The Pension System in Japan and Retirement Needs of the Japanese Elderly

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Abstract

In this paper we examine the current structure of the Japanese pension system and highlight the major issues facing the pension reforms. We also calibrate retirement needs of the Japanese female and male elderly in their post-retirement period. The present value of post-retirement consumption expenses starting at age 65 consists of three major parts: the subsistence and healthcare expenditures, the survival probabilities and the deterministic discount factors. Based on our calibration, we find that the current pension provision has adequately met the retirement needs of the current elderly upon retirement at age 65.

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1. Introduction

Japan is the world's most rapid aging country due to having the longest life expectancy. In 2003, life expectancy at birth for males is 78.36 years, increased by 0.04 years from that of the previous year, and that for females is 85.33 years, increased by 0.10 years.[1] In 2004, there were 24.9 million elderly (65 years and above), accounting for 19.5 % of the total population. The proportion of elderly is expected to increase sharply to reach 25.3% by 2018 and more than 30% by 2033 (Takayama, 2004). The aggregate cost of social security in terms of national income is estimated to increase from 17.2% in 2004 to 24.3% by 2025, if there are no changes to the current provisions for benefits. In Japan, nearly 70% of total social security benefits are distributed to the elderly. In 2004, pension payment amounted to 9.2% of GDP and healthcare expenditure amounted to 5.2%. It is projected that by 2025, pension payment will increase to 11.6% and healthcare expenditure to 8.1%.

Studies on social security in Japan have focused on issues relating to sustainability of the pension system, the cost of social security and the need for pension reforms. Takayama (1992, 1998) assessed the effects of a graying Japan on the government budget and alerted the need for a pension reform to address the sustainability issue. Horioka (1997, 2004) have focused on the savings behaviors and portfolio composition of the Japanese elderly and found strong motives for retirement and precautionary savings. Hurd and Yashiro (1997) examined the economic status of the elderly and found that generally the elderly in Japan are much more dependent on public pension, with as 80% or more of the elderly income come from public pension. The

[1] Ministry of Health, Labour and Welfare, Japan, website.

elderly in Japan have less financial asset income because they hold a much greater fraction of their wealth in housing asset. The latter stylized fact has led many researchers to examine whether there is a possibility of unlocking housing equity in Japan, for example, Noguchi (1997) and Mitchell and Piggott (2004). However, Ishikawa and Yajima (2001) show that the Japanese elderly tend not to take advantage of the accumulated wealth. They do not draw down their assets and instead leave behind assets equivalent to twenty years of consumption.[2] This is in contrast to the elderly in the United States who draw down not only their financial assets but also property asset and move into smaller owned or rented homes.

Few studies have focused on the financial security of the Japanese elderly taking into considerations their post-retirement consumption needs and whether the existing pension system could finance these consumption needs. This paper calibrates the retirement needs of elderly and look at the expenditure side of the lifetime budget of the elderly. Post-retirement monthly expenses of the male and female elderly starting at age 65 are calibrated based on subsistence consumption and health care expenditure. Besides using the appropriate discount factors, the estimation of the present value of future expenses (*PVE*) also factored in the survival probabilities of the elderly conditional on survival at age 65. Instead of using deterministic life expectancy forecast, we adapt the techniques introduced by Bourbeau et al. (1997) to derive cohort life tables from the period life tables, and the Lee-Carter (1992, 2000) method to forecast survival probabilities. The estimated *PVE* could be compared to the accumulated retirement

[2] Takayama and Kitamura (1994) also find evidence of substantial inter-generational transfers from micro data in the National Survey of Family Income and Expenditure.

wealth to assess the cash flow adequacy of pensioners in Japan. Retirement wealth includes financial wealth, housing and incomes from social security and pension.

The rest of this paper is organized as follows. In the next section, we critically evaluate the Japanese pension system, highlighting the major challenges and the recent reforms. Section 3 describes the procedures taken to compute the present value of estimated retirement needs of the elderly. It contains three subsections. First, we discuss in detail the calibration of two main components of the retirement expenditure: the subsistence needs and the health-care expenditure. Second, we use two different interest rate models to generate yield curves to discount the future cash flows. Third, we explain the relevant synthesis in constructing the cohort life tables for the elderly by sex after retirement. Finally, policy recommendations and conclusions are given in Section 5.

2. The Japanese Pension System

Takayama (1998) asked whether the public pension benefits have been too generous and whether there was substantial income transfer from the current young to the elderly. As could be gleaned from Table 1 on the international comparison of the elderly income, Japanese and American elderly have the highest mean disposable income. Figure 1 also shows that the comparing to younger Japanese (age 30 to 44), the elderly Japanese enjoy higher per capita income after income redistribution. Figure 1 also shows that for elderly Japanese, age 65 to 69, the per capita income inclusive of social security transfer is roughly 1.2 times that of per capita income before transfer. About 78% of the elderly Japanese income comes from social security and pensions. Hence there was growing concern on inter-generational equity in that the asset-rich elderly were receiving massive of income transfers from the younger generation through the pension system. It appears that there is room for reduction of pensions. Apparently, the promise of a fixed replacement income for the retirees under the current pension arrangement has put significant pressures on the current and future working populations.

== Insert Table 1 and Figure 1 ==

We shall next examine the Japanese pension system, highlighting the major challenges facing the system and the reforms taken to address these issues. The current pension system in Japan has a two-tier defined benefit system which is operated by the government and is public. A third tier defined contribution plan was introduced in 2001 to complement the defined benefit plans.

2.1 First Pillar: The National Pension or Kokumin Nenkin (KN)

The first tier, known as the National Pension or Kokumin Nenkin (KN) or Basic Pension (Kiso Nenkin), has universal coverage and provides a flat-rate basic benefit to all sectors of the population. Participation of the first tier is mandatory to all residents aged 20 to 59. The premium is set at 13,300 yen (US$125) per month. However, low income persons and non-working spouses of employees are exempt from paying premiums, partially or totally.[3] The full old age pension is payable after 40 years of contribution provided the contributions were made before 60 years old. In fiscal year 2002, the Basic Pension scheme pays a maximum benefit of 66,200 yen (US$630) per month. Benefit

[3] 1,000 yen = US$9.5 = Euro 7.3

payment under KN is independent of salary and wage earnings and is indexed annually to reflect changes in the consumer price index.

The KN operates as a partial pay-as-you-go defined benefit (PAYG DB) program. Two-thirds of the benefits are paid out from the collected premiums from the young and the remaining one-third is financed from the general government budget. In principle, benefit payments begin at age 65. However there is a special legal provision for earlier benefits payment at age 60.[4] Under the pension reform, there is a cut back on the entitlement to full basic benefits for male age below 65. Entitlement to full basic benefit is phased out by stages between 2001 and 2013. The phasing out for female employees occurs five years later in 2006. Furthermore, as part of the reform in the first-tier basic pension, pension benefits are no longer indexed to hikes in gross wages, but to net wages. Most pensioners will thus have benefit payment shaved by 1% as CPI lags wage inflation by the same percentage.

2.2 Second Pillar: Employees' Pension Insurance or Kosei Nenkin Hoken (KNH)

The second tier consists of the Employees' Pension Insurance or Kosei Nenkin Hoken (KNH) and four types of Mutual Aid Pensions (Kyosai Nenkin). KNH provides benefits that are income-related and applies to employees of private companies, and mutual aid pensions apply to public service employees. The second tier operates largely like a pay-as-you-go (PAYG) defined benefit program. Both employers and employees contribute 8.675% of the employees' salary to the KNH. All workers are subject to the

[4] Basic pension may be claimed at any age between 60 and 70 years subject to actuarial reduction (increase) if claim is made before (after) age 65 years.

same contribution rate, with no discount given for low-income workers. However employers of female workers who are on maternity leave (up to one year) are exempt from contribution. Contribution to KNH is subject to a monthly salary ceiling of 590,000 yen. Benefits payments are related to the employees' salary, at an accrual rate of 0.5481% for each year of contribution. Thus a subscriber who starts contributing to KNH at age 20 and is fully retired at age 60 would expect to receive 28.5% of the career average monthly earnings after 40 years of contribution.

The career average monthly earnings are calculated over the employees' entire period of coverage, adjusted by a net wage index factor to reflect inflation. Unlike benefit payment under the first tier KN which is independent of salary and wage earnings, under the second tier KHN, subscribers who continue to work after age 60 would have a 20% reduction in benefits. For earnings exceeding 370,000 yen (which is the average salary of a male Japanese worker), the remaining 80% benefit is subject to a negative benefit tax at an effective rate of 50%, or at the rate of 10,000 yen for each 20,000 yen increase in earnings.[5]

Unlike the KN which operates as a partial PAYG, KNH is financed entirely by contributions of current workers with no support from the government general revenue funds. Since 2001, the KNH has been facing huge current account deficit of 700 billion yen and in 2002, the deficit has increased to 4.2 trillion yen. Not unless reforms are introduced, the deficit in KNH is likely to persist.

[5] For details see Takayama (2003a).

According to Takayama (1998), Japan has had a successful story of PAYG defined benefit system when the economy was enjoying relatively high speed of growth with relatively young population. PAYG has been effective in reducing poverty among the elderly and provided the elderly with a stable living standard after retirement. Furthermore, the operation of the system was relatively efficient with low administrative costs. However with slowing economy and stiffer economic competition, it was difficult to increase the contribution rate. As mentioned earlier, the first-tier, flat-rate basic benefit under KN is currently financed one third by general revenue with the remaining two-thirds by contribution. Sustainability thus becomes a major issue. Indeed in 1999, while social security tax revenue was three times the revenue of corporate income taxes and twice of personal income taxes, deficit from all social security programs amount to 600 trillion yen, which is equivalent to 1.2 times of the GDP. Putting things in perspective, Takayama (2003a) estimated that in 2003 the aggregate social security benefits is 44 trillion yen, constituting about 9% of the Japanese GDP and is almost the economic size of the automobile industry at 40 trillion yen. It is believed that Japan cannot expect to rely on high growth rates and favorable demographic developments to finance the projected substantial increase in social security benefits in coming decades. Moreover, there is a limit to the use of public debt to smooth revenue shortfall without having macroeconomic impacts.[6]

[6] Miles and Cerny (2003) use a calibrated overlapping generations to examine the impacts of deficit financed policy reforms in the pension systems on different cohorts, particularly if the pension contribution rates are not raised sufficiently to balance pension revenues and spending.

Other pension issue concerns the hollowing out of the national pension program. The growing number of delinquent contributors who fail to pay premiums to the national pension program has been interpreted as the growing public distrust in the pension system. In fiscal year 2002, delinquent contributors rose to a record number of 8.3 million, and bringing the delinquent ratio to a record high of 37.2%. Besides delinquent contributors, 12 million people have opted out of the program. This implies a hollowing out of the pension program as one in six members have removed themselves from financing the pension system. To restore public confidence and sustainability in the public pension system, the Social Security Council has been considering putting in place a system of carrot and stick. The carrot includes raising the government's share of contributions to the basic portion of the public pension system from the current level of 33.3% to 50% by fiscal year 2009. The stick consists of tougher punitive measures to collect premiums, such as, legally enforce the collection of premiums by seizing assets from delinquent members.

Japan has made many parametric changes to its pension system at fairly regular time intervals. Since fiscal year 1999, pension benefits under both KN and KNH are indexed to CPI instead of to wages. Historically, in Japan CPI lags wage inflation by 1%, indexing to CPI means a fall in pension benefits payments. Other reforms include increases in contribution rates, reduction in benefit payments and postponing the pensionable age. For example, in March 1999, the government reduced the earnings-related benefits by 5% from an annual accrual rate of 0.75% to 0.7125%. This took effect from fiscal year 2000. In fiscal year 2002, the benefit reduction under the KNH using earnings-test applies also to elderly of age 65 to 69 instead of just for elderly age 60 to 65. Another parametric reform is the postponement of the pensionable age. In the 1994 pension reform, the normal pensionable age for man under the first tier KN was increased in steps from 60 to 63 from fiscal year 2001 to 2013. And from 2013 onwards to 2025, the normal pensionable age for KNH will be increased from age 60 to 65. There were also proposals to extend the contribution period to enjoy full benefit payments from the current 40 to 45 years. However this proposal was turned down. It is estimated that the 1999/2000 reform of reducing benefit level, adoption of CPI indexation of benefits, expanding the earnings-test base and postponing retirement age would cause the KNH obligations to peak at 27.8% instead of the anticipated 34.5% had things left at status quo. (see Takayama, 2004).

2.3 Third Pillar: Defined Contribution Plan

Besides parametric changes, there is increasing pressure to add another pillar to complement the existing dual tier defined benefits system: the flat-rate benefits first tier KN and the earnings-related second tier KNH. In 1 October 2001, Japan introduced a defined contribution (DC) plan, which is the Japanese version of the 401(K) defined contribution plan, which pays benefits based on investment returns. As a fully-funded system, a private DC retirement savings account could possibly address the issues of financial sustainability and inter-generational equity and lead to higher saving rate and labor force participations for the elderly.

Two types of DC pension plans are implemented, namely, the employer-sponsored type and the individual personal type. Under the employer-sponsored DC plan, only employers pay contribution to the plan for workers under age 60 with no matching contribution from employees. The contribution ceiling to the DC plan depends on the employers' participation in DB plans. Employers who are subscribers to a DB plan are limited to a ceiling contribution of 36,000 yen, compared to 18,000 yen for non-subscribers. Under the personal retirement accounts (PRA), each individual could deposit 4 percent of the monthly earnings to the account. The contribution is subject to a ceiling of 68,000 yen and 15,000 yen for self-employed individuals and salaried employee respectively. The PRA is similar to the US 401(K) and employers cannot make matching contributions to the PRA.[7] The PRA contributions are tax-deducible and no tax is levied on the earned income during the phase of accumulation. Participation in PRA could commence at 25 and continues till age 65. At which time, the PRA is converted to buy a constant benefit of lifetime annuity and is payable from then on.

However, the inherent advantages of the unfunded defined benefits (DB) system are the disadvantages of the funded DC system. The DC system lacks insurance elements and the accumulated fund depends on contribution, hence giving rise to adequacy issue. (see Chia and Tsui, 2003). Besides investment risk, the DC system is also subjected to inflation risk.

2.4 Other options

[7] Civil servants and full time housewives are not eligible to participate in the DC pension plans.

There are numerous other options suggested by pension experts in Japan. The Ministry of Health, Labour and Wealth has shown interest to switch to a notional defined contribution plan (NDC). An NDC plan would mean that benefit payment is equivalent to contribution. However the switch to NDC is only possible only after the KNH contribution rate reaches the peak level in 20 years. Others have suggested a partial funding shift to a consumption-based tax. (see Takayama 2003).

3. Retirement Needs: Calibration of Present Value of Retirement Consumption

In this section we highlight the approaches taken to calibrate the post-retirement monthly expenses of the female and male elderly starting at age 65. The calibration involves forecasting the survival probabilities of these elderly using the Lee-Carter methodology; and choosing the appropriate discount factors. The present value of future expenses (*PVE*) is thus weighted by the survival probabilities of the elderly conditional on survival at age 65. The *PVE* can be interpreted as the calibrated amount that each of the representative female and male elderly ought to have to support their monthly consumption during the post-retirement period beginning at 65. Assuming a maximum lifespan of 105 years, the present value of a stream of future expenses is given by:

$$PVE = \sum_{j=1}^{492} c_j v_j \, {}_j P_{65} \qquad (1)$$

where

c_j = amount of calibrated expenditure for month *j*;

v_j = discount factor at month *j*; and

${}_jP_{65}$ = probability of survival of individual starting at age 65 up to age (65 years and j months), respectively.

We note in passing that in our calibration of c_j and ${}_jP_{65}$, we distinguish the representative female from the male elderly cohorts. But for ease of notation, we do not append gender subscripts to the terms in equation (1). The procedure used to calibrate c_j, v_j and ${}_jP_{65}$ are discussed in the following subsections.

3.1 Calibration of expenses

It is essential to distinguish the rapid growth rates of medical expenses from that of the relatively stable non-medical expenses. Table 2 shows the medical growth rates from 1980 to 1999. The key determinants of medical expenses of the elderly depend on the demographic and health sector-related factors. However, there is no published disaggregated data on the medical expenditure of the elderly by age and by sex. We resort to the recently available 1999 Household survey data covering 15,723 households in Japan. The monthly consumptions of the elderly are extracted into two major components: the non-medical expenses and the medical expenses. The non-medical consumption consists of basic necessities such as food, housing, fuel charges, furniture and household utensils, clothes and footwear, transportation and communication, education, reading and recreation, and other living expenditure. Table 3 displays the mean expenses of the non-medical and medical consumptions by age group and by sex.

As can be observed, on average, among all age groups above 65, male elderly consume more than female elderly in terms of both medical and non-medical expenses. The data are consistent with the annual medical expenses reported by Chia and Tsui (2003) based on a longitudinal survey conducted in Singapore for the elderly aged 66 and above.

== Insert Table 2 and 3 ===

In the benchmark calibration**,** we set the annual growth rate of non-medical expenditure at 2% and the per annum medical expenses growth rate at 4%. In addition, Mayhem (2000), based on the past 30 years experiences of the OECD countries, extrapolates the underlying growth rate of medical expenditure to be around 4%. Our choice for the medical growth rate is based on the average growth rates of consumption expenditure of all households reported by the National Survey of Family Income and expenditure (NSFIE) conducted over the period of 1984-1994.[8] Data from the Ministry of Health, Labour and Welfare shows that the real per capita medical expenditure grew at a rate of 4.5% per annum from 1980 to 1999 (Iwamoto, 2003). Growth in medical cost expenditure could be due to ageing population or from medical cost growth. The former is estimated by holding the medical cost of each age group constant and allow population structure to change. Iwamoto reports that the annual growth rate that is attributed to the change in population growth rate was 1.4% from 1980 to 1997 and the residual of 3.1% is attributed to the change in medical technology. Hence population ageing contributed a

[8] The consumption expenditure of all households aged 65 and above based on the NSFIE are reported in Table 3 of Kitamura, Takayama and Arita (2001). We assume that the consumption expenditure consists of medical and non-medical expenditure and that the non-medical expenditure grows rather slowly. Hence we may approximate the growth rates of medical expense by the growth rates of consumption expenditure. The average rate is 3.8% per annum.

27% increase in the real per capita medical cost. The medical expenditure growth rates are incorporated in the calibration of the future expenses.

The calibration of future expenses involves two steps. First, we begin with a representative elderly at age 65, who will be 105 after 41 years. The nominal expenditure at age (65 + t) in year (2004 + t), (t = 0, 1, 2, 3, …, 40) is obtained by the product of the base expenditure corresponding to age (65 + t) and the cumulative factor at a constant annual growth rate of 4% for the medical expenses, and 2% for the non-medical expenses, respectively. Second, we obtain the expenditure in month j at age (65 + j) by taking the monthly average of the calibrated healthcare expenditure within that particular year. This procedure applies to both the medical expenses and the non-medical expenses using the base expenditures at various age groups. The present value of consumption expenses for the elderly by sex at age 65 is then obtained by discounting the corresponding calibrated stream of future monthly sum of medical and non-medical expenses, weighted by the survival probability of the elderly over the entire post-retirement period. The choice of discount rates and forecasts of the survival probability of the elderly by sex and by age will be discussed in sub-sections 3.2 and 3.3, respectively.

To study the robustness of the estimated *PVE*, we use annual growth rates of medical expenditure to 2%, 3%, 5%, 6% and 7%. The lower rate could be interpreted as the medical growth rate due to population aging and the higher rates incorporate the medical growth rates due to population aging and higher medical costs. The growth rates of non-medical expenses are set at 1% and 3%, respectively. Similar to the benchmark case, the stream of future monthly consumption expenditures at alternative growth rates are calibrated accordingly.

3.2 Discount rates

Many studies use constant short-term rates to discount the future cash flows. For example, Chen and Wong (1998) take a constant rate of 4%, while Doyle et al. (2001) assume a 5% nominal interest rate. In contrast, Lachance and Mitchell (2002), and Chia and Tsui (2003) employ the one-factor stochastic model developed by Cox, Ingersoll and Ross (1985) to generate discount rates. In this paper we do not use stochastic models to generate short-term interest rates mainly because an almost zero short-term interest rates policy was implemented in Japan since 1996. Instead, we use two deterministic interest rates models to discount the future cash flows. They are the constant yield curve (CYC) model and the fixed yield curve (FYC) model. The CYC uses a flat annual rate to discount for all future cash flows. Choices include 1%, 2%, 3%, 4% and 5%, respectively. Alternatively, the FYC is constructed based on the average of historical rates for the government bonds across different time to maturities since 1990. They comprise 0.25% for 1-year bills, 1.63% for 2-year bonds, 2.11% for 3-year bonds, 2.44% for 4-year bonds, 2.67% for 5-year bonds, 1.12% for 6-year bonds, 3.09% for 7-year bonds, 1.49% for 8-year bonds, 1.38% for 9-year bonds, 3.38% for 10-year bonds, 2.56% for 15-year bonds, 3.01% for 20-year bonds and 2.20% for the 30-year bonds, respectively. We use the 30-year rate as proxy for spot rates with longer durations. Spot rates for other durations below 30 years are obtained by the method of interpolation.

These spot rates are converted into discount factors using the standard formulae for compound interest rates.

3.3 Survival probabilities

Appropriate life tables are required to compute the present value of consumption expenses of the elderly starting age 65. We follow the procedure in Chia and Tsui (2003) to construct the complete cohort life tables using the available 41 life tables in Japan from 1962 to 2002. The construction takes three main steps. First, we have to predict the future mortality rates of the elderly based on the available life tables. Assume that the maximum lifespan of the representative Japanese elderly is 105 years. The elderly who are aged 65 in year 2004 will be 105 after 41 years. The following Lee-Carter (LC) model (1992, 2000) is employed to fit mortality rates for the male and female elderly of age 65 to 85:

$$ln\ m_{x\,t} = a_x + b_x k_t + \varepsilon_{xt} \qquad (2)$$

$$k_t = \mu + \varphi k_{t-1} + \eta_t \qquad (3)$$

where $m_{x\,t}$ is the central death rate in age class x in year t; a_x is the additive age-specific constant, reflecting the general shape of the age schedule; b_x is the responsiveness of mortality at age class x to variations in the general level; k_t is a time-specific index of the general level of mortality; μ and φ are parameters; ε_{xt} is the error to the actual age schedule, assuming to follow a normal distribution with zero mean and a constant variance; and η_t is the white noise. The long-term patterns of the natural logarithm of central death rates are captured by the single time-specific index of mortality k_t. A lower order autoregressive process is included to absorb the dynamic relationship of k_t between time (t – 1) and t. The interpolation procedure developed by Wilmoth (1995) is employed to calibrate the level of mortality for those elderly aged above 85. Second, based on the predicted mortality rates obtained from Step 1, we obtain the cohort life tables using techniques developed by Bourbeau et al. (1997). Third, the annual mortality rates are in turn converted to the monthly cohort survival rates by assuming that the mortality rates at fractional ages between age x and age x+1 follow a uniform distribution. The survival probabilities conditional on age 65 are computed separately for each representative female and male elderly on a monthly basis. Detailed discussions are provided in Chia and Tsui (2003).

4. Estimation Results

The amount that the elderly ought to have in order to sustain their post-retirement expenses is estimated using equations (1) to (3). All computations and estimations in this paper are coded in Gauss. We obtain values of the estimated *PVE* under different combinations of interest rates, growth rates of medical and non-medical expenses, and cohort survival probabilities by age and by sex. They include various medical expenditure growth rates, r_m, at 2%, 3%, 4%, 5%, 6% and 7%; and non-medical growth rates at 1%, 2% and 3%. Tables 4-6 display the estimated values of *PVE* for the female and male elderly under different medical and non-medical growth rates and under the constant and fixed yield curve models, respectively. As can be observed, the estimated values of *PVE* using the constant yield curve (CYC) model at flat rate (1%, 2%, 3%, 4% and 5%) decreases when the interest rate increases. The estimated values of *PVE* by the fixed yield curve (FYC) model for both the female and the male elderly are close to the average of the estimated *PVE* under the fixed yield model. This pattern is robust across different medical and non-medical growth rates.

As can be gleaned from Table 5, the estimated values of *PVE* for the female elderly are consistently greater than that of the male elderly. For example, under the benchmark scenario (i.e., 2% non-medical growth rate, 4% medical growth rate, and 2% mean interest rate), the estimated *PVE* for the female elderly is 71.269 million yens, and 66.776 million yens for the male elderly. And under the fixed yield curve model, the estimated *PVE* for the female elderly is 65.041 million yens, and 61.668 million yens for the male elderly. Such a difference may be partially explained by the longer life expectancy of the female elderly. Similar pattern is observed for the female and male elderly regardless of the non-medical and medical growth rates and the interest rates models.

Besides the female and male elderly, we also calibrate the amount ought to have for the joint elderly to sustain their consumption expenses during the post-retirement periods. To estimate the *PVE* for the joint elderly, we adjust two components on the right hand side of equation (1). They are the future cash flows and the survival probabilities conditional on age 65. The stream of future monthly expenses for the joint elderly is approximated by summing that of the individual elderly. The joint survival probabilities for the elderly couple are obtained by the product of survival rates of the female and male elderly. For convenience, we assume that the couples are of the same age and that events of deaths are independent in probability. The estimated *PVE* for the joint elderly could be interpreted as the weighted average of the estimated *PVE* for the individual female and male elderly.

== Tables 4, 5 and 6 ===

Turning to the elasticity analysis, we find relative uniformity in responses of the estimated *PVE* to a unit change across growth rates of medical expenses and non-medical expense, and interest rates for the female, male and joint elderly.[9] For example, a 1% increase in growth rates of the medical expense leads to a 0.046% increase in *PVE* for the female elderly in the benchmark scenario under the 2% CYC model, 0.044% under the FYC model; a 0.026% increase in *PVE* for the male elderly under the CYC model and 0.024% under the FYC model; and a corresponding 0.025% under the CYC model and a 0.023% under the FYC model for the joint elderly, respectively. Moreover, a 1% increase in growth rates of non-medical expenses leads to a 0.29% increase in *PVE* for the female elderly in the benchmark scenario under the CYC model and 0.28% under the FYC model; a 0.25% increase in *PVE* for the male elderly under CYC model and 0.23% under the FYC model; and a corresponding 0.21% under the CYC model and a 0.20% under the FYC model for the joint elderly, respectively. Furthermore, a 1% increase in the flat rate of the CYC model leads to a 0.25% decrease in *PVE* for the female elderly in the benchmark scenario; a 0.24% decrease in *PVE* for the male elderly; and a corresponding 0.21% decrease in *PVE* for the joint elderly.

[9] We expect a positive relationship between *PVE* and the growth rate of medical and non-medical expenses; and a negative relationship between *PVE* and the interest rate used to discount a stream of future expenses. The latter is due to the time value of money.

5. Conclusion

In this paper we have computed the present value of expenses that the female and male elderly Japanese family ought to have to cover their consumption needs in the post-retirement period. Our estimation consists of three components: the subsistence needs and the healthcare expenditure, the survival probabilities conditional on living at age 65, and two deterministic term structure of interest rates serving as discount factors. Comparing the *PVE* to preliminary calculations of the retirement wealth indicates that the existing pension provision is indeed generous and is more than adequate to meet retirement needs. However, the Japanese government faces two major economic challenges: a relatively generous, unfunded, pension system with a rapidly ageing population requires policy changes; large fiscal deficits have driven the stock of government debt up sharply, and in a way that is not sustainable. For example, in a recent paper, Miles and Cerny (2003) assess the macroeconomic impacts of deficit financing and pension reform, and analyze how the interaction between these bears on the welfare of different cohorts. Future research works on the Japanese pension reforms should focus on sustainability issues.

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Table 1: Comparison of elderly's income (based on PPP), in US$ for mid 1990s

	Mean Disposable Income of Elderly	GDP per capita	Percentage of Seniors below	
			$7,000	$10,000
Canada	17,000	21,000	1	11
Finland	12,000	19,000	7	41
Germany	14,000	20,000	8	27
Italy	13,000	20,000	20	45
Japan	18,000	23,000	14	26
Netherlands	12,000	19,000	9	51
Sweden	12,000	19,000	4	28
United Kingdom	12,000	19,000	17	53
United States	18,000	26,000	12	27

Source: Casey and Yamada (2002), Table 2.9, p. 43.

Table 2: Medical growth rates and sources of growth

	Growth Rate			Sources	
YEAR	**Medical Costs**	**Medical costs per capita**	**Real medical costs per capita**	**Population aging**	**Others Natural increase**
1980	9.4	8.6	8.6	1.0	7.5
1981	7.4	6.7	5.0	1.0	3.8
1982	7.7	7.0	7.0	1.2	5.7
1983	4.9	4.2	5.5	1.2	4.3
1984	3.8	3.2	5.2	1.2	4.0
1985	6.1	5.4	4.2	1.2	3.0
1986	6.6	6.1	5.4	1.2	4.1
1987	5.9	5.4	5.4	1.2	4.1
1988	3.8	3.4	2.9	1.3	1.6
1989	5.2	4.8	4.0	1.3	2.7
1990	4.5	4.2	3.2	1.6	1.5
1991	5.9	5.6	5.6	1.5	4.0
1992	7.6	7.3	4.8	1.6	3.0
1993	3.8	3.5	3.5	1.5	2.0
1994	5.9	5.7	3.8	1.5	2.1
1995	4.5	4.1	3.4	1.6	1.7
1996	5.8	5.6	4.8	1.7	3.0
1997	1.9	1.7	1.3	1.8	-0.5
1998	2.6	2.3	3.6	1.8	1.8
1999	3.7	3.5	3.5	1.6	1.9
2000	-1.9	-2.1	-2.3	1.7	-4.0
1980-2000	5.4	4.9	4.5	1.4	3.1

Source: Iwamoto (2003)

Table 3: Annual medical and non-medical expenditure

Age Group	Medical Expenditure		Non- Medical Expenditure	
	Female	Male	Female	Male
65-69	109.5	151.0	3039.8	3554.5
70-74	107.8	138.8	2729.3	3253.8
75-79	87.8	11.2	2337.5	3012.1
80+	108.4	133.0	2492.4	2721.9

Source: NSFIE 1999, Japan. Figures are in 1,000 yens

Table 4: *PVE* for the elderly under different interest rates models

Scenario	Model	Female	Male
[a] 1% non-medical growth rate			
Medical growth rates	CYC1	71275	66780
$r_m = 2\%$	CYC2	62203	59496
	CYC3	54842	53435
	CYC4	48811	48349
	CYC5	43820	44047
	FYC	57141	55281
$r_m = 3\%$			
	CYC1	71955	67148
	CYC2	62751	59798
	CYC3	55288	53686
	CYC4	49176	48559
	CYC5	44123	44225
$r_m = 4\%$	FYC	57617	55546
	CYC1	72794	67594
	CYC2	63422	60162
	CYC3	55829	53986
	CYC4	49617	48809
	CYC5	44486	44435
	FYC	58198	55861
$r_m = 5\%$			
	CYC1	73836	68136
	CYC2	64249	60602
	CYC3	56492	54345
	CYC4	50153	49105
	CYC5	44924	44680
	FYC	58913	56241
$r_m = 6\%$			
	CYC1	75137	68797
	CYC2	65274	61134
	CYC3	57306	54778
	CYC4	50807	49460
	CYC5	45454	44973
	FYC	59798	56700
$r_m = 7\%$			
	CYC1	76765	69607
	CYC2	66548	61783
	CYC3	58314	55302
	CYC4	51610	49887
	CYC5	46100	45324
	FYC	60897	57258

Notes: *PVE* for the female, male elderly are computed using two yield curve models. CYCI (I = 1,2 3, 4, 5) is the flat yield curve at 1%, 2%, 3%, 4% and 5%, respectively; and FYC is the fixed yield curve based on the mean spot rates of government bonds with various durations. All figures are in 1000 yens.

Table 5: *PVE* for the elderly under different interest rates models

Scenario	Model	Female	Male
[b] 2% non-medical growth rate			
Medical growth rates	CYC1	81756	75146
$r_m = 2\%$	CYC2	70721	66473
	CYC3	61883	59306
	CYC4	54603	53331
	CYC5	48665	48308
	FYC	64565	61404
$r_m = 3\%$	CYC1	82436	75515
	CYC2	71269	66776
	CYC3	62278	59557
	CYC4	54968	53541
	CYC5	48969	48485
	FYC	65041	61668
$r_m = 4\%$			
	CYC1	83275	75961
	CYC2	71940	67140
	CYC3	62820	59857
	CYC4	55410	53790
	CYC5	49332	48694
	FYC	65622	61984
$r_m = 5\%$	CYC1	84318	76503
	CYC2	72767	67579
	CYC3	63483	60217
	CYC4	55946	54087
	CYC5	49769	48940
	FYC	66337	62354
$r_m = 6\%$	CYC1	85618	77164
	CYC2	73791	68112
	CYC3	64297	60649
	CYC4	56600	54442
	CYC5	50299	49234
	FYC	67222	62823
$r_m = 7\%$	CYC1	87246	77974
	CYC2	75066	68762
	CYC3	65305	61173
	CYC4	57403	54869
	CYC5	50945	59585
	FYC	68322	63382

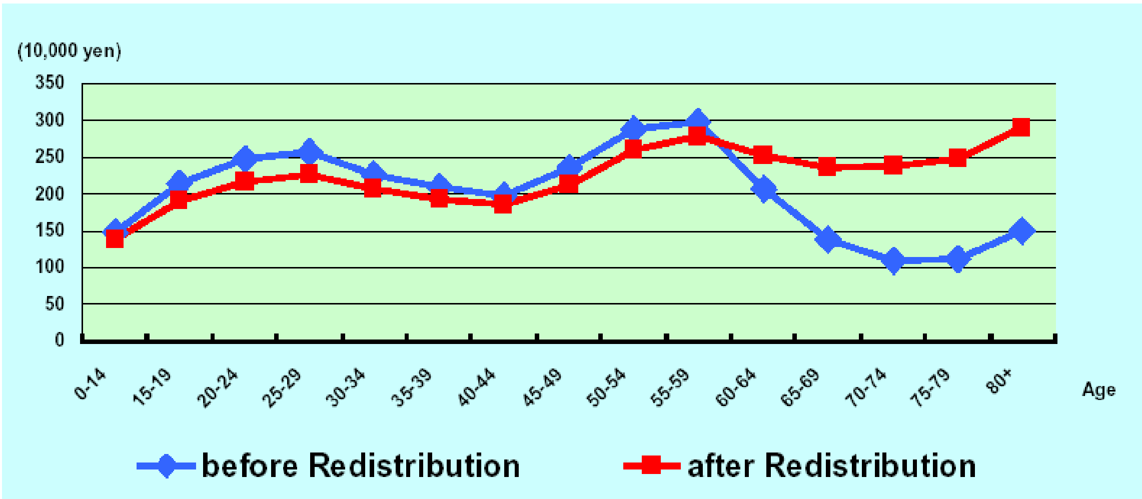
Notes: *PVE* for the female, male elderly are computed using two yield curve models. CYCI (I = 1,2 3, 4, 5) is the flat yield curve at 1%, 2%, 3%, 4% and 5%, respectively; and FYC is the fixed yield curve based on the mean spot rates of government bonds with various durations. All figures are in 1000 yens.

Table 6: *PVE* for the elderly under different interest rates models

Scenario	Model	Female	Male
[c] 3% non-medical growth rate			
Medical growth rates	CYC1	94612	85141
$r_m = 2\%$	CYC2	81089	74750
	CYC3	70276	66221
	CYC4	61545	59158
	CYC5	54428	53260
	FYC	73575	68638
$r_m = 3\%$	CYC1	95293	85510
	CYC2	81636	75053
	CYC3	70721	66473
	CYC4	61911	59369
	CYC5	54730	53437
	FYC	74051	68900
$r_m = 4\%$			
	CYC1	96132	85956
	CYC2	82307	75417
	CYC3	71263	66773
	CYC4	62352	59618
	CYC5	55094	53646
	FYC	74631	69216
$r_m = 5\%$	CYC1	97174	86497
	CYC2	83135	75857
	CYC3	71926	67132
	CYC4	62888	59915
	CYC5	55531	53893
	FYC	75347	69596
$r_m = 6\%$	CYC1	98475	87158
	CYC2	84159	76389
	CYC3	72740	67565
	CYC4	63542	60270
	CYC5	56061	54186
	FYC	76232	70055
$r_m = 7\%$	CYC1	100103	87969
	CYC2	85433	77039
	CYC3	73747	68090
	CYC4	64345	60697
	CYC5	56708	54537
	FYC	77332	70613

Notes: *PVE* for the female, male elderly are computed using two yield curve models. CYCI (I = 1,2 3, 4, 5) is the flat yield curve at 1%, 2%, 3%, 4% and 5%, respectively; and FYC is the fixed yield curve based on the mean spot rates of government bonds with various durations. All figures are in 1000 yens.

Figure 1: Per capita income by age in Japan, 1989



Source: Takayama (2002) Never ending reforms of social security in Japan,