

5 Globalizing Industrial Research and Development

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Executive Summary

Research and development (R&D) spending in the United States by foreign-owned companies is now more than \$17 billion, substantially higher than in 1990. This report, an expanded and updated version of our earlier study, sheds important light on the magnitude, nature, and scope of this investment (see Dalton and Serapio 1995). It also explores the major factors influencing the location decisions of foreign R&D facilities in the United States. This information is important in increasing our understanding of the dynamics of R&D as well as the flow of high-value-added jobs.

In a complementary trend to increased foreign R&D investment in the United States, U.S. companies have substantially increased their R&D spending abroad, more than tripling it between 1986 and 1997. Relative to domestic spending, R&D performed in other countries represents nearly 11 percent of the total, up from 5 percent a decade ago. The overall globalization of the R&D enterprise is illustrated clearly by the actions of both U.S. and foreign firms.

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Investment motivations for U.S. R&D abroad and for foreign R&D in the United States are strikingly similar. These motivations range from assisting the parent company to meet host country customer needs and monitor technological developments, to allowing the firms to take advantage of specialized skills in the host country. U.S. and foreign companies primarily conduct applied research abroad. The pharmaceutical and biotechnology industries also carry out large-scale basic research in offshore locations.

Foreign R&D Investments in the United States: Key Findings

- R&D expenditures by foreign-owned companies in the United States tripled from \$6.5 billion in 1987 to \$19.7 billion in 1997, and accounted for nearly 15 percent of total company-funded R&D.* R&D spending by foreign-owned companies in the United States increased at a faster pace than domestic R&D spending in the past 15 years, but domestic R&D spending began to outpace foreign R&D growth since 1996.
- Foreign companies accelerated the establishment and acquisition of R&D facilities in the United States in the 1990s. At the end of 1998, foreign companies owned 715 facilities designated as R&D centers in the United States. These facilities are owned by 375 foreign parent companies.
- The 251 Japanese R&D facilities in the United States outnumber the U.S. R&D facilities in other countries. Germany has the second largest number of facilities (107), followed by the United Kingdom (103) and France (44). The number of U.S. R&D facilities owned by Korean parent companies has more than doubled, from about a dozen in 1992 to 32 in 1998.
- At the end of 1997, foreign-owned companies conducting R&D in the United States employed more than 115,700 R&D workers.

*Figures for 1997 are the most recent available as of September 1999 for foreign R&D expenditures in the United States and U.S. R&D expenditures abroad.

- Switzerland and Germany rank first in R&D expenditures by foreign companies in the United States, with \$3.3 billion in 1997, followed by Japan (\$3.2 billion) and the United Kingdom (\$3.1 billion).
- The largest recent impact on R&D spending by foreign companies in the United States resulted from several major acquisitions by foreign firms of U.S. pharmaceutical and biotechnology companies with large R&D budgets.
- Industries with the largest number of foreign facilities in the United States are drug and biotechnology (116), chemical and rubber (115), computer software (54), automotive (54), and medical device and instrumentation (53). Japanese firms have the largest number of R&D facilities in the automotive and electronics industries.
- Foreign R&D facilities in the United States are heavily concentrated in certain areas, such as Silicon Valley and greater Los Angeles (CA), Detroit (MI), Princeton (NJ), Research Triangle Park (NC), and Boston (MA).
- The most frequently cited reasons for investing are (1) to assist parent companies in meeting U.S. customer needs; (2) to keep abreast of technological developments in the United States; (3) to employ U.S. scientists and engineers; and (4) to cooperate with other U.S. R&D laboratories.

U.S. R&D Investments Abroad: Key Findings

- U.S. companies have increased their R&D spending abroad from \$5.2 billion in 1987 to \$14.1 billion in 1997, and represent nearly 11 percent of R&D performed in the United States. More than half of U.S. R&D expenditures abroad are accounted for by five countries: Germany, United Kingdom, Canada, France, and Japan.
- In recent years, R&D spending by U.S. affiliates in newly industrializing or developing countries, including Singapore, Brazil, China, and Mexico, has increased.

- Several major studies show that, while the amount of U.S. R&D abroad has increased, leading-edge R&D on a company's core technology almost inevitably is still performed at home. Nearly 90 percent of R&D expenditures by U.S. companies still is spent at their facilities in the United States.
- In 1997, most of the expenditures on U.S. R&D abroad were concentrated in drugs, automotive, computers, and electronic components.
- The drug industry showed the most global R&D, with a ratio of 30 percent of U.S. R&D abroad to 49 percent of R&D performed by foreign companies in the United States. The U.S. auto industry performs nearly 25 percent of R&D in Europe to develop cars and diesel engines for the European market, but the foreign share of U.S. R&D is only 5 percent.
- Of the 186 U.S. R&D facilities abroad listed, Europe contains 88 facilities, followed by Japan with 45 and Canada with 26.

Conclusion

Foreign R&D activities in the United States began to increase significantly in the mid-1980s and continued that increase during the 1990s. Their rapid growth raised questions about why, where, and in what sectors the investment was occurring. It also led to questions about the potential impact on U.S. competitiveness. Similarly, growth in U.S. R&D abroad led to questions about the possible displacement of domestic U.S. research and how U.S. R&D performed abroad would support innovation.

This study provides a comprehensive review of the extent of that growth and a basis for answering some of the questions raised. It is still difficult, however, to determine the real long-term effect of these activities on competitiveness and employment. The U.S. experience during the 1990s does appear to imply that the overall effect has been reasonably positive.

There are economic benefits from foreign-owned R&D activities in the United States. One area of consensus is that foreign R&D spending within the United States increases employment opportunities for U.S. scientists and engineers. University researchers have welcomed foreign funding of academic research and equipment purchases. In addition, a

study by Jaffe, Trajtenberg, and Henderson (1993) documented local R&D spillovers in new products and processes from foreign investment to U.S. companies in the same industry and to spinoff companies. A study by Coe and Helpman (1993) suggests that international R&D may lead to increased economic growth.

Recent studies have not found much evidence of a negative impact on U.S. competitiveness. A survey by Kuemmerle (1996) concludes, "It would be precipitous, however, to assume that foreign firms investing in local R&D facilities are free riders. Foreign firms also create spillovers for the local environment because R&D sites provide employment and learning opportunities for local researchers." The National Academy of Engineering (Reid and Schriesheim 1996) study on foreign R&D also emphasizes the local benefits of R&D, regardless of nationality.

Some empirical research by Patel and Pavitt (1991) also shows little evidence of displaced research. It finds that large multinational companies file most of their patents in the home country. The results from patent data are supported by the expenditure data on U.S. firms' R&D. These data show that U.S. companies spend 90 percent of R&D expenditures at their facilities in the United States. U.S. companies also told the authors that they are benefiting more and more from access to knowledge produced abroad that their foreign facilities afford them.

The Council on Competitiveness (1998) has concluded that the globalization of R&D investment does create new challenges for the United States. If the challenge for the United States in the next century comes not from low-cost producers but from low-cost innovators, then the United States must make a strong, sustained commitment to investment in science and technology, develop the means to rapidly integrate new knowledge and technologies into products, and gain access to growing global sources of innovation. Vernon (1997) argues that policy makers will now have to take into account the increasing presence of foreign-owned R&D in the United States and strategic alliances by U.S. industry.

The data presented in this report support that conclusion. While there has been additional research on this issue since the authors' 1993 benchmark study, much more research needs to be undertaken. It is clear that industrial R&D has become increasingly globalized, with significantly more foreign R&D in the United States and U.S. R&D abroad. Motivations for both are remarkably similar, with access to foreign—especially human—resources and knowledge becoming increasingly important. Patent and other indicators show that a capacity for world-

class research is increasing around the world, and that foreign countries, including some smaller countries, increasingly have high-impact patents.

The United States is the creator and repository of much of the world's industrial R&D. It retains a clear technological advantage in most sectors. Foreign corporations still come to the United States to establish R&D facilities because of the size of the U.S. market and, just as important, because it pays to benchmark yourself against the world's best science and technology. The real question is how to continue to tap the incredible dynamism of global R&D so that U.S. companies can remain the leaders in building new industries and creating high-wage jobs.