Japan competition and trade in the global semiconductor industry

Business, Industries

1. Executive Summary

U. S -Japan relationship intechnological progressis essential for the long-term growth of the countries economy at a rising standard of living. It is also essential to the continued competitive success of U. S. - Japan industry on global markets.

Both countries U. S. and Japan have been carefully designed for success, especially in their focus on generic and enabling technologies, in their linkages to civilian market requirements, in their targeting of clear instances of private marketfailure, in their careful efforts at self-assessment -- and perhaps most important, in their focus on generating domestic-based activities, infrastructures, and work-forces that embed long-term technical progress and ensure localized spillovers for the domestic economy.

The major objective of the Semiconductor Industry cases of the U. S. and Japan can be interpreted in the following ways:

* To illustrate the dynamics of global competition as two major national high-technologyindustries battle for market share and survival

* To teach how private firms and their trade organizations, in two different state- market environments, react to trade conflicts

* To illustrate how private firms and their trade organizations attempt to influence public policy in order to achieve market results

* To explain the dynamics of international negotiations involving several nations' industries

* To explain how industry-interest groups are often composed of different types of firms and interests, and

* To explain how a domestic industry interacts with its domestic customers and suppliers during a trade conflict, where each has its own interests in foreign markets

U. S. - Japan Competition and Trade in the Global Semiconductor Industry case has drawn a high level of attention due to a number of unique events, the terms of the three agreements, and global industry outcomes. Because of these elements, the U. S.-Japan Semiconductor Trade Agreements (1986, 1991, and 1996) have been the subject of numerous short cases at various points in the overall 20-year period of U. S.-Japan trade conflicts in semiconductors. For nearly three decades following World War II, the United States reigned supreme in all high technology and knowledge-based industries, including electronics. But by the mid-1960s this began to change, and by the end of the 1970s, the Japanese had replaced American firms as the dominant firms in the U. S. consumer electronics market. The production and sale of products such as television, video games, and radios, all came under the domination of Panasonic, Nintendo, Sony, Matsushita, and other Japanese manufacturers. And the threat to American manufacturers in the various fields of electronics products did not stop with consumer products.

In 1986, Japan became the world's largest producer of semiconductors as well as the largest market for semiconductors. The trend was felt in the United States as nine of the 11 U. S. DRAM producers left the market,

resulting in Japan's world dominance of this largest market for semiconductor products. The EPROM producers in both Japan and the United States suffered great losses as well. At this time, there appeared to be no signs of relief for U. S. semiconductor producers.

The U. S.-Japan Semiconductor Agreement that was formally signed in September 1986 had three basic conditions.

The first condition was that Japanese firms would stop dumping in all world markets, not merely the U. S. market. This was a precedent setting condition since it was a bilateral agreement that governed behavior in third-country markets. In addition, the Japanese firms were to maintain detailed cost records that were to be the basis under which each firm would set a " fair market value" (FMV). The FMV became the selling price for the firm, as it was based on the total cost of production plus an 8% profit. Each firm could sell at any price as long as the price was at or greater than its " fair market value" (FMV). Thus an efficient Japanese firm could sell below its U. S. or Japanese competitor's prices so long as its price was above the calculated FMV for its product.

The second condition of the U. S.-Japan Semiconductor Agreement was that Japan would encourage and expect that foreign semiconductor firms achieve an increased share of the Japan market. A specific target market share for foreign firms of 20% was included in a side letter to the agreement. Though the side letter was considered to be a secret, in time it would become the SIA's quantitative measure of compliance by Japanese firms.

The third condition of the agreement was that the U. S. government would suspend the antidumping duties estimated to be as high as $1 billion. Consequently the agreement balanced Japan's promise to cease dumping and to open its market in return for a suspension of the hundreds of millions of dollars in penalties. It was expected that full compliance with the first two terms of the agreement would take the Japanese firms some time to achieve.

The Semiconductor Industry Association (SIA) and the U. S. Government wanted it extended, but the Electronic Industries Association of Japan (EIAJ[HT(1]) wanted it buried. In the United States, free-trade proponents opposed the extension of the agreement. They argued that it represented managed trade. " This whole thing is nothing more than a government-supported cartel. The semiconductor industry has relied on government protection rather than develop international competitive strategies," said Bryan T. Johnson, a policy analyst at the Heritage Foundation. However, the Computer Systems Policy Project (CSPP) supported the U. S. semiconductor industry's desire to extend the agreement. Robert Palmer, vice president of manufacturing at Digital and a CSPP member said, " Managed trade is the way of the world. No industrial nation can afford to become totally dependent on another for integrated circuits."

Although the Bush administration opposed managed trade, it, along with Congress, continued to exert pressure on Japan over various trade issues. But in response to this pressure, many Japanese believed that they should stand up to the United States. A book The Japan That Can Say No, written by Shintaro Ishihara, an LDP member of the Diet created a stir both in Japan and

in the United States. Various factions, in the United States and Japan began to position themselves with regard to the agreement. With the approaching expiration of the Semiconductor trade Agreement (STA), it was obvious to all that the expected 20% foreign share in Japan's market could not materialize. Therefore, in spite of opposition, the second agreement was signed in July 1991. At that time, the 20% " expectation" was included in the formal agreement, with the deadline for achieving this target extended from July 1991 to December 1992. The fair market values (FMVs) were discontinued, and all remaining sanctions were eliminated.

2. Evolution of the Semiconductor Industry

The Semiconductor Industry was born with the invention of the transistor at Bell Telephone laboratories in 1947. In 1947, William B. Shockley and a team of Bell Laboratory engineers devised the solid state transistors, one of the most technologically dynamic industries of modern times, (Hill. p. 301). The transistor was first commercialized in the 1950s by the U. S. firms, and it soon becomes a major component of electronic products.

In 1954, Texas Instruments discovered how to make transistors out of silicon, which quickly capsulated the company to a positionleadership.

In the 1960s, the transistor was replaced by the integrated circuit. Like the transistor, the integrated circuit was first developed and commercialized by U. S. firms. Today, semiconductors are the main components of numerous electric products including computers, photocopiers, and telecommunication

equipment. In addition, they are increasingly finding their way into a host of other products from automobiles to machine tools.

Semiconductors can be divided into several broad products, the most important of which are: memory devices, such as DRAM (Dynamic Random Access Memory Chips), and logic chips, such as the microprocessor and micro controllers. The total world markets for semiconductor stood at $35 million in 1998, reached $91. 5 billion in 1994, increased to $ 122 billion in 1998, and hit $ 204 billion in 2000.

During the three decades following World War II, America was the leader in the commercial development and production of semiconductors. Semiconductors, which include early vacuum tubes, transistors, and today's microchips, have been critical components in most electronic products. Today's principal semiconductors are memory and logic chips. Memory chips store information created through mechanical computation; logic chips perform the actual computations that generate the information. These chips are separated into categories based on the amount of memory and computational capacity.

A 256K chip, for example, can hold 256, 000 bytes -- or units -- of information, while a 64K chip can hold only 64, 000 bytes of information. A 1-meg chip holds 1, 000, 000 bytes of information while a 4-meg chip holds 4, 000, 000 bytes. These chips are used in appliances, automobiles, calculators, industrial equipment and machinery, personal computers, video games, and other products.

At the insistence of the United States, in 1986 Japan agreed to limit its exports of semiconductors, mainly the " dynamic random access memory" (DRAM) chips, to America. These chips are used in high- tech consumer electronics equipment like computers and videocassette recorders. The 1986 chip agreement, after all, restricts trade, ostensibly to help some American segments of the semiconductor industry. The agreement in fact has harmed American computer manufacturers, who have found they paying higher prices for computer chips. This makes American computer manufacturers less competitive and drives up computer prices for all Americans.

In 1975, U. S. merchant producers (companies that make chips to sell to others rather than just for their own internal use) had 100 percent of the U. S. DRAM market. In 1986, they had 5 percent of that market. When all chips sold by merchant producers are taken into account, the U. S. producers' market share declined from 60 percent in 1975 to less than 50 percent in 1985, while the Japanese share rose from 20 percent to 40 percent in the same period.

In 1986, the U. S. and Japan signed the Semiconductor Trade Agreement, under which the Japanese promised to take steps designed to alleviate the plight of American chipmakers. In February 1987, the Department of Defense's DefenseScienceBoard issued its " Report on Defense Semiconductor Dependency," which asserted military reasons for protecting and Strengthening America's semiconductor industry; and, finally, in April 1987, in response to Japanese violations of the 1986 Semiconductor Trade Agreement, the U. S. government imposed trade sanctions on Japanese

imports; and, currently, the congressional trade bill would authorize $500 million tofinanceSematech, a government-industry research consortium to develop new semiconductor manufacturing techniques, a proposal advanced by the SIA and then by the Defense Science Board. This, of course, is not the first time foreign trade and protectionism have been discussed in the United States, and will certainly not be the last. In 1987, however, the industry was in transition.

3. U. S Vs. Japan Market Analysis

U. S enterprises dominated the world market from the 1950s until the early 1980s. At the height of U. S success in the mid 1970s, U. S. firms held close to 70 percent of the world market. During the 1980s, however, the market share of U. S. firms plummeted, falling to 29 percent by 1980, while the share held by Japanese producers rose from 24 percent at the end of the 1970s to 49 percent by 1990.

By the end of the 1980s, the United States was net importer of semiconductor, while 5 of the 10 largest semiconductor products were Japanese. More significantly still, by 1988 Japanese firms had captured more than 80 percent of the world market for the most widely used integrated circuit in digital equipment, the DRAM.

In the early 1970s the U. S. held 60 percent of the world market in semiconductors, 95 percent of the American domestic market and 25 percent of the Japanese market.

By 1982, the U. S. control had fallen to 51 percent of the world market in semiconductors; the Japanese had 35 percent, up from about 15 percent in the early 1970s.

By 1989, the U. S. and Japanese positions were reversed, with American firms holding 35 percent of the world market and the Japanese 51 percent.

This trend of the loss of U. S. market share of semiconductors led to political action in the middle of the 1980s. By 1985, U. S. manufacturers were importing record numbers of computer chips, especially the lower capacity Dynamic Random Access Memory (DRAM) and Erasable Programmable Read Only Memory (EPROM) chips, from Japan to meet their production needs. In that year, Japanese firms accounted for 92 percent of the sales of the 256K chips in the U. S. market.

American semiconductor manufacturers, such as Intel Corporation and National Semiconductor Corporation, responded to increased imports by seeking U. S. government restraints on imports. They claimed that to become competitive, they had to be protected from foreign competition. The American firms maintained that their Japanese counterparts engaged in unfair business practices and perhaps were receiving help from the Japanese government. The American firms also claimed that the Japanese firms were " dumping" computer chips in the U. S. and other foreign markets, that is, selling them below the costs of production.