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Inter-generational Equity under the Increasing Longevity

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Abstract

We examine how the extension of life span will affect the relative advantage of each generation, as Japan enters the age of the centenarian. In addition to evaluating the benefits (consumption) that can be additionally enjoyed with a longer life span, we will also focus on the economic contribution by the elderly working longer. If seniors extend their working and earning lives, rolling back the age at which they begin receiving pension benefits, the government's fiscal balance of tax and social security will improve, which can reduce the burden on young and future generations. We consider how far it may be possible to avoid outcomes which place the greatest burden on the youngest generations.

We look at three representative generations, including those born in 1950, the children of this generation born in 1980, and the generation born thirty years later in 2010. We will refer to these generations as Generation 1, 2 and 3 sequentially in this study. Based on data including Sub-sectoring Household Accounts in the System of National Accounts (SNA) and certain macroeconomic assumptions about the future, we found the following points.

First, the lifetime consumption of Generation 3, the youngest of these three generations, will expand by 9%–13% thanks to the lengthening of lifespans gained after Generation 1. If people can delay the age at which they retire from working life

[1] In preparing this paper, the authors have received important insights from Masaaki Kawagoe, Specially Appointed Fellow of JCER. JCER President Kazumasa Iwata also provided advice and comments on the research overall. At PAFTAD(The Pacific Trade and Development) Conference at Tokyo in February 2018, we received very helpful comments from participants including Naohiro Yashiro, Showa Women's University Professor and Shiro Armstrong, Director of Australia-Japan Research Center / Australian National University, who were both discussants in our presentation . The authors would like to express their gratitude to all of them. Any errors that remain are solely those of the authors.
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by ten years, the primary balance of the central and local governments relative to GDP could improve by 6%–7% with other conditions remain unchanged. That fiscal surplus could then be used to lighten the burden on the younger generations. In terms of generational accounting (the balance of tax and social security benefits with the corresponding burdens), the net burden on the youngest generation will be heavy, indicating that the aging of society will be the most disadvantageous for them. But if we consider the increase in consumption owing to longer lifespans and the rise in labor force participation, it may not be true to say that the younger generation would incur the biggest disadvantages. However, it is necessary to pay attention to the fact that in case of full-scale reduction of government debt, a large burden is placed on the young and future generations.

In an age when people live to a hundred, exiting the workforce at the age of sixty-five is too early. We need to build a system enabling people to work an additional ten years. Extending people's healthy lifespan will also be important so they can fully benefit from the additional consumption that longer lifespans make possible.

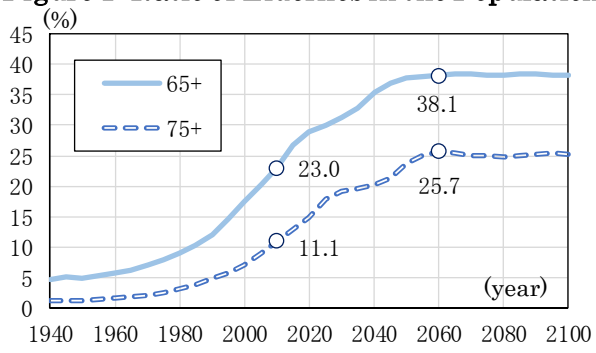
Keywords: inter-generational equity, generation accounting, ageing, longevity, extended labor participation
JEL classifications: D63, H55, H68, J11, J26

1. Introduction

The Japanese population is aging faster than any other population in the world. Data from the Organization for Economic Co-operation and Development (OECD) show that the ratio of persons aged sixty-five and older to the overall population in 2013 was highest in Japan at 25.1%. According to the National Institute of Population and Social Security Research (IPSS), this ratio will rise to 38.1% by 2060. The number of seniors aged seventy-five and over, who use medical and nursing care services with increasing frequency, is rising at a fast pace. By 2060 the share of late-stage elderly aged seventy-five and over will reach 25.7% of the population, or one in four persons (**Figure 1**).

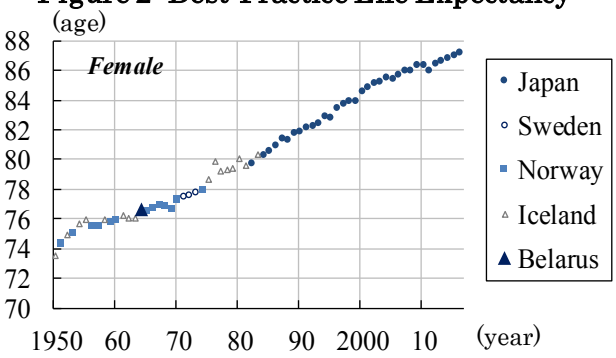
At the same time, lifespans are becoming longer. A look at "best-practice life expectancy," or the maximum life expectancy observed among nations at a given age, shows that female life expectancy over the last 160 years has increased by forty years at nearly a linear rate of more than 2 years every decade (Oeppen and Vaupel, 2002). Since the 1980s, moreover, Japan has occupied the top position (**Figure 2**). For males, Japan ranks second after Hong Kong. Some observers also believe that generations born in the twenty-first century will live past the age of 100 as a matter of course (Gratton and Scott, 2016).

Figure 1 Ratio of Elderlies in the Population



Source: "Population Census". From 2020 onward, projections by National Institute of Population and Social Security".

Figure 2 Best-Practice Life Expectancy



Source: "Human Mortality Database",University of California, Berkeley, USA, and Max Planck Institute, Germany.

The increase in the old-age dependency ratio means there is greater need for society to provide for the cost of living longer. Through public pensions and medical and nursing care benefits, the government is providing for the lion's share of the expenses required in old age. The bulk of these expenses are financed through taxes and social insurance premiums paid by the working generations.

"Generation accounting" investigated typically by Auerbach, Gokhale and Kotlikoff (1991) is an attempt to clarify the balance of benefits and burdens on taxes

and social security by generation. According to a previous study applying the "generation accounting" method to Japan, the net burden ratio is higher for younger generations (Masujima et al., 2010, Suzuki et al., 2012). Among the countries in which generation accounting research was conducted, Japan is the country that burdens the most future generations (Auerbach et al., 1999).

All of the news is not bad, however. By living longer, people will be able to enjoy the positive aspects of life that much longer. Becker (2009) has presented a theoretical model that translates increased lifespan into economic value. Based on an overlapping generations model, Becker derives the value of longer lifespan from a willingness to pay for the cost of a longer life. According to Kawagoe (2009), which applied the same model to Japan, the value of the drop in the death rate in Japan occurring between 1970 and 2005 can be valued roughly at 160 trillion yen annualized.

The aim of the present study is to assess both aspects of aging by incorporating the economic value following from longer life into generational accounting, which measures the disparities between the generations. We regard the value of living longer as the additional consumption one is able to enjoy by living longer. We estimate the extent to which recently born generations will be economically prosperous by having longer lifespans.

If people live longer, it would be natural for them to keep working longer in order to support themselves. We highlight longer working careers as one of the changes that societal aging would produce. Japanese presently begin receiving their public pension (the basic pension) from the age of sixty-five, the general target age for exiting the workforce. In view of the lengthening of lifespans, however, pulling out of the workforce at sixty-five is too early.

In 1961, when universal pension coverage was first established in Japan, average male life expectancy was sixty-six years, and payment of pension benefits began at the age of sixty. Benefits were received for less than ten years on average. In 2015 average male life expectancy was eighty-one years, yet the age at which benefit payments begin has been raised just five years to age sixty-five. This means that the period over which benefits are received has grown to sixteen years. If the average lifespan increases further along the recent trend, Japanese will likely to receive benefits for more than twenty years in 2050.

In January of 2017, the Japan Gerontology Society and the Japan Geriatrics Society proposed that the term “elderly”, which now refers to people aged sixty-five and older, be redefined to mean persons aged seventy-five and older. They also

proposed that the term “early stage elderly”, which currently refers to those aged sixty-five to seventy-four, be regarded as meaning “semi-elderly”, indicating that such persons are still able to contribute to society. The recommendations were based on the judgment that advances in medical care and improvements in the living environment now mean that the physical mobility and intellectual capacity of early stage elderly are at more youthful level than before.

In the present study as well, we consider career prolongation and raising of the starting year for paying pension benefits as promising options. The government would gain latitude in its financial balance relative to GDP from (1) a reduction in pension benefits, (2) an improvement in revenues from taxes and insurance premiums and (3) an improvement in GDP following an expansion of the working population. If these strategies can be mobilized to lighten the burden on the working generations, it could have the effect of reducing the disparity between the burdens of each generation.

We focus on three representative generations, including the population born in 1950[3] (Generation 1), the children of this generation born in 1980 (Generation 2), and the generation born thirty years later in 2010 (Generation 3). We have selected the year 1950 as the starting year of estimation since we can easily collect underlying data with a firm statistical basis for the following years.

We estimated the generational accounting and the consumption that each generation can enjoy under certain macroeconomic assumptions about the future. We found the following points. The Generation 3, the youngest generation, will see its lifetime consumption expand by 9%–13% thanks to longer lifespans gained after Generation 1. If the age at which workers leave the workforce can be raised by ten years over the present while other conditions remain constant, the national and local governments would see a 6%–7% improvement in their primary balance relative to GDP. The resulting financial surplus could then be applied to lightening the net burden on the younger generation with respect to the balance of benefits and burdens relating to taxes and social security. The younger the generation the heavier is the net burden and the greater the disadvantages from societal aging. However, if account is taken of the increase in consumption which follows from longer lifespans and the expansion in labor force participation, the inevitability of the younger generations being hit hardest by societal aging will for the most part be avoided.

[3] We may call them one of baby boomers after World War II in Japan, although the number of birth notably increased in three years 1947-49.

In an age when people live to a hundred, withdrawal from the workforce at the age of sixty-five is too early. Japan needs to forge a system under which people work an additional ten years. Lengthening healthy lifespans will also be important so people can better enjoy the additional consumption that longer lifespans will make possible.

The present paper is structured as follows. The analytical framework will be explained in Section 2. Section 3 introduces the data used on the analysis and the several assumptions we have made concerning such factors as the macroeconomic outlook, taxes and social security. In Section 4, we examine how the consumption, benefits and burdens for the three generations evolve over time with the data we identified. In Section 5, we estimate the impact which longer lifespans (the survival rate) will have on each generation, taking into account the greater number of years spent in the workforce. Our conclusions and recommendations are set forth in Section 6.

2. Analytical Framework

Our study focuses on the disparities between the generations. The elements used in our assessment are (1) consumption, (2) generational accounting, (3) government finances, (4) households, (5) GDP, and (6) discount rates, in that order.

2-1. Consumption

We define lifetime consumption for generation i as follows.

$$\hat{C}_i = \sum_{t=1}^{Z} s_{i,t}\beta^{t-1}C_{i,t}$$

Here, $C_{i,t}$ refers to the per capita real consumption in the period t for generation i. $s_{i,t}$ is the survival rate in the period t with period 1 of generation i set as 1, β being the discount factor. If the discount rate per year is set at ρ, then we may write $\beta = 1/(1+\rho)$. Z is the upper limit of the period, set at 100 years in the present study. Here, we do not consider the disutility from labor. We assume consumption is the only source to affect welfare.

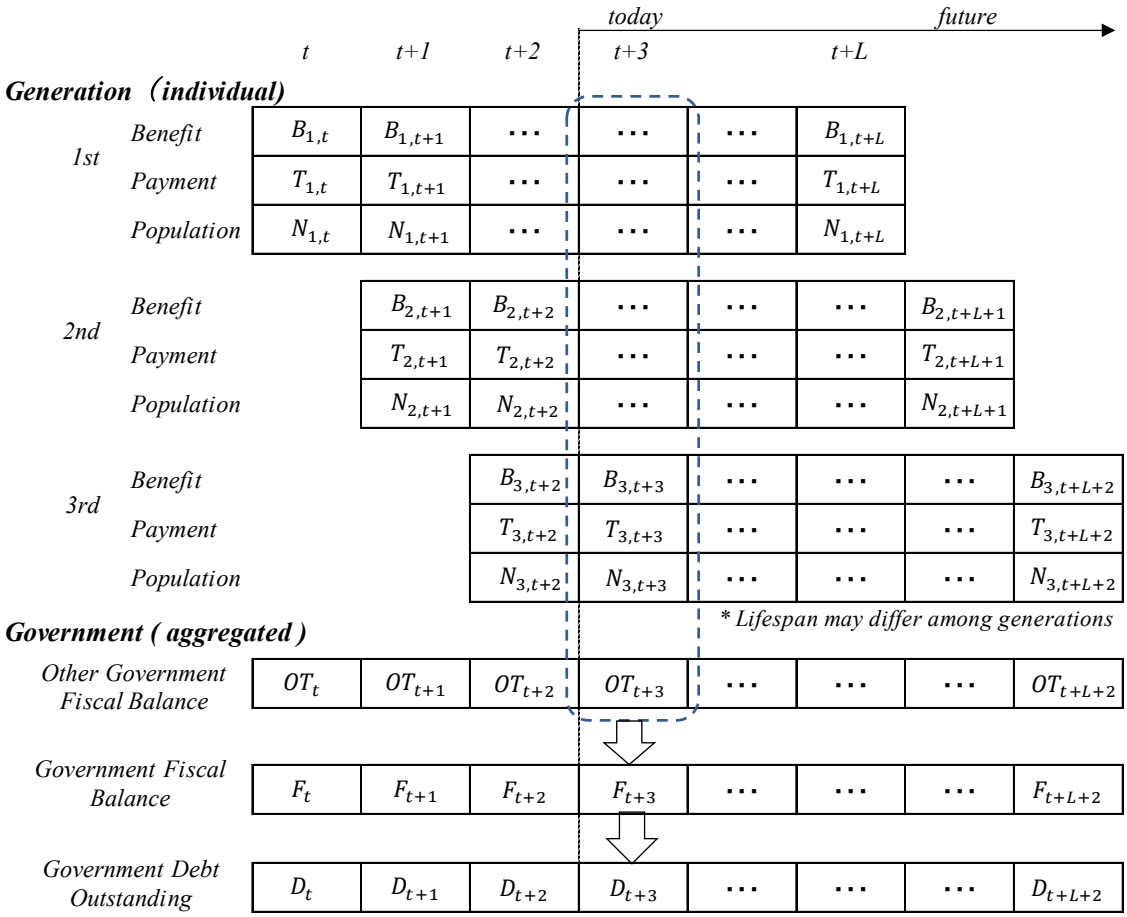
2-2. Generational Accounting

Generational accounting refers to the balance between the benefits of government services and the tax and social security premiums paid for those services. In **Figure 3**, $B_{i,t}$ indicates the benefits received in period t by generation i while $T_{i,t}$

indicates the associated tax and social security premium burden. The net benefit is $B_{i,t} - T_{i,t}$ (omitted from the figure). The generational accounting value $\hat{G}_i$ for generation i is, as with lifetime consumption, defined as follows:

$$\hat{G}_i = \sum_{t=1}^{Z} s_{i,t}\beta^{t-1}(B_{i,t} - T_{i,t})$$

Figure 3 Benefits and Payments by Generations and Government Finance



$B_{i,t}$ and $T_{i,t}$ comprise the following factors, respectively:

$$B_{i,t} = BP_{i,t} + BM_{i,t} + BE_{i,t} + BC_{i,t}$$
$$T_{i,t} = TP_{i,t} + TM_{i,t} + TD_{i,t} + TC_{i,t}$$

$BP_{i,t}$ represents pension benefits, $BM_{i,t}$ represents medical and nursing care in-kind benefits, $BE_{i,t}$ represents education in-kind benefits, while $BC_{i,t}$ represents other cash benefits. $TP_{i,t}$ represents premiums for pensions and $TM_{i,t}$ represents premiums for medical and nursing care insurance. $TD_{i,t}$ represents

income tax and $TC_{i,t}$ indicates the consumption tax burden. Educational benefits are financed through taxes, so their cost payments are not indicated here explicitly as a separate burden. Individual co-payments for medical and nursing care and education constitute a portion of consumption.

The generational accounting approach taken here differs from the traditional generational accounting used by Auerbach, Gokhale and Kotlikoff (1991) in the following sense.

First, we do not take into consideration "future generations." Under traditional generational accounting, the youngest of existing generations is deemed the zero-age generation, and the generations to be born after that are together treated as future generations. Future generations serve as the funding source for ultimately repaying the currently outstanding government debt in full. We include the generations to be born in the future in our calculation, but do not assign to them the task of having to repay the entirety of the government debt.

The second point on which the present analysis differs from traditional generational accounting is related to the first point, but instead of setting the full repayment of the government debt as the criteria for balancing future benefits and burdens, we set the condition as maintaining the government debt to GDP ratio at a fixed target level of about 250%. Japan's combined central and local government debt to GDP ratio is about 190% in 2016. It would not be realistic to place the entire burden of repaying this debt on a particular generation. By taking both the individual's benefits and burdens as well as the government financial balance (explained in the next section) into account, we have computed the extent of the net burden which it would be appropriate to require from individuals.

Third, we have incorporated an assessment of the past into our analysis. Traditional generational accounting focuses primarily on comparing the youngest of presently living generations (the zero-age generation) with future generations. If the net impact on future generations is found to be large, it tends to indicate that a fiscal deficit exists, including a portion that will arise in the future. This excludes from consideration past benefits and burdens, so when making comparisons between the elderly and the present working generation, for example, there is no thought of comparing what their respective benefits and disadvantages may have been in the past. One of the studies that attempted to include this past assessment in the methodology was Masujima et al.(2009). They used a generational accounting formula which assessed the future with survival rates and discount rates taken into account but applied it retroactively to the past to estimate the net burden for

generations grouped into five-year cohorts between the age of zero through ninety. We adopt this same methodology to make generational comparisons. We look at generations separated by thirty years, or those born in 1950, 1980 and 2010 among others.

2-3. Government Finances

As noted in the previous section, we derive the government's fiscal balance by aggregating individual benefits and burdens. The fiscal balance F_t is defined by the following expression:

$$F_t = \sum_i (T_{i,t} - B_{i,t}) N_{i,t} - (1 + r_t) D_t + OT_t$$

The first term is the product of the per-capita net burden and the population by generation $N_{i,t}$ and indicates the government's tax and social security balance with respect to households. D_t is the government debt outstanding, while r_t is the interest rate paid. OT_t indicates other fiscal surpluses. Included in OT_t are corporate income taxes and property taxes from tax revenues, and among expenditures, general administration and public works spending. The fiscal balance less interest payments yields the primary balance. The debt outstanding in period $t+1$ declines (or expands if a deficit) only to the extent of the fiscal balance (surplus) in period t.

$$D_{t+1} = D_t - F_t$$

The fiscal variables are linked by the above identities, but in actual calculation we control the household burden so that the government debt converges to a certain level of GDP (about 250%). We adjust the consumption tax and medical and nursing care premiums in the baseline. In order to obtain the macro-aggregated total, generations other than Generation 1, 2 and 3 are in fact factored into the estimates.

2-4. Households

Budget constraints for households are considered as follows.

$$C_{i,t} + TC_{it} = \left[W_{i,t} - \left(T_{i,t} - \tilde{B}_{i,t}\right)\right] \cdot PC_{i,t}$$

$W_{i,t}$ represents wages and $T_{i,t} - \tilde{B}_{i,t}$ is the tax and social insurance net burden. In-kind benefits (medical treatment, nursing care, education) are excluded from benefits. The terms within the brackets represent disposable income, while $PC_{i,t}$ represents the propensity to consume. The term TC_{it} on the left side of the expression is the consumption tax burden, meaning that consumption expenditures

including the portion expended for consumption tax are factored into the above expression. In one sense, households will seek to spread their consumption evenly over their life cycle, but here we instead assume that consumption is linked simply to disposable income in the period[4]. $PC_{i,t}$ is assumed to be exogenous. The wages $W_{i,t}$ earned on average by generation i at time t are influenced by the labor force participation rate $F_{i,t}$.

$$W_{i,t} = \bar{W}_{i,t} \cdot RLF_{i,t}$$

The term $\bar{W}_{i,t}$ represents the wage level when all workers in the same generation are working.

2-5. GDP

To judge the health of government finances, the ratio to GDP of parameters such as the primary balance or the outstanding balance of government debt are used. We therefore need to derive GDP. To simplify the analysis, we abstract the capital stock and define real GDP (Y) in terms of the following production function.

$$Y = AL$$

The term L represents the labor force population while A is labor productivity. L is the sum of the 5-year-old population of men and women in production age multiplied by their labor participation rates. If RLF_i is deemed the labor force participation rate for each cohort fifteen years and over, we have:

$$L = \sum_i RLF_i * N_i$$

As the labor participation of the elderly rises in tandem with increasing lifespans, Y will rise owing to RLF_i. Nominal GDP $\tilde{Y}$ is the product of real GDP and the deflator P (an exogenous variable):

$$\tilde{Y} = PY$$

2-6. Discount Rates

When assessing the value and the benefits of social welfare and long-term public works projects, cultural properties, environmental protection and other policies extending over the long term and over multiple generations, one important question is how to weight the benefits that arise at different times. There are various

[4] Following the consumption tax hike in 2014, consumption remained weak even after the initial pullback which followed the hike. This implies that many households may be under income or liquidity constraints.

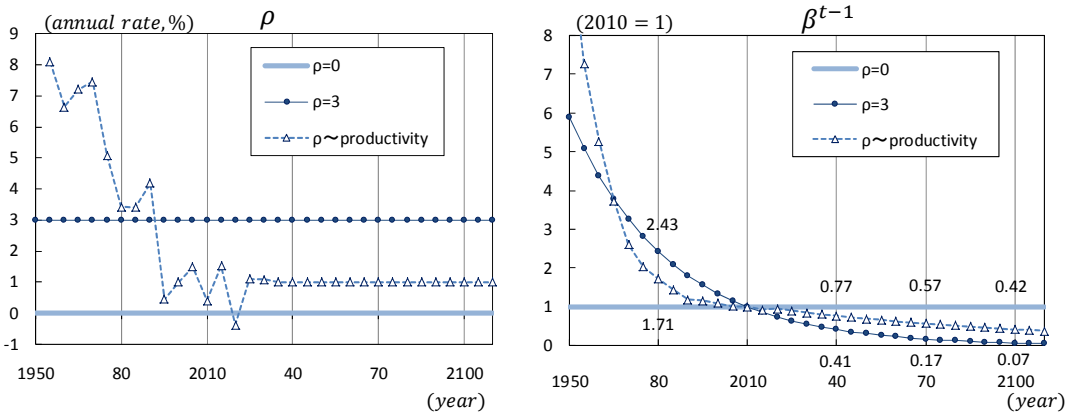
understandings regarding discount rates using a given coefficient to discount values arising in the future.

There are various ways of understanding as to what discounting comes from: (i) time preference and opportunity costs involved in investments, (ii) future uncertainty and value change, (iii) growth rate (productivity) due to capital accumulation and technological progress, (iv) depreciation of capital stock and consumption goods - and so on.

Previous studies of generational accounting often used discount rates of 3-4% per year. Masujima et al.(2010) have adopted variable rates which add a premium on top of the growth rate. Suzuki et al.(2012) have used the pension yield. Auerbach et al. (1991) ran simulations under various discount rates including $\rho = 3\%$ based on past real interest rates and then attempting to verify the robustness of the results.

In the present paper, we adopted three options, namely using 0% (no discount rate), using the rate of 3%, and using the productivity growth rate. Productivity is the approach of using labor expended as a standard for obtaining economic value, and in a practical sense, is close to the per capita growth rate. **Figure 4** is a graphic illustration of our adopted discount rate of ρ and β^{t-1}, which is the cumulative value of β. As indicated below, future productivity is assumed to grow at an annualized rate of 1%. The base year for discounting is 2010.

Figure 4 Discount Rates



3. Data and Assumptions

In this chapter, we explain the data used in the analysis and our assumptions about the future (including the macroeconomic outlook, taxes and social security, and survival rates).

3-1. Data

One contribution of the present study is careful estimation of each generation's consumption on top of the components of generational accounting.

We divide generations into twenty-one cohorts of five years from age zero through 4 up to age 100 and over. The basic statistics used in our estimates are from Sub-sectoring Household Accounts[5] in the System of National Accounts (SNA) and the National Survey of Family Income and Expenditure (NSFIE), which constitutes the basic data for the above, supplemented by medical and nursing care and educational data. Since data from NSFIE are originally in household basis, we convert them into individual basis (equivalent values) using the household member ratio from the Population Census. Children can consume a portion of household consumption, while the tax and social insurance burden is considered to be borne by the head of household.

The consumption is defined as including the individual's co-payment less in-kind medical and nursing care and education benefits, and subtracting imputed rent. Imputed rent is usually a portion of consumption, but it is also regarded as an operating surplus of household in the SNA. We avoid complexities by omitting imputed rent. Also, using data on the elderly from the NSFIE (households of single females aged 80 through 84), we incorporate into our analysis a declining consumption with advancing age[6].

Among benefits, medical and nursing care and educational in-kind benefits comprise a single component of generational accounting. In-kind benefits correspond to costs covered by public insurance in the case of medical and nursing-care and expenses of the government for compulsory education and grant assistance for private schools in the case of education. Co-payments for education (including tuition and other such expense for private schools) are included in consumption. "Other In-kind Benefits" refers to forms of public assistance such as the one-time allowance for childbirth and maternity benefits, childcare leave benefits, the childcare allowance, unemployment benefits and welfare benefits. The

[5] Stiglitz, Sen and Fitoussi (2010) have pointed out that "Aggregate data is insufficient to recognize how distributional policy works." The Organization of Economic Cooperation and Development (OECD) provided guidelines for sub-sectoring of SNA or the System of National Accounts. Estimates are made in conjunction with the National Survey of Family Income and Expenditure (NSFIE) released in Japan every five years. See Kawagoe and Maeda (2017) for more details.

[6] We have referred to the trend for single female households, age eighty through eighty-four cohort. Female data is used because figures on males are easily confused with residents of specified facilities, making it difficult to ascertain the actual numbers.

consumption tax burden is estimated simply as the product of consumption and the consumption tax rate.

We estimate values for the above variables by age (not cohort) in five-year intervals over the period from 1994 through 2014 and for the past applied the data retroactively using relevant macroeconomic indicators. Time series data by cohort could be obtained by tracing and linking values by age using cohort age. For converting nominal and real values, we used the private consumption deflator. Real variables are based on 2011 prices.

3-2. Macroeconomic Assumptions

We have formulated a number of future values based on macroeconomic assumptions (**Figure 5**). For the years through 2030, we base our assumptions on the JCER Medium-Term Economic Forecast. For the years after 2030, we have extrapolated from the JCER Medium-Term Economic Forecast to formulate an outlook along the lines of the cautious scenario H described in the Official Fiscal Projections as released by the Ministry of Health, Labor and Welfare (MHLW) in 2014.

Figure 5. Macroeconomic Assumptions

(annual rate, %)

	This study			Ministry of Health, Labour and Welfare		
	(～2030) based on JCER's Forecast		(2035～2115)	(2024～) F	G	H
(1)	Real wage	0.7	1.0	1.3	1.0	0.7
(2)	Deflator for Consumption	0.6	0.5	1.2	0.9	0.6
(3)	Total Factor Productivity	0.6		1.0	0.7	0.5
(4)	Labor Productivity	1.0	1.0			
(5)	Longterm Interest Rate	1.4	1.0	4.0	3.1	2.3

Note: a) Figures up to 2030 by JCER's Forecast are those for 2025～2030.
b) Longterm Interest Rates are yields on 10-year government bond, while those of MHLW are returns on financial investment.
c) Deflator for GDP is assumed to be identical to that for Consumption.
d) F,G, H are scenarios presented by MHLW as alternatives. A～E are more optimistic.

Our principal assumptions for the years 2035 and after include the following:

(1) Per-capita labor productivity and real wages will grow at an annual rate of 1%.

(2) Prices (the consumption deflator and the GDP deflator) will rise at about

0.5% annually.

(3) The long-term interest rate (gauged by the yield on the 10-year Japanese government bond) will hover at about 1%.

3-3. Assumptions Regarding Tax and Social Welfare

One important factor concerns the social welfare benefits and burdens slide rule (or the link to the macroeconomic indicators). In our study, we have adopted the following assumptions. The medical and nursing care premiums and the consumption tax rate will be raised with a view to maintaining the government debt to GDP ratio even at about 250%. 250% is just one of the stabilized levels of debt which we reach by gradually closing the deficit of primary balance, and does not have specific meaning.

(1) Consumption will be linked to the disposable income with consumption tax deducted.

(2) Income taxes will be linked to the wages for the working population and pensions for the elderly.

(3) The social insurance premium burden:

  (i) Pension premiums (imposed on the working population) will be linked to wages;

  (ii) As for medical and nursing care (the working population), premiums will be raised in line with aggregate benefits up to a ceiling of about 20% of wages through 2065.

(4) Social welfare benefits:

  (i) The “macroeconomic slide” will be implemented with regard to pensions through 2045. The macroeconomic slide serves to cap the growth rate of benefits in periods when the growth rate of elderly is high. Since the projected inflation rate is low, we have assumed zero growth in the amount of benefits for both new recipients receiving pension benefits for the first time and existing recipients already receiving benefits during this period.

  (ii) Thereafter, benefits for new recipients would in principle be linked to wages and benefits for existing recipients would be linked to the price level. However, we have raised the growth rate for existing recipients slightly above the price level so that the difference between new and existing recipients does not widen.

  (iii) We assume that medical and nursing care will be linked to wages.

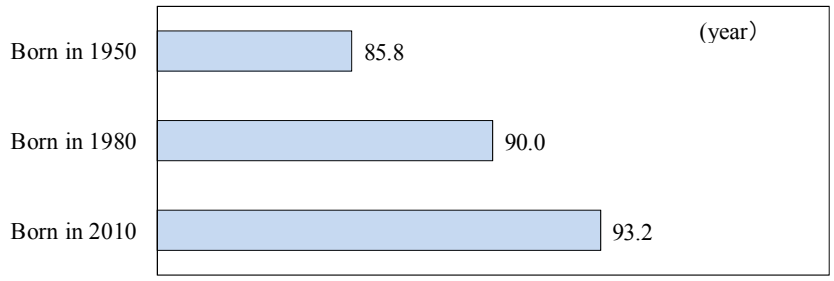
(5) We raise the consumption tax rate to 16% through 2045.

3-4. Survival Rate Projections

Our projections for survival rates are based on MHLW Life Tables. These data measure factors such as mortality rates (i.e., the likelihood of dying within the next year) of persons at every age covered by the Life Table. In our present analysis, we have linked in order Life Tables already released and then projected survival rates for cohorts by birth year. Since all generations covered by our analysis have remaining life as of 2017, we need to establish certain assumptions regarding future mortality rates. We have used mortality rate projections used in the Population Projections for Japan released by the National Institute of Population and Social Security Research (NIPSSR) through 2065. Since there are no mortality rate projections from and after 2066, we have extrapolated based on the projection for 2065 for future years[7].

Based on the above projections, the likelihood of surviving to an age, which we refer to as the survival rate in the present analysis, of each generation would be at age seventy: (i) 76.3% for Generation 1, which is influenced by a high mortality rate during childhood, (ii) 88.6% for Generation 2, and (3) 90% or more for Generation 3, respectively. The median lifespans for each cohort are estimated to be 85.8 years for Generation 1, 90.0 years for Generation 2, and 93.2 years for Generation 3. (**Figure 6**)

Figure 6 Expected Lifespan of Each Cohort (Median)



Source: Estimation using Japanese Mortality Database by National Institute of Population and Social Security Research. Available at http://www.ipss.go.jp/p-toukei/JMD/index-en.asp (data downloaded on Dec. 18 2017)

4. Consumption, Benefits and Burden Profiles for the Three Generations

Figure 7 shows consumption and generational accounting age trends in a baseline case for the three generations (those born in 1950, in 1980 and in 2010), respectively, based on the above premises. All values are presented in 2011 prices. The Δ symbol indicates the status of each generation as of 2015. It should be noted that all values after that year are projections.

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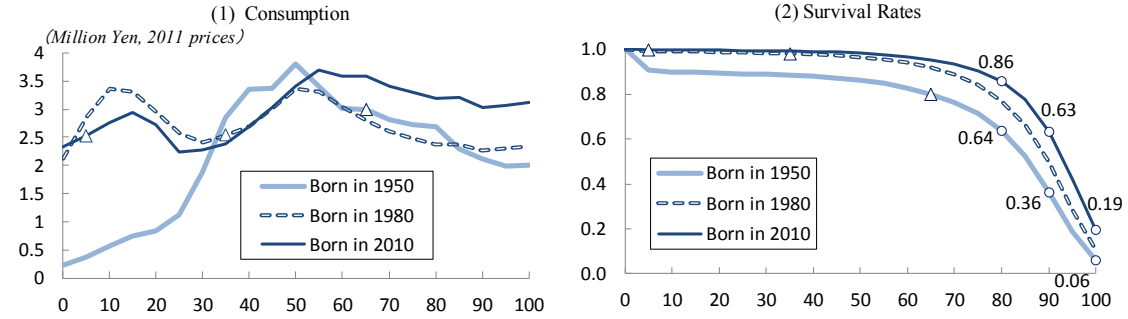
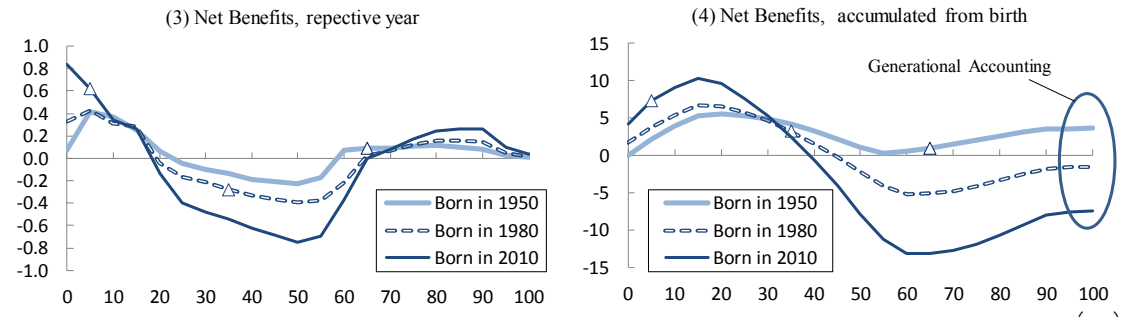
[7] With regard to the generation born in 2010, in our projected morality rate we assume a 0.1% annual erosion in mortality rates based on the lowest mortality rate in 2065.

Figure 7. Consumption and Generational Accounting

Consumption and Survival Rates ***(Millions of Yen, 2011 prices, at birth=1)***



Generational Accounting ***(Millions of Yen, 2011 prices, Discounted at 3% with base year 2010)***



Benefits-Premisums(Pension, Medical and Elderly Care)+Education Benefits-Income tax-Consumption tax

A look at consumption, panel (1) of Figure 7, reveals the following points. First, the consumption level of Generation 1 during its youth is low. This generation was born shortly after the war and in the early stages did not benefit from the subsequent economic growth. In contrast, Generation 2 enjoyed a high level of consumption during youth. The level of household consumption rose in the period of the economic bubble, part of which was enjoyed during childhood. The values for Generation 3 are for the most part projections.

Through around 2070, this generation will feel the impact of the rising burden caused by the need to stabilize government finances through increases in the consumption tax and medical and nursing care premiums. Their consumption during midlife (up to 2060s) will therefore be lower than that of Generation 2. Generation 2, which is 35 years old in 2015, will face a rising burden in almost all parts of their remaining lives, and their consumption growth rate will consequently be low. In the second half of life for Generation 3, the burden increase will run its course, and although the rate of growth will be slow (about 1% per capita in real terms), their consumption level will be highest among the three generations thanks to steady economic growth. The consumption levels three generations will be about the same at age fifty, but if per capita wages for Generation 1 are set at 1, per capita wages will be 1.25 for Generation 2 and 1.69 for Generation 3. It will be seen that,

owing to this rising burden, later generations will be unable to enjoy as much benefits as economic growth would suggest. The consumption that Generation 3 can enjoy can be further reduced if we discount the future.

Panel (2) shows survival rates by cohort. In contrast with Generation 1, which has a 64% survival rate at age 80, the survival rate for Generation 3 is 86% at the same age.

Panel (3) shows net benefits, the basis underlying generational accounting, shown for each respective year. Data are adjusted using a discount rate of 3%. There are disparities in benefits during childhood because allowances for childbirth and childrearing have been increasing in recent years. Generation 1 did not have the opportunity to benefit from such family allowances. From the age of twenty, when people enter the workforce on a full scale, the burdens begin to exceed the benefits. Thereafter, the burden gets larger for each successively older generation. It rapidly expands when they reach their forties and fifties. The consequences of adopting a transferable financing scheme, which requires the current working generation to bear social security expenses as societal aging progresses, are evident here. Benefits in old age are marginally greater for later generations. Panel (4) shows the cumulative net benefits of panel (3) through age t. Net benefits are positive for Generation 1 throughout life, but Generations 2 and 3 begin experiencing a net burden from around age forty, a situation which continues for the rest of their lives. The cumulative total lifelong value on the far right is equal to that under generational accounting. The later the generation, the larger is the net burden.

The components of general accounting are shown in **Figure 8-1** (benefits) and in **Figure 8-2** (payments). A look at panel (1) of Figure 8-1 shows that Generation 1, which will be subject to the macroeconomic slide (through the 2040s), and will see a gradual decline in the amount of benefits in real terms. Generations 2 and 3 will experience a rising trend in receipts because they will begin receiving pensions after the macroeconomic slide is no longer applied but also because existing pensions are expected to see a slightly higher growth than the price level in our setting.

Medical and nursing care benefits are higher the later the generation because we assume that medical and nursing care remuneration will be linked to wages, which is also assumed to be faster in growth rates than the price level. “Other cash benefits” of panel (3), as mentioned above, reflect the fact that benefits paid during childhood such as childbirth benefits and child allowances are higher in recent years. Values for education in-kind benefits are influenced, for example, by the fact that personnel expenses of teachers differ in each period and that in recent years

grant programs have been created for high school tuition costs.

Figure 8-1 Components of Generational Accounting -- Benefits

Benefits (Millions of Yen, 2011 prices) --Individual basis

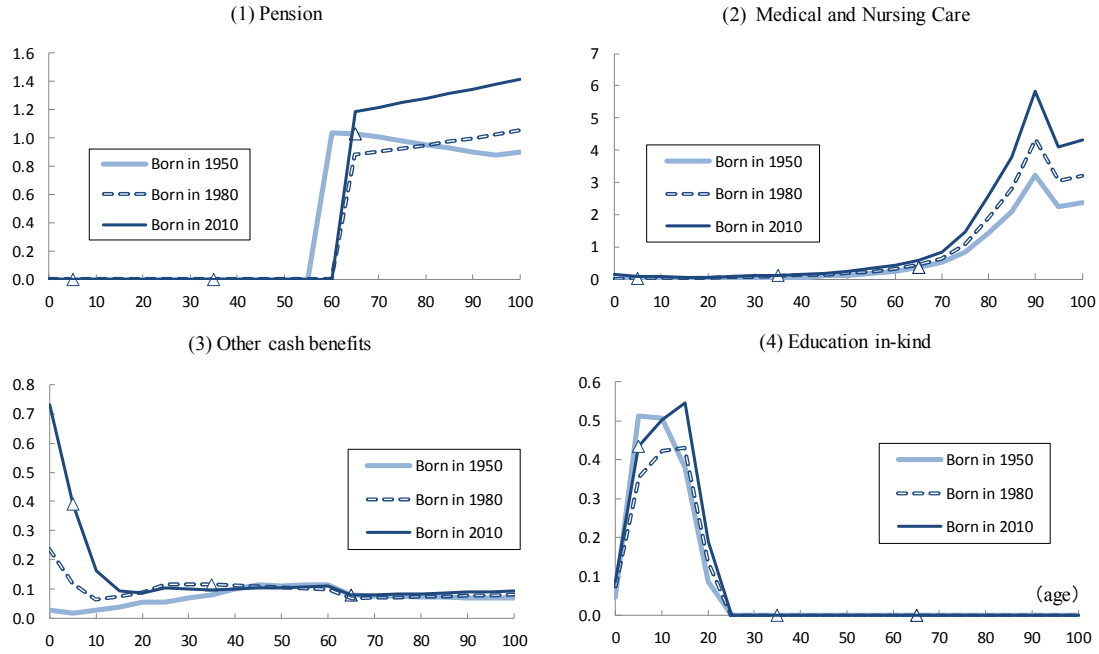
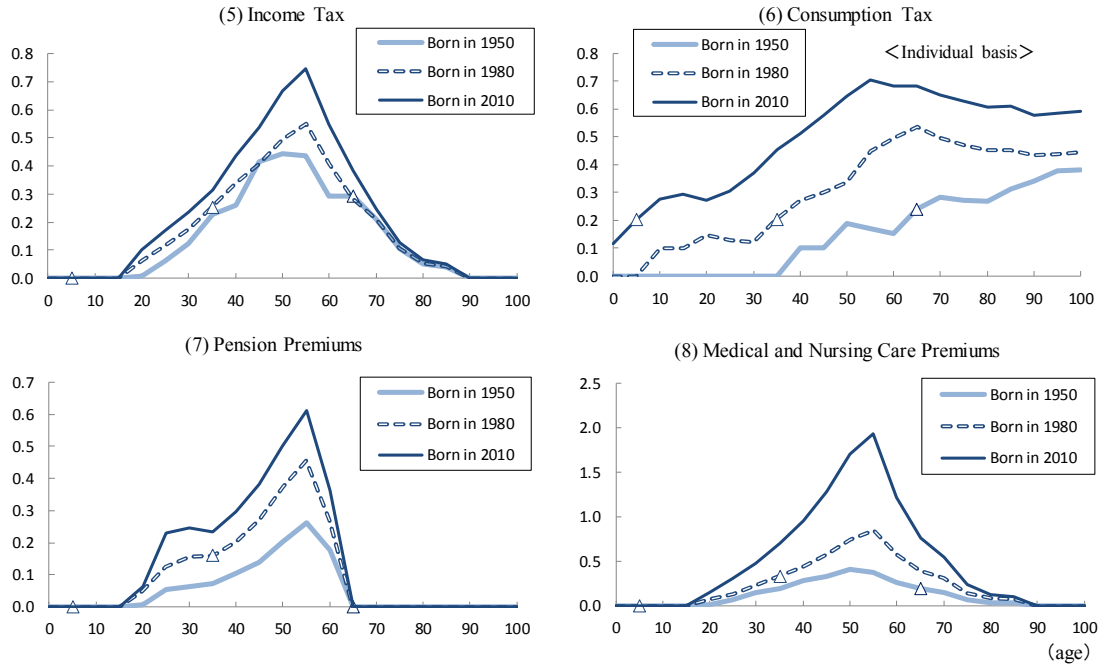


Figure 8-2 Components of Generational Accounting -- Payments

Taxes and Premiums (Millions of Yen, 2011 prices) --imposed on the head of household except Consum. Tax

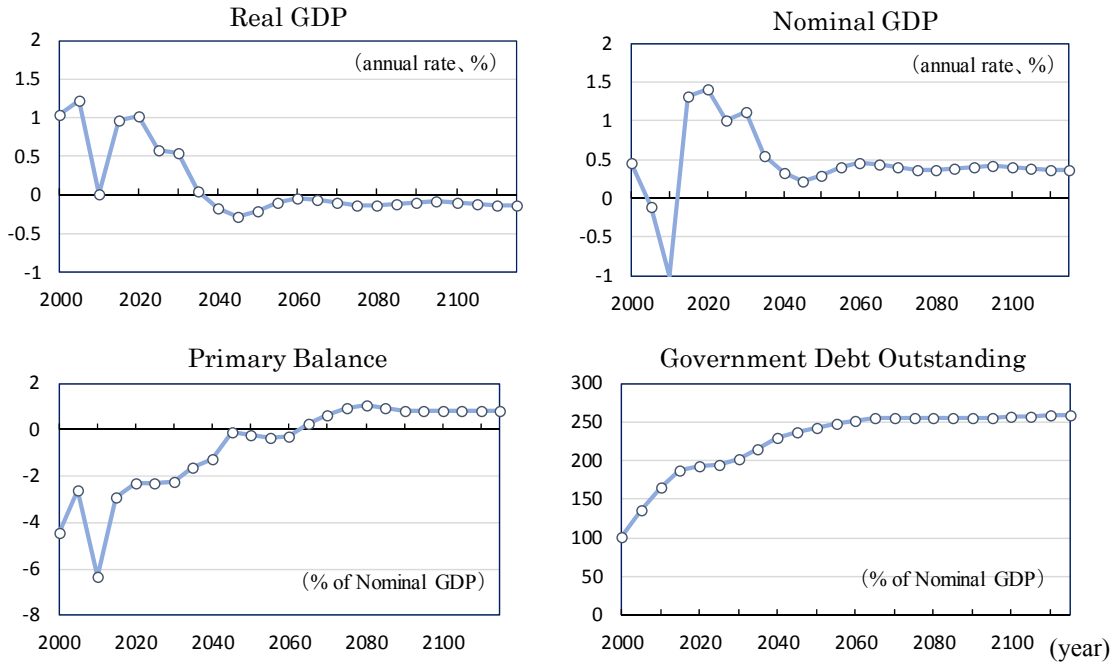


As for the payment components, burdens become heavier the later the generation. This reflects the assumption that the consumption tax and medical and

nursing care insurance premiums will be raised through 2060s. When we compare the burden of each generation at the age of fifty, Generation 3 will bear 2.5 times more burden than Generation 1, and they (Gen.3) cannot make the most of the increase in wages from economic growth.

Next let us examine how macroeconomic aggregates evolve (**Figure 9**). The GDP growth rate will be slightly negative in real terms. We expect per capital labor productivity to remain steady at 1% per annum as the labor force population will decline by just over 1% per year starting in the 2040s. Nominal GDP will grow at a pace of just under 0.5%. We see the long-term interest rate (the yield on the benchmark 10-year Japanese government bond) at 1%, exceeding the nominal growth rate. In the government financial balance, the government debt to GDP ratio will be held to about 250%, in which case it will be necessary for the central and local governments to maintain approximately a 1% surplus in their primary balance to GDP ratio.

Figure 9 Macroeconomic Indicators



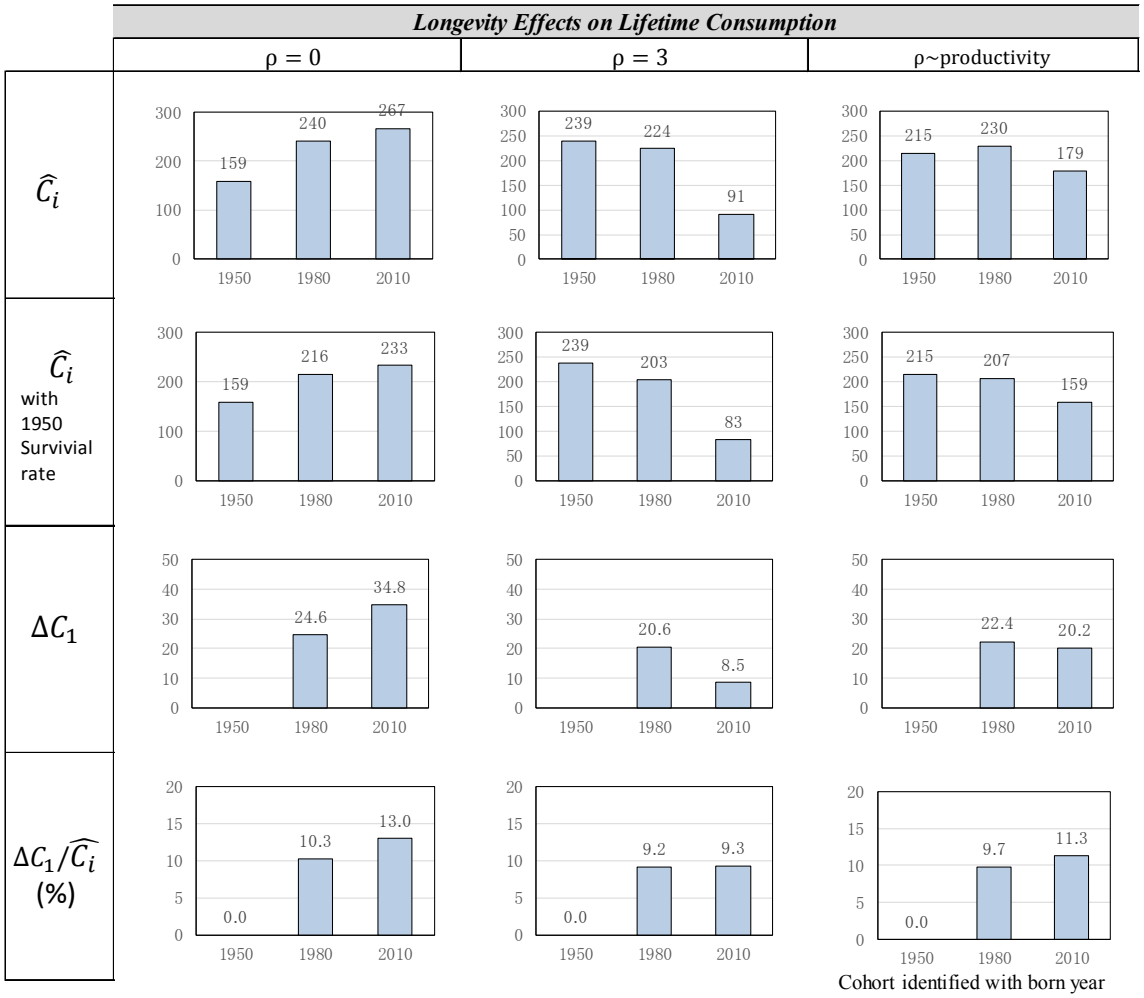
5. Simulation

5-1. Additional Consumption Obtainable from Living Longer

First, we derive the benefits that arise from longer life in terms of the increase in consumption which longer life makes possible. We assume for simplicity that the survival rates for both Generation 2 and Generation 3 were as low as those for generations born in 1950, and see how much more consumption the later generations secure with longer survival rates. Our findings are shown in **Figure 10**. The upper and middle panels show lifetime consumption, the upper panel being the baseline case and the second panel being the case with the survival rates assumed equivalent to that of Generation 1. The bottom panels are the difference between the two ΔC_1 and its ration to the baseline.

Figure 10 Lifetime Consumption $\widehat{C}_i$ and Its Increase from Longevity ΔC_1

(Millions of Yen, 2011 prices)



The following points become evident from the figure. Let us first consider lifetime consumption $\hat{C}_i$. The findings differ according to the discount rate setting. If we focus on the difference between Generation 3 and the preceding generations, the lifetime consumption of Generation 3 is seen to be the lowest except in the no-discounting case. If we adjust the difference between the generations using either 3% or productivity as discount rates that reflect the difference of economic circumstances where each generation is placed, Generation 3 could be viewed as the poorest. When using productivity, the outcome falls in the middle between no discount and 3% discount.

The rate of increase in the benefits ΔC_1 of longer life for Generation 3 are (reading left to right) 13%, 9% and 11%. In the case of Generation 2 the results are 10%, 9% and 10%, not much different from Generation 3. These results are the consequence of a rapid lengthening of lifespans between 1950 and 1980. The differences arising from the discount rate settings are not especially large. We can conclude that the extension of lifespans arising over the past sixty years has given rise to an increase in lifetime consumption of about 10%.

5-2. The Impact of Working Longer

When people live longer, it is natural for them to continue working longer too. Japanese presently begin receiving a public pension (the basic pension) from the age of sixty-five, the general target age for leaving the workforce. In contrast with the present practice, we assume that people will work ten years longer. Our model assumes that the age at which they begin receiving their pension will be rolled back and that they will continue paying pension insurance premiums as they work.

This will give rise to latitude in the government's financial balance. It might be seen as a financial dividend for the government arising from longer lifespans. The upturn in the government's primary balance relative to the baseline case we will define as the fiscal surplus. We also consider a scenario in which the surplus is restored to households (as through reductions in medical and nursing care insurance premiums). In view of further advances in life extension anticipated in the future, we do not see it as overly unrealistic to assume that people will stay in the workforce for an additional ten years, but given the large differences among the elderly, we have also included estimates envisioning a five-year extension of working life. The cases we envision can thus be summarized as follows:

(a) The baseline case

(b) Extension of work by ten years

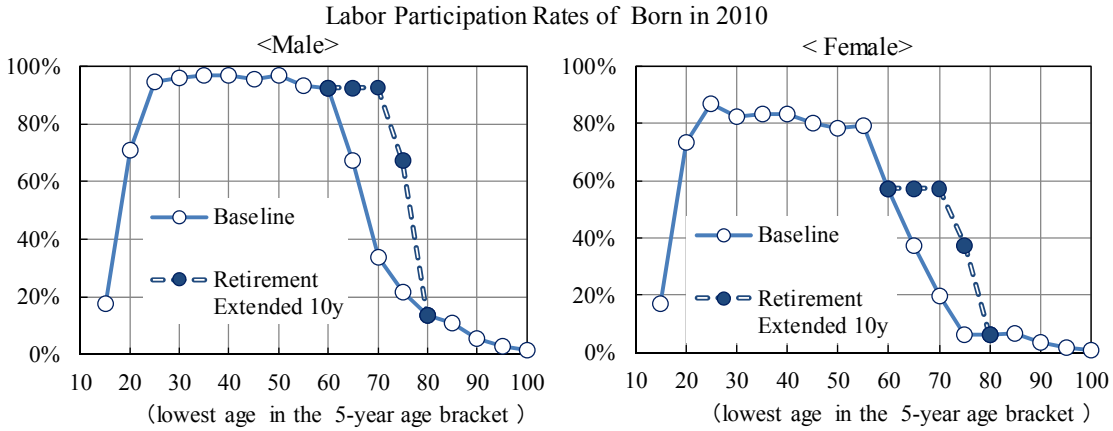
(c) Extension of work by ten years (with the financial surplus being restored to households)

(d) Extension of work by five years

(e) Extension of work by five years (with the financial surplus being restored to households)

The additional time which we assume elderly spend in the labor force is depicted in **Figure 11**. Notwithstanding the retirement age of sixty-five, just under 70% of Japanese men continue working through the ages of sixty-five through sixty-nine and just over 30% continue on working through the ages of seventy through seventy-four. Here assume they work to between age seventy-five to seventy-nine, or in the same way that their predecessors would have when ten (or five) years younger. We assumed that the extensions take place after 2035 for sixty-five through sixty-nine years old, after 2045 for seventy through seventy-four, and after 2055 for seventy-five through seventy-nine.

Figure 11 Assumption of Extended Retirement



The fiscal surplus turns out to be as follows.

Figure 12 Fiscal Surplus Expected from Extended Retirement

(percent of nominal GDP)

10 years longer	case (b)	6.1～6.8
5 years longer	case (d)	3.7～4.1

(Deviation from case (a))

Next, we look at what the impact on consumption and benefits would be for each generation if the fiscal "dividend" is restored to households (**Figure 13**). The upper panel (a) Baseline $\hat{C}_i$ is the same as in Figure 10. The generational

accounting value $\hat{G}_i$ is identical with the value in the final year of Figure 10 (4) for the case of the 3% discounting. Whatever the discount rate setting, the generational accounting value is positive for Generation 1, about even for Generation 2 and negative for Generation 3. This confirms that the younger the generation, the greater is the net burden.

The term $\hat{G}_i + \Delta C_1$ is the sum of (i) generational accounting balance, or the costs imposed on (or benefits gained by) each generation from the advance of aging and (ii) the increase in consumption that constitutes the benefit from longer lifespans. It is the overall assessment indicator for societal aging. The findings show that the disadvantages for Generation 3 are somewhat alleviated. In the absence of discounting, the value is highest for Generation 3, while valuation based on productivity yields puts Generation 2 and Generation 3 at about the same level.

(c) represents a case in which the fiscal surplus from working longer is restored to households. Evident here is the increase of lifetime consumption $\hat{C}_i$ thanks to wages earned by the elderly who remain in the workforce, which we will label ΔC_2. Generation 1 is at the best advantage in terms of generational accounting $\hat{G}_i$, as in case (a), but Generation 2 and Generation 3 are either at about the same level or, in the case of no discounting or productivity discounting, Generation 3 slightly exceeds Generation 2.

When the increased portion ΔC_1 of direct consumption resulting from longer lifespans and the increased portion ΔC_2 of consumption accompanying the longer period in the workforce are added to generational accounting (bottom panel), the benefit for Generation 3 is seen to be largest in the case of no discounting. In the case of discounting for productivity, it is around the same level as for Generation 1. With discounting of 3%, the benefits for Generation 2 and Generation 3 are substantial.

Figure 14 shows the case in which the period in the workforce is extended by five years. The same sort of trends can be confirmed in the case of a five-year extension of time in the workforce. If we factor in the consumption obtainable from living longer and the increased consumption made possible from the elderly working longer, it no longer follows that the youngest are subject to the greatest disadvantages.

In the above calculations, the discount rate has sometimes decisive influence on the evaluation of the result. It is difficult to make deterministic decisions on what to adopt as the discount rate. In this study, we used three discount rates of 0%, 3%, and productivity. 3% is the value often used in the previous generational

accounting studies including Auerbach et al.(1991). The reason we added 0% and productivity as alternatives, which are lower than 3% in the forecast period, is that the setting of 3% seems to exceed the recent real interest rate levels that declined since 2000. We assume the real interest rate in the future stabilizes at 0.5% in the long term. Discount rates by productivity may better match this assumption for the forecast period.

According to the formulation of Ramsay which considers consumption allocation across multiple periods, the discount rate is approximately the sum of the per capita growth rate and the time preference rate. In this study the per capita output is projected to grow 1% annually. Assuming a discount rate of 3% implies that the time preference rate is 2%. One of the lowest time preference rates ever adopted is 0.1% by The Stern Review, which alarmed the climate change. Its discount rate is set at around 1.5% (Stern, 2015). Different time preference and discount rates may be adopted depending on what we evaluate.

Figure 13 Effects of Extended Retirement of 10 Years (Millions of Yen, 2011 prices)

Lifetime Consumption $\hat{C}_i$ and Generational Accounting $\hat{G}_i$

Increase from Longevity ΔC_1, and from Extended Retirement ΔC_2

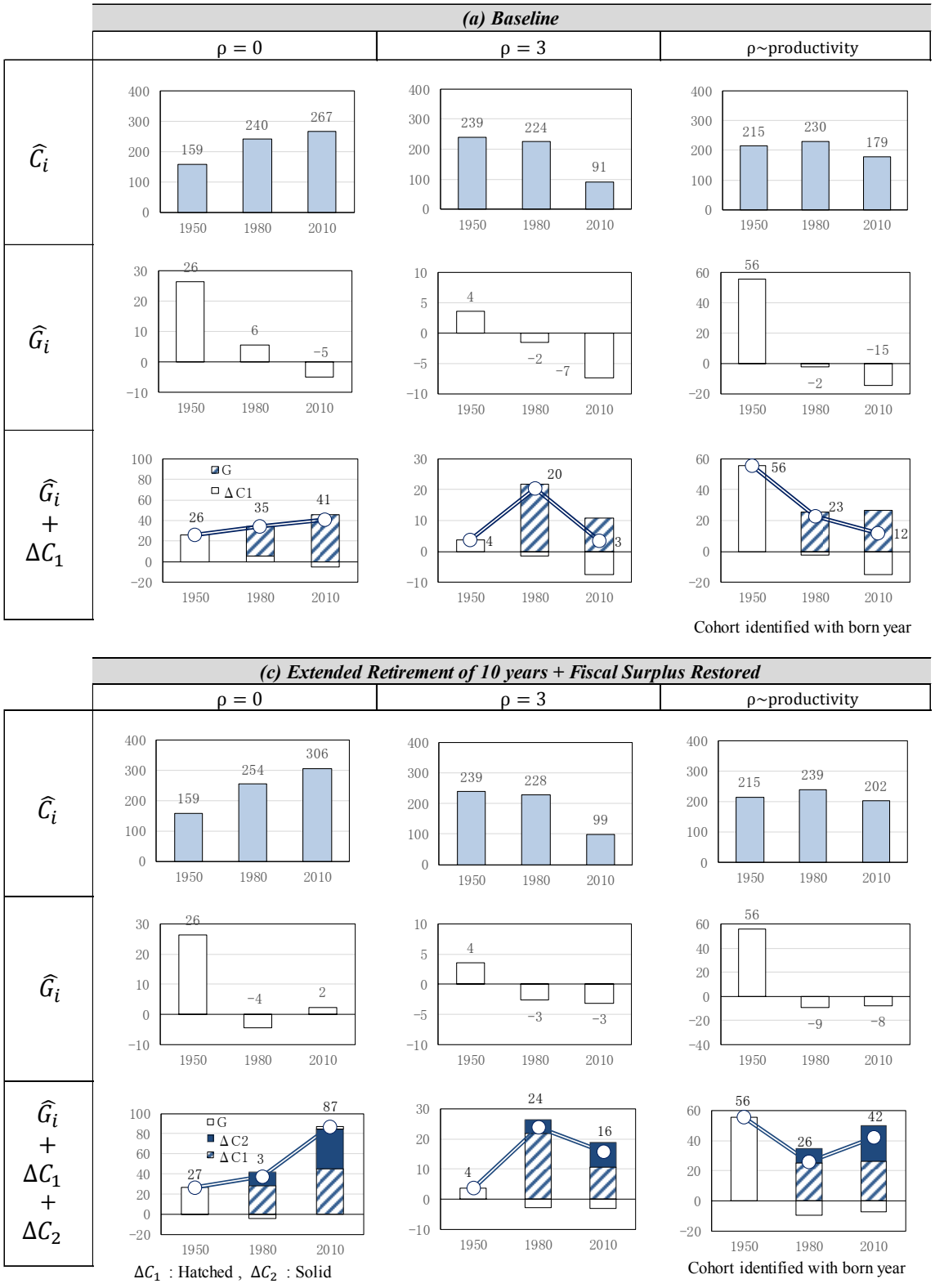
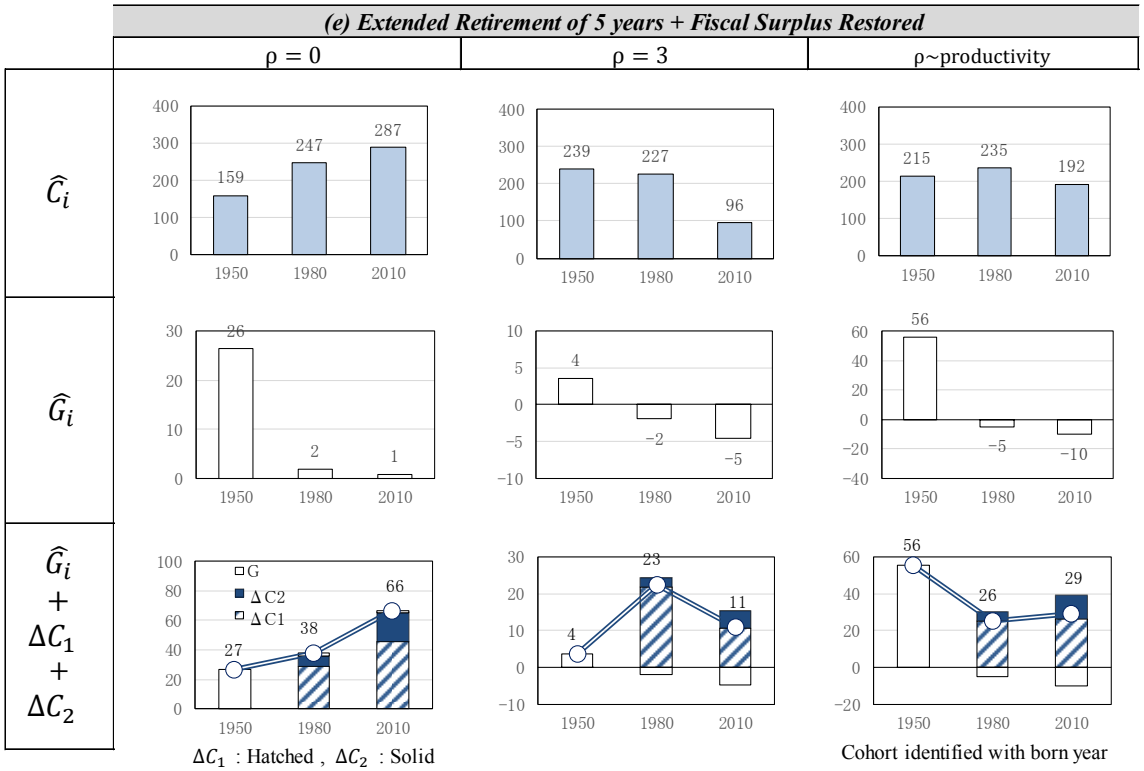


Figure 14　Effects of Extended Retirement of 5 Years (Millions of Yen, 2011 prices)

Lifetime Consumption $\hat{C}_i$ and Generational Accounting $\hat{G}_i$

Increase from Longevity ΔC_1, and from Extended Retirement ΔC_2



6. Conclusion and Discussion

In this study, we have focused on three generations, Generation 1 born in 1950, Generation 2 born in 1980 and Generation 3 born in 2010, with a view to identifying their net tax and social welfare burden and the additional consumption they will enjoy from living longer. In addition to generational accounting as taken up by previous research, we have estimated consumption for each generation.

First, we have confirmed the findings of previous research to the effect that, the younger the generation, the greater will be its net burden with respect to tax and social welfare balances (generational accounting) payable to the government. Even if the ratio of government debt to GDP can be held to 250% in a bid to stabilize government finances, the old age dependency ratio will continue to rise through around 2060. As a result, and because Japan finances social security costs from tax revenues and social insurance premiums, the burden on the working generation will continue to rise over this period. Generation 2 will face a rising burden throughout most of their lives while Generation 3 will face it through midlife.

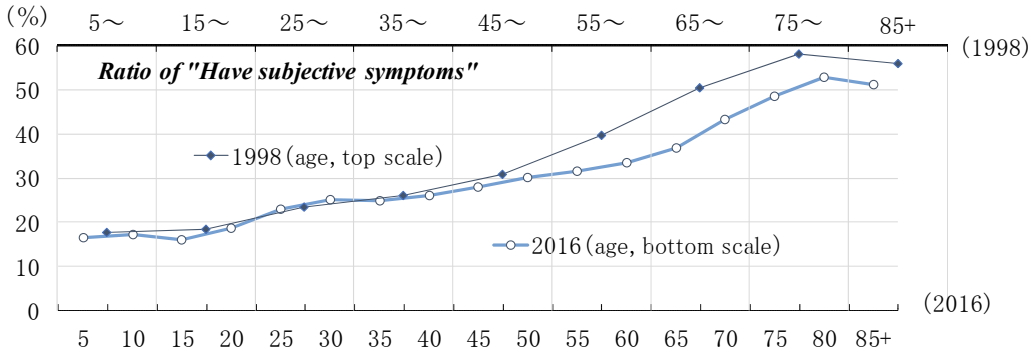
We found out the following three points. First, if we take the survival rate of

Generation 1 as a baseline for measuring the benefits of living longer, Generation 3 will experience a 9%–13% increase in lifetime consumption. Generation 2 will see a 9%–10% increase.

Second, longer participation in the workforce by the elderly have the effect of ameliorating the need for fiscal belt-tightening. In view of the fact that lifespans will go on increasing, we have assumed that people will work ten years longer than at present, that the age at which they will begin receiving pension benefits will in principle be raised to seventy-five, and that while working they will continue to pay social insurance premiums. In that case, the primary balance of the central and local governments to GDP would improve by 6%–7% over the baseline case.

Third, extending people's time in the workforce as noted above will even out the disparities between the burdens and benefits of each generation. If the resulting fiscal surplus is then applied to reducing medical and nursing care premiums, it will be possible to lighten the burden on the younger generations.

Figure 15 Ratio of "Have Subjective Symptoms"



Source: Ministry of Health, Labor and Welfare, "Comprehensive Survey of Living Conditions"

What might the implications of the above analysis be? First, it once again highlights the importance of maintaining good health. Maintaining good health is desirable for its own sake. Increasing healthy lifespans makes it possible to preserve quality of life during old age and to fully enjoy consumption. A look at the health status of Japan's elderly as gauged by the ratio of "Persons with subjective symptoms of physical disorders" in the Comprehensive Survey of Living Conditions published by the Ministry of Health, Labor and Welfare shows that elderly Japanese in 2016 were on average five to ten years more youthful than they were in 1998 (**Figure 15**). Further efforts to maintain and improve health as well as preventive medical treatment and nursing care are thus important[8].

[8] The potential contribution that health-promotion expenditures (investment) and health

The second implication of this study is the importance of creating institutions to promote self-help efforts. This could also be described as narrowing the scope of public insurance. The future burden is concentrated on the younger generations because most of the cost for medical and nursing care for the elderly is funded through public insurance. The extension of time spent in the workforce discussed in our analysis is one form of self-help. The fact that the age at which Japanese begin receiving pensions is set at sixty-five in a sense constrains people over sixty-five from working. Kitao (2015) estimates that reducing the amount of per capita pension payments by 20% would raise the labor force participation rate among people aged seventy through ninety by from 11.6% to 24.2%. In February 2018, the government decided at the Cabinet meeting on the general agenda for aged society measures to make it possible for people to begin receiving public pension benefits after the age of seventy. In 2013, JCER made a reform proposal calling for privatization of the earnings-related component of public pensions and the use of taxes as a funding source for the basic pension (Iwata & Saruyama, 2013). If the social insurance premiums imposed on employers are eliminated, it would also have the effect of creating jobs and boosting wages. Also important would be the use of technological innovation to enhance the productivity of the elderly and continuing education to enhance the human capital of prime-age and elderly workers[9].

Self help also involves the element of saving on one's own. Privatizing the public pension system would raise the household savings rate and, through capital accumulation, would help improve individual utility (Iwata, 1997). Birkeland and Prescott (2007) compare alternative modes of operating the social insurance system by comparing the tax-and-transfer system with an independent savings-for-retirement system, including investment, and argue that adopting a savings-for-retirement system with a sizable government debt would enhance utility. They argue that the optimum size of the government debt for the United States would be about 4.5 times GDP. They estimate Japan's debt to output ratio at just over 2%. Iwamoto and Fukui (2014) have argued for a funded medical and nursing care insurance system. They report that it would be possible to even out the burden among the generations by setting the insurance premium imposed on the working generation at a much higher level.

Thirdly, the burden of "future generation" who is not yet born is hidden in our

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and preventive benefits for medical and nursing care could make toward improving health are described in such health economics studies as Yuda et al. (2013) and Murphy and Topel (2006).

[9] For models relating to the falling birthrate and societal ageing, population decline and technological development see Hashimoto and Tabata (2016); regarding the relationship between recurrent education and longer lifespans see Tanaka (2017).

calculation. The burdens on the existing generations especially younger ones are relieved to some extent on the condition that the government debt is stabilized at 250% of GDP. The policy to ease existing generations is a policy to make future generations pay the price. Even under the above conditions, the 3rd generation's tax and social security burden will be 2.5 times that of the first generation at the age of fifty. The consumption level of them is barely maintained with the condition that per capita productivity grows 1% per year and long-term interest rate is kept at 0.5%. Once more severe economic situation comes or a more large-scale debt reduction plan is required, the disadvantage of the young generation may not be able to be resolved even with the extended retirement enforced.

Japanese societal ageing is only half completed. The most severe stages are yet to come. Japan needs to enhance the sustainability of its social insurance system and urgently institute reforms to narrow the gaps among the generations regarding the related burdens and benefits.

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