The Assessment of the Public Pension Reform in 2004 by the Actuarial Model of the Employees' Pension Insurance

Katsuya Yamamoto

Abstract

In the year of 2004, the Japanese Ministry of Health, Labour and Welfare introduced the macro-economy indexation. and an upper ceiling of 18.3 percent on the contribution rate of the Employees' Pension Insurance (EPI).The main object of this study is to assess the public pension reform in 2004 by the actuarial model of the EPI, using the 2006 population projection. The simulation results show that 70 is the appropriate age for being qualified for full pension benefits because the numbers of insured persons and recipients of the EPI can be balanced at the age. Also, this study finds that a cutback in pension benefits by 10-15 percentage points will maintain the pension scheme sustainable, under the author's assumption such that the earliest age at which full public pension benefits are payable is 70 and the macro-economy indexation is extended for 12 years until the year of 2035.

1. Introduction

The population projection conducted by the National Institute of Population and Social Security Research (IPSS) in December of 2006[i] assumes that the birthrate of around 1.26 and the growing proportion of elderly people will advance more rapidly than the previous population projection in January 2002. Those aged 65 years old or over will account for an estimated 40.5 percent of the total population in 2055. Moreover, the overall population will decrease from the present level by about 38 million. Those over 65 years old and the low birth rate around 1.26 lead to a super graying of society in Japan(However, after 2050, the projection is made via mechanical estimation which uses constant birth rate, death rate and rate of immigrant inflow).

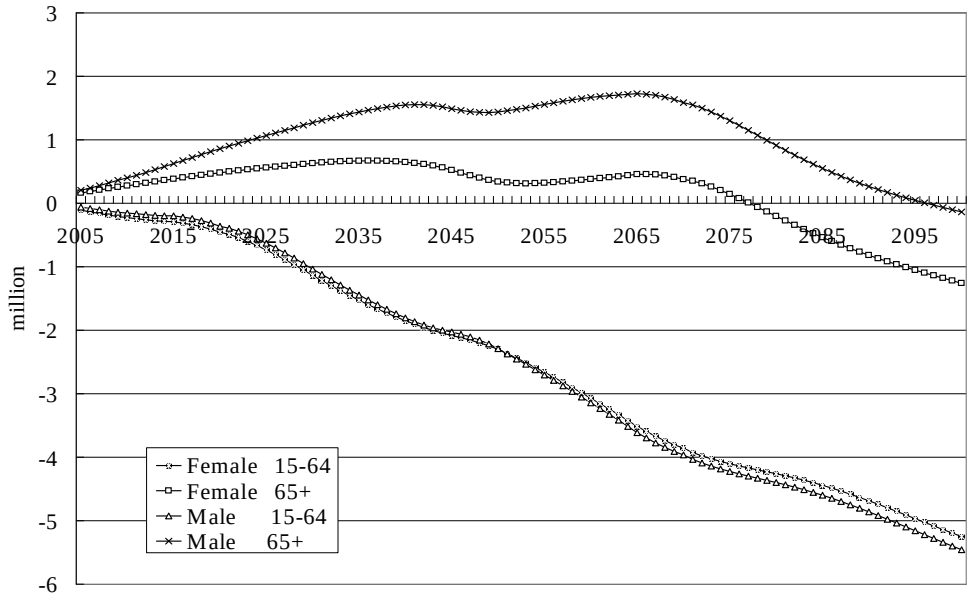
The result of the 2006 population projection will have a large influence on pension revenues and expenditure, in particular on the Employee's Pension Insurance (EPI). The EPI covered private sector workers, its finance method is a pay-as-you-go, the benefit formula is flat rate plus earnings related (basic-pension), and it is a defined benefit scheme. Part time workers are not covered by the EPI. The self-employed are provided only the Basic Pension benefit, however the EPI insured persons get earnings-related part till 2025. For the recent public pension reforms, "*Benefit reduction in various forms as well as the improvement in efficiency and fairness of the system has been the main focus of the recent public pension reforms in Japan. The task of reform is to establish middle- and long-term stability of the system against aging of the population and to maintain contribution levels acceptable to the working population in future years*" (Fukawa 2005).

As describe before, the EPI currently uses a pay-as-you-go financing system, so the level of the ratio of younger population to older population is a big issue for Japan[ii]. After the 1999 reform,[iii] a measure often proposed is the raising of the pensionable age. The pensionable age is currently 60 to 62, decided by birth year. In more detail, insured males born after April 1 of 1961 and females born after April 1 of 1966 will be qualified to receive full benefits of EPI when they become 65 years old.

Rising the pensionable age is the mainstream of pension reform in advanced countries (Holzmann, etc., 2005). In Germany, a pension reform law that rose the pensionable age from 65 to 67 years old was approved at the end of March 2007.This pension reform gradually rises the pension age from the present 65 to 67 years old between 2012 and 2029. The age is raised by one month every year from 2012, and is raised by two months every year from 2024. Likewise, in the United States, the Reagan administration conducted a controversial change in the Social Security which would be rising the pensionable age steadily by two months, from 65 up to 67 years old, for those who were born within or after the year of 1938. For example, those who were born in 1938, 1939, ... , and 1959 are eligible for full pension benefits at the time of two, four, ..., and twenty-two months after they reach 65 years old, respectively, and then, the pensionable age would be fixed at the age of 67 for people born in and after 1960.

Even if the pensionable age is not set at 67 years old, advanced nations are nevertheless trying to raise the pensionable age. France is raising the age to cut the pension-receiving period by 21

Figure 1. Differences in Population Projections between 2002 and 2006



Source: IPSS(2002),IPSS(2007)

months. Although a full pension can currently be received with contribution payments for 40 years, this will gradually be extending to 41 years and nine months. In the U.K. males receive the pension benefit at 65 years old and women at 60 years old, but from 2020 women will receive the pension benefit at 65 years old. Belgium and Austria are rising the pensionable age for women to 65 years old from the current 62 years old.

For the reason that 80 percent or more of the population aged 60-65 years old in Japan work, the pensionable age can be raised to 65 years old. On the other hand, expanding the insured over 65 years old is considered to be difficult. First, there is the problem of health status. Mortality statistics show that the mortality rate increases from 65 years old. The health of Japanese people aged 65 has changed. In the above-mentioned mortality rate, morbidity rates for diabetes, heart disease, apoplexies, and cancers are rising. There is also the problem of labor demand. And, the characteristic of the recent revision is the expansion of the flat-rate part of the pension benefits by reducing the payment multiplication rate in 2003. The EPI pension benefit formula is as follows:

The EPI pension benefit = Earnings-related part + Flat-rate part(Basic Pension part)
= Average Income[iv] ×(birthday's multiplication rate[v]: 5.481 / 1000) × Number of Participation Month × Price Index
+ 792,100yen × Number of Participation Month / 480[vi] × Price Index

The payment multiplication rate was 10/1,000 in old days (for generations born before 1930), however, the multiplication rate of the person to join from the year of 2005 is approximately 5.481/ 1,000, if the current system will be continued. To be sure, this reform is for the total income, the wages and bonuses. Bonuses are often used as a means for contribution evasion, so the contribution is levied on bonuses too. If the insured person gets a bonus of three month's wages, the total is 15 month's wages. So, the multiplication rate is 7.125 × 12 / 15 = 5.7. Actually, the bonus is to be 2.6 month's wage in MHLW and the multiplication rate is 7.125 × 12 / 15.6 = 5.481. As described before, this figure is part of earnings-related benefit formula. The insured persons who get bonuses are unchanged with this multiplication rate, but the insured persons who do not get bonuses are worse off with this multiplication rate. They have a pension benefit of less than the benefit which they had with the multiplication rate of 7.125.

This study presents the EPI actuarial simulation model, and I use it in order to clarify the influence of the 2006 population projection on the EPI finance. Especially, I argue the problem of extending the pensionable age and the period of macro-economy indexation which is newly introduced in 2004 pension reform[vii]. Macro-economy indexation reduces the indexation of a price increase to the EPI benefit. Certainly, rising the pensionable age and extending the period of macro-economy indexation (see section 2 for more detail) are means left for Japan as parametric reforms.[viii]

The composition of this study is as follows:

Section 2 summarizes previous studies, Section 3 carries out a simulation, and the final section briefly discusses the conclusion.

2. Previous studies

There are three major methods for simulating pension finances. The first method is simultaneous equation systems (macro-econometric model). The second is an actuarial model, and the third is a well-known overlapping generation model called the Auerbach-Kotolikoff model. In any model, the center of the argument is the sustainability of the pension finance, and depending on the study some are analyzing the pension benefit distribution and some are analyzing the cohort analysis.

In this study, the focus is on the second type of model. The actuarial model is a combination of simplified images of natural processes that determine the numerical development of a population (e.g. births, deaths and immigration). They also include human behavior (e.g. labor force participation, or compliance with taxes and contribution payment requirements) and simplifications of financial rules for the allocation of certain transfers to subgroups of receiving populations.

The actuarial model can describe the scheme correctly, calculating the entire finances, and make an income re-distribution analysis, e.g. the comparison between the pensioners of the individual lifetime average earning of 100,000 to 620,000, and the cohort analysis, e.g. the comparison between a pensioner born in 1935 and one born in 1955. The actuarial model maintains three functions, except the analysis of the relationship between pension finance and the entire economy. The actuarial model can also deal with three problems, but this has not been simultaneously carried out except in the paper by Yamamoto, Aoyama, and Okada (2006).

Conversely, simultaneous equation systems (macro-econometric model) are good at calculating the entire financing and the analysis of the relationship between pension finance and the entire economy, but are not good at the income re-distribution analysis and the cohort analysis. Furthermore, the overlapping generation model is good at the cohort analysis and the income re-distribution analysis, but not good at the analysis of the relationship between pension finance and the entire economy. They hold only two functions. Therefore in this study the actuarial model is used.

The studies examined are Ogura and Yamamoto (1993), Yamamoto (1994), Tajika, Kaneko and Hayashi (1996), Hatta and Oguchi (1999) and Yamamoto, Aoyama, and Okada (2006), which perform pension financial simulations using the actuarial methods. The problem of continuous of pension finance is common to all of these studies.

Ogura and Yamamoto (1993) pay attention to the structure of Japanese social insurance membership. In Japan, there is the most information about the public medical insurance. For example, the information such as the population composition and the wage of the participating members have the most public medical insurance. This study also performs minute analysis using these present Japanese conditions. Through the relations between public medical insurance and the public pension, those insured under the EPI almost correspond to the members of the Employee's Health Insurance systems.[x] In addition, the persons insured under the National Pension are almost equivalent to the persons aged 20-64 old insured under the National Health Insurance.[xi] Ogura and Yamamoto (1993) made the model of the EPI using this relationship.

On the other hand, the actuarial model is also constructed using only pension data in Tajika, Kaneko, and Hayashi (1996). They propose restructuring the pension system so that the relation between insurance contribution and benefits during a lifetime is actuarially balanced. In addition, they calculate and compare the revenue and expenditure of various generations (e.g. those born in 1930, 1940, ..., 1990) and the results show that those pensioners born in 1930 get more pension benefit than those born in 1940, those pensioners born in 1940 get more pension benefit than those born in 1950, ..., and those pensioners born in 1980 get more pension benefit than those born in 1990. This study also shows that the generation gap is widening.

Hatta and Oguchi (1999) duplicated the pension finance forecast of the MHLW. The fairness of the distribution of burdens between generations is considered by increasing a parameter not used by the MHLW, namely the savings ratio. They propose to shift from the current pay-as-you-go finance to funding methods for adjusting the benefit levels within the revenue from the contributions, so that actuarial fairness[xii] is accomplished.

Yamamoto (1994) duplicated Ogura and Yamamoto (1993) and the income composition of insured persons and beneficiaries of the pension system was estimated using corporate scale meter, sex, and wage according to the academic backgrounds, as well as age based on "Wage Structure Basis Investigation (Chingin Census)" of the Ministry of Health, Labour and Welfare. Therefore, Yamamoto (1994) can treat income distribution problems in the same cohort.

Yamamoto, Aoyama, and Okada (2006) use all the features of the earlier models. This study adds a verification of the comparison of the relations of burdens among various generations (e.g. those born in 2005, 2015,..., 2095) and adjusts the indexation method using many parameters (e.g. wage, interest rate, price). This is a convenient model for analyzing the amendment bill of 2004. This is because the amendment bill of 2004 has big changes.

The first big change is the method for deciding the pension benefit levels. Before 2004, the level of pension benefit was fixed at the level of average wages of young persons (See, Note viii). However, after 2004, the level of pension benefit is based on the contribution and interest of the pension fund. In order to analyze these changes, entire pension finance analysis is indispensable.

The second big modification is the introduction of macro-economy indexation(See, Note viii). The public pension scheme has benefits indexed according to prices and wage levels.[xiii] In 2004, the Pension Reform Act introduced a "new adjustment scheme of indexation." This is called "macro-economy indexation," which is based on the growth of the entire social contribution bearing capacities. The indexation turns out to be CPI less an adjustment rate of 0.9 percent and this influences the entire EPI; the basic pension part and the earnings-related part. This study's actuarial model can describe changes in the scheme accurately. In this study, I carry out the calculation of the entire pension finance in the main model and the cohort analysis and income distribution analysis in the sub model. The model of Yamamoto, Aoyama, and Okada (2006) is essentially applied to this study.

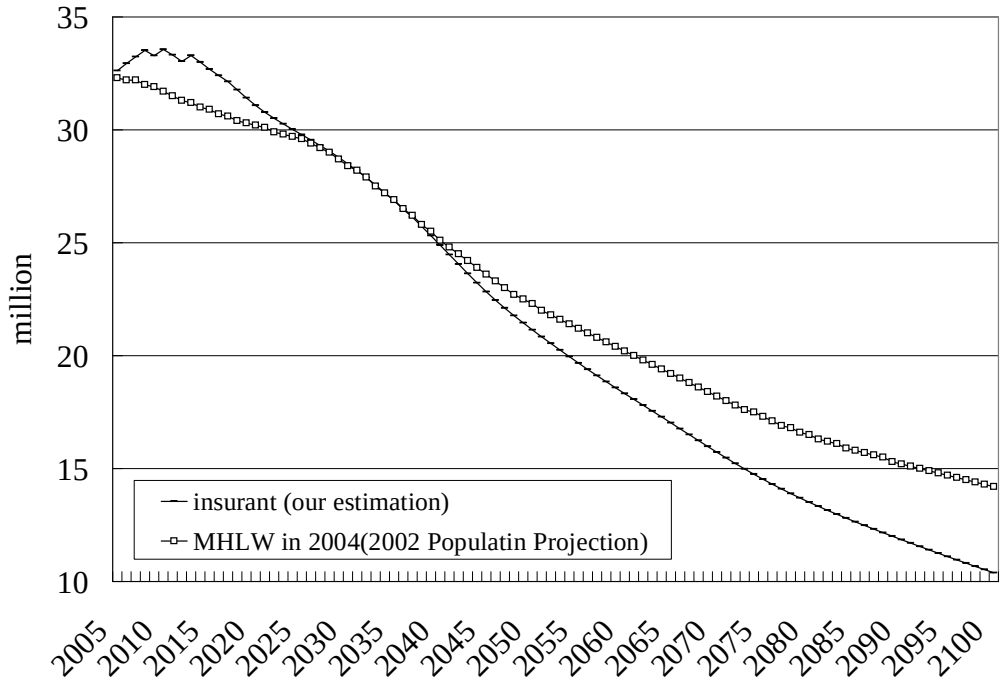
3. Simulations

The way of pension reform carried out by most of all developed country is considered from an institutional extension that changes the pension schemes structure gradually. For this type of method, the World Bank calls the parametric reformation. Parametric reformation includes rising the age of eligibility for payments and expansion of applicants. However, this method attracts objections from the insured persons and the government. For example, although the expansion of application to part-timers was proposed in the time of 2004 revisions, mainly the retail shops' community opposed this proposal. For the rinsing the pensionable age, on account of the labor unions are weak, insured persons might have to consent to rising of the pensionable age. A simulation of the effects of rising the pension age is attempted below. There are two cases:

1) The case of raising the pensionable age to 67 years old
2) The case of raising the pensionable age to 70 years old

According to the life expectancy table in 2006, the average lifespan is 79.00 years for males and 85.51 years for females. In the calculation, 20.6

Figure 2. Estimation of insured persons under the EPI



Source: Calculated by the author.

percent of males and 43.9 percent of females live to the age of 90 years old. As for the pensionable age, for females it is 65 years old after 2031 and for males it is 65 years old after 2026, but there is still a dual circulation period. Therefore, the pension-receiving period on average is 20 years or more for females and 13 years or more for males. This pension-receiving period is obviously long. Raising the pension age reduces the number of beneficiaries and extends the number of the people insured[xiv].

3.1 Insured persons and beneficiaries

The estimated value for the transition of EPI insured persons and the estimation of the 2004 pension finance re-calculation of MHLW [xv] are shown in Figure 2. Consequently, the estimated value of the 2004 pension finance re-calculation of MHLW can be traced almost to 2035. In Figure 2, owing to increasing the pensionable age to 65, insured persons are increasing until 2025 and the results of this study are equivalent to the results of the 2004 pension finance re-calculation of MHLW estimation in 2026 to 2041. Certainly, on account of the result of the 2006 population projection, the gap between the results of this study and the results of the 2004 pension finance re-calculation of MHLW grow after 2042.

As the insured persons are decreasing for a long time, the population aged 15-64 years old people are decreasing in the 2002 population projection and the 2006 population projection. However, the 2006 population projection is often said to underestimate and the IPSS assumes that the birthrate is to be around 1.26 from 2006 to 2105. Because there are not positive measures for increasing the birthrate, the assumption cannot be denied. Finally, after 2042, this study result is less than the 2004 pension finance re-calculation of MHLW estimation. There are big gaps in both estimations.

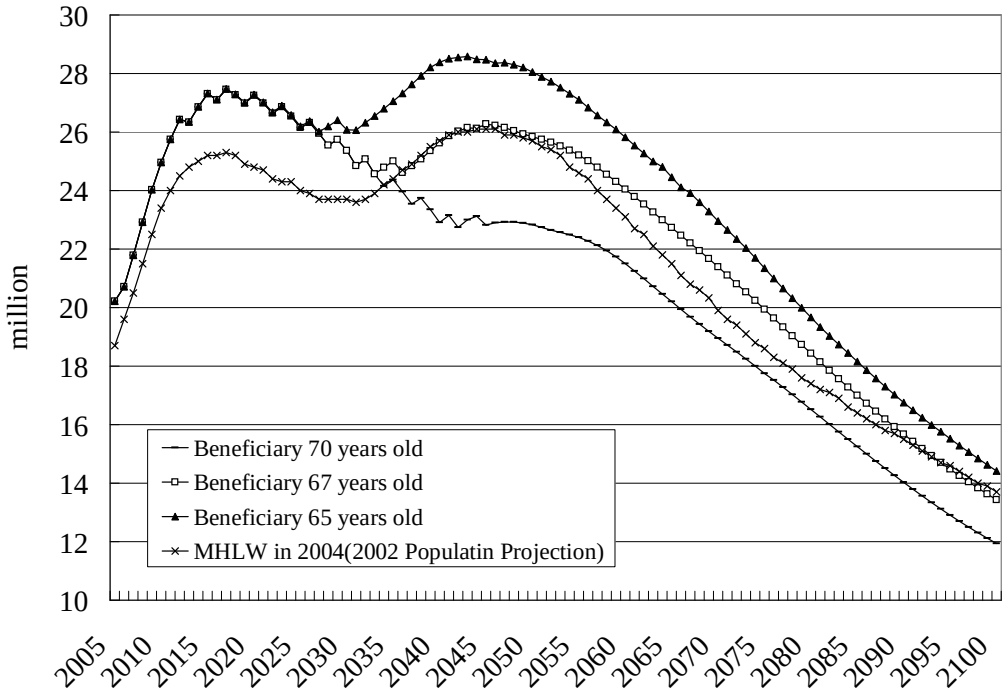
On the other hand, beneficiaries are enumerated in Figure 3. The unbridgeable gulf between this study's estimation and the 2004 pension finance re-calculation of MHLW estimation grows with the boundary at about 2010. The difference is about two million persons. This depends on the increased longevity of females shown by the 2006 population projection and many women being beneficiaries of aggregated old age pensions, plus the raising of the pensionable age to 65 years old and after a delay of five years. Also, if the pensionable age of males is raised to 67 years old or 70 years old from 2031, the age for females is raised to 65 years old from 2026, then to 67 years old or 70 years old. Therefore, the effects of rising the pensionable age to 67 years old or 70 years old emerges after 2026.

As the figure of beneficiaries of the EPI is like a camel with two humps, the first hump is the baby-boomers and the second is baby-boomers' junior. In this figure, the population of 65+ in the 2006 population projection is bigger than the 2004 pension finance re-calculation of MHLW estimation, so the pensionable age 65 is the highest. In contrast, the pensionable age 70 is strange. The pensionable age 70 has only one hump at first glance. The functions of the pensionable age of 70 are two; the eligibility age for pension payments is delayed and those who die between 65 and 69 are excluded. To tell the truth, for the Japanese the age of 65 years is a crossroads of their health. From the age 65, the death rate jumps up. The pensionable age of 70 includes the removal of those who die aged 65 to 69 years old. So, the pensionable age 70 has only one hump. However, in 2048 to 2060, a slight swelling is seen.

Increasing the eligibility age for pensioners is effective for suppressing increases of beneficiaries. Typically, the result of a pensionable age of 67 is almost equivalent to the result of the 2004 pension finance re-calculation of MHLW. The important details are seen in Figure 4. The decrease in the number of insured persons and the increase in the number of pensioners from the 2006 population projection make the ratio of beneficiaries / to insured persons large. Note the comparison with Sweden shown in Figure 4. The features of Swedish pension reforms of 1999 are introduction of the NDC (Notional Defined Contribution), Automatic Balance Mechanism, and a new scheme of pension benefit formula (earnings-related with minimum guarantee).

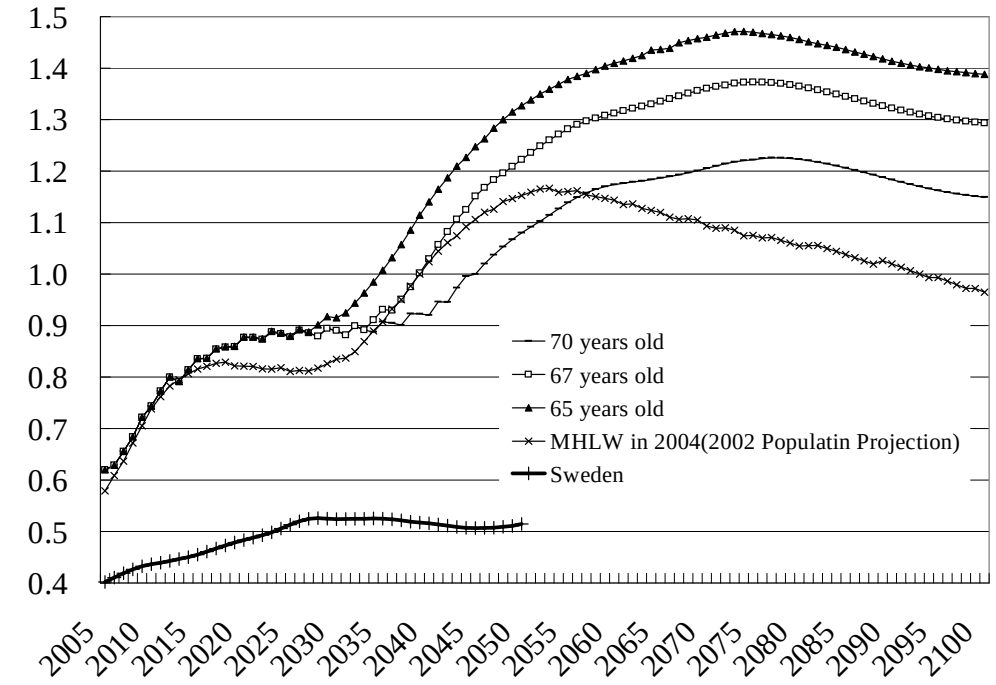
The NDC, Automatic Balance Mechanism and the benefit formula of earnings-related with minimum guarantee are argued in the time of reform 2004 in Japan and especially the second feature; Automatic Balance Mechanism is similar to Japanese macro-economy indexation. Moreover, it is another debate whether Japan should introduce a DC plan or NDC plan into the public pension fields in the near future, for which it is useful to discuss Sweden's population structure. The ratio of the number of beneficiaries / the number of insured persons of Sweden is around 0.4 to 0.5. This means that two insurants support one pensioner. However, the ratio of the number of beneficiaries / the number of insured persons of Japan is over one after 2047 (indeed, the result of this study shows that for a pensionable age of 65 it is the fastest of all). On this point, there is much room for reform in Sweden. However, Japan is

Figure 3. Estimation of beneficiaries of the EPI



Source: Calculated by the author.

Figure 4. Ratio of beneficiaries to insured persons



Source: Calculated by the author, for Sweden, using the data of Statistics Sweden; Population and projection 2005-2050, December 31, 2004.

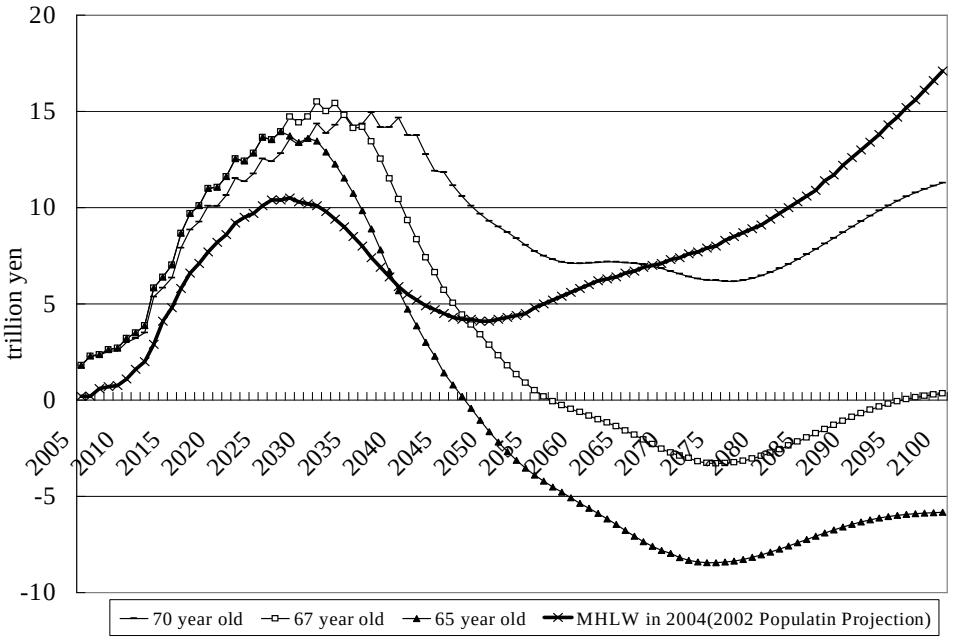
approaching the limit of endurance of the insured person. The ratio of the number of beneficiaries to insured persons equal to one means that one insurant supports one pensioner. This is a serious situation. According to this study's estimation result, there will be fewer insured persons than anticipated and there will be more pensioners than anticipated. In addition, also, the benefits are rising faster than expected and the contributions are decreasing faster too. After 2050, the failure of the pension finance can be foreseen.

3.2 Financial aspects

The situation of revenues and expenditure becomes severe as shown in Figure 5. The difference will be about two trillion yen after 2015, although revenues and expenditures are better than the estimates of the 2004 pension finance re-calculation of MHLW. If pensions are provided from 65, 67 years old or 70 years old, revenues and expenditures will be positive from 2030 until 2040.

However, revenues and expenditures become negative with provision at 65 years old after 2046. (This positive or negative number makes the 2004 pension finance re-calculation of MHLW estimations the benchmark.) It is also negative with provision at 67 years old after 2057. Interestingly, the result of pensionable age 70 exceeds the outcome of the 2004 pension finance re-calculation of MHLW estimations until 2067. The intention of rising the pension able age is the increase of the numbers of insured persons. Although repeated, the 2004 pension finance re-calculation of MHLW uses the 2002 population projection and this study uses the 2006 population projection. Namely, the effects of raising the pensionable age are less than the effect of the new population projection in 2006 which has fewer young people.

Figure 5. Differences between benefits and contributions



Source: Calculated by the author.

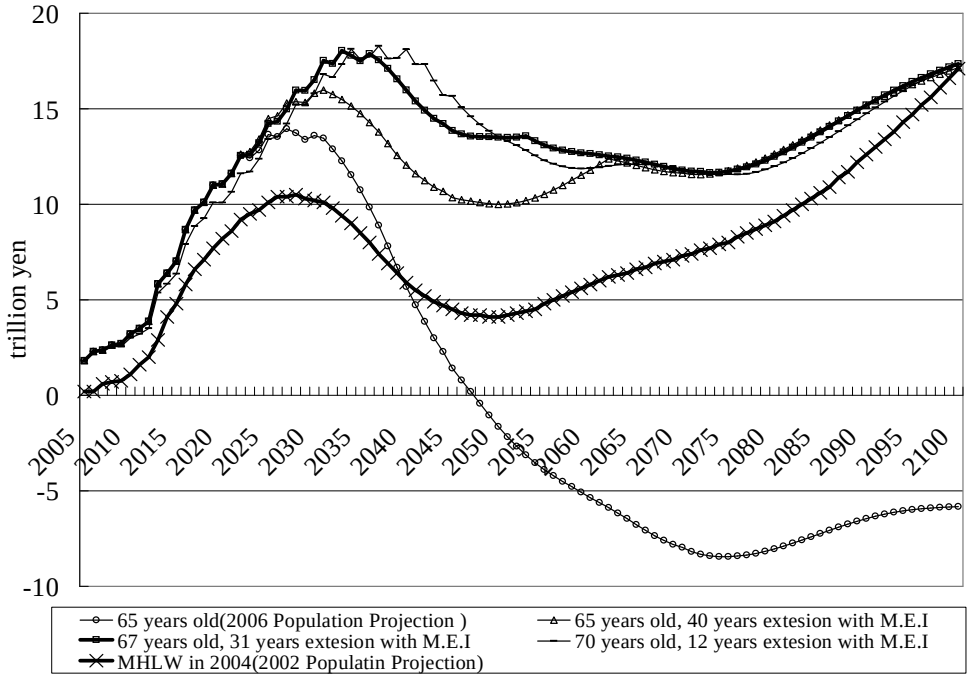
Figure 6 referred a condition that the income and expenditure is not less than the 2004 pension finance re-calculation of MHLW estimation at a point in time in 2105. As mentioned before, Japan introduced the new indexation method, macro-economy indexation. It is effective in cutting the 0.9 percent CPI indexation to the EPI and Basic Pension benefits growing every year. Originally, macro-economy indexation is used 2004 to 2023. In this estimation, the macro-economy indexation period extended for the income and expenditure was not less than the 2004 pension finance re-calculation of MHLW at a point in time in 2105. The results are as follows:

1. Pensionable age 65 extending macro-economy indexation for 40 years
2. Pensionable age 67 extending macro-economy indexation for 31 years
3. Pensionable age 70 extending macro-economy indexation for 12 years

The periods for extending the macro-economy indexation are very long. Typically, the case of pensionable age 65 and 67 are strongly decreasing after 2050 (in Figure 6), and they need long macro-economy indexation periods. Surprisingly, the case of pensionable age 70 needs only 12 years extension of macro-economy indexation. Note that the difference between the simulation results based on the population projections in the year of 2006 and the re-estimated values by the 2004 pension finance re-calculation of MHLW as a reference can be accounted solely for drastic changes in both birthrates and life expectancies estimated based on the population projection from the year of 2002

through 2006. The population projection in 2006 assumes a much smaller birthrate that is 1.26 and longer life expectancies that are 83.37 and 90.07 for male and female, compared to 1.39, 80.95, and 89.22, respectively in 2002. Accordingly, the adjustment of these assumptions decreases the younger population and increases the elderly, that make the financial balance between pension benefits and contributions largely negative.

Figure 6. Differences between benefits and contributions with extending the period of Macro-Economy Indexation (M.E.I)



Source: Calculated by the Author.

3.3 Distribution aspects

If the current system continues, the calculation method of the current (after April 2003) pension benefit is as mentioned before:

The EPI pension benefit = Earnings-related part + Basic Pension part

The two parts are basically indexed by prices and wages. However, wages are no longer indexed since the 1999 public pension reform. As for the insured persons, the contribution rate is fixed at 18.8 percent from 2023.

Additionally, let us think about the following examples of numerical values (see Appendix for new features of this estimation). A group of white-collar workers begin to pay insurance in 2005. Those white-collar workers get a salary of between 100,000 and 620,000 yen at 2005 prices. The salary they receive increases only relative to prices. In other words, there is no substantial rise in pay. A person who gets 100,000 yen in 2005 prices is still getting 100,000 yen in real value ten years later, and a person who gets 620,000 yen is getting 620,000 yen in real value ten years later. A person with an income of 100,000 yen pays a contribution of 3,760,000 yen (2005 prices) over a working life, and a person with an income of 620,000 yen pays a contribution of 23,360,000 yen.

These people finish paying contributions at 2042 and 2045 years, and begin to receive a pension from 2046 if the pensionable age is 65 years old. Moreover, if a man's average life span is assumed 75 years old, a person with an income of 100,000 yen receives an amount of pension of about 10.65 million yen, and a person with an income of 620,000 yen receives 11.43 million yen. Table 1 shows the pension benefits calculated under this assumption and the monthly pension benefit and relative pension level for every individual lifetime average earnings. The pension benefits are composed of earnings-related part (husband) and the basic pensions are doubled (husband and wife). In a word, the households of the husband and the full-time housewife are supposed. The working population's average wage incidentally calculated from economic assumptions is 625,190 yen. Additionally, all the following numerical values are discounted in prices from here in 2005. And the income class of the individual lifetime average earnings 513,000

and more can obtain the pension benefit relative pension level of 50.2 percent which the MHLW secures. It is said that the Treaty No. 102 of the International Labour Organization will secure the relative pension level of 40 percent by subscription for 30 years.

In the case of Japan, it will be appropriate to secure about 50 percent for 40 years[xvi]. However, this secure rate is very high considering the income distribution and the top several percent fulfill that level. If the multiplication rate for calculating the pension benefit is put back to the old levels, it becomes the following. The relative pension level[xvii] becomes 50.2 percent for the individual lifetime average earnings of 400,000 yen if the multiplication rate for calculating pension benefit is returned to 7.125/1000, and if it is 10/1000, the relative pension level clears 50.2 percent for the individual lifetime average earnings of 290,000 yen.

Table 1 Basic Pension, Earnings related parts, Total pension and Relative pension level (current system, start to contribute in 2005, monthly amount and price in 2005)

	Individual lifetime average earnings: ten thousand yen					
	10	30	40	50	60	62
Basic Pension(yen)	177,205	177,205	177,205	177,205	177,205	177,205
Earnings Related(yen)	26,656	79,969	106,625	133,281	159,938	165,269
Total Pension(yen)	203,861	257,174	283,830	310,486	337,143	342,474
Relative pension level(%)	32.6	41.1	45.4	49.7	53.9	54.8

Source: Calculated by the author.

Table 2 The Ratio of Lifetime pension benefits to contributions

Duration of receiving pension(age)	Individual lifetime average earnings: ten thousand yen						
	10	20	30	40	50	60	62
65-79	4.05	2.49	1.97	1.71	1.56	1.45	1.44
67-79	3.54	2.18	1.72	1.50	1.36	1.27	1.26
70-79	2.76	1.70	1.34	1.17	1.06	0.99	0.98
65-85	5.82	3.58	2.84	2.47	2.24	2.09	2.07
67-85	5.31	3.27	2.59	2.25	2.05	1.91	1.89
70-85	4.53	2.79	2.21	1.92	1.75	1.63	1.61

Source: Calculated by the author.

Actually, the calculation base of the pension benefit changed to total reward since April 2003 though the calculation base of the pension supply was basic salary until March, 2003. A "monthly individual lifetime average earnings" is the total reward for one year divided by 12. This monthly individual lifetime average earnings are the main factor of calculating the pension benefit. The EPI earnings-related part's calculation method is as follows (now omitting the basic pension part):

Earnings-related parts (above mentioned)

1) Before March 2003: The EPI benefit = Monthly individual lifetime average earnings × (9.5 ～ 7.125) / 1000 × period of insurant

2) After April 2003: The EPI benefit = Monthly Individual lifetime average earnings × (7.308 ～ 5.481) / 1000 × period of insurant

Monthly individual lifetime average earnings are now calculated by the total reward, including monthly salary and bonuses. Therefore, the income which serves as a standard when calculating a pension will increase with bonuses. However, this penalizes a person with few bonuses. The multiplication rate newly applied is about 25 percent lower than the old multiplication rate. For a person in Table 1 who started the payment of insurance in 2005, a multiplication rate of 5.481 is used.

Next, the ratio of lifetime pension-benefits to contributions according to a duration of receiving pension are shown in Table 2. The average life span of the male is assumed to be 79 years old, and the average life span of the female is assumed to be 85 years old (2002 population projection) .With the numerical value of the 2004 pension finance re-calculation of MHLW, the average life span of female (2002 population projection) 85 years old is used. In this study, the case of 79 years old and 85 years old are calculated.

The ratio of lifetime pension benefits to contributions is regarded as a kind of rate of return throughout the life. For example, let us think about the case where one lives until 79. A person with 100,000 yen in the individual lifetime average earnings gets a value of 4.05, and receives a pension benefit of 4.05 times the paid contribution. However, a person of with 620,000 yen in the individual lifetime average earnings receives 1.44 times the paid contribution. Obviously, the high incomes receipt relatively low pension benefit and the low incomes receipt relatively high pension benefit.

When the pension benefit is received from 70 to 85 years old, a person with 100,000 yen of the individual lifetime average earnings has a ratio of 4.53 for Lifetime benefit / Lifetime contribution. On the other hand, the figure for a person with 620,000 yen of the individual lifetime average earnings is only 1.61. The payment is a fixed rate, and high incomes pay a lot and low incomes pay little. Generally, the proportion of the earnings-related part of the pension benefit becomes large as the income goes up and the proportion of the basic pension part of the pension becomes small as the income goes up. However, the current system has changed to cut down the earnings-related part by decreasing multiplication rates, so the ratio of the earnings-related part is decreasing and the ratio of the basic pensions relative to the total pension has risen. Actually, Lifetime benefit / Lifetime contribution is decreasing as the income goes up.

3.4 The effects of macro-economy indexation

Finally, the verification of macro-economy indexation is shown. In 3.2, it was completely disregarded how much an individual will receive in pension benefits, and the macro-economy indexation was extended so that the fiscal balance might be positive (Figure 4). To be sure, this estimation is based on the 2006 population projection and the 2004 pension finance re-calculation of MHLW estimation is based on the 2002 population projection.

A problem here is the influence that the extension of the macro-economy indexation gives the individuals. For example, those who joined the above-mentioned scheme for 2005 receive a benefit. If macro-economy indexation is extended, the pension benefits are reduced as described before. Like the 2004 pension finance re-calculation of MHLW estimation, in this study's actuarial model pension benefits are indexed to price. To 2023, macro-economy indexation is carried out and 0.9 percent is subtracted from the forecast of the price increase of 1.0 percent. Therefore the pension benefit index increases by only 0.1 percent.

In this estimation, the provision at 65 years with macro-economy indexation extending 40 years is the first case which makes a large cut in the pension benefit, second is the provision at 67 years with macro-economy indexation extending 31 years[viii], and third is the provision at 70 years with macro-economy indexation extending 12 years.

In the case with the provision at 65 years and with macro-economy indexation extending 40 years, the individual lifetime average earnings of 100,000 yen receives 157,604 yen as pension benefit (Table 3). However, the individual lifetime average earnings of 100,000 yen receive 203,861 yen without macro-economy indexation extending 40 years. This is about a 23 percent cut. Moreover, in the case of the individual lifetime average earnings of 620,000 yen, a pension benefit of 342,474 yen changes to 291,341 yen, which is about a 15 percent cut. Note that the large size of a cutback is solely accounted for drastic changes in both birthrates and life expectancies estimated based on the population projection from the year of 2002 through 2006. The case with the provision at 70 years and with macro-economy indexation extending 12 years, the individual lifetime average earnings of 100,000 yen receives 170,890 yen, which is about a 16 percent cut, and the individual lifetime average earnings of 620,000 yen receives 309,503 yen, which is about a 10 percent cut[xix].

On the other hand, the relation between a life time benefit and a lifetime contribution are mentioned in Table 4. When a person of the individual lifetime average earnings of 100,000 yen lived to 79 years old with a pensionable age 65, the pension benefit over the life contribution is 4.82, but this numerical value falls to 3.13 by extending a macro-economy indexation for 40 years.

In Table 4, for a low income earner, it seems that the amount of pension benefit is not so severe for a person of the individual lifetime average earnings of 100,000 yen and with a pensionable age of 70 and extending 12 years of macro-economy indexation because the ratio of the lifetime

Table 3 Basic Pension, Earnings related parts, Total pension and Relative pension level (start to contribute in 2005, monthly amount and price in 2005)

Pensionable Age	M.E.I. Period		Individual lifetime average earnings: ten thousand yen 10	20	30	40	50	60	62
65	Current until 2023	Basic Pension (\)	177,205	177,205	177,205	177,205	177,205	177,205	177,205
		Earnings-related(\)	26,656	53,313	79,969	106,625	133,281	159,938	165,269
		Total Pension(\)	203,861	230,517	257,174	283,830	310,486	337,143	342,474
		Relative pension	32.6	36.9	41.1	45.4	49.7	53.9	54.8
65	until 2063	Basic Pension (\)	131,885	131,885	131,885	131,885	131,885	131,885	131,885
		Earnings-related(\)	25,719	51,438	77,156	102,875	128,594	154,313	159,456
		Total Pension(\)	157,604	183,322	209,041	234,760	260,479	286,197	291,341
		Relative pension	25.2	29.3	33.4	37.6	41.7	45.8	46.6
67	until 2054	Basic Pension (\)	131,885	131,885	131,885	131,885	131,885	131,885	131,885
		Earnings-related(\)	25,719	51,438	77,156	102,875	128,594	154,313	159,456
		Total Pension(\)	157,604	183,322	209,041	234,760	260,479	286,197	291,341
		Relative pension	25.2	29.3	33.4	37.6	41.7	45.8	46.6
70	until 2035	Basic Pension (\)	144,234	144,234	144,234	144,234	144,234	144,234	144,234
		Earnings-related(\)	26,656	53,313	79,969	106,625	133,281	159,938	165,269
		Total Pension(\)	170,890	197,547	224,203	250,859	277,515	304,172	309,503
		Relative pension	27.3	31.6	35.9	40.1	44.4	48.7	49.5

Source: Calculated by the author.

Table 4 Basic Pension, Earnings related parts, Total pension and Lifetime balance (Start to contribute in 2005, monthly amount and price in 2005)

(In ten thousand yen)

M.E.I. Period	Duration of receiving pension		Individual lifetime average earnings:ten thousand yen 10	20	30	40	50	60	62
Current until 2023	65-79	1 Basic Pension	1,639	1,639	1,639	1,639	1,639	1,639	1,639
		2 Earnings-related	900	1,800	2,700	3,600	4,500	5,399	5,579
		3 Contribution	527	1,054	1,582	2,109	2,636	3,163	3,269
		4 Earnings	4,800	9,600	14,400	19,200	24,000	28,800	29,760
		(1+2) /3	4.816	3.262	2.743	2.484	2.329	2.225	2.208
		(1+2) /4	0.529	0.358	0.301	0.273	0.256	0.244	0.243
until 2063	65-79	1 Basic Pension	1,187	1,187	1,187	1,187	1,187	1,187	1,187
		2 Earnings-related	463	926	1,389	1,852	2,315	2,778	2,870
		3 Contribution	527	1,054	1,582	2,109	2,636	3,163	3,269
		4 Earnings	4,800	9,600	14,400	19,200	24,000	28,800	29,760
		(1+2) /3	3.129	2.004	1.629	1.441	1.328	1.253	1.241
		(1+2) /4	0.344	0.220	0.179	0.158	0.146	0.138	0.136
Current until 2023	70-85	1 Basic Pension	1,837	1,837	1,837	1,837	1,837	1,837	1,837
		2 Earnings-related	1,008	2,017	3,025	4,034	5,042	6,051	6,252
		3 Contribution	527	1,054	1,582	2,109	2,636	3,163	3,269
		4 Earnings	4,800	9,600	14,400	19,200	24,000	28,800	29,760
		(1+2) /3	5.397	3.655	3.074	2.784	2.610	2.494	2.475
		(1+2) /4	0.593	0.401	0.338	0.306	0.287	0.274	0.272
until 2035	70-85	1 Basic Pension	1,495	1,495	1,495	1,495	1,495	1,495	1,495
		2 Earnings-related	553	1,105	1,658	2,211	2,764	3,316	3,427
		3 Contribution	527	1,054	1,582	2,109	2,636	3,163	3,269
		4 Earnings	4,800	9,600	14,400	19,200	24,000	28,800	29,760
		(1+2) /3	3.885	2.467	1.994	1.757	1.616	1.521	1.506
		(1+2) /4	0.427	0.271	0.219	0.193	0.177	0.167	0.165

Note: Basic Pension, Earnings-related, Cotriubution and Earnings are lifetime total value.
Source: Calculated by the author.

pension benefit / lifetime earnings is 0.427 (620,000 has only 0.165). In that sense, the current system is hospitable to the low income earner, and it is become a severe system for the high income persons. By the way, the relative decrease of the payment multiplication rate works for persons with high income in particular. When the multiplication rate becomes 5.481/1,000, the ratio of the earnings related parts to a total pension benefit is reduced to 0.483, whereas if the multiplication rate is held at 10/1,000, the ratio is 0.630.

4 Concluding remarks

This study analyzes the public pension reform 2004 by the actuarial model of the EPI, using the population projection 2006. The main findings of the simulation results are the following two points.

First, a cutback in pension benefits by 10-15 percentage points will maintain the pension scheme sustainable, under the author's assumption such that the earliest age at which full public pension benefits are payable is 70 and the macro-economy indexation is extended for 12 years until the year of 2035. Even if the macro-economy indexation is extended for 40 years until 2063, the government should curtail benefits by 20 percent points under the current system keeping pensionable age at 65. Note that the size of a cutback in either assumption is largely influenced by drastic changes in both birth rates and death rates of the two population projections, 2002 and 2006. Consequently, the simulation results will justify that 70 is the appropriate age for being qualified for full pension benefits, because the size of cutback in pension benefits is estimated smaller in the former than in the latter simulation.

Second, adopting the age 70 as a pensionable age and the macro-economy indexation extending for 12 years to the system, the low-income rather than high-income population will definitely be better off because the ratio of the lifetime benefit to lifetime salary will decline to approximately 0.4 from about 0.6 under the current system. This result is induced by a characteristic of the pension reform in the year of 2004 expanding the flat-rate part of the pension benefits by the reduction of the payment multiplication rate.

For further research, it is necessary to replace the method of calculating the pension benefit. To begin with, the earnings-related part must be changed. The current earnings-related part is decreasing year by year as described before. Therefore, to abolish the earnings-related part is preferable. This type of reform controls the expense most. Additionally, it is interesting to introduce perfect earnings-related with the minimum guarantee type benefit formulas. In Japan, this is the method proposed by the Democratic Party and is used in the reforms made in Sweden in 1999. To be sure, how to allocate fiscal resources in the minimum guarantee part is a problem. If the minimum guarantee part is to be financed by the contribution, the actuarial model can consider this in detail, but if this part is to be financed by tax, e.g. a consumer tax, the actuarial model cannot be used. Introduction of consumer tax affects the entire economy, and the actuarial method does not deal with the entire economy. Surely, there is also a method of providing a basic pension with a consumption tax. Concretely, the finance of the basic pension part is to be changed to the consumer tax. In Japan, raising the consumer tax rate is often suggested. Some say that the total basic pension benefit would be financed by a 7.2 percent consumer tax rate. Additionally, there is a option for the earnings-related part to be privatized. In such a system, the government makes the pension policy for the poor only, and the middle and high incomes are left to take care of themselves, as in the U.K. scheme. In this case, a macro model or OLG model will take out a suitable result of analysis.

Acknowledgement

I express my gratitude to Co-Editors and reviewers. I should express my cordial thanks to Dr. Haruko Noguchi (IPSS) for her precious comments and encouragement. For the estimation, thanks to Mr. Tomonori Sugita of Keio University Graduate School of Science and Engineering. Any remaining errors are the sole responsibility of the author and the views expressed in the papers are solely those of the author, and do not present those of National Institute of Population and Social Security Research.

Note

[i] Based on the results of a census carried out every five years, and National Institute of Population and Social Security Research announces the results of the population projection in Japan every five years. Originally, the population estimate that was to have been reported in 2007 was moved forward for about one month and was announced in December 2006.

[ii] When the MHLW estimated the financial balance between pension benefits and contributions in 2004 and 2007, they have adopted different assumptions on the labor market participation rates among male workers. The MHLW assumes higher participation rates in 2007 (89.4 percent in 2030) than in 2004 (85.0 percent in 2025), although they assume the female participation rates the same (65 percent) in both years. The MHLW expected more male elderly workers to be stimulated working in the future labor market, due to the severe excess demand caused by the current population trend on the younger generation.

[iii] Japanese public pension reforms are every five years, e.g., 2004, 1999 and 1994.

[iv] More correctly, the EPI benefit is based on the individual lifetime average earnings.

[v] The multiplication rate varies by birth years (e.g. 9.5 is applied for those born before 1927 and

7.125 is applied for those born after 1966). After April 2003, the multiplication rate varies from 7.308 to 5.481.

[vi] Under this system, the upper limit of participating months is 480 months.

[vii] About the Japanese Pension schemes and pension reform in 2004, see the MHLW web site. http://www.mhlw.go.jp/english/org/policy/p36-37a.html (Access, 11/30/2007)

[viii] Typically, parametric reform generally relies on extending the pensionable age, decreasing the relative pension level, and increasing the contribution rate. In Japan, the relative pension level is already decreasing and contribution rate reaches the upper limit. So, no means remain in the Japanese Government.

[ix] The old-age replacement rate is a measure of how effectively a pension system provides income during retirement to replace earnings, the main source of income prior to retirement. Often, the replacement rate is expressed as the ratio of the pension over the final earnings before retirement. However, the indicator used here shows the pension benefit as a share of individual lifetime average earnings (re-valued in line with economy-wide earnings growth).

[x] In Japan, there are two main employees' health insurance systems. The first is called Government Managed Employees' Health insurance scheme which applies to small and medium-sized company's employees and the second is called Society Managed Employees' Health insurance scheme which applies to large company's employees.

[xi] National Health Insurance scheme applies to all local residents who are not covered by employees' insurance schemes. So, the total members of NHI are aged 0 to 100+. And the membership of the National Pension is aged 20 to 64 who are not covered by employees' insurance schemes. So, the number of NHI insurants aged 20 to 64 are equivalent to the NP insurants.

[xii] In this case, actuarially fair means that the contribution equals the benefit (or more precisely, the current price evaluation) in every cohort.

[xiii] After the 1999 reform, the indexation of the pension benefit is only for prices.

[xiv] Furthermore, raising the pensionble age is important to make pension finances healthy. If pensionable age is raised to 67 years old and 70 years old, the number of insured persons will not be increasing, according to the simulation results of this study. Indeed, there will be a period of around three to five years before the pension benefit is provided and pension beneficiaries earn their bread from the household's financial assets such as savings. Additionally, beneficiaries may accept to start receiving a reduced pension at 65 years old. Although the estimation is carried out until 2105, the reliable period is from 2005 to 2050.

[xv] The pension finance re-calculation is carried out for every five years and is announced based on the population projection reported by the IPSS. In 2004, the pension finance re-calculation carried out using 2002 population projection.

[xvi] Japanese enrollment period is 40 years. It's 10 years longer than the standard of ILO treaty No.102 30 years.

[xvii] The strength of the link between pension entitlements and earnings is measured using the relative pension level, that is, the gross individual pension divided by gross economy-wide average earnings(rather than by individual earnings as in the replacement-rate result).

[xviii] In this study, the insured persons who participate in the pension scheme from 2005 are the model cases. They start to take the pension benefit from 2050. On the other hand, the year of 2063 is extending 40 years macro-economy indexation and the year 2054 is extending 31 years macro-economy indexation. That is, the insured persons who participate in the pension scheme from 2005 are already decided the amount of the pension benefits in 2050. So, the effect of the extending macro-economy 40 years and 31 years are the same for them.

[xix] As Figure 6 shows, supposed that the earliest age at which full public pension benefits are payable is 70 and the macro-economy indexation is extended for 12 years until the year of 2035, the surplus of the EPI funding is projected much larger than the estimation of the 2004 pension finance re-calculation of MHLW. Therefore, the size of cutbacks in pension benefits projected in this study will definitely be getting decreased if the government transfers the surplus of the funding to the payment to beneficiaries.

References

Fukawa. Tetsuo(2005),"Some structural issues in the Japanese social security system", *The Japanese Journal of Social Security Policy*, Vol.4, No.2 (Dec. 2005),pp.67-75,IPSS

Hatta. Tatsuo, and Noriyoshi Oguchi (1999), "*Pension reform theory* - shift to the funded financing! (Nenkin kaikaku ron-tsumiate houshikini ikouseyo)" in Japanese, Nihon Keizai Shinbun-sha

Holzmann. Robert, Richard P. Hinz, et. al. (2005).,

Old-Age Income Support in the 21st Century: The World Bank's Perspective on Pension Systems and Reform (Trade and Development), World Bank

IPSS(2002),"Population Projections for Japan 2001-2050, January, 2002", National Institute of Population and Social Security Research

IPSS(2007),"Population Projection for Japan 2005-2055, December, 2006", National Institute of Population and Social Security Research

JIL (2007), "The present condition and the subject of personnel management towards elderly-people continuation employment (Ko-reisya keizoku koyou ni muketa jinji kanrijouno genjo to kadai)" in Japanese, The Japan institute for Labour Policy and Training.

Ogura. Seiritsu, and Irifune Tuyoshi (1990), "The aging population of our country, and the income and outgoings of each public health insurance system (Wagakunino Jinkou koureika to kakukoutkeki iryouhoken no shuusi nituite)" in Japanese, *Financial Review* August 1990, pp.1-27, Ministry of Finance, Policy Research Institute

Ogura. Seiritsu, and Katsuya Yamamoto (1993), "The cost of public pension insurance, and a simulation of burden (Kouteki nenkin hoken no kosuto to hutan no simulation)" in Japanese, *JCER Economic Journal*, No.26, pp.7-33, Japan Center for Economic Research

SSA (2007), The 2007 Annual Report of The Board of Trustees of The Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds, The Board of Trustees, Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds

Tajika. Eiji, Yoshihiro Kaneko and Fumiko Hayashi (1996), "*Economic analysis of pensions - from the aspect of insurance* (Nenkin no keizai bunseki - hoken no shiten)" in Japanese, Toyo Keizai Shinpo-sha

Yamamoto. Katsuya (1994), "Relation between demographic structure and reward proportion pension in our country" (Wagakuni no jinkoukouzo to houshuhireinenkin no kankei)" in Japanese, Nihon Nenkin Gakkai Shi No.14

Yamamoto. Kastsuya, Kazuki Aoyama and Souichiro Okada (2006), "Evaluation of pension reform by actuarial model (Hokensuri Moderu ni yoru nenkin kaikaku no hyouka)" in Japanese, in *Economics analysis of pension reform*, Eds. Tetsuo Fukawa and Hisakazu Kato, Nihon Hyoron-sh

Katsuya Yamamoto (National Institute of Population and Social Security Research, Japan)