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Offshoring and Trade in East Asia: Statistical Evidence

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Abstract

Japanese shares of export and manufacturing value added in the global market have declined significantly, whereas those in China have risen sharply. Recent increase of global offshoring is noteworthy as a factor to cause changes in the structure of international trade and the production-depth. This paper examines how recent increase of offshoring by Japanese firms relates to the changes in the composition of export and manufacturing value added among Japan, China, East Asian countries, the US, and European countries, on the basis of our original survey of Japanese firm's offshoring and the statistics of export and manufacturing production of these countries. It also discusses how the net cost saving of offshoring due to wage differentials and institutional factors will affect the sustainability of Japanese offshoring.

JEL Classification: F10, F14, F20

Keywords: offshoring, task, coordination cost, wage differential, institutional factor

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1. Introduction

Recent international trade is characterized by expansion in international transactions in parts, intermediate products, and services. It is different from traditional trade on the basis of a comparative advantage between industries and trade in differentiated products under the monopolistic competition within the same industry. This type of international trade has been accelerated by the increase of global locations for the production of goods and services. This development is ascribed to innovation in information and communications technologies (ICT) and air shipping.

The production process of goods and services is comprised of a bundle of tasks. When the performance of these tasks is carried out across different geographical locations, coordinating the tasks entails additional costs. The coordination cost is low when the performance of each task is integrated or carried out within a country, whereas it is high when the tasks are unbundled and performed in different countries. This general nature of coordination costs notwithstanding, recent improvements in ICT and development in air shipping have played a significant role in reducing coordination costs. Consequently, unbundling and offshoring of tasks are on a steep increase. Recent progress in division of tasks has promoted repeated transactions of parts, intermediate products, and services across national borders and helped register an explosive increase in the volume of international trade after the 1990s. Herein, it should be noted that international trade statistics take into account the volume of sales instead of the value added[1]. Baldwin (2006) points out that the global offshoring of tasks is revolutionizing the paradigm of international trade. Looking at the recent increase of trade in East Asia, it is undeniable that offshoring of tasks to China and other East Asian countries is resulting in a dramatic change to the structure of global trade, particularly Japanese trade.

[1] See Yi (2003) and Arndt and Kierzkowski (2001) for fragmentation of the production process.

Recent analyses show that the framework of the international division of tasks is different from the previous trade models in resource allocation and economic welfare[2]. For example, international division of tasks enables offshoring firms to obtain rent by utilizing production factors at a lower cost and with a high level of technology. In other words, the effect of the international division of tasks mimics technical innovation. The offshoring country can realize a higher level of productivity by redistributing resources from a low productivity sector to a high productivity one. Although some producers and consumers secure profits through trade, some may be at a disadvantage in the context of traditional international trade. International division of tasks, however, may bring profits to all producers and consumers concerned[3].

The international division of tasks differs from the traditional international division of labor in that the former has resulted in a sudden and significant change in international trade because the task of offshoring will rapidly bring the risk of unemployment to all workers engaged in the task regardless of industry. Suppose a certain type of task is offshored, all workers engaged in the performance of the offshored task will lose their jobs at the same time, irrespective of the type of industry. Offshoring of tasks engenders a more serious and direct effect on workers than does the traditional division of labor among industries. This is because in the former case, workers encounter more direct instances of loss of jobs. If a task is subdivided precisely, the international division of tasks has a different influence on workers involved in the same company. For example, although offshoring of a specific task results in a higher level of competitiveness in the industry and increases job opportunities for a section of workers in the industry, it also causes other sections of workers to encounter unemployment. Helpman and Trefler (2006) points out that offshoring of tasks has resulted in a remarkable change in the trade, production, and employment

[2] See Grossman and Rossi-Hansberg (2006) and Baldwin and Nicoud (2007).
[3] For example, refer to Baldwin (2006).

situations in the US and China.

Offshoring of tasks accompanies sourcing of intermediate goods or services in two ways. One is outsourcing through arm's-length transactions between firms, another is the insourcing between multinational firms and their subsidiaries. This leads to the question of which type of international transactions—arm's-length or organizational—is more efficient for offshoring. A number of theoretical studies on the organizational aspect of offshoring over the past several years, such as Antras (2003) and Antras and Helpman (2004, 2006), showed that the specificity of offshored tasks and the contractibility affected by institutional factors including legal and financial systems are related. The contractibility of transaction will be important for determining whether or not a task can be offshored.

On the other hand, empirical evidence pertaining to the causes and effects of offshoring has not been sufficiently provided thus far. Feenstra and Hanson (2005), who presented one of the few empirical examinations on this topic, conducted their empirical analysis on the relationship between suppliers and owners in China and discovered that the relationship between the characteristics of tasks and institutional factors affects the progress of outsourcing.

In spite of the importance of analysis of offshoring, only a small amount of empirical evidence has been conducted due to the limitation of availability in firm-level data on offshoring. Although the effect of offshoring tasks from Japan to China on global manufacturing trade needs to be examined, sufficient empirical evidence has not been provided thus far[4]. There are few studies on offshoring or outsourcing except for analysis using input-output tables or international trade statistics in Japan[5]. Such an analysis is insufficient for understanding the actual features of

[4] Offshoring of tasks is found not only in the manufacturing sector but also in the services sector. The increase in the offshoring of data entry and accounting services from the US to India is being viewed as a serious issue for the US economy. However, in the case of the offshoring of tasks to China and East Asia, the ratio of tasks offshored by the manufacturing industry appears to be relatively higher.

[5] As for studies on the basis of firm-level data, see Tomiura (2007).

offshoring. In order to compensate for insufficient empirical evidence, Ito, Tomiura, and Wakasugi (2007) conducted the first investigation on offshore outsourcing by Japanese firms, in collaboration with the Research Institute of Economy, Trade and Industry (RIETI). The results of this investigation are useful for understanding the features of Japanese offshoring. The purpose of this paper is to examine how recent increase of offshoring by Japanese firms relates to the changes in the composition of export and manufacturing value added among Japan, China, East Asian countries, the US, and European countries, on the basis of our original survey of Japanese firm's offshoring and the statistics of export and manufacturing production of these countries, and to discuss whether the net cost saving of offshoring to China due to wage differentials and institutional factors affects the sustainability of offshoring from Japan.

The next section of the paper presents a simple analytical framework and on the basis of our original survey dissects the offshoring of tasks performed by Japanese firms in recent years. It includes the ratio of offshoring firms, destination of offshored tasks, industry characteristics, effects of firm size, types of tasks, and types of transactions undertaken between offshoring and offshored firms. It states that almost 20% of Japanese manufacturing firms employing more than 50 and less than 300 people and more than 50% firms with a workforce in excess of 300 have outsourced the production process of intermediate products and the assembly process of final goods to China.

Section 3 examines the changes in the trade structure of manufactured goods among Japan, China, East Asian countries, the US, and European countries. We investigate via statistical data how offshoring is related to the change of trade structure in the 10 years from 1996 to 2006. Section 4 analyzes the change in the international distribution of manufacturing value added. It shows that both the change in trade structure and distribution of manufacturing value added are related to offshoring to China. Offshoring is determined by net cost saving, which is defined by

the wage differentials, exchange rate, and coordination cost. Changes in these factors determine whether or not offshoring will develop. Section 5 discusses the sustainability of offshoring to China by focusing on the wage differentials, changes in the exchange rate, and institutional factors. Section 6 examines the remaining problems.

2. Offshoring: Firm-level evidence

2.1 Analytical framework

The offshoring of a task comprises its unbundling from the original production process and relocation to a place with a lower factor price. Figure 1 depicts a simple framework of offshoring. We assume that the production of commodity X comprises three production processes—X1, X2, and X3—and each of these processes is carried out at the same location in country A before offshoring. This implies that the three production processes have been bundled into an integrated production process. Due to innovation in ICT and the development in air shipping systems, we assume that each task can be performed in a different place since the coordination of production processes is attainable at a low cost. In this case, innovations enable the firm to move the labor-intensive production process, X1, to country B where unskilled labor is cheap. As shown in Figure 1, we assume that firms in country A (i) transfer their production method to country B, (ii) replace the expensive unskilled labor in country A with the cheap unskilled labor in country B, and (iii) obtain rent caused by wage gap. However, it is necessary for firms to pay additional expenses for coordinating the performance of various tasks at remote places.

Offshoring is implemented if the net cost saving is positive, i.e., the wage differential exceeds the coordination cost. Thus, factor price differentials, possibility of technology transfer, and cost of coordinating tasks serve as important factors for determining the unbundling and offshoring of tasks.

Figure 1

2.2 Offshoring of Japanese firms

2.2.1 Increase in the offshoring of tasks

Ito, Tomiura and Wakasugi (2007), in collaboration with RIETI, surveyed the offshore outsourcing of Japanese manufacturing firms. (Hereafter, this survey is simply referred to as "Survey.") This section introduces the features of offshoring by Japanese firms on the basis of the Survey. The Survey was carried out in January 2007 for 14,000 Japanese manufacturing firms with 50 or more employees, with approximately 5,000 firms responding to it. In the Survey, "offshoring of tasks" is regarded as being the same as offshore outsourcing; the former is defined by offshore outsourcing wherein a contract outlines the specifications of tasks, through (i) intra-firm transactions with the firm's own subsidiaries, (ii) arm's-length transactions with other Japanese subsidiaries, or (iii) arm's-length transactions with foreign firms. In other words, this Survey posits that offshoring includes not only the outsourcing between firms in a market but also the division of tasks with the subsidiaries of multinational firms if the tasks are bound by the specific contract. Thus, offshoring of tasks includes the international division of tasks between firms as well as within a firm. However, offshore outsourcing is different from offshore purchasing in that in the latter a contract to specify the tasks in advance is not concluded

Figure 2 illustrates the extent to which the division of tasks of Japanese firms is progressing in the domestic and overseas markets. The number of firms practicing division of tasks in the domestic market comprises 60% of all firms, while those practicing it in the international market comprise 21%. Moreover, it is noteworthy that the amount of firms which conduct offshoring tasks has increased from 15% to 21% during these five years.

Figure 2

2.2.2 Size effect

Firm size has an influence on offshoring. Table 1 illustrates that the ratio of offshoring increases along with an increase in firm size. The ratio of firms that practice offshoring to the total number of firms is 10% for firms with 99 or fewer employees, 20% for firms with more than 100 and less than 300 employees, 35% for firms with more than 300 and less than 1,000 employees, 50% for firms with more than 1,000 and less than 3,000 employees, and 65% for firms with more than 3,000 employees. A similar effect of firm size on offshoring is found across industries.

Table 1

2.2.3 Destination and industry

More than half of offshored tasks were destined for China. As illustrated in Figure 3, the sum of offshoring to China (52.8%) and ASEAN countries (21.9%) represents three-fourths of all global offshoring. On the other hand, offshoring of tasks to the US and EU comprises only 11.5%.

Figure 3

The extent of offshoring varies across industries. As illustrated in Table 1, the apparel, general machinery, electric machinery, information and telecommunications, and electronic devices industries exhibit a high ratio of offshoring. These industries are characterized by modularization of parts and intermediate products—a feature that tends to lower the cost to coordinate the performance of unbundled tasks at different sites.

2.2.4 Disaggregation by type of task

The second column in Table 2 presents types of task offshored by their share of the total number of tasks. The two types of task most frequently offshored are the production of intermediate and final assembly, each of which accounts for 35% of offshored tasks. The production of jigs/dies ranks third (13%). Thus, the top three most frequently offshored tasks are all directly related to manufacturing activities. While serious concerns are being raised in the US with regard to the offshoring of software programming to India, in the case of the Japanese manufacturing industry, the offshoring of services is still limited to a small segment of firms. This is despite an increase in the volume of offshoring of manufacturing operations to China. However, it must be noted that the low ratio of offshoring in customer support (4.5%), data utility (3.0%), and professional services (2.1%) may be due to a sample bias toward the manufacturing sector in the Survey.

Table 2

The types of offshored task also vary according to the destination. As shown in Figure 4, tasks related to the production of jigs, dies, intermediate products, and final assembly products are offshored largely to China; however, tasks related to R&D are offshored to the US and Europe to a significant extent.

Figure 4

2.2.5 Contract: Within firm vs. between firms

Offshored tasks are categorized based on the division of tasks within firms, i.e., between an MNC

and its subsidiaries, and the division of tasks between firms bound by an arm's-length contract. A transaction between an MNC and its subsidiary is viewed as a transaction within a firm; however, if the transaction is implemented under a contract that specifies the content of tasks, it is appropriate to categorize it under a type of offshoring that falls under the international division of tasks.

As Table 2 presents, in terms of offshoring partners firms' own subsidiaries account for 39% of the total offshoring partners; other Japanese firms 15%; and foreign firms 45%. Thus, while the role of subsidiaries as an offshoring partner is significant, the ratio of offshoring to other competitive Japanese firms is relatively low. The third column in Table 2 presents the share of tasks offshored to own subsidiaries in the case of disaggregated tasks. R&D (55%) and customer support (52%) constitute a significant share of the transactions within multinational firms, followed by final assembly processes (44%). On the other hand, the share of offshoring within firms for professional services (21%), production of jigs and dies (32%), and production of intermediate goods (34%) is lower. Previous theoretical studies demonstrate that the choice of contract or organizational transaction varies according to the characteristics of the transaction[6]. Some empirical studies, including Feenstra and Hanson (2005), illustrate that the type of supplier and ownership affect the choice of offshoring, contract, or organization. This Survey presents the type of tasks that influence the ratio of transactions within firms, and shows that the choice between contracts or organizational transaction relates to the contents of the task.

2.2.6 R&D

Table 3 illustrates that 209 firms (3.9% of the surveyed firms) are offshoring R&D without any contracts, while 80 firms are currently offshoring R&D with contracts specifying the tasks and

[6] For example, see Grossman and Hart (1986), Hart and Moore (1990), and Antras (2003).

results. Offshore R&D is actively implemented in the electrical machinery, chemical, transportation machinery, and general machinery industries. Almost two-thirds of firms engaged in offshore R&D activities possess R&D facilities within their plant sites, and one-fifth of firms have research laboratories, particularly those in the transportation machinery (31%) and chemical (28.2%) industries.

Table 3

Table 4 presents the motivations of offshore R&D by regions and industries. Although local production and sales support is a dominant motivation for offshore R&D in every region, developed countries and regions such as the US and EU/EFTA have different motivations than Asian countries with regard to the recruitment of researchers, lower R&D costs, collaboration with local firms and research institutions, and the establishment of a global research network. R&D facilities in the US and EU/EFTA do not attach much significance to lower R&D costs, while those in Asian countries do. The establishment of a global research network is observed as an important motivation in the US and EU/EFTA. The Survey finds a high ratio of collaboration in R&D activities in the US (23.5%), EU/EFTA (23.8%), and Korea (21.4%).

Table 4

2.3 Production efficiency

Based on the firm-level data of the Survey, we calculated the effects of offshoring on the performance of Japanese firms. The tentative result of our examination finds that firms conducting offshoring recorded a 2.5% higher growth rate in sales and a 1% higher growth rate in

labor productivity than the firms that did not engage in offshoring. The annual growth rate of wage in firms engaged in offshoring was higher than that in firms that did not engage in offshoring by 0.5%. These figures evidence that offshoring has enabled firms to raise their production efficiency[7].

2.4 Between offshoring of tasks and trade

As Table 2 shows, tasks for producing intermediates goods and tasks for final assembly are two major fields of offshoring by Japanese firms. They are figured in international transaction of inputs and outputs at the firm-level. Table 5 presents the share of foreign sourcing to total inputs of Japanese firms in general machinery, electric and electronics machinery, transportation machinery and precision machinery industries in 1997 and 2001[8]. We find that recent increase in Japanese offshoring accompanies the increase of foreign outsourcing and production. The share of outsourcing to total inputs increased from 8.8% in 1996 to 9.6% in 2001. It must be also noted that the outsourcing through arm's-length transactions rose from 4.7 % in 1996 to 5.9% in 2001, while intra-firm transactions decreased from 4.1% in 1996 to 3.7% in 2001. Foreign outsourcing of Japanese firms has increased in market transactions rather than within the intra-firm network. Table 5 also shows the relative size of offshored production, which is defined by the relative size of value added between Japanese firms and their foreign subsidiaries[9]. The figure dramatically rose from 25.5% in 1996 to 46.4% in 2001. The increase of offshoring accompanied the shift of production basis of value added to foreign countries.

[7] Detailed firm-level analyses of offshoring are conducted in other papers.
[8] The figures are calculated by the author, based on "Basic Survey on Overseas Business Activities" 1998 and 2002, Ministry of Economy, Trade and Industry. We note that the statistics may be biased to large-sized firms since the survey only covers the figures of Japanese manufacturing firms employing more than 2,000 persons and operating their foreign subsidiaries.
[9] Value added here is calculated by the difference between sales and intermediates inputs.

Table 5

3. Changes in trade structure

3.1 Replacement of exporter by China

The international division of tasks by offshoring should be considered as a factor to change the composition of international trade. It is consistent with the Heckscher-Ohlin (H-O) model since offshoring is conducted between countries or regions with different factor-price ratios. However, it differs from the H-O model in terms of several aspects including the following: (i) it occurs between countries in which production technology is different, (ii) goods to be traded are not final goods but intermediate products, and (iii) division of tasks is not limited to any specific industry but conducted in industries across the board. For example, assume that the task of data entry is offshored. As data entry is conducted in the production process of many industries such as the textile, processing assembly, chemical, and service industries, once offshoring of data entry is carried out, it changes the production pattern regardless of the type of industry. Therefore, it largely affects the trade structure and domestic industrial structure. In fact, since the late 1990s, the global trade structure, particularly that involving East Asia, the US, and Europe, has dramatically changed. This section examines how exports from China (including Hong Kong and Taiwan), Japan, East Asian countries (including Korea, Singapore, Thailand, and Malaysia), the US, and select European countries (in this case the UK, Germany, and France) changed in 1996–2006[10].

Total exports, given by the sum of exports from the abovementioned countries, grew twofold from $1.022 trillion to $2.08 trillion in 1996–2006, as presented by the matrix of exports of the five regions and countries in the Appendix. Figure 5 illustrates the values of exports from

[10] Statistical data are based on UN Comtrade.

the given countries to the US in 1996 and 2006 and the changes of their share during the period. The share of exports from country i (or region i) to country j (or region j) S_{ij} is defined by equation as follows:

$$S_{ij} = X_{ij} / \sum_{i \neq j} \sum_{j \neq i} X_{ij}$$

where the total exported value of the five countries and regions is denoted by $\sum_{i \neq j} \sum_{j \neq i} X_{ij}$, and the value of exports from i countries (i area) to j countries (j area) is expressed on a free on board (FOB) basis.

We find that total exports from the given countries to the US in 1996–2006 grew twofold, rising from $333 billion to $710 billion. However, total exports from all five regions in the same period also became twofold. Consequently, the share of US absorption, i.e. the ratio of exports to the US to the total exports of the five regions, remained unchanged in the period.

Figure 5

However, it must be noted that the composition of exports to the US changed dramatically. Notwithstanding the fact that exports from Japan and East Asian countries to the US increased by only 30% and 50%, respectively, Chinese exports to the US grew fourfold. Figure 5 reveals the following:

(i) The total ratio of exports from China, Japan, and East Asian countries to the US to the total exports of all five regions remained unchanged

(ii) The distribution of the share of exports to the US varies across countries. While the share of Japanese exports decreased by 4 percentage points and that of East Asian exports decreased by 1

percentage point, the Chinese share increased by 6 percentage points.

Looking at Japanese exports, we find:

(iii) The share of Japanese exports in the total exports of the five regions decreased from 27% to 20%.

(iv) In terms of the destinations of the share of Japanese exports, only exports to China increased, while exports to each of the other four regions decreased.

Such changes in the export composition occurred jointly with the Japanese offshoring of production processes to China. The Survey reveals that more than half of the firms with a workforce in excess of 1,000 employees conducted offshoring, and more than half of these firms offshored to China. The offshoring of production processes accompanied such a change of the trilateral trade pattern among Japan, China, and the US as (i) reduction in the share of Japanese exports to the US, (ii) increase in the share of Japanese exports to China and (iii) sharp increase in the share of Chinese exports to the US.

The increase in the share of Chinese exports to the US may be related to the offshoring of US firms. The US export share also fell from 22% in 1996 to 16% in 2006. More particularly, the share of US exports to Japan, East Asian countries, and European countries decreased, while that of US exports to China registered an increase. It is well known that the US manufacturing industry has been offshoring operations since the 1990s. In addition, considering that only China has increased its share as a destination for US exports, it can be predicted that China has expanded its manufacturing industry as a viable offshoring destination.

3.2 China Coupling with European countries

Chinese exports to Europe have also shown an upsurge. As illustrated in Figure 6, total exports from other countries to Europe grew twofold, from $162 billion in 1996 to $311 billion in 2006.

This is almost similar to the rate of increase of total exports of the five regions. The absorption share of the European countries therefore remained not so much changed at 15%. However, a dramatic change in the composition of countries exporting to Europe was also found. Since Japanese and US exports to European countries increased at only 20% and 60%, respectively, the shares of exports from both countries to European countries decreased. Contrary to this, Chinese exports increased to more than three times their 1996 value. This increase is far beyond the doubling of East Asian exports.

The share of exports to European countries is characterized by decreases in the shares of Japanese and US exports and an increase of the share of Chinese exports. As illustrated in Figure 6 and the Appendix, the share of Japanese exports to Europe fell from 3.5% to 2.1% and that of the US fell from 6.8% to 5.3% in 1996–2006. On the other hand, the share of Chinese exports increased from 2.7% to 5%. Since the share of East Asian exports remained unchanged, a rise in the share of Chinese exports to European countries can be regarded as related to the offshoring of production processes from Japan and the US to China.

Figure 6

We can find that European countries have been linked to China. The share of total exports from China, Japan and East Asian countries to European countries increased only slightly, from 9.1% in 1996 to 9.6% in 2006. On the other hand, the share of exports from European countries to these regions decreased from 7.8% in 1996 to 6.8% in 2006. Based on these trade statistics in this period, it does not appear that European countries have been coupled with East Asia. However, we must take note of a rise in the share of European countries' exports to China amid a decline in the share of exports from European countries to East Asia (excluding China). It

is not clear that such an increase in exports from European countries to China is due to the offshoring of European tasks to China. It needs to be further examined whether European firms are offshoring operations to China.

4. Decline of "production depth" in Japan

Trade volumes do not imply value added; instead, they are indicative of sales of goods. The examination of not only the trade patterns but also the international distribution of value added is necessary for investigating the effects of offshoring on economic growth and welfare. Thus, we observe the changes in manufacturing value added in the five regions from the late-1990s to the mid-2000s.

Figure 7 illustrates the changes in the ratio of manufacturing value added to the GDP of each country. Japan, the US, the UK, and France exhibit a common decline in terms of manufacturing value added, while China and East Asian countries do not reveal any change. They may be a sign to show that OECD countries have been losing the production depth whereas East Asian countries have developed it. However, since the change occurring in nonmanufacturing value added is also included in the change in the ratio of the manufacturing value added to the GDP, consideration of only the ratio of the latter value added does not present accurate evidence to explain the effects of offshoring on manufacturing processes.

Figure 7

Then, we examine the shares of manufacturing value added in term of international comparison. Figure 8 illustrates the changes in each country's share of manufacturing value added to the total manufacturing value added of the five regions. We find a dramatic change in the shares,

outlined as follows:

(i) Japanese share of manufacturing value added has sharply declined from 29% to 22%.

(ii)The shares of the US, European countries, and East Asian countries have remained unchanged during these years.

(iii) The Chinese share witnessed a sharp increase, from 8% in 1996 to 15% in 2004.

An increasing (declining) share of manufacturing value added for a country is caused by the inflow (outflow) of production processes to (from) the country due to the offshoring of tasks[11]. We find that the trend of Japanese offshoring to China matches the decline in the Japanese share of manufacturing value added and the sharp rise in the Chinese share. The Japanese economy has been characterized by the relatively high weight attached to the manufacturing sector among OECD countries. Japanese offshoring of tasks to China should have resulted in the most serious impact on its economy.

It is surprising that the European share of manufacturing value added has remained unchanged in the same period. It must be discounted in some extent since the evaluation of the euro might offset the reduction of real value added. Actually in recent times, the German economy has been characterized by an export boom, serious unemployment, and weak domestic growth. This is due to its struggle to cope with low wage competition from Eastern Europe. Germany has invested in East European regions, and job opportunities for unskilled workers in Germany have decreased rapidly[12]. This German experience can serve as a good lesson for the Japanese economy, in which production workers have suffered due to offshoring to China.

[11] A firm that engages in offshoring can obtain a rent generated by the combination of its own production method and a cheap workforce in the host country. A part of the rent will be returned to the offshoring country in proportion with the increase in value addition achieved by it. This is also included in the change in the value added.

[12] See Sinn (2006).

Figure 8

5. Is offshoring sustainable?

5.1 Wage differentials

For predicting the future trade pattern and production depth in Japan, the US, and European countries, it is important to consider whether or not offshoring to China is sustainable. As described in Section 2, offshoring is conceptualized based on a firm's ability to combine cheap overseas workforces with its own efficient production method, and thereby obtain a rent generated by the net cost saving. Offshoring enables a country to reallocate its resources to production processes generating higher productivity and thus realize higher economic welfare. A major factor to determine the viability of offshoring therefore is the disparity in factor price, particularly the wage rate.

Table 6 illustrates the change in the wage rates of China, Japan, and the US over the 10-year period. The Japanese wage rate in terms of dollars has remained unchanged while the US wage rate has increased by 40%. It must be noted that the Chinese wage rate has risen to 3.5 times its 1996 value. As a consequence, the wage differential between Japan and China reduced from 1:57 in 1996 to 1:14 in 2006. The rapid increase in offshoring from Japan to China has been accelerated by a huge gap in wage differential, but at the same time has been accompanied by a decrease in the wage differential in the period[13].

Table 6

[13] Unit labor cost is often employed as a measure to compare wage differential. However, in the case of examining offshoring, the differential of nominal wage may be useful since the same production technology as that in the offshoring country is used in the offshored country. It is believed that the productivity of the offshored task will not largely vary between the offshoring and the offshored countries. Therefore, we employ the wage rate differential for estimating the rent size.

Exchange rate changes of the renminbi and the dollar must be observed carefully for estimating the sustainability of offshoring. Probably, the upward valuation of the renminbi will soon become unavoidable, since the huge surplus of Chinese trade balance has accumulated. In such a case, the wage differential between Japan and the US would further reduce. It is clear that since the wage differential between Japan and China is still substantial, it is difficult to consider the equalization of wages to an extent that the benefit of rent accrued by offshoring would disappear in a short period of time. However, in the scenario of a shrinking wage differential, the incentive for which a firm conducts offshoring will decline.

5.2 Institutional factors and coordination costs

While a firm conducting offshoring obtains a rent generated by the price gap in the production factors, additional expenses must be paid for coordinating unbundled tasks. If the tasks are conducted and coordinated efficiently in the offshored region, the net cost saving is substantial. On the contrary, inefficient execution and coordination of tasks will reduce the motivation for offshoring. A country with low contractibility raises the cost of coordinating tasks and thus proves to be an obstacle for offshoring. As examined by Antras (2004), better contractual institution raises the prevalence of offshoring. Antras and Helpman (2006) finds that the improvement of contractual institution reduces the relative prevalence of intrafirm on foreign outsourcing if it affects disproportionately the contractibility of tasks. Offshoring of sophisticated tasks requires higher contractibility in transaction. Under insufficient condition of institutional factors, firms will resort to sourcing within intra-firm transaction or domestic sourcing.

Nunn (2007) finds that in sophisticated industries, institutional factors have a larger

effect on trade patterns than does the factor price[14]. Market institutional factors will be perceived as an influence on offshoring decisions. While choosing an offshoring destination, it is important to judge whether or not the market is competitive and transparent, sufficient legal and financial systems are provided, and intellectual property rights are strongly protected. The improvement of institutional factors, including qualified legal and financial system and safety standards, provides a favorable condition for attracting foreign offshoring.

As it is not easy to quantitatively compare the institutional factors among countries, we assume the enforcement of intellectual property right as an alternative measure to reveal better institution in this paper. In the Survey we attempted to construct an index of the enforcement of intellectual property right. The index presents how strongly Japanese firms perceive intellectual property rights are protected in China, East Asian countries, the US, and European countries[15]. From the results presented in Table 7, it is clear that there is weaker protection of intellectual property rights in China and East Asia than in the US and European countries. Actually US, Japanese, and European firms have suffered from the many counterfeit products that frequently appear in the Chinese market. The US government appealed to the WTO panel because US firms suffered damages owing to the inadequate protection of intellectual property rights in China. It is not easy to predict that the protection of intellectual property rights in these countries will be strengthened in the near future.

Table 7

In early 2008, it is reported in Japan that agricultural chemical (Methamidophos) was

[14] Nunn (2007) discusses the importance of institutional factors as a means to determine the comparative advantage of an economy.
[15] See Ito, Tomiura and Wakasugi (2007) in detail.

found in meat dumplings imported from China. According to Japanese mass media, 70% of Japanese consumers harbored grave apprehensions about the origin of imported food items and 40% of consumers desired a rise in the rate of food self-sufficiency[16]. Recent incident provides evidence that the safety of products constitutes an important factor in determining the comparative advantage of products as well as the price factor. The improvement of safety standard for products will affect the destination of offshoring and the type of tasks.

It is predictable that the improvement of institutional factors in China will attract much more offshoring of tasks. Otherwise, insufficient conditions of institutional factors will offset the benefit of factor price differentials. For the further development of offshoring of more sophisticated tasks, institutional factors will become important.

6. Conclusion: New design of statistics

In the recent 10-years, the trade structure involving East Asia, the US, and European countries has shown dramatic change. Japan's relative share of exports has decreased, while that of China has increased sharply. Moreover, the distribution of manufacturing value added has also undergone a change. Although there was no significant change in the share of manufacturing value added in European and East Asian countries (except for China), the Japanese share declined while the Chinese share increased sharply. During this 10-year period, Japanese firms have offshored tasks to East Asia, particularly to China. Firm-level data of offshoring and the statistics of trade and manufacturing value added in this paper suggest that the structural changes in trade and manufacturing value added are related to the recent growth in Japanese offshoring to China. They, however, do not state what part of the changes in trade and production depth is explained by the increase of offshoring. We note that there is a gap between the task-level statistics of offshoring

[16] Cited from an NHK report, February 13, 2008

and the commodity- or industry-level statistics of trade and production. Current supply of statistical information is neither sufficient for filling up the gap between firm level activities and the performance in trade and manufacturing, nor for evidencing the effects of offshoring on changes in the global trade and production pattern.

By offshoring tasks to countries with cheap factor prices, firms can obtain rents generated by the difference in production costs. However, since this requires firms to pay for the coordination of unbundled tasks, they tend to determine the viability of offshoring by examining whether or not it would be a cost-saving proposition. While the difference in wage rates has the biggest influence on a firm's decision to offshore, market institutional factors cannot be disregarded as insignificant with regard to their effect on the coordination cost as well as factor cost differentials. Not only the net cost saving from wage differentials and changes in exchange rates, but also the improvement of institutional factors including legal systems, protection of intellectual property rights, and safety standards of products will determine what type of tasks will be offshored and whether or not offshoring will be sustainable in the future.

Studies of institutional factors have begun to attract the attention of trade economists in recent times even though they were not given due attention under the traditional trade paradigm. In this paper we assumed an index presenting the enforcement of intellectual property rights as a proxy for institutional factors. It, however, is not sufficient for representing the quality of institutional factors. In view of the importance of recent developments in offshoring, sufficient supply of statistics to feature the institutional factors also is indispensable.

References

Antras, P. (2003), "Firms, Contracts, and Trade Structure," *Quarterly Journal of Economics* 118(4), 1375-1418.

Antras, P. and E. Helpman (2004), "Global Sourcing," *Journal of Political Economy* 112(3), 552-580

Antras, P. (2005), "Incomplete Contracts and Product Cycle," *American Economic Review* 95(4), 1054-1073

Antras, P. (2005), "Property Rights and the International Organization of Production," *American Economic Review* 95(2), 25-32.

Antras, P. and E. Helpman (2006), "Contractual Frictions and Global Sourcing," *NBER Working Paper 12747*.

Arndt, Sven W. and H. Kierzkowski (2001), *Fragmentation: New Production Patters in The World Economy*, Oxford University Press, New York.

Baldwin, R. (2006), "Globalization: the Great Unbundling," mimeo,

Baldwin, R. and F. Robert-Nicoud (2007), "Offshoring: General Equilibrium Effects on Wages, Production and Trade," *NBER Working Paper 12991*.

Feenstra, R. C. and G. Hanson (2005), "Ownership and Control in Outsourcing to China: Estimating the Property-Rights Theory of the Firm," *Quarterly Journal of Economics* 120(2), 729-761.

Grossman, G. M. and E. Rossi-Hansberg (2006), "Trading Tasks: A Simple Theory of Offshoring," *NBER Working Paper* 12721.

Grossman, S. J. and O. Hart (1986), "The Costs and Benefits of Ownership: A Theory of Vertical and lateral Integration," *Journal of Political Economy*, 94(4), 691-719.

Hart, O. and J. Moore (1990), "Property Rights and the Nature of the Firm," *Journal of Political*

Economy, 98(6), 1119-1158.

Helpman, E. and D. Trefler (2006), "The New World Division of Labor," mimeo.

Ito, Banri, E. Tomiura and R. Wakasugi (2007), "Dissecting Offshore Outsourcing and R&D: A Survey of Japanese Manufacturing Firms," *RIETI Discussion Paper Series* 07-E-060.

Nunn, Nathan (2007), "Relationship-Specificity, Incomplete Contracts, and the Pattern of Trade," *Quarterly Journal of Economics* 122(2), 569-600.

Sinn, Hans-Werner (2006), "The Pathological Export Boom and the Bazaar Effect: How to Solve the German Puzzle," *The World Economy* 29(9), 1157-1175.

Tomiura, Eiichi (2007), "Foreign Outsourcing, Exporting, and FDI: A Productivity Comparison at the Firm Level," *Journal of International Economics*, 72: 113-127.

Yi, Kei-Mu (2003), "Can Vertical Specialization Explain the Growth of World Trade?" *Journal of Political Economy*, 111(1), 52-102.

Figure 1. Framework of offshoring

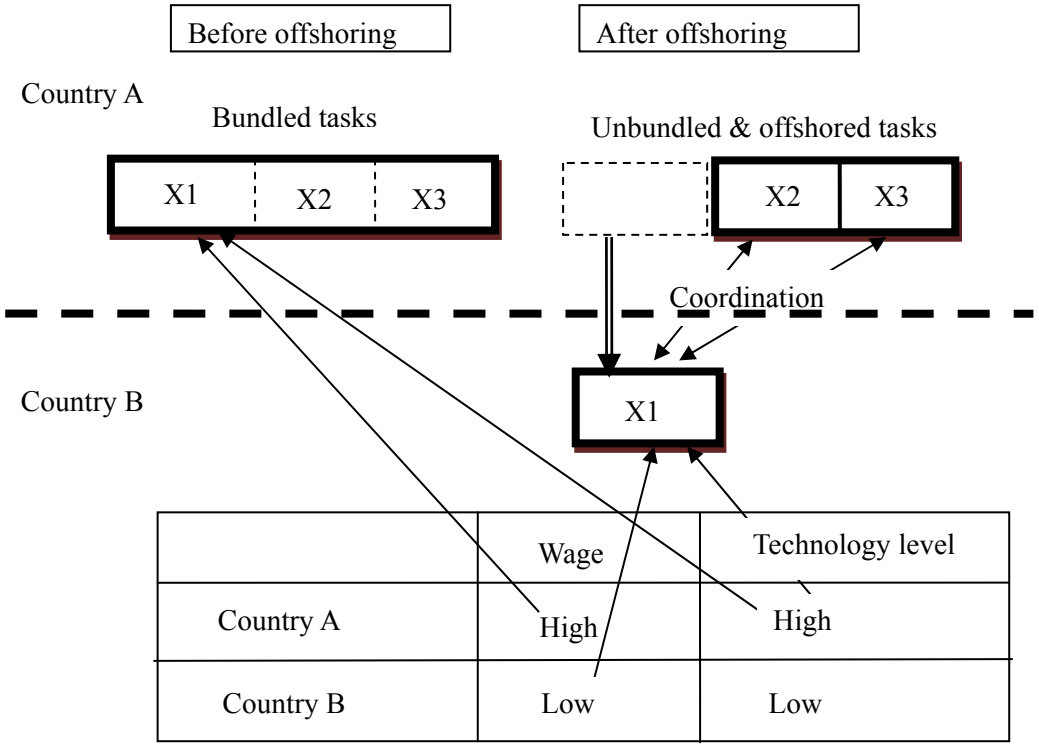
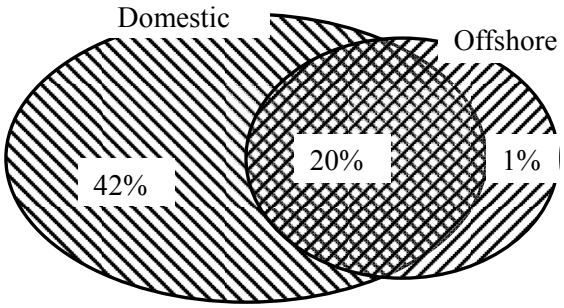
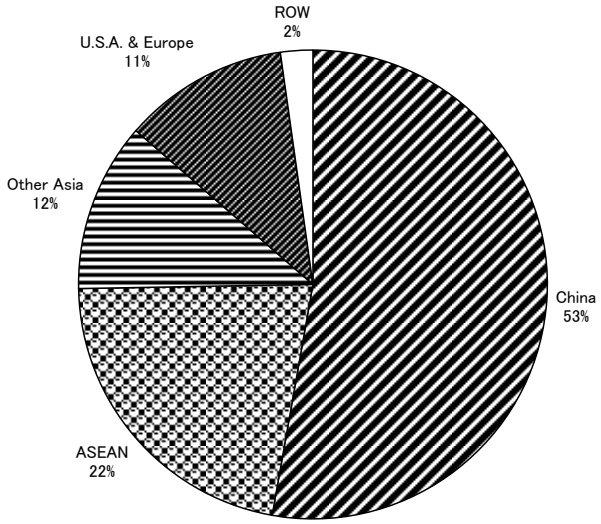


Figure 2. Division of tasks: domestic or foreign



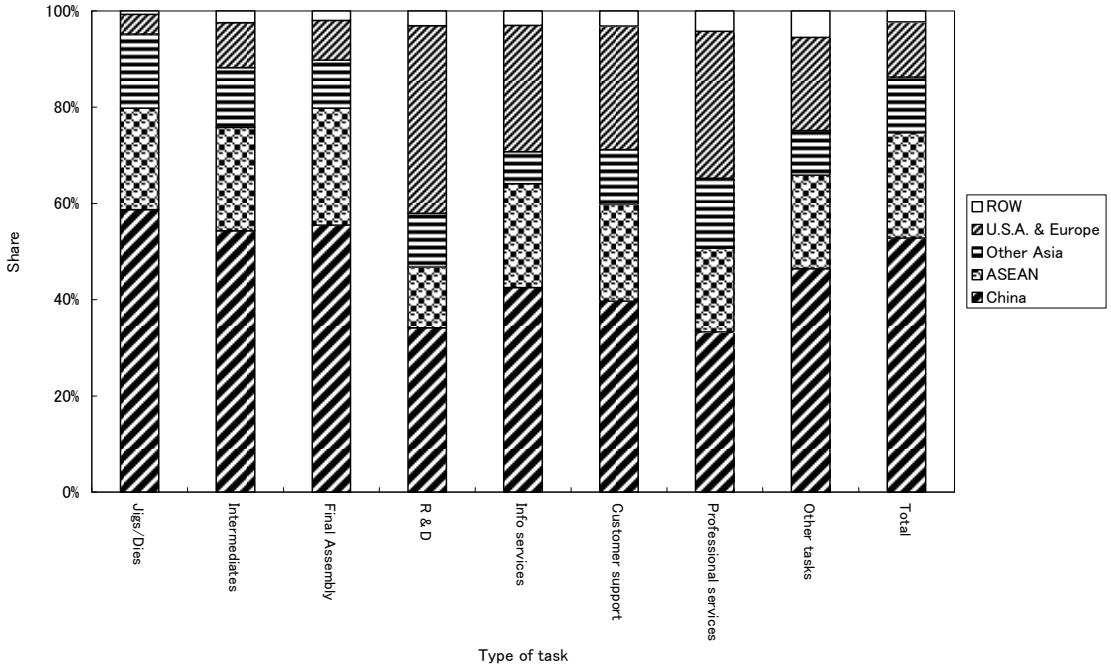
Data source: Author's survey. See Ito, Tomiura and Wakasugi (2007)

Figure 3. Destination of offshoring



Data source: Same as Figure 2.

Figure 4. Destination of offshoring by type of task



Data source: Same as Figure 2

Figure 5. Export to US in 1996 and 2006

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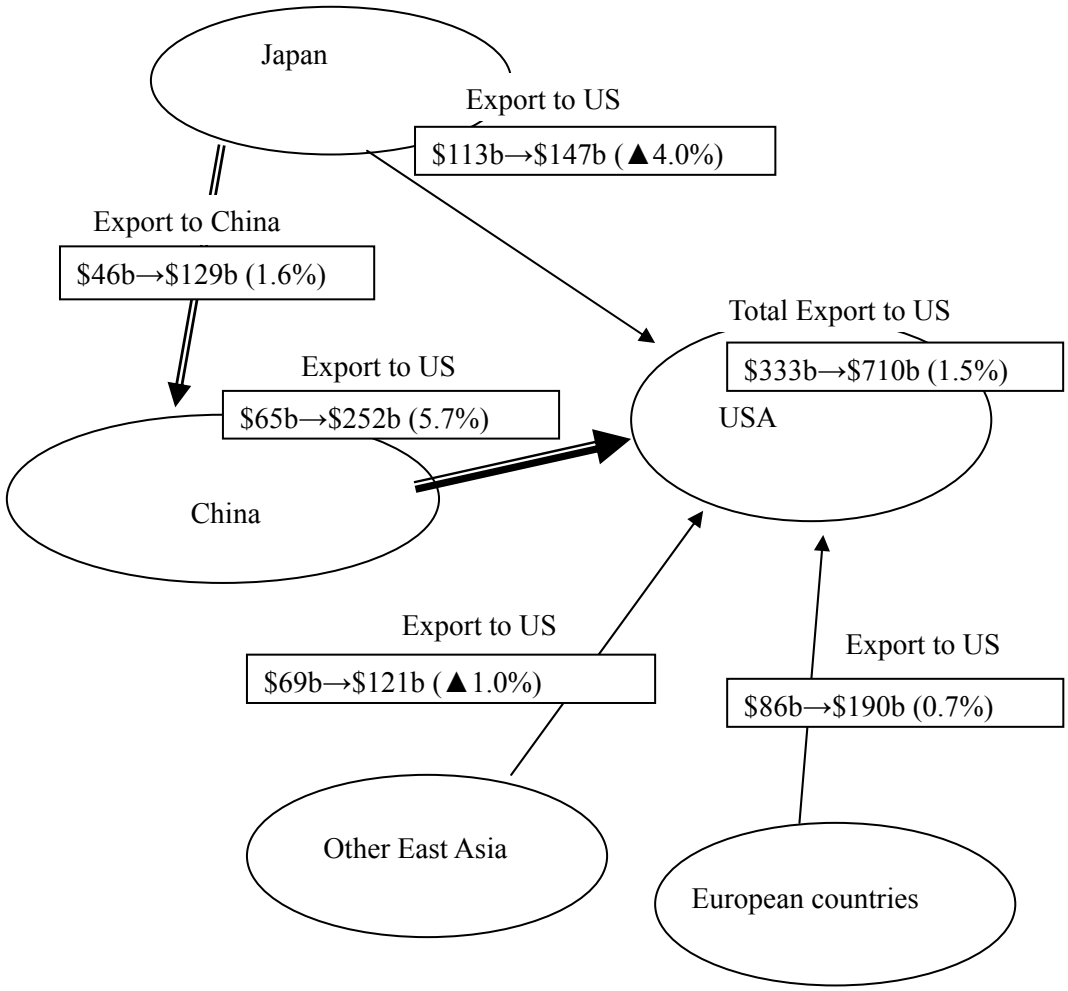
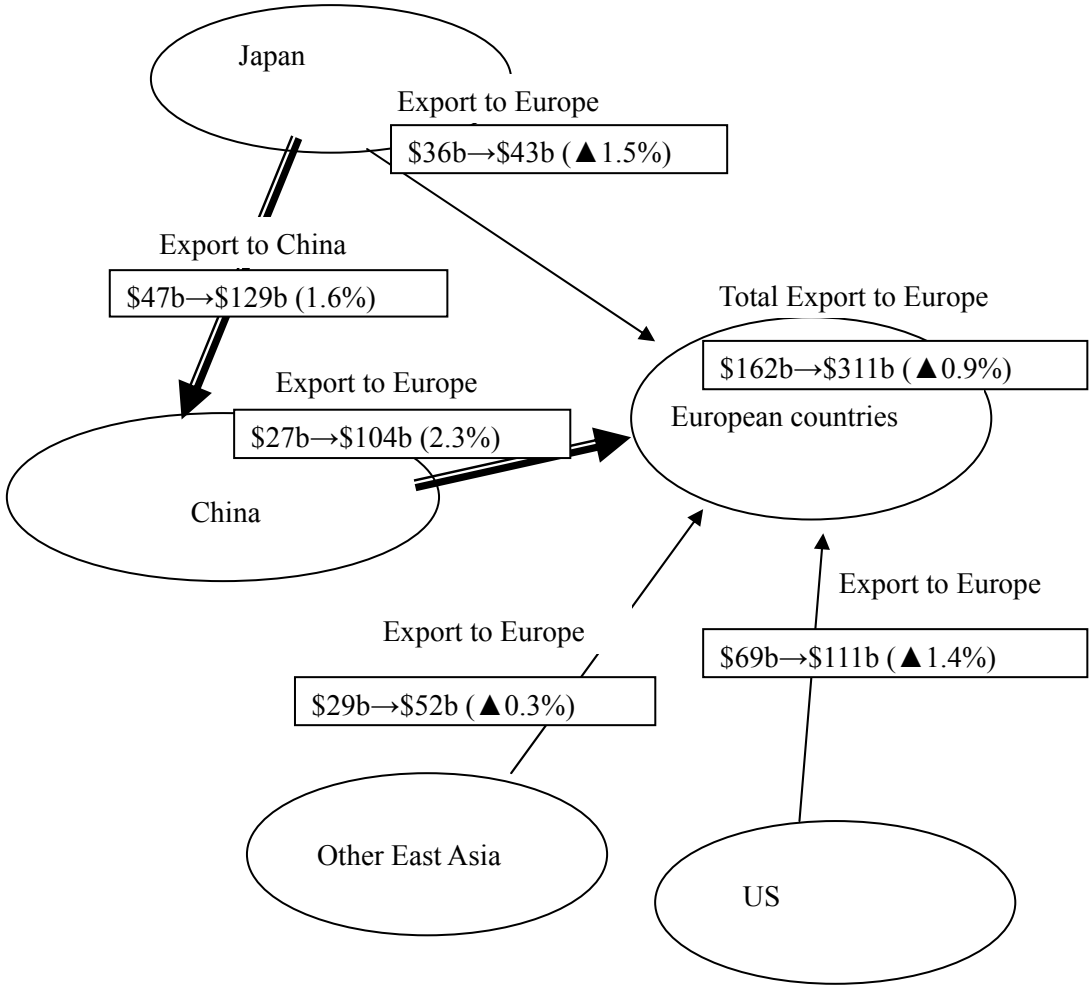


Note: Calculated by the author, using the trade statistics of UN Comtrade.

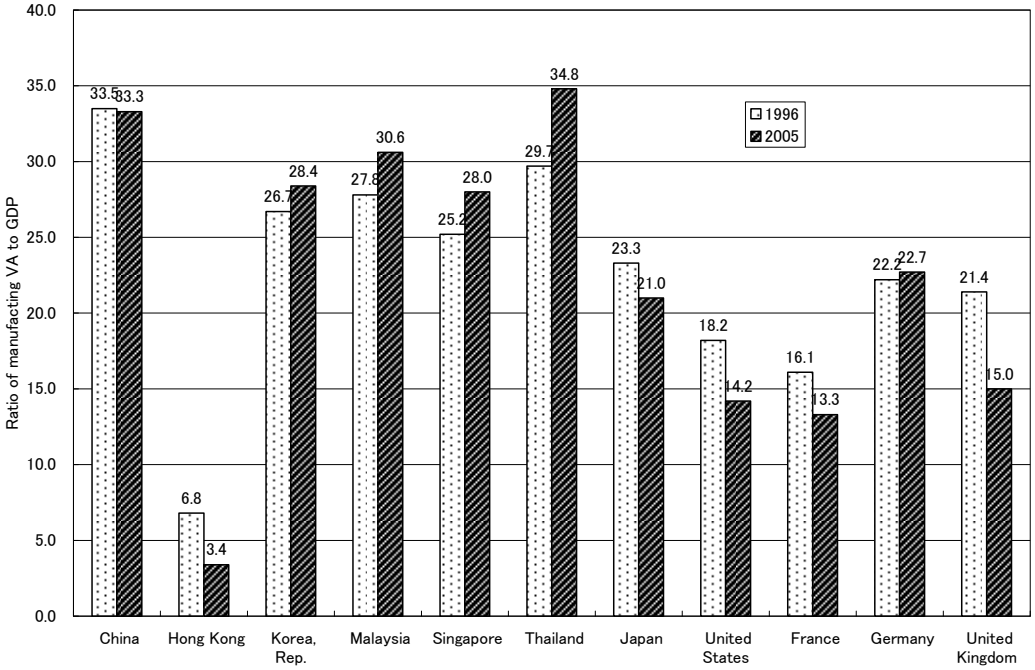
Figures in parentheses present the changes in the shares of the country's exports to total exports from 1996 to 2006.

Figure 6. Export to Europe in 1996 and 2006



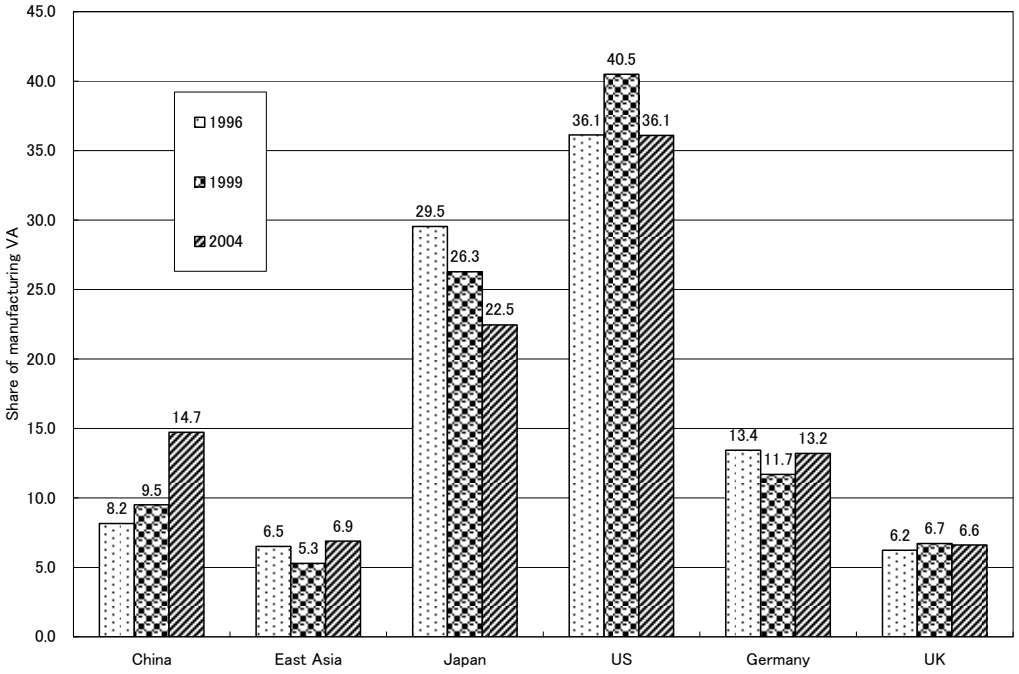
Note: Calculated by the author, using the trade statistics of UN Comtrade
Figures in parentheses present the changes in the shares of the country's exports to total exports from 1996 to 2006.

Figure 7. Ratio of manufacturing value added to GDP



Data source: Calculated by the author, using World Development Indicators 2007.

Figure 8. Share of manufacturing value added



Data source: Calculated by the author, using World Development Indicators 2007.

Table 1. Offshoring by industry and size

	Total	Number of employees				
		-99	100-299	300-999	1000-2999	3000-
Total	21%	12%	21%	34%	51%	65%
Foods	10%	4%	9%	19%	21%	20%
Textile	12%	6%	13%	43%	0%	0%
Apparel	37%	31%	37%	50%	0%	100%
Chemicals	19%	5%	17%	21%	60%	100%
Machinery	32%	21%	34%	56%	53%	100%
Electric Machinery	32%	17%	32%	46%	58%	100%
Information and Telecommunications	35%	23%	24%	47%	86%	80%
Electronics and Devices	31%	16%	25%	46%	73%	100%
Transportation Machinery	22%	10%	17%	32%	59%	60%

Data source: Author's survey. See Ito, Tomiura and Wakasugi (2007)

Table 2. Disaggregation by type of task and share of own subsidiaries

Type of Task	Share of Tasks	Share of Own Subsidiaries
Jigs/Dies	12.52	32.43
Intermediates	35.34	33.73
Final Assembly	35.25	44.11
R & D	3.58	54.75
Info services	3.01	36.88
Customer support	4.51	52.33
Professional services	2.13	21.13
Other tasks	3.66	47.27
Total	100.00	39.14

Data source: Same as Table 1.

Table 3. Distribution of offshore R&D and foreign R&D facility by industries

Industry	The Ratio of offshoring R&D	R&D Facility in		
		Laboratory	Plant Site	Other
Electrical machinery	6.4%	25.0%	62.5%	12.5%
Chemical	5.9%	28.2%	51.3%	20.5%
Transportation machinery	7.7%	31.0%	62.1%	6.9%
General machinery	3.4%	14.3%	66.7%	19.0%
Other industries	2.6%	17.6%	60.8%	21.6%
Total	3.9%	22.7%	60.2%	17.1%

Data source: Same as Table 1.
Note: The share is calculated by the total number of replies allowed multiple answers.

Table 4. Motivations of offshore R&D by region and industry

Region / Industry	Motivations				
	Support for Local Production/ Sales	Recruitment of able human resources	Low R&D Cost	R&D Collaboration	Global R&D Network
U.S.A.	37.8%	16.8%	2.5%	23.5%	19.3%
EU/EFTA	36.3%	17.5%	1.3%	23.8%	21.3%
China	36.5%	15.5%	20.9%	17.6%	9.5%
Korea	42.9%	21.4%	10.7%	21.4%	3.6%
ASEAN	44.6%	15.7%	20.5%	9.6%	9.6%
Other regions	33.3%	20.0%	13.3%	13.3%	20.0%
Electrical machinery	23.0%	27.6%	15.1%	17.1%	17.1%
Chemical	45.3%	8.1%	7.0%	24.4%	15.1%
Transportation machinery	50.7%	9.3%	10.7%	18.7%	10.7%
General machinery	47.9%	16.7%	18.8%	12.5%	4.2%
Other industries	42.0%	13.4%	9.8%	19.6%	15.2%
Total	38.5%	16.7%	12.1%	18.8%	14.0%

Data source: Same as Table 1.

Table 5. Foreign outsourcing and production

	The share of foreign outsourcing to total inputs (%)			The ratio of foreign production (%)
		arm's length	Intra-firm	
1997	8.8	4.7	4.1	25.5
2001	9.6	5.9	3.7	46.4

Source: Calculated by the author, using "Basic Survey on Overseas Business Activities, 1998 and 2002"
Note: Figure presents percent. The ratio of foreign production is defined by the ratio of subsidiary's production to parent firm's production in value added.

Table 6 Wage differentials

		1995	2000	2005	2006	2006/1995
China	Yuan per Dollar	8.35	8.28	8.19	8.11	0.97
	Dollar per month	51.58	88.08	160.24	184.51	3.58
Japan	Yen per Dollar	94.56	107.77	112.1	114.7	1.21
	Dollar per month	2948.39	2719.68	2605.71	2612.03	0.89
China/Japan		1/57	1/31	1/16	1/14	
US	Dollar per hour	12.37	14.37	16.56	16.8	1.36

Data source: Calculated by the author, using LABORSTA, ILO Bureau of Statistics.

Table 7. Evaluation of IPR protection

Country	IPR Score
U.S.A.	4.4
Germany	4.4
United Kingdom	4.4
France	4.3
Singapore	3.4
Korea, Republic of	3.3
Taiwan	3.1
Hong Kong	3.0
Malaysia	2.9
Thailand	2.9
China	2.3

Data source: Same as Table 1.
Note: Each score is calculated as mean value.

Appendix. Matrix of exports of China, Japan, East Asia, US, and European countries

Exported value ($ billion)		From:											
		China + Hong Kong		East Asia		Japan		US		Europe 3		Total Exported	
		1996	2006	1996	2006	1996	2006	1996	2006	1996	2006	1996	2006
To:	China + H.K.			48.7	180.8	47.2	129.2	25.9	73.0	22.6	65.5	144.5	448.5
	East Asia	25.3	110.7			83.7	105.7	59.0	77.8	31.7	44.9	199.8	339.2
	Japan	42.7	107.2	46.0	72.2			67.5	59.6	25.9	32.0	182.1	270.9
	US	65.1	251.7	69.3	120.8	113.0	147.2			86.3	190.0	333.7	709.7
	Europe 3	27.4	104.3	29.2	52.4	36.2	43.3	69.2	111.1			161.9	311.1
Total Exported		160.5	573.9	193.0	426.2	280.1	425.4	221.7	321.6	166.6	332.4	1022.0	2079.4
Share of each exporter (%)		From:											
		China + Hong Kong		East Asia		Japan		US		Europe 3		Total Exported	
		1996	2006	1996	2006	1996	2006	1996	2006	1996	2006	1996	2006
To:	China + H.K.			4.8%	8.7%	4.6%	6.2%	2.5%	3.5%	2.2%	3.1%	14.1%	21.6%
	East Asia	2.5%	5.3%			8.2%	5.1%	5.8%	3.7%	3.1%	2.2%	19.5%	16.3%
	Japan	4.2%	5.2%	4.5%	3.5%			6.6%	2.9%	2.5%	1.5%	17.8%	13.0%
	US	6.4%	12.1%	6.8%	5.8%	11.1%	7.1%			8.4%	9.1%	32.6%	34.1%
	Europe 3	2.7%	5.0%	2.9%	2.5%	3.5%	2.1%	6.8%	5.3%			15.8%	15.0%
Total Exported		15.7%	27.6%	18.9%	20.5%	27.4%	20.5%	21.7%	15.5%	16.3%	16.0%	100.0%	100.0%

Data source: Calculated by the author, using UN Comtrade.
Note: China includes Hong Kong and Taiwan. Europe 3 includes France, Germany and UK.