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INTERGENERATIONAL EQUITY UNDER INCREASING LONGEVITY[1]

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Introduction

The Japanese population is ageing faster than any other population in the world. Data from the Organisation for Economic Co-operation and Development (OECD) show that the ratio of persons aged 65 and older to the overall population in 2013 was highest in Japan at 25.1 per cent. According to Japan's National Institute of Population and Social Security Research (NIPSSR), this ratio will rise to 38.1 per cent by 2060. The number of seniors aged 75 and over and 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 75 and over will reach 25.7 per cent of the population, or one in four persons (Figure 9.1).

1 In preparing this paper, the authors have received important insights from Masaaki Kawagoe, Specially Appointed Fellow of the Japan Center for Economic Research (JCER). JCER President Kazumasa Iwata also provided advice and comments on the research overall. At the PAFTAD (Pacific Trade and Development) Conference in Tokyo in February 2018, we received very helpful comments from participants including Naohiro Yashiro, Showa Women's University Professor; and Shiro Armstrong, Director of the Australia–Japan Research Centre at The 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.

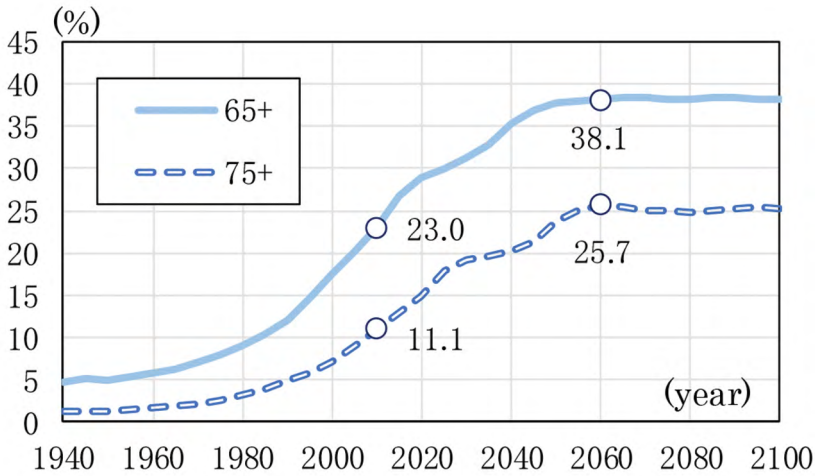

Figure 9.1. Ratio of the elderly in the population

Source. Population Census, Statistics Bureau of Japan. From 2020 onward, projections by NIPSSR

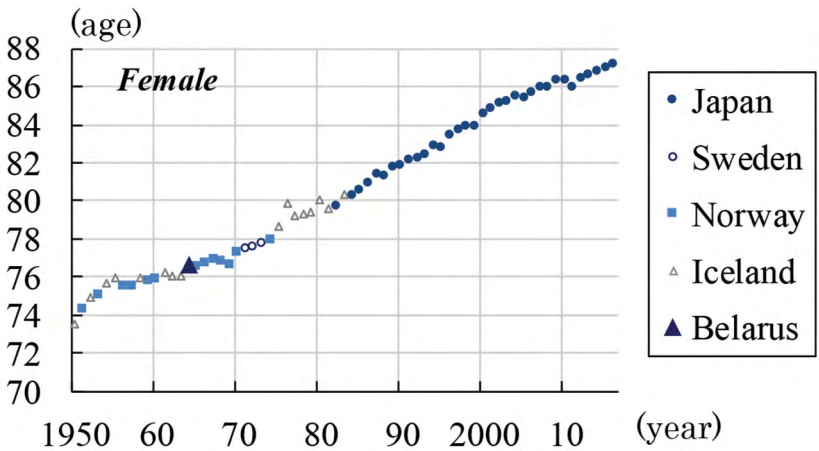

Figure 9.2. Best-practice life expectancy

Source. Human Mortality Database, University of California, Berkeley, United States, and Max Planck Institute, Germany, www.mortality.org

At the same time, lifespans are lengthening. A look at 'best-practice life expectancy', or the maximum life expectancy observed among nations in a given year, shows that female life expectancy over the last 160 years has increased by 40 years at nearly a linear rate of more than two years every decade (Oeppen & Vaupel 2002). Since the 1980s, moreover, Japan has occupied the top position (Figure 9.2). 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 & Scott 2016).

The increase in the old-age dependency ratio means that 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 is financed through taxes and social-insurance premiums paid by the working generations.

'Generation accounting', investigated typically by Auerbach et al. (2011), is an attempt to clarify the balance of benefits and burdens on taxes and social security by generation. A previous study that applied the generation accounting method to Japan found 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 future generations the most (Auerbach et al. 1999).

The news is not all bad, however. By living longer, people can enjoy the positive aspects of a longer life. Becker's (2007) theoretical model translates increased lifespan into economic value. Based on a model of overlapping generations, Becker derives the value of a longer lifespan from a willingness to pay for the cost of a longer life. According to Kawagoe (2018), who applied the same model to Japan, the drop in the death rate in Japan that occurred between 1970 and 2005 can be valued roughly at 165 trillion yen annualised.

The aim of the present study is to assess aspects of ageing 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. 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 ageing would produce. Japanese people presently begin receiving their public pension (the basic pension) from the age of 65, the general target age for exiting the workforce. In view of the lengthening of lifespans, however, pulling out of the workforce at 65 is too early.

In 1961, when universal pension coverage was first established in Japan, average male life expectancy was 66 years, and payment of pension benefits began at the age of 60. Benefits were received for less than 10 years on average. In 2015, average male life expectancy was 81 years, yet the age at which benefit payments begin has been raised just five years to age 65. This means that the period over which benefits are received has grown to 16 years. If the average lifespan increases further along the recent trend, it is likely that Japanese people will receive benefits for more than 20 years in 2050.

In January 2017, the Japan Gerontology Society and the Japan Geriatrics Society proposed that the term 'elderly', which now refers to people aged 65 and older, be redefined to mean persons aged 75 and older. They also proposed that the term 'early stage elderly', which currently refers to those aged 65 to 74, be regarded as meaning 'semi-elderly', indicating that such persons are still able to contribute to society. The recommendations were based on the judgement 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 a 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 gross domestic product (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 mobilised 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: the population born in 1950[2] (Generation 1), the children of this generation born in 1980 (Generation 2), and the generation born 30 years later in 2010 (Generation 3). We have selected 1950 as the starting year because underlying data with a firm statistical basis is readily available for the following years.

In estimating the generational accounting and the consumption that each generation can enjoy under certain macro-economic assumptions about the future, we found that Generation 3, the youngest generation, will see its lifetime consumption expand by 9–13 per cent thanks to the longer lifespans obtained after Generation 1. If the age at which workers leave the workforce can be raised by 10 years over the present while other conditions remain constant, national and local governments would see a 6–7 per cent 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 ageing. If, however, account is taken of the increase in consumption that follows from longer lifespans and the expansion in labour force participation, the inevitability of the younger generations being hit hardest by societal ageing will for the most part be avoided.

In an age when people live to 100, withdrawal from the workforce at the age of 65 is too early. Japan needs to forge a system under which people work an additional 10 years. Lengthening healthy lifespans will also be important so people can better enjoy the additional consumption that longer lifespans will make possible.

Ageing will also accelerate in other Asian countries (Figure 9.3). According to the UN population forecast, the proportion of people aged 65 and over will grow in every country at different rates. Life spans will also be longer and, by 2060, the average life expectancy of women will exceed 90 in Korea and be around 85 in Thailand, China, Vietnam and Malaysia. As Asian countries improve their social security for the elderly, the burden on active workers may increase, and there is a possibility that the inter-generational disparity in fiscal burden will occur as it has in Japan. This analysis, therefore, has important implications for Asian countries.

2 The generation born in Japan after World War II is known as the baby boomer generation, however, the number of births most notably increased in the three years between 1947 and 1949.

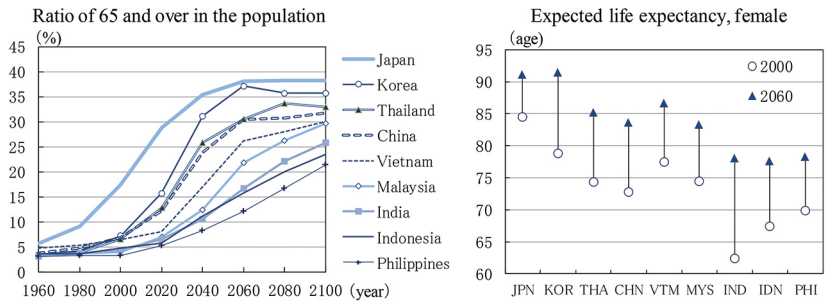

Figure 9.3. The ratio and life expectancy of the elderly in Asian countries

Source. United Nations, World Population Prospects, 2017, population.un.org/wpp/; NIPSSR, Population Projection for Japan, www.ipss.go.jp/index-e.asp

The following section explains the analytical framework on which the study is based. This is followed by an introduction to the data used for the analysis and the several assumptions we have made concerning such factors as the macro-economic outlook, taxes and social security. The next section on consumption, benefits and burden profiles examines how the three generations evolve over time with the data we identified and this is followed by our estimation of the impact that longer lifespans (the survival rate) will have on each generation, taking into account the greater number of years spent in the workforce.

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.

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 labour. We assume consumption is the only source to affect welfare.

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 9.4, $B_{i,t}$ 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,

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

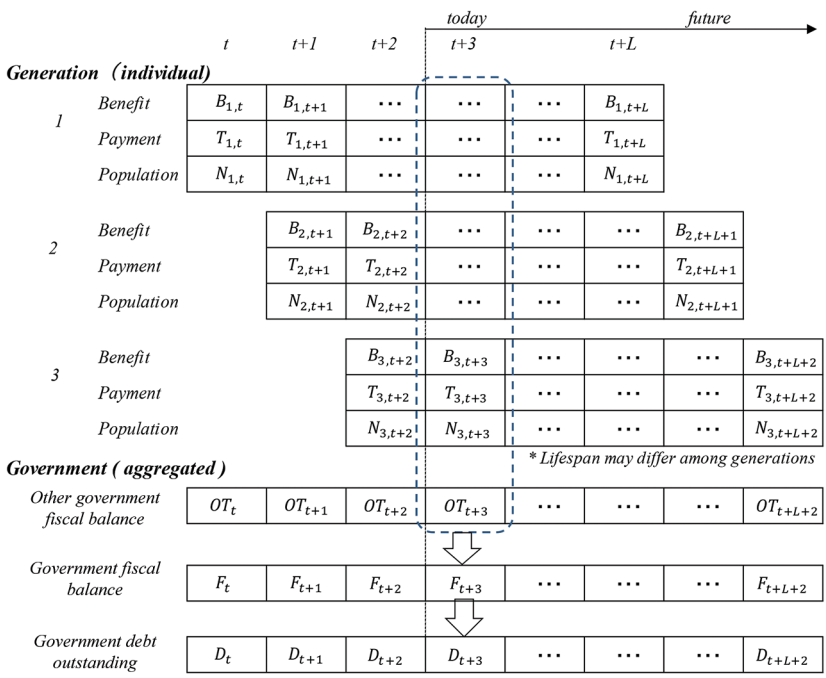

Figure 9.4. Benefits and payments by generations and government finance

Source. Figure compiled by the authors

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

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

where $BP_{i,t}$ 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 et al. (2011) in three ways.

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 per cent. Japan's combined central and local government debt to GDP ratio is about 190 per cent in 2016. It would not be realistic to place the entire burden of repaying this debt on a particular generation. By taking 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 that 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 indicates 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. A study by Masujima et al. (2009) attempted to include this past assessment in the methodology by using a generational accounting formula that 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 90. We adopt this same methodology to make generational comparisons. We look at generations separated by 30 years, or those born in 1950, 1980 and 2010 among others.

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,

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

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 revenue, 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 per cent). 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 generations 1, 2 and 3 are factored into the estimates.

Households

Budget constraints for households are considered as follows,

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

$W_{i,t}$ 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 assume instead that consumption is linked simply to disposable income in the period.[3] $PC_{i,t}$ is assumed to be exogenous. The wages $W_{i,t}$ earned on average by generation i at time t are influenced by the labour 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.

GDP

The health of government finances can be judged via the ratio to GDP of parameters such as the primary balance or the outstanding balance of government debt. 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,

$$Y = AL$$

3 Consumption remained weak even after the initial pullback that followed the consumption tax hike in 2014. This implies that many households are under income or liquidity constraints.

The term L represents the labour force population while A is labour productivity. L is the sum of the five-year-old population of men and women in production age multiplied by their labour participation rates. If RLF_i is deemed the labour force participation rate for each cohort 15 years and over, we have,

$$L = \sum_i RLF_i \cdot N_i$$

As the labour 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):

$$\tilde{Y} = PY$$

Discount rates

When assessing the value and benefit 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. Discount rates using a given coefficient to discount values arising in the future can be understood in different ways.

Discounting can arise from, for example, (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, and (iv) depreciation of capital stock and consumption goods.

Previous studies of generational accounting often used discount rates of 3–4 per cent per year. Masujima et al. (2010) adopted variable rates that add a premium on top of the growth rate. Suzuki et al. (2012) used the pension yield. Auerbach et al. (2011) ran simulations under various discount rates including ρ = 3 per cent 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 zero per cent (no discount rate), using the rate of 3 per cent, and using the productivity growth rate. Productivity is the approach of using labour expended as a standard for obtaining economic value and, in a practical sense, it is close to the per capita growth rate. Figure 9.5 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 annualised rate of 1 per cent. The base year for discounting is 2010.

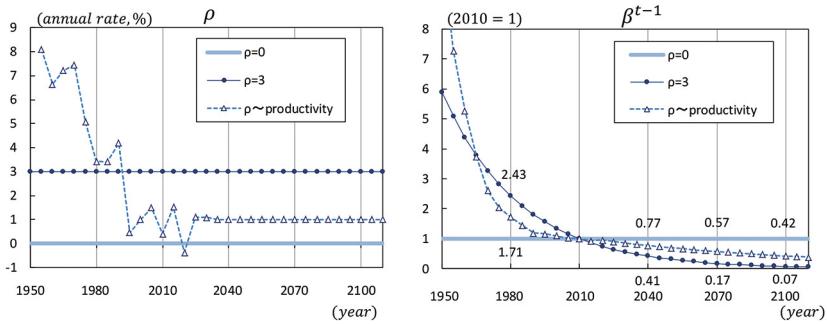

Figure 9.5. Discount rates

Source. Figure compiled by the authors

Data and assumptions

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

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 21 cohorts of five years from age zero through four up to age 100 and over. The basic statistics used in our estimates are from sub-sectoring household accounts in the System of National Accounts (SNA) and the National Survey of Family Income and Expenditure (NSFIE),[4] which constitute the basic data for the above, supplemented by medical and nursing-care and educational data. Since data from NSFIE are originally based on households, we convert them

4 Stiglitz et al. (2010) have pointed out that 'Aggregate data is insufficient to recognize how distributional policy works'. The OECD provided guidelines for sub-sectoring of SNA. Estimates are made in conjunction with the NSFIE released in Japan every five years. See Kawagoe and Maeda (2017) for more details.

into individual amounts (equivalent values) using the household-member ratio from the population census. Children are responsible for a portion of household consumption, while the head of household is considered to bear the tax and social-insurance burden.

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 the SNA also regards it as a household operating surplus. 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.[5]

Among benefits, medical, 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 expenses 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 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 macro-economic 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.

5 Female data is used because figures on males are easily confused with residents of specified facilities, making it difficult to ascertain the actual numbers.

Macro-economic assumptions

We have formulated a number of future values based on macro-economic assumptions (Table 9.1). For the years through 2030, we base our assumptions on the Japan Center for Economic Research (JCER) Medium-Term Economic Forecast. For the years after 2030, we have extrapolated from that 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, Labour and Welfare (MHLW) in 2014.

Table 9.1. Macro-economic assumptions

(annual rate, %)						
This study				Ministry of Health, Labour and Welfare		
(~2030)			(2035~2115)	(2024~)		
Based on JCER's forecast				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)	Labour productivity	1.0	1.0			
5)	Long-term 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 2025–30.

b) Long-term interest rates are yields on 10-year government bonds, 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.

Source. Authors' assumptions based on JCER's Medium-Term Economic Forecast and MHLW's Official Fiscal Projections

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

1. per capita labour productivity and real wages will grow at an annual rate of 1 per cent
2. prices (the consumption deflator and the GDP deflator) will rise at about 0.5 per cent annually
3. the long-term interest rate (gauged by the yield on 10-year Japanese Government bonds) will hover at about 1 per cent.

Assumptions regarding tax and social welfare

One important factor concerns the social welfare benefits and burdens slide rule (or the link to the macro-economic indicators). In our study, we have assumed that medical and nursing-care premiums and the consumption tax rate will be raised with a view to maintaining the government debt-to-GDP ratio at about 250 per cent. This is just one of the stabilised levels of debt that 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:
   a. pension premiums (imposed on the working population) will be linked to wages
   b. 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 per cent of wages through 2065
4. social welfare benefits:
   a. the 'macro-economic slide' will be implemented with regard to pensions through 2045. The macro-economic slide serves to cap the growth rate of benefits in periods when the growth rate of the 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
   b. 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
   c. we assume that medical and nursing-care benefits will be linked to wages.

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 applied mortality-rate projections used in the Population Projections for Japan released by NIPSSR through 2065. Since there are no mortality-rate projections from and after 2066, we have extrapolated for future years based on the projection for 2065.[6]

Based on the above projections, the likelihood of surviving to an age, which we refer to as the survival rate, of each generation would be at age 70: (i) 76.3 per cent for Generation 1, which is influenced by a high mortality rate during childhood; (ii) 88.6 per cent for Generation 2; and (3) 90 per cent or more for Generation 3. The median lifespans for each cohort are estimated to be 85.8 years for Generation 1, 90 years for Generation 2, and 93.2 years for Generation 3 (Figure 9.6).

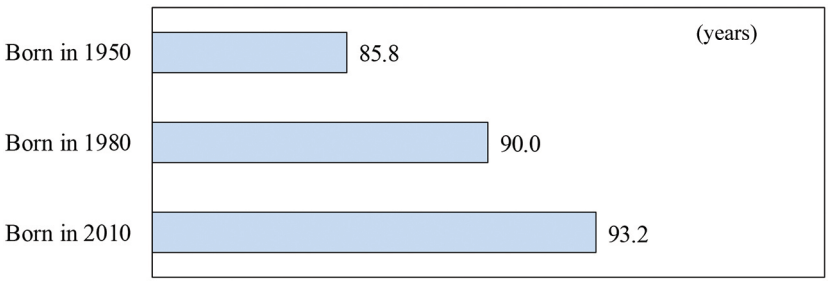

Figure 9.6. Expected lifespan of each cohort (median)

Source. Estimation using NIPSSR's Japanese Mortality Database, www.ipss.go.jp/p-toukei/JMD/index-en.asp

6 With regard to the generation born in 2010, we assume a 0.1 per cent annual erosion in mortality rates based on the lowest mortality rate in 2065.

Consumption, benefits and burden profiles for the three generations

Figure 9.7 shows consumption and generational accounting age trends in a baseline case for the three generations (those born in 1950, 1980 and 2010) respectively, based on the above premises. All values are presented in 2011 prices. The △ symbol indicates the status of each generation as of 2015. It should be noted that all values after that year are projections.

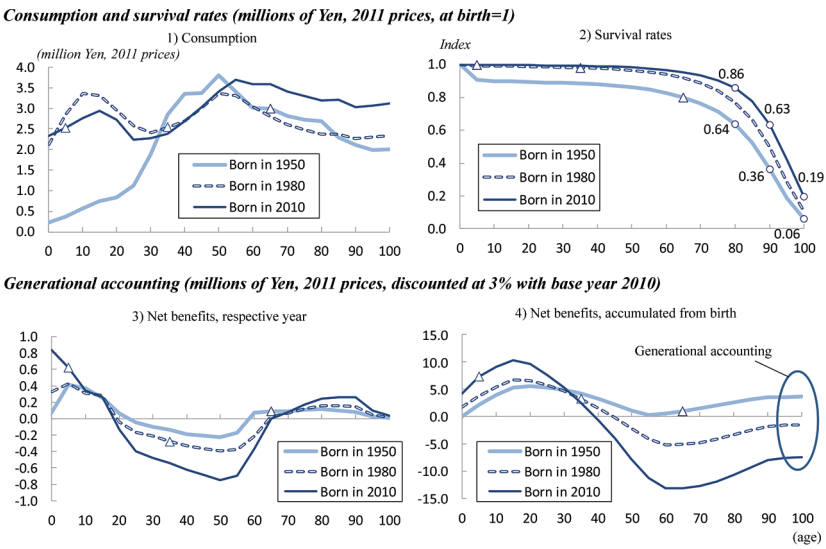

Figure 9.7. Consumption and generational accounting

Note. Benefits–Premiums (pension, medical and elderly care) + education benefits – income tax – consumption tax.

Source. Authors' calculation

A look at consumption (panel 1) in Figure 9.7 reveals that the consumption level of Generation 1 during its youth is low. This generation was born shortly after the war and did not benefit early on 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.

Until approximately 2070, this generation will feel the impact of the rising burden caused by the need to stabilise 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 cent per capita in real terms), their consumption level will be highest among the three generations thanks to steady economic growth. The consumption levels of the three generations will be about the same at age 50, 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. Owing to this rising burden, later generations will be unable to enjoy the benefits suggested by economic growth. 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 per cent survival rate at age 80, the survival rate for Generation 3 is 86 per cent at the same age.

Panel 3 shows net benefits, the basis of generational accounting, shown for each respective year. Data are adjusted using a discount rate of 3 per cent. There are disparities in benefits during childhood because allowances for childbirth and child rearing have been increasing in recent years. Generation 1 did not have the opportunity to benefit from such family allowances. From the age of 20, when people enter the workforce, the burdens begin to exceed the benefits. Thereafter, the burden gets larger for each successively older generation and it rapidly expands when individuals reach their 40s and 50s. The consequences of adopting a transferable financing scheme, which requires the current working generation to bear social security expenses as societal ageing 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. Net benefits are positive for Generation 1 throughout life, but Generations 2 and 3 begin experiencing a net burden from around age 40, a situation that continues for life. 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 9.8.1 (benefits) and in Figure 9.8.2 (payments). A look at panel 1 of Figure 9.8.1 shows that Generation 1, which will be subject to the macro-economic slide (through the 2040s), 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 macro-economic 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 for teachers differ in each period and that, in recent years, grant programs have been created for high school tuition costs.

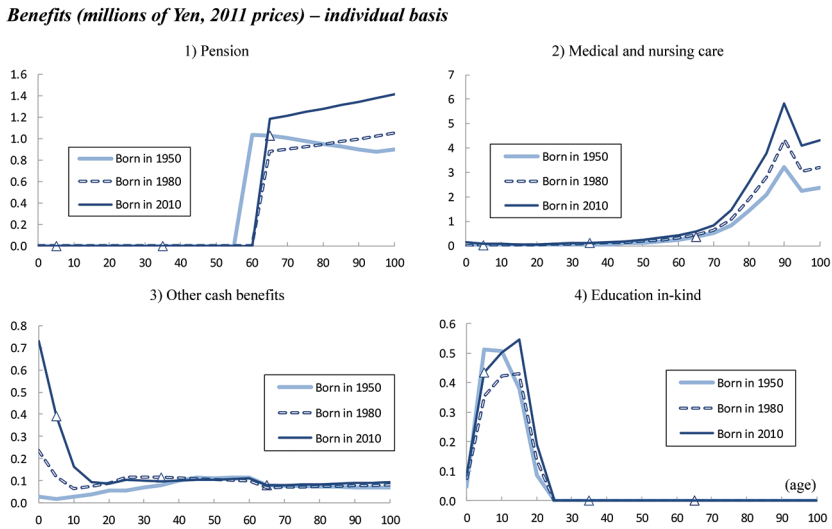

Figure 9.8.1. Components of generational accounting – benefits

Source. Authors' calculation

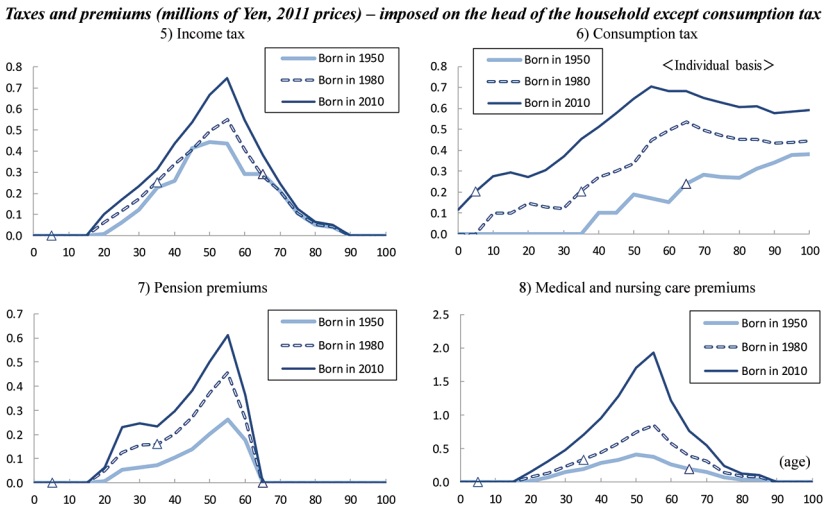

Figure 9.8.2. Components of generational accounting – payments

Source. Authors' calculations

As for the payment components, burdens become heavier the later the generation. This reflects the assumption that consumption tax, medical and nursing-care insurance premiums will be raised through the 2060s. When we compare the burden of each generation at the age of 50, Generation 3 will bear 2.5 times more burden than Generation 1, and Generation 3 cannot make the most of the increase in wages from economic growth.

Next let us examine how macro-economic aggregates evolve (Figure 9.9). The GDP growth rate will be slightly negative in real terms. We expect per capita labour productivity to remain steady at 1 per cent per annum, as the labour force population will decline by just over 1 per cent per year starting in the 2040s. Nominal GDP will grow at a pace of just under 0.5 per cent. We see the long-term interest rate (the yield on the benchmark 10-year Japanese Government bonds) at 1 per cent, exceeding the nominal growth rate. In the government financial balance, the government debt to GDP ratio will be held to about 250 per cent, in which case it will be necessary for the central and local governments to maintain approximately a 1 per cent surplus in their primary balance to GDP ratio.

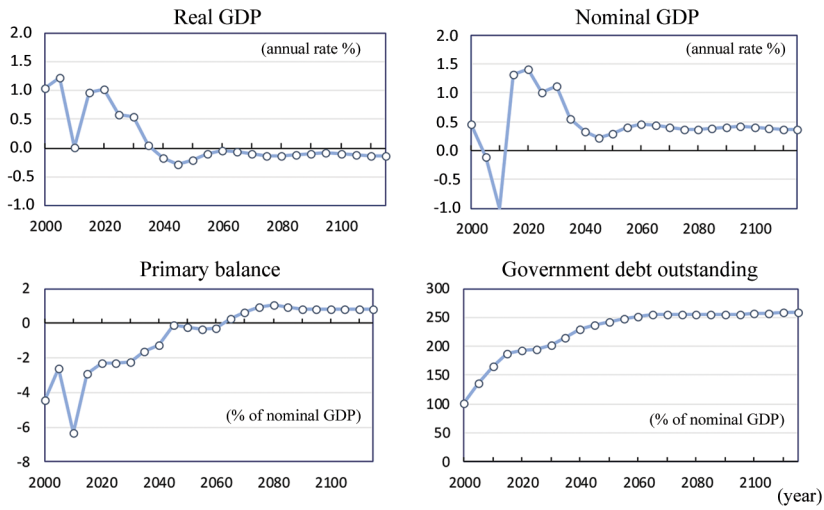

Figure 9.9. Macro-economic indicators

Source. Authors' calculations

Simulation

Additional consumption obtainable from living longer

First, we derive the benefits that arise from longer life in terms of the increase in consumption that longer life makes possible. We assume for simplicity that the survival rates for generations 2 and 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 9.10. 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 ratios to the baseline.

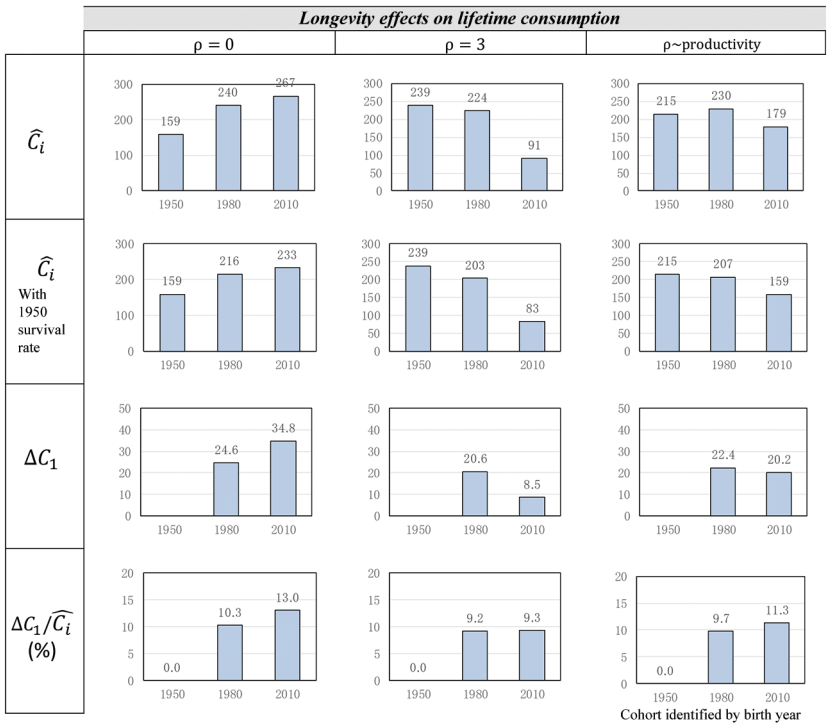

Figure 9.10. Lifetime consumption $\hat{C}_i$ and its increase from longevity ΔC_1 (millions of yen, 2011 prices)

Source. Authors' calculations

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 per cent or productivity as discount rates that reflect the difference of economic circumstances where each generation is placed, Generation 3 can be viewed as the poorest. When using productivity, the outcome falls in the middle between no discount and 3 per cent discount.

The rates of increase in the benefits ΔC_1 of longer life for Generation 3 are (reading left to right) 13 per cent, 9 per cent and 11 per cent. In the case of Generation 2 the results are 10 per cent, 9 per cent and 10 per cent, which is 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 and we can conclude that the extension of lifespans arising over the past 60 years has given rise to an increase in lifetime consumption of about 10 per cent.

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 65, the general target age for leaving the workforce. In contrast with the present practice, we assume that people will work 10 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 life extensions anticipated in the future, we do not see it as overly unrealistic to assume that people will stay in the workforce for an additional 10 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 summarised as follows,

a. the baseline case
b. extension of work by 10 years
c. extension of work by 10 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 that we assume the elderly will spend in the labour force is depicted in Figure 9.11. Notwithstanding the retirement age of 65, just under 70 per cent of Japanese men continue working from the ages of 65 through 69 and just over 30 per cent continue working from the ages of 70 through 74. The assumption is that elderly people aged 75 to 79 work as much as their predecessors would have when 10 (or five)

years younger. We assumed that the extensions take place after 2035 for 65 through 69 year olds, after 2045 for 70 through 74, and after 2055 for 75 through 79.

Along with the assumption of the labour force rate, wages, taxes, social security payments and propensity to consume of those aged from 65 through 69 to 75 through 79 are set to the same level as those 10 (or five) years younger in the baseline. Elderly Japanese people have a willingness to work and, in terms of health, they are younger than the preceding generations of the same age. It is assumed that it will be possible to obtain higher wages if we have a system to encourage elderly employment.

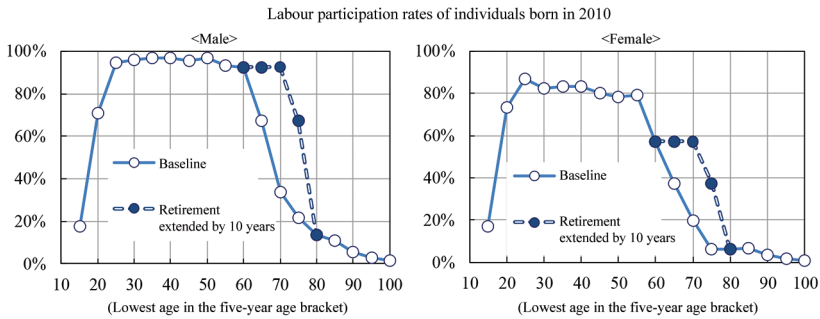

Figure 9.11. Assumption of extended retirement

Source. Figure compiled by the authors

The fiscal surplus turns out to be as represented in Table 9.2.

Table 9.2. Fiscal surplus expected from extended retirement

		(percentage 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))		

Source. Authors' calculations

Next, we look at what the impact on consumption and benefits would be for each generation if the fiscal 'dividend' were restored to households (Figure 9.12). The top panel Baseline $\hat{C}_i$ is the same as in Figure 9.10. The generational accounting value $\hat{G}_i$ is identical with the value in the final year of Figure 9.7 (4) for the case of the 3 per cent 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 ageing; and (ii) the increase in consumption that constitutes the benefit from longer lifespans. It is the overall assessment indicator for societal ageing. 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.

The bottom panel in Figure 6.14 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 of the top panel, 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 per cent, the benefits for generations 2 and 3 are substantial.

Figure 9.13 shows the case in which the period in the workforce is extended by five years and confirms the same trends. 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 can have a 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 zero per cent, 3 per cent, and productivity. Three per cent is the value often used in previous generational accounting studies, including by Auerbach et al. (2011). The reason we added zero per cent and productivity as alternatives, which are lower than 3 per cent in the forecast period, is that the setting of 3 per cent seems to exceed the real interest rate levels since 2000. We assume that the future real interest rate stabilises at 0.5 per cent in the long term. Discount rates by productivity may better match this assumption for the forecast period.

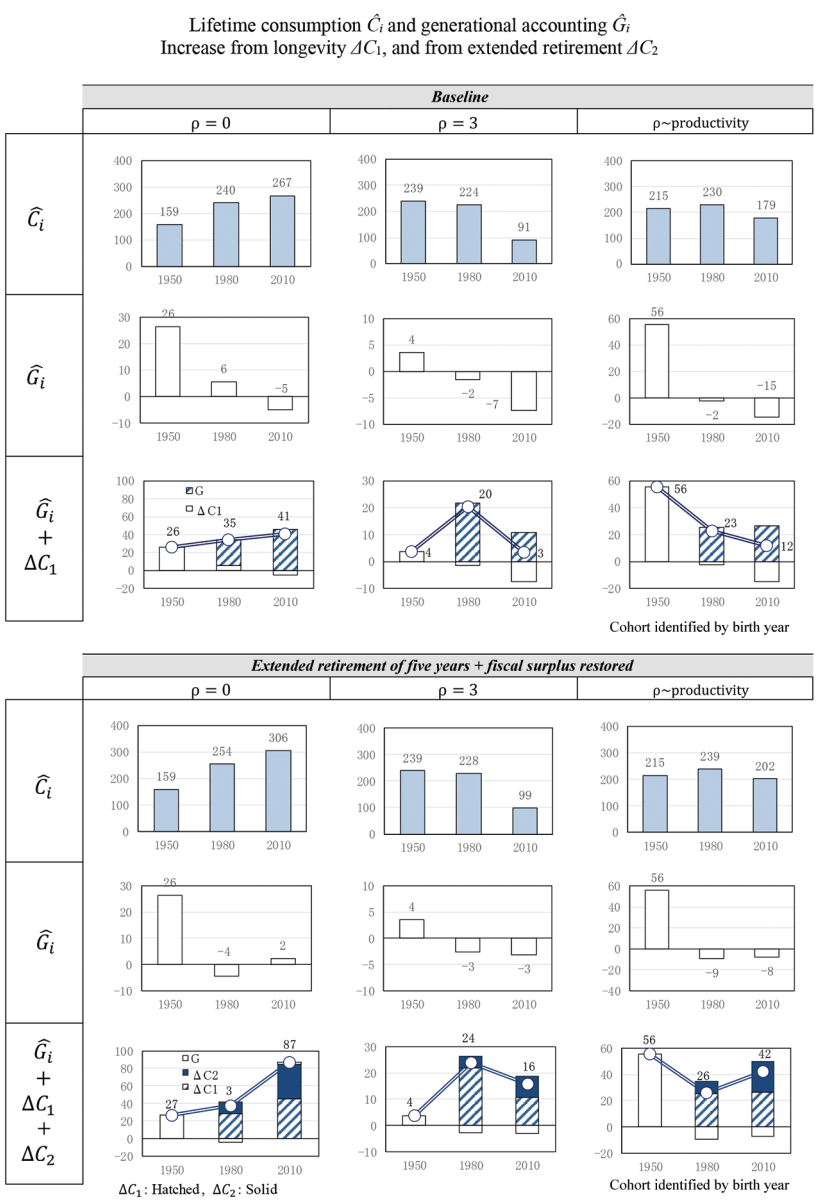

Figure 9.12. Effects of retirement extended by 10 years (millions of yen, 2011 prices)

Source. Authors' calculation

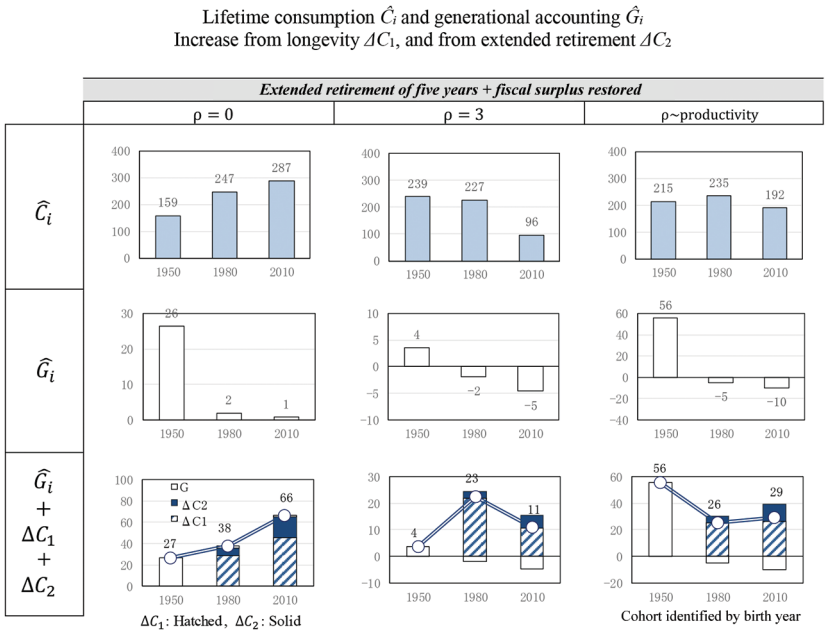

Figure 9.13. Effects of retirement extended by five years (millions of yen, 2011 prices)

Source. Authors' calculation

Considering 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, per capita output is projected to grow 1 per cent annually. Assuming a discount rate of 3 per cent implies that the time preference rate is 2 per cent. The consequences of climate change influenced the Stern Review to adopt one of the lowest preference rates at 0.1 per cent. Its discount rate is set at around 1.5 per cent (Stern 2015). Different time preference and discount rates may be adopted depending on what we evaluate.

Conclusion and discussion

This study's focus on three generations seeks to identify their net tax and social welfare burden and the additional consumption enjoyed from living longer. In addition to generational accounting as taken up by previous research, we have estimated consumption for each generation.

We confirm 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 per cent in a bid to stabilise government finances, the old age dependency ratio will continue to rise until approximately 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.

If the survival rate of Generation 1 forms the baseline for measuring the benefits of living longer, Generation 3 will experience a 9–13 per cent increase in lifetime consumption. Generation 2 will see a 9–10 per cent increase.

The elderly's longer participation in the workforce has the effect of ameliorating the need for fiscal belt-tightening. In view of the fact that lifespans will continue to increase, we have assumed that people will work 10 years longer than at present, that the age at which they will begin receiving pension benefits will in principle be raised to 75, 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 per cent over the baseline case.

As noted above, extending people's time in the workforce 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.

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 MHLW shows that elderly Japanese in 2016 were on average five to 10 years more

youthful than they were in 1998 (Figure 9.14). Further efforts to maintain and improve health as well as preventive medical treatment and nursing care are thus important.[7]

Elderly Japanese people also wish to work. According to a survey conducted by the Cabinet Office in 2014, 57 per cent of those aged 60 or over answer the question of 'What age do you want to work to?' with up to 75 or older (in Figure 9.15, these answers varied from 'forever, if I can', 'until about 75 years old' or 'until about 80 years old').

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 people begin receiving pensions is set at 65 in a sense constrains people over 35 from working. Kitao (2015) estimates that reducing the amount of per capita pension payments by 20 per cent would raise the labour force participation rate among people aged 70 through 90 by from 11.6 per cent to 24.2 per cent. In February 2018, Cabinet met to decide on the general agenda for measures to make it possible for people to begin receiving public pension benefits after the age of 70. In 2013, JCER proposed privatisation 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 were 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.[8]

7 The potential contribution that health-promotion expenditures (investment) and health 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).

8 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).

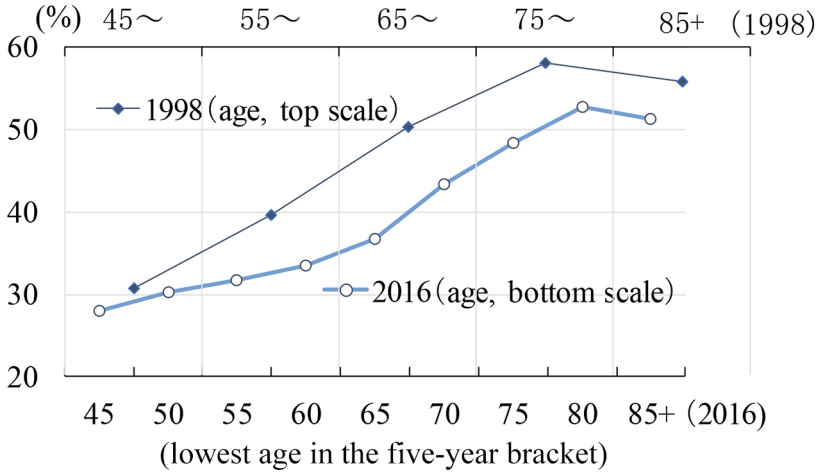

Figure 9.14. Ratio of 'have subjective symptoms of physical disorders'

Source. Comprehensive survey of living conditions, MHLW, www.mhlw.go.jp/english/database/db-hss/cslc-index.html

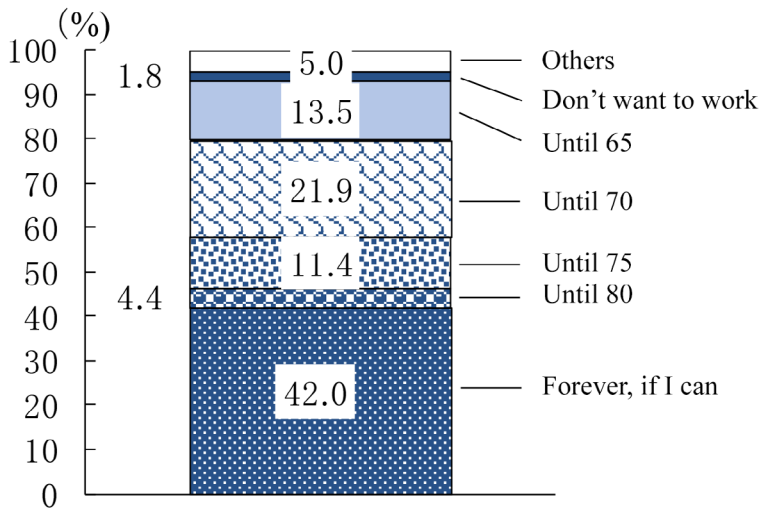

Figure 9.15. What age do you want to work to?

Note. Survey of individuals aged 60 and over who are currently working.

Source. Survey of elderly people's everyday life, 2014, Cabinet Office, www8.cao.go.jp/kourei/ishiki/h26/sougou/zentai/index.html (Japanese)

Self-help also involves the element of saving on one's own. Privatising 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 relative would be about 4.5 times GDP for the United States and just over twice GDP for Japan. 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 the 'future generation' is hidden in our calculations. The burdens on the existing generations, especially the younger generation, are relieved to some extent by stabilising government debt at 250 per cent of GDP. The policy to ease the burden for existing generations is a policy to make future generations pay the price. Even under the above conditions, Generation 3's tax and social security burden at the age of 55 will be around three times that of Generation 1 at the same age. Generation 3's consumption level is barely maintained with the condition that per capita productivity grows 1 per cent per year and the long-term interest rate is kept at 1 per cent. In the event of a more severe economic situation, a larger scale debt reduction plan will be required and the disadvantage of the young generation may not be resolved even when extended retirement is 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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