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Trends in High-Technology Trade

Competition: The Key to Innovation

Two factors have played a pivotal role in fostering the growth of high-technology industries. The first is an education system that nurtures creative individuals and allows them the freedom to innovate. The second factor, competition and the ability to reap rewards from success, is less readily apparent. While individual inventors may be willing to take years to bring a product to market, the investors who are so critical to providing the necessary capital for R&D are not. And while inventors may in some cases have such a passionate devotion to their profession that they are less interested in and willing to eschew financial remuneration, the investors who provide the capital to fund advances are guided primarily by profit motive.

Competition has spurred innovation. This is particularly so in high-technology sectors because the product life of many new technologies is short. A defining characteristic of high-technology sectors is that in some form or other they seem to be subject to “Moore’s Law,” which as noted above states that the amount of performance received per dollar spent doubles every eighteen months because of technical innovation. Computers built three years ago are now largely obsolete. Older computer chips are now almost worthless as improvements in the techniques of electronic data storage allow businesses and consumers to store ever-increasing amounts of data on ever-smaller microchips. Or think of a company that relied solely on selling, for example, hand-held calculators (which cost, on average, one hundred dollars in 1972). If that company did not invest in R&D to expand the range of functions the calculator could perform, it would be out of business. In the year 2002, there are hand-held units that, in addition to performing the functions of a calculator, serve as your appointment and address book, allow you to send and receive electronic mail, and store large amounts of data. In short, one must constantly innovate or be swept aside.

The Globalization of High-Technology Trade

In the 1950s and 1960s, the United States clearly enjoyed a comparative advantage in many high-technology sectors, and the American economy was the envy of the world—so much so that foreign businessmen at the time were fearful that by 1980 the Americans would have a monopoly on science, knowledge, and power. That did not happen. In the 1970s and 1980s, many European and East Asian companies' R&D expenditures began outpacing their American competitors. Not surprisingly, both regions developed a range of new, innovative products.

While many variables influence productivity growth, it is clear that lower investments in R&D are strongly correlated with lower productivity growth rates. In the 1950s and 1960s, when American R&D expenditures were growing at 6 percent per year, productivity growth for the private sector averaged around 2.75 percent annually. In the 1970s and 1980s, when U.S. investment in R&D first declined and then registered only small real annual gains, productivity for the private sector averaged around 1.2 percent annually (Scherer 1992; Boskin and Lau 1996). A direct consequence of this economic malaise was the palpable fear that the United States was losing its competitive edge. Some even went so far as to say, "The Cold War is over and Japan won" (Johnson 1995). Others predicted that the U.S. economy would be "hollowed out" and that Americans would trade "low value" goods for "higher value" goods made overseas.

In the first decade of the twenty-first century, it is clear that the above prediction was far off the mark. In the late 1990s, total R&D spending in the United States grew at an annual rate of just under 6 percent, while productivity averaged 2.6 percent growth between 1995 and 2001. In high-tech sectors from biotechnology to high-end electronics (computer systems, software, telecommunications), U.S. industries far outdistanced world competitors. The January 2001 Economic Report of the President described the combination of factors that produced these beneficent economic results:

Why, then is the U.S. economy awash in technology? The evidence suggests that the combination of increased competition-driven demand for technology, thriving financial markets, increased public and private R&D, and legal protection have created a uniquely favorable climate for entrepreneurship in the technology sector. . . . It is not any one of these factors in isolation but rather the convergence of the favorable conditions that has led to the recent surge in technological innovation. Technology flourishes

when markets are allowed to work, and where government policy provides essential support. (Council of Economic Advisors 2001, 119–120)

It should be noted, finally, that even with the bursting of the “dot.com” bubble in 2001, U.S. productivity growth has remained above 3 percent, and the United States remains at the top competitively in the sectors it came to dominate in the 1990s (Council of Economic Advisors 2003). Capital goods, which are composed largely of high-technology goods, still constitute over 40 percent of U.S. exports.

To be sure, the specific response of U.S. companies to the challenge of increased foreign competition varies by both industry and individual firms. In a variety of ways, though, firms are interacting and seizing opportunities that the increasingly global economy offers. Whether through joint ventures, wholly owned subsidiaries, or even establishment of plants overseas to produce a product (or part of a product), a number of companies are reaping the benefits of globalization.

High-tech companies in particular are becoming increasingly global. For many such companies, there is an emerging international division of labor, in which countries can specialize in the manufacture of individual components for complex products, rather than the entire product. Some companies, for example, have set up research facilities overseas with impressive results. Swiss and German scientists based in Switzerland but working for IBM, for example, made key breakthroughs on high-temperature superconductivity. Similarly, Texas Instruments’ software has engineering laboratories in India, while Toyota has a major research center in southern California.

The specifics of the four industries surveyed here—supercomputers, flat panels, DRAMs, and steel—are discussed below. The broader point, though, is that increased foreign competition has greatly benefited the companies that have risen to the challenge. To be sure, companies have to work harder, be more savvy, and break new technological frontiers, but the payoff is quite large. In the words of one of the world’s leading economists, Frederick M. Scherer:

As more and more nations have elected to play the trading game according to the new high-technology rules, participants have had to run twice as fast in order to secure the rewards of leadership—substantial export and foreign subsidiary sales, supra-normal profit margins, and for employees, compensation providing the purchasing power to enjoy a high and improving standard of living. (Scherer 1992, 173)