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The Changing Structure of Trade in Japan and Its Impact: With the Focus on Trade in Information Technology (IT) Goods

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Contents

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Summary

1. Low-level growth in domestic demand continued in Japan during the 1990s, while foreign trade continued to increase with both imports and exports exerting a strong impact on GDP. The global increase in the demand for computers and other information technology (IT) goods since the latter half of the 1990s has furthermore brought major changes to the structure of trade in Japan. In the background of these changes is the slowdown in the U.S. economy since mid 2000, which is having a strong effect on movements in the business climate of Japan and other Asian countries.

In this report, we (1) present an overview of foreign trade trends in Japan since the 1990s and (2) analyze the changes in comparative advantages, the background of net exports and so forth, centered in trade in IT goods, while (3) discussing trends in intra-industry trade, one additional aspect of foreign trade, and its effects and clarify the characteristics of the structure of trade in Japan.

2. In regard to the share of Japan's trading partners, the U.S. is reaching a peak while trade with other Asian countries is at a high level. Export Intensity Index (a relative value derived by dividing the value of exports by country by the value of imports from trading partners) indicates that, in addition to Taiwan and Korea, the relationship with China has recently been developing more strongly that that with the U.S. Reclassifying the rapidly increasing trade items with Asian countries by the stage of demand shows that equipment components and other intermediate goods, both imported and exported, are increasing and the ratio of the total is rising consistently.

Changes in export competitiveness by item using the revealed symmetric comparative advantage (RSCA) index indicate that, while equipment and transportation equipment boast of a strong comparative advantage, the dominance is gradually weakening. Instead, the competitive advantage of Taiwan is increasing while the relatively lower position of China is rapidly improving.

3. As the result of a verification of the relationship between comparative advantage as seen in net exports (exports - imports) in Japan and domestic factor endowments using data by commodity, a tendency becomes apparent in IT goods of exporting capital-intensive products to China, Korea and Taiwan and importing R&D-intensive products from China, Korea and Taiwan. One of the factors involved in the latter is the possibility that research and development of IT goods is being conducted domestically and the goods are being imported from China, Korea and Taiwan through foreign direct investment or other means.

The relationship between net exports in IT goods and factor endowments, however, is not necessarily strong. It is possible that the activation of bilateral trade within the same industry (or commodity classification) (so-called intra-industry trade), which is not expressed in net exports, is having an effect due to economies of scale or product differentiation, which are not premised on a relationship between the two.

4. The comparative advantage of IT goods is strong with intermediate goods but declines with final goods. On the other hand, the competitive edge of China in final goods and general equipment components is showing steady improvement.

Of trade in IT goods between Japan and China, Korea, Taiwan and the U.S., the U.S. has the strongest demand and the weight of final goods is relatively high. On the other hand, the weight of intermediate goods in Asia has become extremely high and it is apparent that multi-level trade in intermediate goods is being carried out in the region. We therefore see a structure in which trends in IT demand in the U.S. exert a strong impact on trade in Asia and, in turn, on production trends.

5. When focusing on moves in IT goods, in particular, in intra-industry trade in Japan, we see that there is activity in intermediate goods while final goods remain at no more than a low level. This is possibly a strong expression of economies of scale, product differentiation and other factors that stimulate intra-industry trade as a characteristic of intermediate goods rather than final goods in the area of IT goods.

Intra-industry trade occurs when firms in one's own country specialize in the production of certain goods and it is more highly advantageous to import other goods produced by firms in foreign countries when product differentiation or economies of scale are evident. We attempted to confirm this relationship using panel data by commodity. When viewed by industry, intra-industry trade in computers and consumer electric equipment is expanding even if there is no sizable change in the scale of domestic facilities. This is thought to be due to the effect of an increase in reverse imports resulting from expanded foreign direct investments. In addition, in the case of integrated circuits, in particular, both differentiation and the intra-industry trade index are showing strong growth and it is possible to see that the differentiation of products is being carried out globally and that bilateral trade is intensifying in vigor.

6. Finally, we verified the relationship to productivity as an effect that intra-industry trade exerts on the domestic economy. It is possible that productivity improves as intra-industry trade develops due to the promotion of competition with imported goods. Upon verifying this relationship using industry-level data, we recognized a certain degree of significance and realized that the increase in intra-industry trade is enhancing capital productivity.

7. The trade structure in Japan is thus going through a considerable transformation due to the expansion of trade with Asia and global growth in the demand for IT goods. Within the context of increasing trade in intermediate goods, especially IT goods, it is also evident that the increase in intra-industry trade in the medium term stimulates an improvement in productivity in the domestic market. However, along with the multi-level trade in intermediate goods within Asia, it is also necessary to be aware that trends in the business climate of the U.S., the country with the strongest demand for IT goods, are having an immense impact on Asian economies and the effect on Japan is also great. In the management of the economy in Japan hereafter, it will be necessary to promote a further reinforcement of product development capabilities in the domestic market taking this globalization fully into account.

Introduction

The real economic growth rate in FY 2000 was an increase of 0.9%. The contribution of domestic demand was 0.7%, while the contribution of foreign demand of 0.2%. In a breakdown, exports accounted for 1.0% and imports (deducted) 0.8%, indicating that the absolute values of the degree of contribution of imports and exports was greater than that of domestic demand. This means that exports and imports are having a strong effect on the domestic economy and the reason why this occurred is not simply a matter of business cycles in the domestic and foreign markets.

Japan expanded trade overseas throughout the 1990s and trade with other Asian countries demonstrated the most conspicuous movement. China and other Eastern Asian countries demonstrated particular improvement in export competitiveness as economic development progressed. Although economic growth in Asia stagnated following the currency crisis in 1997, they subsequently succeeded in achieving a rapid recovery and the steady increase in the presence of Asia in Japan's trade picture is probably the most notable change in the environment surrounding the issue of trade in Japan in the 1990s.

In addition, trade in Japan also realized other major changes in the composition of goods. Worldwide growth in the demand for computers, communication and other information technology (IT) goods, especially during the latter half of the 1990s, boosted the ratio of IT goods in both imports and exports. While the U.S. was the country with the strongest demand for IT-related final goods, that is, finished products, moves within the economic environment of East Asian countries, which play an important role as production bases for intermediate products, also came to have a considerable effect on the economy of Japan through trade. As a result, the effects of the current deceleration of the U.S. economy are emerging in the form of stunted growth in Asian countries, a rapid drop in exports from Japan as a result and stagnation in domestic production.

In this study, we analyze trends in trade in Japan since the 1990s from the perspective of (1) the strengthening relationship with Asian countries and changes in comparative advantage, (2) the expansion of trade in intermediate goods centered in IT goods and (3) the background and impact of the development of intra-industry trade with the aim of clarifying the characteristics of these structural changes and their background.

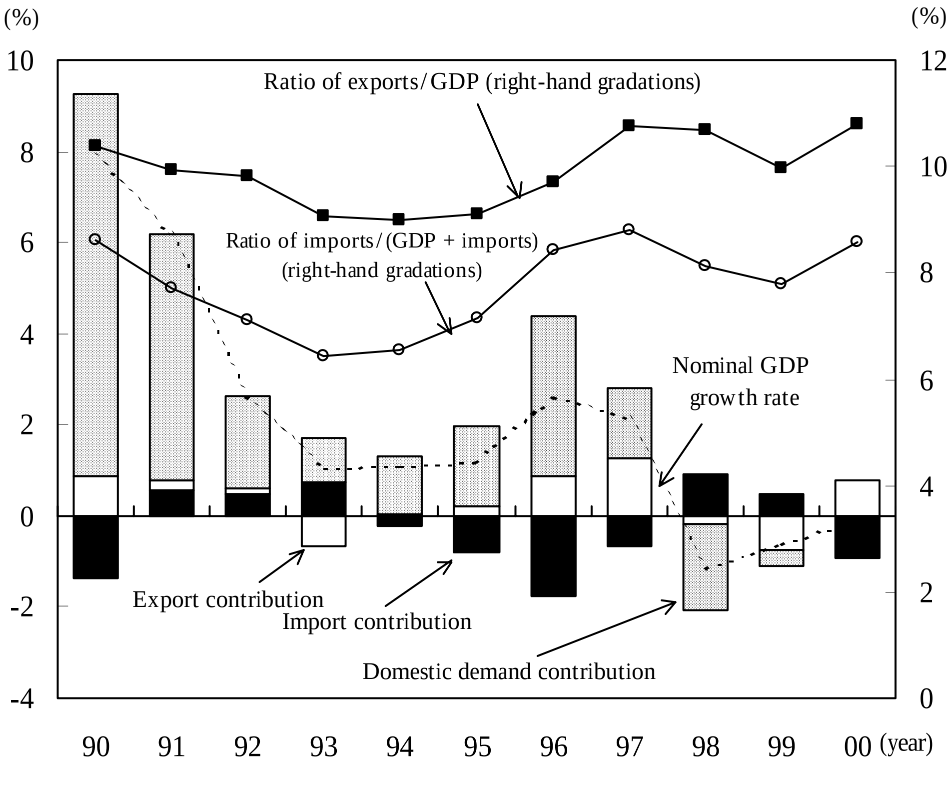
I Trade Trends in Japan in the 1990s

1. Import and Export Trends in Japan

Let us look first of all at economic growth and movements in imports and exports in Japan during the 1990s. Figure 1-1 shows the ratio of imports and exports to nominal GDP in a line graph and the contribution of imports and exports to nominal GDP in a bar graph. The ratio of imports and exports to GDP in 1990 was 8.6% and 10.4%, respectively, while the ratio of both imports and exports dropped as the country forged ahead into the so-called “Heisei slump” through 1993 and both the U.S. and Europe were not able to achieve more than relatively low growth. Later, through 1996, the business climate in Japan regained vigor and, with the good business conditions in both the U.S. and Asia, the ratio of both imports and exports increased.

When the Asian currency crisis occurred in 1997, exports especially to Asia declined the following year, 1998, due to the impact of the crisis. Domestic demand also showed negative growth in real terms and imports declined. In the next year, 1999, exports especially to Europe and the U.S. stagnated along with the progressive appreciation of the yen and there was a general overall slowdown in domestic demand in Japan and, therefore, the ratio of imports and exports to GDP dropped in 1998 and 1999. However, both domestic and foreign demand improved in 2000 and the ratio of exports and imports to GDP rose, reaching a level of 10.8% for exports and 8.6% for imports. Compared to 1993, this represents an increase 1.7 points for exports and 2.2 points for imports.

Figure 1-1 Contribution of Exports and Imports to Nominal GDP

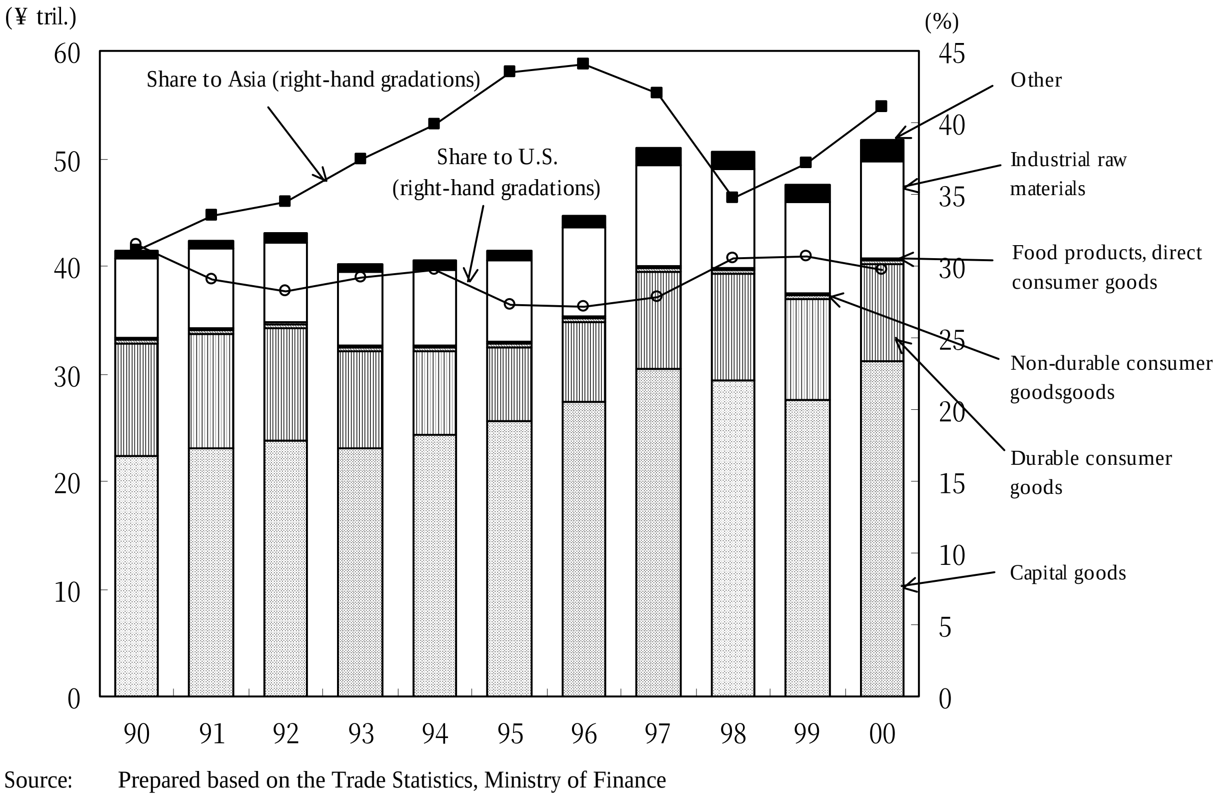


Source: Prepared based on the Economic and Financial Data for Japan of the Office of the Prime Minister

The degree of contribution of imports and exports in the GDP (nominal) was greater than domestic demand in 1999 and 2000. The nominal GDP growth rate in 1999 declined by 0.6% against the previous year and, of that, the contribution of domestic demand declined by 0.3%, while, in contrast, the contribution of exports declined by 0.8% and the contribution of imports increased by 0.5%. Likewise, in 2000, GDP growth declined by 0.1%, of which, domestic demand remained flat at 0.0%, exports increased by 0.8% and imports decreased by 0.9%. Thus, for the past two years, the contribution of the fluctuations in imports and exports has been relatively greater than that of the fluctuations in domestic demand.

We will look next at a breakdown of the import and export of goods based on the Trade Statistics by commodity and region. Although the value of export goods was in the range of about ¥40 trillion during the years 1990-96, that increased to ¥50 trillion from 1997, except in 1999 (Figure 1-2). By category of goods, there is a general tendency for capital goods, which account for the majority, to increase and, in addition, though durable consumer goods also declined for a while in the mid-1990s, that also began to increase again later. By region, exports to Asian countries and the U.S. were of essentially equal importance with shares of 31.1% and 31.5%, respectively. Later, however, exports to Asian countries expanded and the weight of exports to Asia increased, surpassing that of exports to the U.S., which remained at essentially the same level.

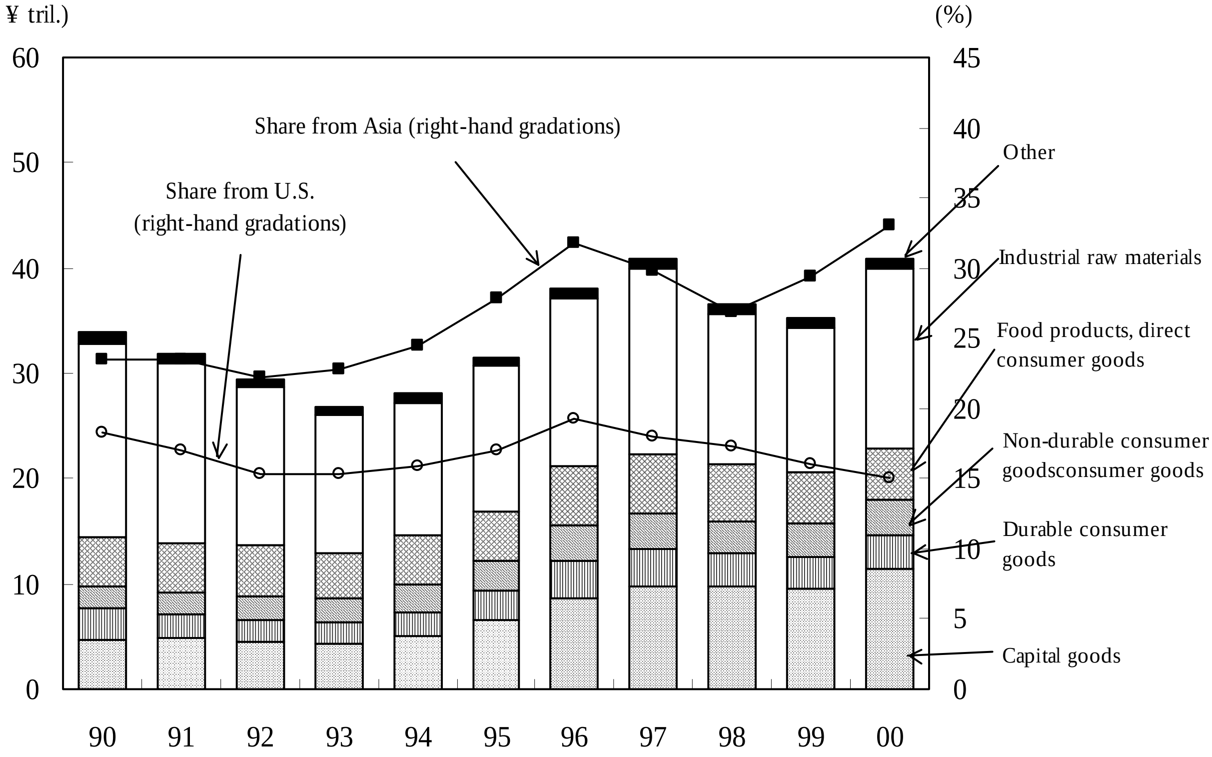
Figure 1-2 Transitions in the Value of Exports by Commodity and Share by Region



Source: Prepared based on the Trade Statistics, Ministry of Finance

Meanwhile, in regard to the import of goods, though the value, which had been ¥33.9 trillion in 1990, declined through 1993, it later began to show a tendency of increase, reaching ¥40.9 trillion by 2000 (Figure 1-3). By commodity, petroleum and other industrial raw materials were the major commodities based on monetary value, while capital goods demonstrated a notable trend toward increase. By region, as with exports, the ratio of imports from other Asian countries rose more throughout the 1990s than from the U.S. By 2000, imports from the U.S. accounted for no more than 15.1%, while those from Asia rose to 33.0%.

Figure 1-3 Transitions in the Value of Imports by Commodity and Share by Region

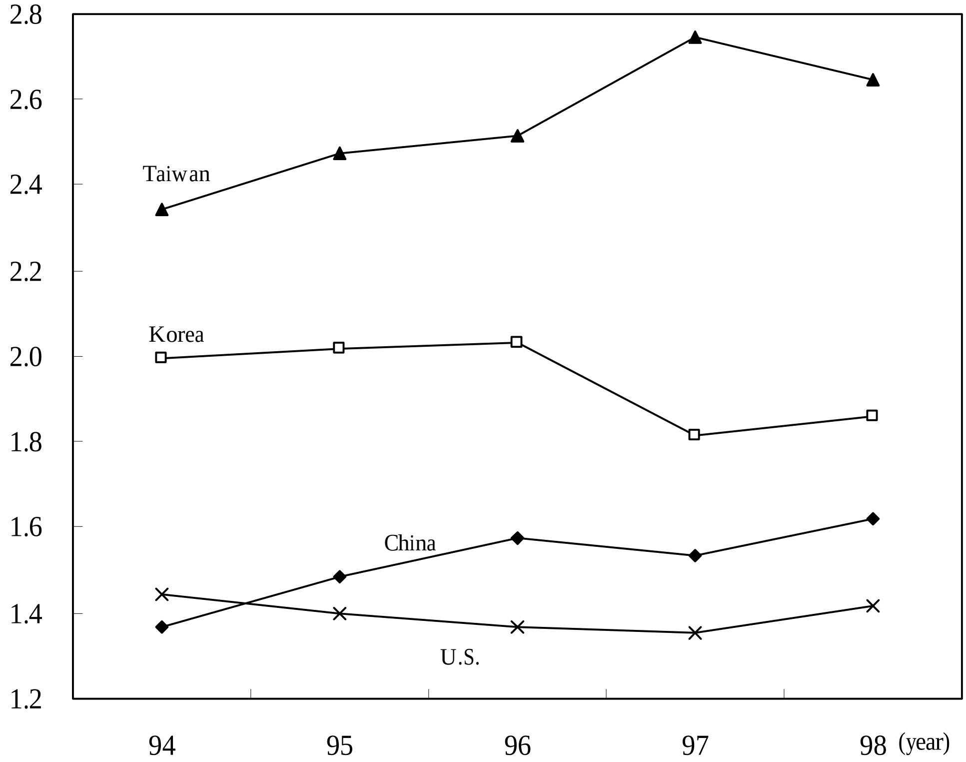


Source: Prepared based on the Trade Statistics, Ministry of Finance

2 Export Intensity Index between Japan and China, Korea, Taiwan and the U.S.

Thus, the ratio of both imports and exports to and from other Asian countries increased and, if imports from Japan increased in importance for trading partners, we can judge that that led to an enhancement in bilateral trade relationships. We thereupon calculated figures ("Export Intensity Index") by dividing the ratio of the value of exports to export trading partner *j* to total exports from Japan by the ratio of the value of total imports into country *j* to total global imports excluding Japan, as indicated in Figure 1-4.

Figure 1-4 Export Intensity Index between Japan and China, Korea, Taiwan and the U.S.



Note: The export intensity index is (ratio of exports to country *j* to total exports from Japan) ÷ (ratio of total imports to country *j* to total world imports excluding Japan). The higher the index, the stronger the relative trade linkage.

Source: Prepared based on the International Trade by Commodities Statistics ("ITCS"), OFCD.

$$XC_{ij} = \frac{X_{ij} / X_{iw}}{M_j / (M_w - M_i)}$$

XC_{ij} : Export Intensity Index
X_{ij} : Value of exports from country *i* (Japan) to country *j*
X_{iw} : Value of exports from country *i* to the world
M_j : Value of imports to country *j* from the world
M_w : Value of total world imports
M_i : Value of imports to country *i* from the world

This export intensity index represents the scale of the economy of country *j* (scale of imports) relativized by the exports to country *j* from Japan. What should be noted here is that it is not possible to gauge the closeness of trade relationships between the two countries by the monetary value itself of the exports from Japan to country *j*. Even if we state, for example, that there has been an increase in the value of exports from Japan to country *j*, the extent of that increase corresponds to an expansion in the scale of the economy of country *j* and, if country *j* also increases its imports from other countries to the same extent, it could not then be said that the trade relationship between Japan and country *j* has necessarily become stronger. In order to consider this point, we used the export intensity index in this study as an index that expresses the strength of the connection in trade relationships. Since the index with a value of 1 or more indicates a relationship that is stronger than the average connection with the other countries, it could be said that there is a relatively stronger connection with export recipient countries.

Transitions in the export intensity indices for the U.S., and China, Korea and Taiwan, which among Asian countries have an especially high volume of exports from Japan, show a strong connection of 1 or more in all of these countries, with especially high ratios for Taiwan and Korea. In addition, the export coupling with China has surpassed the export intensity index for the U.S. since 1995 (in 1990, the export intensity index for China was 1.37 and 1.44 for the U.S. and, by 1995, that had switched to 1.48 for China and 1.40 for the U.S.), evidencing the increasing strength of the trade relationship with China[1].

3. Trade with China, Korea and Taiwan by Stage of Demand

Changes in the content of trade with China, Korea and Taiwan ("CKT"), where the connection with Japan is steadily strengthening, were evident throughout the 1990s. Instead of the usual classification of goods, we reclassified trade goods on our own in this study as intermediate goods, final demand goods and natural resources by stage of demand and attempted to ascertain the way in which they moved.

We used the OECD's International Trade by Commodities Statistics ("ITCS") as the original source of trade statistics in order to unify data used in the analyses starting in this chapter. The 5-digit Revision 2 SITC code is the most detailed commodity classification in the CD-ROM containing these statistics for the year 2000, and we reclassified goods by stage of demand at the level of these commodity classifications. Specifically, we reclassified the following ten categories.

(1) Natural resources
(2) Intermediate goods (consumer non-durable goods)
(3) Intermediate goods (materials)
(4) Intermediate goods (electric equipment[2])
(5) Intermediate goods (non-electric equipment components)
(6) Intermediate goods (transport equipment components)
(7) Intermediate goods (non-equipment components)
(8) Final goods (capital goods)
(9) Final goods (consumer durable goods)
(10) Other

Normally, with classifications (special classifications) such as capital goods and durable consumer goods in the Trade Statistics of Japan, the Summary Report on Trade of the Japan Tariff Association is especially well known and the relationship of correspondence between these special classifications and the classifications used in this study are as indicated in Table 1-1.

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1 It is necessary to be aware that shipments via Hong Kong are not included here. The weight of exports to China from overseas via Hong Kong is rather high; however, in order to define the subject of this analysis, namely, expanding trade with the Chinese mainland, more clearly in this study, in terms of trade relationships, we conducted the analyses separating Hong Kong, where foreign trade was already vigorous prior to 1990, from the Chinese mainland.

2 In this study, "electric components (electric and electronic components)" combine components for electric equipment use and components for electronic equipment. The classification of information technology (IT) goods used in Section 4 of Chapter II only includes electronic components.

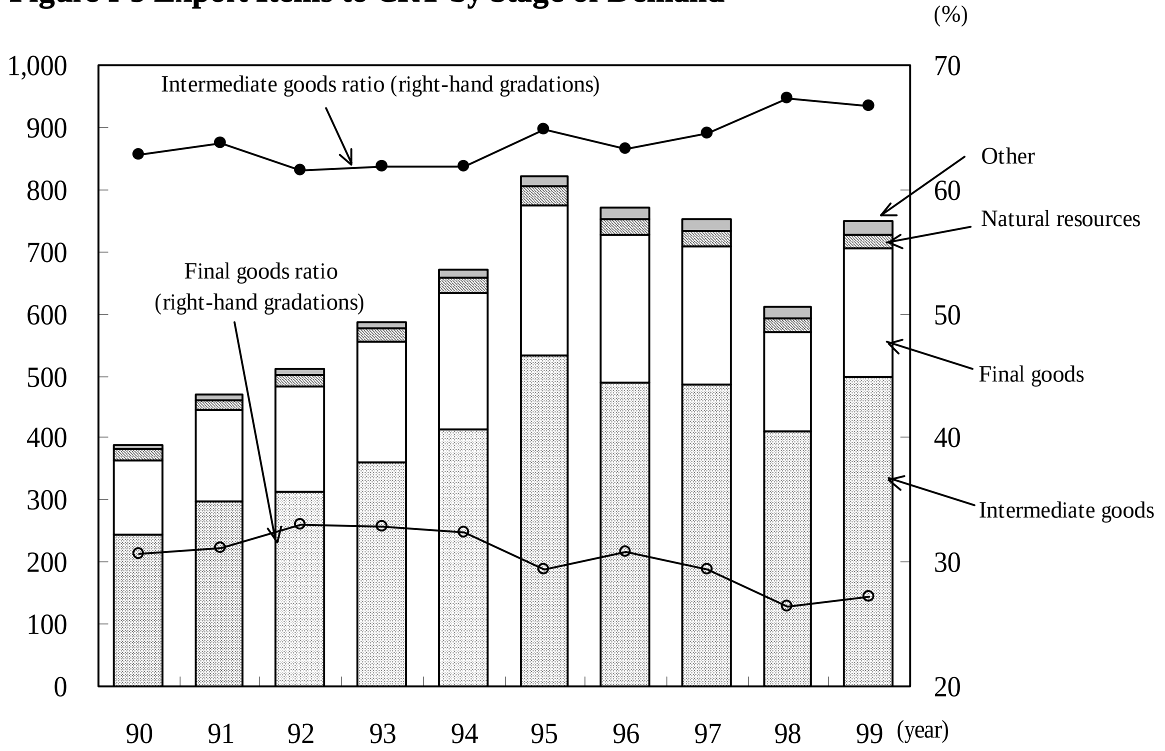
Table 1-1 Classification by Stage of Demand Used in This Study (table of correspondence with special classifications)

Classification in the Foreign Trade Summary: Special classification	Classification in the Foreign Trade Summary: Standard classification	Classification by stage of demand in this study
Food products and direct consumer goods	Natural food products	Natural resources (1)
	Processed food products	Consumer non-durable goods (2)
Industrial supplies	Crude materials	Natural resources (1)
	Mineral fuels	
	Industrial chemicals	Intermediate goods (petrochemical products, steel, etc.) (3)
	Metals	
	Textiles	
	Other	
Capital equipment	Non-electric equipment	Intermediate goods (machine tool components, PC components and accessories) (5) (6) Final goods (machine tools, industrial machines, etc.) (8)
	Electric equipment	Intermediate goods (ICs, other electronic components, etc.) (4) Final goods (computers, computer peripherals, etc.) (8)
	Transport equipment	Intermediate goods (automobile and truck components, etc.) (6) Final goods (trucks, etc.) (8)
	Other	Intermediate goods (7) Final goods (8)
Consumer non-durable goods	Textile products	Final goods (clothes, etc.) (2)
	Other	Final goods (publishing, printing, etc.) (2)
Consumer durable goods	Household equipment	Intermediate goods (furniture components, clock movements, etc.) (7) Final goods (furniture, clocks, etc.) (9)
	Domestic electric equipment	Intermediate goods (air conditioner, washing machine components, etc.) (4) Final goods (air conditioners, washing machines, etc.) (9)
	Passenger cars	Final goods (automobiles) (9)
	Motorcycles, etc.	Intermediate goods (motorcycle components, etc.) (6) Final goods (motorcycles) (9)
	Toys, musical instruments, etc.	Intermediate goods (musical instrument components, etc.) (7) (10) Final goods (toys, musical instruments, etc.) (9) (10)

Note: The numbers (1) - (10) in the diagram primarily correspond to the classification of this study given in Section 3 of Chapter I.
Source: Prepared based on the Summary Report on Trade of Japan, Japan Tariff Association

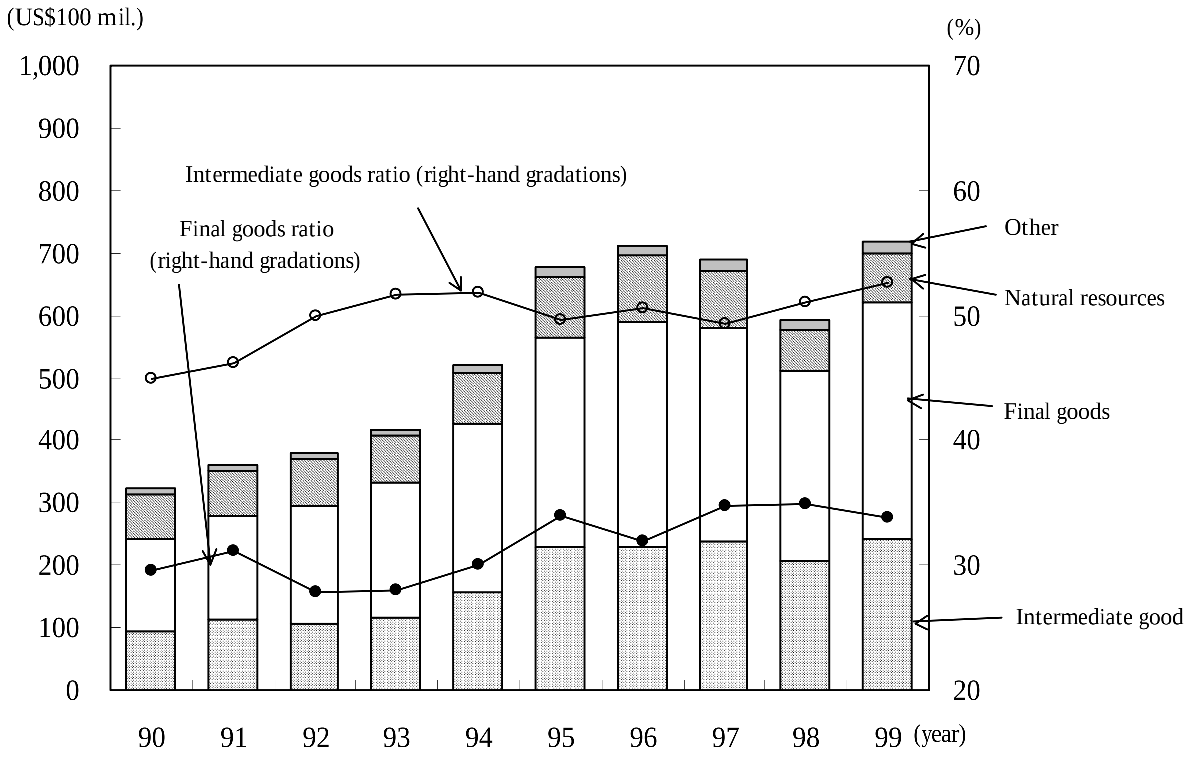
In Figures 1-5 and 1-6, goods divided into the ten classifications above are tabulated into four groups, intermediate goods, final goods, natural resources and other and, of them, exports and imports with CKT are extracted and their transitions are examined.

Figure 1-5 Export Items to CKT by Stage of Demand



Source: Prepared based on the ITCS, OECD

Figure 1-6 Import Items from CKT by Stage of Demand



Source: Prepared based on the ITCS, OECD

Intermediate goods account for a share of just under 70% of exports and it has remained at a consistently high level, though final goods have dropped below 30% in recent years. The transitions in monetary value (US$) also indicate a conspicuous increase in electric equipment component and non-electric equipment component of intermediate goods, in particular, have shown an increase.

Meanwhile, the ratio of final goods, centered in consumer non-durable and other goods of the overall is greater than that of intermediate goods. However, there has also been a tendency of increase in intermediate goods, especially in equipment components, and the import value of electric components, in particular, which reached \$1.65 billion in 1990, showed notable expansion to \$8.93 billion by 1999. Together with this move, the ratio of intermediate goods has also gradually increased.

II Conditions of Comparative Advantage Evident in Japanese Trade

1. Two Trade Structures

In this chapter, we will move forward with an analysis dividing the structure of trade in Japan broadly into two. One of them is based on traditional trade theory and the other is based on intra-industry trade.

When various goods are traded bilaterally between two countries, trade goods from the perspective of one of those countries is broadly divided into three groups.

(1) Goods (or industries[3]) that are only exported
(2) Goods that are only imported
(3) Goods that are both imported and exported

From the viewpoint of traditional trade theory, trade is seen to occur due to differences in production technology or production factor endowments between the two countries. A theoretical system such as this arose from a proposal by Ricardo and this Ricardo model is based on the concept that differences occur in labor productivity due to differences in the technology of each country and that an international division of labor comes into being based on their relative advantages (comparative advantages). In addition, Hecksher-Ohlin, who further expanded on Ricardo's thinking, arrived at the hypothesis that countries that with relatively abundant labor (capital) will export labor- (capital-) intensive goods[4]. The Hecksher-Ohlin (H-O) model based on this hypothesis asserts that an abundance of labor, capital or other production factors available in any given country will give rise to comparative advantages and will generate trade.

Based on such traditional trade theory, if it is assumed that there are differences in production technology or production factor endowments for all goods between any two countries, all goods would be either imported or exported by one of the countries (items (1) and (2) above) and that there would be no goods that are both exported and imported (item (3)). In reality, however, regardless of how detailed the classification of goods may be, it is frequently the case that goods classified in the same category are both exported and imported.

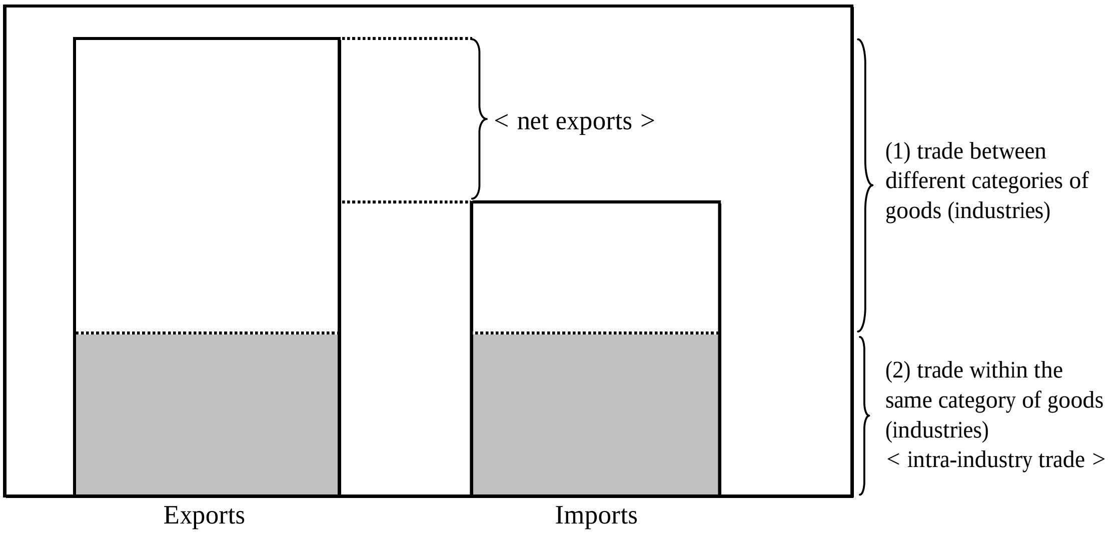
Bilateral trade in goods of the same classification (within the same industry) is referred to as intra-industry trade. It is thought that the background in which intra-industry trade occurs is different from trade based on comparative advantages explained by the above traditional trade theory (further related comments are given in Chapter IV).

Figure 2-1 is a conceptual diagram of these two structures of trade and it shows conceptually that imports and exports consist of trade between different categories of goods (industries) and trade within the same category of goods (industries).

3 If the criteria for the classification of goods is expanded to the industry level, it could be referred to as "industries" that only export.

4 This hypothesis is premised on the conditions of (1) the production function of both goods is homogenous of degree 1, (2) the production function is common to both countries, (3) the factor ratio of both goods does not reverse within an appropriate range and (4) the utility function of both countries is the same and homothetic (if a certain commodity price is given, both commodities will be consumed at the same rate regardless of income level).

Figure 2-1 Trade Structure Categories (conceptual diagram)



(1) Imports and exports between different categories of goods (industries) (E.g., importing natural resources, exporting processed goods)

…Trade occurs due to comparative advantage based on domestic capital, labor and other factor endowments

(2) Imports and exports within the same category of goods (industry) (E.g., exporting special-purpose ICs and importing general-purpose ICs)

…Trade occurs when economics of scale or product differentiation exist

2. Comparative Advantages between Japan, CKT and the U.S.

Since, according to the Hecksher-Ohlin model cited above, there is a comparative advantage in goods that use a concentration of production factors that exist in abundance, exporting those goods makes it possible to maximize profits that the exports yield and enhance effectiveness for consumers. If this relationship is assumed, it becomes possible by using Japan's share of export trade goods to comprehend the nature of the comparative advantage on which each category of goods exported is based, in short, the degree of export competitiveness of trade goods.

Revealed Comparative Advantage index according to Balassa is derived by dividing the ratio of commodity *i* to the total exports of exporting country *j* by the ratio of commodity *i* to total global exports.

$$RCA\ index = \frac{X_j^i / X_j}{M_w^i / M_w}$$

X_j^i : Value of export of goods *i* of country *j*

X_j : Total value of exports by country *j*

M_w^i : Total value of global exports of goods *i*

M_w : Total value of global exports

This, in other words, is an index that indicates export competitiveness using ex-post export performance based on the concept that the export competitiveness of commodity *i* of country *j* based on a comparative advantage will be reflected in the value of exports of commodity *i* from country *j*. If the RCA index of commodity *i* is 1 or more, it could be said that exports of commodity *i* of country *j* are higher than the global average and consequently have a comparative advantage.

In Table 2-1, figures by commodity are calculated by Revealed Symmetric Comparative Advantage index with this RCA index monotonically transformed as indicated below. With the RSCA index, goods with a comparative advantage are expressed as a positive value and goods with a comparative disadvantage are expressed as a negative value.

$$RSCA\ Index = \frac{RCA Index - 1}{RCA Index + 1}$$

Table 2-1 RSCA Index of Japan, CKT and the U.S.

		Food & live animals	Beverages and tobacco	Crude materials, inedible (excl. fuels)	Mineral fuels, lubricants	Animal and oils vegetable	Chemicals	Manufactured goods classified chiefly by materials	Machinery specialized for particular industries
Japan	90	–0.876	–0.896	–0.773	–0.917	–0.806	–0.212	–0.134	0.342
	95	–0.903	–0.793	–0.749	–0.842	–0.934	–0.181	–0.185	0.309
	98	–0.875	–0.830	–0.677	–0.883	–0.912	–0.163	–0.164	0.258
China	92	0.115	–0.147	–0.108	–0.233	–0.300	–0.268	0.107	–0.392
	95	–0.032	–0.027	–0.248	–0.336	–0.135	–0.229	0.152	–0.276
	98	–0.044	–0.303	-0.339	–0.371	–0.376	–0.265	0.085	-0.198
Korea	90	–	–	–	–	–	–	–	–
	95	–0.548	–0.787	–0.552	–0.574	–0.922	–0.163	0.149	0.162
	98	–0.550	–0.783	–0.536	–0.276	–0.886	–0.111	0.183	0.094
Taiwan	90	–0.315	–0.936	–0.521	–0.894	–0.831	–0.344	0.187	0.060
	95	–0.366	–0.880	–0.476	–0.815	–0.874	–0.188	0.188	0.133
	98	–0.638	–0.935	–0.492	–0.770	–0.888	–0.269	0.211	0.145
U.S.	90	0.012	0.291	0.149	–0.538	0.038	0.104	–0.295	0.141
	95	0.027	0.202	0.129	–0.576	0.050	0.064	–0.272	0.117
	98	–0.056	0.074	0.000	–0.601	0.038	0.023	–0.242	0.127

Notes: (1) The RSCA index is (RCA index - 1)/(RCA index + 1).
The RCA index is (ratio of commodity *i* to total exports of exporting country *j*)/(ratio of commodity *i* to total global imports)
(2) The RSCA index expresses the comparative disadvantage of export goods. If it is a positive value, there is a comparative advantage and, if negative, a comparative disadvantage.
Source: Prepared based on the ITCS, OECD

Looking first at the RSCA index for Japan, we see that all goods other than machinery are negative values and that machinery are the only goods with a comparative advantage. The RSCA index of machinery was 0.342 in 1990 and at the comparatively high level of 0.258 in 1998, indicating that they have considerable comparative advantage. Nevertheless, it should be noted that the value declined between 1990 and 1998 and that there was relative deterioration in the degree of comparative advantage. As indicated below, this is thought to be the effect of an improvement in the competitiveness of machinery in other Asian countries.

The comparative advantage that the U.S. had in beverages, tobacco and chemicals in 1990 had weakened by 1998 while very little change was seen in the advantage in equipment and transportation equipment.

Korea and Taiwan, like Japan, have a comparative advantage in machinery and that advantage is particularly gaining in strength in Taiwan. It is possible to see that Taiwan with its notable growth in manufacturing industries, especially electric equipment, steadily improved its export competitive edge not only in materials production but also in processing and assembly type manufacturing throughout the 1990s. Furthermore, China's RSCA index for machinery was a considerably disadvantageous –0.392 in 1990. By 1998, however, this had shown a broad improvement to –0.198 and the effect of the improvement in China's export competitiveness on Asian and world trade is expected to expand significantly hereafter.

3. Relationship between Net Exports and Factor Intensity on the H-O Model

What then is the nature of the domestic factor endowments that give rise to the relative strength of export competitiveness of export goods as indicated above? In this section, we empirically analyze the relationship between trade goods in Japan and domestic production factor endowments using the Heckshen-Ohlin model framework described above.

Leamer was the first to conduct consistent empirical analyses based on the approach of this model. Leamer devised the production factor version of the H-O model, that is, a method for comprehending by directly correlating the export of goods with the production factors that are input in order to produce those goods. Since the factor price is equalized in both countries when two countries produce the same goods under premises such as those described in footnote 4, the ratio of production factors input into those goods is also the same in both countries. It then becomes possible to deem trade in those goods to be the same as trade in the production factors input into those goods. In other words, this is a situation in which "countries with abundant labor will have net exports of labor and net imports of capital (by having labor and capital take the form of input into the goods)."

We will not attempt to clarify the relationship between net exports and factor endowments in Japan by commodity by estimating the production factor version of the H-O model using the Trade Statistics of the Ministry of Finance and the Input-Output Tables (1995) of the Management and Coordination Agency (the current Ministry of Public Management, Home Affairs, Posts and Telecommunications).

We decided to determine the relationship between directly input production factors and net exports[5]. Rather than simply dividing the production factors into capital and labor, we decided to select research and development expenses as a technology-intense factor and technicians as an explicit production facto[66] in order to more clearly define the characteristics of the factor endowments.

The input value and volume of production factors such as capital, labor, research and development expenses and technicians for each type of commodity were described in the Basic Transaction Tables and Employment Matrix included in the Input-Output Tables. Since the most detailed classification in the Basic Transaction Tables and Employment Matrix is the intermediate consolidated sector classification, we tabulated the trade value based on HS classifications integrated with the intermediate consolidated sector classification of the Input-Output Tables and prepared the export and import values by commodity while referring to the correspondence table of the basic classification described in the Input-Output Tables and the HS 9-digit code of the Trade Statistics. We calculated the net export value from these export and import values by commodity as the explained variable and carried out a cross-sectional estimate for 1995 with capital, research and development expenses, number of technicians and the number of other employees as explanatory variables.

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[5] Intermediate input such as embodied in intermediate goods is not taken into account here.

[6] Even if there are three or more commodities and production factors with the production factor version of the H-O model, the above relationship becomes established through the equalization of the factor price. Refer to Wong (1995).

Table 2-2 is a summary of the results of this estimate. The symbols in the explanatory variable column are expressed as pluses or minuses for the various items. If a plus, it can be considered to be exported in a form that embodies the relevant production factor and, if a minus, it can be considered to be imported.

Table 2-2 Relationship between Net Exports and Factor Intensity

(1) Global trade

Explained variable	Explanatory variables			
Net exports	Capital	Research and development	Technicians	Other employees
All industries	–	+ (**)	+ (**)	–
Manufacturing industries (materials production type)	+	–	+ (**)	– (**)
Manufacturing industries (processing, assembly type)	–	+ (**)	+	– (*)
IT goods	+	+		

(2) Trade with China, Korea and Taiwan

Explained variable	Explanatory variables			
Net exports	Capital	Research and development	Technicians	Other employees
All industries	+ (**)	–	+ (**)	– (**)
Manufacturing industries (materials production type)	– (*)	+	+ (*)	– (**)
Manufacturing industries (processing, assembly type)	+ (*)	–	+ (**)	– (**)
IT goods	+ (*)	– (*)	+	

(3) Trade with the U.S.

Explained variable	Explanatory variables			
Net exports	Capital	Research and development	Technicians	Other employees
All industries	– (**)	+ (**)	+ (**)	–
Manufacturing industries (materials production type)	– (**)	+ (**)	–	–
Manufacturing industries (processing, assembly type)	– (**)	+ (**)	–	–
IT goods	–	+	–	

Note: A cross-sectional estimate was conducted by commodity for 1995. "+" and "-" are estimated parameter symbols. (**)means significant at a level of 1% or 5% and (*) means significant at a level of 10%.
Source: Prepared based on the ITCS (OECD) and the Input-Output Tables of the Ministry of Public Management, Home Affairs, Posts and Telecommunications

First of all, looking at the net exports from Japan to the world overall, the tendency to export R&D-intensive goods or technician labor-intensive goods is significant with all goods (all industries). Consequently, it can be said that Japan has an abundance of technological production factors with respect to the world overall and that it is exporting goods with concentrated input of those production factors. This tendency furthermore differs depending on the commodity. With industrial materials type products, technician-intensive goods are exported while there is a tendency to import non-technician-intensive goods. Meanwhile, with processed or assembled type products, there is a strong tendency for R&D-intensive goods to be exported.

When looking solely at trade with China, Korean and Taiwan, based on all industries, capital- and technician-intensive goods and non-technician-intensive goods are imported. Though the relationship is somewhat weak, a tendency is apparent of exporting capital-intensive goods of the processed and assembled type in particular. In addition, in trade with the U.S., there is a tendency to export R&D-intensive goods and import capital-intensive goods whether all industries, industrial materials type industries or processing or assembly type industries.

The relationship described above shows results that are essentially consistent with the tendency of comparative advantage and disadvantage by commodity of the previous section. Since equipment and electric equipment have an abundance of production factors such as capital and technicians, it is exported with comparative advantage. On the other hand, comparative disadvantages are broadly evident in materials production type industries and there is a tendency to import capital-intensive goods from Asia or the U.S. When looking again at the net export value of trade with Asian countries by item (Appended Fig. 2-1), in addition to a broad excess of imports of textiles over exports in materials production type industries, there is a small amount of net exports in non-metallic industries. In addition, the net export value of equipment and apparatus rapidly contracted between 1995 and 2000 and there has been a possibility recently of weakening in the relationship to factor endowments as evident in the previous estimate.

4. Relationship between Net Exports of Information Technology (IT) Related Goods and Factor Endowments

In order to consider the characteristics of net exports by commodity in more detail, we carried out a similar estimate focusing on information technology (IT) related goods. (Table 2-2)

We selected the following three items here while referring to the classification of the OECD's Information Technology Outlook 2000 (Appended Fig. 2-2).

(1) Computer related devices
(2) Communication related devices
(3) Electronic components

According to the results of the estimate, a relationship to IT goods, weak though it may be, was evident in CKT. There is a tendency with IT goods to export capital-intensive goods and import R&D-intensive goods. In regard to the meaning of the latter R&D-intensive goods, rather than shifting R&D bases from Japan to locations overseas, goods with a considerable input of R&D expenses in Japan are probably being shifted to CKT at the production stage, massed produced locally there and then imported.

No significant relationship was seen in IT goods, however, in trade with the U.S. and with the world at large. The relationship between net exports and factor endowments becomes established based on premises such as those given in footnote 4. Actually, however, there are cases when premises such as those are not necessarily consistent. When there is a global shift in production factors or economies of scale, in particular, it is not valid with traditional trade theory such as Hecksher-Ohlin and, as indicated in Chapter IV, is thought to be realized in the form of bilateral trade in the same goods (same industry), in short, intra-industry trade. In other words, it is possible that the reason for the difficulty in applying traditional trade theory to IT goods may be due to the impact of the activation of intra-industry trade. We thus decided to survey moves in IT goods trade such as this in Chapter III and analyze the background and effects of intra-industry trade in the following Chapters IV and V.

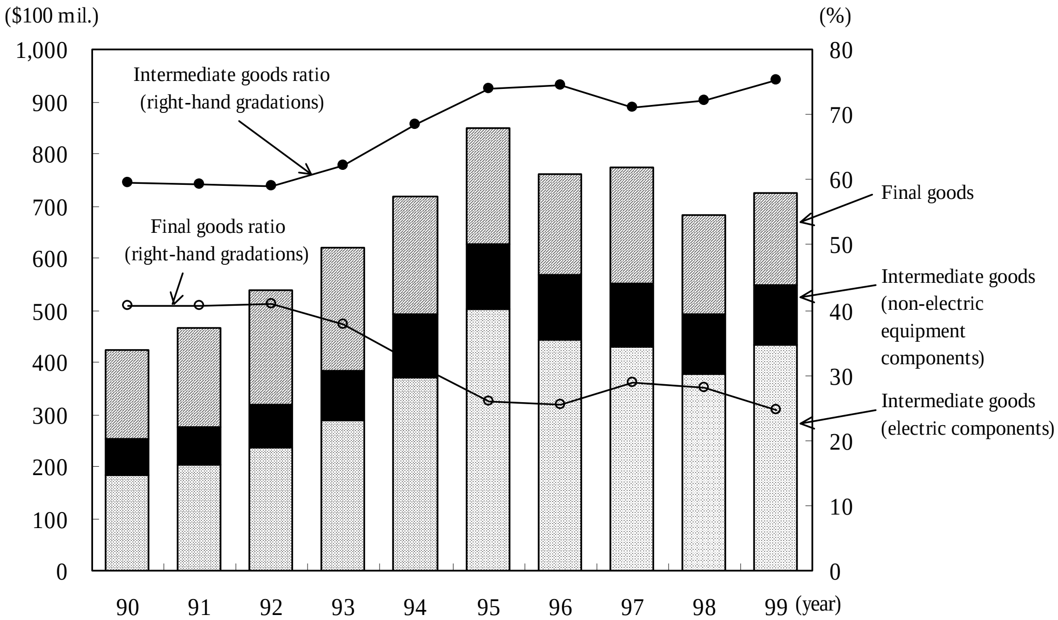
III Characteristics of Japan's Trade in IT Goods

1. Japan's Trade in IT[7] Goods by Stage of Demand

The increase in the global demand for IT goods from the beginning of the 1990s also had a strong effect on trade in Japan. Let us take a look at Japan's imports and exports of IT goods divided into the same commodity classification by stage of demand as in section 3 of Chapter I.

When tabulated based on the OECD's ITCS data, the value of exports of IT goods from Japan (Figure 3-1) was $42.26 billion in 1990, expanding rapidly thereafter to $84.89 billion by 1995. There was a tendency toward decline through 1998, which again turned to an increase to $72.55 billion in 1999. In a breakdown, there was a notable increase in exports of IT-related intermediate goods especially during the first half of the 1990s and there was considerable growth in electric components (semiconductors, ICs, etc.), which accounted for the majority ($18.24 billion in 1990 → $43.26 billion in 1999).

Figure 3-1 Detailed Breakdown of Exports of IT Goods by Stage of Demand



Note: Of IT goods (1) computer-related devices, (2) communications-related devices and (3) electronic components, components included in (3) and (1)/(2) are classified as intermediate parts and finished products included in (1)/(2) are classified as final goods.
Source: Prepared based on the ITCS (OECD)

In addition, there was also an increase in non-electric equipment (computer and peripheral device components, accessories, etc.) ($6.88 billion in 1990 → $11.45 billion in 1999). Meanwhile, final goods, including finished computers and communication equipment, expanded broadly through 1993 but peaked later. Therefore, the ratio of intermediate goods of total exports went through a steep rise during the early half of the 1990s and remained at a high level (59.4% in 1990 → 75.4% in 1999) while the ratio of final goods gradually declined.

Although the import value of IT goods was small in scale compared to the export value, that

[7] The definition of IT goods is the same as that given in section 4 of Chapter II.

continued to grow throughout the 1990s ($10.18 billion in 1990 → $39.92 billion in 1999). In a detailed breakdown, both intermediate and final good increased and imports differed from exports in that the ratio of intermediate goods increased by more than 60% and ratio of final goods by more than 30% throughout the 1990s (Appended Fig. 3-1).

2. Competitiveness of IT Goods in Japan, China / Korea / Taiwan and the U.S.

As in section 2 of Chapter II, we attempted a comparison of export competitiveness of IT goods based on the RSCA index. For the categories of goods, we used the same classification into three groups as in the previous section, final goods, intermediate goods (electric components) and intermediate goods (non-electric equipment components).

In Table 3-1, looking first at the RSCA index for Japan, it is apparent that the values are comparatively high for all categories of goods and that they have an advantage in terms of export competitiveness. However, there was a tendency for that advantage to weaken somewhat through 1998 and final goods, in particular, switched to the negative, becoming comparatively disadvantageous. Since the processing and assembly processes of PC computers and other products tend to be labor-intensive, it is possible for the NIES and ASEAN countries, China and other countries to enhance their export competitiveness through the input of low-cost labor. It is likely that Japan lost its comparative advantage due to this relative improvement in export competitiveness in other countries. Although the RSCA index of final IT goods in China was actually in a conspicuously comparative disadvantage as of 1992 with a negative value of –0.567, this shifted to the positive by 1998[8]. Still, China remains at a comparative disadvantage in the case of ICs and other capital-intensive electric components with high added value. In addition, Taiwan is highly export competitive not only with final goods but also computer motherboards and other intermediate goods components[9] and all RSCA indices also indicate high levels.

Table 3-1 RSCA Index of IT Goods in Japan, CKT and the U.S.

		Final goods	Intermediate goods (electric components)	Intermediate goods (non-electric equipment components)
Japan	90	0.310	0.315	0.294
	95	0.106	0.316	0.248
	98	–0.010	0.201	0.177
China	92	–0.567	–0.534	–0.369
	95	–0.209	–0.529	–0.256
	98	0.011	–0.411	–0.093
Korea	90	–	–	–
	95	0.034	0.465	–0.492
	98	0.012	0.419	–0.616
Taiwan	90	0.389	0.256	0.441
	95	0.343	0.325	0.598
	98	0.399	0.358	0.624
U.S.	90	0.180	0.191	0.321
	95	0.125	0.063	0.225
	98	0.047	0.121	0.157

Source: Prepared based on the ITCS (OECD)

8 According to IDC Japan, the value of IT products produced in China was $5.3 billion in 1996, increasing to $12.4 billion by 1999.

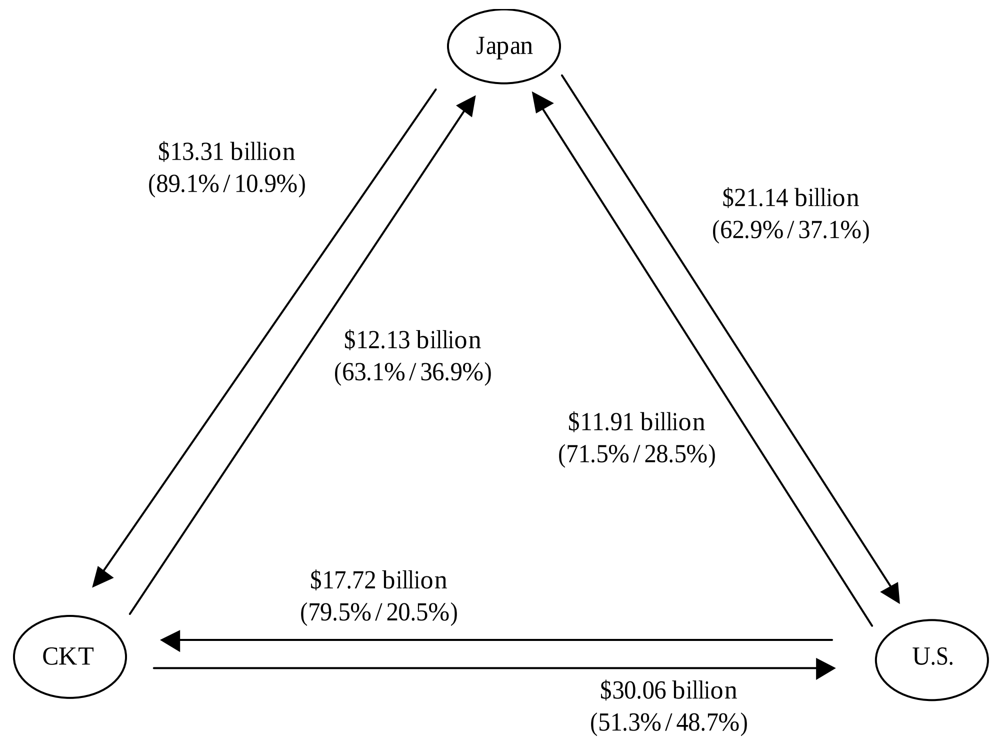
9 According to IDC Japan, the value of electronic products produced in Taiwan as of 1996 was $6.45 billion for ICs and $530 million for LCDs. By 1999, this had increased to $12.00 billion and $1.00 billion, respectively. In addition, the value of the production of computers, peripherals and other IT hardware (not including electronic devices) was $18.87 billion in 1995, increasing to $33.78 billion by 1998 and, even with the effects of the great earthquake in 1999, growth continued in that year to $39.87 billion. The composite ratio by type of major hardware product in 1999 shows that PC computers as finished products accounted for 50.1% overall with high ratios for monitors (16.3%), motherboards (12.5%) and other products.

3. Trends in IT Goods Trade in Japan, Asian Countries and the U.S.

In order to comprehend the scale and characteristics of trade in IT goods as it continues to expand globally, we tabulated the value of exports in IT goods for 1999 between the typical three regions of Japan, CKT and the U.S. (Figure 3-2). The value of exports of IT goods from Japan to the U.S. was $21.44 billion with imports from the U.S. amounting to $11.91 billion, indicating an excess of exports over imports in the amount of $9.53 billion. Meanwhile, exports from Japan to CKT amounted to $13.31. billion against imports of $12.13 from CKT, an excess of exports over imports of $1.18 billion. Furthermore, exports from CKT to the U.S. had a value of $30.06 billion against imports from the U.S. to CKT of $17.72 billion. This would indicate that, in the trade relationship between these three regions, the U.S. has the greatest ability to absorb demand.

We furthermore divided each of these export values between intermediate goods and final goods. When calculating the ratio of final goods of exports and total export value, the ratio from Japan to the U.S. and from CKT to the U.S. was at the relatively high levels of 37.1% and 48.7%, respectively. On the other hand, the ratio of final goods from Japan to CKT and from the U.S. to CKT did not go beyond 10.9% and 20.5%, respectively, indicating that more than 80% consisted of intermediate goods. Given the absolute value of 36.9% for the ratio of final goods exported from CKT to Japan, it is evident that the U.S. has the overwhelmingly strongest demand for final goods. Meanwhile, it is also clear that CKT have a structure centered completely in demand for intermediate goods.

Figure 3-2 Trade in IT Goods between Japan, CKT and the U.S. (1999)



Note: Figures in parentheses express (intermediate goods ratio / final goods ratio)
Source: Prepared based on the ITCS (OECD)

We moreover tabulated the scale of exports of IT goods for Asia overall including not only CKT but also NIES countries such as Singapore and Hong Kong as well as Thailand, Malaysia and other ASEAN countries. The total value of exports and imports from CKT to other Asian destinations (excluding Japan) is as indicated in Table 3-2. In 1999, exports amounted to $38.67 billion and imports to $33.74 billion, both indicating a broad increase over 1995 and, in addition, the ratio for intermediate goods was also at an extremely level.

Table 3-2 Trade in IT Goods in Asia (excluding Japan)

		Value ($100 mil.)	Ratio of intermediate goods
Value of exports from CKT to other Asian countries	1995	226.8	84.2%
	1999	386.7	84.2%
Value of imports to CKT from other Asian countries	1995	133.3	84.3%
	1999	337.4	78.4%

Note: Import and export values also include the value of trade between China, Korea and Taiwan.
Source: Prepared based on the ITCS (OECD)

Based on this, it can be seen that a considerable volume of multi-level trade in intermediate IT goods is being carried out within Asia. It could be said in the case of IT goods that vigorous trade business exists between the countries at the stage of intermediate components until completed as final goods due to the diversification and globalization of production processes[10], the increase in the number of components and other factors.

In the multi-level trade structure centered in intermediate goods, when strong demand occurs from the outside for final goods, there is a spiraling surge of growth of trade in intermediate goods including speculative demand and other factors, energizing production activities in countries within the multi-level structure. When demand for final goods from the outside cools, however, inventories accumulate overall and trade and production activities decelerate due to the diversification of production stages. It is possible to see this trade structure in the background of the deceleration of the U.S. economy in the second half of FY 2000 and, particularly, the cooling of demand that induced stagnation in the economies of Asia and, in turn, a broad decline in exports from Japan.

[10] A shift in production of some computer peripherals from Taiwan to China has been picking up speed. According to IDC Japan, the ratio of Chinese production among components, such as keyboards, mouses, etc., that are installed in PC computers produced domestically in Taiwan has reached a level of some 70-80%.

IV Background of Intra-industry Trade

1. Current State of Intra-Industry Trade in Japan

As touched upon at the end of section 3 of Chapter II, in actual trade activities, not only is trade carried out between two countries in differing goods and between differing industries but trade in the same goods and between the same industries, that is, intra-industry trade, is also common. This has culminated in the erosion that is becoming evident in part in Japan's competitive advantage in the relationship between net exports and factor endowments or export competitiveness seen through the previous chapter. That does not mean, however, that Japan's exports themselves will be reduced or that absolute competitiveness is being lost but it is due rather to changes in the correlation with imports or correlation with exports of other countries. Since IT goods, in particular, do not fit well within models based on traditional trade theory such as that described above, there is great significance in examining the issue from the perspective of intra-industry trade.

Accordingly, let us look first at trends in intra-industry trade in Japan. Though a variety of indices have been considered as means for comprehending intra-industry trade, in this study, we adopted the following calculation method based on Fontagne et al. (1998), Chiarlone (2000) and others[11].

$$Overlap\ index = \frac{Min(X_j; M_j)}{Max(X_j; M_j)}$$

X_j : Value of exports (of commodity *i*) to country *j*
M_j : Value of imports (of commodity *i*) from country *j*

We indicated the transitions in the index by commodity for trade with CKT and trade with the U.S. with figures derived by multiplying the overlap index calculated by the formula above by 100 as the intra-industry trade index (Figures 4-1 & 4-2). Looking that the movement in the intra-industry index in trade with CKT, there is considerable evidence of intra-industry trade in the field of final products in durable consumer goods during the first half of the 1990s; however, the index dropped through the latter half of the 1990s due to the decease in exports from Japan and the increase in imports from CKT.

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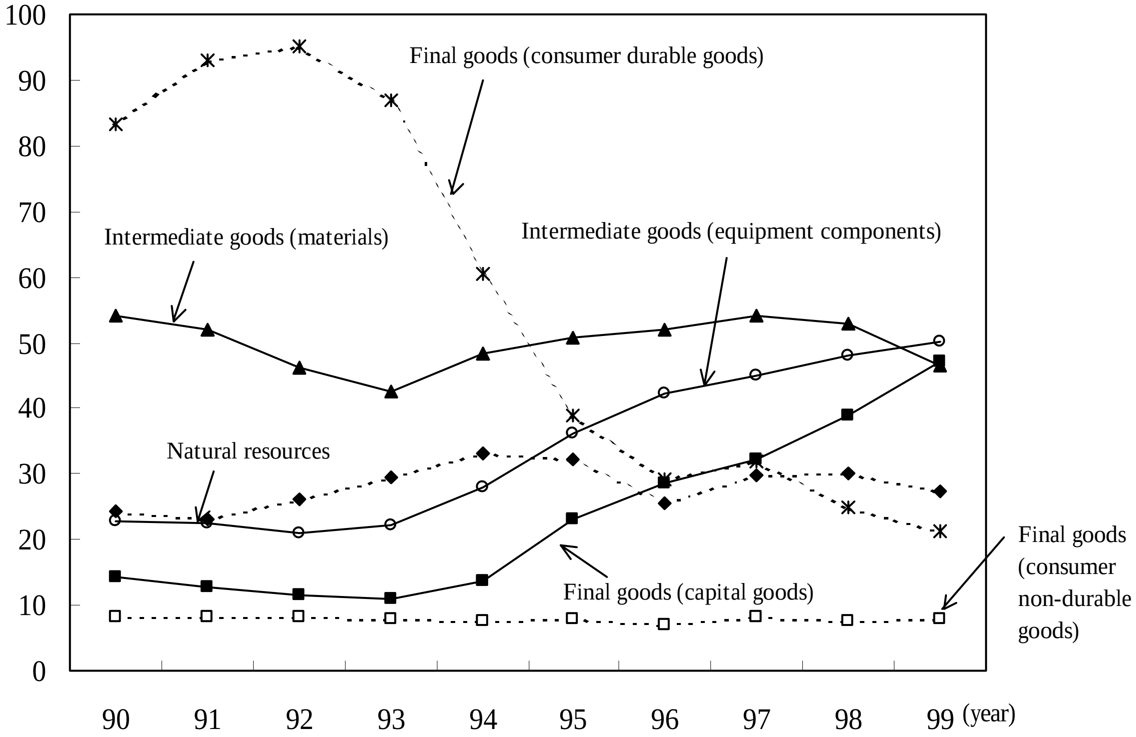
11 The well-known intra-industry trade index according to Grubel-Lloyd (the GL Index) is as indicated below.

$$GL\ Index = \frac{X_j + M_j - |X_j - M_j|}{X_j + M_j}$$

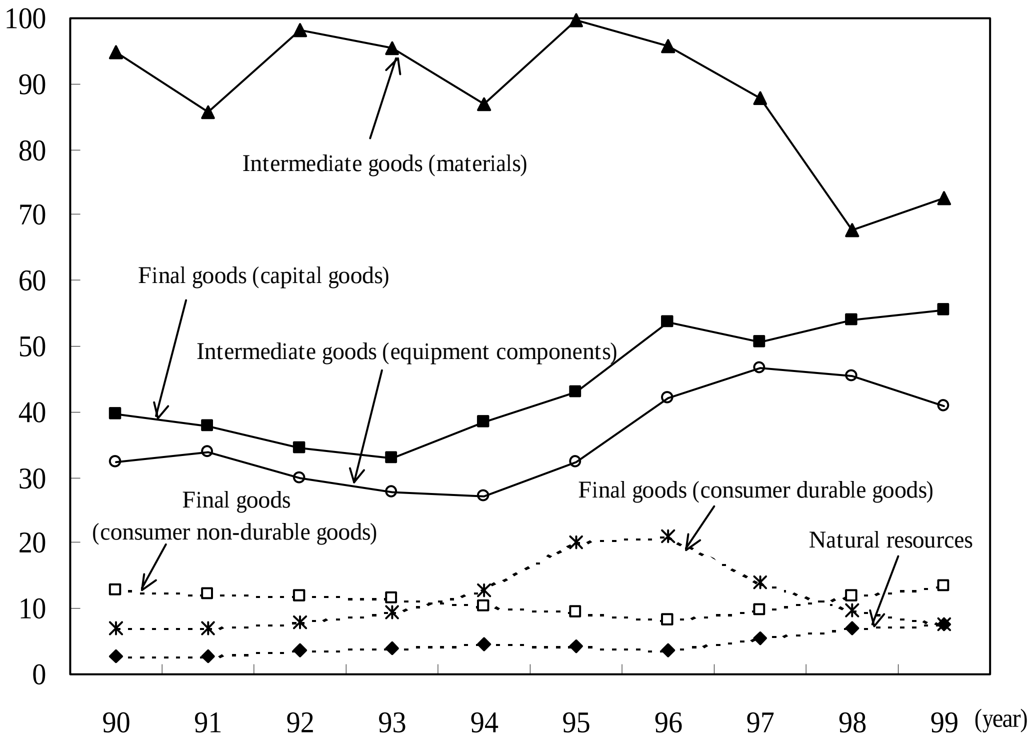
It has been pointed out, however, that there are a number of drawbacks with this index. For example, the larger amount of imports and exports consists of both intra-industry and inter-industry trade while the lesser amount must consist only of intra-industry trade. In reality, though, since the classification of goods has a certain range, bilateral transactions are seen with almost all trade goods and intra-industry trade exists in all of them. In addition, in case intra-industry trade exists in all industries, the trade balance would consist only of the balance of inter-industry trade, albeit such situation would be almost unthinkable in actuality.
With Fontagne et al. (1998), intra-industry exists if the overlap index is 0.1 or more and differentiated goods are being traded bilaterally. It is assumed that, if the index is less than 0.1, there is a strong tendency for trade activities to be carried out in one direction and it is possible to deem the goods to be homogeneous. As a result, it would be possible to classify trade in all goods as either bilateral or unilateral without regard to the import/export balance.

Figure 4-1 Transitions in Intra-Industry Trade with CKT



Source: Prepared based on the ITCS (OECD)

Figure 4-2 Transitions in Intra-Industry Trade with the U.S.

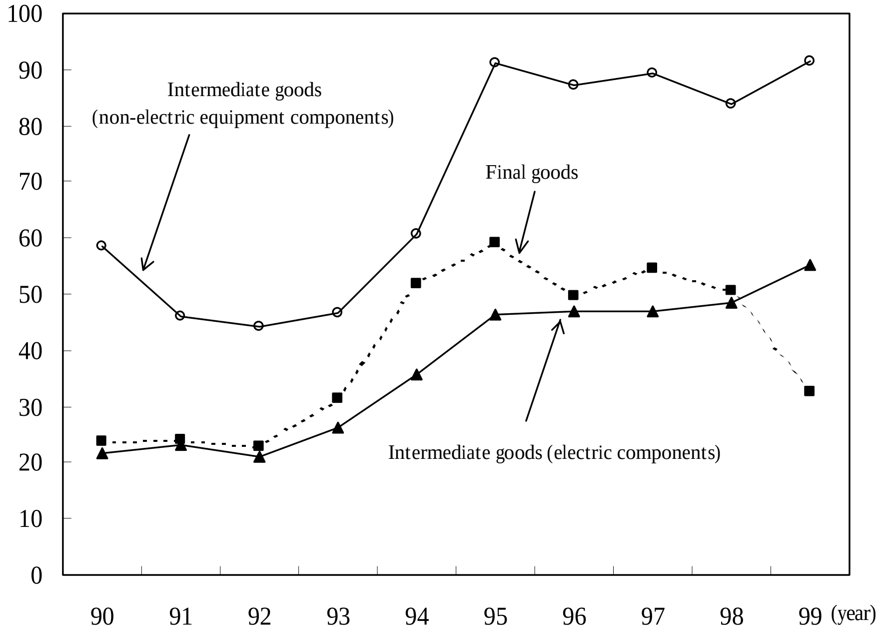


Source: Prepared based on the ITCS (OECD)

Meanwhile, exports from Japan consisted primarily of final products of capital goods and intermediate products of equipment components until the 1990s; however, imports from CKT gradually increased, developing into bilateral trade. This tendency is conspicuous compared to the relationship with the U.S. and suggests an improvement in the export competitiveness of CKT.

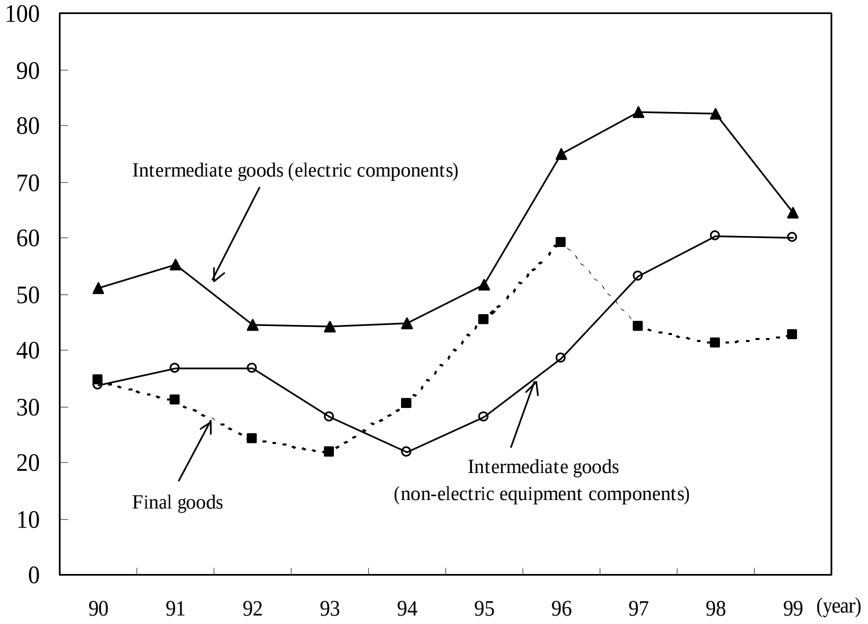
In addition, when we calculated the intra-industry trade index for IT goods, the transitions were as indicated in Figures 4-3 and 4-4.

Figure 4-3 Intra-Industry Trade Index for IT Goods in Trade with CKT



Source: Prepared based on the ITCS (OECD)

Figure 4-4 Intra-Industry Trade Index for IT Goods in Trade with the U.S.



Source: Prepared based on the ITCS (OECD)

It could be said first of all that intra-industry trade in IT goods has been in a trend of overall increase both in trade with CKT and with the U.S. since the latter half of the 1990s. In trade with CKT, in addition to an increase in the intra-industry trade in non-electric equipment components, electric components have also shown a continuous gentle rise. The intra-industry trade index for final goods began to increase around 1994, declining somewhat by 1999. Meanwhile, in trade with the U.S., the intra-industry trade index in electric components reached the highest level. Final goods increased from 1993 through 1996, which was then followed by a slight decline.

Intra-industry trade in IT goods has thus become vigorous, especially in intermediate goods. The question then arises of the nature of the background in the tendency and the significance that it may have. We will consider the background and meaning of intra-industry trade beginning in the next section.

2. Background of Intra-Industry Trade

Krugman et al. developed the so-called "new trade theory" incorporating in trade the concepts of monopolistic competition and differentiated oligopoly. According to Krugman (1980), the monopolistic competition model theorizes the occurrence of trade by establishing such premises as (1) increasing returns to scale, (2) imperfect competition under product differentiation and (3) consumers who select more diverse consumption. In other words, if consumers show preference for a variety of goods when per-unit production cost declines along with increased production volume, firms in one's own country will specialize in the production of certain goods and it becomes more advantageous to import other goods produced by firms in foreign countries. The concept is that trade occurs for that reason.

We attempted to verify whether or not economies of scale or product differentiation generate intra-industry trade using actual data based on the concept of this "new trade theory." In order to examine first of all the relationship between intra-industry trade and economies of scale, we used the intra-industry trade index calculated based on trade statistics as the explained variable and the ratio of tangible fixed assets to total assets as a proxy variable expressing economies of scale as the explanatory variable[12].

In regard to the former, as in the method of section 3 of Chapter II, we prepared data by industry by integrating the goods of trade statistics based on the intermediate classification of the Input-Output Tables. We calculated the latter tangible fixed assets ratio using the Development Bank of Japan's Company Financial Data and, at that time, we maintained consistency between the industries and explanatory variable by matching the industry classification of the Company Financial Data with the intermediate classification of the Input-Output Tables.

When we estimated industry panel data with the estimate term of 1995-99 and 1990-99 using the above data (Table 4-1), we found that, in 1995-99, the significance of parameters of economies of scale that satisfy the sign conditions was somewhat weak. In addition, in the period of 1990-99, the sign conditions did not match and a stable relationship was not obtained between the two[13].

[12] In order to measure economies of scale directly, it is necessary to determine whether or not economies of scale exists by estimating the cost function or by other means. In this study, however, due in part to limitations in data, we used the ratio of tangible fixed assets as a proxy variable. This is used from the ex-post perspective that, if an industry demonstrates economies of scale, the scale of its facilities will be relatively larger; however, there is probably room for improvement in the selection of variables. There are also examples of using the fixed expenses ratio (Hoden, Ito and Kainuma, 1991), etc., as other proxy variables in similar analyses.

[13] Wu-Hauseman test was conducted and the fixed effects model was used.

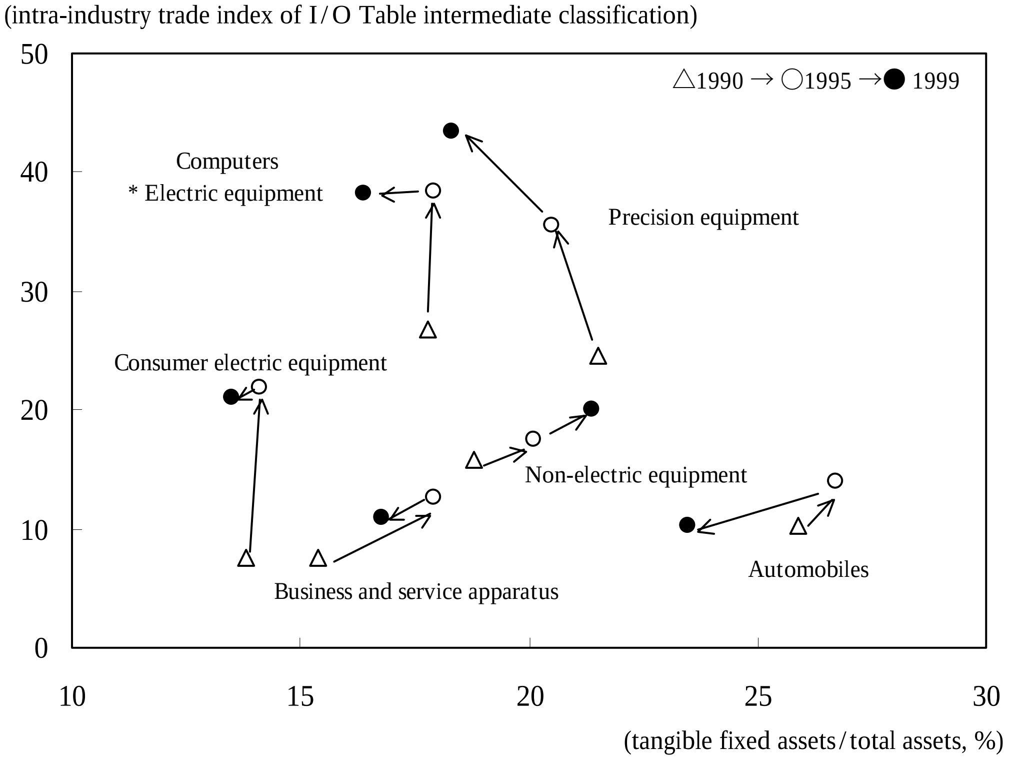
Table 4-1 Estimate of the Factors for Determining Intra-Industry Trade

Explained variable: Intra-industry trade index	Estimate period (estimate method)	Explanatory variables: Economies of scale	Explanatory variables: Product differentiation
I/O Table intermediate classification (45 goods)	1995-99 (panel estimate)	0.30 (1.73)	–
	1990-99 (panel estimate)	–0.04 (–0.43)	–
HS 4-digit classification (1,234 goods)	1990, 1995, 2000 (panel estimate)	–	0.09 (1.17)
	1990, 1995, 2000 (OLS estimate)	–	0.14 (5.70)

Note: The ratio of tangible fixed assets/total assets of the relevant industries was used for the economics of scale and the number of goods of the HS 6-digit code within the HS 4-digit code classification of the Trade Statistics were used for product differentiation.

Source: Prepared based on the Trade Statistics of the Ministry of Finance, Input-Output Tables of the Ministry of Public Management, Home Affairs, Posts and Telecommunications and the Company Financial Data of the Development Bank of Japan

Figure 4-5 Intra-industry Trade of Processing and Assembly Type Industries and Economics of Scale



Note: Only major industries are extracted.

Source: Prepared based on the Trade Statistics of the Ministry of Finance, Input-Output Tables of the Ministry of Public Management, Home Affairs, Posts and Telecommunications and the Company Financial Data of the Development Bank of Japan

The relationship between the two when viewed by industry is as indicated in Fig. 4-6. The trends of major processing and assembly industries indicate a certain degree of correlation between the intra-industry trade index and the tangible fixed assets ratio in the case of non-electric equipment, automobiles and business and service apparatus. On the other hand, intra-industry trade became rapidly active from 1990 through 1995 in the case of consumer electric equipment, precision equipment and computers and electric equipment, while there was a notable lack of any degree of change in the tangible fixed asset ratio.

What factors then are possible as the background of these results? The increase in foreign direct investments can probably be cited as one of them. Along with the increase in Japan's foreign direct investment from the mid-1990s, there was a conspicuous increase in reverse importation[14].

Taking this situation into account, even though no sizable change was evident in the scale of domestic facilities, intra-industry trade is thought to have accelerated through the local production of those products for which local production is advantageous from the standpoint of product differentiation and their reverse importation.

Next, we will confirm the relationship between intra-industry trade and production differentiation. For the explanatory variable, we used the number of goods classification of the Trade Statistics as an index indicating the degree of product differentiation. Specifically, taking into consideration the fact that consistent time-series commodity classification since 1990 have become possible as well as the fact that goods consistently correspond to exports and imports, we based it on the HS 6-digit code as the most detailed commodity classification satisfying the above two points in the Trade Statistics of the Ministry of Finance. As the index of product differentiation, we used the number of goods of the HS 4-digit code that are in the HS 6-digit code[15].

In the relationship between the two, we conducted panel estimates by commodity with estimation periods of 1990, 1995 and 2000[16] (Table 4-1). The outcome indicates that sign conditions are consistent and that the parameters are also significant. In addition, when we confirmed this by OLS estimates of all data of 1990, 1995 and 2000, we found the sign conditions to be consistent as well as a high degree of significance. It could be said, in other words, that this indicates that the more notable the product differentiation of products, the more vigorous bilateral trade within the same product classification will be.

Let us look next at the relationship to product differentiation by industry. Fig. 4-6 shows the degree of the intra-industry trade index and product differentiation for a number of products classified as IT goods[17].

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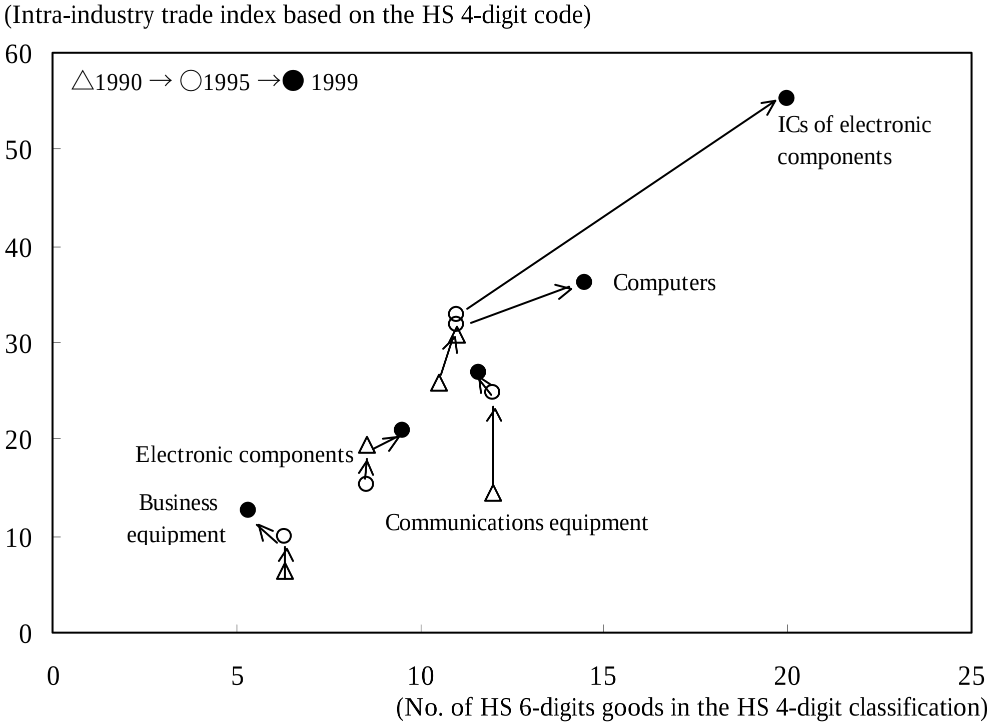
[14] Though Japan's foreign direct investments declined during the early half of the 1990s, there was a tendency toward increase during the latter half as the yen became stronger. There was a broad increase in manufacturing industries in FY 1999, due in part to a reaction following the Asian currency crisis, but this was followed again in 200 by a decline (Appended Fig. 4-1). The tendency for the local subsidiaries of Japanese firms to carry out reverse importation became stronger along with the cumulative increase in direct investments and there has been a particularly rapid surge since the latter half of the 1990s (Appended Fig. 4-2). Meanwhile, there has also been an increase in the export of intermediate goods to those local subsidiaries and this is considered to be one factor that is stimulating intra-industry trade (Appended Fig. 4-3).

[15] The Hufbauer index (standard deviation of product per unit added value / mean value) and the ratio of advertising expenses against sales are among additional indices of product differentiation. In this study, however, we used the indices indicated above due to data availability. One problem regarding such methods of the intra-industry trade index itself is the possibility of random change due to the setting of the range of goods classification; in this study, however, we sought to eliminate that problem as much as possible by using the most highly segmented statistical classification ordinarily available.

[16] Wu-Hauseman test was conducted and the random effects model was used.

[17] A number of HS 4-digit-based products are grouped together and classified for the purpose of simplification in the goods classification of Fig. 4-7 and, therefore, the values are mean values. The value for the product differentiation of "business equipment" in the diagram, for example, is the mean value of number of 6-digit goods including HS 4-digit based "word processors," "calculators" and "other business equipment."

Figure 4-6 Intra-Industry Trade in IT Goods and Product Differentiation



Note: Other than electronic components, HS 4-digit classification mean values (e.g., for business equipment, it is the mean number of 6-digit goods of HS 4-digit-based word processors, calculators and other business equipment)
Source: Prepared based on the Trade Statistics of the Ministry of Finance

While no particularly strong link is apparent between business equipment and communications equipment, a correlation can be seen between electronic components and computers. Among electronic components, product differentiation advanced, in particular, with ICs from 1995 through 1999 and, at the same time, intra-industry trade activity also accelerated.

Though intra-industry trade in IT goods has became active, as mentioned in section 1 of Chapter IV, the relationship with product differentiation indicates that there are disparities in the extent among IT goods. As with IT-related intermediate goods, especially ICs, suppliers of products in which the outcome of technological development is directly transformed into improvements in product function (addition of new functions, increased capacity) and stimulates product differentiation are competing on a global scale in Japan, the U.S., Korea, Taiwan and a number of other countries and production bases are expanding everywhere. Thus, the relationship between product differentiation and intra-industry trade is strengthening, in particular, for such goods in the IT field.

Meanwhile, with IT final goods, that is, business and communications equipment finished products, product differentiation is embodied in minute form by means of the brand, addition of ostensible functions and so forth and there is often no change in the commodity classification. With goods such as these, no strong relationship was evident in the present analyses between product differentiation and intra-industry trade.

We examined the background of the occurrence of intra-industry trade above using actual data. Though no strong relationship was seen between intra-industry trade and economies of scale in an estimate based on all industries, there were indications of a relationship with product differentiation. On the other hand, disparities were noted in relationships in the case of individual goods depending on the commodity.

3. Noteworthy Connotations of the Expansion of Intra-Industry Trade in IT Intermediate Goods

It is possible to point out as one factor that was clarified by the estimate that conspicuous differentiation was realized in IT goods, especially components and other intermediate goods, through practical improvements in product functions and so forth throughout the 1990s and that intra-industry trade in such goods expanded. Let us look at the connotations involved.

As seen in Chapter I, the relationship between Japan and China, Korea, Taiwan and other Asian trading partners strengthened during the 1990s and, in the background, there was improvement in the export competitiveness of goods produced in each of those countries. As touched upon briefly in section 3 of Chapter III, as examples of IT goods, Samsung and many other firms in Korea became ranked among the top names worldwide in DRAM production as the result of aggressive capital investment by these manufacturers. Furthermore, in addition to a gathering of motherboard producers in Taiwan, there are also many OEM production bases of vendors in the U.S. and Europe, which boast of strong competitive power. In China as well, production has been expanding centered in the fields of added value products and assembly.

Thus, in the IT field, though described simply as intermediate goods, the field of product development demonstrates extreme diversity, characterized by the existence of firms with competitive power in each segmented field and a large share. In addition, the current pivot point of IT final goods is computers and computer peripherals, communications equipment and so forth and it is the components of intermediate goods that frequently determine the performance of those final goods. Therefore, there are multiple countries that have firms capable of dominating in the development and production of core intermediate goods and there is vigorous bilateral trade between those countries. Trade patterns such as those described in the preceding section were more than likely formed as a result of an industrial structure with these characteristics.

V Relationship between Intra-Industry Trade and Productivity

1. Impact of the Development of Intra-Industry Trade on Productivity

What sort of impact then does the expansion of intra-industry trade have on the domestic economy? We will not examine the impact of the theoretical background confirmed in the previous chapter, that is, economies of scale and product differentiation. If intra-industry trade develops in industries with strong economies of scale, production will expand further. In addition, if product differentiation advances and many differentiated products are imported from overseas, that will stimulate competition with domestic products.

Meanwhile, the occurrence of the international movement of production factors may bring such aspects as progressive division of labor between processes and the further sophistication of job content. It is possible consequently to expect the effect of improvements in productivity (labor and capital productivity) to emerge under circumstances brought about by the development of intra-industry trade.

We thus attempted to confirm such relationships using actual data. Table 5-1 shows the results of panel estimates of the relationship between productivity[18] and intra-industry trade of 49 goods (industries) based on the Input-Output Tables intermediate classification. The estimate term was 1990-99 and we confirmed that the parameters of the intra-industry trade index, which was the explanatory variable, had a certain degree of significance.

Table 5-1 Effect of Intra-Industry Trade on Productivity

Explained variable	Estimate period	Explanatory variable
Capital productivity		Intra-industry trade index
I/O Table intermediate classification (49 goods)	1990-99	0.22 (1.60)

Source: Prepared based on the Trade Statistics of the Ministry of Finance, the Input-Output Tables of the Ministry of Public Management, Home Affairs, Posts and Telecommunications and the Company Financial Data of the Development Bank of Japan

2. IT Investment Level and the Intra-Industry Trade Index

We confirmed in the preceding section that the development of intra-industry trade had the effect of bringing about an improvement in domestic productivity. In this section, we will examine whether or not there are strengths and weaknesses in this relationship due to goods (industries) from the somewhat different perspective of IT investments.

Japan Development Bank (1997) conducted an analysis of the contributions of intra-industry trade on productivity dividing goods between those that are technology-intensive[19] and those that are not. In the present study, we decided to classify goods by the extent of IT-related investments that are carried out when certain goods are produced.

Specifically, we calculated the ratio of IT-related capital goods[20] and software in relation to capital formation (i.e., capital investments of the relevant industry; total endogenous sectors excluding residential housing) of certain goods based on the Fixed Capital Matrix of the Input-Output Tables ("IT investment level"). We then classified goods into four stages based on that

[18] Here, we are using calculated capital productivity data using the Company Financial Data of the Development Bank of Japan.

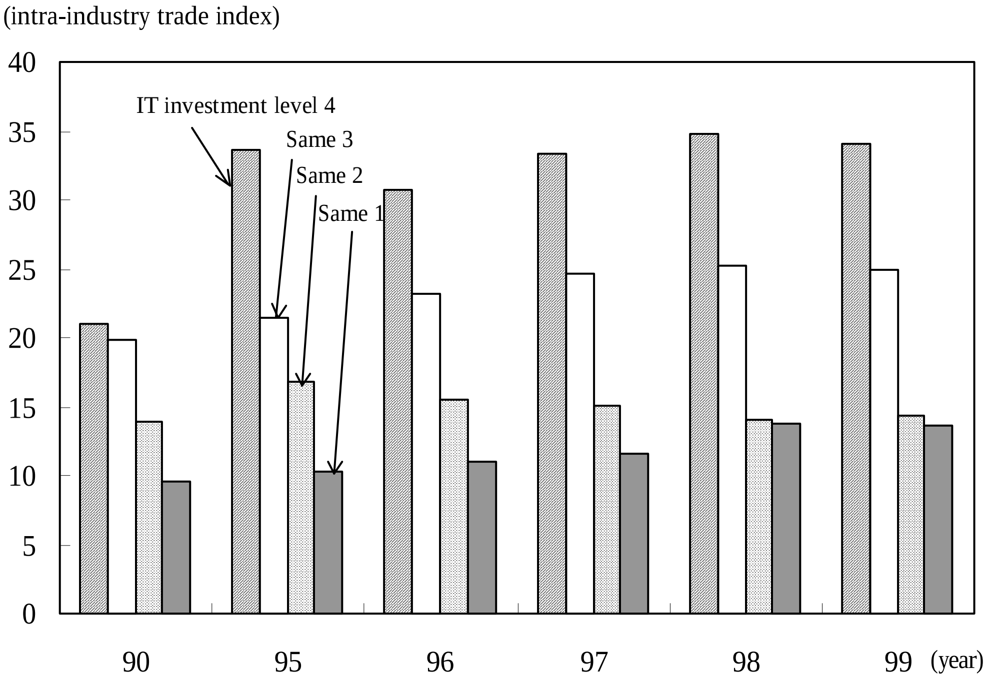
[19] Classification into whether technology-intensive or non-technology intensive using the Input-Output Tables according to whether or not there are large investments to cover research and development expenses.

[20] Duplicating machines, word processors, other business equipment, electronic computers, electronic computer peripherals, wired electric and communications equipment, wireless electric and communications equipment, other electric and communications equipment and construction of electric and communications facilities.

ratio[21].

Figure 5-1 indicates the intra-industry trade index for each commodity classified by IT investment level in time-series. This shows that intra-industry trade increases in vigor in proportion to increases in the IT investment level of a commodity. In addition, comparing the year 1990 with the latter half of the 1990s, it can be seen that increasingly large disparities formed between goods with a high IT investment level and those with a low level.

Fig. 5-1 IT Investment Level and the Intra-Industry Trade Index



Note: Refer to footnote 21 for a definition of "IT investment level." Prepared based on the Trade Statistics of the Ministry of Finance and the Input-Output Tables of the Ministry of
Source: Public Management, Home Affairs, Posts and Telecommunications

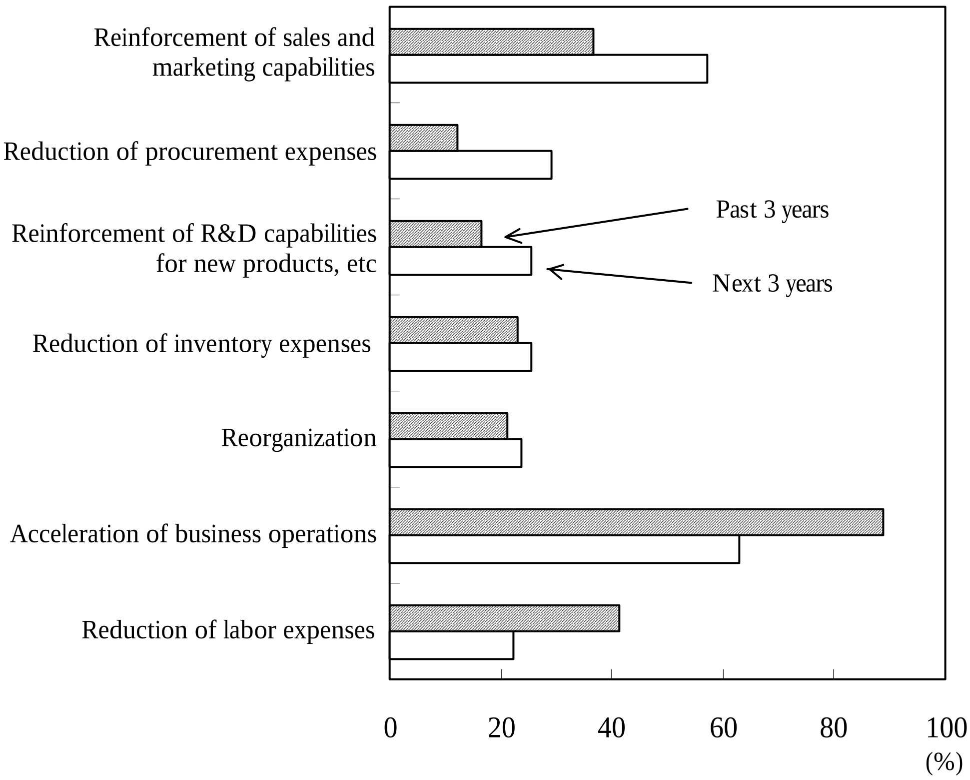
What then do these results signify? Various factors can be cited as the reasons for carrying out IT investments, such as, the acceleration or increased efficiency of business operations and the reduction of labor costs, and they would likely include achieving the effects of new product development, additional production sophistication and so forth. Introducing IT technology in areas such as new product development stimulates anticipation of the effect of the more rapid and effective implementation of product differentiation. In other words, industries with a high level of IT investments actively implement product differentiation and these results suggest a structure of exposure to competition with foreign products through intra-industry trade.

What are the perceptions of firms that actually make IT investments? Fig. 5-2 is based on the Survey of Company Trends in 2000 conducted by the Cabinet Office and indicates the purposes of IT investments over the past three years and next three years. Those reasons for IT investments during the past three years with a high ratio include the "acceleration of business

[21] If the ratio is less than 5%, the IT investment level is 1, if the ratio is 5% or more up to but not including 10%, the IT vestment level is 2, if the ratio is 10% or more up to but not including 20%, the IT vestment level is 3 and, if the ratio is 20% or more, the IT vestment level is 4.

operations," "reinforcement of sales and marketing capabilities" and "reduction in labor expenses." There is also a higher ratio of the former two reasons, in particular, for investments during the next three years. However, those with a ratio during the next three years that is higher than during the past three years indicate that that tendency became stronger because of items such as "reduction of procurement expenses" and "reinforcement of R&D capabilities for new products, etc.," and it is clear that there is anticipation of the effects of IT investments in the future.

Fig. 5-2 Purposes for IT Investments During the Past 3 Years and Next 3 Years



Source: Prepared based on the Survey of Company Trends in 2000 of the Cabinet Office

Conclusion

In this study, we have sought to empirically comprehend changes in the structure of trade in Japan during the latter half of the 1990s from such angles as the enhancement of relationships with other Asian countries and an increase in the importance of IT goods and intermediate goods in trade as well as the background and effects of the development of intra-industry trade.

Viewing the current situation surrounding the issue of trade in Japan, it is clear that since the latter half of the 1990s, the demand for IT goods, which had expanded globally until then, has slowed especially in the U.S. and that the U.S. economy itself has been decelerated since 2001. This tendency is not only evident in the U.S. but also exerts a strong impact on the economies of Japan and other Asian countries that have close connections through trade.

As indicated through the analyses of this study, as the demand for IT goods grew throughout the 1990s, the demand for IT-related intermediate goods, in particular, resulted in the globalization of the production structure, encompassed the related industrial structure even of Asian countries and Japan outside of the U.S. and brought about more closely knit trade relations. This is linked to the fact that the impact of the economic fluctuations of one country on other countries is becoming more short-termed and greater in magnitude.

Though the demand for IT goods may fluctuate in the short term, the general view seems to be that, in the medium term, it will remain firm in tone worldwide in the future. If that is the case, IT-related firms in Japan will be faced with the need to continue competing within the current trade structure created by the industrial characteristics of IT goods. By involving themselves in product development that will make it possible to achieve global competitiveness not only with final goods but also intermediate goods, it will be possible for them to respond to the global demand and, in that sense, it could probably be said that there are still ample business opportunities out there.

On the other hand, though, that element that is dominated by fluctuations in markets overseas is also expanding. Reassessing production and inventory control systems from the perspective of short-term outlook for demand and the global linkage between companies will undoubtedly be of even greater importance in the future. In the management of the economy in Japan hereafter, it will be necessary to promote a further reinforcement of product development capabilities in the domestic market taking the realities of this globalization fully into account.

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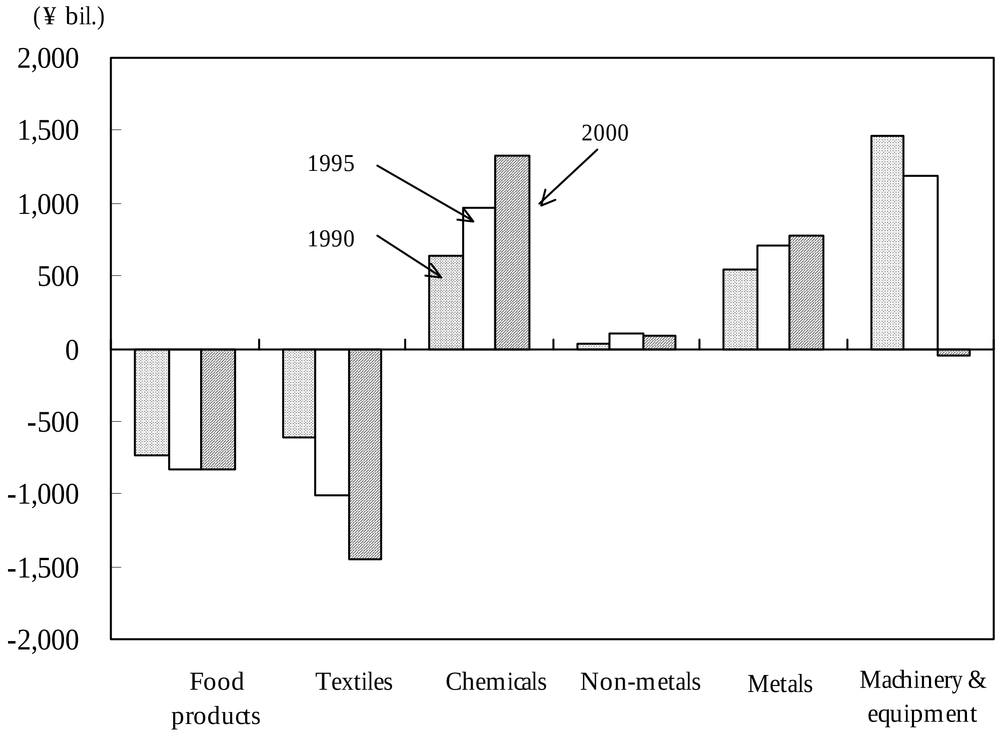
Appended Fig. 2-1 Japan's Net Exports to CKT by Item



Note: Also includes Hong Kong and Singapore besides China, Korea and Taiwan
Source: Prepared based on the Trade Statistics, Ministry of Finance

Appended Fig. 2-2 Definition of IT Goods in Trade Used in This Study

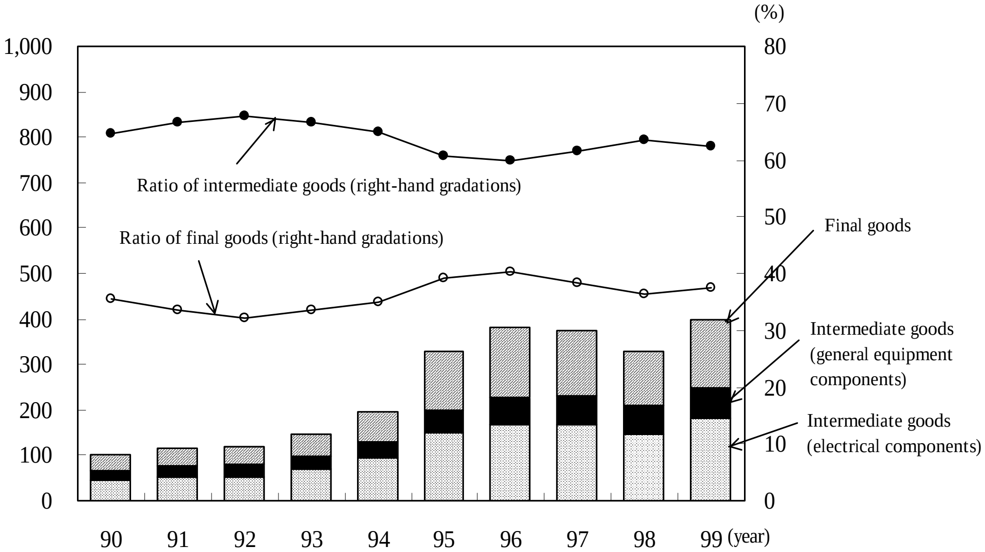
(1) SITC codes of the ITCS corresponding to IT trade goods according to the Information Technology Outlook 2000 of the OECD.

①Computer equipment	752	Automatic data processing machines & units
	759.97	Parts of and accessories suitable for 752--
②Electronic Components	772.2	Printed circuits and parts
	772.3	Resistors, fixed or variable parts
	776.1	Television picture tubes, cathode ray
	776.27	Other electronic valves and tubes
	776.3	Diodes, transistors and semi-conductor devices
	776.4	Electronic microcircuits
	776.8	Piezo-electric crystals, mounted parts of 776--
	778.6	Other electronic machinery and equipment
	776.29	Other electronic valves and tubes
③Communication Equip.	764.1	Electronic line telephonic & telegrahic apparatus
	764.3	Radiotelegraphic & radiotelegraphic transmitters
	764.81	Radiotelegraphic & radiotelegraphic receivers
	764.91	Parts of apparatus of 764.1-

(2) Major commodity codes of the Trade Statistics (Ministry of Finance) corresponding to (1) above (based on HS 4-digit codes)

(1) Computer-related equipment	8469/8470/8471/8472/8473(84.69~84.72)
(2) Communications-related equipment	8517/8525/8526/8527/8529(85.25~85.28)
(3) Electronic components	8532/8533/8534/8535/8536/8537/8538(85.35~85.37)/8540/8541/8542/8543

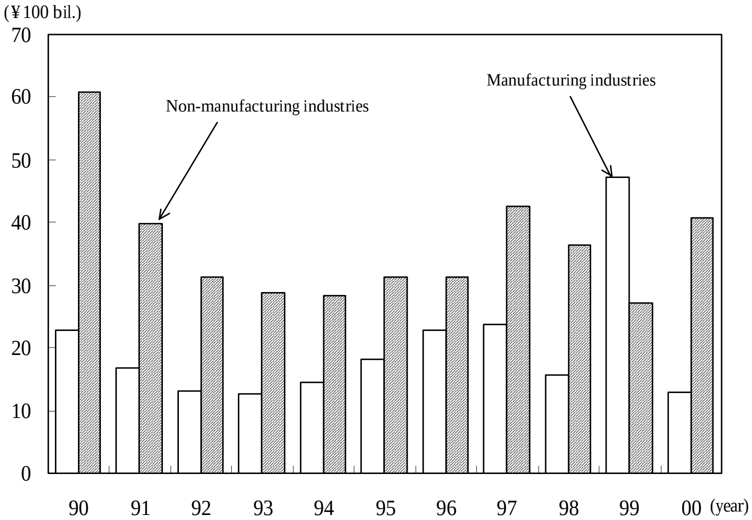
Appended Fig. 3-1 Breakdown of Imports of IT Goods by Stage of Demand



Note: Of IT goods (1) computer-related devices, (2) communications-related devices and (3) electronic components, components included in (3) and (1)/(2) are classified as intermediate parts and finished products included in (1)/(2) are classified as final goods.

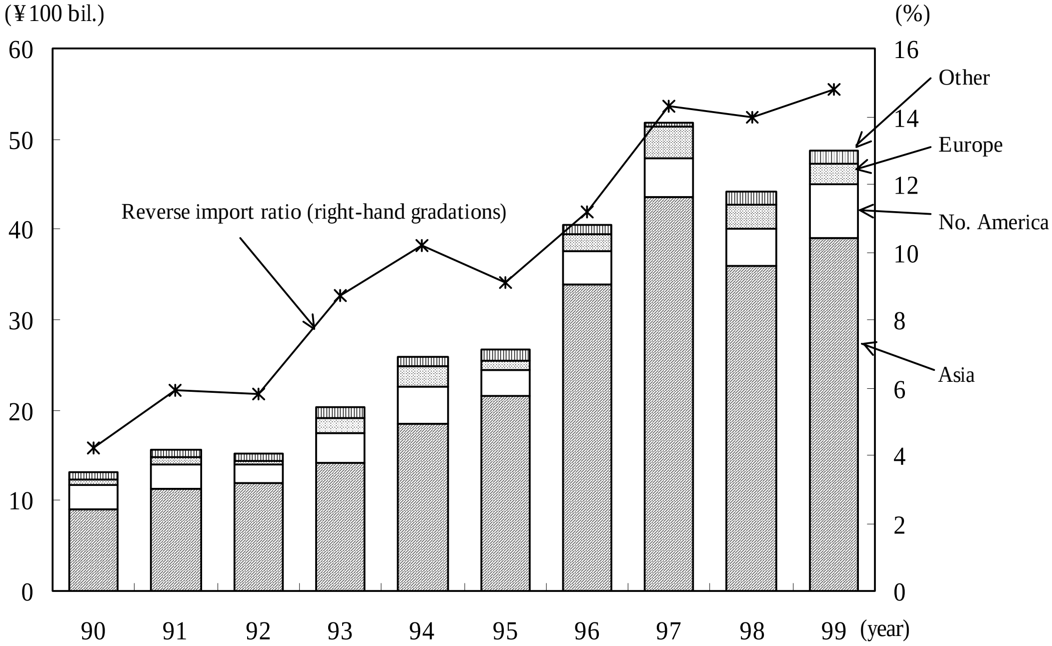
Source: Prepared based on the ITCS (OECD)

Appended Fig. 4-1 Transitions in Foreign Direct Investment



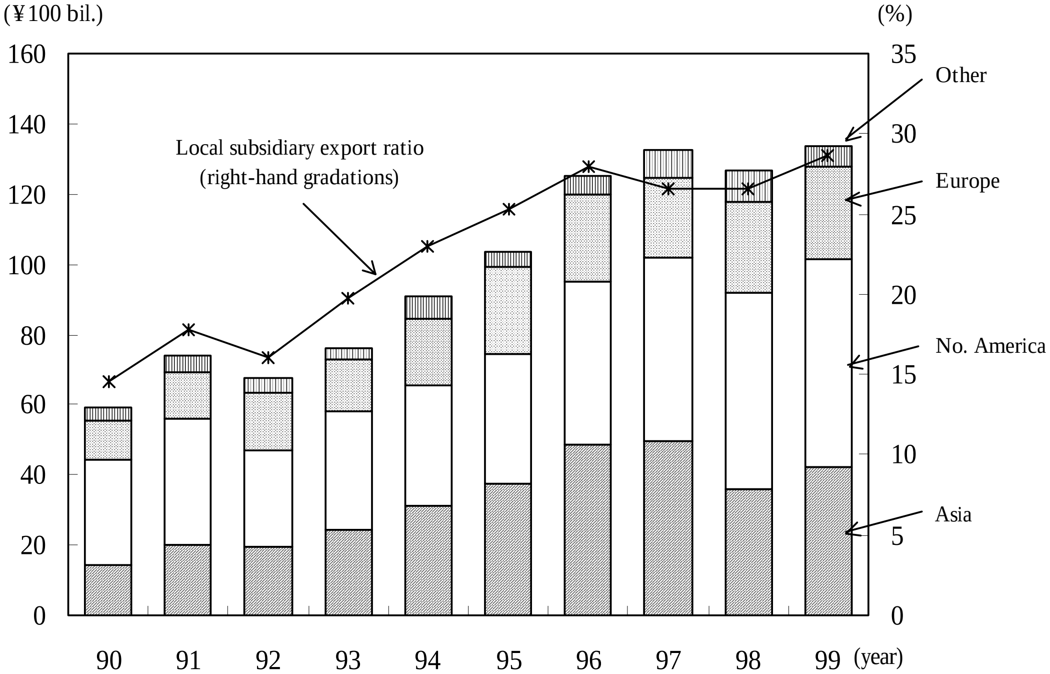
Source: Prepared based on the Foreign Direct Investment Application and Report Results, Ministry of Finance

Appended Fig. 4-2 Transitions in Reverse Imports from Local Subsidiaries



Note: The reverse import ratio is the ratio against total imports; however, since the response rate of the survey is not necessarily high, it is necessary to view these values with a certain degree of latitude.
Source: Prepared based on the Basic Survey of Overseas Business Activities, Ministry of the Economy, Trade and Industry.

Appended Fig. 4-3 Transitions in the Value of Exports of Intermediate Goods to Local Subsidiaries



Note: The ratio of exports to local subsidiaries is the ratio against total imports.
Source: Prepared based on the Basic Survey of Overseas Business Activities, Ministry of the Economy, Trade and Industry

Appended Fig. 4-4 Production Activity Functions of Local Subsidiaries (manufacturing industries, FY 1999)

	Technological level (compared to Japan)	Asia	North America
Division of labor with Japan	Higher	0.2	0.7
	Same	16.2	22.6
	Lower	15.5	7.9
	Sub-total	31.9	31.3
Division of labor with other than Japan	Higher	0.2	1.0
	Same	11.3	16.3
	Lower	10.8	5.1
	Sub-total	22.4	22.4
Integrated production	Higher	0.7	2.2
	Same	24.9	32.6
	Lower	20.1	11.5
	Sub-total	45.7	46.3
Total		100.0	100.0

Source: Prepared based on the Basic Survey of Overseas Business Activities, Ministry of the Economy, Trade and Industry (2000 survey)

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