

Trends in the International Division of Labor in Asia for IT-Related Production

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As the IT (information technology) revolution unfolds, trade in IT-related products continues to grow worldwide — including that of Japan, where strong demand at home and abroad has propelled IT-related trade at an accelerating rate since mid 1999.¹

As a result, IT-related trade comprises a growing weight in Japan's trade with Asia. This trend can be attributed to the international division of labor, which itself is evolving from the IT revolution. Local suppliers across Asia are flourishing from the growing worldwide demand for IT-related goods, and increasingly supplying electronic devices that Japan had supplied in the past.

This paper examines the evolving international division of labor in Asia and background factors since the late 1990s.

1. The Growing Weight of IT in Japan's Trade with Asia

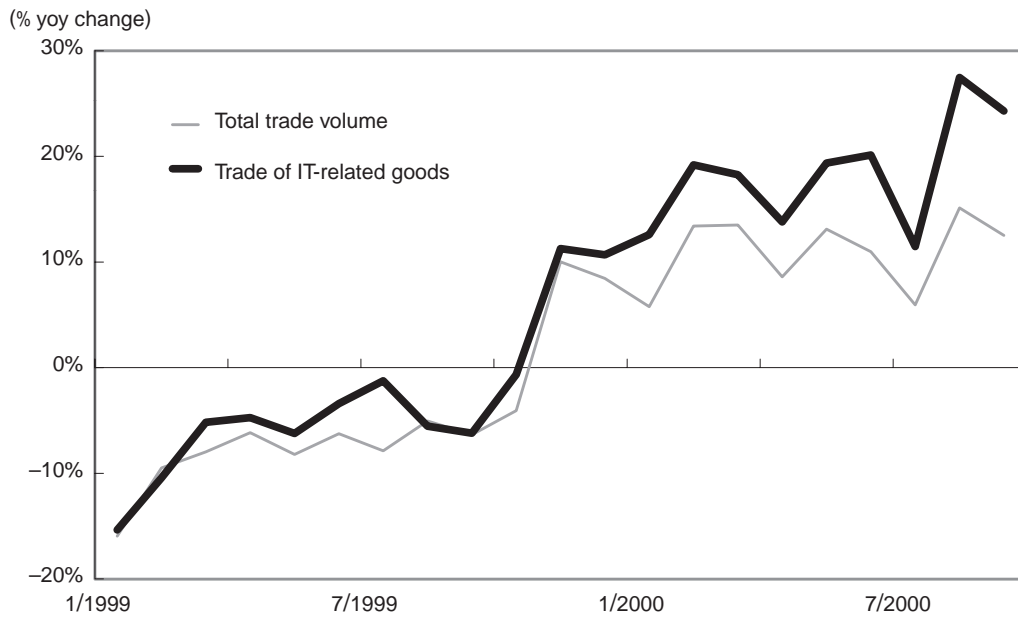
Since mid 1999, Japan's trade has consistently expanded in both exports and imports. In particular, the volume of IT-related trade has outpaced overall trade growth against the backdrop of the global IT revolution (Figure 1).

As a result, since the mid 1990s, the weight of IT-related goods in Japan's trade with Asia has become substantial (Figure 2). This growth is attributed to Japan's direct investments in Asia during this time to build IT-related production facilities.

These quantitative changes have been accompanied by qualitative changes as well. As the transfer of assembly and processing functions to Asia nears completion, signs of change have emerged in the supply chain for components and other intermediate goods, which had previously been manufactured almost entirely in Japan.

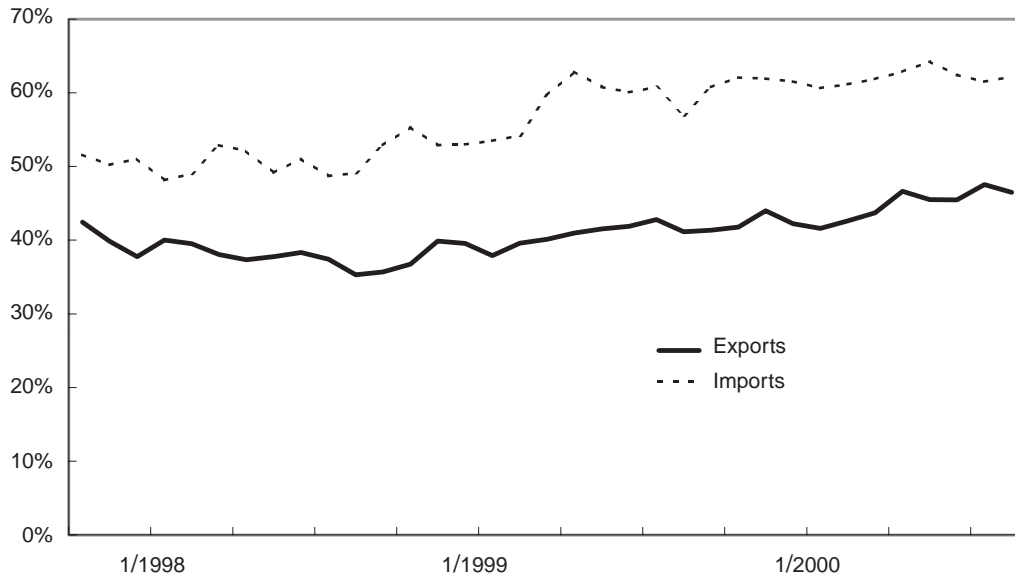
These changes in the trade structure are in turn caused by demand generated by the IT revolution. Below we examine Japan's IT-related trade with Asia from the perspective of these qualitative changes.

Figure 1 Growth in Volume of IT-Related Imports and Exports



Source: Japan Tariff Association, *Summary Report on Trade of Japan*.

Figure 2 Share of IT-Related Exports and Imports in Japan's Trade with Asia



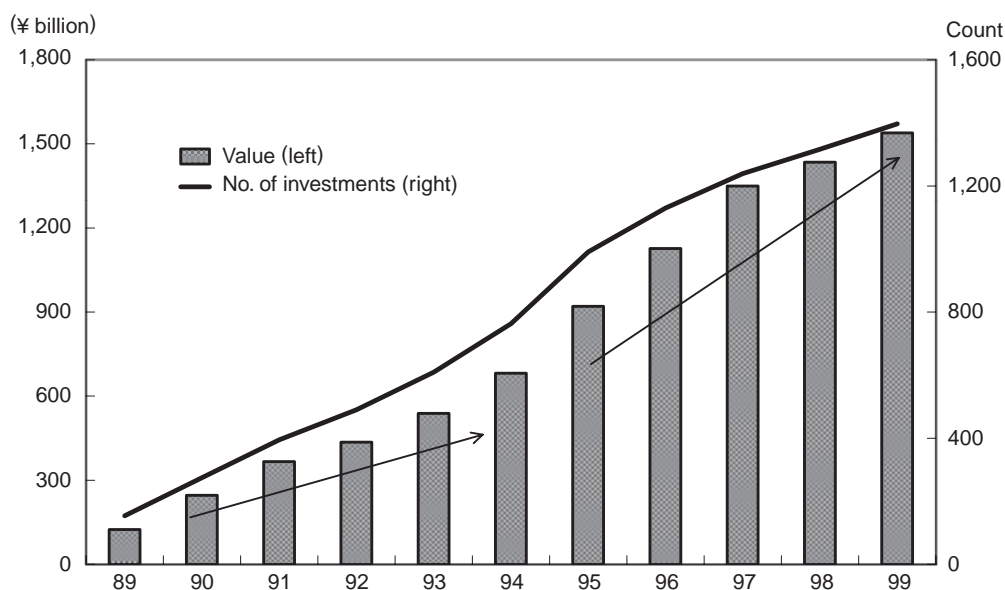
Source: Japan Tariff Association, *Summary Report on Trade of Japan*.

2. Transfer of Assembly and Processing Functions to Asia is Nearly Complete

Asia's electrical machinery industry has benefited from national export promotion policies aimed at attracting foreign capital.² Export-oriented companies were offered breaks on taxes and foreign investment ratio restrictions, which appealed to multinational companies in search of inexpensive labor and other production costs. As a result, local electrical machinery industries quickly became established.

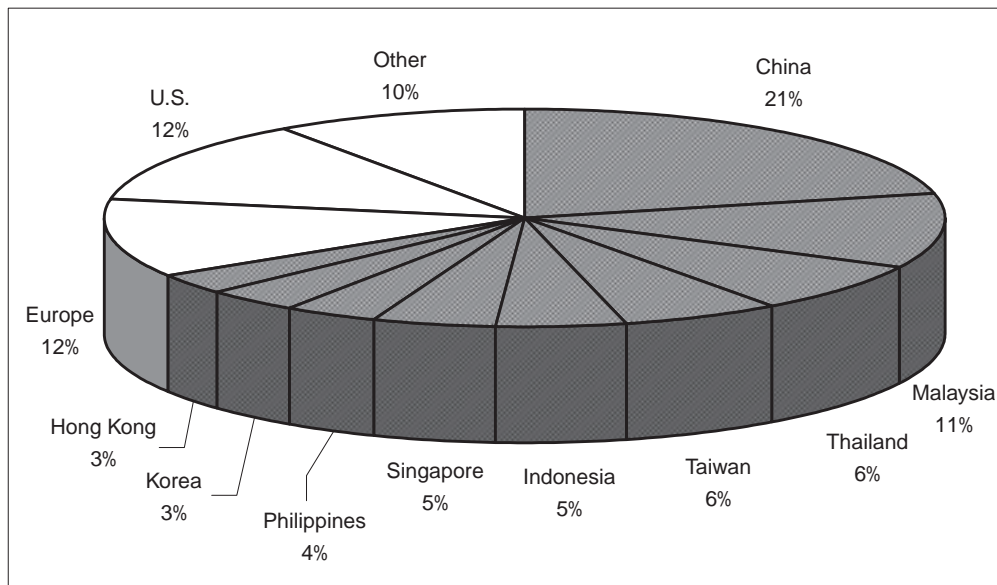
Pressured by trade friction and the strong yen, Japan's electrical machinery industry was particularly aggressive and persistent in making direct investments in Asia. The pace of investment picked up in the mid 1990s (Figure 3). By 1999, approximately 70 percent of the industry's overseas production sites were concentrated in Asia, making Asia a key supplier for Japan's IT-related goods (Figure 4).

Figure 3 Direct Investment by Japanese Electrical Machinery Makers in Asia



Note: Both value and number of investments are cumulative.
Source: MOF, *Foreign Direct Investment*.

Figure 4 Distribution of Overseas Production Sites of Japan's Electrical/Electronics Industries



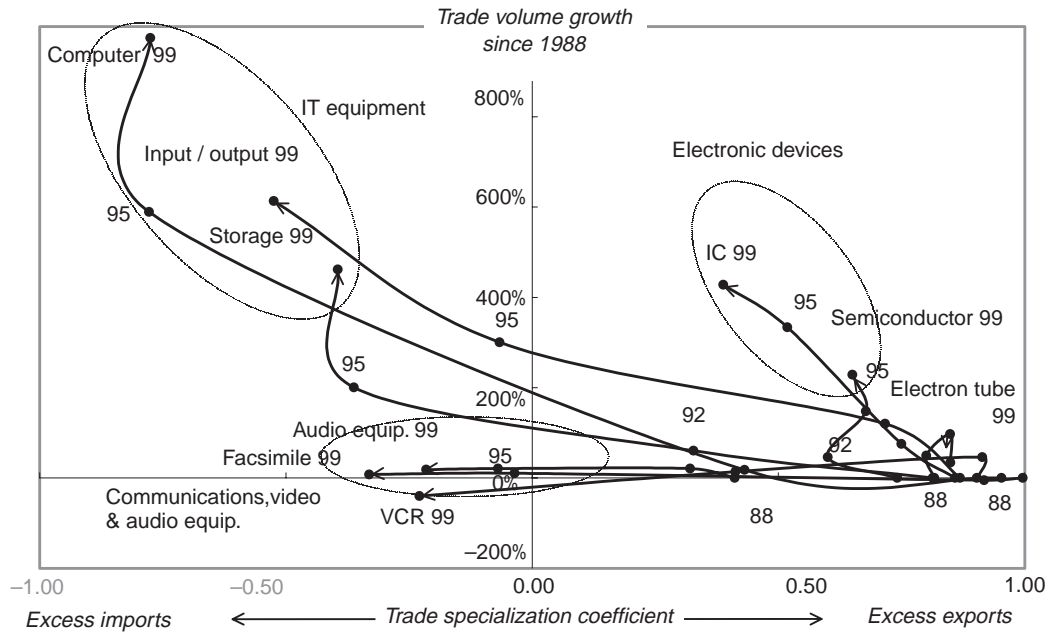
Source: Japan Machinery Center for Trade & Investment, *The Concentration of Industry in Asia and Symbiosis with Japan*.

Trade growth rates of the main IT-related categories are plotted against their trade specialization coefficients in Figure 5.^{3,4} By the mid 1990s, finished consumer goods in IT, communications and AV categories had already shifted to an import trade specialization. This was the result of extensive direct investment in production facilities during the same period.

On the other hand, trade in electronic devices remained specialized in exports in the mid 1990s. Taken together with the import specialization for finished consumer goods, what emerges is a clearly defined international division of labor for the mid 1990s in which Asia assembled and processed components supplied by Japan.

In the late 1990s, the trade specialization coefficient for finished consumer goods advanced even further toward imports. Especially for computers, whose value weighting is large, import specialization became so advanced that any further increase was difficult. In other words, the transfer of assembly and processing functions to Asia was nearly complete.

Figure 5 Japan's Trade with Asia — Trade Growth Rates and Specialization Coefficients for IT-Related Categories



Source: Japan Tariff Association, *Japan Exports and Imports*.

3. Transferring the Production of Electronics Devices Overseas

(1) Backdrop to the Growth in Imports of Electronics Devices

The international division of labor that had occurred by the mid 1990s — in which assembly and processing of finished consumer goods were firmly established in Asia and production of components and intermediate goods in Japan — reflects differences in production technology and capital requirements for electronic device manufacturing compared to other IT-related goods.

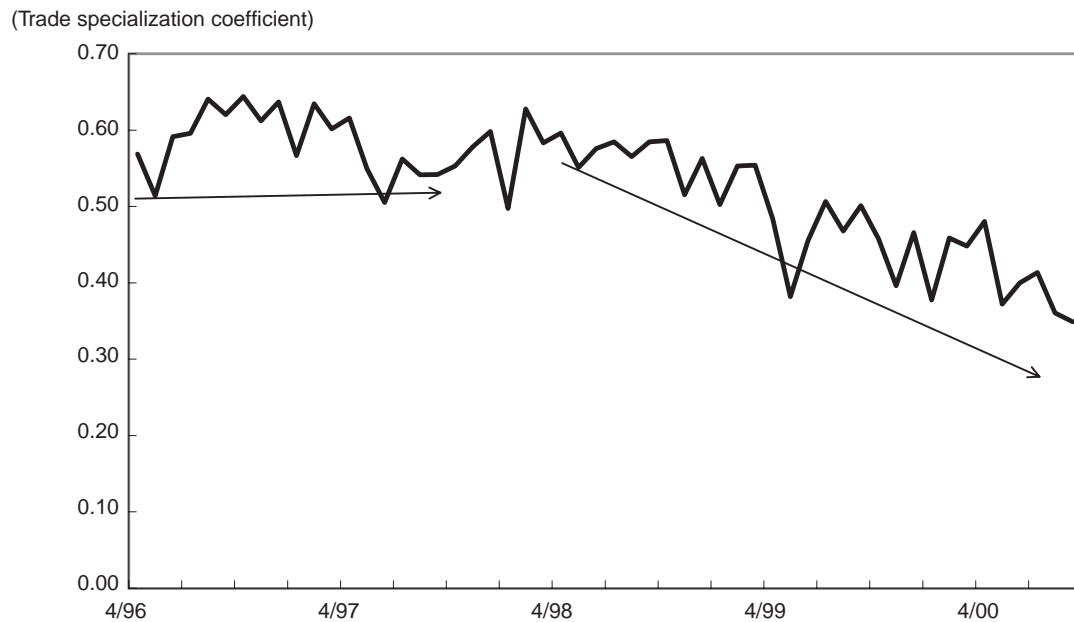
Semiconductor fabrication technology is constantly advancing. In the early stages of Asia's electronics industry, local companies did not have the necessary expertise.

In addition, the capital investment required to build a semiconductor plant runs in excess of two billion dollars. In view of the importance of achieving economies of scale in production, it was not economically feasible to locate semiconductor plants in Asia simply to supply locally based Japanese assembly and processing plants.

These considerations led Japan to specialize in supplying semiconductors and electronic devices, and Asia to specialize in manufacturing finished products.

However, in the late 1990s, Japan's preeminence as supplier of electronic devices began to erode as imports of electronic devices began accelerating (Figure 6).

Figure 6 Japan's Trade Specialization Coefficient for Electronic Devices (vs. Asia)

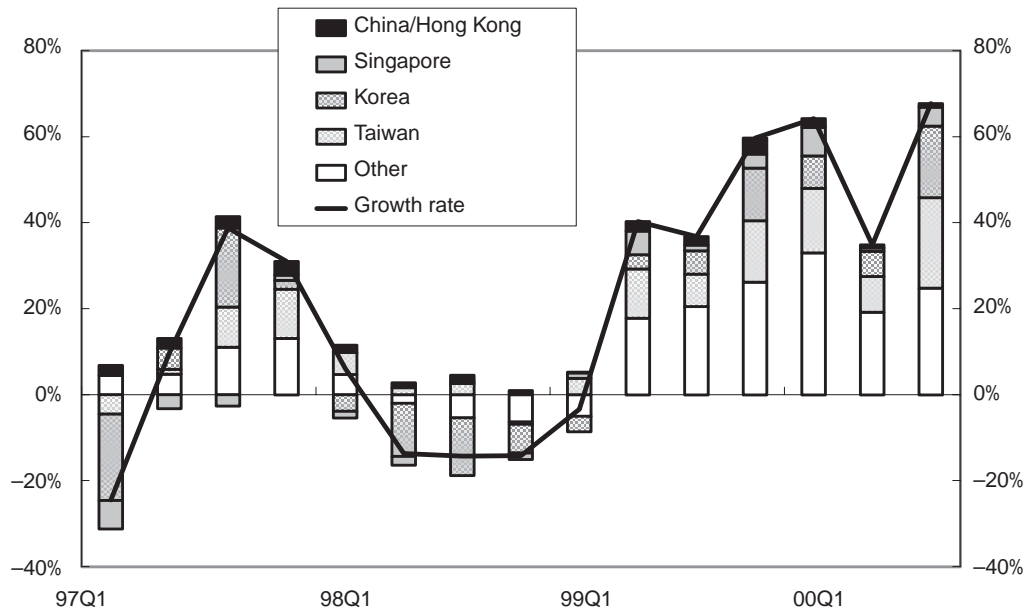


Source: Japan Tariff Association, *Summary Report on Trade of Japan*.

This is due in no small part to imports from ASEAN, where Japanese device makers have built production sites to meet the growing demand for electronic devices.⁵ By country, the largest contributor to the growth of imports in this period has been Taiwan.

As Figure 7 shows, since late 1997, Taiwan has consistently been the largest contributor to the growth in imports of electronic devices. As a result, Taiwan has captured a growing share of Japan's electronic device imports (Figure 8).

Figure 7 Growth Rate of Electronic Component Imports from Asia (contribution by country)



Source: Japan Tariff Association, *Summary Report on Trade of Japan*.

Figure 8 Taiwan's Share of Japanese Imports of Electronic Devices from Asia



Source: Japan Tariff Association, *Summary Report on Trade of Japan*.

(2) Emergence of Foundries

Taiwan's import thrust has been spearheaded by the growth and successful entry of Taiwan's semicon-

ductor foundries into the Japanese market. Foundries supply semiconductors under contract to manufacturers, and are thriving under the IT revolution.

Japanese semiconductor and home electronics makers began outsourcing production to foundries in Taiwan around 1997 (Figure 9).

Once outsourcing of electronic device production became common, foundries began playing a key role in meeting the strong demand for devices spurred by the IT revolution. These foundries have been accelerating the decline of Japan's trade specialization coefficient for electronic devices.

The growth of Taiwan's electronics device makers, and the decision of Japanese makers to outsource production, can be attributed to the following factors.

1. Improved technology and financial strength of local companies

While Asia's electronics industry began with technology transfers by foreign companies, in Taiwan local makers subsequently took the lead in developing new technologies. The foundry business emerged from the advances in production technology by these local makers.

When entering local markets, Japanese makers, whose production facilities were in Japan, relied primarily on demand from other Japanese companies in the local market. On the other hand, foundries have low-cost production systems capable of meeting the global demand for semiconductor production. Moreover, they have grown on the strength of semiconductor demand stimulated by the IT revolution, particularly outsourcing demand from fabless makers — ventures in the U.S. and elsewhere that specialize in researching and developing new technologies, and own no production facilities. Taiwan Semiconductor (TSMC), a leading silicon foundry who has already been listed on stock markets in New York and Taipei, posted sales of 2.3 billion dollars in 1999.

Figure 9 Outsourcing Arrangements of Japan's Electronics Device Makers

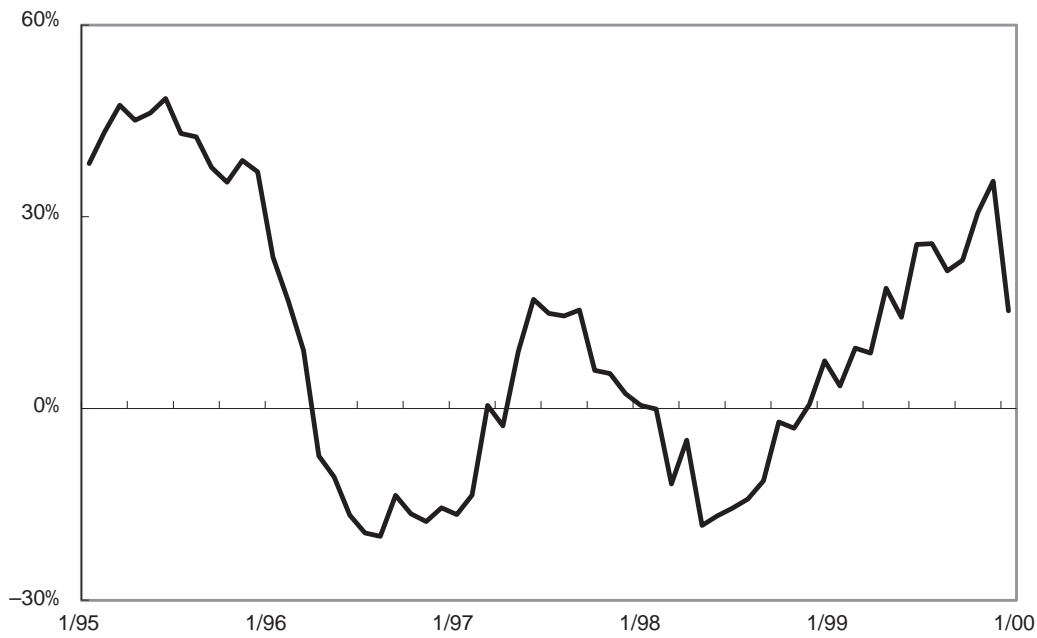
FY	Customer	Product	Contract manufacturer
97	Toshiba	DRAM Logic IC	Winbond Electronics Worldwide Semiconductor Mfg. (WSMC)
	Fujitsu	DRAM DRAM	Taiwan Semiconductor Mfg. (TSMC) Acer Semiconductor Mfg. (ASMI)
	Sony	Logic IC	TSMC
98	Mitsubishi Electric	DRAM	Powerchip Semiconductor (PSC)
	Toshiba	DRAM	Winbond Electronics
99	Hitachi	LSI	United Microelectronics (UMC) Epil Technology
	NEC	LSI/DRAM	
	Matsushita Electronic Compo.	Multilayer PCB	Ya Hsin Industrial
	Mitsubishi Electric	DRAM	TSMC
		DRAM	Vanguard Int'l Semiconductor
	Kawasaki Steel	LSI	UMC
	Sharp	LCD panel	Quanta Computer
	Fujitsu	LCD panel DRAM	Chunghwa Picture Tube ASMI
00	Daido Steel	LED	UEC
	Mitsubishi Elec.	SRAM	Macronix Intl (MXIC)
	Oki Electric	LSI/DRAM	Swift Semiconductor
	Toshiba	DRAM	Winbond
	Fujitsu	Logic IC FCRAM LCD panel	TSMC WSMC, TSMC Chi Mei Optoelectronics (CMO)
	Sony	Personal computer	ASUSTek Computer (ASUS)
	Hitachi	LCD driver	Episil
	JVC	Multilayer printed wiring board	Unicap Electronics Industrial

Note: Shows fiscal year in which press announcement was made.
Source: Media reports

2. Low margins and volatile market

While the massive investment requirements for semiconductor and electronic device production facilities grow larger each year, product cycles are shortening. Stable product prices and demand are necessary to ensure profitability, but the volatility of the semiconductor market is making Japanese semiconductor makers struggle to be profitable. In particular, the semiconductor slump from 1996 forced Japanese makers to shift from being self sufficient to outsourcing to Taiwanese makers from 1997 (Figure 10). Although foundries face the same market conditions, they can thrive based on a business model with superior cost control and economies of scale from supplying the global market.

Figure 10 Global Semiconductor Sales (yoy change)



Source: Semiconductor Industry Association

4. Prospects

The future production plans of Japanese semiconductor makers show a clear direction toward increasing the overseas outsourcing of general purpose DRAMs (Figure 11). For this reason, the production of general purpose electronics devices is certain to shift to Asia at an accelerating rate.

Figure 11 Future Production Plans of Semiconductor Makers

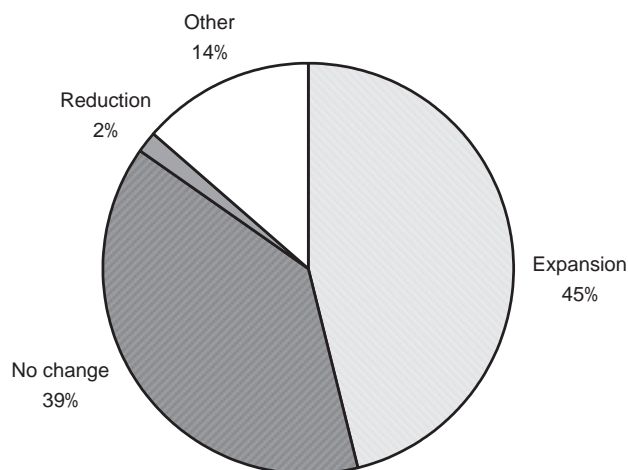
Fujitsu	Will outsource 30% of semiconductor production; 90% of DRAM production.
Mitsubishi Electric	Will withdraw from DRAM business, and purchase DRAMs from Taiwan suppliers.
Toshiba	Will limit semiconductor production investment to 30% of investment budget (presently 50%). Will outsource if production capacity is deficient.
Hitachi	Will outsource 10% of overall production in FY 2000, and 20–30% in medium term.
NEC	Plans to outsource approximately 5% of semiconductor production volume.

Source: Media reports

On the other hand, companies plan to maintain domestic production of customized products such as application specific ICs (ASICs), which have high margins and currently are not subject to economies of scale. This segment is thus unlikely to shift overseas through outsourcing.

Overall, however, in view of strong demand from Japanese set makers for local procurement, and continuing advances in production technology by local companies in Taiwan and Korea, the steady transfer of device production overseas is expected to continue.

Figure 12 Procurement by Local Subsidiaries of Japanese Manufacturers in Asia (Electrical Machinery)



Source: MITI, *Overseas Business Activity of Japanese Companies*.

Should this occur, it is possible that Japan's domestic industry could hollow out. In the future, companies will need to enhance non-production functions such as R&D and marketing to prevent further hollowing out.

Notes

1. In this paper, the definition of IT-related goods is taken from JETRO's 2000 white paper on trade, and includes computers and peripheral equipment, office equipment, communications equipment, semiconductor and other electronic devices, other electronic components, video equipment, audio equipment, measurement and testing equipment.
2. While they do not overlap perfectly with the output of the electrical machinery industry, IT-related products can be tracked by trends in the electrical machinery industry because (1) the IT-related products as defined here are produced almost entirely by the electrical machinery industry, and (2) the industry's non-IT related output is a minor part of the volume of trade with Asia.
3. Trade specialization coefficient: $(\text{Exports} - \text{Imports}) / (\text{Exports} + \text{Imports})$.
4. The categories shown here comprise 60 to 70 percent of the total value of trade (as of 1999 yearend).
5. The number of production sites of Japanese device makers in Asia increased from 125 in 1997 to 174 in 2000.