

# **Future of the Japanese Economy based on its Structural Changes**

## **The Third Sequel to “Toward Twenty Years after the Two Lost Decades”**

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### **1. Preface — The Structural Change confronting the Japanese Economy**

The present Japanese economy has been now confronted with great structural changes in both its domestic and foreign affairs. Within the country, it is under the long-term changes in demographic movement being the declining birthrate and aging population, accompanied with reducing population. Under this situation, the economy has experienced the structural change in industry along with the developing process of the economy. In the relation with foreign economies, it has been faced with the globalization of economic activities and the multi-polarization changing from the previous evolution centered on the U.S. economy to the economic development focused on the Asian newly developing countries. About the latter problem of the way for the Japanese economy to take from now on in the structuring change of the world economy, we have discussed in “the Paper of Number 6” (Takashima, 2012); concerning the former problem of the Japanese economy facing the low birthrate and aging population, we have considered in “the Paper of Number 8” (Takashima, 2014). Further, in “the Paper of Number 10” (Takashima, 2016), we have tried to figure out the real state of the structural change of the Japanese economy, which has taken place in the process through the Two “Lost Decades” from the post-war high growth period, on the basis of the statistical materials of the National Economic Accounts.

The Japanese economy has now been in the state of structural maturity under the present environment of international economy and the domestic change in its demographic structure. The subject matter of this paper is to

examine the problem of how to realize the preservation and improvement of the economic welfare of the nation during the twenty to thirty years from now.

## **2. Is It Possible for Japan to make Economic Growth under its Low Birthrate and Aging Population ?**

As the basic background for consideration of this problem, we have examined in “the Paper of Number 10” (Takashima, 2012), the actual state of the Japanese economy arriving to the present state through the Two “Lost Decades”, based on the statistical materials of the national income. The study based on its statistical change has emerged the fact that the present Japanese economy has been changing its structure so as to be forced to direct its production activities toward those in the foreign countries, too, from the structure of the traditional export country basically relying on the domestic production. The point is how the economic welfare of the Japanese people will become in this change. When it is expressed statistically as GDP per person, that trend towards the present is shown in the Table 2 listed in “the Paper of Number 8” (Takashima, 2014). That is, while the labor force has been decreasing in the total population, the increase of labor productivity in the recent years has changed to be about 1 %. While the increasing rates were 7 to 9 % a year during the high growth period of the 60 years, they were 3 to 4 % a year even in the 80 years. After these periods, they have become around 1 %. Concerning the value of GDP per person, the rate of change has decreased more rapidly; while it was as high as 8 to 10 % a year during the high growth period, it has decreased to be as low as 0.5 % a year recently and the economy has been almost in the stagnant situation. This is brought by the fact that the rate of the population of working age had already stopped to increase in the 70 years in the aging population and has strongly tended to decrease since the 90 years and that its decreasing rate has been greater than that of the total population.

By what measures, is it possible to maintain and improve the economic welfare of the people, in such a situation that the productive-age population decreases ahead of the total population? This is precisely the problem of the Japanese economy of today. Conventionally, the basic

analysis concerning the trends of macro-economics of a nation has been made on the basis of models of production function represented by that of R. M. Solow (1957),

$$Y_t = A_t \cdot F(K_t, L_t), \quad A_t = A_0 e^{\lambda t} \quad (1)$$

(see, Takashima, 2011; 2012). This analysis is based on the idea as follows; when a nation economy makes production activities under the general level of its productivity with the use of that nation's basic productive factors of capital and labor in the volume of  $K_t$  and  $L_t$ , respectively, that nation can obtain production results of volume,  $Y_t$ , with which that country realizes the nation's economic welfare. With this basic model as a starting point, many studies have been made on the basis of scrupulous and complex models of production function. However, they are all analyses only on the side of production activities; they have not the main subject of analysis for economic welfare of the whole nation including people who don't or cannot take part in production activities.

The economic problem facing the present Japan is not solely the welfare problem for working people; going beyond that welfare, it is the welfare problem of the nation as a whole including children and elderly people who do not take part in production. The relation between these two welfare problems is simply shown by the next relation.

$$z_t = y_t \cdot l_t \quad (2)$$

Here,  $z_t$  stands for GDP per person of the nation, and  $y_t$  and  $l_t$  are GDP per working population and the ratio of working population to the nation as a whole, respectively. This equation only expresses a simple relation

$$Y_t / N_t = (Y_t / L_t) (L_t / N_t)$$

Here,  $N_t$  is the total population and the other variables are the same as those in equation (1). And, the trend of the national economic welfare accompanied by a decreasing tendency of the ratio of working population which was described above was derived from the relation among three rates of change in equation (2).

In connection with the subject of this paper which is the national welfare under the vital statistics of our country, the problem is how to

prevent the rate of change of  $z_t$  from falling to a negative number under the condition of a negative rate of change of  $l_t$ . It requires keeping a higher increase rate of labor productivity  $y_t$  than a decrease rate of the laborer-to-population ratio. On the assumption that the above equation F of macro production function (1) is linearly homogeneous, a new relation for labor productivity

$$y_t = A_t \cdot f(k_t) \quad (3)$$

can be obtained. Here,  $k_t$  is a capital-labor ratio.

So then, in the near future of Japan, its movement in population makes it unavoidable for the ratio of labor population  $l_t$  to tend to decline. In this situation, as a measure of offsetting the decline of national welfare and, what is more, a measure of increasing it, it proves that labor productivity  $y_t$  is needed to be pulled up more than to offset the decreasing rate of ratio of laborer-to-population  $l_t$  by changing total factor productivity  $A_t$  and capital-labor ratio  $k_t$ . In consideration that human beings have obtained a lot of economic welfare from ancient times by utilizing tools and instruments, as far as  $f(k_t)$  is considered to be a macroscopic production function, it is regarded as what works increasingly in any period of history. Then, as it is a labor productivity that forms the basis of the nation's economic welfare, what determines a standard of the economic welfare per person comes to be changes of capital equipment ratio and total factor productivity.

Capital equipment ratio shows the volume of capital equipment per labor in the aspect of volume of production factors. What shows the movements of the related statistics is Table 1. The labor population from 15 to 64 years of age has certainly decreased since the end of the 90's as years went on. Under this situation, it is clearly shown that the "number of employees" has also tended to decrease. On the other side, when capital-labor ratio (=capital equipment ratio) is calculated with the statistics of capital stock used for production activities by the private sector, the situation is clearly shown that the ratio has moved from the increasing trend in the past to the gradually lower increasing rate as time comes to the recent years. It means that the function  $f(k_t)$  has tended not to contribute to the rise of productivity of the nation's economic activities, although  $f(k_t)$  is an increasing function with capital equipment ratio as a variable.

Then, as far as the national economy is assumed to be subject to a

**Table 1 Input Trends of Labor· Capital and Capital Equipment Ratio**

Calendar Years	1985	1990	1995	2000	2005	2010	2015
<b>Productive-age Population</b>	82.3	86.0	86.9	86.5	84.6	81.7	77.0
<b>Number of Employees (a)</b>	58.0	62.4	64.5	64.4	63.5	62.9	63.7
<b>Capital Stock (b)</b>	515.1	711.8	911.0	1,073.2	1,142.5	1,230.2	1,322.8
<b>Capital Equipment Ratio (b/a)</b>	8.9	11.4	14.1	16.6	17.9	19.5	20.8

Sources : “Production-age population” and “Number of Employees” are from “Labor Statistics: Long-term Time-series Data” given in the Home-page of the Ministry of Internal Affairs and Communications (MIC) of the Japanese Government.

“Capital Stock” is from “Statistical Data-Capital Stock of Private Firms” given in the Home-page of the Cabinet Office of the Japanese Government.

Notes : For data of “Capital Stock”, original data in and before 2009, given in real term of average price of Heisei 12 (2000), are converted into those evaluated in real term of average price after Heisei 17 (2005).

Unit of persons is million, unit of Capital Stock is trillion yen, and that of Capital Equipment Ratio is million yen per person.

function (1) or (3), the measure left for the Japanese economy under the decreasing labor population to try to maintain and promote the level of economic welfare of the nation is only to increase the total factor productivity  $A_t$  and to shift upwards the function  $f(k_t)$  itself so as to make up the effect caused by the decrease of the ratio of productive-age population. This increase of total factor productivity concerning a production function means the increase of production caused by the other factors than the basic production factors of capital and labor, and is generally regarded as the effect of technological progress. Specifically, it includes all the effects such as an increasing part of production capacity involved in machines and equipment having new technology, an increasing part of labor efficiency caused by education and training of employees, and besides them, systematic increases of production efficiency caused by business structures or a country’s industrial policies. That is what is meant by the “total factor” productivity.

How the economic welfare of the Japanese people will change comes to be determined precisely by how these various kinds of social and economic factors will be developing. The trends as a whole can be estimated by calculating the total factor productivity with the use of remaining terms in the estimation of some econometric model based on the specific production functions. But, although we can get an idea of productivity trends of the

economy as a whole by that method, we cannot know specifically the background of productivity growth in productive equipment and employees consisting in them. Therefore, in this paper, we are going to investigate some guiding principles for preserving and raising future economic welfare of the Japanese nation by means of examining the trends of basic factors consisting of the total factor productivity based on the statistical materials of introduction of new technology, research and development, human capital education and the like.

### **3. Introducing New Technology and Practicing Research and Development**

The fundamental part of increase in total factor productivity consists of increases in productivity of capital and labor. To begin with, we take the aspect of capital equipment and examine how the basic movements of productivity increase have developed in Japan's industrial world, especially in its manufacturing industry. After all, what realizes a rise in productive efficiency in a production site is the introduction of productive equipment involving new technology. However, it is impossible to know quantitatively how much new technology is involved in a certain amount of capital equipment which is introduced by a firm. Therefore, we assume here that newly introduced capital equipment has new technology superior to the old equipment in it, and that the movement of the ratio of introduced new capital equipment to the total volume of existing one shows the general trend of productivity in the side of capital.

Trends of statistics concerning these related items are shown in Table 2. First of all, time-series trends of real values of "Gross Fixed Capital Formation" shows how much fixed capital Japan has newly introduced as a whole country. They suggest that the gross fixed capital formation had well expanded until the early 90's from the 80's, showing that the private sector had actively introduced new equipment in the capital stock. However, the expansion of productive capacity during those periods has made an excess of latent productive capacity owing to the shortage of consumption, marked by the burst of Bubble in the 90's. After that, a little trend of reviving business appeared in the middle of the 2000's, but equipment investment has not lead up to economic stimulus as before and it is shown that the firms' equipment

**Table 2 The Amount of Productive Equipment and its New Introduction**

Calendar Years	1985	1990	1995	2000	2005	2010	2015
<b>Total Fixed Capital Formation</b>	89.5	136.0	132.0	131.7	125.8	105.8	120.4
Equipment of Private Firms	46.0	76.3	65.0	71.4	77.6	66.7	79.7
<b>Net Fixed Assets (a)</b>	478.3	692.4	825.3	871.4	1,110.3	1,154.0	1,366.7
<b>Net Fixed Asset Formation (b)</b>	31.6	52.8	31.4	19.7	12.3	-12.2	4.2
(b/a)*100 (%)	6.6	7.6	3.8	2.3	1.10	-1.05	0.30

Sources : “Annual Report of National Accounts of Economics: Fiscal Year Heisei 27 (2015)” published in May, 2017 by the Cabinet Office of the Japanese Government.

Notes : Monetary unit is trillion yen. “Total Fixed Capital Formation” is real values based on 2011. Values for 1985 and 1990 are obtained by converting statistical materials going back to 1980 listed in CD-ROM appended to the above “Annual Report” published in 2016.

The volume of “Net Fixed Assets” is the nominal value existing at the end of each calendar year. It is obtained by the values of “Tangible Fixed Capital” (excluding “Houses”) in “Productive Assets at the End of Year.”

“Net Fixed Asset Formation” is obtained from “Net Fixed Capital Formation” appearing in “Part 2 Stock; Closing Balance Sheet Account” of the above “Annual Report”.

investment has been inclined to decrease through the “Lost Two Decades”. This situation is suggested by the trends of statistics concerning the “Total Fixed Capital Formation” in the total economic activity of the nation and the total amounts of “Firms’ Equipment” investment by the private sector in the nation’s total activity. It must be noted that these statistics include values of “capital depreciation reserves”. The reserves appropriated for depreciated fixed capital which can be reproduced are costs assessed for replacing broken or damaged parts of existing machines and equipment. In order to know the degree of technical progress in the side of capital as a productive factor, it is required to consider how much new capital equipment embodying new technology is included in capital formation. On the definition of statistical concepts, the value of “capital depreciation reserves” seems to include the part of old technology to be substituted. Therefore, it is appropriate to use “net” values for fixed capital formation by removing the part of the reserves from the “gross” values.

In Table 2, net values of the existing fixed assets excluding houses and their volumes annually input are listed as the capital assets served for the

productive activities of the national economy. They include “intangible Fixed Assets” of computer software and the like which have increased their existence value recently. Their listed values are existing amounts of “Net Fixed Asset” as productive capital stock and the new addition to them, “Net Fixed Asset Formation”.

With regard to the quality of capital as a component of total factor productivity in a production function, it is difficult to figure it out enough quantitatively only with usual official statistics and book value data of firms. It needs at least the yearly time-series data of equipment investment of manufacturing industry, that is, figures of capital vintage distribution of that industry. Prudent studies have been carried out in the United States about the quality of capital involving technical progress based on the time of introduction of capital equipment. Sakellaris and Wilson (2004) estimated production functions by capital inputs using the weighted average of equipment investment carried out in the past concerning American manufacturing industries. In getting these weighted averages, they calculated the values of capital embodied technical progress by making use of values of cumulative depreciation of specific vintage capital and technical progress multipliers. And, Van Biesebroeck (2003) studied the American automobile industry from the end of the 1980's through the early 90's, and showed empirically that the productivity increase of the industry as a whole had been brought by the progress of shift to the new form of production in from the old vintage factories.

In Table 2, statistical values of “Net Fixed Asset Formation” can be regarded as those of capital stock of the latest vintage which ought to embody the newest technology, while statistical values of “Net Fixed Assets” include machines and equipment of all the past vintages which are still used in the present operation. Therefore, the ratio of these two numerical values is considered to be an index indicating the degree of the newest technology embodied in the present capital stock. The time-series movement of that ratio shows the state of affairs that the degree of the newest technology has tended to decline after the bubble burst in the early 1990's. This means that the capital embodied technological progress has been falling in the sense of total factor productivity in the Japanese economy, and if the negative value of that ratio appears successively, it makes one of the sources of reducing the total factor productivity.

Economic maturity may have a relative tendency to reduce capital investment activities mainly in manufacturing industry of domestic economy, but it can be said for production equipment embodying the existing technology. It is the progress of the world economy that developing countries follow the process of industrialization by acquiring such technology one after another from developed countries and introducing it as production equipment. Japan, too, led up to the present after getting out of the feudal system in the Meiji Restoration and out of the ruins after the War by introducing new technology from advanced countries. Then, to stop making progress of equipment investment embodying new technology is not only to wait for overtaking by countries of least developed economy but also to become inevitably unable to compete with productive power of these countries having superiority in the area of other factors than capital productivity such as quantitative input of labor and others. That is shown in the fact that, today, Japan's manufacturing industry has become no match for Korea, China and others in productive power based on the widespread technology.

This situation has spread from the technology of a flat-screen TV up to that of DRAM which has been regarded as high technology. And, leaving this situation as it is only results in the downfall of the Japanese economy and the decline of economic welfare of the Japanese people, starting from the fall into deficit in its trade balance. One and only means for preventing this result in the aspect of capital productivity is to go on with development of new technology always ahead of least developed countries.

Table 3 shows technological development activities of our country concerning the aspect of research expenses and foreign trade in technology. In the Table, as far as the total amount of research expenses are concerned, they have not decreased in terms of the ratio to GDP in both the country as a whole and firms in it. Japan preserves this ratio of the second or third high rank in the OECD member countries, and on the basis of this fact, too, there has been a high rating that "Japan has a technologically advanced economy. Its science and innovation profile demonstrates top performance in several areas" (OECD, 2010). However, the factor of R&D activities which could be called to be essential lies in uncertainty of the results. Therefore, a greater uncertainty is involved in the relation between the amount of funds to be used and the productivity of production capacity equipment involving new

**Table 3 R&D and Technical Trade**

Fiscal Year	1975	1980	1985	1990	1995	2000	2005	2010	2015
<b>Research Expenses</b>	<b>2,974</b>	<b>5,246</b>	<b>8,890</b>	<b>13,078</b>	<b>14,408</b>	<b>16,289</b>	<b>17,845</b>	<b>17,246</b>	<b>18,939</b>
<b>Ratio to GDP (%)</b>	<b>1.91</b>	<b>2.08</b>	<b>2.65</b>	<b>2.86</b>	<b>2.85</b>	<b>3.19</b>	<b>3.53</b>	<b>3.56</b>	<b>3.56</b>
Technology Export	16	38	178	374	618	1,188	2,028	2,426	3,949
Technology Import	71	144	602	753	945	1,218	704	537	602
<b>Balance</b>	<b>-55</b>	<b>-106</b>	<b>-424</b>	<b>-379</b>	<b>-327</b>	<b>-30</b>	<b>1,325</b>	<b>1,907</b>	<b>3,347</b>

Sources : “Annual Report of Scientific and Technological Research: Fiscal Year Heisei 26 (2015)” by the Statistical Bureau of the Ministry of Internal Affairs and Communications (MIC) of the Japanese Government.

“Long-Term Statistical Series of Japan” given in the Home-page of MPM (<http://www.stat.go.jp/data/chouki/index.htm>).

Notes : Monetary units are billion yen.

“Technology Export” and “Technology Import” are the amount received and the amount paid respectively as the rewards of “provision of patent rights and know-how, technological guidance and others in relation to other countries” and the survey is conducted every year by setting the situation on the 31th of March. Statistics in and before Fiscal 2000 are obtained from “royalty of patent and the like” in “Table of Service Income and Expenditure” given in “Monthly Report of International Balance of Payments”.

technology, and many researches concerning this problem have been taken so far. (On the survey of this problem, refer to Syverson, 2011.) Because of this, it must be difficult to declare that a country having great research expenses is an “advanced technological economic country”, but technological trade is considered to become one of the indexes showing the results of R&D activities. Therefore, their actual situations are shown in Table 3 in time-series data, together with the trend of “research expenses”.

Regarding the trend of Japan’s technological balance, the export of technology has rapidly expanded especially after 2000’s. Japan’s trade surplus of technological trade in the latest year of fiscal 2015 was 3,347 billion yen, which was almost the second largest amount recently next to 35.9 billion dollars of America’s surplus (2012) (Statistical Office of MIC, 2014; pp25). Based on these statistical figures only, Japan’s R&D activities appear to have achieved good results meeting the invested funds ahead of foreign countries. If it is true, Japan ought to have actively carried out opening up new market based on new technology and equipment investment

for the production activities. However, new equipment investment of the Japanese economy as a whole in recent years, especially that of new vintage, has shown to be decreasing with time as already described with statistical figures in Table 2, and the economy experiencing “Lost Two Decades” has still been in the situation that it cannot be said to have completely got away from it.

There co-exist three situations in the present Japanese economy, that is, great volume of R&D, increase in technological trade surplus and stagnation of new equipment investment in the domestic industries. How can these situations be understood consistently? A key to do it seems to lie in contents of Japan’s technological trade. After the beginning of the 2000’s, Japan’s technological trade has rapidly increased, and expanded its surplus from 698.4 billion yen (fiscal 2001) to 1906.6 billion yen (fiscal 2010). After that too, it has increased very fast, getting to 3,347.4 billion yen in the latest 2015 fiscal year. However, the actual situation of that export is largely between parent companies at home and their subsidiary companies abroad, and that amount from the former to the latter accounts for 74.7% in the total export in the latest fiscal 2015 year (Ministry of Internal Affairs and Communications, 2016).

Then, supposing that production technology is exported abroad, especially to subsidiary companies, rather than used for equipment investment preparing for new domestic demand, the exported technology may not be new one created from the research expenses invested every year but may be mainly composed of the technology much used in the country of Japan. The technology which is largely exported at present was used for production of goods which already satisfied the domestic demands. The technological exports to foreign countries, especially to Asian developing countries such as China and India, are considered to be related to manufacturing techniques concerning the goods the demands of which are expanding at present among the people of the nation in general in these countries. The exports to the advanced countries like the United States seem to be one of the strategic measures for firms to continue and expand by production of existing goods in these countries because of saturation of the domestic market. As seen in Table 4, these situations are also suggested by the fact that the stage of Japan’s expansion of technological exports has turned out in a way of paralleling very much with the trends of time-series

**Table 4 Income Balance and Trade Balance**

<b>Fiscal Year</b>	<b>1981-85</b>	<b>1986-90</b>	<b>1991-95</b>	<b>1996-00</b>	<b>2001-05</b>	<b>2006-10</b>	<b>2011-15</b>
<b>Income Balance</b>	<b>295</b>	<b>2,240</b>	<b>3,774</b>	<b>6,194</b>	<b>9,166</b>	<b>14,930</b>	<b>17,810</b>
<b>Use Charge of Patent</b>	<b>-194</b>	<b>-437</b>	<b>-390</b>	<b>-193</b>	<b>148</b>	<b>538</b>	<b>1,519</b>

Sources : “Income Balance” (calendar year) is the sum of “Fee of Employees” and “Property Income” recorded in the foreign accounts of “Source” of Table 2 above. Statistics in 2000 and before 2000 are obtained from the table given in CD-ROM as an extra of Annual Report of the same “Source”.

Statistics of “Use Charge of Patent (and so force)” (fiscal year) are obtained from “Service Balance of International Balance of Payments” (1991-2005) in “Long Statistical Series of Japan—Chapter 18. Trade Balance of International payments: International Cooperation” in Home Page of the Statistical Bureau of the Ministry of Internal Affairs and Communication, and from “Trend of International Balance of Payments” (2004-2015) in Home Page of the Ministry of Finance.

Notes : The monetary unit is billion yen in nominal value.

“Use Charge of Patent (and so force)” is the balance between revenue and payment of “Use Charge of Patent (and so force)” given in the table of “Service Balance” in “Monthly Report of Statistics of Balance of payment of International Payments”. This is recorded as “Amount of Technological Trade” in the Statistics of International Balance of Payments. Concerning the statistics of “Balance of Technological Trade” based on the Survey of Scientific and Technological Research, see the note of Table 3. Statistics in this table are average in a year of each period.

data of “balance of income and expenditure”. The large part of expansion of income balance of our country depends on a large part of investment balance of overseas production activities, particularly on interest income and distributed income of corporate enterprises. This means that Japanese firms have expanded the production activities of their overseas subsidiaries in recent years, and it can be naturally considered that the expansion of technological export has been accompanied by it. It must be noted here that “Balance of Technological Trade” is not included in “Income Balance” in the statistics of International Balance of Payments but included in “Service Balance” as use charge of technological patent and so forth. Japan’s service balance itself has continued to be deficit for a long time (see Table 10 in the

Second Sequel (No. 10 issue of this journal) ) but, in recent years, it is recognized that the size of deficit has tended to decrease owing to the sources including the improved balance of technological trade.

The above statistics seem to tell that Japan's R&D activities have not borne on investment of technological innovation in the domestic industries despite the continuous input of research expenses and that firms have just exported the matured technology used in their domestic production along with their direct investment in the situation of the long-lasing stagnation or saturation of the domestic demand and under the inferiority of price competition with newly developing countries. If this is truly the present situation, the productivity of those R&D activities is considered not to have become so high that OECD rated, in the period from the "Lost Two Decades" to the present at least, apart from the period before then.

Many researches have been made so far concerning the relation between R&D activities and their results in each country, and Barbosa and Faria (2011) is one of the recent ones. This is an empirical research about the EU countries concerning the situation that the difference in institutions among countries gives the difference of "innovation intensity" in the industrial level of each country. The conclusions of the analytical results are almost consistent with the results given by the previous researches and their research states that the strict regulations of product and labor markets act negatively on the depth of technological innovation of that country. Also, it expresses that the development of credit market will promote technological innovation but that, on the other hand, the reinforcement of intellectual property rights is questionable for the means of promoting technological innovation. Concerning "the thickness of technological innovation" in Japan, especially its R&D activities and results and their introduction into the industrial world, their relation with various systems of Japanese society remains to be an important subject of future research. As explained in detail in "the No. 6 issue of this journal", "group directivity" proper to the Japanese society has been taken notice of by many foreign intellects, too, and the future research of Japan's thickness of technological innovation will have the relation with that property as an important aspect of analysis.

What has already been pointed out as one of the problems about the future technological innovation of Japanese firms in connection with the above matter is that they have fewer cooperative works with foreign

countries than foreign firms (OECD, 2010; pp.196-7). From a viewpoint of ratio data of number of patents obtained in corporation with foreign researchers to the total number as an index representing R&D cooperation and knowledge exchange with researchers of different countries, that ratio is only 2.87 % in Japan, compared with 20% to 40% in European countries and 11.03 % even in the United States. This ratio in Japan is extremely low among the advanced nations. Considering that this index represents the degree of internationalization of a nation's research activities, Japanese society falls extremely far behind the other countries in that field in today's international economic society of a rapid degree of globalization, and moreover, as already seen in the technical specifications in the cell phone market of the international society, that situation can be considered to be the cause to bring Japanese industrial technology to the state like the Galapagos Islands.

In this way of view, sustainable research activities expressed only by the scale of research expenditures does not preserve Japan's position as a country of science and technology, not to speak of relating to technological innovation in industries based on adequate creation of new technology for the research expenditures. That is because only the sustainable research does not always connect to adequate technological innovation for meeting the existing market demand or for creating the new one and then, cannot draw out firms' new equipment investment. In the actual market, there does not appear the creation of technological innovation which arouses people's new demand and then, the present situation of Japanese economy may be said that its production equipment of mature technology remains to have surplus production capacity and that it has not yet been able to completely get out of the deflationary situation under the gap between supply and demand after it experienced the "Lost Two decades".

#### **4. Structural Changes and the Quality of Human Capital**

The basic way of thinking in the arguments of this paper lies in the equations (2) and (3) presented in the Section 2. The equation (2) represents the relation between the output per labor force  $y_t$  and the output per person of the nation  $z_t$ , and this is the equation to be always kept in mind in order to maintain and promote the economic welfare of each person of the

nation under the situation that the productive-age population is decreasing in the Japanese economy with a low birthrate and an aging population. Equation (3) represents the basic expression showing the necessity of the productivity increase for preservation and elevation of the nation's economic welfare under that difficult condition given to the Japanese society. On the basis of these facts, we have examined the problem of how to increase the efficiency of the economic world relating to its production equipment, including R&D activities as the fundamental activities for it. The production equipment is a physical factor as one of the basic production elements for rise of the total productivity  $A_t$  for the sake of increase in the economic welfare, in the midst of the situation that the capital-labor ratio  $k_t$  in the basic equation cannot be expected to increase any more in the way like that in the past Japanese economy.

What should be examined is the problems about labor which is the other essential production factor to increase the total factor productivity — that is, how to raise the quality of the human capital and whether it is possible in the population aging society. The production efficiency concerning the input side of the element of labor is characterized by great influence coming from the quality change of necessary labor brought by the changes in the social system like school education and the industrial structure, and what is more, from the longer factor such as the changes of age composition of the nation. The changes in the labor production efficiency under these influences are greater than those in the capital production efficiency realized mainly by firms' activities of capital investment. Concerning the long-term changes of factor productivities of the Japanese economy, a joint thesis by Sato and Morita (Sato and Morita, 2009) has been already presented in “the Paper of Number 6” (Takashima, 2012). Conventionally, the economic interest about labor has centered on wage problem in labor economics and there have not been a sufficient buildup of research about the effect to productivity brought by human capital. In this situation, Sato-Morita's thesis is worthy of attention as a valuable research concerning the capital and labor efficiency of Japan's economy, especially including empirical research about the quality of human capital.

Sato-Morita's research measures economic growth processes of both of the United States and Japan by the biased production functions with the use of long-term statistical materials from 1960 to 2004, and calculates the

changes of productivities of physical capital and human capital based on them. A biased production function means the production function that expresses clearly the contribution to production by capital and labor as the basic production factors by splitting each of their contribution into a quantitative part and a qualitative part. Then, the part of qualitative contribution of production factors is figured out to be individual efficiency increase of each of capital and labor, not to be the integrated contribution of all production factors like the total factor productivity  $A_t$  in production function (1) of Section 2.

The points that the research has explained about the Japanese economy are as follows. In the observation divided into period I (1960-1989) and period II (1990-2004), the annual average growth rate of capital efficiency was minus1.63% in period I and minus1.36% in period II, showing that it was minus all through the observation period. As opposed to it, that rate of labor efficiency increased by 5.11% in period I and also increased by 1.01% even in the period II of the sluggish period of economy including the “Lost Decade”. It is felt to be unexpected that the capital efficiency recorded the minus rate of increase all through the period, but this explains that the large part of the growth in the period I of the high economic growth was realized by the quantitative expansion of production equipment embodying existing technology, which was the type of growth realized by following in European-American footsteps. And, in period II, as seen in Table 2, the major part of the equipment investment was to preserve production capacity of the existing equipment, but on the other hand the part of net fixed capital formation embodying new technology was small and it turned even to a negative value in recent years. From these facts, it can be understood that the rate of increase of capital efficiency was minus all through the period.

Concerning the labor, how can it be understood that its production efficiency kept positive values all through the observation period by contrast to the capital? Regarding this problem, my analysis in “the Paper of Number 6” was as follows. That is, “each firm tried to increase its productivity by substituting capital for labor and furthermore to promote the efficiency of labor input per hour by the efforts like a strict labor management of reduction in unnecessary overtime working and so on, as the economic conditions were getting severe. It could be said that this actual situation is explained by the results of the above empirical analysis based on the

theoretical model.” And, for measures to be taken from now on, it described that “it is required to make efforts . . . . to raise the labor productivity further with service industry as the main object for it, now that the decrease in the working population is unavoidable in the long run” (Takashima, 2012; pp.146).

In the Japanese economy, labor productivity has been preserved by labor-capital replacement based on the a large quantity of capital equipment input in the high growth period and mainly by the increased efficiency of labor time based on the adoption of labor management and contractual (non-regular) employment during the long-term economic stagnation period, but the rise in labor productivity based on these measures seems to have only a small part of what is called truly to be the rise in “quality of human capital”. Concerning the capital, the improvement of its qualitative efficiency can be made by introducing production equipment embodying new technology into production process. At that thought, the rise in qualitative efficiency of labor should mean to improve the quality of human capital which is adequate for new technology of capital or can realize its efficiency. A true innovation is realized only after both of these production factors are put into production process as a pair and work together.

The quality of human capital of a nation is capability of people engaged in production, education in a wide sense which sustains it, and a form of organization making these fruits show in production activities. Concerning education, the Japanese economy has been characterized so far, in addition to school education, by having company education in the management structure peculiar to the Japanese companies represented by lifetime employment, but that practice of education has appeared to change in the course of the changes of industrial structure under the globalization.

As for the quality of human capital of the whole country, the aging population problem cannot be ignored as an important factor especially related to it. About this problem, OECD has made the statistical research about the age structure of the nations’ population and also their productivities. From that material, Table 5 shows statistical figures of the aging rates for 8 countries ranking high and for 8 countries ranking low among 34 OECD member countries. (The member countries having no statistics about “Rising Rate of Productivity” in the material are excluded.)

**Table 5 Aging of the Nation and Productivity**

	Japan	Germany	Italy	Portugal	Sweden	Austria	Swiss	Finland
Rate of aging	23.0	20.6	20.3	18.5	18.3	17.6	17.4	17.3
Rate of working-age population	63.8	66.0	66.2	66.3	65.1	67.6	68.0	66.2
Rising rate of productivity	0.76	0.76	-0.44	-0.19	1.03	0.80	0.42	0.93

  

	Denmark	Holland	Canada	Australia	US	New Zealand	Ireland	Korea
Rate of aging	16.6	15.5	14.2	13.5	13.1	13.0	11.4	11.0
Rate of working age population	65.5	67.0	69.4	67.5	67.1	66.5	67.7	72.8
Rising rate of productivity	-0.22	0.21	0.09	0.52	1.27	0.08	1.48	3.13

Sources : OECD FACTBOOK 2014, Economic, Environmental and Social Statistics.

Notes : “Rate of aging” and “Rate of working age population” are respectively the rate of population of aged 65 and over and the rate of population aged between 15 and 64, both in 2010. “Rising rate of productivity” is the average annual rate of changes of multi factor productivity during 12 years from 2000 to 2011. Figures are all in %.

The development of figures in this Table seems to indicate the tendency that the countries of people’s higher rate of aging have lower rising rate of productivity and that the rate of productivity grows higher as the rate of aging becomes lower. (Concerning 20 OECD member countries having the figures of rising rate of productivity including 16 countries of Table 5, Spearman coefficient of ranking correlation coefficient is calculated to be minus 0.2346.) The above Table shows that the Japanese society has already become the highest aging society and it is almost certain that the tendency of aging will proceed further from now. Considering the above statistical facts along with the vital movement of the Japanese society, they seem to show that the decrease of rate of working age population will become a factor of reducing the productivity of the country’s economy.

However, in order to know the clear contents about the influence which the dynamic state of population has on production efficiency of human capital, it is needed to make analysis based on further detailed statistical materials and a prudent method of measurement. The statistical fact shown in Table 5 is just one of the rough materials related to the problems concerning the relationship between aging of the nation and productivity of

human capital. First of all, regarding an aging rate of human capital, the objective of analysis should not be only “Rate of working age population” but should be the trend of average age of employees actually engaged in production activities. As the first approximation, it is needed at least to observe the trend of the average age of working people from 15 to 64 years of age. This work becomes possible by pursue of population statistics, but the basic difficulty lies in the measurement of the trend of productivity.

“Rising rate of productivity” based on OECD data is “Multi-factor productivity growth” similar to total factor productivity, which is obtained as the remainder by subtracting change rates of capital and labor inputs from change rate of output. (Regarding the detailed method of calculation, see OECD (2001) ). That is completely the productivity including all the factors involved in production activities, not only capital and labor but also production materials including intermediate products and also production organization playing to combine all these elements together for production activities. In order to bring up the problem of qualitative efficiency of human capital with the aging of laborers, it is needed to measure the change of that productivity extracted by separating it from the total factor productivity. While the above mentioned joint thesis by Sato=Morita is the very first trial for it, the research theme needed to be taken up from now on is to measure the changes of that qualitative productivity as a time-series of annual changes and, what is more, to measure those changes in relation to the population movement.

At present, Japan has the vital movement of aging population especially with the decreases of working age population in both its total number and its percentage to the total population. In this situation, what is needed to do for maintaining the situation of the nation’s economic welfare at least at the same level as before? The trends of the above statistical data by OECD and of the measurement results may possibly be considered to suggest the facts that aging of a nation’s population brings a fall in the percentage of production age population and that it decreases the qualitative efficiency of labor. And, Sato=Morita’s thesis indicated above shows that the rising rate of labor efficiency came to decrease in the period of the present sluggish economy in comparison with the period from the high economic growth after 1960 to the bubble economy. It can be considered that this situation may have an additional cause of the aging of working age

population.

Table 6 shows the long-term trend of figures in every five years about the average age of workers and the percentage ratios of non-workers due to two causes, which are considered to be factors related to the qualitative efficiency of Japan's labor force. Among 34 OECD countries taken in Table 5, Japan has already become the highest aging population country (in the ratio of population aged 65 and more). Concerning only the working population which seems to be directly related to qualitative efficiency of production

**Table 6 The Age of Working Population and Causes of Non-Workers**

	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015
<b>Average age of the working population</b>	<b>38.2</b>	<b>39.7</b>	<b>40.8</b>	<b>41.7</b>	<b>42.3</b>	<b>42.8</b>	<b>43.3</b>	<b>43.9</b>	<b>44.9</b>	<b>45.7</b>
<b>Rate of the non-work force (education)</b>	<b>36.8</b>	<b>44.3</b>	<b>51.7</b>	<b>52.8</b>	<b>52.3</b>	<b>49.2</b>	<b>50.4</b>	<b>52.8</b>	<b>54.5</b>	<b>55.3</b>
<b>Rate of the non-work force (housework)</b>	<b>33.8</b>	<b>36.9</b>	<b>34.0</b>	<b>31.4</b>	<b>29.2</b>	<b>30.3</b>	<b>31.1</b>	<b>29.6</b>	<b>28.0</b>	<b>25.4</b>

Source : Statistics Bureau, Ministry of Internal Affairs and Communications, "Labor Force Research, Heisei 27 (2017)".

Notes : "Average age of the working population" is calculated using that of the central age in each age division of ten years from 15 years of age given in the above source. For the age division of 65 years of age and the above that, 70 years of age is used for the calculation.

"Rate of the non-work force (education)" is the rate of the figures of "education" in the "non-working population" to the population of "15-24 years of age". "Rate of the non-work force (housework)" is the rate of the figures of "Housework" of women's "non-working population" to women's population "of and above 15 years of age. The rates are all in %, and figures are listed in the average of each calendar year.

activities, the long-term trend of its average age in Japan is shown in the Table. That trend starts from 38.2 years of age in 1970 and arrives at 45.7 years of age in 2015, which means that the average age of the people working in production sites has already increased as many as nearly 7 years. Regarding the trend in the future, the National Institute of Population and Social Security Research of the Japanese government estimates that Japan's "Rate of the aging population" will attain to as high as 38.4% in 2050 while it was 23.0% in 2010, and so, if there is no change in measures of the Japanese

society against that vital statistics, it seems that the aging of labor population will continue further from now on.

In the Japanese economy, regarding the labor force as one of the basic production factors, the productive-age population decreases not only in its overall number but also in the ratio to the total population, in the dynamic state of population entering the decreasing process of its total number with a low birthrate and an aging population. And, as Table 6 shows, the increasing trend of the average age of labor force has already appeared apparently. In the present Japanese economy where the contribution of labor to production has been apparently reducing due to the decrease in its quantitative input, it seems to be very difficult for that negative source to be compensated by the qualitative increase of labor force as far as this problem is thought based on the trend of the average age of labor force. It would become a helpful measure that the fall in efficiency brought by the aging of labor force could be made up by the expanding education of the young generation. It is a difficult work to prove statistically the qualitative increase in labor brought by education, but as an extended fact, Table 6 has the ratio of non-working young generation due to “education” accounted in the total number of the non-working young generation. In view of that trend, the ratio seems to be more increasing after the 2000’s than before, while it decreased once in the 1990’s. Also, concerning the in-house education regarded as one of the characteristic conducts of the Japanese firms related with the life-time employment, they have been unable to afford the expense of continuing that practice in the long-term stagnation and it is even pointed out that there has appeared a tendency of relying on non-regular employment from the outside for their needed skills. And besides, they are lacking in the measures of continuous education for these human resources of non-regular employment.

In order to maintain and improve the economic welfare of the Japanese people in such a declining situation of quantitative input and qualitative efficiency of human resources, it will be needed to expand a positive replenishment of capable people from foreign countries as the basic strategy in the international environment where globalization is progressing. This strategy has been regarded to be what the Japanese society has hesitated so far to adopt most in the world, but the Japanese government cannot help looking straight at it at this point. The “New Growth Strategy ~ A Scenario of the Revival of Healthy Japan” was decided by the Cabinet in July, 2010,

and it declared “Increase in Accepting Capable Persons and the like”, in which it states “to introduce “a point system” adopted by Western countries and a part of Asian countries and to take measures of giving preferential treatment in the system of immigration control for foreigners having good professional career, achievements and the like”. The “point system” is to set up points for “educational background”, “professional career”, “annual income” and the like, and to give preferential treatment in the system of immigration control for persons recognized to be “high-level persons” by having a total point amounting to a certain number. This system has already been carried out by being introduced in May, 2012.

The purpose of this system is written “to promote admittance of foreigners having so much high capability and qualities as to be expected to contribute economic growth and creation of new demand and employment, that is, “high-level persons” (Ministry of Justice, 2011), but this system does not seem to be the measure for improvement in recognition of the problem of the future productive efficiency to be brought by the fall of qualitative standard concerning the human capital of our country in the midst of a low birthrate and an aging population. In fact, this system is taken as a step “within the existing measure of receiving foreigners”. Therefore, we cannot go so far as to say that this system is a radical reform of labor market keeping up with the vital statistics of our country by looking straight at that trend in the progressing situation of globalization of economic activities. For the sake of improvement of qualitative efficiency of capital equipment as the other production factor inevitable for economic growth, too, it is needed to call in “high-level persons” to contribute to innovation within the company organization together with the improvement of Japan’s falling behind in the cooperative research with foreign countries, and also, it is inevitable to open its domestic labor market to a greater extent to foreign countries for securing human resources in the market of nursing services increasing in the aging society.

In relation to the element of labor input in the vital movement of Japan’s population, we have a problem of female labor force. In Table 6, there is shown the proportion of women who do not take part in the labor market due to engagement in “housekeeping” in the total number of female population over 15 years of age. Based on that, the ratio seems to have tended to decrease in recent years, but women over one fourth and above are

non-workers still in the recent years and the ratio of non-working women has only a small change during 40 years from 1970 when that ratio was one-third. A great difference of the way of the Japanese female labor from that of the Western countries is in a pattern of the rate of labor power by age class. When a graph is made by taking age classes in order from younger one to elder one in horizontal axis and taking the rates of female workers corresponding to age classes in vertical axis, it becomes a shape of a reverse U-letter in case of the Western countries. In Sweden in particular, the highest point is formed by female workers in their 40s in the height of working, where the rate of female workers reaches as high as 90%. As opposed to case of the Western countries, that graph takes the shape of M-letter in case of Japan and the rate of female workers becomes the lowest in their late 30s in 2014 (Ministry of Health, Labour and Welfare (2016) ).

“Equal Employment, Children and families” Bureau of Japan’s Ministry of “Health, Labour and Welfare” examines the situation concerning the female labor in the Japanese society and the problems based on statistical materials and publishes the results by collecting it in a report named “The Actual State of Working Women” every year. In the edition of Heisei 22 (published in 2011), they deal with the age distribution of Japan’s female labor force and analyses the situation that it is M-shaped differently from the Western countries. The low position of their 30s in the M-shape has been moving upward gradually year by year, but it has not yet got out of the M-shape. What is particularly noticed in that report is that the difference between women’s rate of actual employment and their rate of potential labor force is large in the Japanese society, and this explains the reason why the curve of women’s rate of employment is M-shaped in Japan while it is reverse U-shaped in the Western countries. The rate of potential labor force is the figure obtained by adding the number of non-working persons wanting to work to the labor force (a number of employees plus unemployed persons) and dividing it by the total number of population (of 15 and older). When the figures of this rate are calculated regarding the Japanese women and a graph is made along the age classes, the central part of its curve of women’s employment rate moves upward as much as 15% and the curve itself becomes closer to the Western reverse U-shaped pattern.

This is thought to mean the following situation. Among the women located in the center part of the present employment rate curve, in other

words, among those who are not in the labor force, many of them especially in their 30s wish to take part in production activities immediately if circumstances permit. Those women of productive generation wish to maintain family life of housework, childcare and the like and social life mainly composed of work supporting their family at the same time as it is actually carried out in Sweden and other Western countries, but the present Japanese society does not allow it yet. The above statistics tells this actual situation.

As seen like this, in the Japanese society in the situation where the reduction of the overall number of productive-age population cannot be avoided under the vital statistics of a low birthrate and an aging population, it cannot necessarily be impossible to complement the decrease in quantitative production power with the increase in qualitative productivity of human capital. As the strategies for it, one of them is to grapple in earnest with “increase in admittance of high-level capable persons” from abroad which seems to be carried out in compliance with the above mentioned “New Growth Strategy” and another is to improve the social environment so as for the women’s labor force to be able to return to work, as stated above. In addition to these matters, it goes without saying that it is indispensable to promote and expand education and R&D activities. However, concerning the problems of receiving foreign capable persons (it seems necessary to admit a wide range of human resources such as those for welfare, nursing care and other services, not limiting to only the “high-level capable persons” in terms of “educational background”, “professional career” and the like) and of making better use of woman labor force, government measures for them would have only a limited effect as far as they are to be simply carried out “within” the “present” general system as the Government is planning, and it is considered difficult to realize the increase in qualitative efficiency so much as to compensate the decrease in quantitative productivity of human capital due to the decrease in labor force. As these two problems take root in the long historical background of the Japanese society towards Japan’s ethnic unitary state and women’s duty, it becomes necessary for them to make a drastic reform exceeding a level of temporary measures simply taken to provisional economic conditions at the time. In order to cope with the structural changes of the international society symbolized by the present globalization, it is needed that the Japanese society itself has a historically structural revolution.

## 5. Structural Changes amid the Globalization

The Japanese economy accomplished the economic expansion from “Jinmu Expansion” toward “Iwato Expansion” and, during “Izanagi Expansion” as early as the latter half of the 1960’s, it achieved the world second largest GDP next to that of the USA and came to be called an “Export Power”. The growth rates during these periods were remarkable and, especially in the latter half of the 1960’s, the growth rate of real GDP was kept to be as high as 10% to 12%. In the 1970’s, there occurred the “Nixon Shock” and, after that, the transition to the floating exchange rate system and oil crises of two times took place. Throughout these events, the annual growth rate of the Japanese economy changed to the level of 4 to 5% in the early half of the 1980’s and its economy began to enter into the same state of mature stage as that of the Western developed economies. The economy seemed to continue to head for that stable mature stage, but it plunged into the bubble economy in the real estate and stock markets in the latter half of the 80’s and, in a few moments of the 90’s, it came to have a long time of economic stagnation called the “Lost Two Decades” brought by a malfunction of the financial market due to the bubble burst.

Following the “Paper of Number 10” and the “Paper of Number 8” as sequels to the “Paper of Number 6”, we have considered the causes of the long stagnation of the Japanese economy continuing from the 90’s to the present and the measures to maintain and improve the economic welfare of the nation heading for the future. What has been placed in the center is the structural changes of the Japanese economy in the domestic and foreign affairs in these periods. The greatest part of the “domestic” structural changes is the change in population structure having content of a low birthrate and an aging population in a rapid progress uncommonly in the world, and the situation to be especially noticed as an economic problem is the structural change of the decrease in productive-age population with the decrease in the total population, and besides, the fall in that ratio in the total number of population. The structural change in the financial aspect accompanying the aging population is a rapid increase in the necessity of political measures for medical welfare, and how to deal with this problem has become what gives a basic effect to the national economy more than the nation’s financial problem. As a remarkable structural change contrasted

with the structure of the private economy in the high growth age, there is a marked phenomenon of increase in excess of savings in the private sector with reduction in scale of equipment investment activities. What is more, at the back of that change in equipment investment activities, there have occurred changes in industrial structure being the spread of economic field to service industries from manufacturing industry centrally maintained by hardware technology and the spread of applicable field of software technology.

What to discuss next is the structural changes in the “outside” of Japan. They are the regional economic integration shown by the EC and the expansion of presence of developing countries represented by the BRICS. Under these situations, the politics and economy of the world have been taking a turn for diversification from the previous concentration in the USA. Many of the structural changes of the Japanese economy cannot turn out indifferently from these “outside” structural changes and some changes have newly taken place with relation to them. The prime thing is a deficit tendency in its international trade and this can be said precisely an about-turn structural change when we recall that the Japanese economy was formerly called a world’s “export power”. This is an “inside (domestic)” structural change in a mature country where investment opportunities for goods production became scarce, corresponding to the “outside (foreign)” structural change of economic development of the Asian emerging countries, in particular.

If Japan only keeps up with these “outside” structural changes by the present resources consisting of the human resources and the productive assets, we can easily see that it will fall into a drain on the resources of economic growth in the gaining-on by the newly emerging countries and that the nation’s economic welfare will continue to decrease. In order to prevent this situation, there is no measure except for making efforts to open up new demands in the “domestic and foreign” markets by a continuous pursuit of both qualitative advance of human resources and innovations based on it.

Table 7 puts together the main statistics showing the facts of how the important structural changes discussed so far have actually taken place while the Japanese economy was faced with them.

**Table 7 Main Indexes of Structural Changes of the Japanese Economy**

(%)	1961-65	1966-70	1971-75	1976-80	1981-85	1986-90
Productive-age population ratio	68.0	68.9	67.7	67.3	68.2	69.5
Aging population Ratio	6.3	7.1	7.9	9.1	10.3	12.0
Dependence ratio on public bonds (fiscal year)	n.a.	11.4	12.0	32.8	24.2	15.1
Ratio of equipment investment to GDP (calendar year)	18.3	18.7	18.0	14.7	15.3	17.3
Ratio of balance of trade to GDP (calendar year)	-0.2	1.2	0.9	0.5	1.9	2.3
Economic growth rate (real: calendar year)	9.2	11.1	4.5	4.4	4.3	5.0-

  

(%)	1991-95	1996-00	2001-05	2006-10	2011-15
Productive-age population ratio	69.4	67.9	65.8	63.8	60.4
Aging population ratio	14.5	17.3	20.1	23.0	27.0
Dependence ratio on public bonds (fiscal year)	17.3	33.6	38.4	39.9	41.3
Ratio of equipment investment to GDP (calendar year)	16.5	14.2	13.4	14.0	14.8
Ratio of balance of trade to GDP (calendar year)	1.9	1.3	1.4	1.0	-1.4
Economic growth rate (real: calendar year)	1.4	0.9	1.2	0.4	0.7

Sources : “Productive-age population (number of people aged 15~64) ratio” and “Aging population (number of people aged 65 or more ratio)” are from “Static state of population” in “Chapter 2 Population· Household” given in “Long-term Statistics Series of Japan” in *the* Ministry of Internal Affairs and Communications *homepage* until 2005 and from “Estimation of Population” given in *the* Statistics Bureau of Ministry of Internal Affairs and Communications *home page* thereafter.

“Dependence ratio on public bonds” is from “Financial Situation of our Country” (Basic Statistics of Government Finance for Heisei 29 fiscal year) given in *the* Budget Bureau of the ministry of Finance *home page*.

“Ratio of equipment investment to GDP”, “Ratio of balance of trade to GDP” and “Economic growth rate” are from “Annual Report on National Accounts for 2016” and its appendix CD-ROM edited by the Department of National Accounts, Economic and Social Research Institute, Cabinet Office.

Notes : “Productive-age population ratio” and “Aging population ratio” are figures for the last year of each period of calendar years. The figure of the last period is the estimated value in February of 2015.

“Dependence ratio on public bonds” is an average value of a fiscal year for each period, about the values in percentage of public bonds revenue to budget revenue of the general account.

“Ratio of equipment investment to GDP”, “Ratio of balance of trade to GDP”, and “Economic growth rate” are yearly average figures for each period of 5 years, calculated based on coefficients of Heisei 2 standard (68SNA) given in the CD-ROM listed in the above Source for those in and before 1993 and based on “Annual Report” following the 1993 International Standards recommended by the UN (93SNA) listed in the above Source for those in and after 1994. Figures for “Equipment Investment” are those of “Private Firms’ Equipment” in “Gross Fixed Capital Formation” of “Gross Domestic Product”, and figures for “Balance of Trade” are those of “Net Exports of Goods and Services” in “Gross Domestic Product”. Each of these figures is divided by “Gross Domestic Product” and those 5 years average numbers are listed in the Table.

## 6. The Summary of the Structural Changes and the Challenge of the Japanese Economy

In the Second Sequel (“the Paper of Number 10”) as the first part of this discussion, we examined the way the total income of the Japanese nation is formed by adding up the results of economic activities of households, firms and government in connection of each other, making use of the actual statistical materials of “National Accounts”. And then, the following expression (F) was derived as what was finally summed up regarding these activities.

$$\begin{aligned}
 & \text{【Private savings, gross} \\
 & \quad - \text{【Private gross fixed capital formation + Private changes} \\
 & \quad \quad \text{in inventories] } \text{】} \\
 & + \text{【 [Government disposable income, gross] } \\
 & \quad - \text{【Government consumption expenditures} \\
 & \quad + \text{Government gross capital formation} \\
 & \quad + \text{Government changes in inventories] } \text{】} \\
 & = \text{【 [Exports of goods and services - Import of goods and services] } \\
 & \quad + \text{【Incomes from the rest of the world} \\
 & \quad - \text{Incomes to the rest of the world} \\
 & \quad + \text{Other current transfers from the rest of the world} \\
 & \quad = \text{Current external balance} \text{】}
 \end{aligned}$$

That is to say, this expression means the relation that, when three largely divided sectors of the nation's economy, that is, households, corporations and government, are considered as the subjects bearing the present national economy, the addition of government's balance of income and expenditure to private sectors' balance of savings and investments always becomes equal to balance of income and expenditure from economic activities with abroad.

The structural changes of the Japanese economy taken in Section 3 have come to bring some great modifications to the statistical contents of this summarized equation of the National Accounts. First of all, regarding the household, a relation between savings and investment of the private sector is influenced by a structural change in vital statistics. In the aging trend of the nation as a whole, the savings to prepare for the future came to increase until recently, but as non-productive age population over 65 years old actually increases, the savings is taking a turn for being withdrawn. A particularly important structural change in this savings and investment relation is a behavioral change in the side of companies. From the high growth period to the stable growth period of the 80's, companies had a great financial demand due to their positive activities for equipment investment, but they have stopped expanding and begun to slow down since 1990 to 91. The former structure of household savings moving around to companies' equipment investment has changed to the situation of an excess of savings in the whole private sector as shown in Table 6 of the Second Sequel (the Paper of Number 10) in spite of the decreasing trend in the rate of household savings because firms' equipment investment has been calming down.

Regarding the Government sector as another term in the left side of equation (F), there has occurred a structural change contrasting to the savings and investment relation of the private sector in its situation of income and expenditure. Largely because of handling nonperforming loans of the financial institutions due to the burst of the Asset Bubble in the beginning of the 90's, the government was financially depressed and its dependence on public bonds rapidly increased. In 2003, that dependence came to exceed 40% and the ratio of the remainder of government bonds to the nominal GDP proved to amount to more than 90%. Then, as social security expenses and government bond costs (interest payments) of the general account are increasing, the issue amount of government bond has grown year by year owing to the need of making up for the deficiency. The

present issue bond amounts to as much as 165% of GDP and the total government debt including borrowing and short-term securities led up to 232% of GDP in 2016. This is the highest ratio among those of the OECD countries and exceeds far 177.2%, the ratio of Greece causing the Sovereign Risk in the Euro Area. This situation of financial balance in the second term is also a large structural change in the Government sector of the Japanese economy, and it has taken place throughout the “Lost Two Decades” after the 1990’s.

Then, regarding the two large terms of the left side of the basic structural equation (F) of the Japanese economy, the surplus of excess savings has come to stay in the savings and investment relation of the private sector of the first term and the deficit of financial balance has tended to increase in the balance of government finance of the second term, and both of these surplus and deficit cannot be anticipated at present to reduce in a short period. Although the Japanese economy stays in this situation, it seems to be stabilized internationally still now differently from the UE countries in the period of the deficit crises. That is because the deficit of one side is compensated by the surplus of the other side in those two terms of the left side of equation (F) of the Japanese economy. That is, the newly issued government bonds to make up for its deficits have been assimilated by the excess savings of the private sector through the financial institutions. From the left side of the structural equation (F), this situation shows that the current balance of trade of the Japanese economy comes to be surplus due to the exports, the receipts of interest and dividend from abroad and so force. Therefore, it is generally said that, as far as current balance is in the black, it is possible to meet government bonds in the domestic market without the anxiety of falling into such a sovereign risk as that of debtor nations of the Euro area, but there is not always such a direct relation between the domestic digestion (selling) of government bonds and a current balance. This can be explained based on a fundamental equation in the statistics of international balance,

$$\begin{aligned} & \text{Current Balance} + \text{Capital Balance} \\ & + \text{Change in Foreign Currency Reserves (+ error \& missing)} = 0 \end{aligned}$$

Oversee holding of government bonds is included in capital inflow from

abroad and the “Capital Balance” is determined in the relation with the capital outflow brought by “direct investment”, “securities investment” and the like to oversee by the Japanese nation. Therefore, the possibility of domestic digestion of government bonds comes to have no direct relation with “Current Balance” statistically. The problem of domestic digestion of government bonds is basically related with trends in the Japanese nation’s readiness of purchasing them. It can be said to depend on the judgment of bond market about an attitude of the Japanese government toward the financial reconstruction. If the Japanese nation comes to lose the will to make an investment of government bonds owing to decrease of savings or discouragement about the government efforts to get rid of the financial deficit, it will prove to be difficult to make a domestic digestion of the government bonds within the country even if a current balance is in the black. Then, the interest rate of the Japanese bonds must become raised at the issue of new bonds. This will not only increase further the expenses of national bond in the government finance but also increase the entry into the market by foreign investors. If this situation is realized, Japan will fall into a greater difficulty than the countries in the Euro area being fell into the risk of government debts, because the issue of the government bonds has already amounted to the highest among the OECD member countries in terms of the ratio to GDP.

Aside from the problem of domestic digestion of government bonds discussed above, there are some points to be remarked about the structural changes in overseas activities of the Japanese economy which have appeared in “Current external balance” positioned in the right side of the basic structural equation (F). Firstly, the Japanese economy had positioned in the “trade country” all through the high growth period, but the growth of its export has tended to stop in recent years and the trade balance has led to downfall to its deficit in 2011 for the first time in 31 years (for the first time in 41 years including the statistics of old standards). It would be true that there occurred provisional influences caused by the great disaster of Eastern Japan and by the debt crisis of Europe, but the trade balance tended to decrease after the first half of the 1990’s and there has been a marked downward trend since the latter half of the 2000’s, in particular. This situation is caused by the level of import catching up with the level of export as the import has rapidly increased while the export has been stagnating. In

view of these changes of tendency, it can be recognized that structural changes have taken place in the export and import of Japan. Behind this change is the beginning of overseas production by the manufacturing industry.

This change of the trade structure of the Japanese economy is generally thought to be caused by the rise of newly developing economies in the globalization and the progress of developing stages of the Japanese economy, that is, the transition period from the fourth stage of an “immature creditor-lender” towards the fifth stage of a “mature creditor-lender”. As stated in the beginning of Section 2 of the Second Sequel 2, this has been generally discussed by quoting from the analysis of Crowther (1957) when the Japanese economy fell into the deficit of “balance of trade”. The deficit of “balance of capital” has come to stay in the Japanese economy owing to capital flight brought by the expansion of overseas direct investment in particular, since about 2005 (except 2011 when the “Eastern Japan Great Earthquake” broke out), and the “overseas net assets” too have been steadily increasing. Generally speaking, as overseas investment expands, “investment profit” increases. In case of the Japanese economy, too, its upward trend is certainly recognized in the long-term trend. Between “direct investment profit” and “securities investment profit” as main elements composing “investment profits”, “securities investment profit” has long been overwhelmingly greater and that value has changed greatly year by year. Therefore, the overseas financial balance has not yet shown a stable tendency in its value.

From a viewpoint of mutual movements of “trade and services balance”, “overseas investment balance” and “overseas capital balance” as three large terms in the statistics of international balance of payments as seen above, it is not clear at present whether the Japanese economy can steadily increase “income balance” by the increase in investment income brought by the active expansion of “direct investment” and whether it can compensate the expanding deficit of “trade and services” balance by that increasing income balance. Therefore, although the present Japanese economy looks to be at an upward transition point to a “mature creditor-lender” country, it seems to be uncertain still now whether it can “mature itself” in a stable way.

## 7. Conclusion — the way left to the Japanese Economy

As discussed so far, the Japanese economy is now faced with great structural changes in itself and the influences have actually appeared in statistical figures of the national accounts and the accounts of the international balance of payments. We have observed this situation in the way of continuing the discussion of the Second Sequel (“Paper of Number 10” (Takashima, 2016). And, when these are taken as a cross section of the process of long-term changes in a nation’s economy, the Japanese economy seems to be making progress right now from an “immature creditor-lender” to a “mature creditor-lender” in the way of running after the United States. However, in such great structural changes of the domestic economy as the decrease in the ratio of productive-age population under a low birthrate and an aging population and as the stagnation of new equipment investment in the domestic manufacturing industry, it is difficult to think that the Japanese economy will take a step for maturity along the route prepared by the “theory of development stages based on international balance of payment” by letting the matter take its own course in these changes. Concerning this problem, I have made a theoretical analysis on the dynamic development routes (Takashima, 2008; Takashima, 2012) and also, have already had an argument about warnings to the Japanese economy based on that analysis in “Paper of Number 6”.

What was made clear in that theoretical analysis was as follows. The development of a nation’s economy is divided into two courses of a long-term growth and a long-term decline based on the initial conditions given quantitatively and qualitatively to its productive resources. However, the economy which has followed a long-term growth until a certain time, in particular, has a strong tendency of gradually changing its direction to a long-term decline after that, depending on how to take measures to raise qualitative efficiency of productive factors. And, once setting foot in a declining track, it becomes difficult for the economy to get away from that track unless they continue a great deal of efforts to take measures for improvement.

The Japanese economy was making its way in the long-term progress route in the 1960’s to the 70’s, and there is the impression that it remained in the growth rout all through the Bubble period after the 1980’s in the state

which could be said to be out of force of habit, but at present after the “Lost Two Decades”, it seems that it is located at the turning point of a stay in the long-term growth route and a stagnant changeover to the declining route. At present, attention is directed to a changeover of development stages based on the international balance of payments due to the change of balance of trade into deficit, but now, it seems that many attentions must be directed to which long-term routes would be taken between the growth and the decline depending on the efforts of taking measures. The reason is as follows. The changeover from a growth route to a decline route is realized without any obvious recognition during the passage of time on the heritage of the past growth route, and once the economy enters into the long-term decline route, it becomes extremely difficult for it to get away from it and to make a great sacrifice. This could be clearly known without seeing the present situation of the southern European countries in the Euro area.

The Japanese economy seems to stand at the important crossroads, and it should prevent from taking a stagnant changeover to a long-term declining route and move its steps forward heading toward a “sound” mature creditor-lender. What it must do at present for that purpose has been already made clear in the discussions carried on so far in this paper. In the given condition of the domestic and foreign structural changes and the movement in population of the Japanese society in particular, the basic things to be carried out are to raise the qualitative efficiency of the human resources in the economic activities and to make the government finance sound. It can be said that all the other things discussed so far are the specific measures to carry out these two objectives. A greater open-door policy of the labor market not restricting to the Government policy of receiving overseas “high-level persons” is necessary measures for quantitative and qualitative problems of a low birthrate and an aging population as the fundamental problem of the Japanese economy, and it would be particularly an urgent problem to secure human resources for welfare and medical services. Concerning the problem of labor market, a solution considered to be solvable domestically before depending on foreign countries is to introduce into the labor market women in their 30s not in the labor force. Since each of these problems is related to the historical, traditional and spiritual structure of the Japanese society, we are required to get ready for social and structural policy changes in the actual practice of these measures.

The government finance as another basic problem is also greatly related with the changes in the population structure which are a decrease in the ratio of productive-age population and an increase in the ratio of the aging population, and the warp in the present systems caused by them proves to obstruct the sound movement of the national economy. The improvement of that situation needs to revise the tax system so as to fit the actual state of affairs and to transform the social security system so as to meet the future movement of population. But, the actual politics in charge of the system revision based on the above necessities cannot keep up appropriately with it and this situation makes economic difficulties serious.

As the basic measures to be needed for the Japanese economy to maintain and progress soundly the economic welfare of the nation in a lot of difficulties in the future, we have taken up the problems of the qualitative improvement of human resources and the soundness of the government finance, and the basic issues related to both of them are reduced to the capability of the Japanese economy to realize innovation. What has led the Japanese economy to the present mature state is the active equipment investment carried out centrally by the manufacturing industry and the Japanese own technologies newly introduced into production processes at the time of new investment. However, through the “Lost Two Decades” after the Bubble burst, although the R&D activities themselves have been continuously carried on in terms of the amount of money in the national economy as a whole, new equipment investment activities of the industries as a whole have become stagnant. Then, as far as it is judged from this situation, it seems that the innovation in the markets linked to open up new demand has been stagnant. This innovation does not mean only creation of new technology concerning the production activities from research and development. It includes the opening-up of new business in the changes of industrial structure and market demands, and thus, it is a concept precisely similar to what Schumpeter (1912) defined to be “neue Kombination” (The 2nd version published in 1926 is cited in the Reference). With respect to this point, it has been already discussed that OECD indicated inactivity of Japanese firms in cooperative works with foreign countries in R&D and also that some of its product markets become “like the Galapagos Islands” as seen in the cell phone market which suffered a defeat in its world market, while the technology of the product was better. It can be said that these facts

explain that the Japanese economy has not fully met the structural changes of the world market globalization in the field of innovation which includes a creation of new markets.

Japan has the basic technologies exceeding the world in the wide field, and also has the human resources embodying them into new products including the talented people in the ordinary small factories. If the capability of technological reform in the hardware aspect is connected with the innovation in the software aspect with regard to creation and cultivation of new markets in the world, it will be able to realize the increase in qualitative efficiency more than compensating for the quantitative restriction of the domestic human resources, and it will be naturally connected with the economic growth. If it is actually realized, the government finance as another structural problem of the Japanese economy under the aging population, too, will take a turn for becoming sound owing to the natural increase in the government income, on the assumption that some drastic reforms will be taken in the tax system and the social welfare policies by looking straight into the movement of population. Then, the Japanese economy in 20 years after the Two “Lost Decades”, that is, around the year 2030, will be able to follow a new path of long-term growth as a “mature creditor-lender”.

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