# THE DUAL–INDUSTRIAL GROWTH IN PREWAR JAPAN

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## I. INTRODUCTION

THE purpose of this paper is to investigate the growth process of the Japanese industrial sector in the prewar period, using the theory of dual–industrial growth as a framework. The growth of the Japanese industrial sector in the prewar period has been regarded as a typical case of successful industrialization of a less developed country. Here we focus on the demand side to examine the mechanism of the generation of investment opportunities in the industrial sector.

Inada, Sekiguchi, and Shōda [3] have analyzed the process of industrial development in prewar Japan based on a two-sector model which consists of the light industry sector (hereafter X sector) and the heavy and chemical industry sector (hereafter Z sector). According to their analysis, industrial development in prewar Japan was successful because of an increasingly higher percentage of investment in the Z sector, where economies of scale were operating.

In their model, the demand-side factor (terms of trade) and the supply-side factor (economies of scale) determine the profit rate of each sector; investment is allocated between the two sectors according to the difference in the profit rates; and investment opportunities are represented by profit rates. But the way investment opportunities are generated is not considered. Though demand-side factors are indirectly reflected in the assumption of the terms of trade, the development in the demand side in the dynamic process of industrialization is almost completely absent. Moreover, the relationship between the two sectors is considered only in terms of a trade-off in investment allocation. The demand-supply linkages between the sectors are not considered.

In this paper, we center our argument on the demand side (i.e., how investment opportunities are generated) which Inada, Sekiguchi, and Shōda ignored. Here we intend to indicate what kind of demand contributed to the rapid growth of the industrial sector and to show the significance of the linkages on the demand side between the X and Z sectors. It will be suggested that the expansion of the X sector played a significant role as a demand-side factor which fostered the expansion of the Z sector. We will point out the interaction between the two sectors as a stimulus for the generation of investment opportunities, as is emphasized by the theory of dual–industrial growth.

The policy implication also reflects the difference between the two approaches. In their analysis, Inada, Sekiguchi, and Shōda show that, to succeed in *take-off*, it is necessary to expand the Z sector *artificially* by protection policy so that it can realize economies of scale. From our point of view, to realize economies of scale in the Z sector, emphasis will be placed on the need to expand the X sector, which demands the products of the Z sector. This implies that some policy measures should be taken to promote development with a balanced view towards the pattern of dual–industrial growth. These points need to be noted in relation to the contrast between export-oriented industrialization and import-substitution industrialization in the controversy on development policy, and to the dual–industrial growth policy which is the integration of these two industrialization strategies. We will refer to this point again in the last part of this paper.

## II. THE PATTERN OF JAPAN'S INDUSTRIAL DEVELOPMENT

### A. Sector Classification

In order to identify the pattern of dual–industrial growth, here we classify manufacturing industries mainly in relation to performance in international trade. We adopt two indicators as the criteria for classification: (1) the export ratio, which is defined as the ratio of export to production, and (2) the import ratio, which is defined as the ratio of import to domestic demand [i.e., production + import − export] (see Tables I and II). In prewar Japan, the relative levels of both ratios for individual industries in relation to those ratios for the total manufacturing sector remained unchanged, except for a few industries for short periods of time. On the whole, therefore, we can apply a single scheme of grouping throughout the whole prewar period under study.

The manufacturing sector is decomposed and classified into four groups: the domestic-market-oriented light industry group (LD group), the export-oriented light industry group (LE group), the processing-type heavy and chemical group (HP group), and the machinery group (M group). The LD group includes industries whose export ratios and import ratios are lower than the average for total manufacturing. This group consists of food, wood products, and printing. The only exception is the period from the 1920s to the 1930s, when the import ratios of wood products slightly exceeded the average level for manufacturing.

The LE group consists of industries whose export ratios are higher and import ratios lower than the mean. Textiles, ceramics, and others are included in this group. The fact to be noted is that, until the beginning of the 1890s the import ratio of textiles had been higher than that of total manufacturing, that is to say, both export and import ratios were higher than those for total manufacturing in this period. However, thereafter the import ratio of this group stayed much lower than the manufacturing average. The export ratio for ceramic industry is not much higher than that for total manufacturing throughout the period, and some-times lower. The reason for inclusion of the ceramic industry in this group is that the ceramic industry includes pottery, porcelain, and glass, whose export ratios were higher than average.[1]

Fig. 1. Long-term Trend of the Value of Production of the Manufacturing Sector
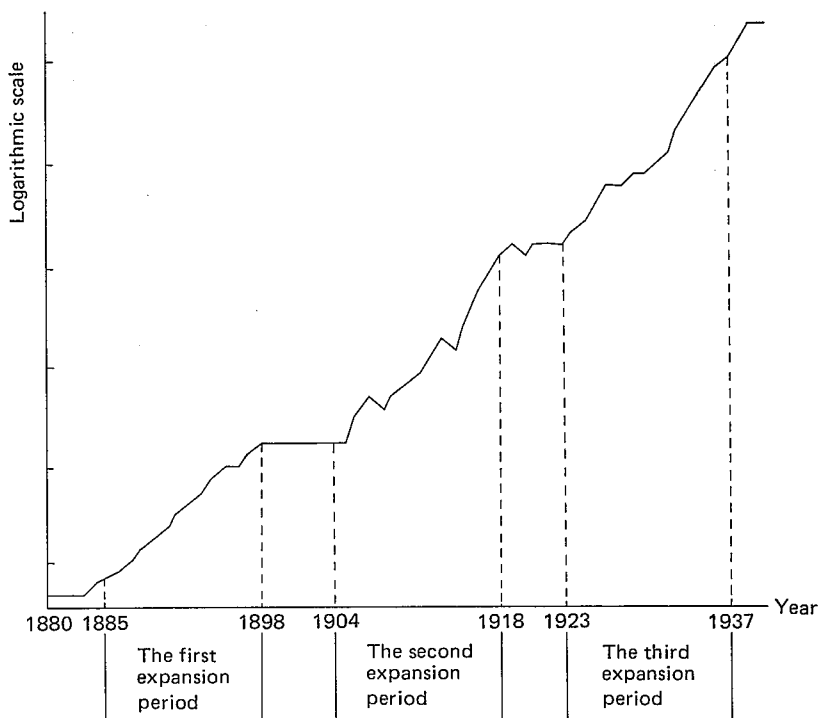


Source: [7, Table A21].
Note: The vertical axis indicates natural logarithms of the real production of the manufacturing sector in the 1934–36 constant prices.

The remaining industries—chemicals, metals, and machinery—comprise the heavy and chemical group. These industries are characterized by high import ratios. We divide them into two groups according to the properties of the products. The first group consists of chemicals and metals, which are materials-producing industries. Machinery, which is an investment-goods-producing industry, is classified as the second group. We call the former, according to the convention, processing-type heavy and chemical group (HP group) and the latter, machinery group (M group).

B. *Periodization and the Pattern of Industrialization*

In this subsection, we investigate the periods in which rapid growth in production was observed, identify the pattern of industrialization, and examine whether the mechanism of dual–industrial growth was at work.

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[1] The ceramic industry includes the cement industry, which is a processing-type and highly capital-intensive industry. In this paper, however, I emphasize the export orientation of the ceramic industry to center arguments on the demand side.

TABLE I

EXPORT RATIOS FOR MANUFACTURING INDUSTRIES

| | Food Products | Lumber and Wood Products | Textiles | Stone, Clay, and Glass Products | Others | Chemicals | Metals | Machinery | Total |
|---|---|---|---|---|---|---|---|---|---|
| 1874–78 | 0.7 | 0.5 | 20.3 | 2.9 | 6.1 | 2.2 | 10.3 | 0.0 | 6.2 |
| 1879–83 | 0.5 | 0.4 | 15.7 | 7.7 | 7.3 | 3.4 | 12.2 | 0.0 | 6.2 |
| 1884–88 | 0.6 | 0.7 | 20.4 | 18.8 | 13.2 | 5.5 | 26.7 | 0.5 | 9.2 |
| 1889–93 | 0.6 | 1.4 | 18.2 | 17.4 | 19.7 | 8.9 | 39.5 | 1.0 | 11.1 |
| 1894–98 | 0.8 | 1.6 | 19.9 | 15.9 | 32.5 | 10.8 | 36.1 | 1.5 | 12.6 |
| 1899–1903 | 1.7 | 3.8 | 31.9 | 17.4 | 39.2 | 13.5 | 48.0 | 3.0 | 17.1 |
| 1904–8 | 3.3 | 11.2 | 40.1 | 26.5 | 46.8 | 14.9 | 46.3 | 5.3 | 20.6 |
| 1909–13 | 3.5 | 13.2 | 39.7 | 19.8 | 45.6 | 15.0 | 39.7 | 4.3 | 20.7 |
| 1914–18 | 5.8 | 15.1 | 41.2 | 24.6 | 51.7 | 20.9 | 25.8 | 6.4 | 23.2 |
| 1919–23 | 3.5 | 8.6 | 34.2 | 18.9 | 33.2 | 13.7 | 12.9 | 4.2 | 18.2 |
| 1924–28 | 4.6 | 7.7 | 42.1 | 20.6 | 32.9 | 13.8 | 9.9 | 5.8 | 21.3 |
| 1929–33 | 5.7 | 7.3 | 36.4 | 24.0 | 40.3 | 12.6 | 11.7 | 8.5 | 19.0 |
| 1934–38 | 8.2 | 9.6 | 34.4 | 25.3 | 41.6 | 13.2 | 11.9 | 10.1 | 18.4 |

Note: Export ratio ≡ export/output.

TABLE II

IMPORT RATIOS FOR MANUFACTURING INDUSTRIES

| | Food Products | Lumber and Wood Products | Textiles | Stone, Clay, and Glass Products | Others | Chemicals | Metals | Machinery | Total |
|---|---|---|---|---|---|---|---|---|---|
| 1874–78 | 5.0 | 0.3 | 30.5 | 5.3 | 9.3 | 5.7 | 23.6 | 31.0 | 13.1 |
| 1879–83 | 3.9 | 0.5 | 18.3 | 2.9 | 4.4 | 3.9 | 20.1 | 12.5 | 8.6 |
| 1884–88 | 5.1 | 0.3 | 17.2 | 6.6 | 5.2 | 6.9 | 32.6 | 41.0 | 10.9 |
| 1889–93 | 6.0 | 0.2 | 12.1 | 6.4 | 5.2 | 9.7 | 42.0 | 43.8 | 10.9 |
| 1894–98 | 7.4 | 0.1 | 10.6 | 6.8 | 7.1 | 15.8 | 57.2 | 53.7 | 13.5 |
| 1899–1903 | 7.3 | 0.2 | 10.4 | 8.9 | 7.5 | 22.7 | 62.5 | 42.9 | 14.3 |
| 1904–8 | 6.8 | 0.4 | 13.6 | 10.8 | 9.6 | 28.8 | 64.2 | 32.1 | 16.9 |
| 1909–13 | 6.9 | 0.6 | 8.1 | 7.7 | 8.2 | 29.0 | 57.6 | 23.1 | 14.7 |
| 1914–18 | 6.9 | 1.2 | 3.0 | 4.3 | 6.0 | 26.3 | 31.1 | 7.6 | 11.3 |
| 1919–23 | 8.1 | 7.5 | 5.2 | 3.9 | 5.9 | 27.1 | 35.7 | 14.7 | 12.7 |
| 1924–28 | 8.5 | 15.2 | 6.9 | 6.0 | 8.2 | 25.4 | 27.7 | 18.9 | 13.2 |
| 1929–33 | 8.8 | 7.8 | 4.0 | 6.3 | 9.0 | 18.2 | 17.7 | 12.2 | 10.1 |
| 1934–38 | 8.5 | 3.4 | 2.1 | 5.0 | 6.0 | 13.7 | 17.8 | 7.1 | 9.0 |

Note: Import ratio ≡ import/(domestic demand) = import/(output − export + import).

TABLE

THE PROPORTIONS AND THE CONTRIBUTION

| | LD | | | | LE | |
| --- | --- | --- | --- | --- | --- | --- |
| | Subtotal | Food Products | Lumber and Wood Products | Printing and Publishing | Subtotal | Textiles |
| Proportions | | | | | | |
| 1885 | 58.2 | 51.7 | 6.2 | 0.3 | 27.2 | 14.8 |
| 1898 | 53.2 | 48.4 | 3.9 | 0.9 | 35.5 | 27.1 |
| 1904 | 51.4 | 45.2 | 4.6 | 1.6 | 31.0 | 22.4 |
| 1918 | 34.2 | 29.1 | 2.3 | 2.8 | 32.7 | 25.7 |
| 1923 | 38.7 | 33.0 | 2.7 | 3.0 | 36.2 | 29.6 |
| 1937 | 20.2 | 15.1 | 2.7 | 2.4 | 35.5 | 29.4 |
| Contribution rates | | | | | | |
| 1885–98 | 49.6 | 46.1 | 2.3 | 1.2 | 41.4 | 35.9 |
| 1904–18 | 24.6 | 20.1 | 1.1 | 3.4 | 33.7 | 27.6 |
| 1923–37 | 9.3 | 4.6 | 2.7 | 2.0 | 35.1 | 29.2 |

Source: Calculated from [7, Table A21].
Note: Based on real production in terms of the 1934–36 constant price.

In the history of the industrialization of prewar Japan, we find a cyclical pattern in which an expansion period of around fifteen years alternates with a stagnant period of around five years (Figure 1). There were three expansion periods, from 1885 to 1898, from 1904 to 1918, and from 1923 to 1937 (hereafter we call each period the first, the second, and the third expansion period). The growth rates of industrial production in these periods are 6 to 7 per cent per annum on average, while the growth rates for the stagnant periods between three expansion periods are as low as 0 to 2 per cent per annum.

Now we will examine the sectoral proportions in industrial production at the beginning and end of the three expansion periods, and their contributions to the growth in overall industrial production in these periods (Table III).

1. *Sectoral proportions*

The percentage share of the LD group was very high and did not decline much during the first period. The most salient change during this period is the increase in the share of the LE group, which was caused solely by the sudden rise in the share of textiles. The share of the HP group fell and the share of the M group rose, though the latter still remained at an extremely low level.

In the stagnant period between the first and the second expansion periods, the share of textiles fell, while that of the heavy and chemical industries rose.

During the second expansion period, the share of the LD group fell considerably and that of the LE group rose only slightly. The shares of the HP group and, more markedly, the M group rose.

In the stagnant period between the second and third expansion periods, decline

III

RATES BY INDUSTRY GROUP AND INDUSTRY

(%)

| Stone, Clay, and Glass Products | Others | HP | | | | M | Total |
| | | Subtotal | Chemicals | Iron and Steel | Nonferrous Metals | Machinery | |
|---|---|---|---|---|---|---|---|
| 1.3 | 11.2 | 13.2 | 11.3 | 0.3 | 1.6 | 1.4 | 100.0 |
| 1.4 | 7.0 | 8.8 | 7.5 | 0.4 | 0.9 | 2.5 | 100.0 |
| 1.7 | 6.9 | 12.9 | 10.9 | 0.8 | 1.2 | 4.7 | 100.0 |
| 2.0 | 5.0 | 17.2 | 8.7 | 2.6 | 5.9 | 15.9 | 100.0 |
| 2.4 | 4.2 | 16.5 | 9.2 | 3.3 | 4.0 | 8.6 | 100.0 |
| 2.7 | 3.4 | 29.9 | 17.3 | 9.5 | 3.2 | 14.4 | 100.0 |
| 1.5 | 4.0 | 5.7 | 4.8 | 0.4 | 0.4 | 3.3 | 100.0 |
| 2.1 | 4.0 | 19.6 | 7.5 | 3.6 | 8.5 | 22.1 | 100.0 |
| 2.9 | 3.0 | 37.8 | 22.0 | 13.1 | 2.7 | 17·8 | 100.0 |

in the shares of the HP and M groups (whose share rose during the second expansion period) can be observed. The decline was large in machinery and nonferrous metals, whose shares rose significantly during the second period. On the other hand, chemicals and iron and steel showed a slight rise in this period.

The third expansion period is similar to the second, that is, the share of the LD group fell considerably and that of the LE group remained almost unchanged. One characteristic of this period is a large increase in the share of the HP group. This is because both the shares of chemicals and iron and steel rose considerably. The rise of the share of the M group during this period was not small, but it was not as large as the rise in the second expansion period, and the share of machinery at the end of the third expansion period stood at less than the half that of the HP group.

2. *Contribution to growth*

We examine now the contribution of each group to the growth of the gross real output of the whole manufacturing sector.

During the first expansion period, the contributions of the LD and LE groups were exceedingly large. The share of food was largest in the LD group and that of textiles in the LE group. More than 80 per cent of the growth of the whole manufacturing is attributed to the growth of these two industries.

During the second expansion period the contributions of the LD and LE groups fell, while those of the HP and M groups rose significantly. All of these four groups made significant contributions to the growth of manufacturing industry.

During the third expansion period, the contributions of the LE and HP groups

TABLE

GROWTH RATES OF INDUSTRY

| | LD | | | | LE | |
| | Subtotal | Food Products | Lumber and Wood Products | Printing and Publishing | Subtotal | Textiles |
|---|---|---|---|---|---|---|
| 1885–98 | 4.9 | 5.0 | 2.8 | 11.4 | 8.8 | 11.2 |
| 1904–18 | 4.1 | 3.8 | 2.4 | 11.4 | 7.1 | 7.9 |
| 1923–37 | 2.0 | 1.0 | 8.1 | 4.2 | 7.0 | 7.1 |

Source: Calculated from [7, Table A21].
Note: Estimated by the ordinary least squares method.

were so high that more than 70 per cent of the growth of the manufacturing industry as a whole is attributed to the growth of these two groups. This means that the development pattern of the Japanese economy in this period can be explained in terms of the dual–industrial growth between these two groups, similar to the cases of Taiwan and the Republic of Korea in the 1960s and the 1970s.

One of the outstanding phenomena observed in the process of industrialization in prewar Japan is that the contribution of the M group exceeded that of the HP group in the second expansion period. As will be shown later, this was to some extent caused by the sudden increase in demand for ships during World War I. However, it seems that there is a long-term factor which caused the M group to "precede" the HP group. This point will be examined in the next part of the paper.

### C. Growth Performance by Industry and Group

First, let us identify the industries and groups which grew rapidly during each expansion period (Table IV).

During the first expansion period, the growth rates of printing, textiles, and machinery were far higher than the others. On the other hand, the growth rates of the industries in the HP group were lower than the average, and the growth rate of this group as a whole was extremely low. The groups which exhibited growth rates higher than the average were the M and LE groups. The growth rate of the LD group was lower than the average rate for the whole manufacturing.

During the second expansion period, the growth rates of nonferrous metals, iron and steel, and machinery were more than twice as high as the average for total manufacturing. The growth rate of chemicals was lower than the average, though it increased substantially from the first period. In contrast with this, the growth rates of both the LD groups and LE group were lower than the first period.

During the third expansion period, the growth rates of iron and steel and machinery declined, though they were still far higher than the average for total manufacturing. The growth rate of chemicals rose to a great extent, while nonferrous metals had its growth rate reduced cinsiderably. The HP group as a whole attained a higher growth rate than the previous period. The growth rates of the

IV

GROUPS, ANNUAL AVERAGE

(%)

| Stone, Clay, and Glass Products | Others | HP | | | | M | Total |
|---|---|---|---|---|---|---|---|
| | | Subtotal | Chemicals | Iron and Steel | Nonferrous Metals | Machinery | |
| 7.4 | 3.5 | 3.9 | 4.0 | 5.3 | 2.2 | 10.3 | 6.1 |
| 7.2 | 3.9 | 9.7 | 6.3 | 15.9 | 18.1 | 14.3 | 6.8 |
| 6.6 | 6.1 | 11.2 | 11.2 | 14.1 | 5.9 | 11.0 | 7.0 |

industries in the LD and LE groups were equal or less than the average. The growth rate of the LD group declined considerably.

We now summarize the long-term trend through the periods discussed above.

First, the growth rate of the manufacturing sector increased over time. This trend of acceleration for as long as fifty years indicates the strong momentum of the industrialization of prewar Japan.

Secondly, in the LD and LE groups the rates of growth diminished, while in the HP and M groups the growth accelerated (in HP group) or remained unchanged at a higher-than-average level (M group).

Thirdly, the growth rate of the LE group was higher than the average of the manufacturing sector throughout the period, while that of the LD group was lower than the average. In addition, the decline of the growth rate was far more gradual in the LE group than in the LD group.

Lastly, the most rapidly growing industry within the heavy and chemical industry group varied. In the first and second expansion periods the growth rate of the M group had exceeded that of the HP group, but in the third period this relation was reversed. The growth dynamics within the HP group changed from the parallel growth pattern between iron-and-steel and nonferrous metals in the second expansion period to that between iron-and-steel and chemicals in the third period.

As can be inferred from the above overview, the leading group in industrialization shifted occasionally, so that we need to investigate more carefully the mechanisms of growth in each period. Here we will make a preliminary observation with regard to the trend of acceleration of the growth rate of the overall manufacturing sector.

As described above, the rise in the growth rates of the HP and M groups was a major contributor to the sustained rapid growth of the manufacturing sector. However, the dynamic process of the expansion of production in the two groups cannot be explained in terms of the increase in domestic final demand. As we see in the data in Table V, there does not seem to be any systematic linkage between the growth rate of equipment investment, which determines the domestic demand for machinery, and the growth rate of machinery production. The similar

TABLE V

GROWTH RATES OF INVESTMENT, PRODUCTION OF MACHINERY,
AND PRODUCTION OF IRON AND STEEL, ANNUAL AVERAGE

(%)

|  | Equipment Investment | | Machinery Production | Construction Investment | | Iron and Steel Production |
|---|---|---|---|---|---|---|
| 1885–98 | 12.2 | > | 10.3 | 7.8 | > | 5.3 |
| 1904–18 | 8.1 | < | 14.3 | 4.3 | < | 15.9 |
| 1923–37 | 6.4 | < | 11.0 | 3.0 | < | 14.1 |

Source: The data on investment are from [7, Table A39]; the data on production are from [7, Table A21].

relationship can also be seen between construction investment and iron and steel production. What can be observed in common in these cases is the contrast of performance by period, that is, the growth rate of investment demand was higher than that of production in the first period, while production expanded far more rapidly than investment demand in the second and third periods.

The discrepancy between domestic final demand and domestic production is accounted for by international trade and the use of the product as intermediate good. In the next part of the paper, we proceed with investigation on this point, mainly with regard to the linkage between international trade and domestic production.

## III. THE MECHANISM OF THE GENERATION OF INVESTMENT OPPORTUNITIES: EXPORT AND IMPORT SUBSTITUTION

### A. The Shift in the Degree of Export Orientation and of Dependency on Imports

Here we focus on export and import substitution as the mechanism of the generation of investment opportunities. For this analysis, we define the investment opportunity as the possibility of production greater than the scale of the domestic market or the possibility of the growth of production more rapid than the growth of the domestic market.

First we examine exports. In relation to the magnitude of the derived demand for intermediate and investment goods from the export industries, the important factors are the level of production in the export industries and the level of the export ratio which determines the level of production. In this paper, we examine the investment opportunities in the export industries and the investment opportunities in the backward-linkage industries (in a broad sense) which benefit from the derived demand from the export industries. We use the export ratio as an index of the degree of export orientation to show the process of creating investment opportunities.

Next we examine import substitution. The degree of dependency on imports, which is represented by the import ratio, indicates the ratio of the domestic market which is not supplied by domestic production. We can analyze the process of the generation of investment opportunities through import substitution within the

Fig. 2.   Export and Import Ratios for the Manufacturing Sector
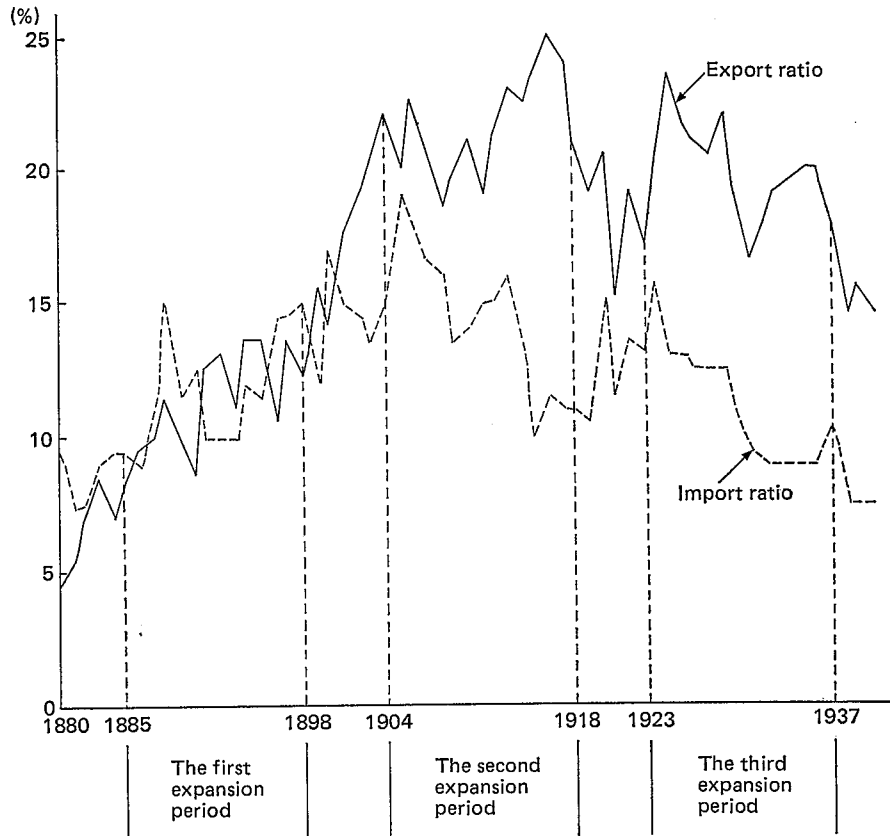


Source:   Calculated from [7, Tables A19, A26, A27].

following framework. Let the growth rate of domestic demand be $g$ per cent, and the degree of dependency on import (the ratio of imports to domestic demand) at the beginning of a period be $a_0$ per cent. If the degree of dependency falls to $a_1$ per cent, the growth rate of domestic production will be $[g + (a_0 - a_1)]$ per cent. It means that if the degree of dependency can be lowered ($a_1 < a_0$), the growth rate of domestic production can exceed that of domestic demand. Therefore we can argue that the possibility of import-substitution will increase the investment opportunities and can use the difference in the degree of dependency on import between two points of time as an index of investment generation through import substitution.

First we examine the change in the export ratio of the whole manufacturing sector in prewar Japan (Figure 2). The export ratio, starting from 5 per cent at the beginning of the 1880s, rose rapidly to more than 20 per cent by the middle of the 1900s. However, the upward trend ceased thereafter and the export ratio

fluctuated around the level of 20 per cent. The difference between the peak in the era of World War I and the trough in the postwar recession was extremely large. Moreover, it seems that from the first half of the 1920s to the first half of the 1930s, the export ratio was on the downward trend.

Next, let us examine the import ratio of the whole manufacturing sector. From the first half of the 1880s to the first half of the 1900s, the import ratio rose from a little under 10 per cent to around 15 per cent, similar to the trend of the export ratio. Then the trend turned downward. The effect of World War I and the postwar slump was the reverse of the case of the export ratio, recording an increase in the import ratio during the first half of the 1920s. However, the downward trend of the import ratio emerged distinctively again from the latter half of the 1920s.

As discussed above, the degree of export orientation of the manufacturing sector rose rapidly until the middle of the 1900s, then remained almost constant until the middle of the 1930s. The degree of dependency on imports increased until the middle of the 1900s, after which it turned downward.

What is to be noted here is that the second and third expansion periods were characterized clearly by import substitution. In contrast, there was an increase in the degree of dependency on imports during the stagnant period between the second and third expansion periods (1918–23). In order to explain the mechanism of industrialization through import substitution we need to understand how the expansion of domestic production was realized.

In the following, we will examine the levels of the export and import ratios by industry and the change in both ratios during each expansion period (Table VI).

During the first expansion period, both the export ratio and the import ratio for the entire manufacturing sector rose. This is attributable to the increased importance of the textile industry in which both ratios were higher than the average for the overall manufacturing sector. When we observe the change in the import ratios during this period by industry, we find that, in many industries, the import ratio moved upward. An outstanding exception to this tendency was the textile industry, in which import substituion was already taking place.

During the second expansion period, import substitution was in progress in most of the industries. The import substitution in textiles had been almost completed and the import ratios of machinery and metals had declined drastically. In the last third of this period (1914–18), supply from imports had been reduced owing to World War I, which brought a boom to the domestic economy. During the boom, production grew at a high rate in every industry. Especially, the growth rates of machinery and nonferrous metals were as high as 35 per cent annually on average. In the period of the postwar recession, however, the inflow of imported products resumed, which resulted in negative growth rates of machinery and nonferrous metals and a sharp increase in the import ratios.

During the third expansion period, import substitution occurred again in almost all industries. The overall import ratio of the manufacturing sector was on the downward trend, while the export ratio of machinery rose for the first time. Nevertheless, the level of the export ratios for both the HP group and M group

TABLE VI

LEVELS OF AND DIRECTIONS IN EXPORT AND IMPORT RATIOS

| | LD | | LE | | | HP | | M | |
| | Food Products | Lumber and Wood Products | Textiles | Stone, Clay, and Glass Products | Others | Chemicals | Metals | Machinery | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Export ratio** | | | | | | | | | |
| 1885–98 | L↑ | L→ | H→ | H→ | H↑ | L↑ | H↑ | L→ | ← |
| 1904–18 | L↑ | L↑ | H→ | L→ | H→ | L→ | H↓ | L→ | ↑ |
| 1923–37 | L→ | L→ | H→ | L↑ | H↑ | L→ | H↓ | L↑ | → |
| **Import ratio** | | | | | | | | | |
| 1885–98 | L↑ | L→ | H↓ | L→ | L→ | L↑ | H↑ | H↑ | ← |
| 1904–18 | L↓ | L↑ | L↓ | L↓ | L↓ | H→ | H↓ | H↓ | ↑ |
| 1923–37 | L→ | H↓ | L↓ | L→ | L↓ | H↓ | H↓ | H↓ | → |

Source: Same as Figure 2.

Notes: 1. H(L) denote higher (lower) export and import ratios for individual industries than those for the manufacturing sector.

2. ↑ (↓) indicate increasing (decreasing) trends in export and import ratios for individual industries during the periods. → indicates absence of upward or downward trend.

Fig. 3.  Import Ratios for Metals, Chemicals, and Machinery
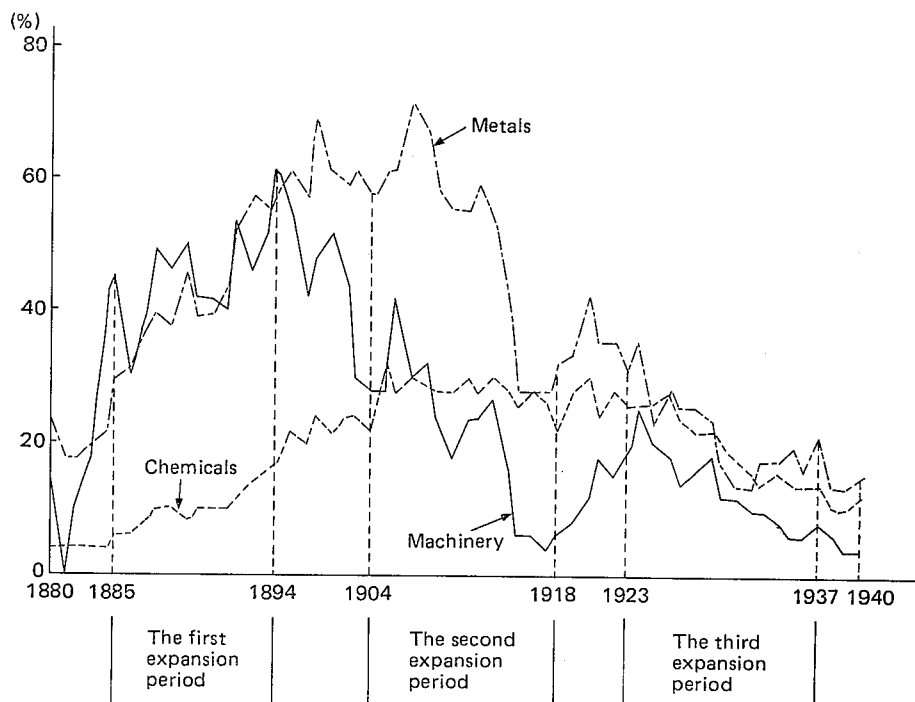


Source:  Same as Figure 2.

remained low.  The export ratio of the manufacturing sector as a whole decreased in the 1930s, because of the increase in the shares of these groups.

We can observe the pattern of the dual–industrial growth between the LE group and HP group during the third expansion period, in that the growth rate of the HP group rose substantially in comparison with the second expansion period; within this group the increase in the growth rate of chemicals was outstanding.

We have already mentioned the importance of import substitution as the mechanism of industrial development in prewar Japan. What is to be noted here is that the import substitution in machinery preceded that in metals, and that the import ratio of machinery had been lower than those of both metals and chemicals since the second expansion period (Figure 3). In examining the process of industrial development in prewar Japan, therefore, it is necessary to take into consideration the derived demands in a broad sense, which includes not only the backward-linkage demand for intermediate goods but also the demand for investment goods.

B.  *The Expansion of the Backward-Linkage Demand and Dual–Industrial Growth*

The theory of dual–industrial growth emphasizes the significance of the expansion of domestic production in response to the expansion of the backward-linkage

demand for intermediate goods as the mechanism of industrial growth. We find, especially within the HP group, a number of industries producing industrial raw materials which benefitted from this backward-linkage demand. This suggests that the transmission of growth via this linkage will be a key factor to explain the process of expansion of the HP group.

To extend this point of view, we can consider the backward-linkage demand in a broad sense including the derived demand for investment as well as intermediate goods as a mechanism of growth of industrial production. As we stated before, import substitution in machinery preceded that in metals and chemicals. Thus it is important to investigate the background of the expansion of the demand for machinery.

In the machinery, metals, and chemicals industries, efficient production and the strengthening of international competitiveness are attained mainly through cost reductions from economies of scale. So there is a positive feedback between the expansion of production and the strengthening of competitiveness. This also implies, however, that these industries may be subject to the vicious circle of under-scaled production and the lack of competitiveness. It is not settled theoretically whether or not policy interventions to promote the expansion of production can be justified in such a case like this.[2] In the following sections, we summarize the process in which a vicious circle of small-scale production at first was replaced by a virtuous circle of large-scale production according to the framework of the dual–industrial growth. Though we will refer frequently to policy factors, we do not undertake here any rigorous assessment of the effects of the policies.

To realize economies of scale in chemicals, metals, and machinery, the industries which use the products of these industries should be sufficiently large and the derived demand should be captured by the domestic producers (i.e., should not leak in the form of imports). The higher the degree of export orientation of the user industries, the easier it is to meet the former condition. The latter condition is affected by the extent to which a well-operating industrial infrastructure (technical, managerial, interfirm relations, etc.) is present, the macroeconomic situation (especially the exchange rate) and the nature of protection policy. In the following sections, we examine the demand- and supply-side factors which made possible the realization of economies of scale in the industries mentioned above.

## C. The Protection Policy for Dual–Industrial Growth

The first part of this subsection focuses on tariff protection in prewar Japan, and surveys the development of import-substitution policy and related trade policies.

The recovery, in 1899, of the right of self-determination to impose tariff protection was a milestone in the development of protection policy in prewar Japan. The Law of Tariff Rates of 1899 required tariff rates to be between 5 per cent and 40 per cent, instead of 5 per cent in principle which prevailed at that time.

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[2] In the theory of infant industry protection, the existence of static economies of scale as discussed here is not considered as a sufficient condition to justify protection. On the other hand, in the welfare analysis of international trade under imperfect competition, expansion of production through policy intervention is justified in some cases.

However, for about one-fifth of all goods, including principal imports such as cotton cloth, woolen textiles, and steel products, the actual tariff rates were restricted by treaties with major powers.

In spite of these constraints, the average tariff rate for manufactured goods rose from 4 per cent to 10 per cent. This was the beginning of trade policy aimed at the protection of industries.

The other major change brought about by the Law of Tariff Rates of 1899 was in the tariff structure. That is, the tariff rates were set at different levels according to the type of imports. The tariff rates for final products were higher than for raw materials and intermediate goods, and were higher for consumer goods than for capital goods. This also demonstrates that tariff policy was employed as an industrialization policy.

Subsequent revisions of the tariff system brought about the reductions in the tariff rates of raw materials and intermediate goods, and the rise in the tariff rates of final products. These revisions were aimed at the development of domestic industries and the promotion of exports. The most significant is the sixth revision in 1921. In this revision the tariff rates of steel products, machinery, and chemical ash were raised, which reflected the government's intent to protect these industries. At the same time, for the raw materials used in the production of exports, the tariff-repayment system was converted into a tariff-free system to improve its effectiveness as a measure to promote exports.[3]

The general reconsideration of tariff policy after World War I resulted in the New Law of Tariff Rates of 1926. This law introduced a plan for protecting and fostering industries. In determining the tariff rates, however, much consideration was given to the role of tariffs in the general industrial policy. In this respect, the most significant issue was the steel industry. It was feared that the rise in the tariff rates of iron and steel might adversely affect the industries which used them as input. Therefore the protection and fostering of the steel industry took the form of subsidization to the firms which had sufficient scale and were operating under an integrated production process. This accomplished two objectives simultaneously—protection for the steel industry and maintenance of low domestic prices for the industries using steel.

The tariff on pig iron was occasionally made a political issue in the form of confrontation between the domestic steel industry and the user industries. The rise in the tariff rate was not realized until the slump of the steel industry under the declining import price in yen due to the depreciation of the pound sterling in 1932. On this occasion, policy measures directed to the questions of industrial organization were also considered to prevent the rise in the tariff rate from countering the reduction in the production cost through the above-mentioned policies. The industrial organization policy for the steel industry after World War I was directed towards "integration of the public and the private sectors." This led to the establishment of a national-policy company, Japan Steel Co., Ltd. (Nihon

[3] The tariff-repayment system granted rebates to importers for the tariffs they paid if they used the imported goods as inputs for the production of exports. The tariff-free system simply removed this exchange.

seitetsu kabushiki-gaisha). This was followed by the promotion of the so-called Japan Steel First policy—a policy specifically designed to foster and promote the company.

As we illustrated with the case of the steel industry, the import-substitution policy in prewar Japan was characterized more by the promotion of industrial policy to intensify international competitiveness than by the protection of the existent domestic producers from imports. This point will be emphasized again in the following section in reference to the chemical industry.

## D. The Dual–Industrial Growth between Textiles and Chemicals

In this subsection, we examine the dual–industrial growth between staple fibers and chemicals. The growth of the staple fiber industry expanded the backward-linkage demand for the products of the chemical industry, including scouring agents, bleach, and dyes. Moreover, in the third expansion period, chemical fibers increased their importance in the chemical industry because of the rapid increase in the production of rayon. This in turn increased demand for basic chemical products used in the rayon production process.

### 1. The expansion of the production of dyes

As the production of staple fibers grew, the demand for the chemical products for scouring and bleaching increased. The demand for artificial dyes, which increased with the diffusion of the western-style dyeing process, was met through imports in earlier periods. During the first expansion period, the import of dyes grew at 11 per cent per annum, the same growth rate as that of the production of staple fiber. The growth rate of imports rose to 20 per cent per annum in the 1900s.

Until World War I, Japan received almost all of its supply of artificial dye from abroad, especially Germany. Consequently, the effect of the interruption of the supply of German-made artificial dye due to the outbreak of World War I was extremely great; the price of dye rose abruptly, which brought about a rapid expansion of domestic production. The reaction of the government concentrated mainly upon the establishment of the management and technological foundations of the industry rather than countermeasures against the shortage of dye of the moment.

In the Law on the Promotion of the Production of Dyes and Medicines of 1915, the scope of the subsidization was limited to the corporations producing that kind of products which required higher technology. The corporation to which the law applied was Japan Dye Manufacturing Corporation (Nihon senryō-seizō kabushiki-gaisha), established in 1916. In 1920, when the corporation was faced with the fall of price owing to the resumption of the import after the war, the tariff rate was raised to foster the domestic dye industry. The import permit system was adopted in 1924. As for production promotion, the scope of the subsidization was extended in the Law on the Promotion of the Production of Dyes of 1925; three corporations were subsidized in addition to Japan Dye Manufacturing Corporation as a result. However, the dye users persistently opposed to the protection

policy of the government for the dye industry. Chief among these were the textile and dyeing industries. This example clearly shows the difficulty of the dual–industrial growth policy, in which export promotion and the import substitution of intermediate inputs are pursued simultaneously.

## 2. *The expansion of rayon production*

The domestic production of rayon commenced on a full scale in the 1920s. It experienced a record average annual growth rate of 30 per cent from 1930 to 1937, when the production reached its peak. The expansion of rayon production resulted in a sizable demand for industrial chemical products such as caustic soda, sulfuric acid, and ammonia, which in turn had a great impact upon the expansion of the chemical industry as a whole.

Let us examine the factors on both demand and supply sides which enabled the expansion of the rayon production. As for the demand side, the central factor was the growth of the production of rayon textiles, especially the rapid growth of export-oriented production. The first use of rayon as a material for textiles was for mixed textiles (with silk or cotton) for export. As these mixed textiles became more popular in the domestic market, all-rayon textiles were accepted gradually, which accelerated the demand for rayon thread. The export of rayon textiles had become full-fledged since the Great Depression (1930–31). Around 1935 the export ratio was as high as 60 per cent. As for trade policy, the tariff for rayon thread was raised significantly in 1926 to protect and foster the domestic rayon-thread industry, so that the domestic market for rayon thread was preserved for the domestic industry.

Next we examine the supply-side factors. The rapid growth of the production of rayon textiles described above derived not only from the shift in demand-side factors, but also the supply-side factors. These supply-side factors include reduced production costs from mass production of rayon thread and quality improvement from accumulated production experience, which led to further demand increase.

Economies of scale at the factory level and reduced input costs (including power and labor) through the efficiency improvement in production process helped to reduce production costs. The larger scale factories were established partly as a result of the tariff protection for the domestic rayon-thread industry in 1926; at the same time, the framework of oligopolistic competition of six main corporations was established. Thereafter, until the end of 1932 a cartel was in effect to regulate excess supply from the rapid increase in production capacity. During this period, thorough reexamination of the production process was pursued under the cartel-imposed limit on productive capacity in order to achieve the increase in productivity and improvement in quality.

The growth of the rayon industry generated considerable demand for industrial chemical products, particularly for caustic soda. Since the beginning of the 1930s, the domestic production of high-quality caustic soda increased significantly and import substitution rapidly ensued as a result. Most of the increase in the production of caustic soda in this period occurred in response to the demand from the rayon industry.

The backward-linkage derived demand (in a broad sense) from the rayon industry also had a considerable effect on the manufactures of mechanical equipment. This effect was particularly prominent at the beginning of the 1930s, a period of rapid productivity improvement. The integration of various stages of production and the demand for spinning motors with higher revolutions per minute had two beneficial impacts. It improved the quality and expanded production of electric motors and also of machines used in chemical processing. For plant expansion or for new entries since 1933, domestic machinery was utilized almost exclusively. This was possible because the technological level of machinery manufactures had improved through their efforts to embody in equipment technical improvement achieved by the rayon-thread manufacturers during the previous period. Thus the rayon-thread industry provided positive forward-linkage effects to the rayon-textile industry and received such effects from the chemical-machinery industry.

The rayon industry is an interesting case of dual–industrial growth policy, in which export promotion and import substitution was pursued in parallel. The domestic production of rayon operated on a full scale from the middle of the 1920s. The substantial rise in the tariff rate in 1925 contributed noticeably to the rapid expansion of domestic production of rayon. Since the tariff rates were defined in terms of quantity, the effective tariff rate in terms of price rose substantially, from 27 per cent in 1920 to 85 per cent in 1930. Thus the protection to domestic industry was intensified. However, the high price of rayon could exert a harmful influence on the export of rayon textiles by raising the cost of raw materials for the rayon-textile industry.

One of the ways to resolve this dilemma was to remove the export restraining effect of the tariff through a tariff exemption for imported rayon used for export-oriented rayon-textile production. This measure was instituted in the revision of the Law of Tariff Rate in 1906 and had been applied to rayon thread thereafter. However, as the ratio of rayon-textile exports to domestic production rose, the problem of expensive domestic rayon thread emerged as a problem which would have to be solved for the continued development of rayon-textile exports. In 1931, the tariff rate for rayon thread was reduced by 40 per cent; the new tariff rate was determined taking into account both the effects to domestic production of rayon thread and to the export of rayon textiles. This case can be regarded as one typical example of dual–industrial growth, in which an attempt is made to achieve simultaneously both the promotion of manufacturing exports and the import substitution of intermediate inputs.

E. *Dual–Industrial Growth between the Machinery Industry and the Steel Industry*

As we discussed earlier, the progress of import-substitution in the machinery industry could be observed from the end of the 1890s in the industrialization of prewar Japan.

Here, we examine when and to what extent the increase in machinery production brought about a backward-linkage demand effect to the steel industry. Two-thirds

of the increase in machinery production during World War I is attributable to the increase in shipbuilding. This caused rapid growth of the demand for steel, so that the domestic production of steel and steel products increased more than 2.5 times. Also, a trend towards plant expansion emerged, though it was not realized on a full scale until after the war. Other industries such as industrial machinery and electric machinery also expanded their production which again contributed to the expansion of the demand for iron and steel. This expansion was stimulated by the difficulty in obtaining imports and by the increase in demand owing to the growth of investment. However, because the production expansion in the steel industry was insufficient both in quantity and quality to respond to the rapidly growing demand, the constraint in steel supply set a limit to the increased domestic production of machinery during this period. The bottleneck in machinery supply, in its turn, set a limit to the equipment investment in the entire manufacturing sector. Thus the virtuous circle between machinery and steel, in which investment stimulates further investment, was not experienced extensively during the period of World War I.

After World War I until the middle of the 1920s, cartels were organized and efficiency improvement in the production process was realized in both the machinery industry and the iron and steel industry, to enable survival under conditions of stagnant demand and the reentry of imports. In this period, several new trends emerged: (1) the strengthening of managerial and technological capabilities in larger firms; (2) through these changes, the emergence of competitive firms from among small-scale firms; (3) the expansion of the productive capacity at the level of the individual firm and the improvement in efficiency at the industry level. These conditions fostered the resumption of import substitution from the middle of the 1920s. Dual–industrial growth between the machinery industry and the steel industry, took place in full scale in the 1930s. In the steel industry, where the economies of scale at the factory level strongly affect the production cost, the construction of blast furnaces and open-hearth furnaces comparable in size to those in western countries were already in progress by the middle of the 1930s. Import substitution ensued step by step, helped by the import restraining effects of the exchange rate which stabilized at a lower level from 1931 and of the rise in the tariff rate.

The increase in the production of machinery can be explained by the increase in the production of capital goods used in the mining and manufacturing sectors. It is notable that this represents a different pattern from that of the era of World War I, when the growth of shipbuilding was the main contributor to the growth of machinery production.

The increase in capital-goods production is attributable mainly to the increase in the production of industrial machines and electrical machines. These were produced in response to the expansion of equipment investment in sectors like metals, machinery, chemicals, and staple fibers. The virtuous circle of demand was in full force in the 1930s. The generation of investment opportunities through the expansion of exports (of staple fibers) and the import substitution (of machinery, metals, and chemicals) led to the expansion of the demand for machinery. This further led to the expansion of the demand for metals. It was in this way that

the dual–industrial growth between machinery and metals had been fully realized in this period.

## IV. CONCLUDING REMARKS

This paper surveyed the pattern of industrial growth in prewar Japan and emphasized the demand-side factor in the generation of investment opportunities, namely, export and import substitution, from the viewpoint of the theory of dual–industrial growth. First, we ascertained that, in the history of industrial growth in prewar Japan, the industries which attained high growth rates were the industries in which substantial import substitution was realized. Second, we focused upon the chemicals and iron and steel industries, where substantial import substitution took place. We showed that the expansion of backward-linkage demand made significant contributions in both industries.

To take advantage of expanded backward-linkage demand as investment opportunities for domestic producers, import-restriction policy such as tariffs and other policy measures were adopted. It seems that this protection policy did not impair the efficient long-term development of the industries. This development took place, on the demand side, through sufficiently large backward-linkage demand, and on the supply side, through the establishment of industrial organizations which gave rise to economies of scale at the factory level. Nevertheless, we need to note that the extent of the protection given to domestic industries was far milder in comparison to that provided by the governments of developing countries today. It should be remembered that the very absence of excessive protection of domestic industries enabled the export-oriented industries to grow rapidly and to realize the expansion of backward-linkage effects discussed above.

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