

THE IMPACT OF THE RECENT YEN APPRECIATION ON THE JAPANESE ECONOMY

HIROHISA KOHAMA
SHUJIRO URATA

I. INTRODUCTION

THE magnitude and speed of the recent appreciation of the Japanese yen has been remarkable, as it doubled its value against the U.S. dollar in three years; from around 260 yen to a dollar in early 1985 to around 130 yen to a dollar in early 1988. There has been a considerable amount of concern both in the business community and in the political circles that the appreciation of the yen might undermine the Japanese economy by reducing exports and by increasing imports. Just as predicted, exports stopped rising and imports started to increase. Moreover, there was an increase in the number of bankruptcies, and the unemployment situation worsened. The unemployment rate was as high as 3 per cent in early 1987, a level never previously reached in post-Second World War Japan. However, thanks to active construction and pent-up demand for fixed investment, the economic situation turned around in mid-1987, and achieved substantial growth in the latter half of 1987.

Despite economic recovery taking place at the macroeconomic level, certain problems remain at the microeconomic level. A number of firms in labor-intensive sectors such as textiles, and some in low-technology-intensive heavy industrial sectors such as iron and steel and shipbuilding have cut down their operations in these sectors, and have diversified their operation in high-technology sectors such as biochemicals and electronics. Such a shift in the fields of operation by the firms causes structural unemployment, due to the mismatch in the supply and demand of labor.

The objective of this paper is to examine the impact of the recent appreciation of the yen on the Japanese economy by focusing on its effects on the structure of foreign trade and on unemployment, both at sectoral level. As our hypothesis on the effect of the appreciation of the yen is that it precipitated the structural changes, rather than caused them, we examine the issue in the medium- to long-term perspective.

The paper is organized as follows. Section II briefly examines the pattern of

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the changes in the structure of production and foreign trade in Japan, and then discusses the factors that led to these changes. Sections III and IV analyze the impact of the recent appreciation of the yen on the Japanese economy; Section III concerns the effect on the pattern of foreign trade and investment, while Section IV quantitatively examines its effect on employment. Finally, Section V presents some concluding comments.

II. THE CHANGING PATTERN OF ECONOMIC STRUCTURE IN JAPAN

Based on our assumption that the recent appreciation of the yen speeded up the structural changes that had been taking place, rather than causing them, in this section we briefly review the changes in the structure of production and foreign trade in post-Second World War Japan. We then discuss some of the factors that led to the structural changes.

In 1955 those sectors with the shares of the value of shipments in total manufacturing exceeding 10 per cent were food, textiles, and chemicals.¹ The shares of these three sectors declined over a period of time. In particular the share of textiles declined dramatically from 16.2 per cent in 1955 to 2.7 per cent in 1987. Iron and steel, a typical low-technology-intensive heavy industry, has also experienced a decline in its share since the 1970s, after maintaining a 9–10 per cent share throughout the 1960s. The iron and steel share in 1987 was as low as 6.1 per cent. In contrast to the declining shares for light manufacturing and low-technology-intensive heavy industrial sectors, the shares of high-technology-intensive sectors such as machinery increased remarkably. In particular, electrical machinery increased its share more than fourfold between 1955 and 1987, to 17.3 per cent in 1987. Electrical machinery is followed by transport machinery at 12.9 per cent in the same year. The increase in the value of shipments in electrical machinery between 1980 and 1987 amounted to more than one-third of the increase in the value of shipments for total manufacturing.

Changes in production structure are reflected in the structure of foreign trade. The structure of exports shifted from light manufactures to low-tech.-intensive heavy manufactures, and then to high-tech.-intensive heavy manufactures. The share of textiles declined substantially from 37.3 per cent in 1955 to 3.0 per cent in 1987. The share of iron and steel increased from 9.6 per cent in 1960 to 18.2 per cent in 1975, but then declined to 5.5 per cent in 1987. Unlike the declining shares observed for light manufactures such as textiles and low-tech.-intensive heavy manufactures such as iron and steel, the share of machinery, a high-tech.-intensive heavy industry, increased rapidly from 25.5 per cent in 1960 to 71.2 per cent in 1987.

Turning to the structure of imports, one observes a high share of raw materials, making up more than half of the total imports, throughout the post-Second

¹ In this section twenty-sector disaggregation and fourteen-sector disaggregation are used for the discussion of the changes in the production and export structures, respectively.

World War period. However, in recent years the share of manufactures in total imports started to increase rapidly, from 31.0 per cent in 1985 to 41.8 per cent in 1986, and then to 44.1 per cent in 1987. These statistics indicate that the drastic appreciation of the yen in recent years brought about a major structural shift in the pattern of imports. One should note that, in spite of a recent rapid increase in the share of manufactures in total imports in Japan, the share is still considerably lower than that in other developed economies, where the corresponding share are around 60–80 per cent.

These changes in the structure of production and foreign trade from light manufacturing to low-tech.-intensive heavy manufacturing, and then to high-tech.-intensive heavy manufacturing appear to be explained by the interaction of the factors related to the supply of and demand for these products.² On the supply-side these include the accumulation and efficient use of factors of production such as labor and capital, whereas on the demand-side these include changes in the pattern of intermediate and final demand. Below we examine the effect of supply-side and demand-side factors on the pattern of structural changes in post-Second World War Japan.

The foregoing discussions of the changes in the patterns of production and foreign trade indicate that the post-Second World War period may be conveniently divided into three sub-periods as regards changes in the structure of production and exports: the end of Second World War to the mid-1950s, the mid-1950s to the first oil crisis, and the first oil crisis to the mid-1980s. These three sub-periods more or less correspond to the dominance of the following industries in production and export respectively: light industry, low-tech.-intensive heavy industry, and high-tech.-intensive heavy industry.

During the 1950s the Japanese economy grew quite rapidly, even if one discounts the fact that its original base was quite small as a result of damage due to the Second World War. Growth accelerated in the 1960s, and the last five years of the decade were distinguished by an average growth rate of over 10 per cent. This rapid growth was largely attributable to active investment, which in turn resulted from the favorable expectations of private firms for the future economic performance. It should be noted that aggressive government policies such as the "National Income Doubling Plan" and a favorable world trade performance played a large part in creating such expectations.

Active investment not only resulted in capacity expansion by increasing physical capital stock, but also contributed to an increase in the GNP by creating additional demand. These two effects of active investment contributed to a change in production structure from light industry to low-tech.-intensive heavy industry through the following mechanism. Coupled with an increasing shortage in the labor supply, an expansion in capital investment increased the capital-labor factor endowment ratio, implying that Japan gained a comparative advantage in the production of low-tech.-intensive heavy industry products. Moreover, active investment meant an increase in the demand for heavy industrial products. It should

² See [3] [5] [13] for similar explanations of the changes in economic structure.

also be mentioned that an increase in household disposable income as a result of rapid economic growth increased the demand for consumer durables whose production requires heavy industrial products, thereby contributing to an increase in the share of low-tech.-heavy industry. Imported technologies, most of which were adapted for efficient use in Japan by Japanese engineers, played an important role in output expansion in heavy industrial products by improving productivity.

The Japanese economy, which appeared to be performing very well, started to face various problems toward the end of 1960s. Among them environmental problems and trade problems with the United States had the greatest influence on the production and export structures. An increasing concern for environmental problems such as air and water pollution led to the introduction of regulatory policies. As low-tech.-intensive heavy and chemical industries were a major source of pollution, the regulatory policies increased the cost of production for these products. As for the trade problems with the United States, the Japanese economy was facing two problems: an increasing overall trade surplus vis-à-vis the United States and trade friction in certain specific products such as textiles, iron and steel. The trade imbalance resulted in a substantial appreciation of the Japanese yen in the early 1970s, while the trade problems in specific products resulted in various forms of export restriction; for example, voluntary export restraint was imposed on iron and steel as well as on textiles. The increase in the cost of production because of the regulatory policies, and the decline in demand because of the appreciation of the yen, as well as export restraint resulted in the decline in production and export of low-tech.-intensive heavy industrial products.

In 1973 the first oil crisis hit the world economy, with oil prices quadrupling. Furthermore, the growth in the world economy was declining from a peak in 1973 and the Japanese economy was overheated from excessive effective demand, largely brought about by expansionary monetary and fiscal policies. As a result, during 1973-74 the Japanese economy underwent severe inflation, and a shift to a large balance of payments deficit. These incidents brought the period of high economic growth to a halt as contractional policies were adopted to cope with the problems. In the middle of 1970s the rate of economic growth declined not only for Japan, but also for other developed economies which were facing similar problems. In contrast, a number of middle-income economies, most notably the Asian NIEs (Hong Kong, Korea, Singapore, and Taiwan), accelerated their economic growth, mainly through active investment and favorable export performances.

The first oil crisis and its aftermath shifted the comparative advantage in the production of low-tech.-intensive heavy industrial goods from Japan to some of the middle-income economies such as NIEs. Japan was losing its comparative advantage because of high oil prices and low investment. In contrast, some middle-income economies were gaining a comparative advantage mainly because of the same supply and demand factors that had given Japan its comparative advantage in the 1960s, as discussed earlier. Namely, investment driven rapid economic growth not only led to an expansion in the capacity to produce low-tech.-intensive goods but also provided a demand for these products, thereby interacting with each other to result in a rapid expansion of output. This process was

facilitated by the cooperation of Japan and other developed economies in the form of direct investment and technology transfer.

During the 1970s and 1980s Japan's comparative advantage was shifting from low-tech.-intensive heavy industry to high-tech.-intensive industry. As further expansion in the production of low-tech.-intensive heavy industrial goods was deemed difficult as early as the late 1960s because of the environmental and trade problems discussed above, the Japanese government, as well as private firms, sought to expand high-tech.-intensive sectors. Indeed, there appeared to be a national consensus as regards the expectation that the high-tech. sector was going to be the sector of the future.³ The Japanese government played an important role in the formation of such expectation through presenting its future vision of the economy as the one oriented toward high-tech. industries. It also encouraged the expansion of high-tech. industries by providing various incentives as well as conducting a number of programs designed to advance the level of technology. R & D effort was intensified by the two oil crises and their aftermath as they further increased the cost of producing low-tech.-intensive heavy industrial goods. Active investment in R & D by both the public and private sectors improved the technological level of Japan and also made the Japanese economy energy efficient. At the same time, the demand for high-tech.-intensive products increased in Japan and in the rest of the world. Both of these factors led to an increase in the share of high-tech.-intensive products in manufacturing production and export in the 1970s and 1980s.

The discussions on the changing structure of production and foreign trade and their causes appear to indicate that a dynamic version of the Heckscher-Ohlin hypothesis and the catching-up product cycle hypothesis may be applicable to the theoretical explanation of the changing structure of production and trade.⁴ A dynamic version of the Heckscher-Ohlin hypothesis explains the changing pattern of production and trade by focusing on the changes in the factor endowments of trading partners, whereas the catching-up product cycle hypothesis, whose arguments are also based on the changing factors of endowments, emphasizes the role played by technology transfer and foreign direct investment in the development process. One should note, however, that in addition to the supply-side factors as discussed in both a dynamic version of the Heckscher-Ohlin hypothesis and in the catching-up product cycle hypothesis, the above discussion of the factors influencing the patterns indicated the importance of the demand-side factors as well.

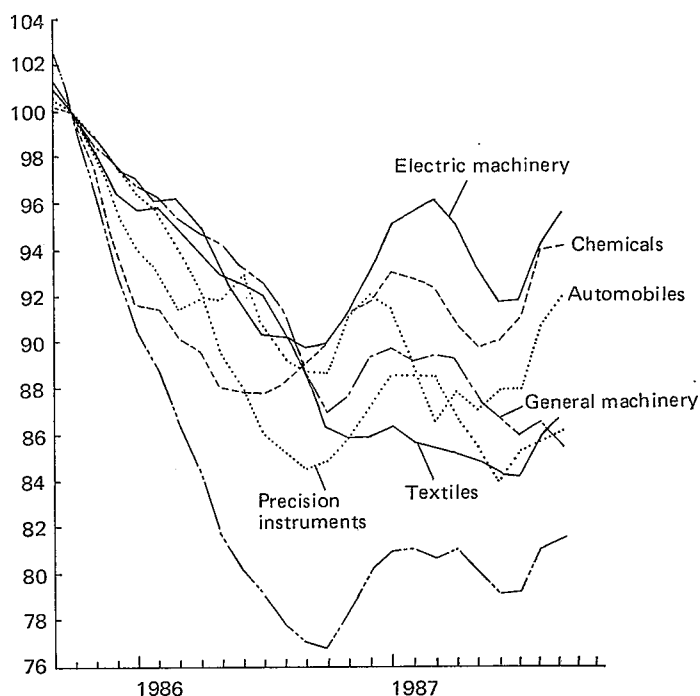
III. THE IMPACT OF THE APPRECIATION OF THE YEN ON THE PATTERN OF FOREIGN TRADE AND FOREIGN DIRECT INVESTMENT

The rapid appreciation of the yen, starting in early 1985, led to a drastic structural change in the pattern of foreign trade in Japan. The upward trend of the volume

³ See [14] for further discussion on the technology policy and R & D investment in Japan.

⁴ For a dynamic version of the Heckscher-Ohlin hypothesis, see [2] [15]. For the catching-up product cycle hypothesis, see [1] [11] [17].

Fig. 1. Profitability of Export Activities in Various Sectors
(1985=100)



Source: [7].

Note: Profitability is computed as the ratio of export price and input price; both are measured in the respective price indices.

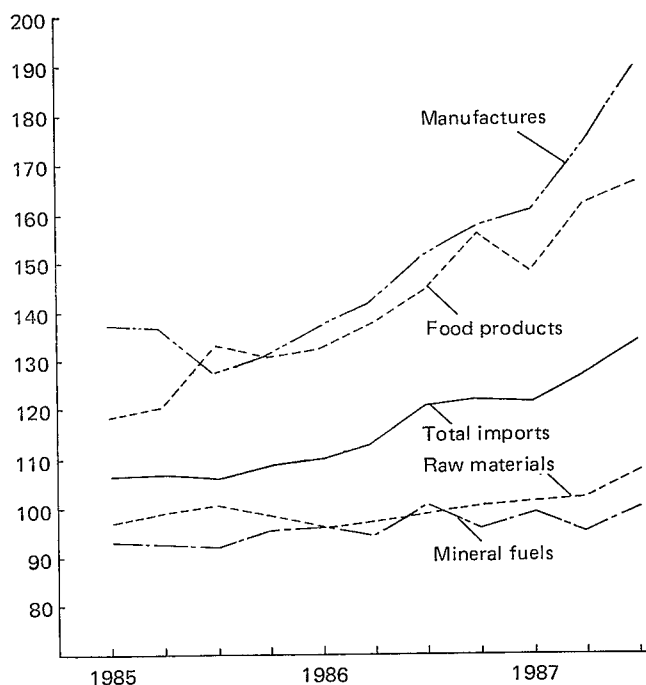
of exports reversed, as the volume of exports declined consecutively in 1986 and 1987. In contrast, the volume of imports increased rapidly during these two years. In this section we examine the pattern of changes in the structure of foreign trade, and then attempt to discern the factors and mechanisms that led to the structural change in foreign trade.

A. Foreign Trade

The appreciation of a currency generally leads to a decline in the relative price of tradeables (exportables and importables) to non-tradeables in terms of the currency of the economy experiencing the currency appreciation. Such a change in the relative price results in a decline in the profitability of the tradeable sector in comparison with that of the non-tradeable sector, thereby leading to a reduction in the production of tradeables and to an expansion in the production of non-tradeables.

Figure 1 depicts the changing pattern of profitability in various exportable sectors in Japan between August 1985 and August 1987. From the figure a

Fig. 2. Changing Volume of Imports for Various Products
(1980=100)



Source: [7].

declining trend is clearly observed for all the sectors until the middle of 1986. After mid-1986 profitability in most sectors recovered somewhat, but not to the level achieved in 1985. The figure also shows that there are wide variations in the changes in profitability among the exportable sectors. The rate of decline in profitability was most remarkable in iron and steel, whereas it was least serious in electrical machinery. A reduction in the profitability of export sales in comparison to domestic sales led to a decline in the ratio of export sales to domestic sales. According to the Economic Planning Agency [7], the rate of decline in the export-output ratio was most serious for iron and steel, a low-tech.-intensive heavy industrial products, whereas the rate of decline in the export-output ratio was less serious for high-tech.-intensive heavy products. This observation is consistent with the changing pattern of exports based on the dynamic version of comparative advantage and/or the catching-up product cycle hypothesis discussed in the previous section.

Turning to imports, one observes a rising trend in the volume in Figure 2. The figure shows that the increase in the volume of total imports was mainly attributable to the increase of imports in manufactured goods and in food products. Among the manufactured imports, consumer durables (especially automobiles) and

consumer nondurables (especially clothing) increased rapidly in 1986, while in 1987, in addition to consumer nondurables, ferrous and nonferrous metals increased substantially. As for the origins of manufactured imports, the share of the United States declined from 32.8 per cent in 1986 to 26.8 per cent in 1987, while the share of the Asian NIEs, ASEAN, and EC increased respectively from 13.6, 4.0, and 22.7 per cent to 17.6, 4.7, and 23.0 per cent during the same period. These average figures, however, mask substantial variations in the rate of growth of imports among different commodities and among different import origins. A number of imports from Korea and Taiwan more than doubled in dollar value between the first half of 1986 and the first half of 1987. A list of such imports from Korea includes consumer electronics such as radio-cassette recorders and electric fans, as well as a number of apparel products. A list of such imports from Taiwan includes consumer durables such as cameras, watches, radio-cassette recorders, and wireless telephones.

In spite of a rapid increase in imports of manufactured goods as witnessed above, the share of imports in domestic consumption (import penetration ratio) is still low for most products (Table I). A comparison of imports from the Asian NIEs and domestic products reveals that product differentiation exists between these two types of products. Japanese products tend to be of the high quality and price, whereas the imports from the NIEs tend to be of lower quality and price. For example, a walkman made in Japan has automatic rewinding capability, but an imported walkman from the NIEs often does not.

What are the factors that contributed to the recent decline in export volume and the expansion in imports, especially in manufactured imports? Apparently the appreciation of the yen contributed to such structural change by affecting relative prices. However, the appreciation of the yen does not seem to be the only factor. Indeed, according to a decomposition analysis of the factors responsible for the increase in manufactured imports for 1987, the Economic Planning Agency found that the price effect, coming mainly from the appreciation of the yen, and the income effect only explained a part of the increase in manufactured imports [7]. In addition to the price and income effect attributable to the appreciation of the yen, globalization of the Japanese firms, which in fact was accelerated by the yen appreciation, contributed substantially to the change in the pattern of foreign trade. Two of the most important objectives of the firms pursuing globalization are to improve efficiency through cost minimization, and to secure the market for its products. Consequently, in order to minimize costs and maximize sales, a firm pursues various strategies such as establishing production and sales facilities overseas through foreign direct investment (FDI), expanding the overseas network for the procurement of intermediates and for the collection of information, frequently through establishing cooperative relationships with foreign firms.

The effect of FDI on exports may be unfavorable, especially in the long run, because local production replaces exports. However, in the short run FDI is likely to increase exports from the home country as regard the parts and equipment necessary for local production. FDI not only replaces exports, but also increases

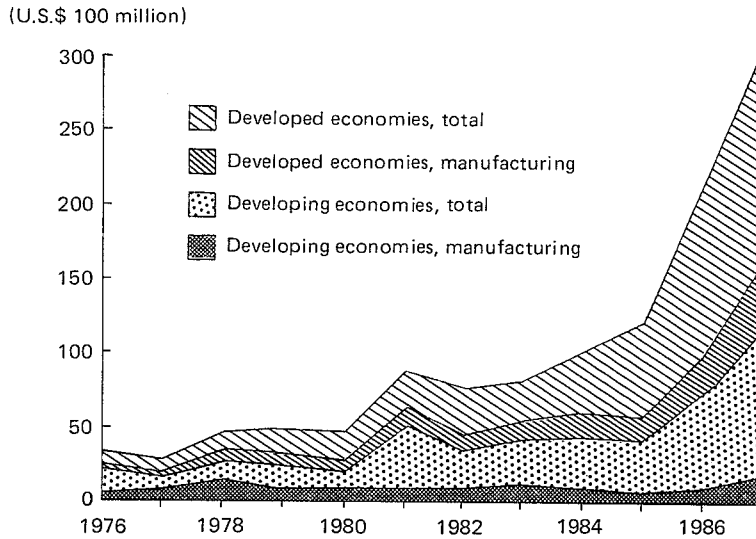
TABLE I
IMPORT PENETRATION RATIO OF THE SELECTED PRODUCT

	1980	1985	1986	1987
				(%)
Vinyl chloride				
World	2.6	6.9	11.4	7.7
Korea	0.6	2.7	4.9	2.2
Taiwan	0.9	0.9	1.1	0.3
Metal working machine				
World	6.2	n.a.	14.9	n.a.
Korea	0.5	n.a.	0.5	n.a.
Taiwan	2.9	n.a.	9.1	n.a.
Electric calculator				
World	12.9	11.8	44.9	49.1
Korea	11.2	0.3	0.2	4.1
Taiwan	1.5	9.2	23.4	33.7
Black and white TV				
World	1.5	1.2	14.3	54.4
Korea	0.8	1.1	1.8	14.8
Taiwan	0.7	0.1	12.5	39.5
Radio-cassette recorder				
World	4.6	3.8	15.3	47.5
Korea	1.3	1.0	1.2	2.2
Taiwan	1.7	1.8	3.5	10.3
Electric fan				
World	21.7	25.4	30.1	54.8
Korea	2.9	4.8	5.3	17.0
Taiwan	16.5	16.7	21.1	32.1
VCR				
World	0.5	0.9	0.2	1.6
Korea	n.a.	n.a.	n.a.	1.4
Taiwan	n.a.	n.a.	n.a.	n.a.
Piano				
World	0.8	1.4	2.0	3.8
Korea	0.4	0.5	1.3	2.9
Taiwan	0.0	n.a.	n.a.	n.a.
Steel bar				
World	0.0	0.2	0.6	1.6
Korea	0.0	0.2	0.4	1.1
Taiwan	0.0	n.a.	n.a.	n.a.

Sources: [9, January–June 1987 edition (1987) and 1987 edition (1988)]; [4].

Note: Import penetration ratio (IPR) = import / (domestic production – export + import). For electric calculator, IPR = import / domestic production.

Fig. 3. Outflow of Japanese Foreign Direct Investment



Source: [8].

imports from the host country, once the comparative advantage is in favor of the host country. The expansion of the procurement network for parts undoubtedly increases manufactured imports, as a firm adopting such a strategy purchases intermediate inputs from the cheapest sources.

Beside the globalization of Japanese firms, the acquired taste of Japanese consumers for foreign manufactured products, especially taste for low-priced, low-quality manufactured imports, appears to have contributed to the increase in manufactured imports.

These factors contributing to the structural change in the pattern of foreign trade appear to have already existed, and it seems that the appreciation of the yen only acted as a catalyst which speeded up the process. As Japanese FDI appears to have played an important role in creating structural change in the pattern of foreign trade as discussed above, in the rest of this section we shall empirically examine the pattern of Japanese FDI and its effect on foreign trade in the light of the current appreciation of the yen.

B. *Foreign Direct Investment*

Japanese FDI has been rising rapidly since the early 1980s, and the rate of increase was accelerated in 1985 as shown in Figure 3. The rapid increase starting in 1985 clearly is attributable to the appreciation of the yen. The sectoral composition as well as the destination of Japanese FDI changed over time. During the 1960s a large portion of Japanese FDI was distributed to the exploitation of natural resources, mainly in the Asian economies, while during

the 1970s a large number of textile producers undertook FDI in the Asian economies, in order to take advantage of the cheap labor. Toward the end of 1970s foreign direct investment in manufacturing began to be undertaken in developed economies, mainly in order to deal with protection policies adopted by the developed economies. During the 1980s, not only the magnitude of FDI increased remarkably, but the composition and destination of FDI changed notably. The share of non-manufacturing increased, and the share of developed economies rose. In spite of a relative decline in the share of manufacturing, as well as in the share of developing economies in the Japanese FDI, the absolute value of FDI in manufacturing as well as in developing economies has been increasing substantially, particularly since 1985.

As for the motive of Japanese FDI in manufacturing, there appears to be an interesting contrast between FDI undertaken in developed economies and that in developing economies. For FDI in developed economies, where the application of protection policies has been rising, maintaining the market share is an important motive, whereas in developing economies, especially those of the Asian NIEs and of ASEAN, exploitation of comparative advantage in production appears to be an important motive. Because of these characteristics of Japanese FDI in developed and developing economies the expansion of Japanese FDI is likely to reduce Japan's exports to developed economies, while at the same time increasing manufactured imports from developing economies. Examples of such FDI in developed economies include automobiles in the United States and Europe, whereas examples of such FDI in developing economies include electronics and electric industries in the Asian NIEs and ASEAN. It should be noted here that the sectoral distribution of Japanese FDI undertaken in the Asian NIEs has been shifting from labor-intensive manufacturing sectors to technology-intensive sectors along with a similar shift in comparative advantage in these economies. Such a shift stems from rising wages and the appreciation of the currencies of the Asian NIEs. Instead of the Asian NIEs, the ASEAN economies have been the recipients of Japanese FDI in labor-intensive manufacturing. Indeed, not only Japan, but also the Asian NIEs have been undertaking FDI in labor-intensive manufacturing in ASEAN.

We should note that the expansion of Japanese FDI was brought about not only by the supply-side factors discussed above, but also by the demand-side factors. The demand-side factors, which are frequently argued to have contributed to the increasing attractiveness of the Asian NIEs and ASEAN as a host economy for FDI, include favorable economic performance, political stability, and development policies encouraging export as well as inflow of foreign direct investment.⁵

IV. THE EFFECT OF THE APPRECIATION OF THE YEN ON EMPLOYMENT

One of the reasons that currency appreciation attracts so much attention is its potentially unfavorable effect on employment. However, currency appreciation is only one of the factors that affect employment. In this section we analyze the

⁵ For a concise description of the policies adopted in ASEAN economies see [12].

source of changes in employment by decomposing the change in employment into changes in the following four factors: domestic demand, exports, imports, and labor productivity. The analysis is performed for the two recent periods of substantial yen appreciation: from the fourth quarter of 1975 to the fourth quarter of 1978 (IV/1975–IV/1978, hereafter), and from the first quarter of 1985 to the first quarter of 1988 (I/1985–I/1988, hereafter). These two periods correspond to the period of substantial appreciation of the yen; during the first period the yen appreciated in value against the U.S. dollar by 37.2 per cent, while during the second period the rate of appreciation was about 50 per cent. In this section we first describe the methodology of the decomposition and the data, and then discuss the results of the decomposition.

A. Methodology and Data

Starting with two equations (1) and (2), which are respectively the balance equation between supply and demand, and the definition of labor productivity, one obtains the decomposition formula as equation (3), after some manipulations.⁶

$$X = D + E - M, \quad (1)$$

$$P = X/L, \quad (2)$$

$$\frac{\dot{L}}{L} = \frac{\dot{D}}{D} \cdot \frac{D}{X} + \frac{\dot{E}}{E} \cdot \frac{E}{X} - \frac{\dot{M}}{M} \cdot \frac{M}{X} - \frac{\dot{P}}{P}, \quad (3)$$

where X = output,

D = domestic demand,

E = exports,

M = imports,

P = labor productivity,

L = labor,

$\dot{}$ = growth rate (e.g., $\frac{\dot{A}}{A}$ is a growth rate in A).

What equation (3) indicates is that an expansion of domestic demand and exports increases employment, whereas an import expansion and increase in labor productivity reduce employment, given that other things remain constant. Let us examine the expected impact of a currency appreciation on employment by using equation (3). A currency appreciation generally results in the expansion of imports and a reduction in exports. The expansion of imports and reduction of exports, in turn, reduce the level of effective demand. In addition, an outflow of foreign direct investment, which may be induced by a currency appreciation, possibly leads to a reduction in domestic investment, resulting in a further decline in the level of domestic demand. Moreover, with the passage of time, overseas production from direct investment starts, possibly leading to a reduction in exports from the capital exporting economy and to the expansion of imports to that economy. These discussions indicate that the appreciation of the Japanese yen would lead to a

⁶ This methodology is adopted from Frank [6].

reduction in the contribution of domestic demand and of export demand on employment. In contrast, the appreciation of the yen would increase the negative contribution of import expansion on employment. As for labor productivity, the appreciation of the yen is likely to force Japanese firms to improve productivity to deal with increased foreign competition, thereby resulting in an increase in the magnitude of the negative contribution of labor productivity on employment.

A few observations should be noted regarding the methodology. First, the methodology is similar to growth accounting exercises that decompose observed changes into their sources. As such, it cannot address the question of a causal relationship among the variables. For such a purpose, a model consisting of a system of behavioral equations has to be constructed. Second, only the direct effect of the changes in the right-hand-side variables on employment is taken into account, and the indirect effect through inter-industry relationship is not incorporated. However, such treatment may be justified for an analysis of the changes for a relatively short period, as it is considered to take some time for the changes in technological relationship, as expressed in inter-industry relationship, to be realized. Finally, it should be noted that the changes observed during this period cannot be ascribed solely to the appreciation of the yen; other factors such as changes in macroeconomic policies would also influence them.

In carrying out the decomposition we compute the growth rates by taking natural logarithms of the values of each variable for the two end points, and for the weights attached to the growth rates, the simple averages of the values for the two end points are used. It should be noted that the contribution of changes in labor productivity is obtained as a residual.

In the calculation employment is measured by the total number of hours worked, which is constructed by multiplying the number of workers by the number of working hours. Data for these variables are taken from *Monthly Labor Statistics* (the Ministry of Labor). In the calculation production, exports and imports in constant 1980 prices are used. Domestic demand is obtained by subtracting the net export surplus (export—imports) from domestic production. Data for domestic production came from the *Census of Manufactures, An Analysis of Production Activity in Mining and Manufacturing*, and *Monthly Statistics of Japan*. The first two publications are from the Ministry of International Trade and Industry, and the third publication is from the Statistics Bureau, Management and Coordination Agency. Data on exports and imports are taken from *The Summary Report on Trade of Japan* (Japan Tariff Association). Wholesale price indices taken from *Price Indices Annual* and *Price Indices Monthly*, both of which are published by the Bank of Japan, are used to obtain the production figures in constant 1980 prices, while unit price indices from *The Summary Report on Trade of Japan* are used to obtain the trade figures in constant 1980 prices.

B. *The Results of the Decomposition of the Changes in Employment*

The results of the decomposition are shown in Table II.⁷ For the IV/1975–IV/1978 period, employment declined at an annual rate of 0.1 per cent in total

⁷ Kohama [10] performs a decomposition analysis of the change in production.

TABLE II
SOURCES OF CHANGES IN EMPLOYMENT IN JAPAN
(Annual Growth Rate)

	Employment	Contribution to the Changes in Employment			
		Domestic Demand	Exports	Imports	Productivity
(%)					
(A) IV/1975-IV/1978					
Food	2.0	2.2	0.0	-0.1	-0.2
Textiles and clothing	-4.4	1.5	-0.5	-0.9	-4.5
Wood products	-1.7	2.2	0.0	-1.5	-2.4
Paper and pulp	-0.2	4.5	0.1	-0.4	-4.4
Chemicals	-4.9	9.9	0.7	-1.3	-14.2
Petroleum and coal products	-5.0	2.8	0.1	-0.4	-7.5
Ceramics	-0.3	6.5	0.2	-0.7	-6.3
Iron and steel	-2.2	2.8	1.3	0.0	-6.4
Nonferrous metals	-2.7	10.4	0.5	-2.2	-11.4
Metal products	-3.5	10.1	0.3	0.0	-13.9
General machinery	-3.3	5.1	2.5	-0.3	-10.6
Electric machinery	1.0	13.3	1.8	-0.3	-13.8
Transport machinery	-0.6	1.0	0.8	-0.6	-1.8
Precision instruments	2.7	15.1	4.3	-0.7	-15.9
Manufacturing total	-0.1	5.2	0.7	-0.6	-5.5
(B) I/1985-I/1988					
Food	2.5	1.6	0.0	-0.5	1.3
Textiles and clothing	0.9	2.4	-0.8	-4.0	3.3
Wood products	3.0	4.3	0.1	-1.9	0.5
Paper and pulp	4.1	6.0	0.1	-0.5	-1.6
Chemicals	1.2	4.7	0.8	-1.3	-3.0
Petroleum and coal products	-4.8	2.5	0.3	-6.4	-1.2
Ceramics	0.9	3.6	-0.3	-0.1	-2.2
Iron and steel	-3.3	4.2	-1.7	-1.3	-4.5
Nonferrous metals	-0.9	4.9	0.0	-2.9	-2.9
Metal products	0.6	4.5	-0.6	-0.3	-2.9
General machinery	3.0	-0.1	2.7	-0.6	1.0
Electric machinery	4.8	9.3	1.8	-0.8	-5.6
Transport machinery	-0.4	2.4	-0.4	-0.4	-2.1
Precision instruments	-3.3	7.0	-1.3	-0.1	-8.9
Manufacturing total	1.8	4.5	0.4	-1.2	-1.9

Source: Own calculations. See text for data sources and methodology.

manufacturing. Indeed, employment declined in eleven out of fourteen sectors under analysis. Food, electrical machinery, and precision instruments are the only three sectors that experienced an increase in employment. Among the sectors that experienced a decline in employment, the rate of decline was particularly significant in petroleum and coal products, chemicals, and textiles, each one of

which recorded an annual rate of decline in excess of 4 per cent. The rate of decline in employment was also high in metal products and general machinery, each recording an annual rate of decline around 3.5 per cent.

As for the sources of the changes in employment, they were largely contributed to by expansion in domestic demand and from changes in labor productivity: that of domestic expansion being positive, and that of the increase in labor productivity being negative. Such a pattern was particularly noticeable in precision instruments, electrical machinery, nonferrous metals, metal products, and chemicals. In contrast to the significant contribution of domestic demand expansion and from the change in labor productivity, the contribution of changes in either export expansion or import expansion was relatively small in these sectors. For example, employment in precision instruments increased at an annual rate of 2.7 per cent. For this increase in employment, the positive contributions of demand expansion and export expansion were respectively 15.1 and 4.3 per cent, while the negative contributions of labor productivity and import expansion were respectively -15.9 and -0.7 per cent.

One also notices that domestic demand expansion contributed positively, and labor productivity contributed negatively in all fourteen sectors, indicating that in the period of the yen appreciation between IV/1975 and IV/1978 not only domestic demand but also labor productivity increased in all manufacturing sectors. The contribution from export expansion was positive, although small, in all the manufacturing sectors except textiles, indicating that exports expanded in most sectors. In contrast, the contribution of import expansion was negative for most sectors, reflecting an expansion in imports. The negative contribution was especially large for nonferrous metals, which appears to have become less competitive as a result of appreciation.

Unlike the IV/1975–IV/1978 period the results for the period covering I/1985–I/1988 show that employment in manufacturing increased at an annual rate of 1.8 per cent. Out of fourteen manufacturing sectors, nine sectors registered an increase in employment: a decline in employment was observed for petroleum and coal products, iron and steel, nonferrous metals, transport machinery, and precision instruments. The rate of decline in employment was particularly substantial in petroleum and coal products (-4.8 per cent), iron and steel (-3.3 per cent), and precision instruments (-3.3 per cent). Food and electrical machinery are the only two sectors that experienced an increase in employment in both of the two periods under study.

As for the sources of the change in employment for total manufacturing for I/1985–I/1988, one notices that the sign of each contribution was the same as that for IV/1975–IV/1978, although the absolute size of the contribution was larger during the earlier period except for that associated with the changes in imports. A decline in the size of the contribution from domestic demand expansion over a period of time may reflect not only relatively weak demand in I/1985–I/1988, but also a shift in demand from manufacturing to services during that period. Unlike the positive contribution observed for all the sectors for IV/1975–IV/1978, the contribution of demand expansion was negative for general machinery

for I/1985–I/1988. Domestic demand contributed significantly in electric machinery (9.3 per cent), precision instruments (7.0 per cent), and paper and pulp (6.0 per cent).

The contribution of export expansion was smaller for I/1985–I/1988, compared to that for IV/1975–IV/1978. Furthermore, the number of sectors showing the negative contribution of exports increased from one in IV/1975–IV/1978 to six in I/1985–I/1988. Of the six sectors that recorded a negative contribution, the largest was for iron and steel, registering -1.7 per cent. It should also be noted that it was only the textiles sector that experienced negative contribution from export expansion in both sample periods.

As for the contribution from import expansion, one finds that the size of the contribution for total manufacturing increased in absolute terms between the two periods. Moreover, for I/1985–I/1988 the contribution from import expansion was negative for all the sectors while for IV/1975–IV/1978 two sectors showed a positive contribution. The size of the negative contribution was especially high for petroleum and coal products (-6.4 per cent) and textiles and clothing (-4.0 per cent). Finally, the contribution of the changes in labor productivity was shown to be relatively small compared to that for the earlier period. In addition, unlike the uniformly negative contribution observed for all the sectors in IV/1975–IV/1978, the direction of its contribution for I/1985–I/1988 was mixed: four sectors showing positive contributions, while the remaining nine sectors showed negative contributions.

A comparison of the results from the two sample periods reveals some interesting observations. First, the appreciation of the yen affected export expansion more severely in I/1985–I/1988 than in IV/1975–IV/1978. This finding may indicate that the Japanese producers of exports still had some breathing space despite the appreciation of the yen in IV/1975–IV/1978, but such a breathing space was not present for I/1985–I/1988. More specifically, the Japanese producers could cope with the appreciation of the yen by improving efficiency and/or lowering profitability in IV/1975–IV/1978. However, faced with the further appreciation of the yen in I/1985–I/1988, the Japanese producers found it difficult to improve efficiency further and/or to further reduce profitability. This point may be clearly shown in the decline in the contribution from productivity (in absolute value) between the two periods. Indeed, as mentioned above, during I/1985–I/1988 labor productivity actually declined in four sectors. A similar argument regarding the changes in efficiency and profitability may be applied to explain the more serious effect of import expansion in I/1985–I/1988 compared to that for IV/1975–IV/1978. These findings appear to indicate that Japan lost its comparative advantage in the production of manufactured products in general more seriously in I/1985–I/1988 than in IV/1975–IV/1978.

Second, at sectoral level, one observes a pattern of the changes in comparative advantage, which is consistent with the earlier discussions based on the changing pattern of supply and demand. Specifically, labor-intensive sectors such as textiles, and low-tech-intensive sectors such as iron and steel appear to be losing their comparative advantage, as shown by the negative contribution of export expansion

as well as the increasingly negative contribution of import expansion. In contrast, a sign of losing comparative advantage does not seem to be present for some high-tech. sectors such as general machinery and electric machinery.

V. CONCLUSIONS

We have seen that the appreciation of the yen speeded up the process of structural change in production and foreign trade. Specifically, the appreciation led to a decline in the volume of exports and to a reduction in the ratio of exports to production. In contrast, the appreciation of the yen resulted in an increase in the volume of imports and also in the ratio of imports to consumption. These changes are caused by a shift in the pattern of comparative advantage, which in turn has been accelerated by the appreciation of the yen. The shift in the pattern of comparative advantage is reflected in the changes in the structure of production and foreign trade. The share of light manufactures and that of low-tech.-intensive heavy manufactures declined and the share of high-tech.-intensive heavy manufactures increased in production and exports. In contrast, the share of labor-intensive light manufactures and that of low-tech.-intensive heavy manufactures in manufacturing imports increased.

In addition to the price effect due to the appreciation, globalization of Japanese firms, which was precipitated by the appreciation, contributed to the structural change. Globalization of Japanese firms has been advancing, especially in the form of foreign direct investment, in order to attain the most efficient production arrangement and to expand the market share. For example, the following type of arrangement in production has been developing for various products.⁸ A product is developed in developed economies, mainly in Japan in the case of Japanese firms, intermediate goods needed for the production of the new product are produced in the Asian NIEs, and the final product is assembled in ASEAN to be sold in the developed economies, including Japan.

As a result of these structural changes, frictional unemployment increased. Moreover, pleas for protection policies have been voiced in textiles and other labor-intensive light manufacturing sectors. However, the Japanese government has not been responsive to these pleas. Instead, to alleviate the problem, the Japanese government has been pursuing expansionary macroeconomic policies, with an emphasis on the expansion of domestic demand. Although such short-run demand management policy would reduce the cost incurred from the unemployment of resources, the government is expected to carry out long-run, supply-oriented policies more rigorously with a view toward the desirable pattern of international division of labor in the next century. Policies in this category would include encouraging the development of social goods such as human capital through R & D. This does not mean that the Japanese government has not been active in promoting R & D. On the contrary, the government has played a crucial role in improving the technological level, as was discussed in Section II. What

⁸ For the case of the Japanese automobile industry, see [16].

is likely to happen in the future is a change in the type of government support in R&D. As the technological level of Japan approaches closer to the frontier, it will become difficult for the government to identify the type of technology to be developed and to formulate a strategy for achieving that goal. Therefore, instead of playing a leading role through organizing R&D projects involving private firms, previously a typical form of government support for R&D, the government's role as a provider of the R&D fund to the private firms and research institutions would become more important in the future, giving the initiative in R&D to the private sector.

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