

6. Gross Domestic Product by Country

The economies of the six countries studied for this report have flourished, allowing for the very high growth rates in research and development (R&D) investment and precipitating the need for an ever-more talented labor force. The per capita gross domestic product (GDP) has doubled in South Korea and Singapore over the last 15 years, and tripled in Taiwan. Japan's per capita GDP has increased by one-third. See figure 42.

China

China's GDP grew from 358 billion yuan in 1978 (in current national currency) to 1.7 trillion yuan in 1990, a growth rate of 14.9 percent. In purchasing power

parity dollars (\$PPPs), this is equivalent to increasing from \$1.6 trillion to \$2.9 trillion, as shown in figure 43. The GDP growth rate in constant currency has been more than 6 percent since China opened up to the West in 1982; 4.9 percent over a 12-year period. This growth has been fueled by exports to U.S. open markets, which reached \$15 billion in 1991. One growth industry in the Fujian economic zone has been the assembly of semiconductors, with Taiwanese companies entering China for lower costs and the supply of highly educated engineers. Another economic zone in Guangdong, across from Hong Kong, draws in foreign capital, companies, and expertise. By 1991 there were 37,000 joint venture enterprises and 28 economic development zones.

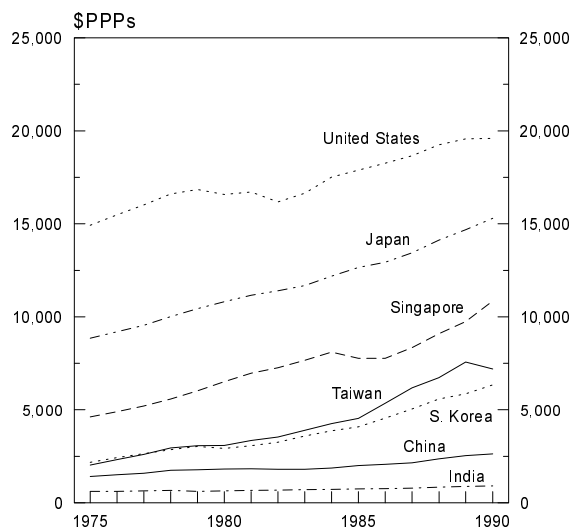
India

India's economy has grown from 790 billion rupees in 1975 (in current national currency) to 5.2 trillion rupees in 1990. In 1990, its GDP was equivalent to \$770 billion. In constant currency, the Indian economy grew at 5 percent in the last 15 years, as shown in figure 44.

In 1991, India made a substantial shift toward a more liberal economic policy on direct foreign investments. Joint ventures may now have up to 51 percent foreign equity participation, and many have been quickly approved by the Government. For example, IBM, which left India in 1977 because of restrictive policies, is now returning in a 50-50 joint venture with the Tata Group to produce personal computers and software packages for exports as well as for sale to the local market (United Nations 1992).

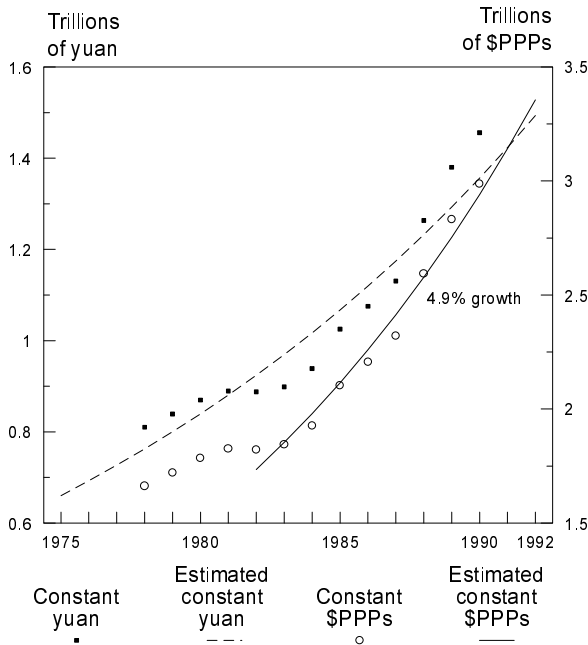
However, there is still no large-scale investment from abroad nor any big jump in exports. A balance of

Figure 42. Per capita GDP in selected Asian countries and the U.S.: 1975-90



NOTE: See tables A-14 and A-22.

Figure 43. Growth in GDP in China: 1975-92



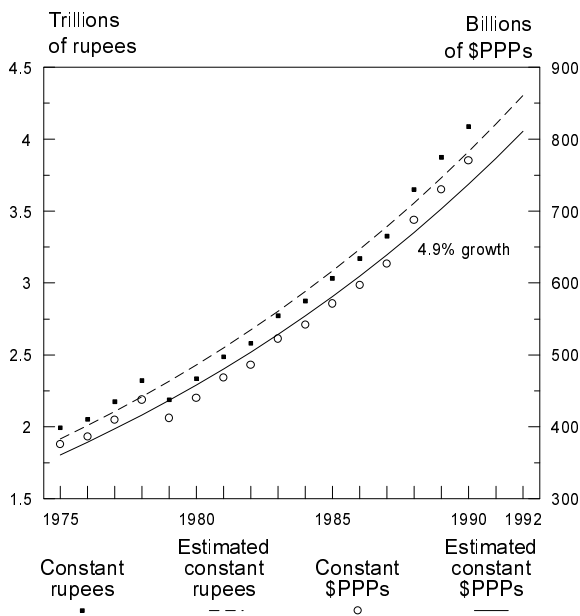
NOTE: See table A-22.

payments crisis was triggered by the collapse of the Soviet Union, India's main trading partner, and the impact of high oil prices during the Gulf War. India is undergoing a program of structural reform, closing down financially draining State industries, providing infrastructure and telecommunications, lowering tariffs, and bringing the deficit under control. Austerity measures introduced in 1991 resulted in a GDP growth rate of only 2 percent that year.

Japan

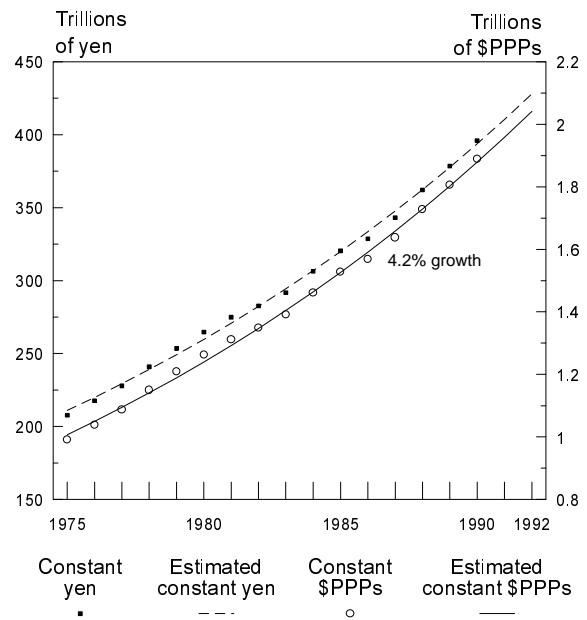
Japan's economy grew from 148 trillion yen in 1975 to 415 trillion yen in 1990 (in current national currency), with a growth rate of 6.6 percent. In dollars, this is equivalent to a \$1.9 trillion economy in 1990, with a growth rate of over 4 percent in constant currency, as shown in figure 45. Japan has approximately the same percentage of GDP invested in R&D as does the United States (2.9 and 2.8, respectively), but Japan's economy has more heavily invested in new plant and equipment throughout the 1980s. Japan's GDP growth rate is slowing, but the country will still reap the benefit to productivity improvement of this heavy

Figure 44. Growth in GDP in India: 1975-92



NOTE: See table A-22.

Figure 45. Growth in GDP in Japan: 1975-92



NOTE: See table A-22.

investment in modern industrial processes and infrastructure.

Japan's investment in industrially funded R&D correlates with the number of U.S. patents granted over the last 15 years, as shown in figure 46.

Singapore

Singapore's economy grew from 13 to 64 billion Singapore dollars (in current national currency) between 1975 and 1990, with a growth rate of more than 10 percent. In dollars, this is equivalent to \$26 billion in 1990, with a growth rate of more than 7 percent, as shown in figure 47.

About 17 percent of Singapore's GDP is based on production of information technology hardware. Singapore wants to be a computer information-based economy in the near future and has invested in people and research centers to facilitate this shift. Singapore has outstanding researchers in information systems and computer science, many of whom received doctoral training in the United States. The National University of Singapore is cited as one of the centers of excellence in Southeast Asia where significant research is being done, of as high a quality as U.S. research in areas of data base systems and design automation (Kahaner 1992). The U.S. National Science Foundation (NSF) has established, with Agency for International Development funding, information-education exchange linkages among NSF-funded university research centers and these Singapore research centers. The University of Pittsburgh's Parallel, Distributed & Intelligent Systems Center will link with the Institute of Systems Science of the University of Singapore, and Carnegie Mellon's Data Storage Systems Center will link with the University of Singapore's Magnetic Technology Center (Lepkowski 1992).

South Korea

The South Korean GDP has grown from 10 to 142 trillion won (in current national currency) over the last 15 years, with a 19.8 percent growth rate. In dollars, this is equivalent to a \$248 billion economy in 1989, with a growth rate of more than 8 percent, as shown

Figure 46. Industrially funded R&D and U.S. patents granted to inventors from Japan: 1975-90

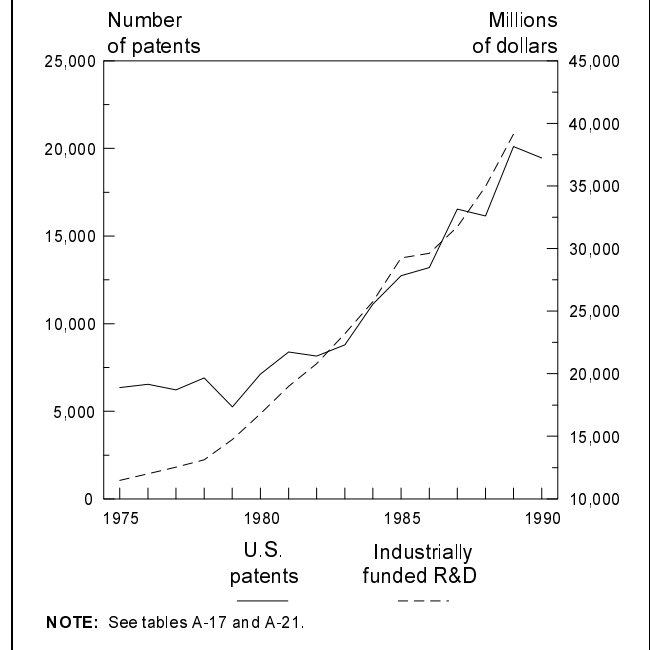
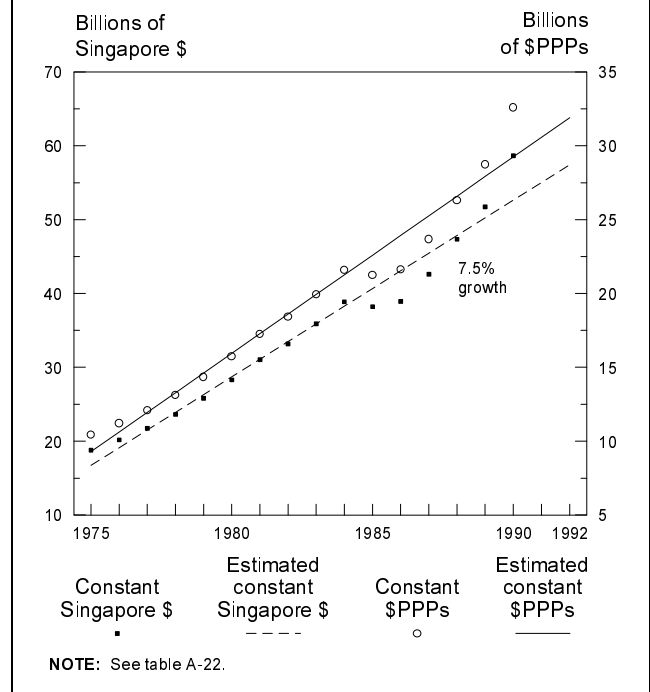


Figure 47. Growth in GDP in Singapore: 1975-92



in figure 48. South Korea is now a net exporter of foreign direct investments.

South Korea's investment in industrially funded R&D correlates with the number of patents granted over the last 15 years, as shown in figure 49.

Taiwan

Taiwan's GDP grew from 590 billion to 4 trillion New Taiwanese dollars (in current currency) over the 15-year period, with a growth rate of 14.2 percent. Taiwan has been exporting far more than it imports since the early 1980s, particularly electronics, computer chips, machinery, and textiles, and reached a trade surplus of \$13 billion in 1991.

In dollars, Taiwan had a \$146 billion economy in 1990, with a growth rate of more than 10 percent, as shown in figure 50.

In trying to upgrade industry and acquire foreign technology, Taiwan is entering joint ventures with U.S. companies. Its large financial reserves are also being used for investments in developing countries, exceeding \$5 billion in Malaysia since 1987. Currently focusing on China, Taiwan is investing in setting up factories, not just in the southern economic development zone of Guandong Province. The bulk of Taiwan's investment is in Fujian Province, where high technology firms are located, but investments are also being made in other Provinces. No longer necessarily using Hong Kong as a third party for investment, Taiwan can now make direct investments in China. Taiwan's exports to the United States have recently fallen, but Taiwan is developing its China market. There are many more open exchanges of science and engineering delegations between China and Taiwan.

Taiwan has a large number of patents relative to the small amount of industrially funded R&D, as shown in figure 51. The Director of the Planning and Evaluation Division of Taiwan's National Science Council explained some of the reasons for this imbalance: Because many electronic consumer items are sold in the United States, Taiwan is very careful to register all patents to avoid lawsuits with the United States. Additionally, the Industrial Technology

Figure 48. Growth in GDP in South Korea: 1975-92

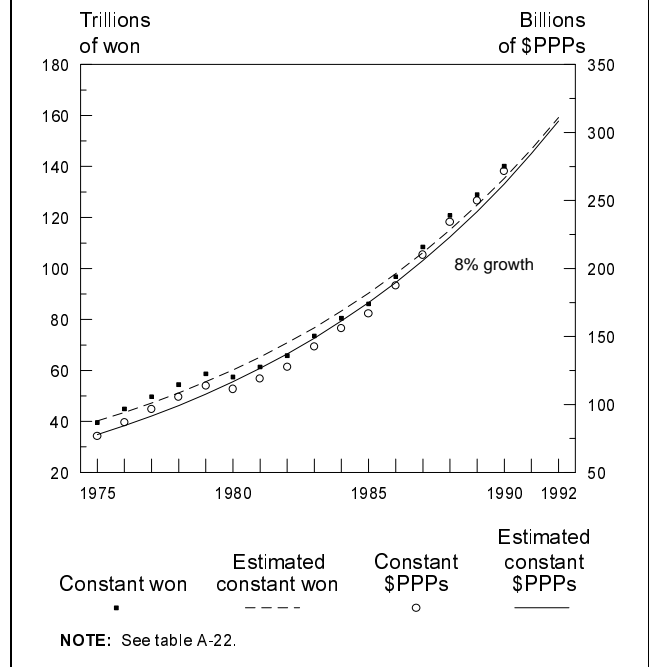


Figure 49. Industrially funded R&D and U.S. patents granted to inventors from South Korea: 1975-90

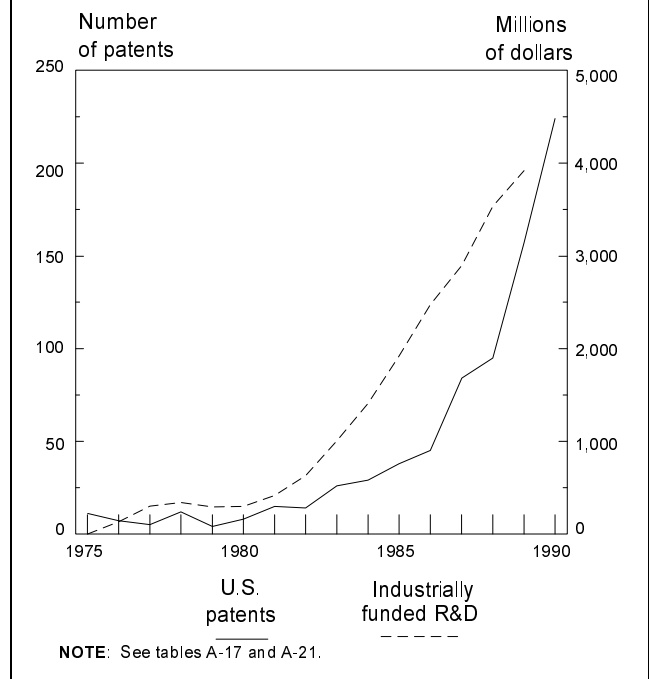
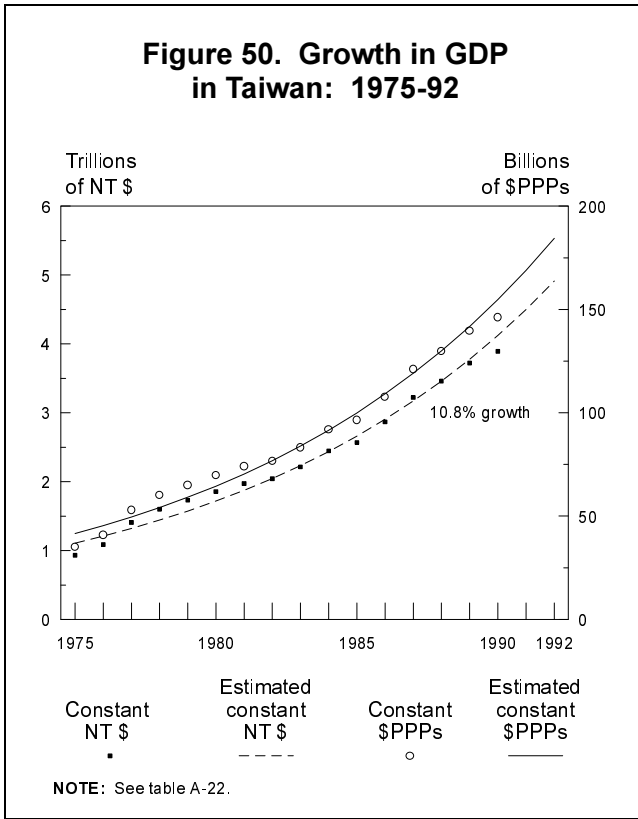


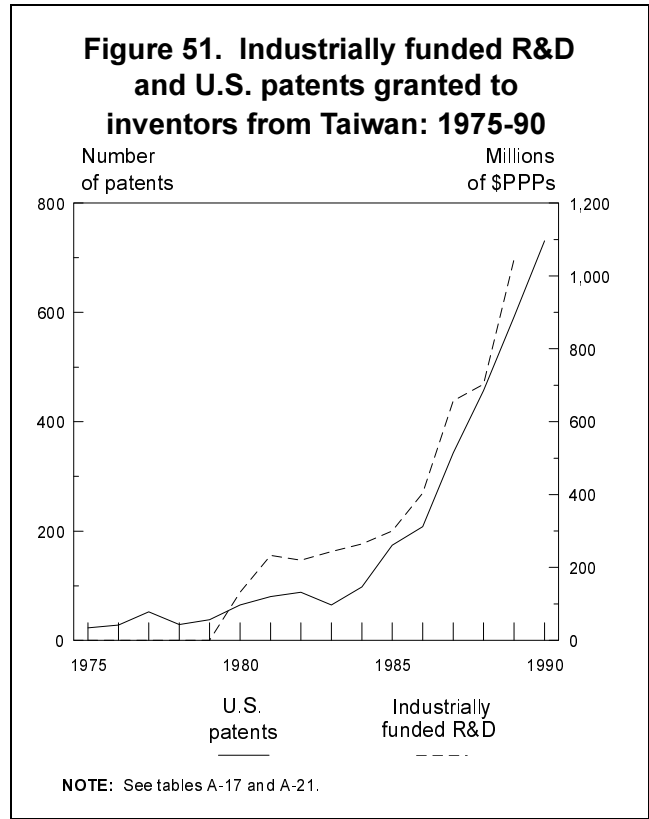
Figure 50. Growth in GDP in Taiwan: 1975-92



Research Institute (ITRI) evaluates R&D programs it funds by patents, so researchers are encouraged to patent their ideas.

To accelerate industrial research and innovation, Taiwan's recent National Development Plan provides \$18 billion in funds for speeding up technology

Figure 51. Industrially funded R&D and U.S. patents granted to inventors from Taiwan: 1975-90



development and increasing R&D. Since Taiwan sees its future economic success in moving away from hardware to software and in developing future markets, it will establish a software industrial park to accelerate the development of specialized areas in a domestic software industry.