4

The Supercomputer Story

Background

In the spring of 1996, the University Corporation for Atmospheric Research (UCAR), an agency funded by the National Science Foundation (NSF), signaled its intention to award a $32.25 million contract for a supercomputer system to NEC, a Japanese company. When UCAR's intention became known, Cray, the leading U.S. supercomputer manufacturer, immediately went into action—first lobbying Congress to prevent the award and ultimately filing an antidumping petition with the Commerce Department alleging that NEC was dumping in order to force American manufacturers out of the market (Maur and Messerlin 1999).

Even before the formal petition, two highly significant political events occurred. First, Congressman David Obey (D-WI), who represented Cray, introduced an amendment, which the House of Representatives passed, that would have withheld the salaries of NSF personnel if they awarded the contract to the Japanese company. At the same time, on their own, political officials at the Commerce Department launched an investigation that concluded—to no one's surprise—that dumping existed. An assistant secretary of commerce also informed the NSF that the NEC sale would "threaten the U.S. supercomputer industry with material injury"—a determination that only the USITC is supposed to make after a careful analysis of market conditions (Goldman 1996; Maggs 1996, 1997; *Inside U.S. Trade* May 24, 1996; Dumler 1997).

Despite the charged political atmosphere, NSF officials pushed ahead with plans to award the contract to NEC. They did so for two reasons: First, NSF's trade consultant concluded (contrary to Commerce's finding) that dumping had not occurred. Second, NSF officials steadfastly believed NEC had submitted a much superior bid. They reaffirmed this belief (despite congressional threats to their salaries) throughout the proceedings that followed. Indeed, much later in the USITC final hearings, the director of the competitive bid process stated that the Cray machine met only one of four technical criteria of the contract. For that reason, UCAR concluded that NEC "offered and demonstrated overwhelmingly superior technical performance and low risk relative to Cray" (*Inside U.S. Trade* August 2, 1996).

Subsequently, the Commerce Department found a dumping margin of 454 percent, and the USITC followed with a determination of "material injury." Interestingly, unlike other Japanese companies in other proceedings, NEC throughout the process took bold and defiant stances—actually to the discomfort and dismay of the Ministry of International Trade and Industry, which feared American retaliation on other trade and diplomatic issues. NEC refused to cooperate with the Commerce Department during the proceedings and publicly stated that Cray had not—and could not—meet the bid requirements. It directly challenged the handling of the case, and appealed the department's and the USITC's final determinations to the Court of International Trade and then to a federal circuit court, arguing in part that political intervention had corrupted the decision-making process. Ultimately, NEC lost the appeals, and the antidumping duties went into effect (U.S. International Trade Commission 1999b).

The supercomputer proceedings teach a remarkable series of lessons, some of which duplicate lessons from the experience in semiconductors and advanced flat-panel displays. With supercomputers, as with semiconductors and flat panels, government officials either never understood or willfully ignored the structure of the industry and the nature of worldwide competition in the sector. With supercomputers, as with semiconductors and flat panels, they seemed blissfully unaware of technological trajectories in the industry. Knowledge of industry structure and competition, as well as future technological pathways, demonstrate how unlikely (if not impossible) it is for predatory tactics—the only real justification for antidumping actions—to succeed in this industry.

The Structure of the Supercomputer Industry and the Nature of Competition

Industrial policy proponents, who argue that antidumping is a key tool for "leveling the playing field" and allowing U.S. firms to keep up with foreign (particularly Asian) competitors, have identified supercomputers (and specifically Cray, as the leading American company in the area) as strategic assets that must be protected at all costs. With supercomputers and other high-tech electronic sectors, they despaired of matching the *keiretsu* system (a system of close ties among producers and suppliers) of Japanese companies, which benefit from strong financial ties and low costs of capital. As industrial policy advocate Maria Anchordoguy has lamented, Japanese "corporate structure seems to be more suitable to the development of high-cost, high-risk technologies such as supercomputers" (Anchordoguy 1994, 39).

Yet the record of recent years belies these gloom and doom forecasts, even as it raises doubts about the use of antidumping as an industrial policy tool for the United States. A look at the evolving structure of the supercomputer industry and who is competing with whom in that market illustrates why this is so.

Supercomputers are often divided into three main categories based on processor architecture (the key input of the machines): vector processors and parallel vector processors (PVPs), massively parallel processors (MPPs) and symmetric multiprocessor systems (SMPs).[3] The Cray and NEC computers that formed the basis of the antidumping action were both vector computers; significantly, the USITC confined the affected market for calculating antidumping margins narrowly to vector computers.

Processors used in supercomputers can be divided into two categories: "off-the-shelf" processors and custom processors. Custom processors are used in PVPs; they are very powerful chips designed for a specific architecture. "Off-the-shelf" processors are basically commodity chips, and are used in MPPs and SMPs. Large semiconductor manufacturers make them for use in both supercomputers and for less advanced mainframes and servers. Supercomputers made with them are substantially cheaper than those with custom chips, but until recently they lacked the flexibility and capability of custom processors. That situation is changing rapidly and will form a key part of our story.

Changes in technology and resulting shifts in market structure, with the entrance of new players, highlight the general absurdity of U.S. antidumping analysis and the inability of government officials to fathom not only trends in the distant future but also short-term trends right under their noses. A recent study by Jean-Christophe Maur and Patrick Messerlin has calculated changes in the markets for various supercomputer technologies, as well as the growth of computing power. They trace the steeply rising total capacity of supercomputers in the mid-1990s, with huge increases between 1995 and 1997 (the period of the antidumping investigation) resulting from the introduction of RISC technology for MPPs and a new generation of parallel vector systems. Of greater significance for the Cray/NEC case is the revolution that occurred in the competition between vector and non-vector supercomputers. Astonishingly, the share of the supercomputer market supplied by vector computers dropped from almost 35 percent in 1993 to 1.2 percent in 1999, rendering the competitive struggle between Cray and NEC vector computers virtually irrelevant to true market trajectories (Maur and Messerlin 1999).

Further, because of technological leaps, particularly with regard to MPPs, the global supercomputer industry experienced major structural changes. First, new companies entered the market, most of which were large established electronic or computer firms such as IBM, Hewlett-Packard, Intel, and Sun Microsystems. The reason for their sudden appearance was that their position in "off-the-shelf" processors allowed them to gain a footing in the supercomputer market. In addition, because of the squeeze from new competition, the industry concentrated, with Cray being absorbed by SGI, Convex by Hewlett-Packard, and Digital by Compaq. Today, they share the bulk of the world market with Cray (SGI), the historic industry leader (U.S. National Science and Technology Council 1999; Maur and Messerlin 1999).

Finally, there is Cray's charge that NEC's UCAR bid was part of a pattern of Japanese predatory dumping. In a press release, SGI stated: "Japanese vendors of supercomputers are attempting to drive U.S. competition from the market by establishing unsustainable low prices for such systems" (Maur and Messerlin 1999, 7). (This is close to the textbook definition of predation—that is, decrease prices in order to drive competition out of business and introduce even larger monopoly prices afterward.) What is the likelihood that NEC could have pulled off this feat? First, let us examine the entire supercomputer market and then narrow the focus to vector supercomputers.

In assessing the potential for successful predation, there are several tests that can be introduced: Is there the possibility of large market power in the U.S. market? Is there the possibility of large market power in the world market? Is there collusion among Japanese firms? Are there significant barriers to entry into the sector? None of these tests is positive for Japanese supercomputer firms.

First, the Japanese share of the total supercomputer market in the United States ran between 2 and 3 percent during the 1990s. Second, the market share of Japanese supercomputers worldwide was about 15 percent, again an unlikely base from which to embark upon predation.

Regarding the potential collusion among Japanese supercomputer firms, NEC, Hitachi, and Fujitsu are about the same size in terms of capacity installed, and industry specialists cite evidence that they compete vigorously in foreign markets. At the same time, Hitachi has turned away from vector supercomputers entirely, while Fujitsu and NEC generally pursue different end-use capabilities. Finally, given the sizable numbers of new entrants into the supercomputer fields, clearly barriers to entry are not high or offputting (U.S. International Trade Commission 1999).

There is, however, one ironic potential result of the antidumping assault on Japanese companies. With Japanese market share stagnant or falling in America (and around the world), and with the industry consolidation that is proceeding apace in the United States, a growing risk of anticompetitive behavior by U.S. firms is not impossible. In other words, the antidumping system essentially protects U.S. supercomputer manufacturers from all foreign competition.