

May, 2010

NIRA Report

Is the Aging of Society a Threat to Japan?

-Increasing Productivity in the Next Decade is the Key-

[Executive Summary]

The decline of Japan's birthrate and the aging of its population have long been considered to represent a threat to the Japanese economy. This perspective assumes that not only will the increase in the nation's elderly population dramatically increase the national deficit through its negative impact on the social security budget, but it will also cause a decline in productivity and act as a dampener on economic activity. The main purpose of the present report is to respond to the question of precisely what effect the aging and decline of the nation's population will have on productivity in the Japanese economy.

The considerations of the study group working on this project clarified the following points:

- 1) There is a strong possibility that the aging and decline of Japan's population will result in a decline in the growth of productivity in the nation's economy. Looking at both total factor productivity (TFP) and labor productivity, it appears that the rate of growth of productivity will become negative, on a continuing basis, in the early 2020s.
- 2) However, the aging and decline of the population is unlikely to affect the nation's rate of economic growth by causing a decline in productivity in the next decade. From this perspective, the threat represented by the aging of the population should not be emphasized in the short term.
- 3) The study group predicts that the negative effects of the aging of the population will become manifest from the mid-2020s, when the growth of productivity becomes negative on an ongoing basis. Given this, it will be essential to make efforts to increase the potential for technological innovation and boost labor productivity in

the next ten-year period.

- 4) In concrete terms, on the micro-economic level it will be necessary for companies to work directly to increase their numbers of full-time workers and to enhance in-house training programs for elderly and non-full-time workers. It would also be desirable for the government to make a more active contribution towards the implementation of vocational training programs. On the macro-economic level, it will be necessary to further increase the openness of the economy and the labor market in order to increase the potential for technological innovation. Further, it will be essential to reconsider immigration policy and implement measures designed to boost the birthrate in order to increase the nation's population.

Five empirical analyses, considering the following questions, formed the basis for these conclusions.

Analysis 1: What effect will the decline of the nation's population have on the rate of technological progress? (Chapter 2)

Analysis 2: What effect will the aging of workers have on the rate of technological progress? (Part of Chapter 3)

Analysis 3: What are the differences in terms of productivity between workers of different ages? (Chapter 4)

Analysis 4: What effect will the aging of workers have on wages and company revenues? (Part of Chapter 3)

Analysis 5: Will the aging of workers suppress employment opportunities for young people? (Chapter 5)

Analysis 1: Effect of Population Decline on Rate of Technological Progress

-There is a positive relationship between the size of the population and the rate of technological progress, while there is a negative relationship between the percentage of the population aged 65 and over and the rate of technological progress.-

A decline in population can be projected as having a variety of effects on the rate of technological progress, including a reduction of collective capacity and a decline in the number of potential innovators due to the aging of the population and a reduction in the working population. In this analysis, the rates of growth of multi-factor productivity (MFP) and total factor productivity (TFP), as published by the OECD, were employed as indicators of the rate of technological progress, and the effects of the size of the total population, the percentage of the elderly in the population, the level of economic

openness, and the rate of increase of the population were determined. The main conclusions were as follows:

- 1) An analysis using OECD data showed that there is a positive relationship between the total population and the rate of increase in MFP, while there is a negative relationship between the percentage of the population aged 65 and over and the rate of increase of MFP.
- 2) Despite a certain level of statistical unreliability, an analysis using Japanese time series data showed that a decline in the working population has a negative effect on the rate of increase of TFP.
- 3) Simple extrapolation of Japan's rate of technological progress into the future produced a figure of 1% year-on-year growth. However, calculations based on (median) future projections of a decline in the working population showed that the rate of growth of the rate of technological progress would become negative in the latter half of the 2020s.

Analysis 2: Effect of Average Age of Workers on Rate of Technological Progress (TFP)

-TFP and wages both increase when the percentage of workers in their 40s increases-

This analysis attempted to determine the effect of the average age of workers (or the age structure of the working population) on the rate of technological progress. The analysis was based on the hypothesis that an average worker age (or worker age structure) would exist at which the potential for technological development and the level of technological progress would reach their highest levels in specific industries or in the economy as a whole.

This analysis clarified the following points:

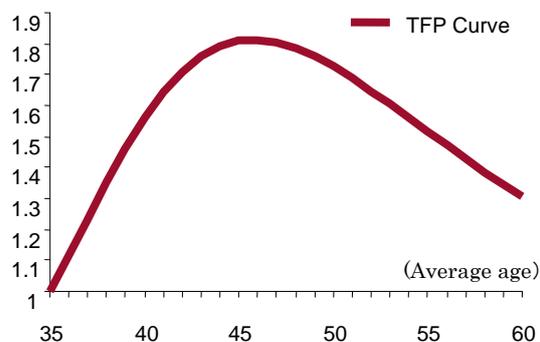
- 1) There is a strong possibility that the rate of technological progress increases to its highest level when the percentage of workers in their 40s in the working population increases.
- 2) Industry panel data showed that the level of technological capacity reaches its peak when the average age is just under 46.
- 3) As the aging of the population progresses, as viewed from the perspective of average age, there is a strong possibility that the nation's level of technological

capacity will decline, but the pace of the decline will be comparatively mild (Figure 1).

- 4) An estimate of Japan's future rate of technological progress conducted on the basis of the above empirical analyses showed that the nation's rate of technological progress will increase at a gradual pace until 2022, and will reach its peak in 2023, when the average age of the population is just under 46; following this, it will commence to decline (Figure 2).

Figure 1

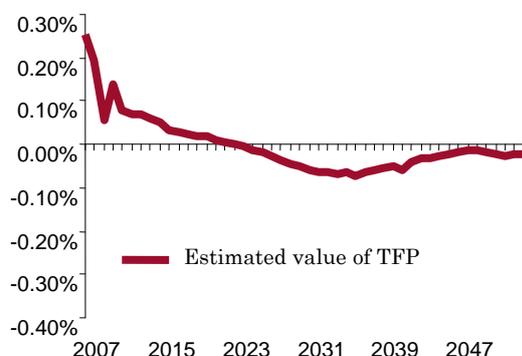
Inverse Weibull distribution of hypothetical values for TFP (Fixed effects model)



Note: Model values with value for 35 years of age as 1.
 Source: JIP Database, Research Institute of Economy, Trade and Industry (RIETI)
 Calculations: Credit Suisse

Figure 2

Future estimates of TFP (year-on-year)



Source: JIP Database, Research Institute of Economy, Trade and Industry (RIETI)
 National Institute of Population and Social Security Research
 Ministry of Internal Affairs and Communications
 Calculations: Credit Suisse

Analysis 3: Calculation of Labor Productivity for Different Age Groups

-The relationship between age group and labor productivity describes an inverted U shape, with the 45-49 age group at its peak-

Analysis 2 demonstrated that a fixed relationship exists between the average age of workers and the rate of technological progress. Analysis 3 was conducted to determine whether, against the background of this macro-economic relationship, any relationship exists between labor productivity per employee¹ and the age of workers.

¹ The relationship between TFP and labor productivity per person is defined as

The results were as follows:

- 1) The level of labor productivity of workers was highest in the 45-49 age range. The relationship between age ranges and labor productivity described an inverted U shape with this age range at the peak.
- 2) The decline in labor productivity following the peak in the 45-49 age range is comparatively mild, with labor productivity in the 55-59 age range almost identical to that in the 40-44 age range. This indicates that it is possible that labor productivity will not decline drastically with the aging of the population (Figure 3).
- 3) A projection of the future trend of labor productivity in Japan at the macro-economic level based on the estimated values for the labor productivity of different age groups showed that positive growth in labor productivity can be maintained until around 2020, because the “second-generation” baby-boomers will reach their 40s, the peak age range for labor productivity, between 2015 and 2025.

Analysis 4: Effect of Increase in Average Age of Workers on Wages and Company Revenues

-Real wages reach their peak when the average worker age is just under 44, following which they decline-

What effect does an increase in the average age of workers have on average real wages? The following conclusions were reached when the relationship between workers' average real wages, the worker age structure, and the average age of workers was considered:

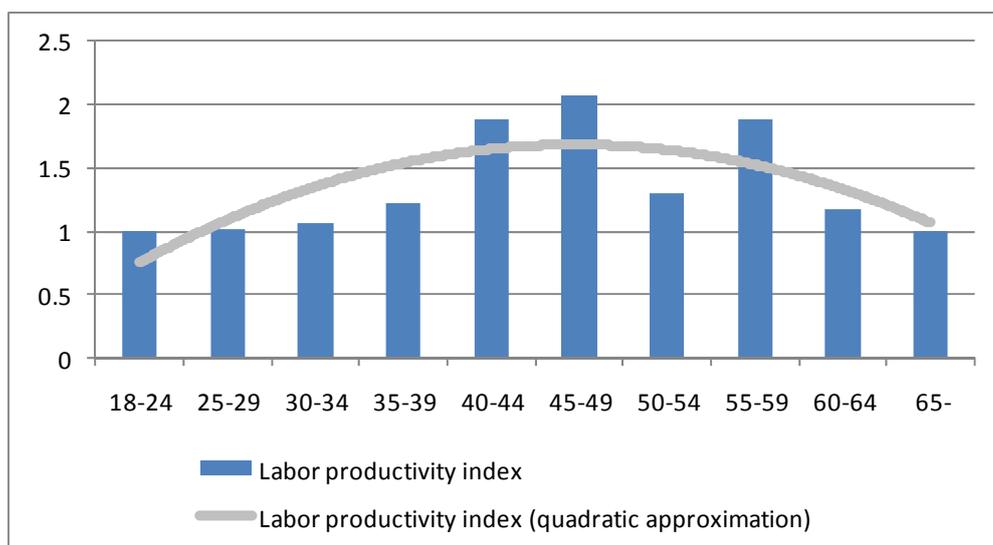
- 1) When the ratio of older workers in the 50+ age group increases, the downward pressure on real wages becomes greater than the downward pressure on the rate of technological progress
- 2) Analysis of the relationship between the average age of the working population and real wages using industry panel data shows that the level of real wages reaches its maximum value when the average employee age is just under 44. As the average age increases following this point, the decline in the level of real wages becomes greater than the decline in the rate of technological progress

follows: The rate of growth in labor productivity per person = The rate of growth in TFP (technological progress) + The rate of increase in labor productivity due to increase in the rate of capital intensity per person

The average level of real wages reaches its peak at an average worker age approximately two years younger than that at which the rate of technological progress reaches its peak, but the rate of decline with increasing worker age, following the peak, is higher than that for the rate of technological progress. This suggests the possibility that many companies may receive a “bonus” with the aging of the workforce (it should be noted, however, that this is exclusively a discussion of the allocation of income, and it is not clear whether or not company revenues will increase in absolute terms). From this perspective, there is a strong possibility that there is a sufficient margin for Japanese companies to invest in research and development and increase their rate of employment of younger workers in order to avoid a future decline in productivity.

Figure 3

Labor productivity indices for five-year age groups, with productivity for the 18-24 age group as 1



Analysis 5: Effect of Aging of Workers on Employment of Younger Workers

-Employment of younger workers tends to increase as the percentage of older workers increases-

It has been pointed out that employment opportunities for young people will be lost if the jobs of middle-aged and older workers are retained. The concept that workers in the middle and older age brackets in companies are suppressing employment of younger workers is termed the “replacement effect” theory. The study group investigated whether this was a real world phenomenon, with the following results:

- 1) Analysis of the hiring rate shows that there is no clear evidence that job opportunities for

younger workers are being sacrificed in order to protect the jobs of middle-aged and older workers.

- 2) Analysis of industry panel data shows that in industries in which the ratio of middle-aged and older workers is high, the rate of increase in employment of younger workers is also high, and at the same time employment of middle-aged and older workers tends to be restricted.

This indicates a strong possibility that Japanese companies are aware of the optimum employee age ratio necessary to achieve the highest level of productivity, and have adjusted the age ratio of their workers towards that optimum range.

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The full report: http://www.nira.or.jp/pdf/0905english_report.pdf

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