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THE PATTERN OF JAPANESE LONG-TERM ECONOMIC GROWTH
THE PATTERN OF JAPANESE LONG-TERM ECONOMIC GROWTH

Kazushi Ohkawa

I

The modern economic development of Japan started from a densely populated state with a peasant-handicraft economy, following the Meiji Restoration in 1868, when most of the presently advanced countries already had modernized their economy to a considerable extent. These historical features of the initial condition, among other things, must undoubtedly lead to a particular pattern of economic growth as compared with those of the Western type. For one thing, we can say that today Japan is the only highly industrialized country which still embodies a lot of economic activities in the sectors of the traditional type. The study of its growth pattern, therefore, will shed light on the problems of economic development of the presently underdeveloped countries of densely settled areas, particularly, in Southeast Asia.

The pattern of economic growth can be approached in several ways, depending upon the particular aim one may have in mind. But in any case, it is desirable to define what "pattern" will mean, as this term has often been used loosely. The purpose of this paper is to analyse the Japanese long-term growth process from the supply side, particularly from a viewpoint of the changes in labor-capital-output relationships in relation to the technological developments. It seems to me that the most basic phase of a growth pattern can be defined as structural changes in factor combination in relation to the output increases.

Recently the historical macro-quantitative study of Japanese economic growth has made considerable progress, although many vague points still remain. A few relevant cross-section data also recently became available. To my knowledge these data are sufficiently reliable to serve our broad descriptive analysis that follows.
By using a two-sector (agriculture and non-agriculture) approach, we will first try to clarify the long-term changes in the growth rate of output, by breaking it down into the growth rates of two components—the output per labor force and the labor force. In this respect, particular attention will be directed to the changes in the flow of labor force from agriculture to the non-agricultural sector, but, in principle, our key point is to use these two components as basic tools in order to clarify our problems.

Next, we will try to find certain relationships between two items, the rate of increase in output per labor force and that of capital intensity for the non-agricultural sector. To get a broad knowledge of the incremental changes in capital intensity, we will make use of movements of the capital-output ratio. This will be done by observing identical relationships about the rates of increase of several terms, instead of making functional approaches. As is well known, within the framework of the macro-empirical approach it is very difficult, if not impossible, to use a certain type of production function with full confidence, in particular, in the case of weak data of investment or capital. As a rough substitute, I hope that even these speculative observations will serve to clarify the growth pattern in its broad interpretation.

Thirdly, in order to interpret the results of the above observations, certain specific relationships among output, labor, and capital will be introduced in the light of data obtained by the cross-section surveys. To reach a consistent understanding of the growth patterns suggested by both time series and cross-section-data is our ultimate task, and this will be worked out in the light of long-term swings, including the Post-World War II period.

II

It has often been suggested that the most outstanding feature of
Japanese economic development is its rapidity or what is even more important, the rapidity of increasing per-capita national income. It must be admitted that the international comparison of growth rates depends for its reliability very much upon the degree of data refinement in individual countries as well as on their conceptual comparabilities, so that we should be cautious of the ranges of statistical errors and biases of various kinds. As far as the comparison of average growth rates in the long run is concerned, however, the risk may be minimized. According to Professor S. Kuznets' most comprehensive research on the long-term rates of growth of many countries, we recently got the almost confirmed facts that the United States, Canada, Sweden and Japan were the most rapidly growing nations in terms of national product, and that, in terms of growth rates of per-capita national income, Sweden and Japan, were the most rapidly growing nations in this group.

This raises a question. By what process has Japan sustained such a high rate of growth? The discussion that follows attempts to answer the question from the particular viewpoint mentioned above.

To begin with, let us observe the long-term movement of the growth rates of national product. As is shown in Table 1 (in Column 1) and illustrated in Chart I (the aggregate), we can recognize two and a half long swings: the first from 1885 to 1905, the second from 1905 and the third seems to start from 1945. The trough in 1945 is of course caused by war damage, but for the trough around 1905, the exact reason is not yet clear. The procedure of computation was as follows: the averages of net national product in constant prices for 10 years, moving in overlapping five-years (1878-87, 1883-92, ---) were first taken as the unit and then the annual compound rates of growth between these two successive units were calculated. The years in the Chart represent the mid-point of each unit-period. To discuss the real long swings in the rate of
growth in an elaborate manner, we have to do many more statistical operations, but even these unrefined figures might be enough for the present discussion, as our prime aim is not to deal with long swings as such.\footnote{In the same Table (Ga, Gn in Column 3, 4) and Chart I, the shares in aggregate growth rates by both agriculture and non-agriculture are shown. The behaviour of the share of non-agricultural sector presents similar swings as in the case of the aggregate, while that of agriculture suggests a minor effect to the aggregate output growth pattern except during the first swing, where this sector played an influential part in the aggregate swing. Thus, the analysis that follows can concentrate mainly on the non-agricultural sector as its change in growth rate can almost represent the aggregate pattern of growth.\footnote{For the period after 1940 in the Chart, because of data discontinuity, sectoral observation is too risky.}}

The actual growth rate of output being composed of two parts—the growth rate of employed labor force and that of output per employed labor force ("employed" will be omitted for short on the following pages), the long swings observed above can be broken down into these two parts. These figures for the non-agricultural sector are shown in Table I (n, g in Column 6, 7) and illustrated by Chart II. (The discussion of the post-World War II period will be postponed to the later pages.) It is impressive that the growth rate of output per labor force is mainly responsible for the ups-and-downs of output growth rates in the long process, while the growth rate of the labor force always pushes the trend almost straight down, suggesting that its major effect lies in changes in the level of output growth rates. If we describe these facts on the average for the two periods of long swings suggested above, it is quite clear that in the first period, the growth rate of the labor force is definitely higher than that of output per labor force, while in the second period one can observe a reverse relation—
Table I. Growth Rates of Output, Labor Force and Output per Labor; Rates of Investment and Capital-Output Ratio

(All in percentage except C)

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Remarks: i) Notations: $G$, aggregate growth rate of output. $G_a$ and $G_n$, its share by agriculture and non-agriculture. $G$, growth rate of output of non-agriculture. $n$ and $n$, growth rates of labor force in aggregate and non-agriculture. $n_1$ and $n_2$ shares of non-agricultural origin and agricultural origin in the growth rate of labor force in non-agriculture. $g, I$ and $C$, rate of increase in output per labor, rate of investment and capital-output ratio in non-agriculture.

ii) There is some inconvenience in a continuous computation between pre- and post-war years. A tentative calculation of $G$ by the same method for the later years shows $-1.8$ for 1938-42, $-3.5$ for 1943-47 and $5.9$ for 1948-52. The data for these years are taken from the Appendix Table in Economic Planning Agency, "kokumin shotoku hakusho" (National Income White Paper) 1959.

iii) --, data are not available.

iv) For other explanations of data and computing method, see footnote 4.
CHART I

Change in the Growth Rates of Outputs

- Aggregates
- Non-agriculture
- Agriculture

%

1885 1895 1905 1915 1925 1935 1945 1955

Change in the Growth Rates of Outputs

- Aggregates
- Non-agriculture
- Agriculture

%
CHART II

Rates of Increase in Output-Labor Ratio ($g$) and in Labor Force ($n$) in Non-Agricultural Sector
ship. This suggests the fact that the changes in rates of both labor supply and labor productivity had played important roles alternately in changing the pattern of growth throughout these years. In the discussion that follows, first the supply of labor and next, productivity will be analyzed, both as incremental changes.

In general, the long-term behavior of labor force supply is mostly influenced by three factors: the natural rate of increase in working age population, their participation rate in the labor force and international migration effects. In Japan the effect of the last factor was trifling, since she could not send a substantial number of emigrants abroad, and this is one of the peculiar features of labor supply in the course of economic development in Japan as compared with most Western experiences. As for the long-term change in the participation rate, we have not enough reliable data to present a more or less definite measurement result, but it is almost safe to say that this rate had a slowly decreasing trend over time—a similar phenomenon experienced in the process of economic development in most advanced countries. This had definitely a partial effect on the sharp downward trend of the growth rate of labor force described above.

The major determinant of direction of this trend, however, seems to be found in the effect of the first factor—natural rate of increase in working age population, and for the discussion of the non-agricultural sector, the crucial point is to be observed in the transition process of the out-migration of this population from rural to urban districts. We will, therefore, focus our attention on this factor. Statistically, there are considerable difficulties in quantifying the changes in and shifts of the "labor force," in terms of modern definitions, both for conceptual and factual reasons. It will be, however, not difficult to understand, depending on several estimates, that almost all the increase (net of replacement) in the labor force produced in
the agricultural sector had migrated to the non-agricultural sector, leaving the total labor force engaged in agriculture almost unchanged (or very slightly decreasing) throughout the whole period under discussion except the years during and immediately after World War II. Thus the incremental increase of the labor force supply to the non-agricultural sector has been composed of two parts; one, migrants from agriculture to this sector ($A$) and the other, the net increase produced within this sector ($N$). Under a general assumption of an unchanged labor force in agriculture and of constant rates of increase in labor force in both sectors, it is quite natural that the share of $A$ will decrease and that of $N$ will increase and it is also obvious that the growth rate of labor force in non-agriculture will decrease as time goes on if we add another assumption to the above model that the rate of increase in producing labor force is greater in agriculture than in non-agriculture. This is universal phenomenon experienced with various modifications in the course of economic development of presently advanced countries. Japan's case, however, presents us with a most impressive, rapid effect of forces of this kind in a comparatively short period. As can be naturally supposed, in Japan after the emancipation from feudal restraints, the spurt of population increase occurred mainly in the rural districts because at that time the urban population was still proportionately very small and its age-and-sex structures were not favourable to the acceleration of population increase. Besides, in Japan almost all the labor force shifted from rural to urban districts by single units, instead of family units, so that it accelerated a young age-structure in the urban area, which naturally had a very small effect on the production of working age population in this area. This feature contributed much to produce and maintain the wide difference in magnitudes between $A$ and $N$ in ensuing years.
The figures presented in Table I were estimated under certain assumptions in order to quantify the facts described above in a convenient form for the discussion in the growth-term formula. The rates of increase of parts $A$ and $N$ are denoted by $n_2$ and $n_1$ (in Column 9 and 8), both in terms of rates of increase in total labor force in the non-agricultural sector. It is most impressive that the dominant share of $A$ had continued almost throughout the period before World War II, but that towards the later period starting around 1908-12, the major portion of the retarded rate of increase in the labor force in this sector was mostly caused by a relative decrease of labor supply from agriculture with a sign of significance of the self-increase of labor in this sector towards the end of this period, 1933-37. Thus, it is quite clear that the changes in relative magnitude of this shift has been most responsible for formulating the dramatic changing pattern of labor supply which happened during a relatively short time interval before World War II.

The significance of this phenomenon will be discussed in relation to the changes in the rates of increase in output per labor in the following pages. One point, however, I would like to make here, in particular, about its effect on the growth pattern in early economic development. On the average, during the first period, the output growth rate of the non-agricultural sector was 5.4 percent while the rate of increase in labor force was 3.5 percent. This means that this initial high rate of growth was achieved largely (two-thirds) by the increase of the labor force. In other words, during this period, productivity increases were still minor (one-third) in its incremental contribution to the economic growth. This fact naturally suggests a particular growth pattern of this period, which will be elaborated in the later pages.
III

"Output per labor force" as used here is not a productivity concept by itself, but is relevant to it. This term implies that all the contributions to the increased output stemming from factors other than the input of labor should necessarily appear in the changes of this ratio. In this sense, here we would like to use this ratio as an index of productivity in terms of labor. The changes in this output-labor ratio are often discussed in relation to two main factors, capital intensity and technological change. Without knowing the particular type of production function, we cannot weigh quantitatively the effects of these factors. In the discussion that follows, and attempt will be made to describe the relationships between the output-labor ratio and the capital intensity both in growth terms in the course of the long swings described above. In order to do so, first we must answer a question—by what way will it be possible to know the changes in the rate of increase in capital intensity?

The capital problem is very difficult, and usually we have very few data to be used directly to measure the rate of capital accumulation in a similar way as in the case of labor force. The relevant data we do have for the Japanese Economy are investment rates and capital-output ratios in incremental form,12 Hence, the problem before us is to find out possibilities of indirect measurement of capital increase, in particular, in relation to the labor increase, by using these terms.

As in the case of labor, we have an identical relationship \[ g = k + h, \]
where \( k \) is the growth rate of capital stock and \( h \) the growth rate of "capital productivity", (the reciprocal of the capital-output ratio), though statistically the case of capital is much different from the case of labor because we have no direct data for either \( k \) or \( h \). As for the ex-post data for an arbitrary period, however, there must be an identity \[ k+h=g+n, \]
so that we can specify the following three cases:
if \( h < 0 \), then \( k - n > g \) \((g < k)\)
if \( h = 0 \), then \( k - n = g \) \((g = k)\)
if \( h > 0 \), then \( k - n < g \) \((g > k)\).

The concept of capital intensity usually concerns labor input rather than labor stock. If we disregard the difference between the rate of increase in labor stock and that of labor input, (which might not be substantial in the present discussions), \((k-n)\) is nothing but the growth rate of capital intensity, and since the capital-output ratio will be increasing, unchanged or decreasing, corresponding to whether \( h \) is \(< 0\), \(= 0\), or \(> 0\) (and the growth rate of output will be smaller, equal or larger as compared to the rate of capital accumulation), we can observe the relationship between the growth rate of capital intensity and that of the output-labor ratio by the actual data of the movements of capital-output ratio. In reality, however, our data for the capital-output ratio are given only as average figures for each period in incremental form. Therefore, in order to apply the above formula to our case, we have to assume that the changes in the incremental capital-output ratio can represent the movements of the average capital-output ratio, although, in principle, the former can differ from the latter.

Let us look at the relevant figures shown in Table I. The incremental capital-output ratio, inventory investment excluded, \((c\) in Column II) seems to change from period to period, ranging from 2.6 in 1888-92 to 5.2 in 1933-37. But, broadly speaking, the fluctuations seem to show neither a definite upward or a downward trend throughout the whole period. For instance, the average of the early four figures is 3.9 and that of the later six figures is 4.1. We cannot see substantial changes between the first and the second periods, though there might be a sign of slight increase. If our view is adopted, it become possible to use the assumption of unchanged capital-output ratios as a
long-term trend in our case and to say that the rate of increase in the
output per labor can broadly represent the rate of increase in the
capital intensity.

We can see that the rate of increase in the output per labor has
changed very much between the first and second periods as already
touched upon in the last section; its range is 1.1 - 3.2 per cent in
the first period, while in the second period it is from 2.7 to 6.0 per
cent. This gives us a suggestion that both the capital intensity and
labor productivity had increased rather slowly during the early years
and that they increased much faster (about two times on average) in the
later years. This distinction characterizes the patterns of growth in
each period. Taking the facts described in the last section into
consideration, we would like to say that in the early years until around
1903-07 the big rate of increase in the labor force, accompanied by a
moderate increase of capital intensity, was the crucial factor for the
then rapid growth rate of output, while during the period since around
1908-12 the accelerated increase of capital intensity, accompanied by
a moderate rate of increase in the labor force, became the dominant
factor for the accelerated growth rate of output. Further from the
standpoint of technical development, it can be suggested that in the
first period improvement of simple, labor-intensive techniques of the
traditional type was dominant, while in the second period introduction
of capital-intensive techniques of the modern type became more important,
both corresponding to the different behaviour of the rates of increase
in capital intensity in each period.

Thus, speaking in average terms about the second period, out of a
5.9 per cent growth rate of output, 3.8 per cent or about two thirds
was achieved by the growth of productivity, while only the remaining
one third was obtained by the increase of labor force. By taking these
facts up together, I would like to characterize the two periods as
follows: a labor-growth dominant pattern was the feature of the first period and that towards the second period it turned out to be a productivity-growth dominant pattern.

Such a broad characterization, however, would be misleading if we do not pay more minute attention to the changes of figures from period to period, because, as mentioned above, the figures of the capital-output ratio sometimes change considerably from period to period. Our next topic, accordingly, is to clarify the relationships between the changes in the capital-output ratio and the upward or downward movements of the growth rate of output per labor in the process of the long swings.

Between the changes in the capital-output ratio and those in the rates of increase in output per labor, we can recognize a reverse relation during the early years, while in the later years we can not necessarily see such a clear reverse relation. For example, from 1882-92 to 1893-1902 (these years belong to the upward period of the first long swing) the rate of increase in output per labor has been raised greatly (from 1.7 to 2.2 per cent), but the capital-output ratio decreased at the same time, so that the rate of capital accumulation must have been lower than the growth rate of output, and accordingly the rate of increase in capital intensity can not necessarily be estimated to increase by the above-suggested rate. On the other hand, from 1893-97 to 1898-1902 (the period that forms the downward trend in the first long swing) the capital output ratio increased, while the rate of increase in output per labor decreased. In this case, the rate of capital accumulation was faster than the growth rate of output, so that the rate of increase in capital intensity must be higher than the rate suggested by that of output per labor. Therefore, for the early years we can not say much about the rates of increase in the capital intensity by too heavily depending on the figures of rates of increase.
in output per labor.

Next, for the relatively long period from 1898-1902 to 1918-22, we may say with confidence that the rate of increase in capital intensity had been accelerated to a considerable extent. This period, as pointed out in the previous pages, constitutes both the downward part of the first swing and the upward part of the second swing. It is impressive that the capital-output ratio was kept in a range of only slight differences throughout this period. From 1908-12 onwards both the rates of investment and rates of output-growth were accelerated under the condition of almost unchanged capital-output ratio, so that we can say that the figures of rates of increase in output per labor (an increase from around 1 to 4 per cent) do express more or less the real upward trend of the rate of increase in capital intensity.

After that, however, the picture has changed again. Toward 1923-27, the peak period of the second swing the output growth rate was still accelerated, but the rate of investment decreased with the effect of a smaller capital-output ratio, and this was followed by the downward part of the second swing toward 1933-37. During this period the capital-output ratio showed an increasing trend, while the rate of increase in output per labor turned to decline. We should say that the rate of increase in capital intensity did not decrease so much as indicated by this rate.

In sum, what can we say about the relationships between the output-labor ratio and capital intensity? It may best be summarized as follows from a viewpoint concerning the features of different stages in long swings. First in the upward part of the long swing, the acceleration of the rate of increase in the output-labor ratio occurred almost at the same rate as that of capital intensity, due to the acceleration of capital accumulation under the condition of almost unchanged rates of increase in the labor force. Second, in the downward part of the long
swing, the rate of increase in the output-labor ratio was overcome by
that of capital intensity. Third, near the peak of the long swing, the
rate of increase in the output-labor ratio was accelerated faster than
that of capital intensity. These propositions apparently seem to be
not too substantial, but it is beyond our scope to get into the analy-
sis of particular causes responsible for these changes. They seem,
however, to suggest that our assumption of an unchanged capital-output
ratio is plausible for the long-term growth process and that the
deviations of this ratio from the "normal" trend should be understood
as corresponding negatively to the fluctuations in the growth rate of
output per labor. 14

IV

In the foregoing discussions we paid no attention to the changes
in the structure of the economy, which necessarily occurred in the
growth process. The term "dual structure" or "differential structure"
is recently often used to express the present feature of the Japanese
economy in the sense that it contains a large field of pre-capitalistic
production of the traditional type side by side with the large scale,
capitalistic production of the modern type, thus embodying a wide range
of differentials in productivity, wage rates etc. This is an undeniable
fact. As far as our present problem is concerned, our main interest is
to clarify the real process by which such a structure has been built up
as the result of the specific pattern of economic growth described in
the previous discussions.

From the observations of the data of several kinds related to this
matter, we can almost confirm the following facts relevant to our
present aim. In the comparison of large-scale and small-scale estab-
ishments of manufacturing, the capital-output ratio, the output-labor
ratio and the capital intensity, all these three magnitudes are bigger
in the large-scale establishments than in the small-scale ones. Actually, in most data, the scale measure is taken as the number of workers, but better data in which the scale is taken in terms of capital amounts are also available, although they are few. The above-mentioned propositions are proposed in terms of capital-scale, in principle.

It is quite understandable that output per worker in large-scale establishments is bigger due to the larger capital intensity, because this suggests a reasonable technical relationship which is often used in the discussion of the production function. There may be some doubt, however, about the bigger capital-output ratio in the larger firm, as this suggests a possibility of a lower profit rate in the large-scale establishment. In reality, if the wage differential between large-scale and small-scale establishments is smaller enough as compared with that of output per worker between them (the labor's relative share is smaller in the former than in the latter), the profit rate can be higher in the former.

To illustrate the above propositions, Table II compiled by Mr. Umemura is presented here although reliability is not so high. This is the only data of this kind available for the inter-war period.

Table II. Differential Structure of Manufacture in 1932

<table>
<thead>
<tr>
<th>Capital class (1,000 yen)</th>
<th>Average No. of workers</th>
<th>Average Output per worker</th>
<th>Average wage</th>
<th>Labor's share</th>
<th>Average capital-output ratio</th>
<th>Capital intensity (1,000 yen) per worker</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 - 5</td>
<td>3.5</td>
<td>492</td>
<td>304</td>
<td>62</td>
<td>2.3</td>
<td>11</td>
</tr>
<tr>
<td>5 - 10</td>
<td>6.7</td>
<td>639</td>
<td>363</td>
<td>57</td>
<td>2.0</td>
<td>13</td>
</tr>
<tr>
<td>10 - 50</td>
<td>14.5</td>
<td>852</td>
<td>453</td>
<td>53</td>
<td>2.1</td>
<td>18</td>
</tr>
<tr>
<td>50 - 100</td>
<td>29.3</td>
<td>949</td>
<td>523</td>
<td>55</td>
<td>2.6</td>
<td>25</td>
</tr>
<tr>
<td>100 - 500</td>
<td>67.9</td>
<td>1,101</td>
<td>566</td>
<td>51</td>
<td>3.1</td>
<td>31</td>
</tr>
<tr>
<td>over 500</td>
<td>409.8</td>
<td>1,574</td>
<td>671</td>
<td>43</td>
<td>66.1</td>
<td>96</td>
</tr>
</tbody>
</table>

Remarks: Reproduced, excluding capital classes under 2,000 yen, from
Table 6 on page 258 of M. Unemura, "Chingin kakusa to rodo shijo" (Wage Differentials and Labor Market), Section VIII in Tsuru, Ohkawa, "Nihon keizai no bunseki" (Analysis of Japanese Economy), Vol. II (Kaisei Shobo, Tokyo, 1955). This was estimated by him from "Kogyo choza" (Survey of Manufacturing) compiled by Shoko-sho (Ministry of Commerce and Industry) in 1932. The coverage is restricted to six prefectures where six great cities are located. All figures are per annum. Salaried worker included in x. Capital intensity is calculated by the writer in multiplying the figures of output per worker by those of capital-output ratio.

No detailed explanation is needed about the tendencies that from small-scale to large-scale classes, output per worker, capital intensity and capital-output ratio all have increasing trends almost without exceptions and that the wage differentials among them in relation to productivity differentials are favourable to the enterprises of large-scale classes to gain possibilities of larger profits as is revealed by the figures of labor's share.

As for the post-war data of this kind, the Economic Research Institute, Economic Planning Agency, recently made a comprehensive work. Quite a similar fact was revealed more exactly by this research. Three kinds of data -- the survey of national wealth and its annex data, the basic survey of small-medium-scale enterprises and statistics of incorporated enterprises -- were arranged and analyzed, and in all cases they found out that a formula $Y/L = a \log K/L - b$ is the best fitting curve (where $Y$, net or gross value added, $L$, number of workers, and $K$, amount of capital, $a$ and $b$, constants). It is obvious in this equation that the capital intensity, output-labor ratio, capital-output ratio, all will increase as the scale goes larger.  

Anyway, if we can enlarge these relationships found in manufactur-
ing to the non-agricultural sector as a whole, it will shed light for a better understanding of the growth pattern and its changes. We have seen that in the early years until around 1903-07, the rate of increase in capital intensity was small in relation to that in labor force. This does not imply an even distribution of capital-labor combinations, but does suggest a dominant position of small-scale establishments and their high rate of growth. In discussing the growth pattern during this early stage at a previous occasion, I called it the period of "dual development" in order to specify the feature of such a formative stage.17 In using this term we tried to characterize a growth process in which the substantial part of the aggregate growth rate in terms of output is achieved by the traditional sectors while the modern sector show an impressive initial rapidity of growth although its place in the economy in terms of output is still not dominant. If we define the traditional sectors as composed of a great number of small-scale establishments whose output growth will be attained by a moderate increase of the capital intensity, and the modern sectors as composed of relatively small number of large-scale establishments, whose output growth will be attained by a comparatively big increase of the capital intensity, then in the course of dual development as a whole, the capital intensity must increase slowly as compared with the rapid increase of labor force. This was exactly the case in Japan. In other words, the rapid growth in terms of output was mainly achieved by an intensive utilization of young, simple laborers, mainly migrants from rural districts, combined with moderate improvements of labor-intensive techniques, and with small amount of capital. In fact, the bulk of outflow of labor from agriculture went into spheres other than factory (see footnote 10). This is the only explanation which can be consistent with the fact that the rate of investment was kept almost unchanged during this period (see I in Column 10 in Table I). Therefore, the
upward part of the first swing should be distinguished from the later ones in the pattern of growth, which were described in previous pages.

So far as such a pattern of economic growth could go on, the aggregate capital-output ratio can be kept at low magnitudes, as is really shown during the most early years. However, from around the turn of the century it became bigger. This might be the outcome of some slow-down of the rate of improvement of production techniques of the traditional type, together with the effects of increased social over-head investments, on which I cannot dwell here.

Turning into the second period after around 1906-12, the modern sector became more and more important in terms of output growth. In reality, this was achieved by accelerating the rate of increase much more in productivity than in the number of laborers. The introduction of production techniques of the modern type, which require bigger amounts of capital investment, must be the main cause of the accelerated growth rates during this period. The rate of investment was accelerated from 16 to 27 per cent toward the peak time of the second swing as clearly seen in the column 10 of Table I. On the other hand, the role of the traditional sector declined, and it is to be noted that this corresponds to the decline of the rate of increase in the labor force, due to the decreased rate of labor-flow from agriculture. In fact, this labor-flow from agriculture was the main condition of developing the traditional sectors in non-agricultural sector. Thus, around the beginning of the 1930’s, the so-called "dual structure" or "differential structure" of the Japanese economy was firmly established in the sense that large capital was accumulated in the modern capitalist sector while in terms of employment the traditional sector was still dominant, in particular if agriculture is included. Therefore, the accelerated rates of increase, both in capital intensity and output per labor during this period, which we discussed in the previous pages,
should be understood to be a combination of a much higher rate achieved in the modern sector and a much lower rate prevailing in the traditional sector.

I am afraid that such a brief explanation might lead the readers to some misunderstandings because such a multi-layer structure embodies in itself a complex of various inter-relationships in its growth process, which should be analyzed further in details. Here I would only like to demonstrate that an aggregate approach without paying any attention to the structural problems cannot be successful in analyzing the growth pattern of a country like Japan.

Two things, however, I would like to point out in this respect. One is the fact that the capitalistic sectors themselves have changed their methods of production from the labor-intensive to the capital-intensive type both in intra- and inter-industry shifts. Transformations within textile industries and shifts from light to heavy industries are remarkable examples. Our dichotomy does not intend to deny this fact, but rather took it for granted because this phase of the problem seems to have already been analyzed by other authors to a considerable extent.

The other is the factor-proportion thesis. In the case of a late comer to modern economic development like Japan, in spite of the abundance of relatively cheap labor, the modern sectors are forced to adopt techniques which permit almost no elastic proportions of the factor combinations, in order to cope with severe international competition. This fact is highly responsible for formulating a dual structure as is often pointed out. A simple illustration in footnote 15 has no intention merely to demonstrate the importance of wage differentials. In the historical development described above, we understand that such an element was in action and has gradually increased its significance.
Now, if we take these facts together into consideration, it appears that we have to face a difficulty to be consistent between the thesis of an unchanged capital-output ratio proposed in the last section and the structural changes described in this section. This comes out from the fact that, in the course of economic development, as the share of large-scale enterprise becomes larger in the aggregate or the shift from labor-intensive to the capital-intensive techniques of production goes on, the aggregate capital-output ratio must necessarily become higher, or in other words the rate of increase in labor productivity must necessarily fall behind the rate of increase in capital intensity. Therefore, to be consistent, we have to assume a factor or factors which will act as a counter-balance to the increasing tendency of the capital-output ratio stemming from the structural changes. At this juncture I have no sufficient factual evidence to identify such counter-balancing factors, but I would suggest that either in the social-overhead sector or through industries, there may be technological and institutional developments of a capital-saving nature which could, in effect, reduce the aggregate capital-output ratio. If we can assume such effects, the capital-output ratio could be unchanged in the long run, inspite of the changes in the structure, I would be inclined to assume the existence of such capital-saving effects.

V

The full discussion about the War and post-War period would require a separate and extensive analysis since the effects of the War were too enormous and radical in changing the situation of the Japanese economy to be treated in a simple manner. It would be not so risky, however, to touch upon the post-War period within certain defined limits set by our present discussion. Statistically, we have some difficulties in linking the post-War data to the pre-War figures. This is another
reason why we treat this period separately. 19

It is convenient to observe the period during which the rehabilitation effects were still largely separated from the period in which the growth process has been more or less normalized. For this purpose, 1952 might be a plausible year by which these two periods should be demarcated. In the former period, 1946-52, the growth rates of output, labor force, and output per labor force were 16.1, 7.1 and 9.0 per cent respectively for the non-agricultural sector; all appear to be abnormally high rates. They may not be explained fully, however, by abnormal factors only because they imply post-war structural changes in the pattern of economic growth already started immediately after the war.

For the period 1952-57, the corresponding figures of growth rates are estimated 9.7, 5.1 and 4.6 per cent respectively, which suggests something common to the former period if we compare these with those of the pre-war long-term process. The greatly accelerated growth rate of output is composed of two equally important components, the accelerated rate of increase in the labor force and also the accelerated rate of increase in the output-labor ratio. The former is the combined result of the rehabilitation and the baby boom immediately after the war and the change in age-structure due to the changes in the post-war demographic pattern. Immediately after the war the labor force in agriculture increased abnormally, but recently it started to show a decreasing trend, and its percentage to the non-agricultural labor force decreased accordingly. Thus, its share of contribution to an increasing labor force has greatly diminished while the non-agricultural sector got a much more self-producing power in this respect (see Umemura's estimate, footnote 10) — a shift of main origin of labor supply from rural to urban districts. (This shift of origin presents an important problem of the changes in the structure of labor market, on which we cannot dwell here.)
In spite of this, the more pronounced fact is that the rate of increase in the labor force to be employed in this sector has increased to a great extent (5.1 per cent as mentioned above), which even in the first period Japan had never experienced, and this is supposed to be a more or less sustained character because the present high rate of increase of working age population is estimated to continue at least for the coming ten years. Thus, as for the rate of increase in labor supply, we would say that, following the first long period of rural origin appearing mostly in the pre-war period, now it shifted to the second period of urban origin. This means a step toward the third stage where labor supply will become smaller in relation to capital supply, but still during this second period the pressure of labor supply continues to be a basic feature of the Japanese economy.

It is impressive that in spite of this great pressure of the labor supply, the rate of increase in the output per labor force in 1952-57 reached the highest figure (4.6 per cent) in the whole process of economic development under consideration, except for the pre-war peak time in the second swing. We have seen that during the pre-war period, the larger rates of increase in productivity were achieved by the smaller rates of increase in the labor force, so that in the post-war period we are facing a new situation. In analysing this new situation, it is particularly to be noted that the capital-output ratio seems to make no substantial difference between the pre-war and post-war period.

Because of some lack of comparability of concepts and methods of estimation, there are difficulties in comparing post-war data of national income and capital formation with those of pre-war days, which we used in the previous discussions. It may not be so risky, however, to try a tentative comparison of the capital-output ratios by using the preliminary estimates of the Economic Planning Agency for the pre-war years since 1930 in comparison with the official estimates for the
post-war years by the same Agency. The aggregate capital-output ratio for 1952-57 is estimated 3.3, while the corresponding pre-war figures come out 3.0 for 1928-32 and 3.7 for 1933-37. These are all measured as the ratio of the rate of gross investment, inventory excluded, to the growth rate of net national product. I would say that these figures may be good enough to give evidence of the almost unchanged capital-output ratio between pre- and post-war periods as a long-run observation. (The differences of figures between these and those in Table I may be mainly due to two causes: one is the different ways of treating government expenditures, in particular, military expenditures, and the other is the effect of agriculture, as in this estimate agriculture is not excluded because of lack of continuous data for the pre-war years).

This estimate, if admitted, not only endorses the proposition made in the previous section but also enables us to understand the post-war growth pattern by the same thesis continuously throughout the whole growth process despite the war break. Thus we can say that the post-war rate of increase in the capital intensity became higher on average, as suggested by the higher rate of increase in labor productivity as compared with pre-war periods, and that the rates of increase both in labor force and in capital intensity have been raised at the same time. This naturally suggests an accelerated rate of investment and in reality we see it is estimated as high as 32 per cent for the non-agricultural sector according to the category rearranged to be more or less comparable with the pre-war period. We have seen that the rate of investment was accelerated from the first to the second period. Now it made a second acceleration. This re-acceleration of the investment rate is basically supported, among other things, by the re-accelerated supply of labor force.

In structure, the rate of capital accumulation and the rate of introducing capital-using techniques are accelerated in the domain of
large-scale enterprises while in the fields of medium and small-scale enterprises, much of the increased labor force are employed year by year, thus, making possible the high rate of increase in the total employment of the economy. As a result, the differentials of productivity between them are apt to be enlarged although the progress of labor-intensive techniques are again accelerated to some extent. Thus the once-established dual structure is now developing in an enlarged scale.

In conclusion, we can say that in the post-World War II period, the pattern of economic growth of Japan became a combination of two elements, the labor-growth dominant pattern, experienced in the first period, and the productivity-growth dominant pattern, started in the second period.
NOTES

1. This paper was written while I was staying at the University of California, Berkeley. I would like to thank the Center for Japanese Studies for its generous hospitality. I have benefitted a great deal by the discussion with Professor H. Rosovsky and would like to acknowledge my debt to him for many helpful suggestions.

2. Since the publication of "The Growth Rate of the Japanese Economy since 1870" by K. Okawa and others (Tokyo: Kinokuniya, 1957), we have been engaged in a research project to explore basic data further at the Institute of Economic Research, Hitotsubashi University. This research was supported by the Rockefeller Foundation. This is still unfinished and much remains to be done to reach a comprehensive revision of the old data through the whole long-term period after the Meiji Restoration up to the present. Therefore, in this paper mostly the old series contained in the volume cited above were used. The tentative results of this research, however, were taken into consideration as a means of checking the old data, and careful reservation was made not to go further beyond a possible range of broad interpretation.


the Post-World War II period.

5. These data for both national income and labor force used in the Table are all taken from our volume cited above. The figures of both output and labor force for non-agricultural sector were estimated tentatively as the weighted average of the figures for secondary and tertiary industries. (In this discussion agriculture includes forestry and fishery, and all the other activities are included in the non-agriculture.) The weights are respectively the income percentage and the percentage of gainfully occupied population in each sector at the mid-period. The rate of increase in output per labor force (g) is estimated simply by \( g \) (the growth rate of output) - \( n \) (the growth of labor force).

The rate of investments were calculated from Professor H. Rosovsky's worksheets, the original data of which were mainly prepared in collaboration with Mr. K. End at the Institute of Economic Research, Hitotsubashi University. This does not include invetory changes. As for concept, scope and method of estimation, see Henry Rosovksy, "Japanese Capital Formation: The Role of the Public Sector," "The Journal of Economic History, Vol. XXI, No. 3, September 1959. Because of lack of data, the rate of investment is calculated as domestic net product / gross investment and the marginal capital-output ratio is obtained by a simple procedure - investment rate / growth rate of output.

6. To clarify this point a further analysis of the breakdown into major sectors is desirable. For example, from 1898-1902 to 1908-12 the retardation of domestic manufacture in terms of net output is particularly noticeable. It must be admitted that our estimate of the output for this sector is especially weak because we had to use indirect methods, but still the slow-down of growth rate of domestic
manufacture during this period seems to be a fact. In the factory production also, items such as "food, beverage" and "textiles" showed retardations from 1898-1902 to 1903-07, while "machinery and chemicals" had sustained and speedy growth. (See Part II, II Secondary industry in our volume cited above).

7. To discuss the problem of long swings more properly, the revision of the deflators, among other things, is particularly urgent. Our national income series were deflated by a wholesale price index because of lack of better deflators at that time. Generally speaking, real national income of this type must tend to be under-valued in the boom and over-valued in the depression because the prices of consumer goods do not fluctuate as much as the wholesale prices. I made a tentative check on this point by using a new cost of living index recently constructed by Mr. S. Yamada and Miss Y. Ando. The result is more or less all right as far as our present discussion is concerned. It may be a problem to be examined further, however, whether there was another trough around 1920 before Japan entered into the war-time economy. In this paper, however, I would like to treat the inter-war period as one set without making a breakdown.

After finishing my manuscript I learned that in Japan Prof. M. Shinohara made a more elaborate study on the long swings of the Japanese Economy. He used parts of the results of our project supported by the Rockefaller Foundation, as well as the relevant time series other than national income, and found three long swings, including the third trough around 1930 throughout the long growth process before World War II. I was pleased to know that his result seems to suggest no substantial differences with mine. As for the causes of long swings, however, he believes that the effects of war and monetary contraction are most important and thus indicates a different line of
approach from ours'. (M. Shinohara, "Nihon keizai no seicho to choki hado" (The Growth and Long Swings of the Japanese Economy) - a mimeographed paper issued by the Institute of Statistical Research, Tokyo, 1960)

8. As for the importance of agriculture during the first swing, see K. Chikawa, "The Role of Agriculture in Early Economic Development", presented to the Round Table on Economic Development with Special Reference to East Asia by the International Economic Association, Gamagori, Japan, April 1960. In brief, agriculture raised its output per worker almost parallel with that of non-agriculture by introducing various kind of technological improvements of the traditional type.

In the discussion of the output per worker or productivity, we should be cautious about the so-called "shift-effect", caused by the labor-flow from the sector of lower productivity to that of higher productivity. If we do include agriculture, the major sector of low productivity, in the present discussion, the effect of this kind will certainly be substantial. For example, from 1878-82 to 1908-12 the aggregate rate of growth of output per worker is estimated 3.2 per cent per annum, but those of the major sectors - agriculture, manufacture, services, are 2.6, 2.3 and 2.3 per cent respectively. The gap between the aggregate and the sectoral figures will give us a rough idea of the magnitude of the shift-effects. This is another reason why our discussion is concentrated on the non-agricultural sector.

9. For the years after World War I, the story is not so simple. For example, according to Irene B. Tauber, during the years 1920-1940, 18.2 per cent of the increase of Japanese males of working ages (15-59) were removed by civilian emigration from Japan; of these 45.3 per cent were replaced by immigration of colonials, mainly Koreans.
10. M. Umemura made an attempt to estimate the flow of labor force between agriculture and non-agriculture. According to him, for example, out of 159,000 (the increase of labor force in non-agriculture), 134,000 was the outflow from agriculture in 1880, and in 1920, this was 168,000 out of 289,000 and in 1953, 162,000 out of 757,000. The percentage declined as 85, 58 and 22. See M. Umemura, "Sangyokan rodojo to sono koka," (Flow of labor between industries and its effect), Chap. III, Section 2 in Tobata, Ohkawa, Mihon no keizai to nogye (Japanese Economy and Agriculture) (Tokyo: Iwanami Shoten, 1956).

According to Namiki, from 1872 to 1920, the increase of working population in non-agriculture was almost all migrants from agriculture, and it was estimate around 8 million, and since the number of factory workers employing more than five workers was approximately 2 million in 1920, the bulk of outflow of labor from agriculture went into spheres other than factory. (M. Namiki, "The Farm Population in the National Economy before and after World War II," a paper for the Conference mentioned in footnote 9).

These studies give the background of my simple estimation in growth terms. The estimation was done in a simple way: first, for the period 1883-87 we assumed that 85 per cent of the increase in labor force in the non-agricultural sector was supplied by the shifted labor force from agriculture. This is 0.95 per cent increase per annum in terms of the assumed constant agricultural labor force, and 3.6 per cent in terms of non-agricultural labor force; second, it is assumed that this 0.95 per cent will continue for the whole period, and this is converted to the
rate of increase in the non-agricultural sector by using the ratios of agricultural labor force to non-agricultural labor force in each period. Therefore, we disregarded the facts that the rate of natural increase was actually accelerated slightly in the later years and that the number of the labor force actually engaged in agriculture has slightly decreased and that there was a slight reverse flow from urban to rural districts. These may be misgivings for the more refined discussion on the demographic studies, but for our present aim of more or less broad interpretations, they may not be serious.

11. The importance of the rate of increase in non-agriculture in relation to that of total population is demonstrated in F. Bovring, "The Share of Agriculture in a Growing Population," Monthly Bulletin of Agricultural Economics and Statistics, August/September 1959, Vol. VIII, No. 8/9. Though his discussion is developed from the side of agricultural problems, his idea is relevant to our problem, and his data are useful to make international comparisons. According to his estimations about the long-term growth process, the compound-rates of annual increase in population or employment in the non-agricultural sector in most advanced countries of the Western type were ranged from 1.3 to 2.7 per cent except the United States, whose rates were exceptionally high (4.2 for 1850-80, 3.6 for 1880-1910). By the way, his figures for Japan (2.6 for 1890-1915 and 1.8 for 1915-40) are not without doubts.

12. If we would have good data of capital stock in constant prices, it might be better to use direct measurements of capital intensity, but this is still not the case for Japan as yet.

13. Because of lack of adequate data of capital depreciation for the years before 1930, our figures of the capital-output ratio give the
ratio of gross domestic fixed capital formation to the net domestic product. In the discussion of long-term behaviour of the capital-output ratio, it is a controversial issue whether we should use a net or gross concept. I think the latter is better as a first approach in this case. Keeping in mind the degree of reliability of our statistical data, however, this issue seems to raise no serious problem to our discussion.

According to the official estimates (Economic Planning Agency, "Kokumin shotoku hakusho" [National Income White Paper] 1959), the percentages of capital depreciation to the net national product at market prices are 7.1 for 1930-33, 7.5 for 1934-36, 8.3 for 1937-40 in the pre-war period, and 7.0 for 1951-54, 9.5 for 1955-58 in the post-war period.

Although these figures are for the aggregates instead for non-agricultural sector and there is a minor difference between net national product and net domestic product, they can give us an idea of the difference between net and gross calculation. If we assume that the percentage of capital depreciation was smaller in the earlier years (supposing the figure for 1951-54 was exceptionally low) and take up three hypothetical cases -- 4.0, 7.0 and 10.0, then the capital-output ratio 4.0, for instance, will be modified to 3.8, 3.7 and 3.5 respectively. This is a simple calculation and different from the method used in the main text, but still I would say that such a slight decreasing trend makes no substantial effect for our broad interpretation in the main text.

14. The following chart was made to give a quantitative illustration of the thesis proposed in the main text. If the assumption of unchanged capital-output ratio is valid, the relation between the rate of increase in labor productivity and that in the capital intensity must be expressed by the 45° line (o) passing through the origin. The dotted points (the number shows each period in their historical order designated in Table 1) are given to illustrate their movements around the above line. The
figures of rate of increase in the capital intensity were tentatively calculated on the assumption that the average growth rate of output throughout the whole period (g') is equal to the "normal" rate of capital accumulation (k') and that the rate of increase in capital productivity (h') can be obtained by a relation h'=g'-k'. Therefore, this is nothing but an simple presentation without theoretical reasoning, but will be a help to understand the idea developed in the text. The line a seems to be better than β (downward capital-output ratio) or γ (upward capital-output ratio).

15. Prof. K. Miyazawa and others, "Kibobetsu shihonkoso to seisansai kakusa" (Capital Structure by Scale-class and Productivity Differentials), a mimeographed paper, February 1960.

16. It is not an easy problem to give theoretical explanations with full confidence about the problem of co-existence of large-scale and small-scale enterprises in terms of our definition. A most simple idea, however, might be suggested here. Under assumptions of differential supply price of labor, uneven distribution of ability among enterprisers
as to command the necessary fund for investments and a given set of knowledge on the possibilities of adopting certain types of technical techniques, we can say that enterprisers will choose different types of techniques, in order to maximise their profit rates, as is shown by the simple Chart. The two lines \( \alpha \) and \( \beta \) express the different technological character of production process. (See K. Okawa, An Analysis of Differential Structure, Economic Review Vol. 10 No. 3, (in Japanese with English summary)).

![Graph showing Wage Rates and Profit Rates](image)

So far as the capital amount shown in these data are used, the average profit rates tend to be smaller in the larger scale enterprises although the wage differentials in relation to productivity differentials are favourable to the enterprisers of large scale classes. This is also true for the data of 1932 mentioned above. Is this really a fact? We can elucidate only one point: in the smaller scale enterprises the "wage earnings" for self-employment of enterprisers are included in the profit shares, which nominally raises profit rates.

17. It was treated preliminarily in K. Okawa, "The Role of Agriculture in Early Economic Development" cited above.

18. In these two respects, it may be interesting to refer to Gustav
Ranis, "Factor Proportions in Japanese Economic Development," American Economic Review, September, 1957, Vol. XLVIII, No. 5. His crucial point is the change in relative factor prices. Statistically, his data are not without doubt since a formation of a long-term price series of investment goods in Japan is still a problem to be solved. But his analytical viewpoint is very close to ours. The difference lies rather in emphasis; he gives us an impression that changes in factor prices and the adaptation to them were worked out uniformly in each historical stage (I believe this is not his intention). Our crucial point lies in the dual structure, which embodies differentials of relative factor prices concurrently.

19. The data of post-World War period were all taken from M. Kawakami, "Kokumin soseisan to keizai seicho" (Gross National Product and Economic Growth), Chap. II in Kokumin shotoku (National Income) edited by K. Ohkawa (Tokyo: Shunju-sha, 1960), especially from Table 8 on p. 90.

In the text, we did not work out the breakdown into sub-sectors within non-agricultural sector. One thing deserves special attention here is the elastic nature of service industry in employments. The post-World War II jump in the rate of increase in labor force was most evident (5.6 per cent per annum in 1952-57) in this sector.

20. Both of these data are reproduced in the volume "National Income" edited by K. Ohkawa cited above.

21. To be comprehensive in the discussion of these points, we have to dwell on the features of and the changes in the wage-profit formulation and of savings-rate. But these topics would have required an extensive treatment and deserve separate analysis.