

Structural Changes in the Tohoku Economy of Japan: A Front-yard of Manufacturing Electric and Electronics Intermediates¹

By
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Abstract

This paper analyzes structural changes in the Tohoku economy of Japan during the 1975 and 1995 period, when the industrial structure changed from an agricultural to a more manufacturing-oriented economy, with the region now having evolved into a front yard for the manufacturing of electric and electronics intermediates. Plants in the region ship their products not only to factories in other regions of Japan, mainly in the Kanto (Tokyo) and Chubu (Nagoya) areas, but also to their trade partners abroad, especially to the Asian NIEs and to ASEAN members. Finally, this paper observes the present state of business relations between the Japanese, US, European and Asian economies.

1. Introduction

Located in the northeast part of the main Japanese island of Honshu, the Tohoku region covers 79,527 square kilometers, approximately 21 percent of the whole area of the country. According to a 1995 census, the population of the region is about 12.3 million. The percentage share of Tohoku's population in relation to that of the whole of Japan has continuously decreased during the last forty-five years, having been 13.7 percent in 1950, 12.5 percent in 1960, 10.9 percent in 1970, 9.9 percent in 1990, and 9.8 percent in 1995.

The Tohoku region consists of six prefectures as shown in Figure 1: Aomori, Akita, Iwate, Miyagi, Yamagata, and Fukushima. Niigata prefecture is sometimes included as part of the region depending upon the purpose of analysis. Because Niigata prefecture enjoys transportation systems with direct access to Tokyo, for example the Joetsu Bullet train and the Joetsu Highway, residents of Niigata tend to consider their area an extension of the Kanto (Tokyo) region rather than part of Tohoku.

The Tohoku region is well endowed, as is Hokkaido (the Northern Island of Japan), with nature and natural resources: fertile land, an adequate water supply and, in particular, a high quality labor force. Tohoku used to be, and still partly is, a rich

Received November 2000, final version received March 2001.

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¹ The author appreciates the useful comments and constructive suggestions provided about this paper by an anonymous referee and the editorial board members of this journal. Errors, if any, are the responsibility of the author.

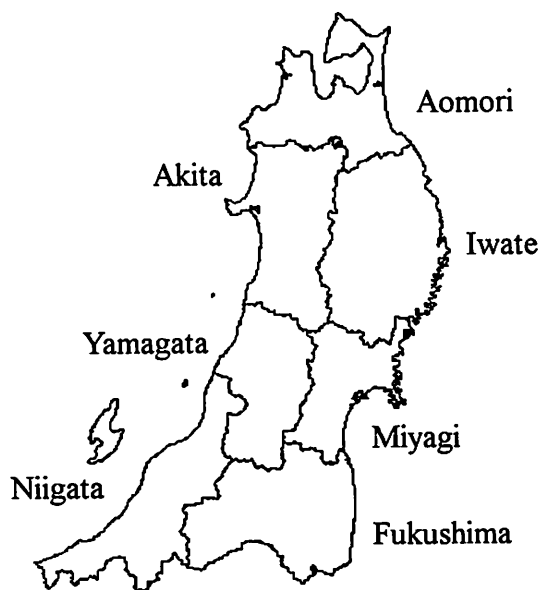


Figure 1: Map of the Tohoku Region

agricultural land, producing mainly vegetables of various kinds and several famous varieties of rice, such as the “Sasanishiki” and “Hitomebore” brands from Tohoku-6, and the “Koshihikari” brand produced in Niigata.

2. Structural Changes in the Tohoku Economy

The gross regional product of Tohoku-7 (nominal) increased from 13.1 trillion yen in 1975 to 41.9 trillion yen in 1995, a 3.1 fold increase. Its percentage share in Japan was approximately 8.5 percent in 1995, slightly less than the share of the population of the region. The tertiary sector grew fastest among all sectors, by 3.6 times, while the primary sector decreased by 11.1 percent during the same observed period. As for the tertiary sector, electric power, gas and water supply boosted production by 6.2 times, the fastest among all industries. The manufacturing sector of Tohoku-7 increased by 3.5 times, while that of Japan grew by only 2.7 times from 1975 to 1995. During these two decades, some industries in Tohoku-7 grew faster than the equivalent industries in the nation as a whole: construction (Tohoku-7: 3.3 times; Japan: 3.2 times); electric power/gas/heat/water utility (Tohoku-7: 6.2 times; Japan: 4.3 times); and transportation/communications (Tohoku-7: 3.9 times; Japan: 3.4 times), along with manufacturing (Tohoku-7: 3.5 times; Japan: 2.8 times) (see Figure 2). Figures for these industries, except for manufacturing, relate more or less to public expenditures of

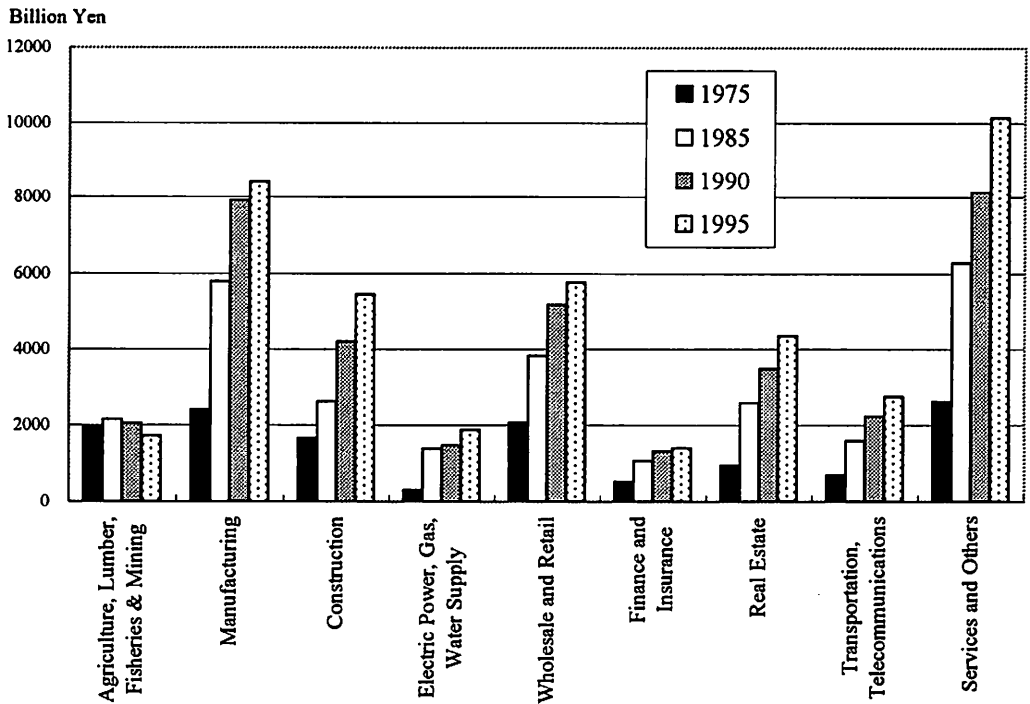


Figure 2: Gross Regional Product of Tohoku-7 by Industry: 1975, 1985, 1990, and 1995

the national and/or local governments. Governments have been expected to achieve fiscal policies for developing peripheral regions, particularly when the economic circumstances of Japan were sluggish and under the deflationary pressure following the burst of the 1986-1991 bubble economy.

The total number of employees in the Tohoku-7 work force in 1995 was approximately 6.3 million (3.6 million men and 2.6 million women). The three largest industries of Tohoku-7 in terms of labor force are services (22.7 percent), wholesale/retail/restaurants (20.8 percent), and manufacturing (19.8 percent), while the three smallest ones are mining (0.2 percent), real estate (0.5 percent), and electric power/gas/water supply (0.6 percent). The Tohoku-7 labor force grew by 139 thousand people during 1990-1995. The service sector increased its labor force by 186 thousand, the construction sector by 115 thousand and the wholesale/retail/restaurant sector by 74 thousand. On the other hand, the agriculture/forestry/fishery sector decreased its labor force by 179 thousand people, and manufacturing by 89 thousand in the same period. As may be seen in Figure 3, Tohoku-7 has concentrated its labor force, and specialized in such industries as agriculture/forestry/fishery, mining, construction, and public office services. Specialization indices for those industries in 1995 are 2.0 for the primary industry (agriculture/forestry/fishery), 2.0 for mining, 1.2 for construction, and 1.1 for public office services. Specialization indices for the other industries of Tohoku-7 are below unity, meaning that Tohoku-7 suffers from a

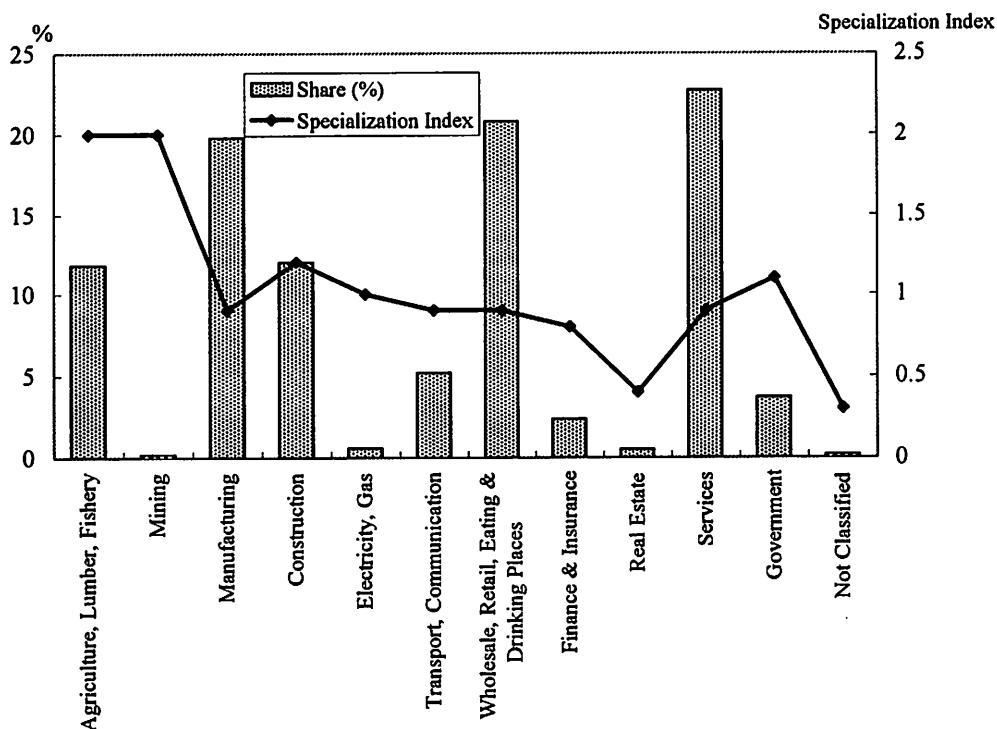


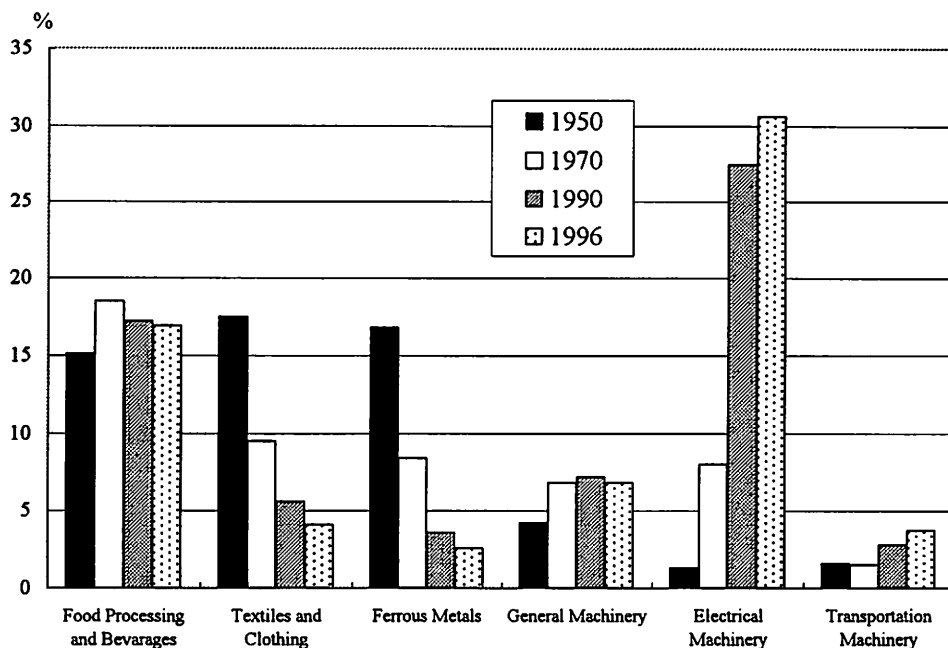
Figure 3: Industrial Structure of Tohoku-7: Labor Force and Specialization Index

comparative disadvantage in those industries: real estate (its specialization index is 0.5), manufacturing (0.8), finance and insurance (0.8), transportation and communications (0.9), wholesale/retail/restaurants (0.9), end services(0.9).

Thanks to the abundant natural resources in Tohoku-7, the Tohoku economy has been specializing in the primary industries of mining, construction, and public utilities rather than in secondary industries and the service sector. The percentage share of Tohoku-7 shipments has also increased from 5.8 percent in 1950 to 7.2 percent in 1996, while the percentage share of its employment grew faster than shipments, i.e., 7.1 percent in 1950 to 10.6 percent in 1996. This means that Tohoku manufacturing has been a labor-using or labor-intensive economy compared to the economies of other regions in Japan and that Tohoku is characterized by a low productive economy.

3. Changes in Tohoku-7 Manufacturing

We can obtain some clear findings when we look closely at Figure 4, which shows changes in the percentage share, during 1950-1996, of Tohoku-7 shipments by some selected important manufacturing industries.



**Figure 4: Percentage Share of Tohoku-7 Shipments by Industry:
1950, 1970, 1990, and 1996**

The percentage share of shipments of food processing/beverages and general machinery mildly grew throughout the entire observed period of 1950-1996. The shipments of both textiles/clothing and ferrous metals lost their percentage shares drastically during this observed period. Conversely, the electric and electronics machinery/instruments of Tohoku-7 boosted its outputs continuously during the observed period, especially during 1950 and 1970. Tohoku-7 shipments of electric and electronics machinery/instruments grew by 563 billion yen during 1991-1996, though this period was basically lackluster. The equivalent data on Japan as a whole shows a decrease of 877 billion yen. The percentage share of the industry in the manufacturing sector jumped tremendously from 1.3 percent in 1950 to 30.6 percent in 1996, while the equivalent share of Japan moved from 3.2 percent in 1950 to 18.4 percent. On the contrary, shipments of food processing and beverages grew from 1950 to 1970 and then decreased during 1970 and 1996. Likewise, shipments of general machinery increased from 1950 to 1990 and then decreased slightly.

Of interest is that shipments of Tohoku-7 electric and electronics machinery/instruments developed during 1991-1996 increased by 563 billion yen while the number of employees of the industry decreased by 66 thousand people. This means that the Tohoku-7 electric and electronics industry increased its shipments by enjoying higher productivity, in clear contrast to the ratio between shipments and labor force of the Tohoku-7 electric and electronics industry, as seen in Figure 5.1 and 5.2.

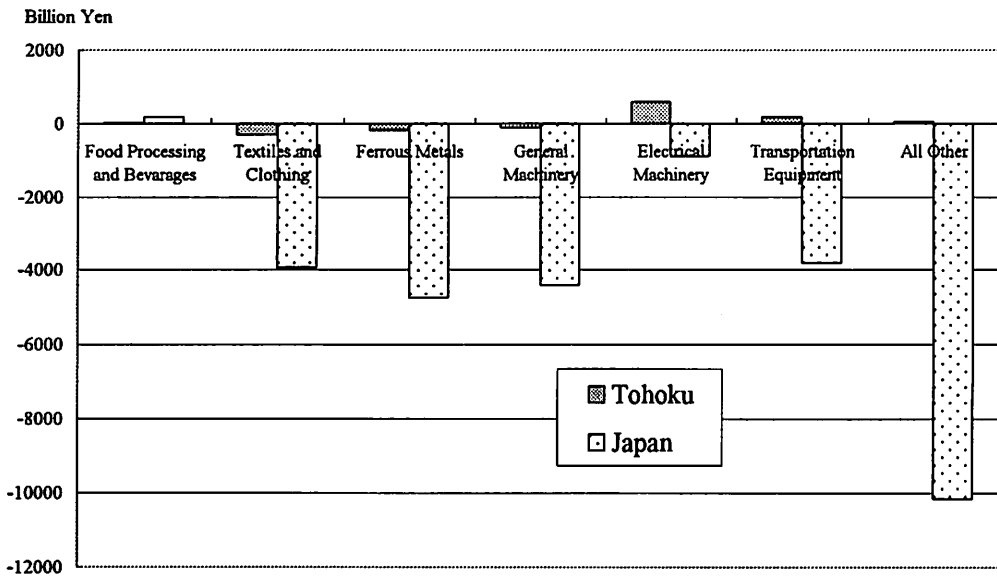


Figure 5.1: Changes in Tohoku-7 Shipments in Manufacturing: 1991-1996

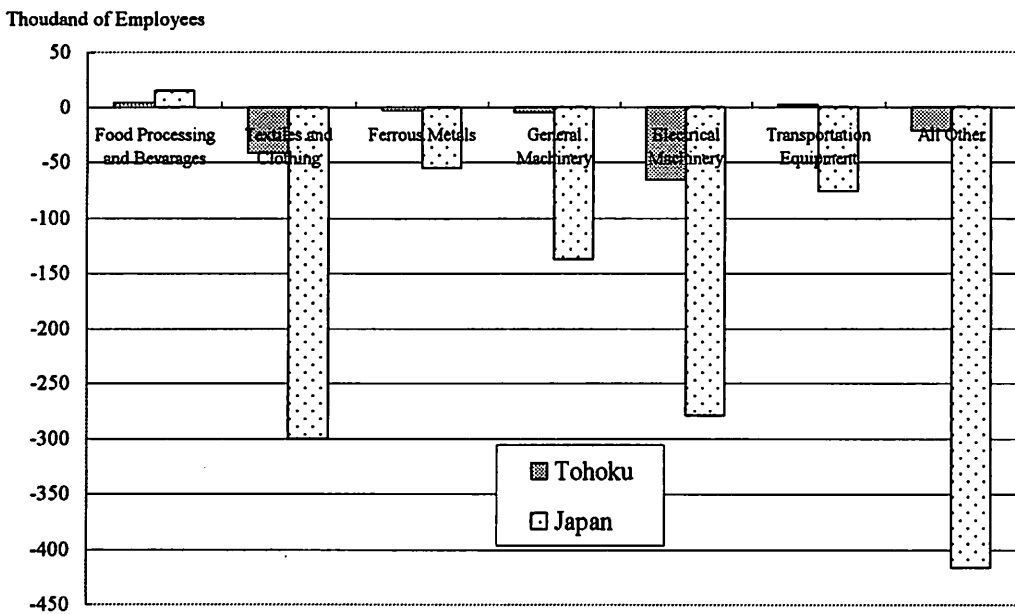


Figure 5.2: Changes in Tohoku-7 Employees in Manufacturing: 1991-1996

Conversely, shipments of electric and electronics products of Japan decreased during the same period by 877 billion yen, with a decrease in the labor force by 279 thousand people. Also during the same period, shipments of Tohoku-7 transportation equipment grew by 169 billion yen, with an increase of only two thousand employees. Shipments of transportation equipment in Japan decreased by 3,815 billion yen, with a decrease in employees of 76 thousand.

A big surge of new plant establishment has been observed in the Tohoku region since the beginning of the 1970s. We divide the observed period during 1978 through 1997 into the following four terms for the sake of convenience: Term 1: 1978-1982; Term 2: 1983-1987; Term 3: 1988-1992; and Term 4: 1993-1997, Term 1 includes the period of the second oil crisis and the subsequent economic recession. The Plaza Accord(1985) was agreed in Term 2. Soon after the Plaza Accord the Japanese yen appreciated rapidly and the Japanese economy stagnated due to the drastic realignment in exchange rates. Term 3 represents the bubble economy in Japan, a boom which lasted until March 1991. Term 4 represents a period of rather stable economic growth and circumstance, particularly up until September 1997, which marked the onset of the economic crisis in Asia.

There were 1,292 cases of new plant establishment in the Tohoku-6 region in Term 1. Cases of new plant establishment increased continuously in Terms 2 and 3, and then declined in Term 4. The number of new plant establishments was 1,818 in Term 2, 2,881 in Term 3, and 1,149 in Term 4. The number of new plant establishments for electric and electronics products was 254 cases in Term 1, a 20 percent share in the whole manufacturing sector. The number of new plant establishments in Term 2 more than doubled at 545 cases (30 percent in the whole manufacturing sector). The electric and electronics industry of Tohoku-6 expanded more than any other manufacturing industries in the region, as may be seen in Figure 6, and it became still higher in Term 3, i.e., 580 cases. The number in Term 4, however, declined sharply to 141 cases (12 percent of the sector) because of deflationary pressure.

Most of these newly established plants in Tohoku are local factories of electric/electronics or optic electronics (optronics) manufacturers, well equipped with the latest state-of-the-art technologies for processing key components, parts and accessories (intermediates for final goods) of electric/electronics, transportation and optronics instruments and appliances. They ship a portion of these intermediates to their other factories in Japan for more processing, and since the mid-1980s, they have shipped a portion of their products (key components and parts) directly to their business partners abroad, especially the Asian Newly Industrialized Economies (NIEs) and members of the Association of Southeast Asian Nations (ASEAN). Since the early 1990s, China has emerged as a new frontier for processing electronics final products after importing the Tohoku region's intermediate products.

Reflecting the rapid growth of the electric and electronics industry in Tohoku-6, exports of electric and electronics machinery/instruments were the largest in value among the various commodities of Tohoku exports in 1997. The percentage share of exported products was 41.6 percent. General machinery took the second place (11.4 percent), and transportation machinery was in third place (8.8 percent). The NIEs in

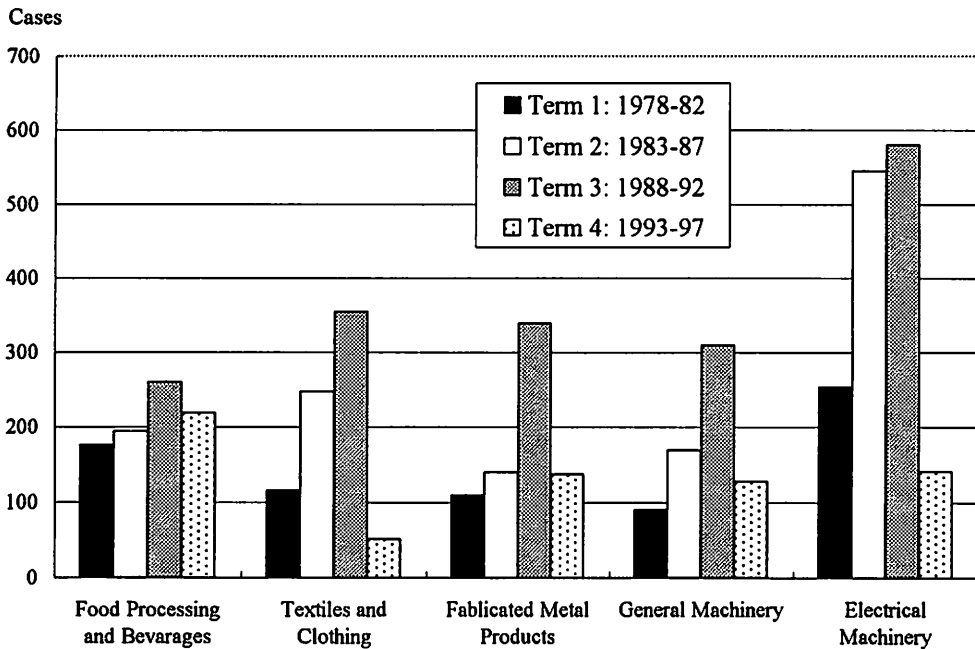


Figure 6: Cases of New Plant Establishment in the Tohoku-6 Region: 1978-1997

Asia (particularly Korea and Taiwan), the United States of America (USA) and ASEAN members (especially Malaysia, Thailand, the Philippines, and Indonesia) are the three main destinations for Tohoku-7 exports. Asian NIEs' percentage share of Tohoku-7 exports was 29.5 percent in 1997, the US' was 24.7 percent, and ASEAN's was 16.2 percent. More than half (70.4%) of Tohoku-7 exports concentrated on these three economies. It is evident from these data that the Tohoku region has become a manufacturing front-yard in which key components, parts and accessories of electric/electronics and transportation machinery/equipment are processed. Those intermediates have been shipped from the region not only to other regions of Japan but also to foreign markets.

If we look at the other side of the coin, the imports of the Tohoku-7 region, we find that the three largest commodities imported from abroad are raw materials like liquid natural gas (LNG) and liquid propane gas (LPG) (their percentage share was 13.1 percent in 1997), lumber & wood products (12.5 percent), and nonferrous metal ore (12.1 percent), rather than processed products. The three largest exporters to the Tohoku-7 region are ASEAN (21.4 percent in 1997), the United States (15.7 percent), and Australia (9.1 percent).

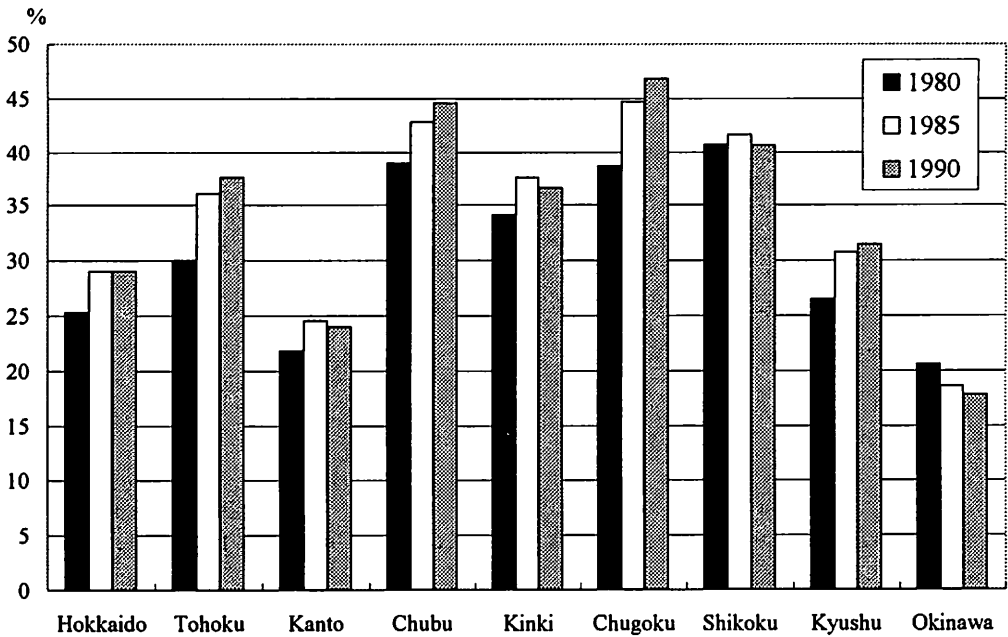


Figure 7: Percentage Share of Regional Product Derived from Final Demand of the Other Regions

4. Business Relations of the Tohoku Economy with Other Regions of Japan

An input-output analysis of the Tohoku economy provides us with more detailed observations of the economy, particularly concerning the economic linkages of Tohoku-6 with other economic regions of Japan. First, let us break down the whole economy into nine economic blocks (regions): Hokkaido (the hub of which is Sapporo), Tohoku (Sendai), Kanto (Tokyo and Yokohama), Chubu (Nagoya), Kinki (Osaka and Kyoto), Chugoku (Hiroshima), Shikoku (Takamatsu), Kyushu (Fukuoka), and the Okinawa (Ryukyu) Islands (Naha). As for economic size in terms of gross regional product, Kanto is naturally dominant, followed by Kinki, and then Chubu. On the contrary, Hokkaido, Shikoku, and Okinawa are relatively small regions in economic size.

Figure 7 shows changes in the percentage share in 1980, 1985 and 1990, of each region's gross regional product derived from the final demand of the rest of the national economy. For the i -th industry of each regional economy, gross regional product derived from the final demand of other regions can be defined and calculated as follows: ($i = 1, 2, \dots, n$)

$$X = [I - (I - \hat{M} - \hat{N})A]^{-1} F_c$$

Where X = the gross regional product,

I = a unit matrix,

M = an import (foreign trade) matrix (competitive imports),

N = an import (domestic exchange) matrix (competitive imports),

A = an input coefficient matrix,

F_c = final demand of other regions.

Figure 7 helps us to understand how economic linkage, or the business relationship of the Tohoku-6 economy with the economies of other regions strengthened from 1980 to 1990.

First, the Kanto economy is least influenced by the other economic regions, with the exception of Okinawa (the Okinawa economy is fairly independent, and its independence has strengthened during this observed period). Second, conversely, the economies of Hokkaido, Tohoku, Chubu, Chugoku, and Kyushu have increased their economic dependence on other regions. Third, since the level of this percentage reveals the strength of economic dependence on other economies, the economies of Chugoku, Chubu, and Shikoku link much more to other economies than do those of Kanto and Okinawa. It may clearly be observed that the economies of Chugoku, Chubu, Tohoku, and Kyushu strengthened their economic ties with their trading partner regions during these ten years. Also, the Okinawa economy seems to be relatively isolated from the rest of the national economy. A closer look at the Tohoku economy in Figures 7 and 8 provides more information on its features.

Figure 8 shows changes in percentage share of Tohoku-6 regional products, from 1980 to 1985 and from 1985 further to 1990, derived from the final demand of other regions. The Kanto economy has the strongest economic impact on the Tohoku economy, and the degree of economic influence heightened over these ten years. Kanto's percentage share of economic impact on the Tohoku-6 regional product was dominant at 53.5 percent in 1980, remained so in 1985. Its percentage share became higher in 1990, at 55.2 percent, indicating that the Tohoku economy became more closely linked with the Kanto economy through input-output transactions. Also, the Tohoku-6 economy has strengthened its business linkages with the Chubu economy. Chubu's percentage share of economic impact on the Tohoku-6 regional product was 12.7 percent in 1980, 13.2 percent in 1985, and 14.6 percent in 1990. On the contrary, the Tohoku-6 economy lost its relative business relationships with the Hokkaido, Kinki, Chugoku, Shikoku, Kyushu, and Okinawa regions over these ten years.

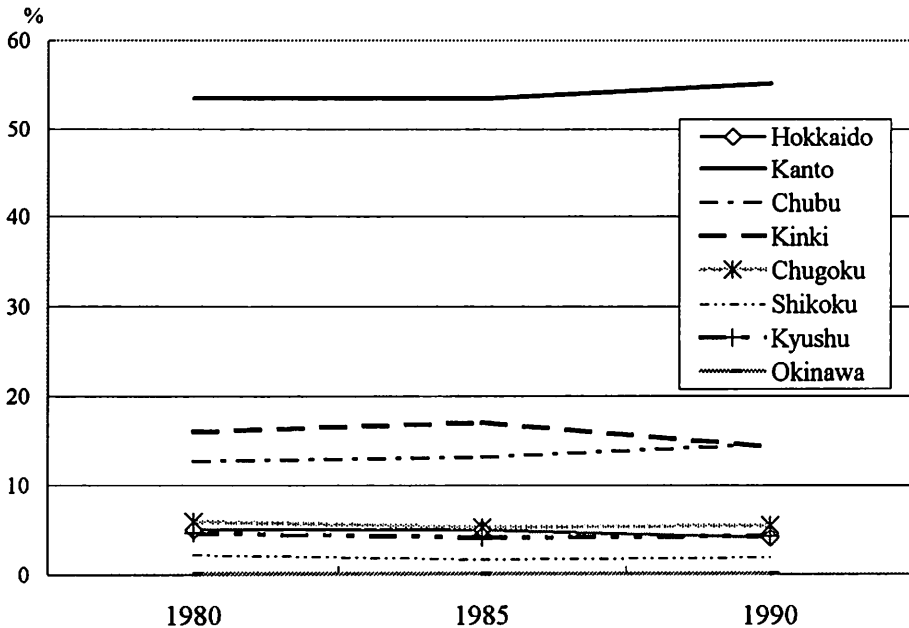


Figure 8: Percentage Share of Tohoku-6 Product Derived from Final Demand of Other Regions: 1980, 1985 and 1990

5. Business Relations of the Japanese/Tohoku Economy with Asia, Europe and the United States

Finally, by using an international input-output technique, let us consider the business relations of the Japanese/Tohoku economy with Asian, European and the US economies. The 1985-1990 international input-output table for these four linked economies presents the input-output structure of each of these economies, with details shown in Figure 9.

The ratio of intermediate input requirements to total inputs decreased in such economies as Europe, the United States and Japan, while the Asian economy increased its input requirements from 48.7 percent in 1985 to 50.6 percent in 1990. Moreover, the ratio of intermediate input requirements to total value added for the former economies decreased, while that for the latter economies increased during the same period. As an economy becomes more global, foreign trade and foreign direct investment play an important role in the international economy. Figure 10 helps us to understand the economic linkages and transactions between these four economies by analyzing the ratio of imports to intermediate requirements and that of imports to final demand.

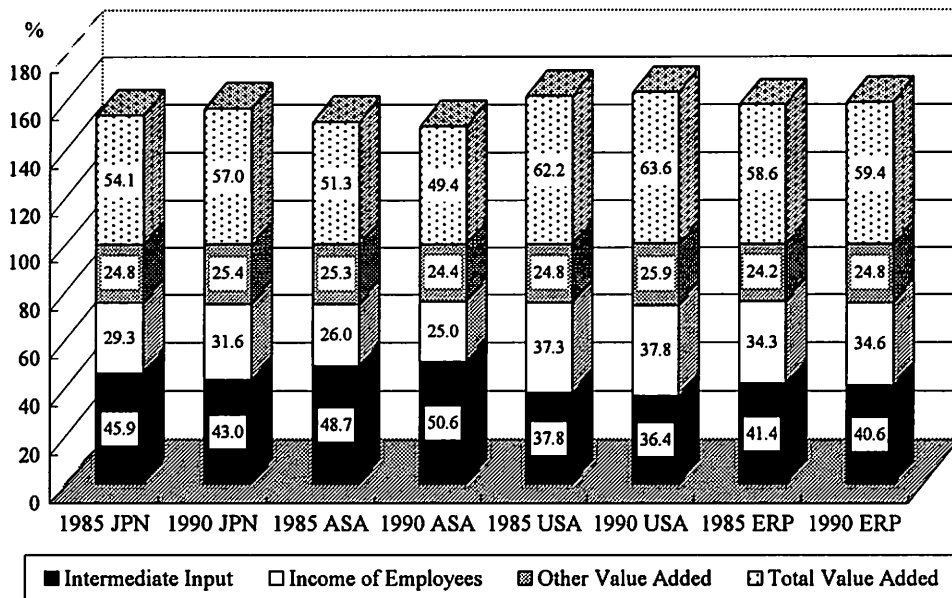


Figure 9: Input Structure by Country (Group of Countries): 1985, 1990

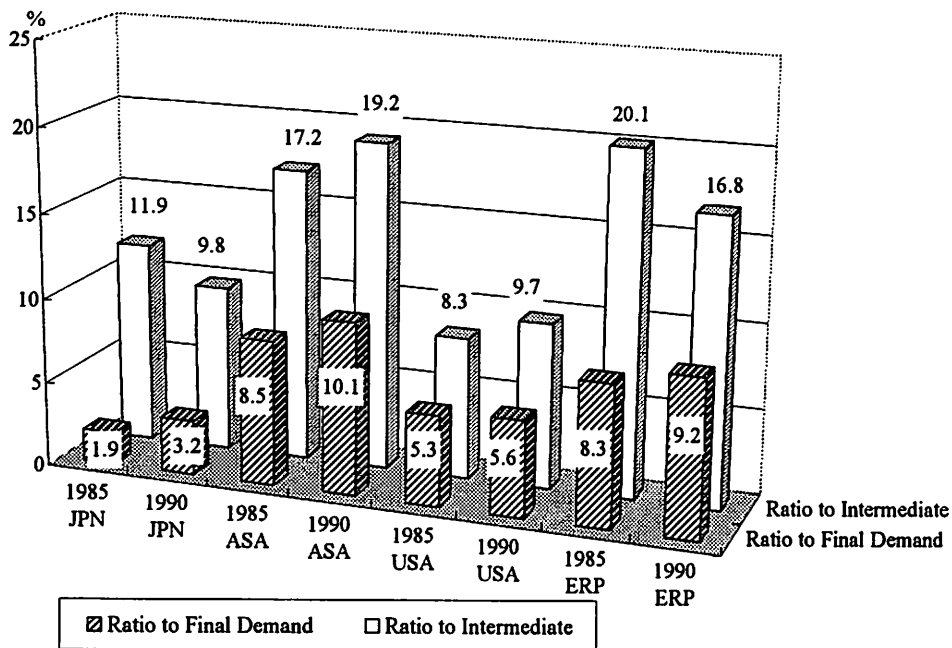


Figure 10: The Ratios of Imports to Intermediate Inputs and to Final Demand by Economy: 1985, 1990

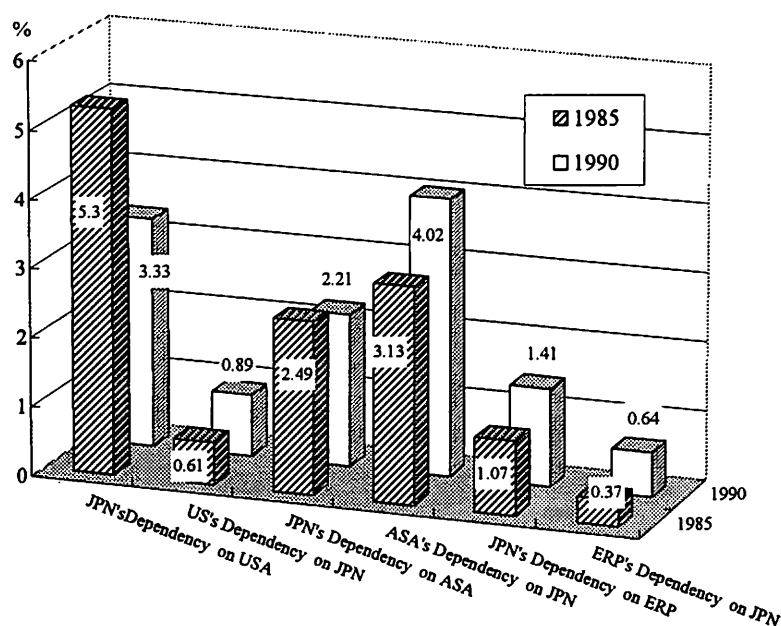


Figure 11: Economic Interdependence among Four Economies: 1985, 1990

The ratio of imports to total intermediate inputs decreased in the Japanese and European economies in 1985 and 1990. The equivalent ratio for Asia and for the United States increased, which means that these economies have become more interdependent in terms of intermediate input-output structure, or in other words that they have a roundabout production process. The ratio of imports to final demand grew for all of these economies during this observed period, implying that each of these economies expanded their final demand markets to other trading partners.

Next, let us examine the input-output relations (economic linkage) between a pair of these economies (international economic interdependency). Economic interdependence is defined here as the mutual economic dependence between a pair of trading partners. The economic dependence of an economy on its partner is calculated by the ratio of its domestic product, derived from the final demand of its input-output partner to the gross domestic product. Figure 11 provides us with a clear image of this.

The economic interdependence between the European and the Japanese economies strengthened during 1985-1990. Japan's economic dependence ratio on the European economy was 1.07 percent in 1985 and increased to 1.41 percent in 1990. Also, the percentage share of Europe's dependence on Japan grew from 0.37 in 1985 to 0.64 in 1990, showing that the Japanese and European economies had become more interdependent with each other by 1990. Both the US and the Asian economies have strengthened their ties with (become more dependent on) Japan. However, Japan's dependence both on the Asian and the US economies decreased in 1990. The percentage share of Japan's dependence on the Asian economy decreased from 2.49 in 1985 to 2.21 percent in 1990, and its dependence on the US economy changed from 5.3

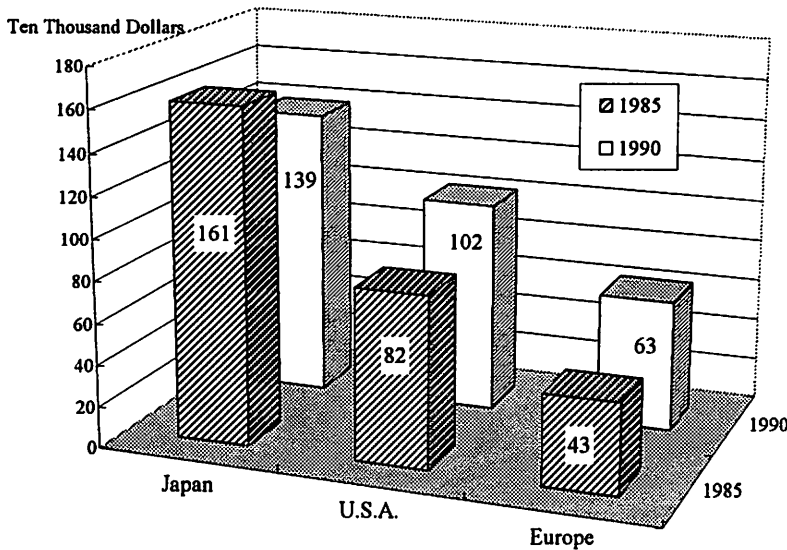


Figure 12: Asia's 'Value Added' Derived from an Additional US\$100 Million Increase in Final Demand of Its Trading Partners: 1985, 1990

percent to 3.33 percent during the same period. Therefore, the economic relationship between the United States and Japan became more interdependent, while the Asian economy became more dependent on the Japanese economy.

Asia's value added derived from an additional US\$100 million increase in final demand created by the other economies can be calculated as the "repercussion effect". Figure 12 shows the results.

In 1985 US\$1.61 million of value added was derived in Asia from an additional US\$100 million increase in Japan's final demand. This decreased in 1990, but still US\$1.39 million of Asia's value added was created by an additional US\$100 million increase in Japan's final demand. Therefore, the Japanese economy is very powerful in creating effective demand for the commodities and services produced in Asian nations. Both American and European repercussion effects on Asia's value added were calculated, respectively, at US\$0.82 million for the US and US\$0.43 million for Europe in 1985. Their repercussion effects on the Asian economy increased to US\$1.02 million derived from US final demand and US\$0.63 million derived from European final demand. The Asian economy has certainly become more interdependent with its trading partners.

6. Concluding Remarks

- The Tohoku region of Japan is usually considered to consist of six

prefectures located in the northeastern part of the main island. Niigata prefecture is sometimes included in the region, depending on the purpose of investigation. Tohoku-7 accounts for approximately 21 percent of Japan's landmass and 9.8 percent of its population. The Tohoku economy has been enjoying a comparative advantage in producing agricultural products, particularly rice, because of the area's rich natural resources, fertile land sufficient water supply, and adequate labor force.

- The industrial structure of the Tohoku economy has shifted toward a more manufacturing-oriented economy since the early 1980s.
- The gross regional product of Tohoku-7 increased from 13.1 trillion yen in 1975 to 41.9 trillion yen in 1995, a 3.1 fold increase, accounting for about 8 percent of total production in Japan.
- Between 1975 and 1995, the tertiary sector of Tohoku-7 grew fastest among all sectors, by 3.6 times, while the primary sector decreased by 11.1 percent. The manufacturing sector of the economy increased by 3.5 times during the same observed period.
- Business relations of the Tohoku economy with Kanto and Chubu strengthened in the 1980s.
- The specialization index for Tohoku-7 manufacturing reveals that the electrical and electronics machinery/equipment have rapidly grown with a high tide of new plant establishment since the mid-1980s.
- The Tohoku economy enjoys a comparative advantage, not only in the domestic economy but also in the world economy, as it has improved productivity in electric and electronics manufacturing.
- Most of the new state-of-the-art plants established since the mid-1980s in Tohoku are local factories of large electric, electronics and transportation equipment manufacturers, and they produce primarily key components, parts and accessories (intermediates for final goods) for more processing.
- Plants in the Tohoku region ship their products not only to factories in other regions of Japan but also to their trade partners abroad, especially the Asian NIEs and ASEAN members.
- An additional Asia's value added to Asia is expected to be derived to a large extent from an additional US\$100 million increase in Japan's final demand, as US\$1.39 million value added was derived in 1990.

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