a worthwhile goal[36], it is beyond the scope of this paper to offer solutions. Nevertheless, if the government does manage to control its borrowing for consumption, it may also want to provide opportunities for increased personal savings.

I offer an approach that takes advantage of the Federal Reserve Banking System's ability to "increase the money supply." Without describing the mathematics involved, the Federal Reserve's requirement for member banks to hold a certain amount of deposits in reserve is the key to the creation of money. As loans are made by (and deposits made in) member banks, a

multiplicative effect causes the actual amount of money in circulation to increase. Unfortunately, many financial institutions that are not required to hold these reserves have attracted savings (often through more risky and higher paying investment alternatives). These "near banks" do not contribute (directly) to an increased money supply that could be used for capital investment.

There is a simple incentive to attract more private savings to Federal Reserve member banks: allow a personal income tax exemption on any interest earned at a Fed institution. Even with today's low interest, the effective yield might compete closely with such products as money market funds. Moreover, it might attract capital to ailing Federal Savings and Loan institutions that need a strong capital base. It might also help level a playing field that many in the banking industry feel was tilted in favor of the near banks by banking deregulation. Finally, increased deposits can provide needed capital for semiconductor investment.

Trade Policy - Negotiated Agreements: The Semiconductor Agreement of 1988 addresses the problems of "dumping" (selling products abroad at less than actual costs for the purpose of gaining market share) and improved access to Japanese markets. The provision relating to improved access is quoted below:

> "The Government of Japan will impress upon the Japanese producers and users of semiconductors the need to aggressively take advantage of increased market access opportunities in Japan for foreign-based firms which

wish to improve their actual sales performance and position. In turn, the Government of the United States of America will impress upon the U.S. semiconductor producers the need to aggressively pursue every sales opportunity in the Japanese market." *Agreement*, Part I.1.

While some critics feel that the language is weak and difficult to implement or enforce, the alternative of increased protectionism is no more appealing. At least this provision of the Agreement gives U.S. negotiators a point on which they can continue to focus and keep highly visible in all subsequent negotiations.

As an aside to the anti-dumping provisions of the Agreement, Japanese firms were accused in 1991 of dumping active matrix displays in the U.S. market. Rather than try to negotiate a solution along the lines of the Semiconductor Agreement, the U.S. placed tariffs on Japanese-built displays. The response (not unexpected) by U.S. assemblers of laptop computers was to move assembly operations offshore, use Japanese displays imported into the assembly country, and thereby avoid anti-dumping tariffs. The result was (and continues to be) a displacement of jobs from the U.S.

I suggest that a better response to unfair practices is to immediately demand negotiation of infractions as they occur. The concept is to address problems quickly and build a solid foundation of agreement in as many areas as possible. The agreed upon provisions can later be incorporated in more comprehensive

negotiations such as the Semiconductor Agreement. The strength in this approach is that it addresses infractions of perceived fairness as they occur and builds a base of agreed-to policies that can be cited in future negotiations. Further, it keeps the issue of fair and open trade constantly visible. Finally, it helps avoid the kind of response (as cited in the active matrix display example) that is probably not in our long-term economic interests.

Trade Policy - Export Control Changes: Howell considers our security controls on exports to be one of our most serious competitive handicaps.[37] The system of multilateral controls on exports to (formerly) Eastern Bloc nations is conducted through the Coordinating Committee on Multilateral Export Controls (COCOM), consisting of 15 allied nations.[38] A lack of consensus has resulted in major disparities between the U.S. and other members. A brief list of controls required by the U.S. for trade between *friendly western nations* is shown below:[39]

1. License required for re-export from another country
2. Exporters required to screen transactions against list of denied parties
3. Prelicense and/or postshipment check of consignees conducted in country of destination
4. Applies controls to transactions retroactively
5. Requires license for export to other CoCom country

6. Uses national security to deny licenses to free world destinations

7. Estimated average time for licensing West/West Exports in weeks: 4

Neither Japan, Germany, or Great Britain require any of these controls! Moreover, processing time for licenses is only one week in Japan and Great Britain.

Howell and his co-authors present a series of relaxed alternatives that would bring the U.S. more in line with its major trading partners. In fairness, Howell's solution still had a considerable Soviet threat to consider. Given today's realities I would further relax our policies to be no more restrictive that the most restrictive of our major trading partners.

- **Consortia, Alliances, and Collaborations:** A consortium is a R&D effort (usually nonprofit) between companies, industries, universities, and sometimes a state or national government. The goal is help companies and industries maintain or gain a competitive advantage over their international competitors.[40] With the passage of the 1984 Cooperative Research Act, approximately 70 potential consortia filed their intentions to form.[41] This act loosened some of the antitrust rules as they applied to cooperative R&D.

Sematech, a Department of Defense backed group of 14 companies, is one of our first government sponsored attempts at what the Japanese have been doing for years -- spreading the development risk (as well as the rewards) among many firms.

Sematech's goals: to pool resources for precommercial research, to infuse America's small chipmaking-equipment companies with sorely needed cash, and to leapfrog Japan's chipmaking prowess by 1993.[42]

While Sematech's efforts are beginning to bear fruit in the form of improved circuit printing machines, the $100 million federal subsidy ends in 1992. Still, the consortium may reach its goal and "prove that you can make state-of-the-art circuits using all U.S.-built equipment."[43] However, the costs of implementing this technological dream are enormous, as discussed earlier. Even the largest members of Sematech will find it difficult to go it alone. Without further relaxation of the antitrust laws, the results of this consortium may not be realized on a commercial scale.

A radical, yet simple solution, is to suspend all antitrust regulation for any manufacturing and marketing that results from Sematech R&D. This suspension could be time limited (say three to six years -- one or two generations of semiconductors). Moreover, since many smaller firms can not afford the entry fees required by Sematech, these companies could be similarly exempted for work that they do in smaller consortia.

I also recommend continued funding for Sematech. Recalling the $100 million subsidy to Sematech, you may think that our government is doing its share to underwrite joint R&D. This funding looks rather paltry when contrasted with the $5 billion that Europeans appropriated for their microelectronics consortium.[44]

Despite the obvious advantages of a continued infusion of capital, an increase in direct government funding faces tough opposition in Congress. With massive budget deficits, direct funding is politically visible. According to the Electronics Industry Association, the House Ways and Means Committee response was: "Hey, we've got a deficit right now. What do you want us to cut out to fund your program?"[45] We can expect an even tougher line in an election year. Nevertheless, Senate legislation proposes a five year continuance of Sematech and funding at $80M per year. A Senate staff member felt confidant that the Conference Comittee would support an increase to $100M per year, the current funding level.

Summary:

While there are other options that could be offered (development of U.S. *Keiretsu*, for example), I have concentrated on those that allow us to change existing legislation. I purposely avoided options that I think would require more than 10 years to show results. The necessity to concentrate on independence in the short term is driven by the current economic situation as well as the potential impact on national security if nothing is done.

Protectionism will do nothing to improve our real competitive position in the electronics industry. The interlocking nature of our electronics economy with Japan's is simply to tightly meshed to allow "surgical" protectionist policies. Increased direct government funding in the face of today's budget deficits will simply not be considered in an

election year. However, there are encouraging indications that the Congress will continue Sematech for another five years at about the same level of funding.

I firmly believe that investment capital formation is the key to both short and long run success. I think that we must also recognize that competing in a world market (where the players abide by different rules) is different than in the domestic market. Finally, a company and industry that can return profits earlier in the product cycle will attract investment.

This suggests a combination of the investment and R&D tax credits, capital gains reforms, antitrust changes, and depreciation reforms described above. Targeted capital-gains of the type that I described would cause immediate capital formation. Moreover, this option may be politically feasible given bipartisan support for some form of targeted capital gains. Recall that my proposal would exclude 40% of the capital gains for new stock issues held for four years. It would require that companies demonstrate a high level of R&D investment (18% of total expenditures). It would allow similar treatment for "old" stock on a one-for-one basis with "new" stock. This may be a bargaining chip that could be exchanged for the "small company" approach suggested by the Democratic leadership.

Closely tied to the capital formation policy is the ability to exploit R&D results at levels that make economic sense. Additional R&D investment could be generated by the 50 percent R&D credit described earlier. Investment tax credits on a

similar scale would help reduce the risk of capital expenditures. We could then adopt policies that further spread production risk. This would require the temporary suspension of antitrust laws as they apply to manufacturing and marketing in the electronic component sector. This would allow the industry to get its foot back in the door with an innovative product line and in manufactured quantities that have competitive unit costs.

Capital formation is closely tied to return on investment. We can spur accelerated return on investment by allowing first year write-offs of semiconductor plant and equipment costs. This accelerated profit potential will draw even more private investment to the industry. This could be targeted to two or three product cycles and then be set at three years.

There may have been some justification for our restrictive export control policies during the Cold War. The Cold War is over and we need to adjust our policies. At a minimum, we should help insure our competitiveness by adopting controls that are no more strict than our major trading partners.

With these incentives it is possible that the American semiconductor and electronics industries will be a major and expanding sector of our economy. More importantly, we will have the capability to produce our own components for high technology commercial products and military hardware, thus reducing dependence on foreign producers. This is key to maintaining and improving our position in the information technology arena. It also insures a technically capable and strategically flexible military component of our national strategy.

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