The Impact of Outward Foreign Direct Investment on the Employment and Industrial Structure in Japan

by

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List of Abbreviations

BSOBA	Basic Survey on Overseas Business Activity
DPG	Deviation from Proportional Growth
FDI	Foreign Direct Investment
JETRO	Japan External Trade Organization
MHLW	The Ministry of Health, Labor and Welfare's of Japan
METI	The Ministry of Economy, Trade and Industry of Japan
MIAC	The Ministry of Internal Affairs and Communications of Japan
MITI	The Ministry of International Trade and Industry of Japan
MNC	Multinational Corporations
OFDI	Outward Foreign Direct Investment
OIL	Ownership advantage, Internalization advantage, Location advantage
UNCTAD	United Nations Conference on Trade And Development
WIOD	World Input-Output Database

Chapter 1. Introduction

1.1 Research background and significance

With the development of economic globalization, outward foreign direct investment (OFDI), as one of the most important methods of capital transfer between countries, has become the most significant engine to accelerate the increase of economic growth. OFDI is an important method to get resource and participate in the international division of labor. Also, it benefits to seek revenue from economic globalization. From the 1980s, great changes have taken place in the international investment market. Governments, no matter of traditional developed countries or emerging developing countries, all put forward many positive policies to encourage domestic corporations to invest overseas. Therefore, the research on OFDI is very necessary for global economic growth.

After the war, Japan made all efforts to develop the economy. Until the 1970s, Japan has become the second biggest economy after the US, which kept 10% economic growth for twenty years. The export production of Japan had high competitiveness in synthetic fiber, petrochemical industry, automobile, and machinery industry under the industrial revitalization planning of the Japanese government. Since 1980, Japan's GDP has exceeded one trillion dollars, and Japan's economy reached its peak time. Japan's industrial structure was further optimized with the promotion of economic scale and growth quality in that period. Experienced rapid and stable economic growth for twenty years, Japan has accumulated an enormous amount of capital and advanced productivity. In 1981, Japan's foreign exchange reserve has reached 25.7 billion dollars, which exceeded the US of 20.9

billion dollars and British of 20.1 billion dollars. The huge amount of capital reserve laid a solid foundation for Japan's large scale of OFDI. Since the 1980s, the trade conflict between Japan and the U.S. become more and more serious. The trade surplus of Japan to the US increased from 8.7 billion dollars in 1980 to 46.5 billion dollars in 1985. The Japanese yen became to appreciate rapidly after "Plaza Accord" of 1985, which caused the beginning of a sharp expansion of Japanese OFDI. Japan's OFDI increased from 10 billion dollars in 1984 to 67.5 billion dollars in 1989 and ranked the first position in the global foreign direct investment market. The huge amount of capital of Japanese enterprises flowed into foreign countries, especially the U.S. Japanese corporations acquired many American companies in that time. After the collapse of the bubble economy of Japan in 1990, Japan's economy entered the depression time so that Japan's OFDI also went to the adjustment stage. However, with the recovering of Japan's economic situation, Japanese enterprises increased their overseas investment again and that symbols a new stage for Japan's OFDI and domestic economy.

The development of OFDI affected Japan's economy in many different ways. It contributed to solving the lack of production resource and steady industrialization of Japan. On the other hand, OFDI also leads to the industrial structure change of Japan's economy by transferring capitals and industries to foreign countries. Since the 1960s, some economists put forward that OFDI would cause the "Hollowing-out" effect in the parent country, which because the domestic production and employment would decrease because of the overseas transformation of manufacturing industries. Also, overseas production activities would substitute for the export of the parent country, which has a negative effect on manufacturing industries in the home country. Therefore, it is meaningful to make a research on the impact of Japan's OFDI on the domestic economy, which are benefited for Japanese policymakers

to promote Japan's OFDI and domestic economy in the future. Also, the long history of Japan's OFDI is a good experience for those new emerging investing countries to be used for reference to solve the similar problems in the expansion of OFDI.

China, as a new emerging investor in the global market, has developed very fast in recent years and become one of the most important countries in foreign direct investment. However, there appeared many problems in the process of outward foreign direct investment. The same worry as Japan is that outward FDI may cause "Hollowing-out effect" in the domestic economy of the home country. Considering the similar situation of Japan in the 1970-1990, the experience of Japan in outward FDI is good enlightenment for China.

1.2 Research questions and objectives

This dissertation attempts to investigate the impact of outward foreign direct investment on Japan's domestic economy and employment. Also, to investigate the industrial structure change of Japan with the expansion of OFDI. Then China could get some valuable enlightenment on outward foreign direct investment from Japan's experience. Before starting this research, we firstly state the research questions as follows:

(1) What is the developing path of Japan's outward foreign direct investment?

Japan's outward FDI started from the 1950s, which has a long history in investing overseas. It is important to know the developing history of Japan's outward FDI so that we can find out the factors which influenced Japan's OFDI.

(2) What are the characteristics of Japan's outward foreign direct investment?

In traditional opinion, the motivations for outward foreign direct investment are classified into natural resource oriented, labor-oriented and market-oriented. Which type is the Japanese outward FDI? How did the motivations of Japanese outward FDI change with the development of economic situation? Also, what are the regional distribution and industrial structure of Japan's outward FDI?

(3) What is the reason that Japan's outword FDI increased?

Japan's outward FDI increased a lot from 1970s. It is important to investigate why it increased in different stages.

(4) What is the impact of Japan's outward foreign direct investment on domestic production and employment in manufacturing industries?

With the expansion of Japan's overseas business, there is a fear that the production of overseas affiliates will replace the parent country's export and output. As a consequence, it will cause job losses in the home country, especially in the labor-intensive manufacturing industry. On the other hand, outward FDI also has export promotion effect on the domestic economy of the home country. Parent enterprises need to export capital and intermediate goods for the construction and production of affiliates abroad in the early stage of outward FDI. This effect will enhance the export and employment of the home country. Therefore, it is significant to indicate the different effects of Japan's outward FDI on domestic production and employment in manufacturing industries.

(5) How Japan's industrial structure changed with the expansion of outward foreign direct investment?

There is a common opinion that outward FDI would help to upgrade the industrial structure of the home countries in two ways. Firstly, outward FDI can transfer

the traditional industries to foreign countries which process comparative advantages, then promote the emerging industries in the domestic economy. Secondly, the home countries can achieve advanced technology from the host countries to push domestic industrial structure to a higher level.

(6) What should policymakers do to promote outward foreign direct investment and avoid the negative effects on the domestic economy?

This is the most significant question for the Japanese government. The outward FDI brings huge amounts of earnings to Japanese investors, at the same time, it could cause some negative effects on the domestic economies, such as "Hollowing-out" effect and unemployment problem. It is very important for Japanese policymakers to adjust policies for promoting Japan's outward FDI and domestic economy. It is also important for other emerging countries to use Japan's experience for reference to avoid possible problems that will occur in their expansion process of outward foreign direct investment.

Therefore, the objective of this dissertation is to find the answer to these questions above. Through these questions, it helps to investigate the Japanese model of outward foreign direct investment which China can learn the experience from. The main objectives of this dissertation can be summarized as following:

Firstly, to clarify the developing history of Japan's outward foreign direct investment.

Secondly, to summarize the characteristics of Japanese model outward foreign direct investment.

Thirdly, to investigate the reason why Japan's outward FDI increased in different stages.

Fourthly, to investigate the impact of outward foreign direct investment on Japan's domestic production and employment.

Fifthly, to illustrate the industrial structure change of Japan's economy with the expansion of Japan's outward foreign direct investment.

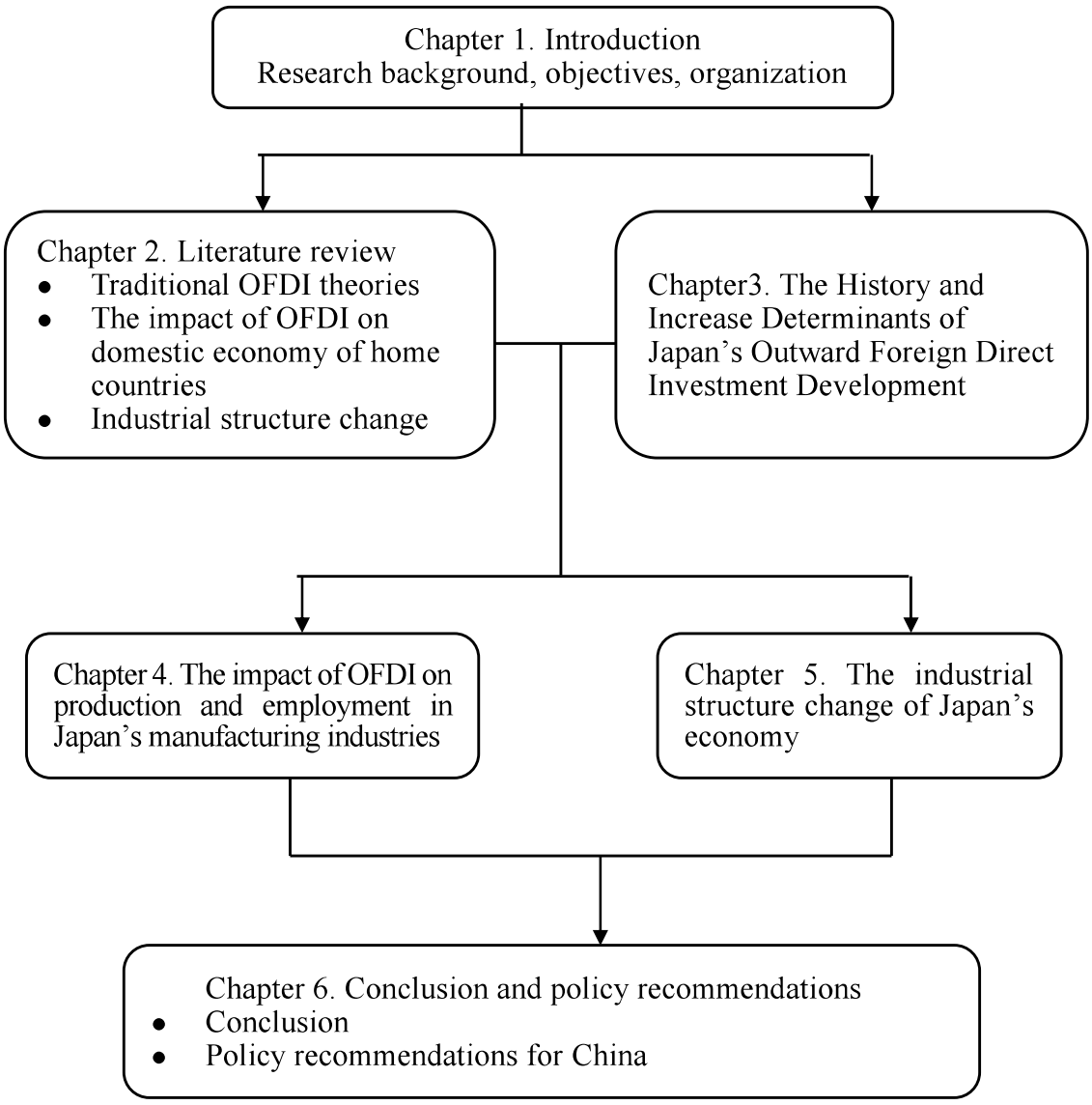
Finally, to put forward some useful policies for promoting Japan's outward foreign direct investment and useful enlightenments for China's outward FDI.

1.3 Research scheme and organization

The analysis framework is shown in Figure 1-1, there are six chapters in this dissertation. Chapter 1 introduces the research background and significance, research questions and objectives, research scheme, and organization of this dissertation. Chapter 2 reviews the traditional theories of foreign direct investment. Then reviews the relevant kinds of literatures about the impact of outward foreign direct investment on domestic economy and employment of the home countries and industrial structure change of the domestic economy. Chapter 3 makes an overview of the development history of Japan's outward FDI and analyzes the reason why Japanese outward FDI increase in different stages. Chapter 4 utilizes the Input-Output analysis to investigate the impact of Japan's outward foreign direct investment on domestic production and employment in the manufacturing industry. Chapter 5 quantitatively measures the degree of change in production composition of Japan and factors which had an impact on the change by utilizing the DPG (Deviation from Proportional Growth) analysis. Then mesure the impact of industrial structure change on Japanese employment. Chapter 6 concludes this dissertation and put forward some useful policy

recommendations for promoting outward FDI and domestic economic growth. Also, it gives some recommendations for China according to Japan's experience.

Figure 1-1. Research scheme and organization



Source: Complied by author.

Chapter 2. Literature review

2.1 The traditional theories of outward foreign direct investment

Since the 1960s, with the rapid development of global outward foreign direct investment, many economists put forward a lot of OFDI theories to explain the motivations, mechanism, and influence on home countries and host countries of OFDI. The core question of the research is "why" and "how" enterprises choose to make overseas investment, which can be explained to a certain extent by following theories.

2.1.1 The theory of monopolistic advantages

The theory of monopolistic advantages was first put forward by Hymer in 1960, then Kindleberger supplemented and developed the theory in 1969.

The theory considered that there are two motivations for multinational corporations to make overseas investment. Firstly, they can maximize the investment revenue and minimize the investment risk of the host countries. Secondly, they can utilize their monopolistic advantages compared with the host countries. These monopolistic advantages come from the imperfect competition of the international market, which can be manifested as following four types: (1) The imperfect competition in production market, such as the difference of production, the brand advantage and the difference of marketing skills; (2) The imperfect competition in production market, such as the monopoly of patents and technology,

the access of capital; (3) The imperfect competition from scale economy and external economy; (4) The imperfect competition from government intervention.

In a word, the theory of monopolistic advantages insisted that the main reason for multinational corporations to invest overseas is to achieve high monopolistic profit and control the market of host countries depending on their monopolistic advantages, such as unique technology, management experience, capital access and marketing ability, which can cause the imperfect competition.

2.1.2 The theory of internalization

The theory of internalization was put forward by Buckley and Casson (1976) based on Coase (1937) to explain the motivation of outward FDI from the view of the enterprise organization.

This theory considered that there are two kinds of the market: external market and internal market. External market is out of enterprises whose price is decided by the law of value. Internal market is the inside market of enterprises whose price is decided by the headquarters of multinational corporations. When the transaction costs of intermediate products in the external market are higher than in the internal market, enterprises prefer to transact intermediate products between subsidiary corporations in different countries to establish an internal market. This market could help enterprises to avoid the negative effects of the imperfect external market and decrease the transaction cost of intermediate goods. Also, it could maintain the supply and demand for intermediate goods and promise an optimal resource allocation.

However, this theory is only suitable when the transaction market of intermediate products has great enough influence on the production cost of enterprises, and the supply and demand for intermediate goods are not stable. The limitation of this theory is that it can not explain the regional distribution of outward FDI.

2.1.3 The eclectic theory of international production

The eclectic theory of international production is mainstream in theories of outward FDI, which was put forward by Dunning (1977). This theory is a synthesis of the theory of monopolistic advantages by Hymer (1960), the theory of factor endowment by Heckscher-Ohiln (1933) and the theory of internalization by Buckley and Casson (1976).

The core of this theory is that enterprises make overseas investment only when they own OIL paradigm: ownership advantage (O), internalization advantage (I) and location advantage (L). The ownership advantage aims to the unique advantage of enterprises, such as advanced technology, management skill, innovation, capital, and scale. This is the precondition for enterprises to make overseas investment. The internalization advantage indicates that multinational corporations establish an internal market to transact intermediate goods so that they can avoid the negative effects from the outside imperfect market and maximize their profit. This is the objective and method of outward foreign direct investment. The location advantage aims that the host countries must process more favorable conditions in the investment environment. This is the sufficient condition of outward FDI which can decide the destination of outward FDI. The location advantages include natural resource,

infrastructure, tax incentive, production and labor cost, market scale, and government policies.

Dunning (1977) proposes a model for outward FDI as Table 2-1. (1) If a company processes only ownership advantage, it is better to transfer technology to foreign countries; (2) If a company processes both ownership advantage and internalization advantage, it should export production to other countries; (3) Only if a company processes all three advantages, it can choose to do outward foreign direct investment.

Table 2-1. Dunning OIL paradigm

	Ownership advantage	Internalization advantage	Location advantage
Transfer technology	○	×	×
Export	○	○	×
Outward FDI	○	○	×

Source: Complied by author based on Dunning, J.H. (1977).

2.1.4 The theory of product life cycle

Vernon (1966) firstly utilized the theory of product life cycle to explain the destination of outward FDI. He found that the overseas investment activities of the US multinational enterprises always occurred after a period of development in the domestic market. Therefore, he regarded that multinational enterprises decided the destinations of production and sales according to different stages of their products. Figure 2-1 shows three stages of product life cycle, according to Vernon.

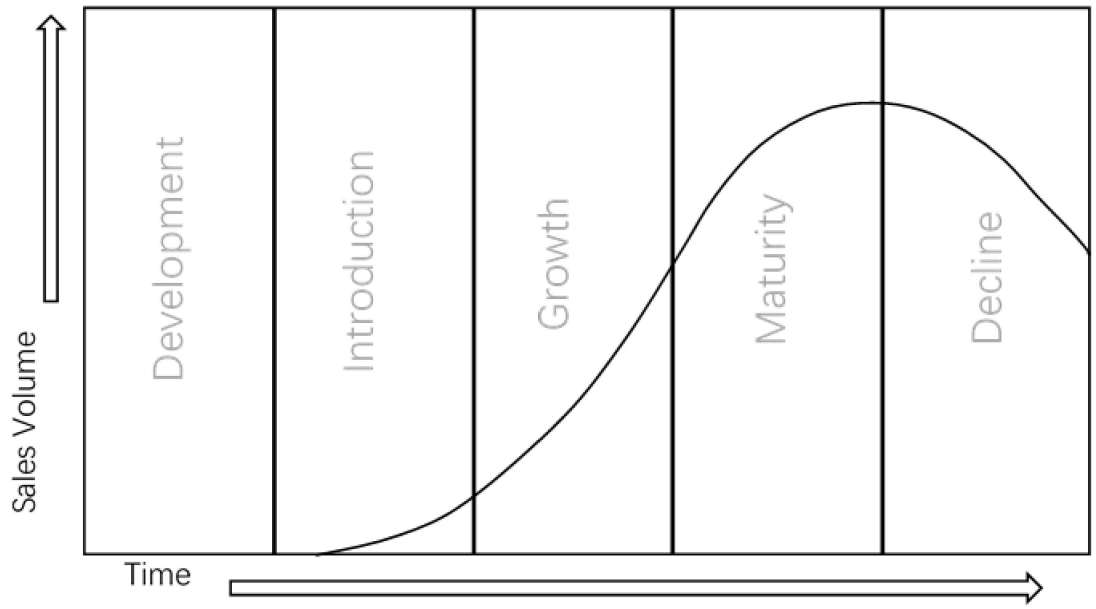
In the first stage of product life---the innovation stage, developed countries, such as the US, innovated new technology and products depending on their abundant research capitals. Enterprises mainly produce and sell new products in the domestic market. There are two reasons for that phenomenon: Firstly, the products in this stage are not very stable, so companies can adjust the new products any time according to the reaction of consumers and solve the potential problems caused by new technology; Secondly, the new products always have high price and low demand for the market, so the companies can sell them in the domestic developed market and export to other countries. In this stage, other countries can not produce this new product because of the lack of new technology, so that they have to import new products from the innovation countries. The innovation countries can earn the profit by their technology, products, and brand, so they have no reason to do outward foreign direct investment with higher risk.

In the second stage of product life---the maturity stage, production technology has been matured, and products have shaped up. It is necessary to decrease the production cost because of the increase in demand. In this stage, with the mass sales to foreign countries, overseas competitors also handle the new technology and become to produce similar imitations. Therefore, the innovation countries become to invest in other developed countries to control local markets, which can also decrease the operating cost and avoid tariff and non-tariff barrier.

In the third stage of product life---the standard stage, the production, and technology have been standard so that the innovation country has lost the monopolistic advantage. The production of products has been popularized between other developed and developing countries. The production cost and price play a decisive role in this stage. Therefore, the innovation country transferred capital and production plants to developing

countries for lower labor cost and production factors. The innovation country also imports products from the host countries.

Figure 2-1. Vernon's Product Life Cycle



Source: Complied by author based on John Dudovskiy (2014). Vernon's Product Life Cycle. <https://research- methodology.net/vernons-product-life-cycle/>

2.1.5 The theory of the marginal industry expansion

Japanese famous expert of foreign direct investment Kojima (1987) put forward the theory of the marginal industry expansion to explain Japan's outward FDI from macroeconomic view based on the principle of the international division of labor and the theory of comparative advantage.

Kojima (1987) indicated that the reason for foreign direct investment comes from the division of international labor. In Japan's case, the major part of the investment was directed towards industries in which the Japanese economy is comparatively disadvantaged. The Japanese corporations can increase exports, substituting for exports of final products, exports of machinery and equipment for the factory, and technological support. In this sense, Japanese direct investment is complementary to changes in its comparative advantage position. The point is that it is better for Japan to transfer out of those industries in which she is losing her comparative advantage, and to invest in developing countries which are gaining comparative advantage in the same industries. In other words, foreign direct investment to developing countries should be aimed at complementing and strengthening comparative advantage in investing and receiving countries alike.

By contrast, the U.S. has transferred abroad those industries which ranked in the top of her comparative advantages and has thus brought about the balance of payments difficulties, unemployment and then need for protection of her remaining industries.

With the changes in comparative advantage, outward direct foreign investment would accelerate structure adjustment in Japan, and lead to a contraction of traditional industries of the labor-intensive type. It is in the parent corporation's interests to make its investment activities prosperous by opening markets both in Japan and other developed countries and taking advantages of general preferences provided only for developing country's products. The parent company's marketing facilities are indispensable for the entry of developing country's products to advanced country markets. Outward foreign direct investment for Japanese small and medium scale companies which played a major role in

manufacturing overseas investments in the past is a promising method of survival and accelerated internal structural adjustment[1].

2.2 The literature review about the impact of OFDI on domestic economy and employment in the home countries

This section will introduce some literature about the relationship between outward FDI and employment in the home country. The term "hollowing-out effect" was first put forward in the 1980s in the U.S. The U.S. incurred inflation at that time so that the Reagan administration adopted a tight monetary policy. Therefore, the U.S. manufacturing industry began to transfer production plants overseas because of the high-interest rate, and dollar rate in U.S. Lipsey (1995) initially revealed that overseas production of U.S. affiliates in developing countries reduced the employment of the home country. He stated that US manufacturing multinationals allocated their labor-intensive business activities to developing countries, which would reduce the labor intensity in U.S. domestic production. Blomström et al. (1997) investigated the relationship between outward FDI and employment of the U.S. He found that the U.S. companies allocated their labor-intensive productions in low-wage developing countries which reduced the employment of the homeland. Lipsey (2000) found that the U.S. companies appeared to reduce the employment at homeland with the increase of production of overseas affiliates, which is in contrast with Japan.

In the 1990s, "Hollowing-out Effect" also became one of the primary economic problems in Japan. Many Japanese political and economic experts started to make research on the relationship of outward FDI and employment at the home country. The Ministry of

1 Kojima, K. (1978).

Labor's of Japan published "White Paper on Labor" (1994) which analyzed the influence of FDI on Japan's domestic employment from 1986 to 1991. The result showed that the total effect of Japan's outward FDI had a negative influence on domestic employment in 1986 and 1991 and positive influence in 1987-1990. Also, the influence of Japan's outward FDI was marginal around 1990. The Ministry of International Trade and Industry (MITI) of Japan presented an estimation in "The Overseas Business Activities of Japanese Companies" (1997) for the period from 1991 to 1995. The results showed that the effect of Japan's outward FDI was positive in 1991 and 1992 and negative from 1993. It revealed that outward FDI reduced Japan's employment with the acceleration of itself. The Ministry of Health, Labor and Welfare's (MHLW) of Japan presented similar results in "White Paper on Labor Economy" (2003). It showed that almost 4% of the employees in Japan's manufacturing industry lost their job because of the negative effect of outward FDI.

Moreover, it stated that Japan's outward FDI to Asian countries is the primary reason for the job losses. Yamashita and Fukao (2011) suggested that Japanese FDI in East Asia caused around 600,000 workers losing their job in Japan. However, market-oriented FDI of Japanese MNCs in East Asia increased the employment of Japan. Fujikawa and Watanabe (2004) indicated that Japanese outward FDI caused unemployment and had a negative effect on domestic production. Simeon (2011) used time series regression to examine the "hollowing-out effect" in Japan's manufacturing sector. He showed that outward FDI and other domestic factors would cause unemployment and recession in the home country.

The literature mentioned above insisted that overseas production of labor-intensive industries tended to reduce the employment in the home country. However, many researchers put forward that outward FDI creates more job opportunities in parent countries. Hanson et

al. (2003) indicated that the increase of sales of U.S. foreign affiliates raises the labor demand of the home country. Desai et al. (2005) found evidence that the expansion of foreign production has stimulated the scale expansion of U.S. home corporations. Hijzen et al. (2007) found that Japan's outward FDI enhances domestic output and employment of parent companies. Yamashita et al. (2008) suggested that Japan's overseas business activities have helped to alleviate the pressure of home unemployment in Japan's manufacturing industries to a certain extent.

Different types of outward FDI can also complicate the different effect of foreign economic activities (Caves, 1996). It is hard to use one simplistic theory to explain the effects of overseas investment on the home country. The complicated impact of increased outward FDI on the domestic economic activity of home country can be either positive or negative, depending on the scale of foreign operations and the substitution effects (Hanson et al., 2003). Harrison and Mcmillan (2006) found significant evidence that the employment of U.S. overseas companies in developing countries substituted for the employment of parent corporations in manufacturing industries. On the contrary, the employment of U.S. overseas branches in developed countries is complementary to parent firms. Some studies also analyze the impact on the home country according to different types of FDI. Hayakawa et al. (2013) considered that horizontal FDI increases demand for non-production workers, and vertical FDI increases demand for skilled production workers in the home country. Lee et al. (2015) argued that labor-seeking outward FDI of Japan's MNEs reduced home employment and market-seeking outward FDI of Japan's MNEs increased home employment. Hijzen et al. (2011) found that horizontal FDI has a significant positive effect on domestic productivity of the home country, but not vertical FDI. Debaere et al. (2010) states that neither of the types of FDI has a positive impact on home countries' employment.

The literature above investigated the impact of outward FDI on home counties' employment, either positive or negative. However, they all covered a short period. This paper is based on Fujikawa and Watanabe (2004), using Input-Output empirical analysis to examine the impact of Japanese foreign production activities on domestic output and employment and then compared two calculation results to see the change of "Hollowing-Out" effect in Japan's manufacturing industry in a long period. It is helpful to observe the impact of outward FDI on the employment of the home country in different stages of investment.

2.3 The literature review about the impact of outward FDI on industrial structure change in the home country

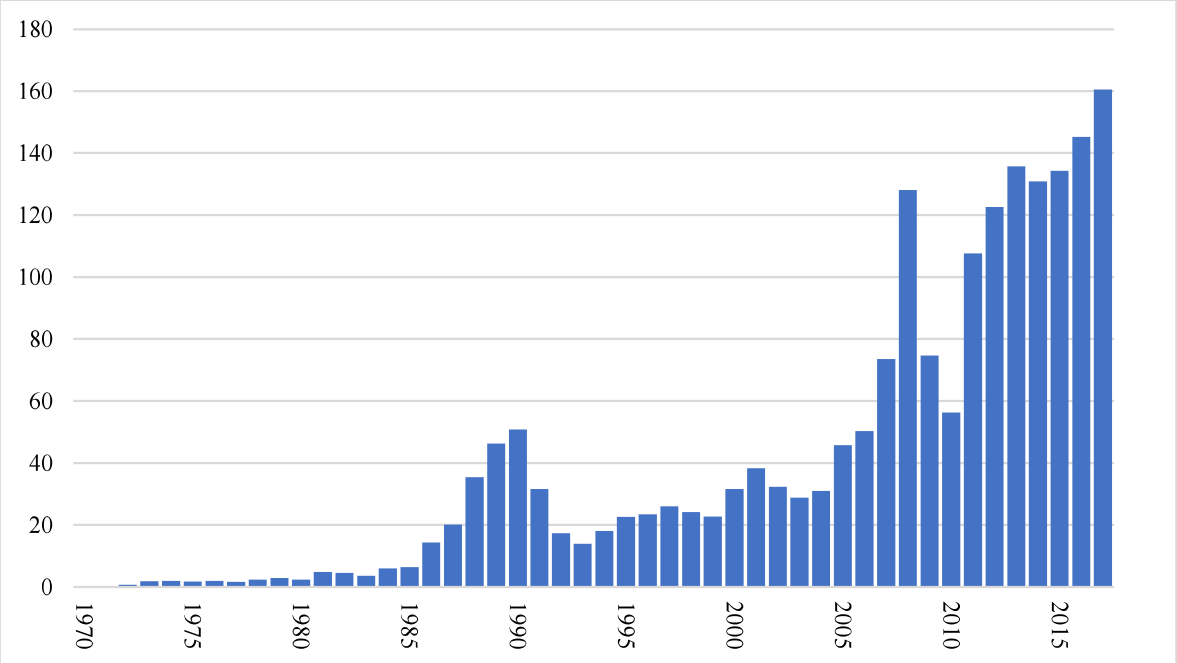
Clark (1957) and Kuznets (1966) firstly put forward that the economic developments of a country have a universal common pattern which structurally transferred from a primary industry-oriented economy to a manufacturing industry oriented economy, then to a service industry oriented economy. Chenery (1960) intended to give an empirical explanation to such a pattern of the economic structural change. Chenery, Shishido, and Watanabe (1962) firstly applied a multi-sectoral model coordinating the Input-Output analysis, which is called DPG (Deviation from Proportional Growth) analysis to Japan. This method specifies the leading industries in the expansion of economic growth and factors which played an important role in the development. We have a sizable number of DPG type studies which were applied to the data of Japan in Watanabe and Suruga (l977), of Korea in Aoki and Inada (l980) and Han (1989); of Japan, Korea and Taiwan in Chen and Fujikawa (1992). However, their research is all in the early stage of Japan's outward FDI so that we can not observe the long trend of economic structural change in Japan.

Chapter 3. The History and Increase Determinants of Japan's Outward Foreign Direct Investment Development

3.1 The development history of Japan's outward foreign direct investment

Japan started foreign direct investment from the 1950s. After 70 years' development, Japan has become one of the most important countries in global investment market. Figure 3-1 shows Japan's foreign direct investment flow from 1970 to 2017. The history of Japan's foreign direct investment can be divided into five stages: the starting stage of 1951-1970, the steady growth stage of 1971-1980, the rapidly expanding stage of 1981-1990, the depression and recovery stage of 1991-2004 and the huge expansion stage from 2005 up to 2017.

Figure 3-1. Japan's outward FDI flow, 1970-2017 (Billion Dollars)



Source: Complied by author based on the data from UNCTAD, Data Centre: <https://unctadstat.unctad.org/wds/ReportFolders>

3.1.1 The starting stage: 1951-1970

After World War II, the scale of Japan's FDI is very small in this period because of the strict restriction for foreign exchange and the lack of capital. The average FDI flow was only 140 million dollars one year. In Japan, it was a problem that there were not enough raw materials for production. Therefore, most of Japan's FDI was supported by the government and directed towards a natural resource for domestic economic recovering and growth.

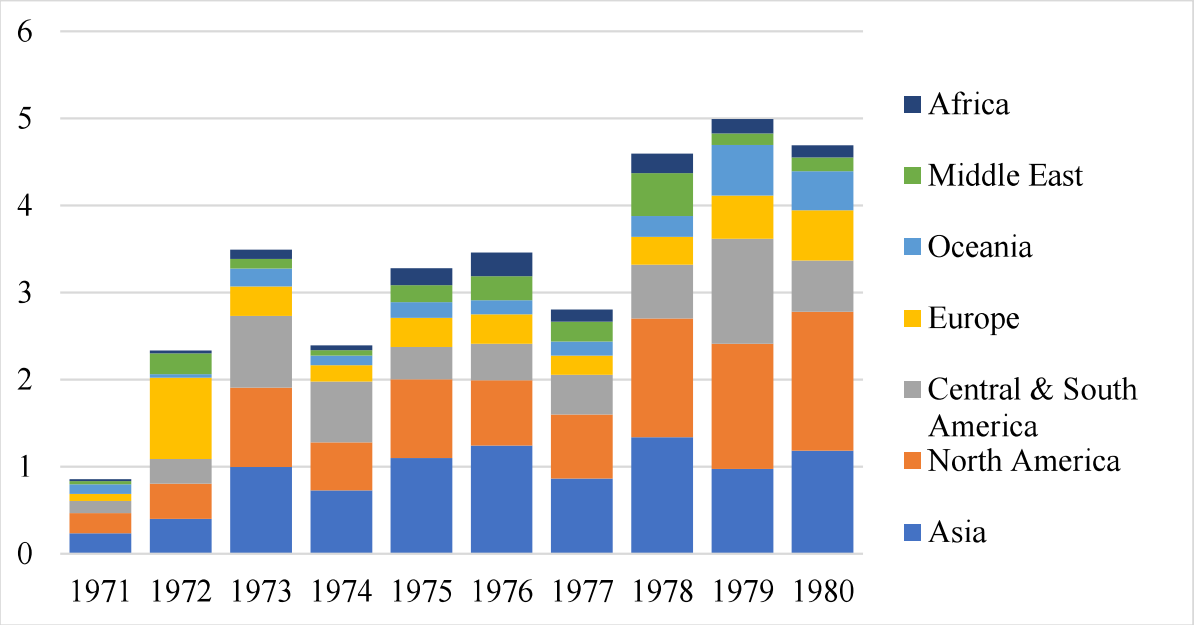
3.1.2 The steady growth stage: 1971-1980

From Figure 3-1, we can observe that Japan's FDI started to enlarge gradually since 1970. Japan became the second economy in the world since the rapid economic growth in this period. The increasing production cost, the enlargement of trade surplus, and more extra capital, made Japanese enterprises preferred to invest overseas. Also, the Japanese government loosened up restrictions to promote outward FDI. Japan's FDI was not only directed towards the natural resource but also towards the business and manufacturing industry, especially in Asian countries and U.S.

Figure 3-2 shows the investment region of Japan's outward FDI in the period 1971-1980. The most significant target of Japan's outward FDI is Asia and North America, accounting for 27.6% and 27.0% respectively. The Japanese outward investment towards developing countries increased rapidly in this decade. The total outward FDI towards Asia, Central & South America, Middle East, and Africa accounted for 54.5%, exceeding developed countries.

Figure 3-2. The distribution of Japan's outward FDI by region, 1971-1980

(Billion Dollars)

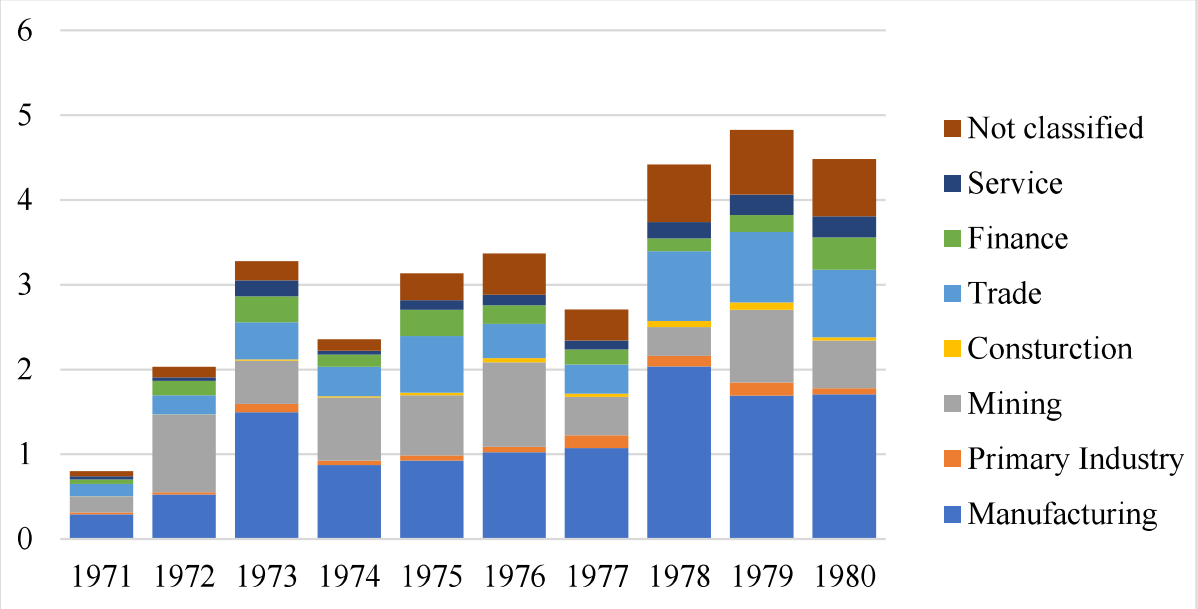


Source: Complied by author based on the data from JETRO, Statistic of Japan's FDI: <https://www.jetro.go.jp/world/japan/stats/fdi/>

Figure 3-3 shows the industry distribution of Japan's outward FDI in 1971-1980. Investment in non-manufacturing industry accounts for 62.9% of total Japan's outward FDI, which exceeded the manufacturing industry (37.1%). Among non-manufacturing industries, Mining (19.9%) and Trade (16.0%) were the most significant industries which Japan's outward FDI flow into.

Figure 3-3. The distribution of Japan's outward FDI by industry, 1971-1980

(Billion Dollars)



Source: Complied by author based on the data from JETRO, Statistic of Japan's FDI: <https://www.jetro.go.jp/world/japan/stats/fdi/>

3.1.3 The rapidly expanding stage: 1981-1990

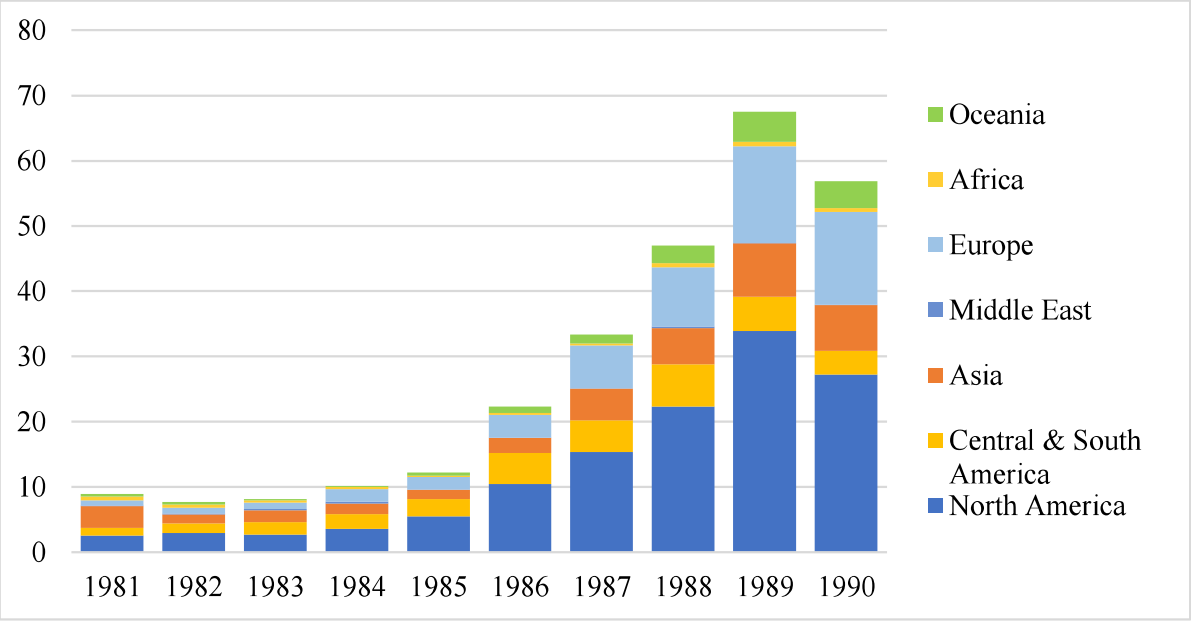
In the 1980s', Japan's outward FDI was booming with the substantial appreciation of Japanese yen after the Plaza Accord in 1985. In 1989, Japan ranked first in the global investment market.

From Figure 3-4, we can observe that developed countries became the most significant destinations in this period, especially America. Japanese outward FDI increased from 28.2% in 1989 to 50.2% in 1989. The investment towards North America, Europe and Oceania accounted for 72.5% of total Japan's outward FDI. It is important that mergers and acquisitions (M&A) played an important role when Japanese enterprises invested in

developed countries. In 1988 and 1989, almost half of Japan's investments towards America were M&A. Among developing countries, Japan's outward FDI to Asia countries increased very fast in the decade. Since the higher production cost cause by the yen appreciation in Japan, many enterprises started to transfer their plants to Asia countries for keeping comparative advantages.

Figure 3-4. The distribution of Japan's outward FDI by region, 1981-1990

(Billion Dollars)



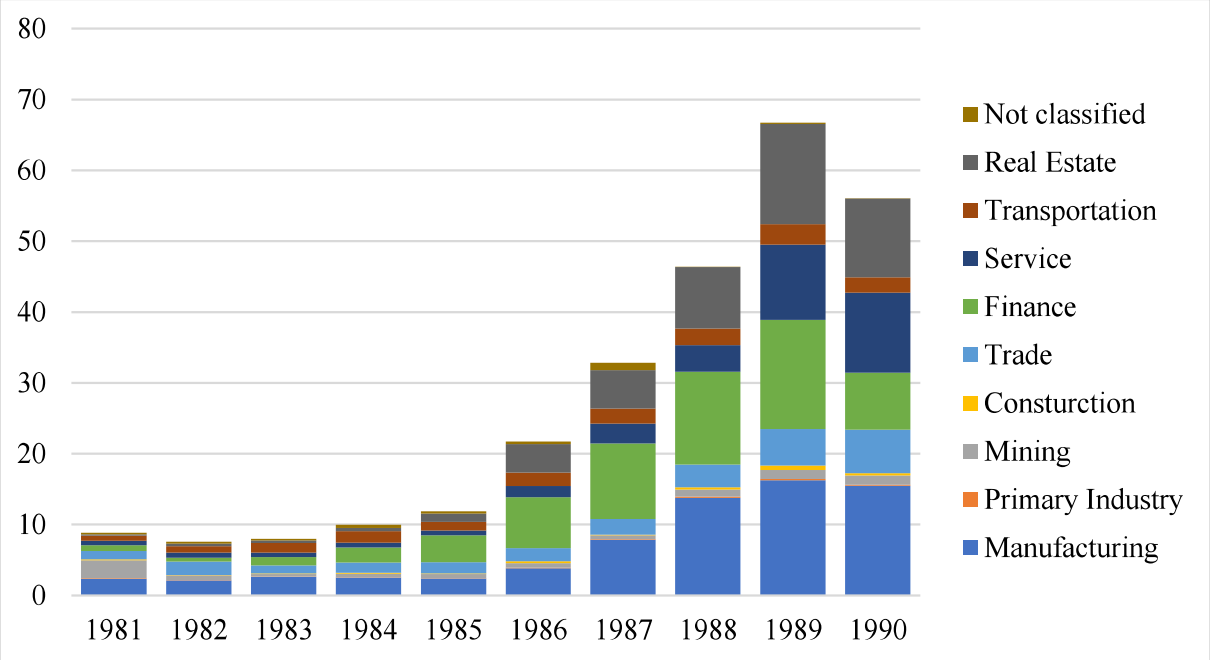
Source: Complied by author based on the data from JETRO, Statistic of Japan's FDI: <https://www.jetro.go.jp/world/japan/stats/fdi/>

From Figure 3-5, we can observe that manufacturing industries accounted for 25.6% of total Japanese outward FDI. Many labor-intensive industries, like machinery, were transferred to Asia countries for low production cost. Non-manufacturing accounted for 74.4% of total Japanese outward FDI. Finance & Insurance industry and service are the most significant among non-manufacturing industries. Most of these investments are towards

developed countries, especially America and Europe. However, investments to the Mining industry had a large slump compared with the last decade.

Figure 3-5. The distribution of Japan's outward FDI by industry, 1981-1990

(Billion Dollars)



Source: Complied by author based on the data from JETRO, Statistic of Japan's FDI: <https://www.jetro.go.jp/world/japan/stats/fdi/>

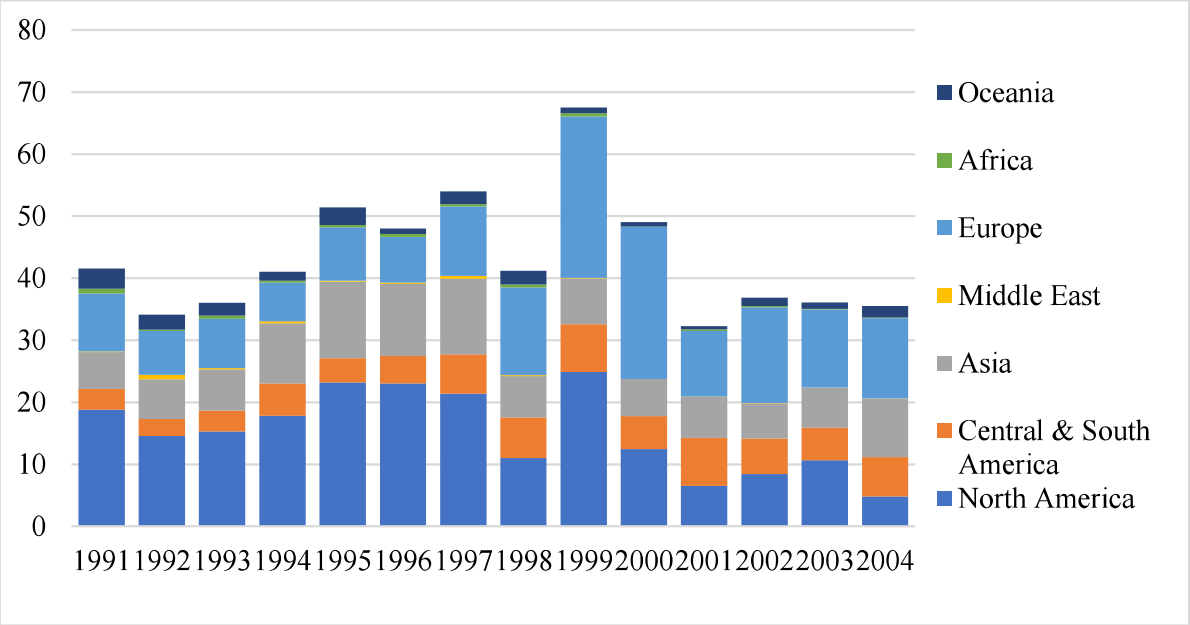
3.1.4 The depression and adjustment stage: 1991-2004

Since the collapse of Japan's bubble economy, Japanese outward FDI started a three-year decline from 1991. With the global economic depression, Japanese overseas investments had a sluggish recovery between 1994-1997. However, the Asian financial crisis made Japan's outward FDI decreased again until 1999. Then Japan's outward FDI had an adjustment and stable increase trend between 2000-2007.

Figure 3-6 indicates that America and European countries were the main recipients of Japanese outward FDI in this period. North America accounted for a 35.2% share, and Europe accounted for 28.8% share. However, the share of America decreased in the latter half of this period while the share of Europe increased. Asian countries accounted for 18.7% of Japan's outward FDI. It is conspicuous that Japan decreased foreign direct investment to Asia since the financial crisis in 1997. In this period, China began to play the most important role as a host country of Japanese outward FDI among Asia countries. It accounted for almost half of Japan's FDI outflow to Asia. There are several reasons that could be put forth. Firstly, the rapid growth of China's economy attracted international investors to this country. Secondly, the Chinese government put forward many preferential policies for FDI to attract foreign investment since the reform and opening-up policy. Thirdly, Japanese enterprises exploited low production cost and expanded the new market in China.

Figure 3-6. The distribution of Japan's outward FDI by region, 1991-2004

(Billion Dollars)

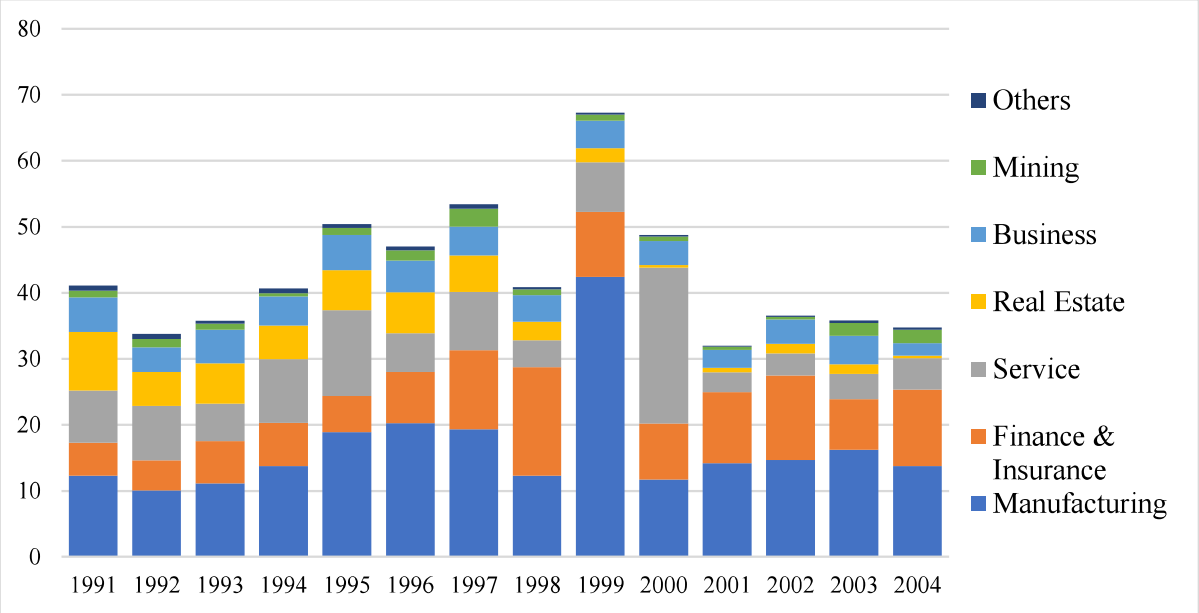


Source: Complied by author based on the data from JETRO, Statistic of Japan's FDI: <https://www.jetro.go.jp/world/japan/stats/fdi/>

From Figure 3-7 to observe the industry which Japan invested in, the share of manufacturing industry has increased and exceeded the share of non-manufacturing industry in 1999 which accounted for 62.8% of total Japan's outward FDI in that year. The investment in electrical machinery and transportation machinery industry increased very fast and become the most significant industry among manufacturing industries. The share of non-manufacturing decreased from 70.1% to 37.0% from 1991-1999. After 2000, Japan began to increase the outward FDI to America and Europe in Financial & Insurance, Service and Real Estate, which made the share of non-manufacturing increased to 60.4%.

Figure 3-7. The distribution of Japan's outward FDI by industry, 1991-2004

(Billion Dollars)



Source: Complied by author based on the data from JETRO, Statistic of Japan's FDI: <https://www.jetro.go.jp/world/japan/stats/fdi/>

Although Japan's outward FDI experienced depression and adjustment in this period, Japan was still one of the most significant countries in global investment. Japan had the most advanced technology in manufacturing industries, such as the automobile industry and electric machinery in the 1990s'. This is also a time that Japan was adjusting its structure of not only outward FDI but also the domestic economy.

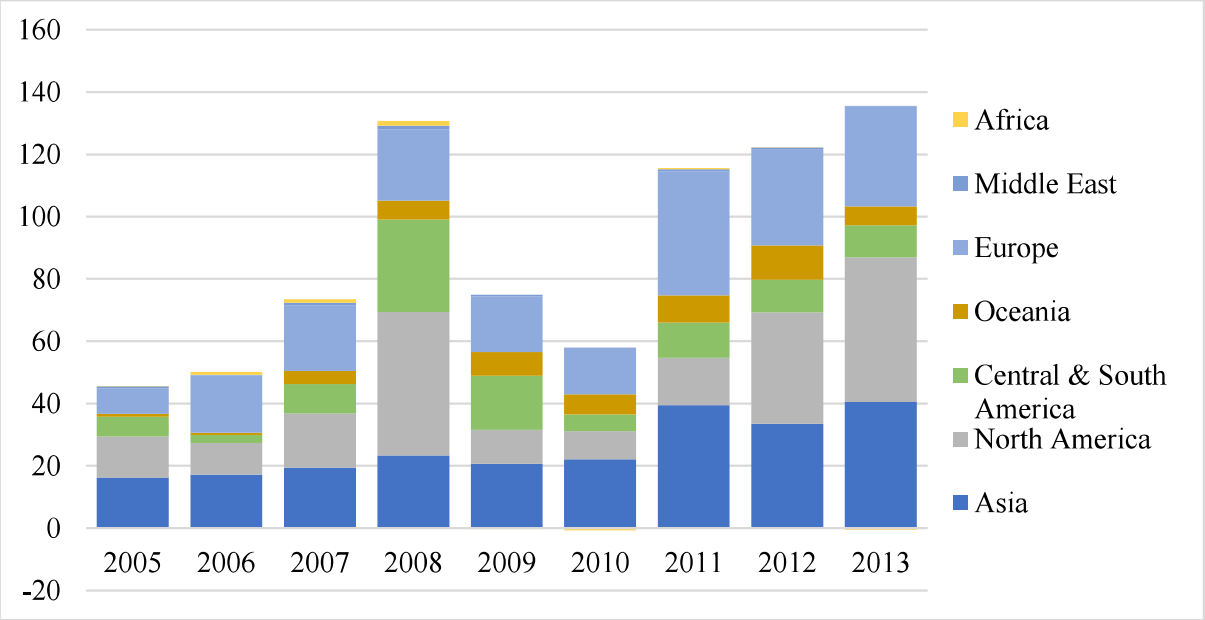
3.1.5 The huge expansion stage: 2005-2017

After the long-time adjustment in the 1990s', Japan's outward FDI began a great expansion from 2005. The main recipients of Japan's outward FDI are America, Europe, and

Asia. Figure 3-8 shows that huge amount of Japanese FDI flowed into America in 2008, and then the investment to America decreased until 2010. The reason is that America subprime mortgage crisis in 2008 make many Japanese companies in America facing a severe challenge so that they financed from the parent country-Japan to support the business. This caused a large amount of capitals flowing into America in 2008. After this crisis, Japan decreased the outward FDI to America because of the depression of America's economy.

Figure 3-8. The distribution of Japan's outward FDI by region, 2005-2013

(Billion Dollars)



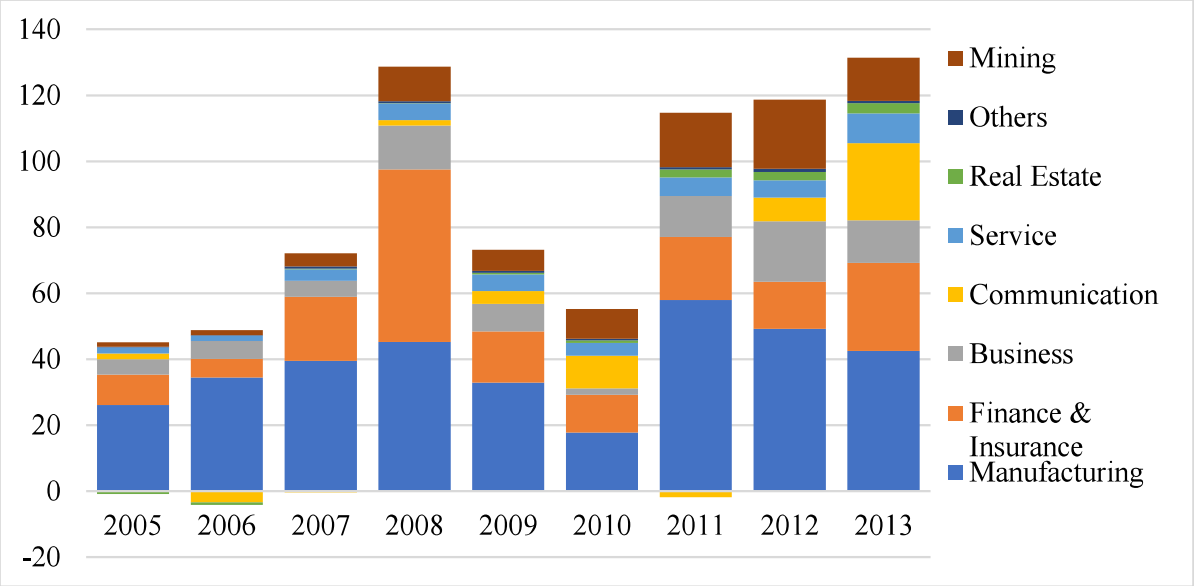
Source: Complied by author based on the data from JETRO, Statistic of Japan's FDI: <https://www.jetro.go.jp/world/japan/stats/fdi/>

From Figure 3-9, we can observe that the investment to financial & insurance industry had a huge increase in 2008. It is caused by America subprime mortgage crisis. After 2011, Japan's outward FDI increased in almost every industry except Mining. The increasing speed of non-manufacturing industries is faster than manufacturing industries. It is worth

noting that the communication industry played an important role in Japan's outward FDI with the rapid development of communication technology in this period.

Figure 3-9. The distribution of Japan's outward FDI by industry, 2005-2013

(Billion Dollars)



Source: Complied by author based on the data from JETRO, Statistic of Japan's FDI: <https://www.jetro.go.jp/world/japan/stats/fdi/>

3.2 The characteristic of Japan's outward foreign direct investment

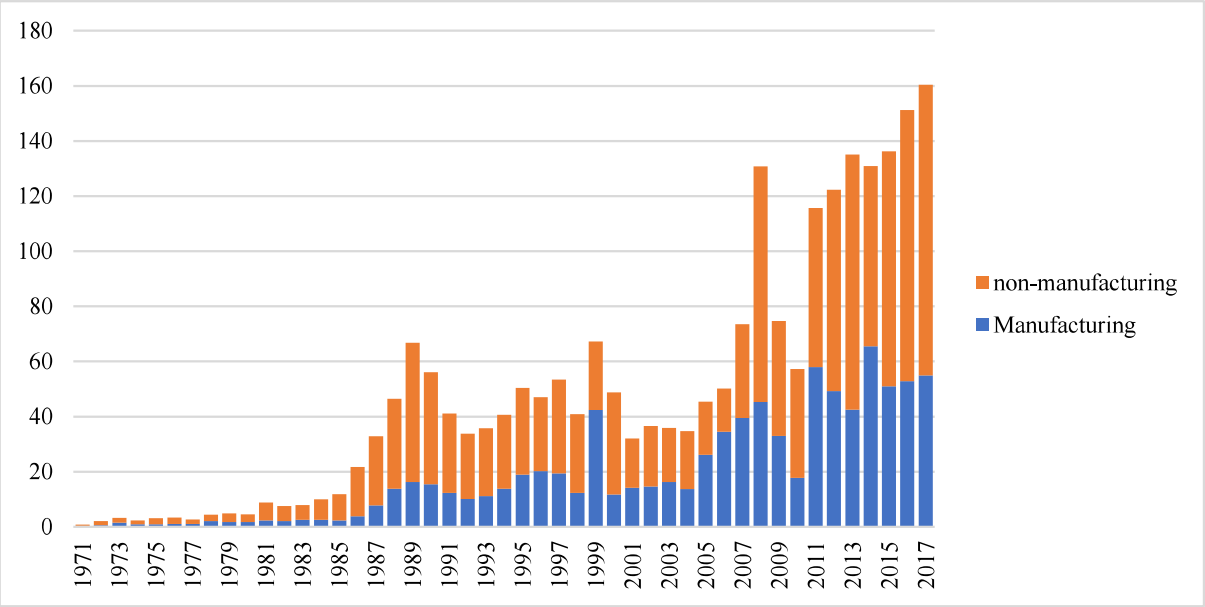
3.2.1 The industrial structure of Japan's outward FDI

The structure change of Japan's outward FDI is always accompanied by the economic structure change of the homeland. Japan's outward FDI experienced the change from natural resource oriented to labor-intensive industries, then transferred to capital and technology-intensive industries, which are also in harmony with the change of Japan's

comparative advantages. It also accelerated the industrial structure upgrade and adjustment in Japan's domestic economy.

Figure 3-10 shows Japan's OFDI in manufacturing and non-manufacturing industry in the period 1971-2017. It is conspicuous that Japan's outward FDI centered on non-manufacturing industries before 1990. In 1951-1970, the mining industry accounted for 22.5% of investment in non-manufacturing industries because of the lack of natural resource in Japan. In the 1980s', with the great Japanese yen appreciation, finance & insurance, business and real estate occupied the main status in non-manufacturing industries. After 1990, the collapse of Japan's bubble economy made a sharp decline in non-manufacturing investment. At the same time, the share of manufacturing industries increased. In 1999, the Japanese OFDI to manufacturing industries firstly exceeded non-manufacturing. After 2000, the share of manufacturing industries had a further development and focused on technology-intensive industries, such as electric machinery, transportation machinery, and chemical industry.

Figure 3-10. Japan's OFDI in manufacturing and non-manufacturing industries, 1971-2017 (Billion Dollars)



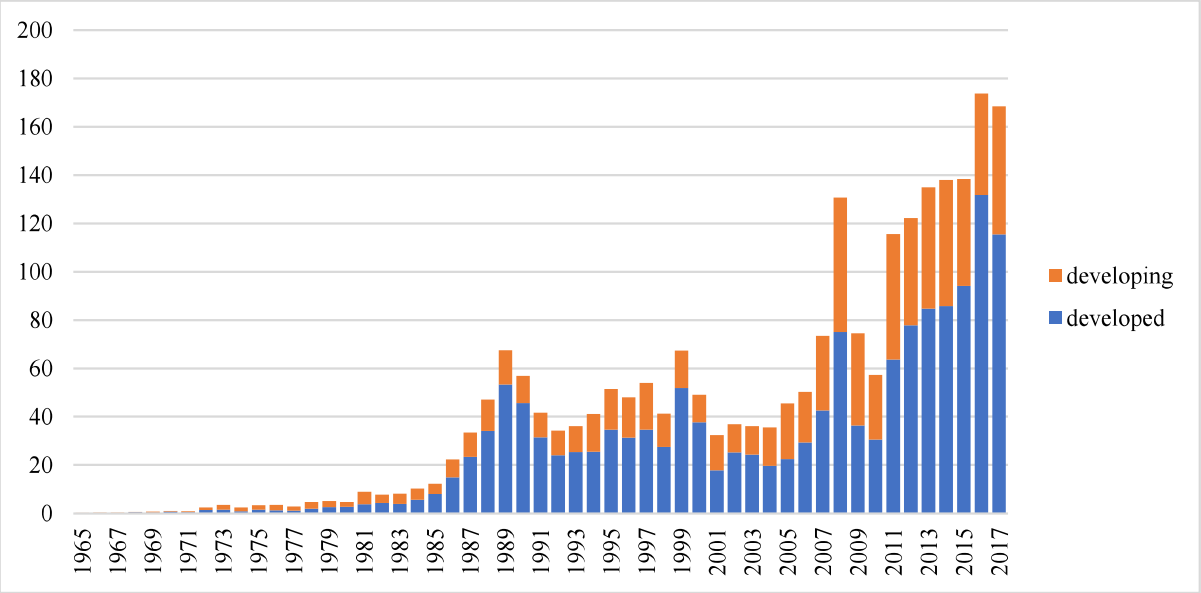
Source: Complied by author based on the data from JETRO, Statistic of Japan's FDI: <https://www.jetro.go.jp/world/japan/stats/fdi/>

3.2.2 The regional distribution of Japan's outward FDI

The destination of Japan's outward FDI changed with motivations of overseas investment. From Figure 3-11, we observed that Japan's outward FDI focused on developed countries before 2004. Then the investment in developing countries increased faster than developed countries so that developing and developed countries almost had the same share of Japan's outward FDI in 2004-2011. After 2011, Japan shifted the emphasis of investment to developing countries again, which lead a sharp slump in the outward FDI in developing countries. America, Europe, and Asia are the most significant destinations of Japan's outward FDI. The most of Japanese investment in developed countries flowed into non-manufacturing

industries, especially in finance & insurance, business, and service industry. In developing countries, manufacturing industries occupied the dominant position in Japan's outward FDI. The transportation machinery, chemicals, and electric machinery are the three most important industries which attracted Japan's outward FDI.

Figure 3-11. Japan's OFDI in developed and developing countries, 1965-2017 (Billion Dollars)



Source: Complied by author based on the data from JETRO, Statistic of Japan's FDI: <https://www.jetro.go.jp/world/japan/stats/fdi/>

3.3 The increase determinants of Japan's outward foreign direct investment

There are three surges in the development history of Japanese outward FDI. The first surge occurred in the middle of 1980s, which characterized by the great increase of Japanese outward FDI to the U.S. and European countries. The second surge is from 1993 to 1997, which features that Japanese enterprises increase the investment to China and ASEAN

countries. The third surge is from 2005. There are different reasons to cause the expansion of Japan's overseas investment in different stages.

3.3.1 To decrease the great trade surplus

In 1980s, Japan had a breakthrough in microelectronics technology and applied it in television, refrigerator, washing machine, camera, automobile and machine tool and so on. It makes these Japanese productions automatic and light. Also, the production cost decreased because of this technology. The increase of competitiveness caused huge export from Japan to the U.S., which produced great trade surpluse. For example, the export of automobile from Japan to the U.S. increased from 940 thousand in 1975 to 1990 thousand in 1980, which accounted 22% of American automobile market. At the same time, the import of automibile from the U.S. are only 20 thousand in 1980. Japanese productions not only occupied American market, but also global markets, which made American enterprise to got great hit. In this situation, the Japanese government come to terms with the American government to make export restrictions in related high-tech productions. American government also setted up many trade barriers to protect national industries. As a result, Japanese companies transferred their plants to the U.S. to avoid the export restrictions and trade barriers, which decreased the great trade surplus from Japan to the U.S.

3.3.2 To decrease the production and sales cost

After the collapse of Japanese bubble economy in 1990, Japanese enterprises tried to adjust the industrial structure to survive from the economic depression. They transferred production plants to China and ASEAN countries for cheap labor force and production materials especially from 1993-1997. Also, Asian countries put forward many policies to abstract foreign investment in this period, such as reducing restrictions on foreign investment and preferential tax policies for foereign companies. Therefore, Japanese enterprises reduced their cost by producing and selling in local markets in developing countries.

3.3.3 The Plaza Accord

In 1985, Japan accepted the Plaza Accord with the U.S., British, France and German because of huge trade surplus. This agreement caused great yen appreciation. The dollar/yen rate rised from 1:238 in 1985 to 1:138 in 1989. The rise of Japanese exchange rate made the price of Japan's export production increasing and the price of import production decreasing, which would reduce Japan's export and accelerate the import, especially in manufacturing industry. With the decrease of export, Japanese companies transferred to developing countries to reduce the production cost and keep the advantages.

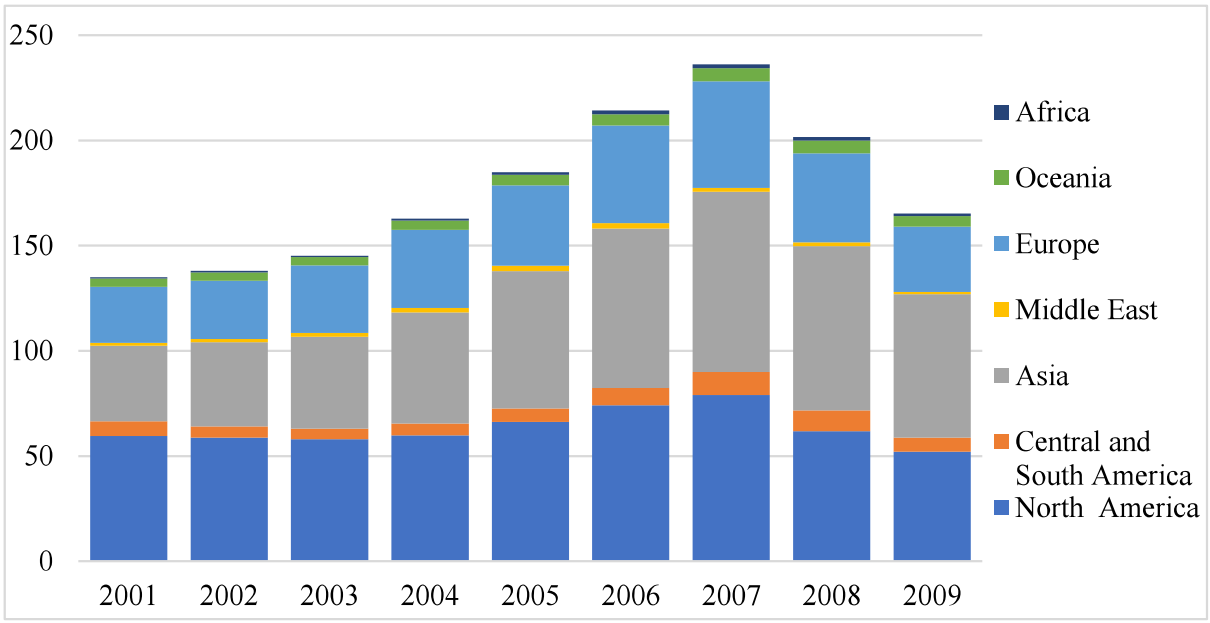
3.3.4 The labor shortage in Japan

After 2000, Japan's labor force population has continuous decrease caused by aging society and low birth rate, which caused labor shortage in manufacturing industries. According to Japan Cabinet Office, Japan's woking age population (15-64 years old) decreased from 87 million people in 1995 to 76 million people in 2017. As their forecast, it will continue to decrease to 45 million people until 2065. Also, the high income level has also contributed to the labor shortage of Japanese manufacturing industry, which has low wage. As a result, many labor-intensive sectors, such as automobile, shifted their production locations to the U.S. and Asia, which are also potential markets for them.

3.3.5 Looking for new emerging markets

The main motivation of Japan's outward FDI after 2005 is to seeking new emerging markets in China and other Asian countries with the fast economic development of these developing countries, such as Thailand, Indonesia and Philippines. From figure 3-12, we can observe the trend of sales amount of Japanese foreign companies. The sales amount of Japanese enterprises in Asian countries is stablely increasing after 2001 and exceeded that in the U.S.. The fast economic development of Asian countries absorbed Japanese companies to expand new markets, not only for Japan but also other developed countries. The large population and low income level contributed to the biggest revenues for Japanese multinational corporations in these new emerging markets.

Figure 3-12. The sales amount of Japanese foreign enterprises, 2001-2009 (Tillion Yen)



Source: Complied by author based on the data from METI, Basic Survey on Overseas Business Activity: <https://www.meti.go.jp/statistics/tyo/kaigaizi/index.html>

Chapter 4. The impact of outward foreign direct investment on production and employment in Japan's manufacturing industries

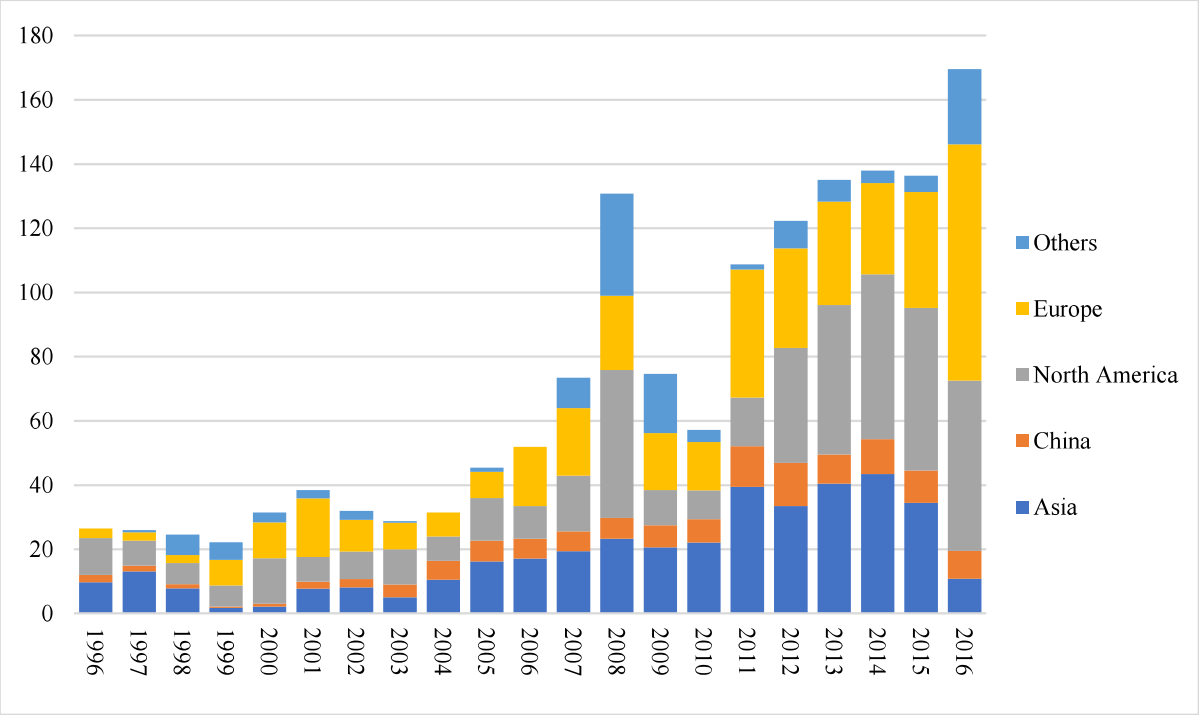
This chapter utilizes the Input-Output analysis to investigate the impact of Japan's outward foreign direct investment (FDI) on domestic production and employment in the manufacturing industry. With the expansion of Japan's overseas business, there is a fear that the production of overseas affiliates will replace the parent country's export and output. As a consequence, it will cause job losses in the home country, especially in the labor-intensive manufacturing industry.

On the other hand, outward FDI also has export promotion effect on the domestic economy of the home country. Parent enterprises need to export capital and intermediate goods for the construction and production of affiliates abroad in the early stage of outward FDI. This effect will enhance the export and employment of the home country. The results of this paper suggest that the negative impact of export substitution effect and inverse import effect is greater than the positive impact of export promotion effect from 2000 to 2014, which means that the total effect of Japan's outward FDI is negative and it causes the decrease of domestic production in Japan's manufacturing industry. As a result, it leads to unemployment in Japan, which is called the "hollowing-out" effect. Also, this paper compares the calculation result of period 2000-2014 with the period of 1990-1999 and finds that the "hollowing-out" of Japan has become more serious in recent years with the increase of Japan's outward FDI. It is necessary to change the structure of the economy in Japan to alleviate the unemployment problem caused by outward FDI.

4.1 Introduction

According to the Japan External Trade Organization (JETRO), Japan has increased its outward FDI a lot from 1996 to 2016 with the rapid expansion of overseas affiliates. The flow of Japan's outward FDI has ranked second in the world for many years until 2015. Figure 4-1 shows the flow of Japan's outward FDI from 1996 to 2016. We can observe that there is a peak in 2008, which is the year of the global financial crisis. Japan Bank for International Corporation did finance to support Japanese overseas firms, especially in North America this year. Then Japan's outward FDI slumped because of the global depression and recovered rapidly from 2011. In the Basic Survey on Overseas Business Activity (BSOBA) conducted by Japan Ministry of Economy, Trade, and Industry (METI), the ratio of overseas production for Japanese manufacturing industries has marked a record high—25.3% in 2015. From the trend of Figure 1, it is obvious that Japan has improved its overseas expansion ceaselessly through outward FDI.

Figure 4-1. The flow of Japan's outward FDI from 1996-2016 (Billion Dollars)

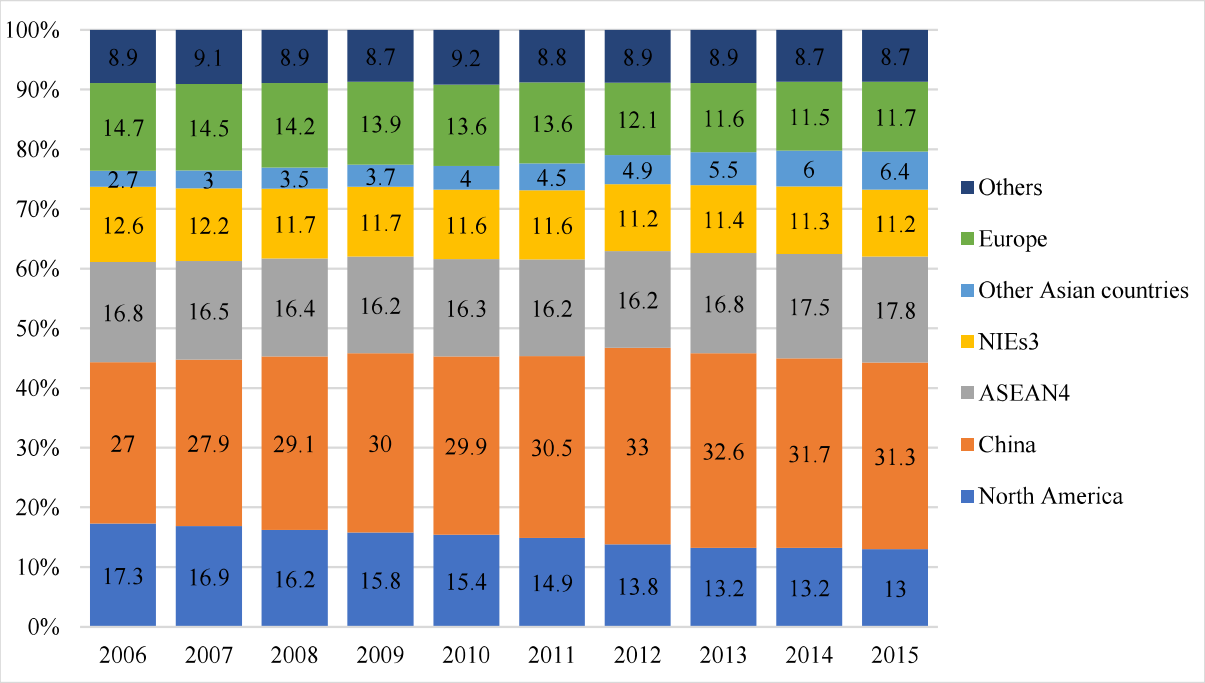


Source: Complied by author based on the data from JETRO, Statistic of Japan's FDI: <https://www.jetro.go.jp/world/japan/stats/fdi/>

Figure 4-2 shows the trends in the distribution ratio of Japan's overseas affiliates by region. It can be observed from Figure 2 that almost 30% of Japanese overseas affiliates are located in China; other Asian countries also account for about 35%. Japanese multinational corporations (MNCs) established many affiliates in China and other Asian countries in the recent decade. An important reason for this phenomenon is that Japanese MNCs relocated their production facilities to these neighboring developing countries through outward FDI to exploit low-cost factors of production. Theoretically, this kind of FDI is called vertical FDI, which is a strategy for MNCs to utilize the comparative advantage of the host country. At the same time, China and these Asian countries are also huge sales markets which have great potential. 69.4% of Japanese enterprises consider the most important deciding factor for overseas investments is that market demand is strong or perspective in

the future in host countries. Other major factors include that other Japanese MNCs have a successful experience, including delivery destinations (29.3%); market demand in neighboring countries is strong or expected in the future (27.8%); high-quality and cheap labor force can be secured in host countries (17.4%). [2](METI, 2015). Therefore, Asian countries become emerging markets for Japanese MNCs in recent years, especially China. However, with the acceleration of Japan's outward FDI, a fear peaked among researchers that such vertical FDI will cause the closure of domestic plants and decrease of export and domestic productivity of Japan. As a consequence, it will result in unemployment problem in Japan, which is the so-called "Hollowing-out Effect," especially in the manufacturing industry.

Figure 4-2. Trends in distribution ratio of Japan's overseas affiliates by region



Source: Complied by author based on the data from METI, Basic Survey on Overseas Business Activity: <https://www.meti.go.jp/statistics/tyo/kaigaizi/index.html>

2 Basic Survey on Overseas Business Activity (BSOBA) conducted by Japan Ministry of Economy, Trade and Industry (METI).

This chapter uses Input-Output analysis to investigate the impact of outward FDI on domestic production and employment in Japan's manufacturing industries through firm-level data. The impact is calculated from three effects: export promotion effect, export substitution effect, and import inverse effect. Then compare the results with twenty years ago in preceding researches to verify the "hollowing-out effect" in Japan caused by the transfer of manufacturing industries.

4.2 Research methodology

4.2.1 Leontief Import Endogenous Open Model

In a general way, there are four stages of outward FDI, and the impacts on the domestic economy are different. In the first stage, the home country exports the capital for the construction of production plants to the host country, which will increase the export of the home country. In the second stage, the home country exports intermediate goods to the host country for production. The capital-output in these two preliminary stages leads to the export promotion effect to the home country. In the third stage, affiliates in the host country have enough productivity to satisfy the demand of the local market and start to export to other countries instead of the home country, hence outward FDI has substitution effect on the export of the home country. In the last stage, the home country imports from the host country, which is called the boomerang effect. This paper analyzes the impact of outward FDI on Japan's domestic economy through these three different effects.

The overseas investment activities of Japanese multinational corporations cause the change in domestic production in Japan via the demand of Japan's capital. The change of the domestic production can be calculated by Leontief Import Endogenous Open Model. According to the model, we have a supply-demand equivalent equation as equation (4-1):

$$(\mathbf{I}-\hat{\mathbf{M}})\mathbf{A}\mathbf{x}+(\mathbf{I}-\hat{\mathbf{M}})\mathbf{f}+\mathbf{e}=\mathbf{x} \quad (4\text{-}1)$$

Therefore, we can achieve the Equilibrium Production Model to calculate the domestic production change of Japan as equation (4-2):

$$\mathbf{x}=[\mathbf{I}-(\mathbf{I}-\hat{\mathbf{M}})\mathbf{A}]^{-1}[(\mathbf{I}-\hat{\mathbf{M}})\mathbf{f}+\mathbf{e}] \quad (4\text{-}2)$$

Where **x, f, e** respectively represents the domestic production, the final domestic demand and the export; **I** represents the identity matrix; **A** standards for the direct input coefficient matrix. $\hat{\mathbf{M}}$ represents the diagonal matrix of import ratio, the definition of diagonal elements m_i is as equation (4-3):

$$m_i = M_i/(\sum_j a_{ij}x_j + f_i) \quad (4\text{-}3)$$

where M_i represents the import amount of industry *i*; the denominator is the total domestic demand of industry *i* except export, that is to say, the sum of intermediate demand $\sum_j a_{ij}x_j$ and final domestic demand f_i of industry *i*.

To investigate the impact of OFDI on employment, here multiply equation (4-2) by Labor Coefficient as equation (4-4):

$$\mathbf{n}=\hat{\mathbf{N}}\mathbf{x} \quad (4\text{-}4)$$

Where **n** represents the quantity of employment influenced by OFDI; $\hat{\mathbf{N}}$ is the diagonal matrix of Labor Coefficient (the necessary number of employees every unit of production need); **x** represents the domestic production of Japan.

4.2.2 Data source

This chapter uses the input-output tables of Japan from 2000 to 2014 are issued by the Ministry of Economy, Trade, and Industry of Japan (METI)[3]. The input-output tables of 2001-2004 are extended IO tables which based on 2000, the input-output tables of 2006-2010 are extended IO tables which based on 2005 and the input-output tables of 2012-2014 are extended IO tables which based on 2011. The employment tables are also issued by the Ministry of Economy, Trade, and Industry of Japan (METI). The detailed data of Japan's overseas corporations are collected from the Basic Survey on Overseas Business Activities (BSOBA) carried out by METI.

4.2.2.1 Export promotion effect

As mentioned before, outward FDI promotes the export of the host country in the early stage. To estimate this effect, we take the amount of intermediate goods that Japan's overseas companies import from Japan in BSOBA as the increment of export **e** in equation (4-2). Thus, we can achieve the export promotion effect.

However, the data of SOBA cannot identify which industry these intermediate goods imported from. For example, when overseas companies produce a car, they need to import not only automobile parts but also plastic products for decoration. Therefore, this paper analyzed two situations when calculated export promotion effect. In the first case, we supposed that overseas corporations import intermediate products only from the same

3 Ministry of Economy, Trade, and Industry of Japan (METI): www.meti.go.jp

industries. In the other case, we supposed that these intermediate products are imported from different industries and have the same input coefficient as production industries in Japan.

4.2.2.2 Export substitution effect

Overseas affiliates substitute for Japan's export by sales in the host country and export to a third country. However, it is hard to measure the substitution effect of the latter. Actually, the export to a third country may take the place of Japan's export. It may also replace the local products of the host country or the import from other countries. Therefore, this paper only investigated the export substitution effect of local sales. We take the local sales amount of Japan's overseas corporations as the decrease of export **e** in equation (4-2). This data also comes from BSOBA.

4.2.2.3 Import inverse effect

With the increase of competitiveness, overseas affiliates start to export to the home country---Japan. As a result, the final demand of Japan will decrease because of this inverse input from the host country. This paper takes the export from Japan's overseas affiliates to Japan as the decrease of final demand **f** in equation (4-2). The data of sales to Japan is also collected by BSOBA.

4.3 Research results

This paper calculated the impact of Japanese outward FDI on domestic production and employment from 2000 to 2014, using the Input-Output model above. This part will only show the result table in 2014. The results of 2000~2014 will be showed by the graph to observe the trend of impact.

4.3.1 The impact of Japanese outward FDI on domestic production of manufacturing Industry

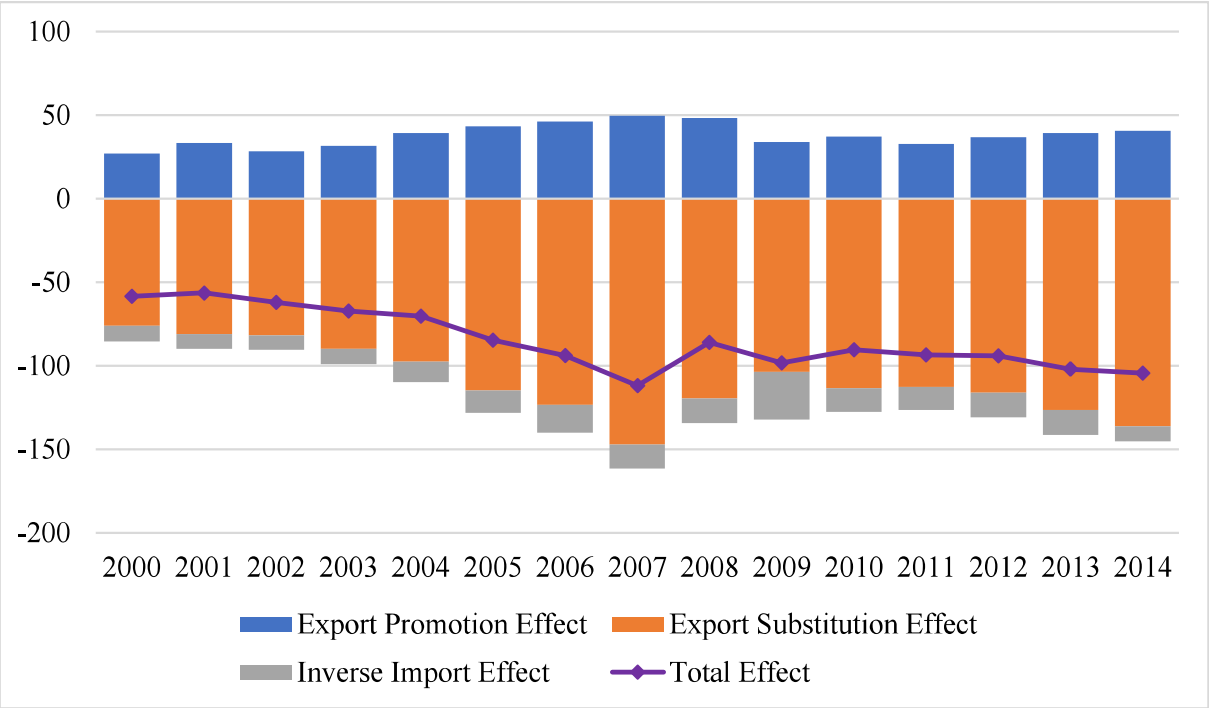
Table 4-1 shows the impact of outward FDI on domestic production of Japan's manufacturing industry in 2014. The impact has been divided into three part---export promotion effect, export substitution effect, and inverse import effect. Export promotion effect A is the case when Japanese overseas corporations import intermediate products only from the same industries of the parent country. Export promotion effect B is the case when intermediate products are imported from different industries and have the same input coefficient as production industries in Japan.

From Table 4-1, we can observe that export promotion effect is positive, export substitution effect and inverse import effect are negative, so the total effect of Japan's outward FDI is negative. In export promotion effect A, transportation equipment industry has the most positive impact on domestic production. In export promotion effect B, iron and steel industry has the most positive impact, and transportation equipment industry ranked second. In export substitution effect, the transportation equipment industry has the most negative effect. In inverse import effect, information and communication electronics equipment

industry and transportation equipment industry have a very huge impact. In total effect, both cases A and B, the transportation equipment industry has the most impact, and it is negative, which is the main reason that caused the total effect of Japan's outward FDI to be negative. Also, among three effects, the export substitution effect is even greater other two effects, which determined the total effect.

The trend of the impact from 2000 to 2014 can be observed from Figure 4-3. The export promotion effect showed in the graph is case A. This effect has always been positive in these years and reached a peak in 2007. In 2014, the impact of export promotion effect on Japan's domestic production reached 40,729 billion yen, increased two times by 2000. It is obvious that export substitution effect is more significant than the other two effects. It increased rapidly from 2000 to 2007, then decreased because of the financial crisis and recovered from 2010. In 2014, the impact of export substitution effect on domestic production had reached 136,094 billion yen, almost two times of 2000. The inverse import effect has a small impact compared with two others. As a consequence, the total effect of Japan's outward FDI on domestic production has increased from 58,329 to 104,456 billion yen, almost two times.

Figure 4-3. Impact on the domestic production of Japan (2000-2014), (Trillion Yen)



Source: calculated by author
Remark: Export Promotion Effect is case A

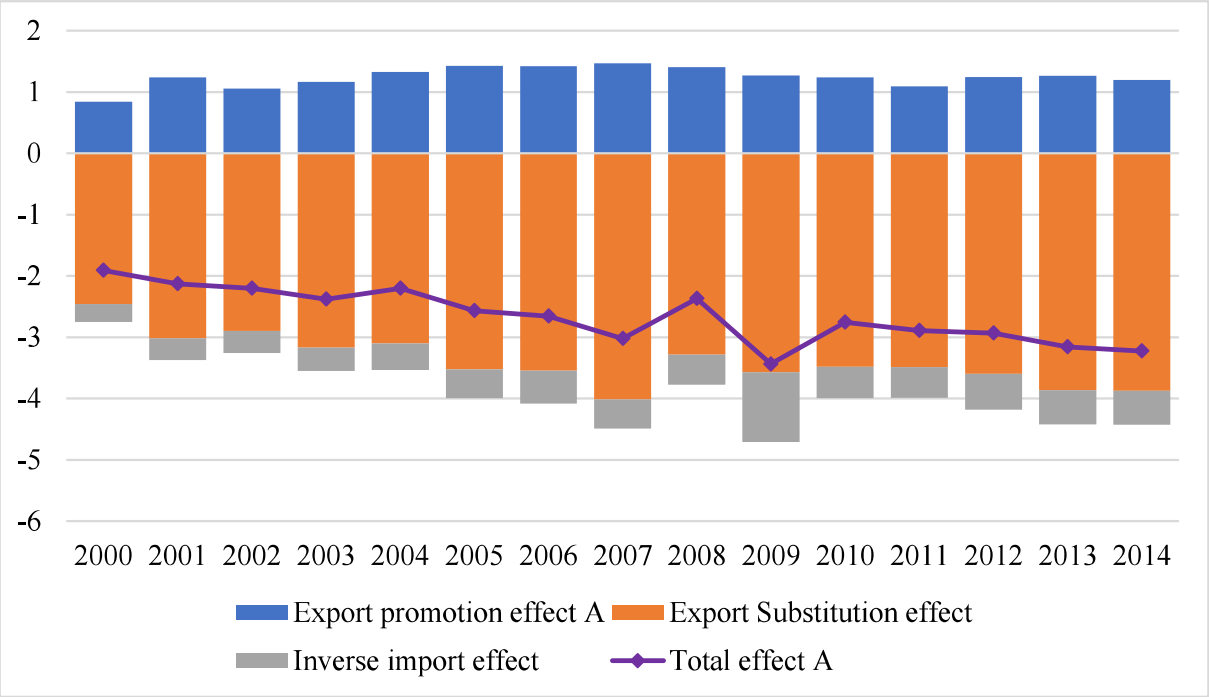
4.3.2 The impact of Japanese outward FDI on the employment of manufacturing industry

The calculation result of the impact on employment is shown as table 4-2. The total effect both case A and B are negative, which means that Japanese outward FDI has the impact to decrease the employment in Japan's all manufacturing industries. Overseas production of Japanese affiliates resulted in 3.23 million people losing their job in Japan in 2014, which is almost one-third of employees of Japan's manufacturing industry in that year. Export promotion effect is positive so that it can stimulate employment. Export Substitution effect and inverse import effect are both negative, which could decrease the employment. In case

A, the information and communication electronics equipment industry has the most significant impact. In case B, the metal products industry has the greatest impact on employment. In export substitution effect, the transportation equipment industry has the greatest impact. In inverse import effect, the information and communication electronics equipment industry has the greatest impact. As a result, both total effect A and B are negative, and the transportation equipment industry has the greatest negative impact on Japan's employment. Among three effects, the export substitution effect is also larger than export promotion effect and inverse import effect, which is the primary reason to decrease the employment in Japan.

According to the total effect from 2000 to 2014 showed as Figure 4-4, we can investigate the trend of impact of outward FDI on the employment of Japan. The total effect is always negative and increased from 1.91 million in 2000 to 3.23 million in 2014. The export substitution effect is undoubtedly the greatest among the three effects. It slumped in 2008 because of the global depression after the financial crisis, which caused total effect also slumped. The export of Japanese overseas affiliates to other countries decreased a lot in 2008. With the recovering of Japan's economy, the total effect rose rapidly in 2009, especially the inverse import effect. Although decreased a little in 2010, it expanded continuously from 2011.

Figure 4-4. Impact on the employment of Japan (2000-2014), (Million People)



Source: calculated by author
Remark: Export Promotion Effect is case A

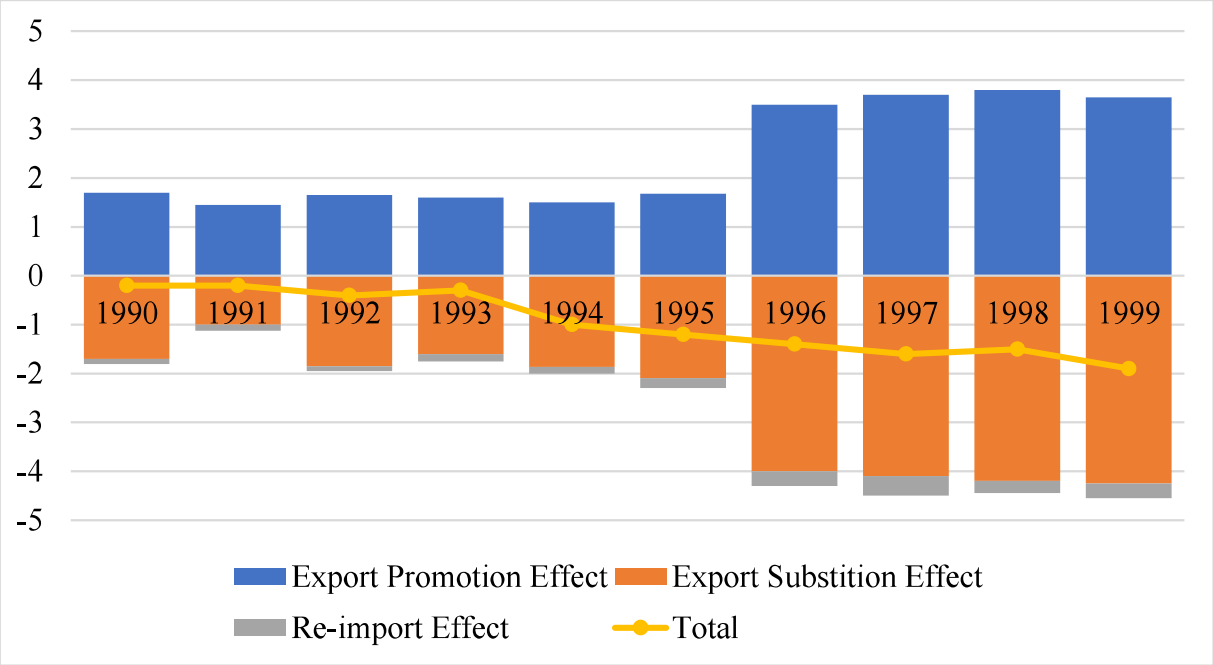
4.4 Comparison of 1990-1999 and 2000-2014

Fujikawa and Watanabe (2004) investigated the impact of outward FDI on the employment of Japan from 1990-1999, and the result is showed as Figure 4-5. This period is an early stage of Japan's foreign expansion, so the negative impact of decreasing the employment had increased continuously with the rapid growth of Japan's outward FDI. However, compared with the period of 2000-2014, the "hollowing-out" problem has not been so serious. The total negative effect on employment of 2014 is about 3 million people bigger than in 1999. Export promotion effect increased rapidly in the period 2000-2014, which makes the gap between positive and negative effect greater. It is obvious that the negative

impact of outward FDI on Japan's domestic employment has become much serious with the continuous expansion of Japanese foreign investment in the period of 2000-2014 compared with 1990-1999. The "Hollowing-Out Effect" in Japan's manufacturing industry is gradually serious with the development of overseas expansion.

Figure 4-5. Impact of outward FDI on the employment of Japan (1990-1999)

(Million People)



Source: Fujikawa and Watanabe (2004) P14.

4.5 Conclusion

This paper investigated the impact of outward FDI on domestic production and employment in Japan's manufacturing industry by Input-Output analysis. Three effects are analyzed separately: export promotion effect, export substitution effect, and import inverse

effect. As a result, export promotion effect is positive, export substitution effect and import inverse effect is negative. Export substitution effect has the most negative impact than the other two so that the total effect of Japan's outward FDI has a negative impact on domestic production and employment, which means that outward FDI caused the decrease of domestic production and employment in Japan's manufacturing industry. Among these manufacturing industries, the transportation equipment industry has the greatest negative impact. The unemployment in this industry is more than other industries because production plants transferred to foreign countries. From the trend of the result, we can know that the unemployment caused by foreign investment became serious from 2000, although it decreased in 2008 because of depression.

Also, after the comparison of 1990-1999 and 2000-2014, we can observe that the "Hollowing-Out" effect in Japan's manufacturing industries has actually become serious in recent decades with the development of Japan's overseas expansion. The unemployment problem cannot be neglected in the later stages of outward FDI. It is necessary for the Japanese government to find other industries to absorb these unemployment workers caused by foreign investment, such as service industries. How to change the structure of the economy to solve the "hollowing-out" problem is an important issue for Japan, considered its outward FDI is increasing continually.

Chapter 5. The Industrial Structure Change of Japan's Economy

5.1 Introduction

From Chapter 4, we achieved the result that Japan's outward foreign direct investment has the impact to decrease the employment in Japan's manufacturing industries because of the "hollowing-out effect" caused by transformation aboard of the production. However, Japan did not have an unemployment problem in these years. Which industry absorbed these employees from manufacturing industries? Table 5-1 shows the real employment of Japan from 1995-2011. The real trend was the same as we calculated in Chapter 4, the employment of manufacturing industries in Japan decreased by almost three million people from 1995-2011.

Nevertheless, the employment of the service industry has increased about three million people in the same period. That is to say, the employment of Japan is directed from the manufacturing industry to the service industry. The assumption is that Japan is developing the service industry to make up the depression in manufacturing industries so that the service industry absorbed labor force from manufacturing industries. In this chapter, we will check how Japanese industrial structure of economy changed in these years and what is the impact of this kind of structural change on employment.

Table 5-1 The employment of Japan from 1995-2011

(Person)	1995	2000	2005	2011
Primary Industry	5,935,186	5,569,678	4,966,807	4,816,106
Mining	63,234	47,442	34,218	32,023
Light Industry	4,250,012	3,755,897	3,055,281	2,909,262
Chemical Industry	1,849,888	939,663	1,464,588	1,380,401
Heavy Industry	6,440,697	6,292,190	5,295,897	5,057,272
Construction & Utilities	7,649,346	7,250,445	6,333,131	6,807,421
Trade	13,698,178	13,987,846	12,033,046	11,414,789
Finance	2,096,325	1,874,102	1,691,101	1,629,548
Transportation	3,305,779	3,186,040	3,336,178	3,148,582
Communication	1,499,845	770,243	1,985,542	1,972,853
Other Services	21,735,322	24,567,534	26,482,205	27,366,016
Not classified	23,006	48,368	22,538	34,609
Total	68,546,818	68,289,448	66,700,532	66,568,882

Source: Complied by author based on the data from Portal Site of Official Statistics of Japan, Employment Status Survey: <https://www.e-stat.go.jp>

With the promotion of economic globalization, the development of a country is usually accompanied with the adjustment of industrial structure. Such adjustment could not leave the international flow of production factors and global industrial transfer, which realized by international trade and foreign direct investment.

Kojima (1978) indicated that FDI could transfer the industries to overseas, which have comparative disadvantages in the home countries and save the domestic input to these marginal industries. It benefits the home country to focus on developing industries which have comparative advantages, thereby accelerate the upgrade of industrial structure in the home country.

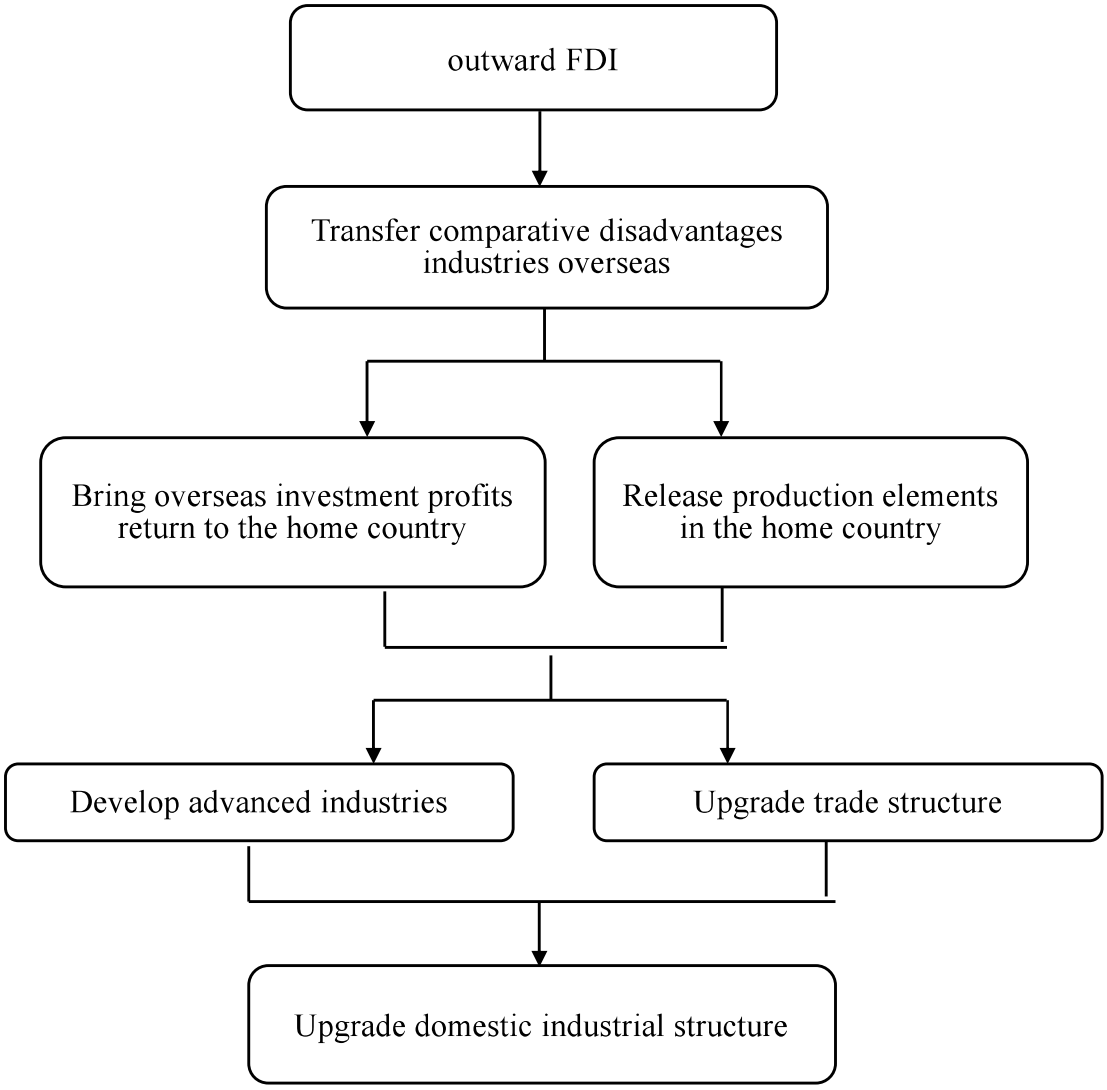
The purpose of this chapter is to quantitatively measure the degree of structural change in domestic production composition of Japan and factors which had an impact on the change after 1990. Then make a comparison with periods before 1990. It is meaningful to observe the economic evolution of Japan's growth pattern with the expansion of Japan's

foreign direct investment from a long-term view. Then use the same method to indicate the structure change of the Japanese labor force.

5.2 The influence mechanism of outward FDI on industrial structure optimization in the home countries

According to Kojima (1978), outward FDI influenced the industrial structure change of the home country mainly from two ways showed as Figure 5-1. The home country transferred industries which are losing comparative advantages to other countries so that the home country can achieve revenues and earn capitals from foreign markets. Also, the home country can release production resource in the domestic market to develop new advanced industries which have comparative advantages. In the other hand, the home country can also promote export scale and structure. Therefore, in these two ways, the outward FDI can optimize the industrial structure of the domestic economy in the home country.

Figure 5-1 The influence mechanism of outward FDI on industrial structure optimization



Source: Complied by author based on Kojima (1978)

5.3 Research method and data

5.3.1 Research method: the DPG model

The DPG (Deviation from Proportional Growth) analysis is the main method to quantitatively measure the degree of economic growth and structure change of economic industries. The deviation $\Delta\mathbf{x}$ is the difference between actual growth and proportional growth caused by the different growth speed of each industry, which can be defined as equation (5-1):

$$\Delta\mathbf{x} = \mathbf{x}_{t+1} - \alpha\mathbf{x}_t \tag{5-1}$$

$$\alpha = \sum_{i=1}^{n} x_{it+1} / \sum_{i=1}^{n} x_{it} \tag{5-2}$$

where

$\mathbf{x}_{t+1}, \mathbf{x}_t$ standards for the gross domestic output in period *t+1* and *t*;

α represents the proportional growth ratio of production, which is the division of the domestic output of each industry *i* in period *t+1* by that of period *t*.

$\Delta\mathbf{x}$ standards for the growth deviation of domestic output. It is positive when the growing speed of this sector is faster than α; it is zero when the growing speed is equal to α; it is negative when the growing speed is slower than α.

To analyze different factors of the structure change of production, the DPG analysis decomposes $\Delta\mathbf{x}$ into several parts based on the following output equation (5-3):

$$\mathbf{x}_t = \left(\mathbf{I} - \widehat{\mathbf{M}}_t\right)\mathbf{A}_t\mathbf{x}_t + \left(\mathbf{I} - \widehat{\mathbf{M}}_t\right)\mathbf{f}_t + \mathbf{e}_t \tag{5-3}$$

where

I standards for the identity matrix;

$\widehat{\mathbf{M}}_t$ represents the diagonal matrix whose diagonal elements are import coefficients of each sector in period *t*;

$\mathbf{A}_t$ represents the direct input coefficient matrix in period *t*;

$\mathbf{f}_t$ represents the final domestic demand in period *t*, including consumption, investment, and stocks;

$\mathbf{e}_t$ standards for the export in period *t*.

Solve equation (5-3) to get $\mathbf{x}_t$ as equation (5-4):

$$\mathbf{x}_t = [\mathbf{I} - (\mathbf{I} - \widehat{\mathbf{M}}_t)\mathbf{A}_t]^{-1}[(\mathbf{I} - \widehat{\mathbf{M}}_t)\mathbf{f}_t + \mathbf{e}_t] \quad (5\text{-}4)$$

Substitute equation (5-4) into equation (5-1), we can get the following formula (5-5):

$$\begin{aligned}\Delta\mathbf{x} = {} & [\mathbf{I} - (\mathbf{I} - \widehat{\mathbf{M}}_{t+1})\mathbf{A}_{t+1}]^{-1}\left[(\mathbf{I} - \widehat{\mathbf{M}}_{t+1})\mathbf{f}_{t+1} + \mathbf{e}_{t+1}\right] \\ & -[\mathbf{I} - (\mathbf{I} - \widehat{\mathbf{M}}_t)\mathbf{A}_t]^{-1}[(\mathbf{I} - \widehat{\mathbf{M}}_t)\alpha\mathbf{f}_t + \alpha\mathbf{e}_t] \quad (5\text{-}5)\end{aligned}$$

According to formula (5-5), $\Delta\mathbf{x}$ can be decomposed into four parts as the following DPG model:

$$\begin{aligned}\Delta\mathbf{x} = {} & \mathbf{B}_{t+1}(\mathbf{I} - \widehat{\mathbf{M}}_{t+1})(\mathbf{f}_{t+1} - \alpha\mathbf{f}_t) + \mathbf{B}_{t+1}(\mathbf{e}_{t+1} - \alpha\mathbf{e}_t) \\ & +\mathbf{B}_{t+1}(\mathbf{I} - \widehat{\mathbf{M}}_{t+1})(\mathbf{A}_{t+1} - \mathbf{A}_t)\alpha\mathbf{x}_t + \mathbf{B}_{t+1}(\widehat{\mathbf{M}}_t - \widehat{\mathbf{M}}_{t+1})\alpha(\mathbf{f}_t + \mathbf{A}_t\mathbf{x}_t) \quad (5\text{-}6)\end{aligned}$$

where

$$\mathbf{B}_{t+1} = [\mathbf{I} - (\mathbf{I} - \widehat{\mathbf{M}}_{t+1})\mathbf{A}_{t+1}]^{-1}$$

Also, according to the same method, the DPG model can also be written by using the inverse matrix $\mathbf{B}_t$ as the following formula:

$$\begin{aligned}\Delta\mathbf{x} = {} & \mathbf{B}_t(\mathbf{I} - \widehat{\mathbf{M}}_t)(\mathbf{f}_{t+1} - \alpha\mathbf{f}_t) + \mathbf{B}_t(\mathbf{e}_{t+1} - \alpha\mathbf{e}_t) \\ & +\mathbf{B}_t(\mathbf{I} - \widehat{\mathbf{M}}_t)(\mathbf{A}_{t+1} - \mathbf{A}_t)\mathbf{x}_{t+1} + \mathbf{B}_t(\widehat{\mathbf{M}}_t - \widehat{\mathbf{M}}_{t+1})(\mathbf{f}_{t+1} + \mathbf{A}_{t+1}\mathbf{x}_{t+1}) \quad (5\text{-}7)\end{aligned}$$

where

$$\mathbf{B}_t = [\mathbf{I} - (\mathbf{I} - \widehat{\mathbf{M}}_t)\mathbf{A}_t]^{-1}$$

From formula (5-6) and (5-7), we can decompose the structure change of production into four factors:

1. The deviation from the change of domestic final demand (consumption, investment, and stocks).

$$\mathbf{B}_{t+1}\left(\mathbf{I}-\widehat{\mathbf{M}}_{t+1}\right)(\mathbf{f}_{t+1}-\alpha\mathbf{f}_t)$$

or $\mathbf{B}_t\left(\mathbf{I}-\widehat{\mathbf{M}}_t\right)(\mathbf{f}_{t+1}-\alpha\mathbf{f}_t)$

2. The deviation from the change of exports.

$$\mathbf{B}_{t+1}(\mathbf{e}_{t+1}-\alpha\mathbf{e}_t)$$

or $\mathbf{B}_t(\mathbf{e}_{t+1}-\alpha\mathbf{e}_t)$

3. The deviation from the change of the input coefficient.

$$\mathbf{B}_{t+1}\left(\mathbf{I}-\widehat{\mathbf{M}}_{t+1}\right)(\mathbf{A}_{t+1}-\mathbf{A}_t)\alpha\mathbf{x}_t$$

or $\mathbf{B}_t\left(\mathbf{I}-\widehat{\mathbf{M}}_t\right)(\mathbf{A}_{t+1}-\mathbf{A}_t)\mathbf{x}_{t+1}$

4. The deviation from the change of the import ratio.

$$\mathbf{B}_{t+1}(\widehat{\mathbf{M}}_t-\widehat{\mathbf{M}}_{t+1})\alpha(\mathbf{f}_t+\mathbf{A}_t\mathbf{x}_t)$$

or $\mathbf{B}_t(\widehat{\mathbf{M}}_t-\widehat{\mathbf{M}}_{t+1})(\mathbf{f}_{t+1}+\mathbf{A}_{t+1}\mathbf{x}_{t+1})$

This research uses the average deviation as the result of four factors.

Then we can indicate the impact of industrial structure change on Japan's employment from the deviation of labor change. The labor force is defined as equation (5-8).

$$\mathbf{l}=\widehat{\mathbf{N}}\mathbf{x} \qquad (5\text{-}8)$$

where

l represents the number of employees; $\widehat{\mathbf{N}}$ is the diagonal matrix of Labor Coefficient (the necessary number of employees every unit of production need); **x** represents the domestic production of Japan.

Therefore, the labor change effect $\Delta\mathbf{l}$, which caused by industrial structure change of the Japanese domestic economy can be calculated as equation (5-9). α is the growth speed of domestic production.

$$\Delta\mathbf{l} = \mathbf{l}_2 - \alpha\mathbf{l}_1 = \mathbf{N_2}\mathbf{x}_2 - \alpha\mathbf{N_1}\mathbf{x}_1 \quad (5\text{-}9)$$

Δl can be decomposed into two parts as equation (5-10) or (5-11): the labor change effect caused by industrial structure change and the labor change effect caused by labor coefficient change.

$$\Delta\mathbf{l} = \mathbf{N_2}(\mathbf{x}_2 - \alpha\mathbf{x}_1) + (\mathbf{N_2} - \mathbf{N_1})\alpha\mathbf{x}_1 \quad (5\text{-}10)$$

$$\Delta\mathbf{l} = \mathbf{N_1}(\mathbf{x}_2 - \alpha\mathbf{x}_1) + (\mathbf{N_2} - \mathbf{N_1})\mathbf{x}_2 \quad (5\text{-}11)$$

This research used the average result of equation (5-10) and equation (5-11) as the final result.

5.3.2 Basic data

This chapter analyzes the industrial structure change of Japan's production in five periods: 1990-1995, 1995-2000, 2000-2005, 2005-2011, and 2011-2015. For periods 1990-1995, 1995-2000, 2000-2005, and 2005-2011, we use the continuous Input-Output tables which issued by Japan Ministry of Internal Affairs and Communications (MIAC)[4]. The data of MIAC is up to 2011, so we use the Input-Output table which issued by the Japan Ministry of Economy, Trade, and Industry (METI) when analyzing period 2011-2015. Considered that the emphasis of this article is the relative degree of the production change of different sectors and the relative magnitude of the change from different factors, we normalize the result of

4 Japan Ministry of Internal Affairs and Communications (MIAC): http://www.soumu.go.jp

the production deviation so that the total positive (or negative) deviation equals 100 to make the result easier to compare.

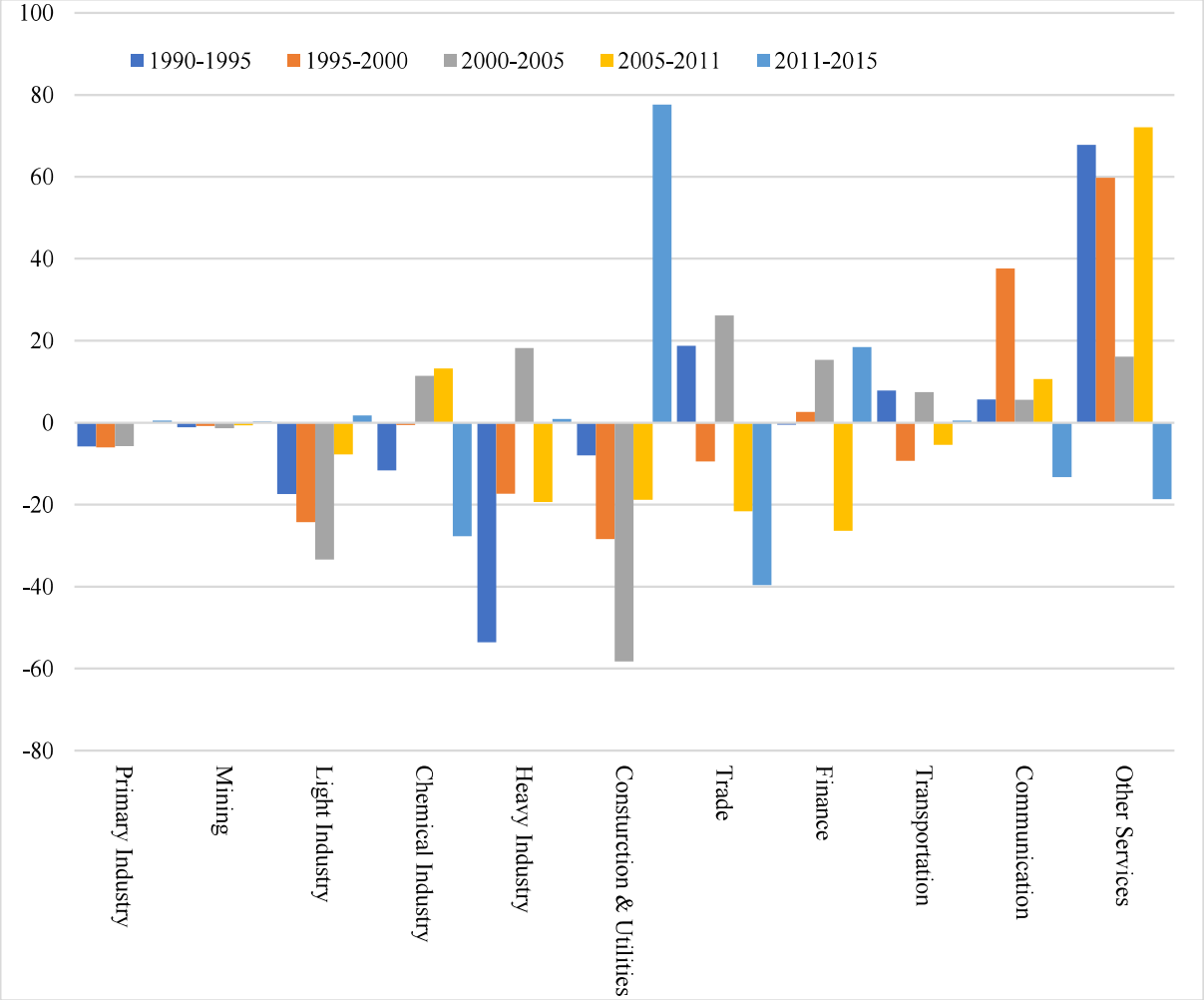
Since the access of employment table, this article indicates the labor deviation caused by industrial structure change in three periods: 1995-2000, 2000-2005, and 2005-2011. The employment tables are also issued by Japan Ministry of Internal Affairs and Communications (MIAC).

5.4 Research results of production DPG

Figure 5-2 shows the historical DPG change of Japan's main industries in five periods: 1990-1995, 1995-2000, 2000-2005, 2005-2011, and 2011-2015. We can see that the primary and mining industry have a small deviation share in all five periods compared with other industries, which means that these two industries almost have the same increasing speed with the total output. It is obvious that the service industry has much greater positive deviation share than others, especially other services industry (including official business, education, research, medical, entertainment, catering and accommodation, and other services). It illustrates that the other services industry leads to the increase in Japan's economy from 1990 to 2011. However, a great decreasing trend can also be observed in the period 2000-2005, and the leading sector shifted from the other services industry to the construction and utility industry in the period 2011-2015 because of the "3.11 East Japan earthquake" in 2011. The heavy industry has the most negative deviation share in the period 1990-1995, but it decreased after 1995 and has the same speed with the total output in the period 2011-2015. The DPG of the light industry is always negative and become positive in

the period 2011-2015, which indicates that the increasing speed of the light industry has been quicken in these years. In the other side, the deviation shares of the chemical industry changed from negative to positive from 1990-2011, which indicates that the increasing speed of this sector has exceeded the speed of the total output. In the period 2011-2015, almost all industries had negative deviation shares because of the depression from the earthquake. The construction and utilities and finance industry are leading the Japanese economy because of the post-disaster reconstruction.

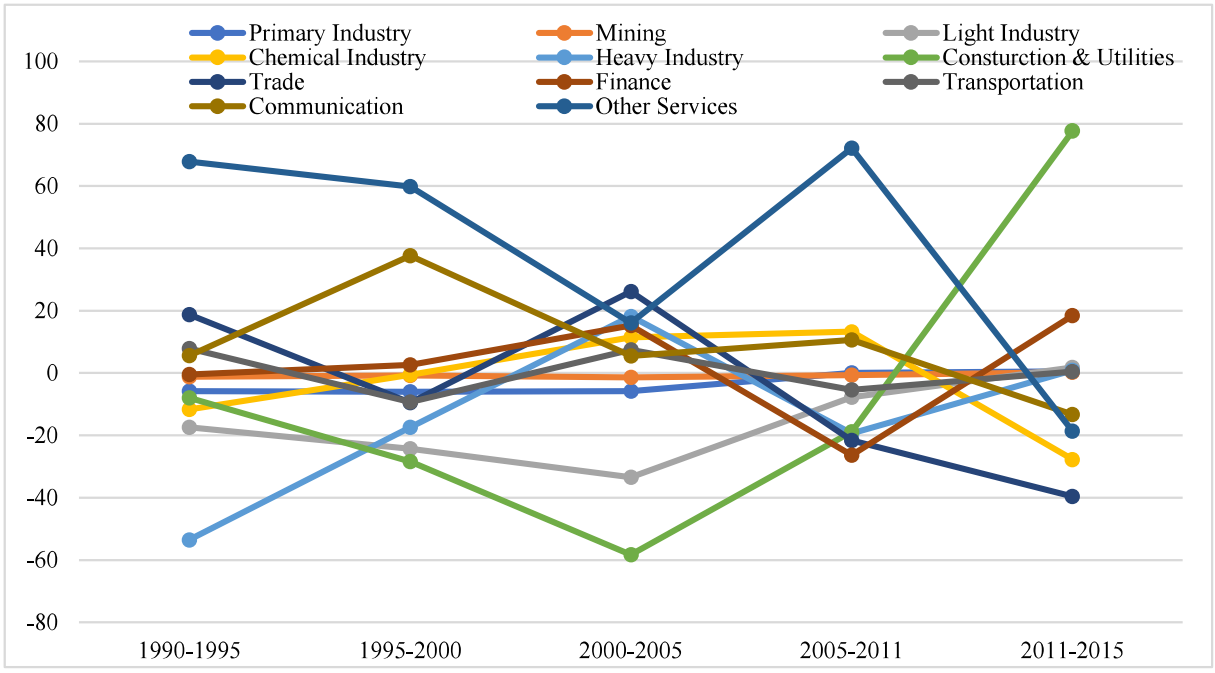
Figure 5-2. The DPG of Japan's main industries (%)



Source: Calculated by author

From Figure 5-3, we can clearly observe the trend of the DPG of Japan's main sectors from 1990 to 2015. The other services industry was leading Japan's economy from 1990, but the positive deviation share of this industry has been continuously decreasing. In the period 2011-2015, the other services industry has a negative deviation share, which indicates that it is slower than the speed of total production in economic expansion. The DPG of the construction and utility industry decreased at first, then increased from 2000 and became the leading industry in the period 2011-2015, which mainly because of "The 3.11 earthquake of East Japan" in 2011. The deviation share of the light industry was always negative and had an increasing trend. The heavy industry had the lowest speed in the period 1990-1995. However, it increased to positive between 1990 to 2005, then decreased in the period 2005-2011 and recovered in the period 2011-2015. The mining and primary industry always keep the same path with the total output. The chemical industry had a gentle incline, but it decreased in the period 2011-2015. The communication industry had a great positive deviation share in 1995-2000, which indicates that Japan's communication developed very fast in this period.

Figure 5-3. The trend of the DPG of Japan's main industries (%)

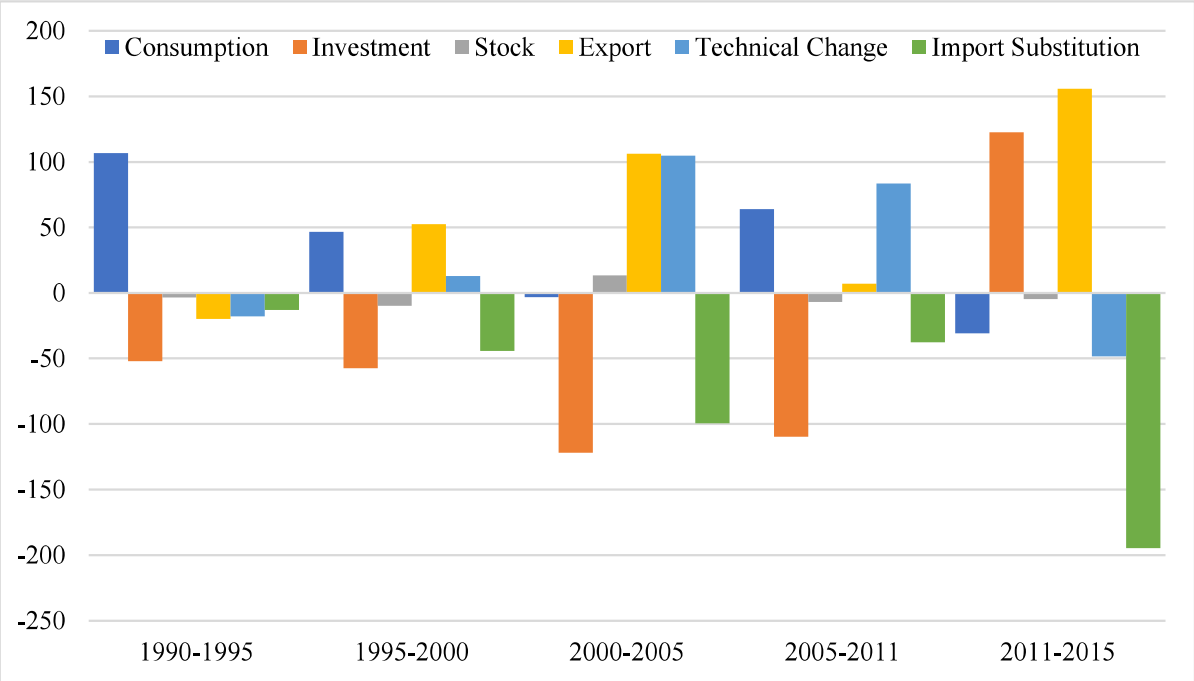


Source: Calculated by author

Figure 5-4 shows the DPG by different factors in five periods. This article decomposed the DPG of Japan's production into six parts which caused by the change of consumption, investment, stocks, export, import substitution, and technical change. We can see that the consumption effect is the main impetus of Japan's economic increase in 1990-1995, then it has decreasing trend and become negative in the period 2000-2005, which indicates that the consumption of Japan is on the decline after 1995 because of the depression caused by the burst of Japan's bubble economy. The investment always has a negative effect from 1990 to 2011, which indicates that the investment is continuously decreasing in Japan. However, it becomes a huge positive effect in the period 2011-2015 because of the post-disaster reconstruction after the earthquake. The export effect is positive from 1995, but it has a sudden drop in the period 2005-2011 because of the global financial crisis in 2008.

All in all, the main engine of Japan's economy shifted from consumption to investment and export. However, if we considered the influence of the earthquake in 2011, we can observe that the technical change and consumption are the two most important impetus of the Japanese economy. The import substitution effect is always negative, which implicates that the import is continuously increasing in Japan. The DPG caused by the change of input coefficient, which represents the technical change is positive and increasing from 1995 to 2011. However, it changed to negative in the period 2011-2015.

Figure 5-4. The DPG from different factors, 1990-2015 (%)



Source: Calculated by author

The detailed results of DPG for Japan are showed as following tables which showed the DPG in period 1990-1995, 1995-2000, 2000-2005, 2005-2011, and 2011-2015.

5.4.1 The DPG decomposition for Japan in 1990-1995

From Table 5-2, we can observe that the most five positive deviations were real estate (23.48%), trade (18.72%), medical (13.46%), official business (12.49%) and miscellaneous services (8.78%), therefore Japan's economy was characterized by the large expansion of the service industry. In this period, almost all sectors of the service industry had a positive deviation share except entertainment industry and banking & insurance industry. Also, all deviation share of primary industry and manufacturing industry were negative, which indicates that the primary industry and manufacturing industry decreased the expansion speed of the Japanese economy. Steel & iron (-15.11%), construction (-12.33%), transport equipment (-11.30%), machinery (-9.94%) and electric machinery (-6.64%) had the largest five negative deviation shares, which indicated that the heavy industry and construction industry was in the depression in this period.

The last row of table 5-2 shows deviation shares from each different factors of all sectors. It is obvious that the consumption effect (106.89%) is the only positive deviation which played the most significant part in the expansion of Japan's economy. On the contrary, the investment effect (-52.10%) is the most negative deviation. In this situation, Japan's economy was in a stage with increasing consumption and declining investment. Real estate (26.02%), trade (15.81%) and medical (13.66%) have the largest positive consumption effect. Construction (-14.12%) and machinery (-7.44%) were the largest negative industries in the investment effect.

Table 5-3 shows the DPG decomposition for Japan in aggregated 11 sectors in 1990-1995. We can observe that other services (67.79%) had the greatest positive deviations share, including official business, education, research, medical, entertainment, catering trade,

and accommodation. Consumption effect (70.21%) was the most important factor to make this industry increase. Heavy industry (-53.55%) had the most negative deviation share, and the investment effect (-22.43%) was the main reason, which indicates that Japan's heavy industry decreased the speed of the economic growth because of the lack of investment.

5.4.2 The DPG decomposition for Japan in 1995-2000

Table 5-4 showed the DPG decomposition for Japan in 1995-2000. In this period, the sectors which had large positive deviation shares were communication (37.61%), miscellaneous services (27.45%), medical (18.19%), official business (7.92%) and petroleum products (5.56%). The Services industry was still the engine of Japan's economy. Among sectors which had negative deviations, the top five sectors were construction (-32.73%), fabrics, garments & apparel (-11.05%), wooden & paper products (-9.49%), trade (-9.46%) and transportation (-9.29%). With the deep depression of Japan's economy, the construction industry continued to decrease its share in this period because of the lack of investment.

The effect on export (52.33%) has become the most significant source in positive deviations, which played a considerate role in the transport equipment (10.08%) and electric machinery (9.58%). It indicates that Japan's transport equipment and electric machinery had competitiveness in international markets in this period. The consumption effect (46.53%) becomes the second important source of positive deviations. Medical (18.17%), communication (11.66%) and miscellaneous services (11.72%) still had great positive deviations in consumption effect. The investment effect (-57.57%) and import substitution effect (-44.40%) continue to decrease their shares. Nevertheless, the change of input

coefficient turned the technical change effect (12.88%) into a positive factor for economic growth in this period, especially in communication (20.10%) and miscellaneous services (17.36%), which indicates that the technology development accelerated the production increase of these two industries.

Table 5-5 shows the DPG decomposition for Japan in aggregated 11 sectors in 1995-2000. The other services industry (59.79%) accounted for the most positive deviations share. However, it decreased by about 10% deviation shares compared with 1990-1995 (67.79%). The reason is the great decrease in the consumption effect, which decreased from 70.21% in 1990-1995 to 45.62%. Japan was in a deep economic depression in this period because of the collapse of the bubble economy, which resulted in the underconsumption in the domestic service industry. However, the technical change effect (input coefficient change) increased from 0.56% in 1990-1995 to 15.34% in 1995-2000. What is the meaning of the technical change or input coefficient change in the service industry? For example, in the education industry, when teachers start to use projector and computers to do teaching in the class instead of traditional blackboard and chalk, schools need to increase the input cost to purchase new machines, which is the reason why technical change will cause the input coefficient change. The communication industry accounted for 37.61% in this period, which increased a lot compared with the last period (5.63%). The technical change effect (20.10%) is the main factor to lead to the increase in the communication industry.

The construction & utility industry (-28.42%), light industry (-24.28%), and heavy industry (-17.37%) were still the main negative deviations industries.

5.4.3 The DPG decomposition for Japan in 2000-2005

As shown in Table 5-6, the most significant positive sectors were transport equipment (30.42%), steel & iron (27.72%), trade (26.13%), medical (20.29%) and banking & insurance (15.28%). The services industry kept the leading position, while the heavy industry also accelerated the expansion of the economic growth of Japan in this period. The construction industry (-32.73%) still had the largest negative deviation share because of the lack of investment. However, the electric machinery (-39.85%) had a second large negative deviation what had a positive deviation in the last period. Other significant negative deviations were in processed food (-11.90%), wooden & paper products (-11.49%) and fabrics, garments & apparel (-10.04%).

The export effect (106.28%) become the most important source of positive deviations, and the technical change effect (105.00%) continue to increase its share, suggesting that these two effects are increasing in a higher speed than average growth of production in Japan. In this period, Japan's technology developed very fast, and export was the engine of the Japanese economy. Investment effect (-121.94%) and Import Substitution effect (-99.44%) were still the most significant sources of negative deviations. Construction (-57.54%) had the largest negative deviation share in the investment effect, which indicates that Japan's economy was still under the deep depression, and the investment was still not enough. For import substitution effect, electric machinery (-22.21%) accounted for the largest of negative deviation.

Table 5-7 shows the DPG decomposition for Japan in 11 sectors in 2000-2005. The trade industry (26.13%), heavy industry (18.16%) and other services industry (16.06%) were

significant positive deviation industries. The construction & utility industry (-58.29%) continued to decrease the negative deviation share in this period.

5.4.4 The DPG decomposition for Japan in 2005-2011

Table 5-8 showed the DPG decomposition for Japan in 2005-2011. The medical (39.15%) recorded the most important positive deviation, then followed real estate (24.91%), steel & iron (20.40%), miscellaneous services (19.23%) and petroleum products (11.07%). We can observe that the medical industry is increasing its deviation share in this period because of the expansion of consumption.

Technical change effect (83.69%) was still the most significant factor for positive deviation, especially for miscellaneous services (25.11%) and steel & iron (20.73%). The second source of positive deviation was consumption effect (63.90%), especially for medical (36.48%), real estate (12.57%) and communication (11.11%). It is conspicuous that Japan's economy becomes to recover from the financial crisis and depression in this period with the great increase in domestic consumption. Nevertheless, the investment (-109.88%) was still not enough to increase the share. One important reason to cause this situation is the expansion of overseas investment in this period, which declined the domestic investment in Japan.

Table 5-9 showed the DPG decomposition in aggregated 11 sectors for Japan in 2005-2011. In this period, other services industry (72.13%) has much greater positive deviation shares than other industries. The main reason is the great increase of consumption (42.93%) and technical change effect (42.48%). It is leading the economic growth of Japan in this period.

5.4.5 The DPG decomposition for Japan in 2011-2015

In Table 5-10, we can observe the DPG decomposition for Japan in 2011-2015. A new leading sector emerged in this period: huge enlargement of the construction sector (52.57%) which always had negative deviation share in periods before. The reason for this situation is the post-disaster reconstruction after "3.11 Japan earthquake" in 2011. Other sectors which had large positive deviations were transport equipment (47.95%), medical (32.94%), electricity & gas & water (28.36%) and banking & insurance (18.45%). Nevertheless, the deviation shares of the services industry turned to be negative in this period, which had always been positive before, especially for the trade industry (-39.64%). The services sector experienced a great slump in the depression caused by the earthquake. Therefore it could not continue to lead the economic growth anymore in this period.

From the growth factors, the export effect (155.99%) recovered and became the most significant factor of positive deviations, with the contribution of transport equipment (40.42%). It is necessary to point out that the investment effect (122.76%) dramatically rise to the second largest positive deviation factor, which is the first time to be positive from 1990. This is also benefited from the post-disaster reconstruction. The construction (47.96%) played an important role in positive deviation share of the investment effect. This condition can also include to the post-disaster reconstruction. The import substitution effect (-194.67%) had much more negative deviation compared with other effects, especially for electric machinery (-35.58%). This indicates that the Electric Machinery industry of Japan has relied on import.

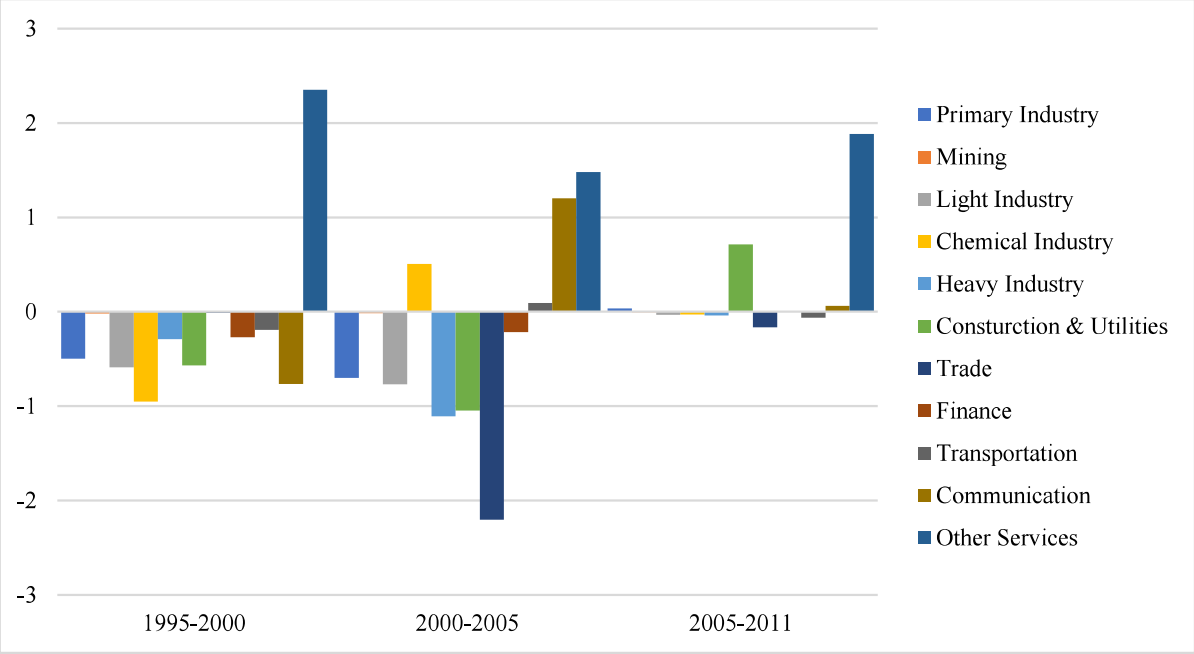
Table 5-11 shows the DPG decomposition for Japan in 11 sectors in 2011-2015. The construction & utility industry (77.61%) was undoubtedly the leading industry of Japan's

economic increase. This is the special condition of a country and can not be explained by economic theories. This condition also caused service industries to become negative deviation because of the post-disaster reconstruction.

5.5 Research results of labor DPG

From the result of production DPG, we have an overview of Japan's industrial structure change from 1990-2015. The engine of the Japanese economy is the service industry except for the period 2011-2015 because of the "3.11 East Japan earthquake", especially education, research, medical, entertainment, catering, and accommodation industry and the other services industry. Then we can calculate the labor change effect caused by industrial structure change and labor coefficient change. Figure 5-5 shows the impact of industrial structure change on employment in Japan from 1995-2011. We calculated three periods: 1995-2000, 2000-2005, and 2005-2011 because of the limitation of the employment table. It can be observed that the other services industry (including official business, education, research, medical, entertainment, catering and accommodation, and other services) has the most significant positive impact on Japan's employment in all three periods. The manufacturing industries have a negative impact on employment in Japan's industrial structure change. It indicates that the other services industry can absorb the most labor force which comes from manufacturing industries.

Figure 5-5. The impact of industrial structure change on employment in Japan, 1995-2011 (Million People)



Source: Calculated by author

The detailed results of the impact of industrial structure change on employment in Japan in three periods are showed as the following tables.

5.5.1 The labor DPG decomposition for Japan in 1995-2000

Table 5-12 showed the impact of industrial structure change on employment in Japan in 1995-2000. This dissertation decomposed labor deviation into labor coefficient change and industrial structure change. Also, the same as the production, we decomposed deviation of industrial structure change into consumption, investment, stock, export, technical change, and import substitution effect.

In 1995-2000, it was noticeable that the other services industry (including official business, education, research, medical, entertainment, catering trade, and accommodation) is the only positive impact to increase the employment which can increase 2353.12 thousand employees. Industrial structure change is the main reason for the positive labor deviation for the other services industry. We can also observe that consumption is the most significant factor to accelerate the employment of the service industry. Other industries all have a negative impact on employment, which can decrease employment, especially manufacturing industries. This indicates that the service industry can absorb the most labor force from manufacturing industries in the process of "hollowing-out effect" caused by the expansion of outward FDI.

From the last line of the table 5-12, we can observe that the decline of investment is the main reason to cause the total labor deviation to become negative, which indicates that the decrease of investment in Japan in 1995-2000 would has influence to decrease 1489.77 thousand employment opportunities in this period. In the same time, positive export effect would increase 1120.71 thousand employment opportunities.

5.5.2 The labor DPG decomposition for Japan in 2000-2005

Table 5-13 showed the impact of industrial structure change on employment in Japan in 2000-2005. In this period, the other services industry (including official business, education, research, medical, entertainment, catering trade, and accommodation) (1481.69 thousand) and the communication industry (1201.72 thousand) have obvious positive impacts which could increase the employment. However, the positive impact of these two industries

is caused by the change of labor coefficient, which indicates that the improvement of labor technique is the main reason to increase the employment. Manufacturing industries almost have negative labor deviation except for the chemical industry (508.36 thousand), which is also caused by the change of labor coefficient. In industrial structure change effect, export (1735.93 thousand) and technical change (1717.53 thousand) are main factors to increase the employment. Trade industry has the greatest negative impact in this period, which mainly caused by the great decrease of labor coefficient.

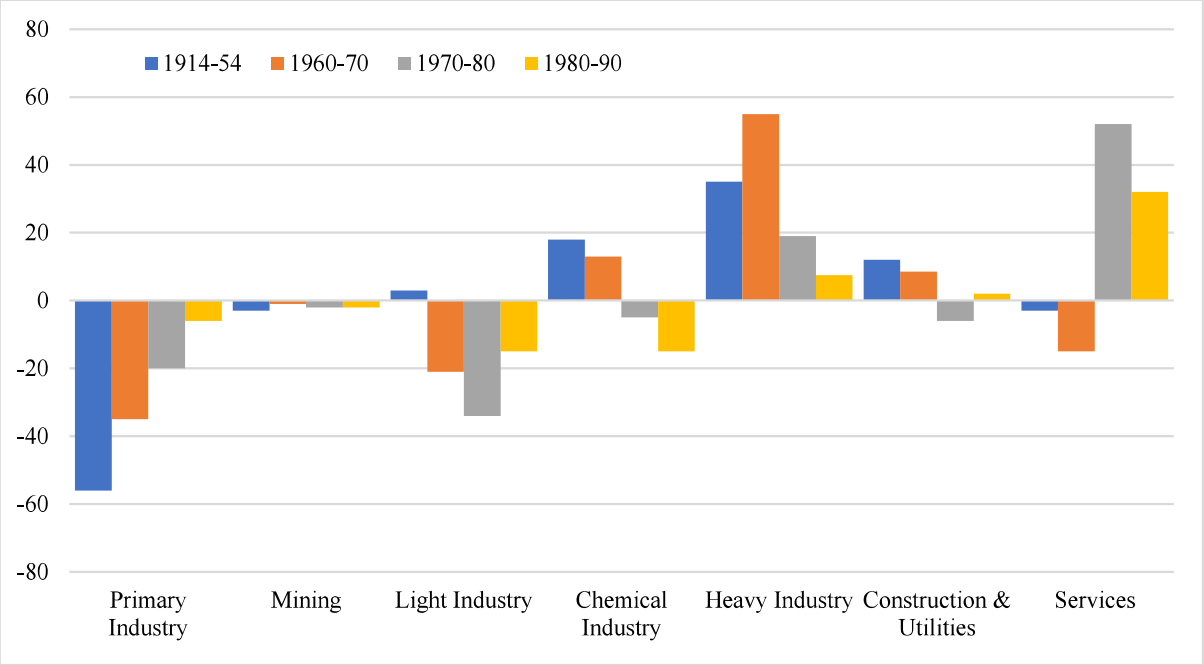
5.5.3 The labor DPG decomposition for Japan in 2005-2011

Table 5-14 showed the impact of industrial structure change on employment in Japan in 2005-2011. The other services industry (including official business, education, research, medical, entertainment, catering trade, and accommodation) has much more positive impact on employment compared with other industries, which would has influence to increase 1885.14 thousand job opportunities in Japan. The increase of domestic consumption and improvement of labor technique are two main reasons to increase the employment in the other services industry. Although the impact of manufacturing industries is still negative, the total labor deviation becomes positive in this period. Among effects of industrial structure change, the consumption and technical change effect are main factors to increase employment in the service industry.

5.6 Comparison of 1914-1970 to 1990-2015

This chapter has got the result of DPG analysis of Japan from 1990-2015. Fujikawa (1995) calculated Japan's deviation change from 1914-1990. Now we have the complete evolution path of Japan's economic structural upgrade for a long period. Figure 5-6 shows the DPG decomposition of Japan from 1914-1990 calculated by Fujikawa (1995). Compared with Figure 5-2, it is conspicuous that the heavy industry was the leading industry from 1914 to 1970. However, the leading sector of Japan shifted from the heavy industry to the service industry after the 1970s when Japan started massive expansion of foreign FDI and transferred many production activities of manufacturing industries overseas. This is a symbol that Japan's economy transferred from manufacturing industry-oriented to the service industry-oriented economy, and it continued to 2011.

Figure 5-6. DPG decomposition of Japan from 1914-1990 (%)



Source: Fujikawa (1995) P162.

5.7 Conclusions

This chapter uses the DPG analysis to explain the growth pattern of Japan's economy from 1990-2015 and factors caused the industrial structure change. Also, we compared the result with the analysis of 1914-1990 calculated by Fujikawa (1995) to observe the economic evolution of Japan in the long term. The result of this chapter can be summarized as the following:

(1) Japan's economy, characterized by the expansion of the service industry from 1990 to 2011. However, the leading sector shifted from the service industry to the construction and utility industry in the period 2011-2015, which mainly because of "The 3.11 earthquake of Japan" in 2011.

(2) The main engine of Japan's economy shifted from consumption to investment and export. The import substitution effect is always negative, which implicates that the import is continuously increasing in Japan.

(3) Compared DPG decomposition of 1990-2015 with the period 1914-1990, the leading sector shifted from the heavy industry to the service industry after 1970s, which represents that Japan's economy transferred from manufacturing industry-oriented to the service industry-oriented economy from 1970 to 2011.

(4) The Other Services industry (including official business, education, research, medical, entertainment, catering and accommodation, and other services) has the most significant positive impact on Japan's employment in all three periods. The manufacturing industries have a negative impact on employment in Japan's industrial structure change. It indicates that the Other Services industry can absorb the most labor force which comes from manufacturing industries.

Chapter 6. Conclusion and policy recommendations

6.1 Research conclusion

Japan is a traditional developed country which has a long history in outward foreign direct investment. Japan started foreign direct investment from the 1950s. After 70 years' development, Japan has become one of the most important countries in global investment market. The development of OFDI affected Japan's economy in many different ways. It contributed to solving the lack of production resource and steady industrialization of Japan. On the other hand, OFDI also leads to the industrial structure change of Japan's economy by transferring capitals and industries to foreign countries. However, with the expansion of outward foreign direct investment, a fear peaked among researchers that outward FDI, which transferred production plants overseas, will cause the closure of domestic factories and decrease of export and domestic productivity of the home country. As a consequence, it will result in the depression and unemployment problem in the home country, which is the so-called "hollowing-out effect," especially in the manufacturing industry.

This dissertation investigate the impact of outward foreign direct investment on Japan's domestic production and employment to observe that if the "hollowing-out effect" occurred in Japan's manufacturing industries with the development of outward FDI. Then investigate the industrial structure change of Japan and its influence on the employment with the expansion of OFDI. Then China could get some valuable enlightenment on outward foreign direct investment from Japan's experience.

China, as a new emerging investor in the global market, has developed very fast in recent years and become one of the most important countries in foreign direct investment.

However, there appeared many problems in the process of outward foreign direct investment. The same worry as Japan is that outward FDI may cause "hollowing-out effect" in the domestic economy of the home country. Considering the similar situation of Japan in the 1970-1990, the experience of Japan in outward FDI is good reference for China.

From chapter 3, we know that there are three surges in the development history of Japanese outward FDI. The first surge occured in the middle of 1980s, which characterized by the great increase of Japanese outward FDI to the U.S. and European countries. The second surge is from 1993 to 1997, which features that Japanese enterprises increase the investment to China and ASEAN countries. The third surge is from 2005. There are different reasons to cause the expansion of Japan's overseas investment in different stages. In 1980s, the main reason of the increase of Japanese outward FDI is to decrease the great trade surplus. In 1985, Japan accepted the Plaza Accord with the U.S., British, France and German because of huge trade surplus. This agreement caused great yen appreciation, which contributed to the decrease of the export and the increased of the overseas investment. After the collapse of Japanese bubble economy in 1990, Japanese enterprises tried to adjust the industrial structure to survive from the economic depression. They transferred production plants to China and ASEAN countries to decrease the production and sales cost. After 2000, the labor shortage in Japan and looking for new emerging markets are main reason for increasing Japanese outward FDI.

Chapter 4 utilized the Input-Output analysis to investigate the impact of Japan's outward foreign direct investment (OFDI) on domestic production and employment in the manufacturing industries. Three effects are analyzed separately: export promotion effect, export substitution effect, and import inverse effect. As a result, export promotion effect is positive, export substitution effect and import inverse effect is negative. Export substitution

effect has the most negative impact than the other two so that the total effect of Japan's outward FDI has a negative impact on domestic production and employment, which means that outward FDI has the influence to reduce the domestic production and employment in Japan's manufacturing industry. Among these manufacturing industries, the transportation equipment industry has the greatest negative impact, which means that the influence to reduce the employment in this industry is more than other industries because production plants transferred to foreign countries. From the trend of the result, we can know that the influence of reducing the employment caused by foreign investment in Japan became serious from 2000, except 2008.

Also, after the comparison of 1990-1999 and 2000-2014, we can observe that the "hollowing-out" effect in Japan's manufacturing industries has actually become more serious in recent decades with the development of Japan's overseas expansion. However, Japan did not have an unemployment problem in these years. Which industry absorbed these employees from manufacturing industries?

Chapter 5 uses the DPG (Deviation from Proportional Growth) analysis to explain the industrial structure change of Japan's economy from 1990-2015 and factors caused the structure change. Also, we compared the result with the analysis of 1914-1990 to observe the evolution of Japan's industrial structure in the long term. As a result, the leading sector of Japan's economy shifted from the heavy industry to the service industry after 1970s, which represents that Japan's economy transferred from manufacturing industry-oriented to the service industry-oriented. The main engine of Japan's economy shifted from consumption to investment and export. The import substitution effect is always negative, which implicates that the import is continuously increasing in Japan. According the result of production deviation, this chapter also calculated the labor deviation of Japan. As a result, the other

services industry (including official business, education, research, medical, entertainment, catering and accommodation, and other services) has the most significant positive impact on Japan's employment in all three periods. The manufacturing industries have a negative impact on employment in Japan's industrial structure change. It indicates that the other services industry can absorb the most labor force which comes from manufacturing industries.

6.2 Policy recommendations for China

Nowadays, the situation of China's outward FDI is similar to that of Japan in the 1980s. Firstly, China and Japan are all developing outward FDI with rapid economic growth. Secondly, they are all under the pressure of currency appreciation, which promotes the outward FDI. Thirdly, the governments of the two countries all give preferential policies to encourage outward FDI. Fourthly, the same as Japan in the 1980s, China is facing more and more serious trade barriers which would impede the export of China. Therefore, it is meaningful for China to draw lessons from Japan's experience.

However, there are also many differences between two countries. Firstly, the difference of the labor markets. Unlike the serious labor shortage of Japan, China has a large labor population, which indicates that the "hollowing-out effect" may reduce more employment than Japan. Secondly, China has strict household registration system to impose restrictions on labor movement between cities. Thirdly, the different stages of outward FDI. Chinese enterprises are still in the early stage of outward FDI which lack of competitive advantages. Fourthly, the different domestic market size. China still has a large and potential

domestic market, which means that the demand of new markets for Chinese enterprises are not so urgent as Japan.

Therefore, this dissertation put forward some recommendations for China, which take Japan as a reference. First of all, China should optimize the industrial structure and improve the competitive strength of companies. Also, transfer the emphasis of export and investment structure from low value-added manufacturing industries to advanced technology industries. To develop service industries, because the service industries are labor-intensive and easier to absorb the unemployment people from manufacturing industries. In the Japanese case, the increase of employment in service industries avoid the huge amount of unemployment in the home country after great overseas transfer in manufacturing industries.

Secondly, Chinese government should loosen the restriction of labor movement. Since the different economic development level, it is hard to improve service industries in rural area. However, the "hollowing-out effect" normally occurred in these low income area. In Japan's case, Tokyo is expanded to a bigger region for urban efficiency of agglomeration, which absorbed huge amount of labor force from rural area and improve the service industries. China could also build metropolitan areas with Beijing, Shanghai, Guangzhou and other first-tier cities. It is benefit to absorb the low-skilled labor force from undeveloped regions.

Finally, the Chinese government should put forward some policies to encourage the employment movement from manufacturing industries to service industries. For example, to provide free job training for unemployment people from manufacturing industries; to encourage the development of vocational education; to perfect the social insurance system of service industries.

6.3 Possible future extensions

This dissertation indicates the impact of outward foreign direct investment on Japan's domestic production, employment and industrial structure change. Since China is now still in the early stage of outward FDI, it is hard to get the same detailed data of Chinese foreign enterprises to compare with Japan up to now, which is the reason why this dissertation take Japan as a reference. Japan's experience for outward FDI is valuable for China to avoid possible problems in the development process of outward FDI. However, it is necessary to compare Japan and China with the same method, considering that there are many different situations between two countries. In the future research, I plan to use the same analysis method to compare the impact of outward FDI on the economy of Japan and China, which may be an interesting result.

Data Appendix

Table 4-1. Impact on the domestic production of Japan's manufacturing industry in 2014

(Billion Yen)	Domestic production	Export promotion effect A	Export promotion effect B	Export Substitution effect	Inverse import effect	Total effect A	Total effect B
Food	36,853	488	4,258	-6,736	-269	-6,517	-2,747
Textiles	3,323	222	380	-991	-107	-876	-718
Lumber, wood, paper and pulp	11,515	882	2,373	-3,123	-164	-2,406	-914
Chemicals	28,250	3,589	5,563	-14,847	-592	-11,849	-9,875
Petroleum and coal	22,361	2,798	4,964	-4,161	-174	-1,536	629
Ceramic, stone, and clay products	6,427	716	1,047	-2,106	-90	-1,480	-1,149
Iron and steel	30,158	3,871	9,152	-14,792	-35	-10,956	-5,675
Non-ferrous metals	9,154	1,386	1,953	-4,847	-340	-3,800	-3,234
Metal products	11,320	943	1,855	-2,993	-254	-2,304	-1,392
General-purpose machinery	9,853	697	1,097	-2,737	-292	-2,332	-1,932
Production machinery	15,403	918	1,390	-3,109	-314	-2,505	-2,032
Business oriented machinery	6,307	378	669	-1,579	-885	-2,086	-1,795
Electrical machinery	15,601	1,704	1,849	-5,417	-700	-4,414	-4,268
Information and communication electronics equipment	17,979	5,317	2,242	-9,920	-2,081	-6,684	-9,759
Transportation equipment	52,910	14,362	8,608	-49,274	-2,005	-36,917	-42,672
Other manufacturing industries	23,312	2,458	3,882	-9,465	-788	-7,795	-6,371
Total	300726	40729	51282	-136094	-9091	-104456	-93903

Source: Calculated by author

Table 4-2. Impact on the employment of Japan's manufacturing industry in 2014

(million)	Total employees	Export promotion effect A	Export promotion effect B	Export Substitution effect	Inverse import effect	Total effect A	Total effect B
Food	1.280	0.017	0.148	-0.234	-0.018	-0.235	-0.104
Textiles	0.400	0.027	0.046	-0.119	-0.019	-0.112	-0.092
Lumber, wood, paper and pulp	0.752	0.058	0.155	-0.204	-0.037	-0.183	-0.086
Petroleum and coal	0.024	0.003	0.005	-0.005	-0.001	-0.002	0.000
Chemicals	0.420	0.053	0.083	-0.221	-0.021	-0.189	-0.160
Ceramic, stone, and clay products	0.310	0.035	0.050	-0.102	-0.014	-0.081	-0.065
Metal products	1.385	0.170	0.355	-0.619	-0.070	-0.519	-0.334
Information and communication electronics equipment	1.164	0.344	0.145	-0.642	-0.170	-0.468	-0.667
Electrical machinery	0.483	0.053	0.057	-0.168	-0.029	-0.144	-0.139
Machinery and equipment	0.845	0.053	0.085	-0.199	-0.048	-0.194	-0.162
Transportation equipment	1.097	0.298	0.179	-1.022	-0.070	-0.794	-0.914
Other manufacturing industries	0.832	0.088	0.139	-0.338	-0.057	-0.307	-0.256
Total	8.993	1.198	1.446	-3.872	-0.553	-3.227	-2.979

Source: Calculated by author

Table 5-2. The DPG decomposition for Japan in 34 sectors, 1990-1995 (α=1.064)

34 Sectors	Deviation	Consumption	Investment	Stock	Export	Technical Change	Import Substitution
Primary Industry	-5.82	-1.13	-0.59	0.54	-0.15	-4.69	0.20
Mining	-1.14	0.02	0.16	0.00	-0.02	-1.36	0.06
Oil & Natural Gas	-0.01	0.01	0.00	0.00	0.00	-0.08	0.07
Processed Food	-4.73	-0.75	-0.08	-0.10	-0.20	-2.76	-0.84
Fabrics, Garments & Apparel	-7.79	-3.80	-0.35	-0.09	-0.70	-0.53	-2.32
Wooden & Paper Products	-4.93	1.86	-3.97	-0.24	-0.63	-0.84	-1.11
Chemicals	-4.24	2.52	-0.89	-0.09	-0.10	-4.98	-0.70
Petroleum Products	-3.77	1.16	-0.78	-0.33	-0.56	-4.38	1.13
Non-Metallic Minerals	-3.65	0.10	-0.65	-0.19	-0.51	-1.82	-0.58
Steel & Iron	-15.11	0.58	-3.47	-0.51	-1.95	-9.29	-0.46
Non-Ferrous Metals	-3.21	0.15	-0.56	-0.15	-0.21	-2.25	-0.19
Metal Products	-3.88	0.67	-2.98	-0.36	-0.45	-0.51	-0.25
Machinery	-9.94	0.27	-7.44	-0.81	-0.24	-1.41	-0.31
Electric Machinery	-6.64	2.17	-3.47	-0.06	0.03	0.21	-5.53
Transport Equipment	-11.30	0.58	-3.92	-0.61	-9.97	2.34	0.27
Precision Apparatus	-2.16	-0.02	-0.48	-0.10	-0.77	-0.34	-0.46
Miscellaneous Manufacturing Products	-1.31	-0.22	-0.12	-0.11	-0.48	-0.31	-0.08
Construction	-12.33	1.79	-14.12	-0.02	-0.08	0.16	-0.06
Electricity & Gas & Water	3.87	3.01	-0.71	-0.06	-0.23	2.10	-0.24
Waste Disposal	0.50	0.51	-0.03	0.00	-0.02	0.05	0.00
Trade	18.72	15.81	-4.49	-0.14	0.84	7.00	-0.30
Banking & Insurance	-0.50	1.25	-1.11	-0.08	-0.26	0.29	-0.60
Real Estate	23.48	26.02	-0.47	-0.01	-0.12	-1.85	-0.09
Transportation	7.85	5.03	-1.08	0.15	-1.63	5.00	0.39
Communication	5.63	4.45	-0.10	-0.02	-0.04	1.47	-0.12

Table 5-2. The DPG decomposition for Japan in 34 sectors, 1990-1995 (α=1.064) (continued)

34 Sectors	Deviation	Consumption	Investment	Stock	Export	Technical Change	Import Substitution
Official Business	12.49	12.21	-0.02	0.00	-0.06	0.33	0.03
Education	5.48	5.57	-0.01	0.00	-0.01	-0.06	-0.01
Research	1.15	0.93	-0.78	-0.07	-0.34	1.94	-0.54
Medical	13.46	13.66	0.00	0.00	0.00	-0.20	0.00
Entertainment	-5.00	-4.78	0.01	0.00	-0.03	-0.21	0.02
Catering Trade	6.30	6.19	0.00	0.00	0.00	0.00	0.11
Accommodation	1.66	1.38	0.00	0.00	0.03	0.00	0.24
Miscellaneous Services	8.78	9.03	0.83	-0.16	-0.11	0.61	-1.41
Not classified	-1.89	0.66	-0.41	-0.02	-1.03	-1.58	0.51
Total	0.00	106.89	-52.10	-3.65	-20.01	-17.95	-13.18

Source: Calculated by author

Table 5-3. The DPG decomposition for Japan in 11 sectors, 1990-1995 (α=1.064)

Aggregated 11 sectors	Deviation	Consumption	Investment	Stock	Export	Technical Change	Import Substitution
Primary Industry	-5.82	-1.13	-0.59	0.54	-0.15	-4.69	0.20
Mining	-1.16	0.03	0.15	-0.00	-0.02	-1.44	0.12
Light Industry	-17.45	-2.69	-4.39	-0.42	-1.54	-4.14	-4.28
Chemical Industry	-11.67	3.77	-2.31	-0.62	-1.18	-11.18	-0.15
Heavy Industry	-53.55	4.19	-22.43	-2.70	-14.04	-11.55	-7.01
Construction & Utilities	-7.96	5.31	-14.86	-0.08	-0.33	2.31	-0.30
Trade	18.72	15.81	-4.49	-0.14	0.84	7.00	-0.30
Finance	-0.50	1.25	-1.11	-0.08	-0.26	0.29	-0.60
Transportation	7.85	5.03	-1.08	0.15	-1.63	5.00	0.39
Communication	5.63	4.45	-0.10	-0.02	-0.04	1.47	-0.12
Other Services	67.79	70.21	-0.45	-0.25	-0.63	0.56	-1.64
Not classified	-1.89	0.66	-0.41	-0.02	-1.03	-1.58	0.51
Total	0.00	106.89	-52.10	-3.65	-20.01	-17.95	-13.18

Source: Calculated by author

Table 5-4. The DPG decomposition for Japan in 34 sectors, 1995-2000 (α=1.022)

34 Sectors	Deviation	Consumption	Investment	Stock	Export	Technical Change	Import Substitution
Primary Industry	-6.03	-2.24	-0.33	0.30	0.14	-3.28	-0.62
Mining	-0.69	-0.03	-0.49	-0.01	0.03	-0.14	-0.04
Oil & Natural Gas	-0.12	0.03	-0.01	0.00	0.01	0.16	-0.31
Processed Food	-3.74	-3.96	-0.01	0.84	0.02	0.00	-0.63
Fabrics, Garments & Apparel	-11.05	-4.28	-0.29	-0.28	0.24	-1.85	-4.59
Wooden & Paper Products	-9.49	-0.02	-2.57	-0.61	1.01	-5.10	-2.20
Chemicals	-0.62	1.65	-0.76	-0.52	3.27	-1.14	-3.10
Petroleum Products	5.56	2.38	-1.51	-0.05	1.97	5.26	-2.48
Non-Metallic Minerals	-5.54	-0.62	-2.67	-0.41	0.94	-1.39	-1.38
Steel & Iron	-8.65	-0.35	-2.82	-0.75	1.18	-5.01	-0.90
Non-Ferrous Metals	-1.03	-0.13	-0.74	-0.27	1.55	-0.24	-1.20
Metal Products	-6.76	-0.14	-3.54	-0.58	0.55	-2.30	-0.76
Machinery	-2.19	0.05	-0.85	-2.51	4.05	0.06	-2.99
Electric Machinery	3.69	4.17	-0.78	-0.79	9.58	2.94	-11.44
Transport Equipment	-1.15	-5.62	-2.60	-1.08	10.08	-0.78	-1.15
Precision Apparatus	0.11	0.18	0.65	-0.19	0.34	0.02	-0.89
Miscellaneous Manufacturing Products	-1.39	-1.11	0.33	-0.08	0.42	-0.65	-0.30
Construction	-32.73	0.80	-34.80	-0.07	0.29	1.31	-0.27
Electricity & Gas & Water	3.75	1.90	-0.75	-0.21	1.00	2.66	-0.86
Waste Disposal	0.57	0.35	-0.07	-0.01	0.05	0.27	-0.02
Trade	-9.46	-10.63	-2.12	-0.54	5.31	1.93	-3.41
Banking & Insurance	2.60	7.74	-1.30	-0.24	0.75	-5.25	0.90
Real Estate	3.76	8.68	-0.15	-0.11	0.48	-4.75	-0.38
Transportation	-9.29	-1.04	-2.09	-0.54	2.97	-5.96	-2.63

Table 5-4. The DPG decomposition for Japan in 34 sectors, 1995-2000 (α=1.022) (continued)

34 Sectors	Deviation	Consumption	Investment	Stock	Export	Technical Change	Import Substitution
Communication	37.61	11.66	5.63	-0.29	1.41	20.10	-0.91
Official Business	7.92	7.32	-0.03	-0.01	0.03	0.57	0.03
Education	0.93	1.02	0.00	0.00	0.03	-0.08	-0.03
Research	3.35	1.63	-0.39	-0.22	1.62	2.05	-1.34
Medical	18.19	18.17	0.00	0.00	0.00	0.02	0.00
Entertainment	-3.63	-3.88	0.00	0.00	0.05	0.17	0.03
Catering Trade	-1.01	-1.20	0.00	0.00	-0.19	0.00	0.38
Accommodation	2.82	2.17	0.00	0.00	0.17	0.00	0.49
Miscellaneous Services	27.45	11.72	-2.26	-0.47	2.73	17.36	-1.63
Not classified	-3.74	0.17	-0.24	-0.07	0.28	-4.10	0.22
Total	0.00	46.53	-57.57	-9.78	52.33	12.88	-44.40

Source: Calculated by author

Table 5-5. The DPG decomposition for Japan in 11 sectors, 1995-2000 (α=1.022)

Aggregated 11 sectors	Deviation	Consumption	Investment	Stock	Export	Technical Change	Import Substitution
Primary Industry	-6.03	-2.24	-0.33	0.30	0.14	-3.28	-0.62
Mining	-0.81	-0.00	-0.50	-0.01	0.03	0.02	-0.35
Light Industry	-24.28	-8.26	-2.87	-0.05	1.27	-6.94	-7.42
Chemical Industry	-0.60	3.41	-4.95	-0.99	6.17	2.73	-6.97
Heavy Industry	-17.37	-2.96	-10.35	-6.25	27.75	-5.95	-19.61
Construction & Utilities	-28.42	3.05	-35.62	-0.29	1.34	4.25	-1.15
Trade	-9.46	-10.63	-2.12	-0.54	5.31	1.93	-3.41
Finance	2.60	7.74	-1.30	-0.24	0.75	-5.25	0.90
Transportation	-9.29	-1.04	-2.09	-0.54	2.97	-5.96	-2.63
Communication	37.61	11.66	5.63	-0.29	1.41	20.10	-0.91
Other Services	59.79	45.62	-2.83	-0.82	4.92	15.34	-2.45
Not classified	-3.74	0.17	-0.24	-0.07	0.28	-4.10	0.22
Total	-0.00	46.53	-57.57	-9.78	52.33	12.88	-44.40

Source: Calculated by author

Table 5-6. The DPG decomposition for Japan in 33 sectors, 2000-2005 (α=1.018)

33 Sectors	Deviation	Consumption	Investment	Stock	Export	Technical Change	Import Substitution
Primary Industry	-5.77	-2.27	-0.35	-0.77	0.18	0.13	-2.69
Mining	-1.38	-0.05	-0.98	0.12	0.10	-0.33	-0.24
Oil & Natural Gas	-0.01	0.03	-0.01	-0.01	0.03	0.23	-0.28
Processed Food	-11.90	-8.72	-0.02	-0.05	0.60	0.95	-4.66
Fabrics, Garments & Apparel	-10.04	-3.92	-0.36	0.01	-0.06	0.51	-6.23
Wooden & Paper Products	-11.49	-1.80	-3.94	1.00	1.55	-4.66	-3.64
Chemicals	3.26	-0.08	-1.44	0.77	8.53	4.30	-8.82
Petroleum Products	13.82	3.72	-3.64	-0.03	8.07	10.81	-5.11
Non-Metallic Minerals	-5.67	-0.58	-4.65	0.59	2.05	-0.53	-2.54
Steel & Iron	27.72	-0.29	-5.85	2.47	11.67	23.14	-3.42
Non-Ferrous Metals	3.83	-0.01	-1.77	0.28	1.99	4.92	-1.57
Metal Products	-4.25	-0.66	-5.53	0.70	1.19	2.26	-2.20
Machinery	4.56	-0.14	-0.80	3.22	4.80	1.79	-4.31
Electric Machinery	-39.85	-1.36	-18.36	-0.67	-0.20	2.96	-22.21
Transport Equipment	30.42	3.12	2.70	2.28	21.67	4.30	-3.66
Miscellaneous Manufacturing Products	-4.26	-1.79	-0.11	0.10	0.12	-0.48	-2.10
Construction	-56.96	0.03	-57.54	0.09	0.65	0.40	-0.59
Electricity & Gas & Water	-2.33	-1.13	-1.63	0.33	2.29	-0.07	-2.12
Waste Disposal	1.00	-0.80	-0.18	0.02	0.14	1.97	-0.14
Trade	26.13	-3.34	0.26	0.94	18.55	14.54	-4.82
Banking & Insurance	15.28	4.11	-1.89	0.21	2.54	11.96	-1.65
Real Estate	-2.85	0.57	-0.42	0.09	1.25	-3.66	-0.68
Transportation	7.42	-1.12	-3.22	0.45	7.73	7.66	-4.08
Communication	5.54	0.97	3.08	0.27	2.17	0.15	-1.10

Table 5-6. The DPG decomposition for Japan in 33 sectors, 2000-2005 (α=1.018) (continued)

33 Sectors	Deviation	Consumption	Investment	Stock	Export	Technical Change	Import Substitution
Official Business	14.08	12.72	-0.16	0.01	0.11	1.88	-0.49
Education	-4.88	-5.12	-0.04	0.00	0.08	0.39	-0.21
Research	1.75	1.35	-1.75	0.20	1.66	3.29	-2.99
Medical	20.29	20.08	0.00	0.00	0.00	0.22	-0.01
Accommodation	-5.59	-5.13	0.00	0.00	0.80	0.00	-1.25
Catering Trade	-5.93	-5.68	0.00	0.00	0.66	-0.39	-0.51
Entertainment	-4.29	-4.57	-0.02	0.00	0.20	0.28	-0.19
Miscellaneous Services	3.46	-1.36	-12.63	0.65	4.63	14.91	-2.74
Not classified	-1.12	0.00	-0.69	0.07	0.52	1.17	-2.20
Total	0.00	-3.23	-121.94	13.34	106.28	105.00	-99.44

Source: Calculated by author

Table 5-7. The DPG decomposition for Japan in 11 sectors, 2000-2005 (α=1.018)

Aggregated 11 sectors	Deviation	Consumption	Investment	Stock	Export	Technical Change	Import Substitution
Primary Industry	-5.77	-2.27	-0.35	-0.77	0.18	0.13	-2.69
Mining	-1.40	-0.02	-1.00	0.12	0.13	-0.10	-0.52
Light Industry	-33.43	-14.45	-4.31	0.96	2.10	-3.20	-14.52
Chemical Industry	11.42	3.06	-9.73	1.32	18.64	14.58	-16.46
Heavy Industry	18.16	-1.13	-29.74	8.37	41.23	38.89	-39.47
Construction & Utilities	-58.29	-1.90	-59.35	0.44	3.08	2.30	-2.85
Trade	26.13	-3.34	0.26	0.94	18.55	14.54	-4.82
Finance	15.28	4.11	-1.89	0.21	2.54	11.96	-1.65
Transportation	7.42	-1.12	-3.22	0.45	7.73	7.66	-4.08
Communication	5.54	0.97	3.08	0.27	2.17	0.15	-1.10
Other Services	16.06	12.85	-15.01	0.96	9.40	16.93	-9.07
Not classified	-1.12	0.00	-0.69	0.07	0.52	1.17	-2.20
Total	-0.00	-3.23	-121.94	13.34	106.28	105.00	-99.44

Source: Calculated by author

Table 5-8. The DPG decomposition for Japan in 33 sectors, 2005-2011 (α=0.962)

33 Sectors	Deviation	Consumption	Investment	Stock	Export	Technical Change	Import Substitution
Primary Industry	0.06	0.87	-0.32	-0.26	-0.02	0.92	-1.14
Mining	-0.95	0.00	-0.31	-0.15	0.08	-0.34	-0.22
Oil & Natural Gas	0.26	0.02	-0.01	0.01	0.02	0.21	0.02
Processed Food	2.47	1.08	-0.05	-0.29	0.17	2.37	-0.80
Fabrics, Garments & Apparel	-2.85	-0.07	-0.17	-0.11	-0.10	-0.28	-2.12
Wooden & Paper Products	-7.37	0.00	-2.68	-0.70	-0.09	-1.96	-1.94
Chemicals	3.95	4.04	-1.00	-0.12	1.20	7.36	-7.54
Petroleum Products	11.07	1.74	-2.75	0.51	3.31	12.24	-3.98
Non-Metallic Minerals	-1.79	-0.19	-2.46	-0.25	0.90	1.27	-1.05
Steel & Iron	20.40	-0.13	-5.08	-0.85	6.81	20.73	-1.08
Non-Ferrous Metals	6.68	0.11	0.34	-0.20	3.77	4.29	-1.64
Metal Products	-6.26	0.08	-2.80	-0.19	0.20	-2.36	-1.19
Machinery	-9.03	-0.25	-7.66	0.04	5.68	-4.70	-2.12
Electric Machinery	-16.88	-1.34	1.81	0.63	-10.59	-0.70	-6.69
Transport Equipment	-11.94	-0.74	-8.84	-3.27	-1.67	2.95	-0.38
Miscellaneous Manufacturing Products	-2.35	-0.55	-0.33	-0.03	-0.79	-0.27	-0.38
Construction	-27.52	1.05	-31.43	-0.04	0.07	3.05	-0.22
Electricity & Gas & Water	8.14	3.51	-1.64	-0.15	0.23	6.81	-0.61
Waste Disposal	0.55	-0.73	-0.13	-0.01	-0.02	1.38	0.07
Trade	-21.60	4.32	-24.21	-0.53	-2.53	4.23	-2.88
Banking & Insurance	-26.37	-1.09	-1.69	-0.08	-0.39	-21.08	-2.05
Real Estate	24.91	12.57	-1.24	-0.04	0.03	13.83	-0.25
Transportation	-5.40	-2.17	-2.94	-0.27	0.97	-0.73	-0.27
Communication	10.61	11.11	-2.46	-0.10	-0.36	3.56	-1.15
Official Business	-3.23	-3.38	-0.17	-0.01	-0.01	-0.21	0.56

Table 5-8. The DPG decomposition for Japan in 33 sectors, 2005-2011 (α=0.962) (continued)

33 Sectors	Deviation	Consumption	Investment	Stock	Export	Technical Change	Import Substitution
Education	1.76	1.14	-0.05	0.00	0.01	0.75	-0.10
Research	-1.96	0.68	-0.95	-0.07	-0.50	0.25	-1.37
Medical	39.15	36.48	-0.01	0.00	0.00	2.67	0.00
Accommodation	-5.74	-7.17	0.00	0.00	-0.88	0.00	2.31
Catering Trade	1.49	0.20	0.00	0.00	-0.19	-0.15	1.63
Entertainment	-3.47	-3.50	-0.03	0.00	-0.14	0.24	-0.04
Miscellaneous Services	19.23	5.91	-9.91	-0.31	1.78	25.11	-3.34
Not classified	3.97	0.31	-0.71	-0.03	-0.04	2.25	2.18
Total	0.00	63.90	-109.88	-6.87	6.94	83.69	-37.78

Source: Calculated by author

Table 5-9. The DPG decomposition for Japan in 11 sectors, 2005-2011 (α=0.962)

Aggregated 11 sectors	Deviation	Consumption	Investment	Stock	Export	Technical Change	Import Substitution
Primary Industry	0.06	0.87	-0.32	-0.26	-0.02	0.92	-1.14
Mining	-0.69	0.02	-0.33	-0.15	0.10	-0.13	-0.20
Light Industry	-7.74	1.01	-2.91	-1.10	-0.01	0.14	-4.86
Chemical Industry	13.23	5.58	-6.21	0.14	5.41	20.87	-12.56
Heavy Industry	-19.38	-2.82	-22.56	-3.87	3.42	19.94	-13.48
Construction & Utilities	-18.83	3.83	-33.20	-0.20	0.27	11.23	-0.76
Trade	-21.60	4.32	-24.21	-0.53	-2.53	4.23	-2.88
Finance	-26.37	-1.09	-1.69	-0.08	-0.39	-21.08	-2.05
Transportation	-5.40	-2.17	-2.94	-0.27	0.97	-0.73	-0.27
Communication	10.61	11.11	-2.46	-0.10	-0.36	3.56	-1.15
Other Services	72.13	42.93	-12.36	-0.43	0.11	42.48	-0.60
Not classified	3.97	0.31	-0.71	-0.03	-0.04	2.25	2.18
Total	0.00	63.90	-109.88	-6.87	6.94	83.69	-37.78

Source: Calculated by author

Table 5-10. The DPG decomposition for Japan in 32 sectors, 2011-2015 (α=1.061)

32 Sectors	Deviation	Consumption	Investment	Stock	Export	Technical Change	Import Substitution
Primary Industry	0.49	1.07	0.38	-0.80	1.39	0.32	-1.87
Mining	0.42	0.02	0.53	0.06	0.06	-0.31	0.06
Oil & Natural Gas	-0.17	-0.02	0.02	-0.01	0.03	-0.24	0.05
Processed Food	5.42	2.01	0.06	-1.77	4.13	6.49	-5.50
Fabrics, Garments & Apparel	-0.40	1.17	0.29	0.56	1.19	0.56	-4.17
Wooden & Paper Products	-3.23	-0.68	2.31	-0.20	3.36	-1.90	-6.14
Chemicals	-7.56	5.27	1.30	-1.54	9.01	-4.12	-17.48
Petroleum Products	-19.28	-5.62	3.49	-2.54	6.12	-13.50	-7.23
Non-Metallic Minerals	-0.90	0.98	3.53	-0.18	0.94	-1.60	-4.56
Steel & Iron	-32.15	0.48	9.13	-3.40	1.85	-32.61	-7.60
Non-Ferrous Metals	-3.02	0.26	0.46	0.28	0.94	-1.36	-3.60
Metal Products	5.45	-0.31	3.81	0.30	1.80	4.29	-4.43
Machinery	6.83	-0.34	10.61	-0.31	4.31	3.47	-10.91
Electric Machinery	-23.43	-0.79	0.53	1.86	9.07	1.49	-35.58
Transport Equipment	47.95	6.93	12.31	4.60	40.42	-2.30	-14.01
Miscellaneous Manufacturing Products	-0.73	0.72	0.88	-0.67	1.39	0.30	-3.35
Construction	52.57	-0.60	47.96	-0.05	1.00	5.60	-1.33
Electricity & Gas & Water	28.36	7.37	1.93	-0.15	3.44	19.81	-4.03
Waste Disposal	-3.32	-0.48	0.18	-0.01	0.30	-3.13	-0.19
Trade	-39.64	-14.69	3.66	0.33	11.78	-27.54	-13.18
Banking & Insurance	18.45	3.42	1.76	-0.01	7.86	9.84	-4.41
Real Estate	-11.16	-11.45	0.83	-0.02	2.00	-0.75	-1.76
Transportation	0.50	-3.73	1.74	-0.04	13.94	-5.60	-5.82
Communication	-13.32	-8.67	2.58	-0.91	4.63	-4.26	-6.68
Official Business	-8.44	-7.49	0.19	0.00	0.14	-1.06	-0.22

Table 5-10. The DPG decomposition for Japan in 32 sectors, 2011-2015 (α=1.061) (continued)

32 Sectors	Deviation	Consumption	Investment	Stock	Export	Technical Change	Import Substitution
Education	-12.34	-12.33	0.07	0.00	0.37	0.60	-1.05
Research	3.31	0.61	1.33	0.12	3.83	3.81	-6.40
Medical	32.94	33.02	0.01	0.00	0.02	-0.09	-0.02
Accommodation & Catering	-5.65	-13.14	0.00	0.00	7.26	-0.16	0.40
Entertainment	-2.04	-2.97	0.03	-0.03	0.62	0.58	-0.27
Miscellaneous Services	-15.27	-10.53	9.73	-0.18	11.95	-4.12	-22.12
Not classified	-0.66	-0.41	1.13	-0.02	0.83	-0.92	-1.28
Total	0.00	-30.91	122.76	-4.73	155.99	-48.44	-194.67

Source: Calculated by author

Table 5-11. The DPG decomposition for Japan in 11 sectors, 2011-2015 (α=1.061)

Aggregated 11 sectors	Deviation	Consumption	Investment	Stock	Export	Technical Change	Import Substitution
Primary Industry	0.49	1.07	0.38	-0.80	1.39	0.32	-1.87
Mining	0.25	0.01	0.55	0.04	0.09	-0.55	0.11
Light Industry	1.79	2.51	2.67	-1.41	8.68	5.15	-15.80
Chemical Industry	-27.74	0.63	8.32	-4.26	16.07	-19.22	-29.27
Heavy Industry	0.91	6.95	37.73	2.67	59.78	-26.73	-79.48
Construction & Utilities	77.61	6.29	50.06	-0.21	4.74	22.28	-5.55
Trade	-39.64	-14.69	3.66	0.33	11.78	-27.54	-13.18
Finance	18.45	3.42	1.76	-0.01	7.86	9.84	-4.41
Transportation	0.50	-3.73	1.74	-0.04	13.94	-5.60	-5.82
Communication	-13.32	-8.67	2.58	-0.91	4.63	-4.26	-6.68
Other Services	-18.64	-24.28	12.19	-0.11	26.19	-1.20	-31.43
Not classified	-0.66	-0.41	1.13	-0.02	0.83	-0.92	-1.28
Total	0.00	-30.91	122.76	-4.73	155.99	-48.44	-194.67

Source: Calculated by author

Table 5-12. The impact of industrial structure change on employment in Japan, 1995-2000 (thousand people)

α=1.022	Labor Deviation	Labor Coefficient Change	Industrial Structure Change	Consumption	Investment	Stock	Export	Technical Change	Import Substitution
Primary Industry	-496.33	392.08	-888.41	-329.86	-49.07	44.64	20.64	-483.36	-91.40
Mining	-17.19	-5.68	-11.51	-0.04	-7.03	-0.16	0.44	0.23	-4.95
Light Industry	-587.79	-59.88	-527.91	-179.61	-62.48	-1.16	27.50	-150.93	-161.24
Chemical Industry	-951.00	-945.59	-5.41	30.62	-44.50	-8.87	55.48	24.50	-62.64
Heavy Industry	-290.47	-38.49	-251.98	-43.00	-150.17	-90.61	402.56	-86.26	-284.50
Construction& Utilities	-567.51	194.02	-761.53	81.78	-954.60	-7.69	35.93	113.83	-30.79
Trade	-12.27	513.05	-525.31	-589.90	-117.66	-30.02	294.62	107.10	-189.44
Finance	-268.43	-322.59	54.16	161.45	-27.08	-5.09	15.60	-109.59	18.87
Transportation	-192.60	105.55	-298.15	-33.23	-66.99	-17.38	95.25	-191.25	-84.56
Communication	-762.66	-1283.61	520.95	161.55	77.94	-3.97	19.56	278.44	-12.57
Other Services	2353.12	503.03	1850.10	1411.68	-87.46	-25.24	152.36	474.60	-75.84
Not classified	24.85	35.21	-10.35	0.47	-0.67	-0.18	0.78	-11.36	0.60
Total	-1768.27	-912.90	-855.37	671.92	-1489.77	-145.73	1120.71	-34.05	-978.46

Source: Calculated by author

Table 5-13. The impact of industrial structure change on employment in Japan, 2000-2005 (thousand people)

α=1.018	Labor Deviation	Labor Coefficient Change	Industrial Structure Change	Consumption	Investment	Stock	Export	Technical Change	Import Substitution
Primary Industry	-701.03	-48.51	-652.52	-256.97	-39.79	-86.89	20.80	14.85	-304.52
Mining	-14.06	-0.51	-13.55	-0.22	-9.69	1.12	1.26	-1.00	-5.04
Light Industry	-766.81	-262.55	-504.26	-217.93	-65.02	14.47	31.61	-48.30	-219.09
Chemical Industry	508.36	447.55	60.82	16.31	-51.83	7.03	99.33	77.68	-87.71
Heavy Industry	-1107.19	-1279.31	172.13	-10.69	-281.82	79.37	390.76	368.60	-374.09
Construction& Utilities	-1045.10	94.40	-1139.50	-37.14	-1160.26	8.55	60.19	44.94	-55.78
Trade	-2201.33	-3165.12	963.79	-123.09	9.61	34.58	684.34	536.27	-177.92
Finance	-216.03	-414.79	198.75	53.47	-24.53	2.67	33.10	155.54	-21.49
Transportation	93.99	-78.81	172.80	-26.19	-75.02	10.48	180.09	178.36	-94.93
Communication	1201.72	1154.15	47.57	8.32	26.42	2.36	18.64	1.29	-9.46
Other Services	1481.69	1115.09	366.59	293.45	-342.69	21.88	214.54	386.44	-207.03
Not classified	-26.68	-23.95	-2.73	0.01	-1.69	0.17	1.27	2.84	-5.35
Total	-2792.47	-2462.36	-330.11	-300.66	-2016.31	95.80	1735.93	1717.53	-1562.40

Source: Calculated by author

Table 5-14. The impact of industrial structure change on employment in Japan, 2005-2011 (thousand people)

α=0.962	Labor Deviation	Labor Coefficient Change	Industrial Structure Change	Consumption	Investment	Stock	Export	Technical Change	Import Substitution
Primary Industry	37.10	29.94	7.16	104.18	-38.13	-31.09	-1.94	110.56	-136.42
Mining	-0.90	6.98	-7.88	0.23	-3.73	-1.68	1.09	-1.47	-2.32
Light Industry	-30.49	90.50	-120.99	15.77	-45.45	-17.25	-0.19	2.13	-76.01
Chemical Industry	-28.81	-114.03	85.22	35.96	-39.96	0.90	34.83	134.40	-80.91
Heavy Industry	-38.38	137.55	-175.93	-25.60	-204.89	-35.15	31.07	181.08	-122.44
Construction & Utilities	713.75	1145.12	-431.37	87.75	-760.70	-4.55	6.23	257.33	-17.43
Trade	-163.27	600.44	-763.71	152.86	-856.12	-18.73	-89.36	149.55	-101.92
Finance	2.39	364.76	-362.37	-15.01	-23.17	-1.14	-5.29	-289.60	-28.16
Transportation	-61.45	71.79	-133.24	-53.62	-72.56	-6.57	24.06	-17.98	-6.57
Communication	62.39	-72.39	134.78	141.10	-31.19	-1.23	-4.56	45.28	-14.63
Other Services	1885.14	96.85	1788.29	1064.30	-306.35	-10.74	2.63	1053.24	-14.80
Not classified	12.92	5.42	7.50	0.59	-1.34	-0.05	-0.07	4.25	4.13
Total	2390.38	2362.92	27.46	1508.51	-2383.58	-127.28	-1.50	1628.78	-597.47

Source: Calculated by author

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