Net Pension Liabilities, Intergenerational Equity, and Pension Reforms

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Abstract

This paper examines an ideal pension system that would prevent an increase in net pension liabilities and redress intergenerational inequalities. The direction of pension system reform that this paper proposes is to limit the amount of pension benefits to the sum of premiums, state contributions, and yields on investment of reserves, and also to minimize the burden on the insured of premium payments. This reform would have roughly the same effect as a switchover to a funded system.

It will be, however, no easy task to carry out this kind of reform, because the reform requires a politically unacceptable step: to request those generations already receiving pensions and those who have paid pension premiums to accept reductions in the amount of pension that the government has pledged to pay. One possible means to deal with this problem is to withdraw the reserve funds, which are now over 100 trillion yen. However, withdrawal of the reserves would reduce the opportunity of future generations to use the funds and yields on investment of the funds.

Any attempt to reform the pension system will cause conflicts of interests between generations. This is why the government should positively disclose the outlook for its pension finance, mainly net pension liabilities, and information about intergenerational disparities to provide the public with data for objective discussions on a more desirable form of public pension.

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1. Introduction

Public pensions in Japan have a number of problems, and the following three are the most important. First, net pension liabilities have reached a rather high level. Pension liabilities are the amount of pension benefits pledged to be paid to the insured of a pension system or to the recipients of pensions according to their past premium payment performance (benefits cost corresponding to the past period). Net pension liabilities are defined as pension liabilities less those supported by available pension funds. It is often said that public pensions barely exist by shifting burdens onto future generations, and these burdens are net pension liabilities. According to the "Government Balance Sheet" for 2000 published by the Ministry of Finance, the net pension liabilities of the Employees' Pension Insurance reached 552 trillion yen (about 110% of GDP) at the end of 2000. If these liabilities continue increasing, fears about the sustainability of the pension system will be intensified.

Second, intergenerational inequalities are increasing, which is related to the first problem referred to above. Even after the 2000 reform, there remain great disparities between generations as to the benefits and the burdens of the Employees' Pension Insurance. For example, an average couple of the generation born in the 1990s would pay about 11% of their lifetime wages, which is more than the amount of pension benefits they would receive (based on the premiums paid by the couple and their employers; state contributions excluded). On the other hand, those of the generation born in the 1950s would pay only about 6% of their lifetime wages and would receive benefits that are greater than the premiums they would pay. The greater the net pension liabilities are, the heavier are the burdens future generations would have to bear.

Finally, the future of the pension systems is uncertain. Pension reforms in the past were repetitions of raising premium rate and making pension payment conditions stricter as a result of past birth rate estimates being found to be too optimistic. This means that the government continued to change its promise to the people, so it will be natural that their worries about the future of the pension system will not be alleviated however the government may explain its policies to them. In fact, the new population estimate,

published in late January 2002 by the National Institute of Population and Social Security Research, revised down its total fertility rate forecast for 2050 from 1.61 to 1.39. If this forecast is correct, a substantial increase in the premium rate will be inevitable, which will further deepen public anxieties concerning pension systems.

With the three questions above in mind, this paper discusses the desirable direction of pension reforms. In other words, it examines the kind of public pensions that could attain the three objectives: (1) avoid a further increase in net pension liabilities; (2) correct intergenerational inequalities; and, (3) enhance the transparency of the pension system. Section **2** summarizes the concepts of net pension liabilities, and Section **3** discusses three basic methods for avoiding an increase in liabilities (funding, full pay-as-you-go, and balanced income and expenditure methods). Section **4** compares the theoretical characteristics of the three methods, and Section **5** evaluates the existing systems, especially from the viewpoint of the divergence of net pension liabilities. Finally, Section **6** proposes several reform plans on the basis of the discussions in previous sections, and Section **7** gives a summary of all of the arguments.

2. Concepts of net pension liabilities

2.1 Formulation of net pension liabilities

This section summarizes problems related to the handling of net pension liabilities using very simplified overlapping-generations models for two generations and two periods[1]. Let us suppose that generation *i* lives in two periods, the working and retirement periods, and generation *i+1* is still in the working period when generation *i* retires. Generation *i* pays premiums in the amount of P_i, and receives pension benefits in the amount of B_i on retirement. The period when generation i is working is defined as period *i*.

Also, suppose the government owns reserves amounting to A_0 at the end of period 0, the period when generation 0 is working. If the government pledged to pay generation 0 pension benefits amounting to B_0 starting from period 1, its net pension liabilities at the end of period 0, N_0, can be expressed by

$$N_0 = \frac{B_0}{1+r} - A_0, \tag{1}$$

where r is the interest rate, which is supposed to be fixed for each period below to simplify the discussions. Although the government promised generation 0, who had paid premiums, to pay pensions amounting to B_0, the government now has reserves in hand only, and has to procure the amount of the shortfall by some means.

Similarly, the government's net pension liabilities at the end of period 1, expressed as N_1* and estimated by the discounted value at the end of period 0, are given by

$$N_1^* = \frac{B_1}{(1+r)^2} - \frac{A_1}{1+r}. \tag{2}$$

The relation between the reserves at the end of period 0 and those at the end of period 1 is expressed as

$$A_1 = (1+r)A_0 + P_1 - B_0. \tag{3}$$

In addition, by substituting (1) and (2) for (3) we get

$$N_1^* = \left[\frac{B_0}{1+r} + \frac{B_1}{(1+r)^2}\right] - \frac{P_1}{1+r} - A_0.$$

That is, the government pays generation 0 the pledged amount of pension B_0 in period 1 and at the same time promises generation 1 anew to provide benefits in the amount of B_1, whereas the pension funds available for such payments are the premiums collected from generation 1 in period 1 plus the reserves already existing at the end of period 0.

By the same token, the value of the net pension liabilities at the end of period i is given by

$$N_i^* = \sum_{t=0}^{i} \frac{B_t}{(1+r)^{t+1}} - \sum_{t=1}^{i} \frac{P_t}{(1+r)^t} - A_0. \tag{4}$$

As noted, the portion of the sum of pension benefits the government pays by the end of period i and pension benefits it pledges to pay in period i + 1 (first term, right side), which exceeds the sum of total premiums collected by the government by the end of the same period (second term) and the initial reserves (third term), represents the net pension liabilities the government has in period i.

2.2 Net pension liabilities and generational accounts

Now let us take a look at the relation between net pension liabilities and generational accounts. The net pension liabilities at the end of period *i* should be jointly shouldered by generation *i* + 1, which is in the working period in period *i* + 1 and by generation *i* + 2 and subsequent generations. Therefore, the assumed generational account equation can be given by

$$N_i^* = \left[\frac{P_{i+1}}{(1+r)^{i+1}} - \frac{B_{i+1}}{(1+r)^{i+2}}\right] + \sum_{t=1}^{\infty}\left[\frac{P_{i+t+1}}{(1+r)^{i+t+1}} - \frac{B_{i+t+1}}{(1+r)^{i+t+2}}\right],$$

where the first term at the right side shows the net burdens of generation *i* + 1 and the second term, those of generation *i* + 2 and after. If we call generation *i* + 1 the "active generation" at the end of period i, and generation *i* + 2 and after "future generations," the above equation suggests that the active and future generations must share the cost of net pension liabilities. In this sense, the economic interest of the active and future generations has a trade-off relation.

The net pension liabilities at the end of period *i* + 1 are shown by

$$N_{i+1}^* = N_i^* + \left[\frac{B_{i+1}}{(1+r)^{i+2}} - \frac{P_{i+1}}{(1+r)^{i+1}}\right] = \sum_{t=1}^{\infty}\left[\frac{P_{i+t+1}}{(1+r)^{i+t+1}} - \frac{B_{i+t+1}}{(1+r)^{i+t+2}}\right].$$

This equation shows that the portion of the net pension liabilities that have not been borne by the active generation, that is, the portion whose liquidation has been shifted to the responsibility of future generations, becomes the net pension liabilities of the next period. In other words, as long as the government continues to promise each generation the provision of pension benefits in an amount that is greater than the premium payments of the generation, net pension liabilities will continue increasing.

The above discussion shows that an increase in net pension liabilities is closely related to an increase in intergenerational inequalities in public pensions. Avoiding the divergence of net pension liabilities is basically the same as preventing an increase in intergenerational disparities in generational accounts.

3. Methods of avoiding the divergence of net pension liabilities

One of the problems the government should solve is how to avoid the divergence of net pension liabilities, which is expressed by (4). As is evident from this equation, net pension liabilities diverge because the existing pension system has, in the long run, a structure by which the government continues to pay insured amounts of benefits that are greater than the premiums it collects from them (plus the portion of its initial reserve funds withdrawn). Therefore, what is needed is to change the existing structure. Several methods are available, but the following three would be the most basic strategies: funding, full pay-as-you-go, and balanced income and expenditure methods.

3.1 Funding methods

The first option is to introduce a funding method to the pension system – or shift to a funded scheme -- for generation 1 and after[2]. In this case, the premiums and the pension benefits have the same discounted present value for each generation, that is,

$$\frac{B_i}{1+r} = P_i, \ i = 1, 2, \cdots.$$

In addition, (4) can be changed into

$$N_i^* = N_0^* + \sum_{t=1}^{i} \frac{1}{(1+r)^t} \left[\frac{B_t}{1+r} - P_t \right]$$

and the [ ] in the second term of the right side of this equation is zero in the funding method. Hence, in this case, net pension liabilities are fixed at the value at the end of period 0 in terms of discounted present value, that is,

$$N_i^* = N_0.$$

Also, the discounted present value of reserves at the end of period i (assessed at the end of period 0), Ai*, is expressed as

$$A_i^* = \frac{A_i}{(1+r)^i} = \frac{P_i}{(1+r)^i} - N_0 = \frac{B_i}{(1+r)^{i+1}} - N_0. \qquad (5)$$

The reserves the government holds at the end of period *i* are equal to the amount obtained by deducting the initial net pension liabilities from the premiums collected from generation *i* as funds for pension benefits to be provided to the generation after retirement. In the next period, the government has to spend these premiums as benefits for retired generation *i*,

while it receives premiums from the active generation, which will provide pension funds for the generation after the next. And, unless the amount of premiums (or amount of pension benefits) increases at a faster pace than interest rates, the reserves will gradually decrease in terms of discounted present value.

3.2 Full pay-as-you-go method

The second option is to change the pension system into a full pay-as-you-go one in period 1 and after. The term 'full' is used here because the current pay-as-you-go method may have promised to provide benefits that are greater than those which can be supported by premiums (plus state contributions), instead of adopting a textbook-like system where pension income and expenditure are balanced at a point in time[3]. The pay-as-you-go method, in which premiums and benefits agree with each other in each period, can be expressed as:

$$B_{i-1} = P_i, \ \ i = 1, 2, \cdots$$

Since (4) can be rewritten as

$$N_i^* = \frac{B_i}{(1+r)^{i+1}} - A_0 + \sum_{t=1}^{i} \frac{B_{t-1} - P_t}{(1+r)^t},$$

the third term of the right side becomes zero. Therefore, the net pension liabilities in the full pay-as-you-go method are shown by:

$$N_i^* = \frac{B_i}{(1+r)^{i+1}} - A_0. \qquad (6)$$

This equation contrasts with (5) for the funding method. In the full pay-as-you-go method, all the government must pay attention to is the amount of benefits it pledges to provide in the next period, because premiums and benefits agree with each other in each period. The government needs to procure the amount of these benefits less its reserves, but can collect premiums equal to benefits from the active generation in the next period and does not have to withdraw its reserve funds. Instead, it has to worry about the benefits it will provide in the period after the next. Thus, unless the benefits increase at a faster pace than interest rates, the discounted present value of net pension liabilities will not diverge and will rather decline little by little.

In case public pensions are managed by the full pay-as-you-go method, net pension liabilities can be calculated, but are no longer important in the government policy. In fact, there seem to be no cases where other countries record pension liabilities as government debts when preparing their government balance sheets. In addition, if the government switches over to a pension system that would automatically adjust the amount of benefits within the limits of premium income[4], it will distribute only the premium income to the elderly as benefits (but the premium payments of the respective recipients will be reflected on the allotment of benefits), so the concept of pension liabilities will itself become meaningless.

Finally, let us pay attention to the fact that because the amount of premiums and that of benefits agree with each other in each period, the discounted present value of reserves, Ai*, is fixed as

$$A_i^* = A_0.$$

3.3 Balanced income and expenditure method

The third option is to always make the amount of benefits agree with the sum of premiums and yields on investment of reserves. This option is referred to as the "balanced income and expenditure method" below. In this method, the following equation applies to each period:

$$B_{i-1} = P_i + rA_{i-1},\ i = 1, 2, \cdots.$$

Here, because the reserves are fixed at their initial value[5], we get

$$A_i = A_0, \quad A_i^* = \frac{A_0}{(1+r)^i},\ i = 1, 2, \cdots$$

which means that the discounted present value of the reserves gradually decreases. And since the net pension liabilities are expressed as

$$N_i^* = \frac{B_i}{(1+r)^{i+1}} - \frac{A_0}{(1+r)^i},$$

net pension liabilities will not diverge unless the amount of benefits increases at a faster pace than interest rates. This method will also obviate the need to pay attention to net pension liabilities in the policy-making process.

This balanced income and expenditure method may be regarded as a method for withdrawing reserve funds to apply them to part of the pension funds. In other words, if only $rA_{i} - {}_{1}/(1 + r)$ of the reserves available at the beginning of period *i* is withdrawn and operated, and the principal thus obtained is used as pension funds, this will be the same as the balanced income and expenditure method.

In this method, too, if there is a mechanism for automatically adjusting benefits within the limits of premiums and yields on the investment of reserves, the concept of pension liabilities will become substantially meaningless.

4. Evaluation of the three methods

In this section, let us compare the three methods explained in the previous section from four standpoints: (1) redemption of net pension liabilities, (2) possibility of "claim renouncement," (3) rate of return of pensions, and (4) change over time of net pension liabilities and reserves.

4.1 Redemption of net pension liabilities

The first comparator is the redemption of net pension liabilities, which poses the most important problem in the case of a switchover to the funding method. In this case, the portion of pension benefits promised to generation 0 that cannot be covered by reserves will manifest itself as net pension liabilities to be redeemed. This is often referred to as the problem of so-called "double burdens."

As means to redeem these net pension liabilities, two methods have been studied so far: (a) to make generation 1 and subsequent generations to shoulder the liabilities as additional premiums and/or taxes, and (b) to cover the liabilities by issuing government bonds, redeeming those bonds and paying interest on them in subsequent years. However, both methods cannot avoid laying additional burdens on generation 1 and subsequent generations, and the size of the burdens agrees with the amount of the already existing net pension liabilities[6].

By contrast, with the full pay-as-you-go and balanced income and expenditure

methods, there is little need to pay any particular attention to net pension liabilities. This is because the benefits pledged to each generation will be fully provided when they retire. In case the amount of benefits is automatically adjusted within the limits of premiums and state contributions, it is possible to consider that no pension liabilities arise themselves.

Two things should be mentioned here. First, even if the government switches over to the funding method, it does not always need to redeem its net pension liabilities immediately. t may instead make only avoiding an increase of liabilities its policy target for the time being. This resembles the strategy of attaining the primary balance first and avoiding rises in the discounted present value of government debts, instead of aiming at reducing such debts at once.

Second, net pension liabilities are now off-balance sheet liabilities not listed on the government balance sheet, and there is a problem of which of two methods should be adopted: explicitly redeem the liabilities as on-balance sheet ones by recording them on the balance sheet, or implicitly redeem them as off-balance sheet ones. In case the pension system is changed to the funding method, there will arise the need to turn existing net pension liabilities into on-balance sheet ones. In such a case, the on-balance sheet liabilities should be listed as national debt, which will pose another problem: whether the national debt should be made marketable or not. In the case of the full pay-as-you-go and balanced income and expenditure methods, there will be no need to make net pension liabilities on-balance sheet ones.

4.2 Possibility of "claim renunciation"

In carrying out a pension reform program, an important problem is whether the government should fully provide the pension benefits it promised to generation 0. We can consider the method by which the government cancels part of its pledge and asks generation 0 to give up some portion of the benefits it has promised to provide to them (this means partial "claim renunciation" to the generation). If generation 0 is given favorable treatment in terms of pension rate of return under the current system, this strategy might be acceptable at least from the viewpoint of intergenerational equity.

In the case of the funding method, however, claim renunciation by generation 0 is

very difficult. In case the funding method is introduced in period 1 and after, if generation 1 and subsequent generations pay premiums only to secure their own pension benefits, funds for benefits for generation 0 must be raised from sources other than premiums. Conversely, if the government wants to limit claim renunciation by generation 0 to a small scale, it has to ask generation 1 and subsequent generations to pay additional premiums.

In the case of the full pay-as-you-go and balanced income and expenditure methods, however, partial claim renunciation by generation 0 becomes more realistic. With these methods, it is possible to adopt the management strategy of automatically adjusting the amount of benefits by premium income from the active generation (plus yields on the investment of reserves in the case of the balanced income and expenditure method) in period 1 and after. In this case, we can employ the method of determining the amount of benefits for generation 0 by this strategy, too, asking the generation to give up only the deficiencies. In case adequate premium income from the active generation can still be expected to some extent or in case there is a substantial yield on investments of reserves, claim renunciation, which this strategy forces generation 0 to accept, can be controlled to a smaller amount.

How then can the size of claim renunciation be expressed? Let us suppose pension management where pension benefits at each period are automatically adjusted to an amount within the limits of premium income for the full pay-as-you-go method, and within the limits of premium income plus yields on investments of reserves for the balanced income and expenditure method. In each case, the size of the claim renunciation by generation 0 can be shown as follows:

The full pay-as-you-go method: $\frac{B_0}{1+r} - \frac{P_1}{1+r}$

The balanced income and expenditure method: $\frac{B_0}{1+r} - \left(\frac{P_1}{1+r} + \frac{rA_0}{1+r} \right)$.

Needless to say, to carry out claim renunciation, there is also the need to solve a problem related to property rights, that is, partial cutback on already determined pensions. Compared to a shift to the funding method, however, claim renunciation will be easier with a changeover to these two methods.

If no claim renunciation is approved for generation 0, that portion of benefits will be added to net pension liabilities. If generation 1 and subsequent generations pay additional premiums to make up for the portion added, the increase in net pension liabilities will be checked. Also, in case generation 1 and subsequent generations do not make up for the portion and the government issues bonds and continues to refund existing bonds, an increase in net pension liabilities can be avoided in terms of discounted present value. Another possible alternative is to withdraw reserves. In this case, however, future generations will be unable to use yields on the investment of the withdrawn part of the reserves.

4.3 Rate of return of pensions

The third comparator is the rate of return of pensions. To make comparison easier, suppose that premiums are collected in proportion to wages (the premium rate is fixed). In this case, the increase rate of premium income is equal to that of wage income (sum of per capita wage hike and population growth rates; shown by ρ).

First, what is the rate of return at the completion stage of the system? With the funding method, it is evident that the rate of return equals interest rate, *r*, regardless of the increase rate of wage income. With the full pay-as-you-go method, the rate of return equals the increase rate of wage income ρ. In a situation of low birth rates and aging population, this method is likely to be inferior to the funding method in terms of rate of return. The rate of return of the balanced income and expenditure method is not constant, because it is affected by the income and expenditure of pension finance in each period. Suppose the rate of return for generation *i* is μ_i, then we get

$$m_i = \frac{B_i}{P_i} - 1 = \frac{P_{i+1} + rA_0}{P_i} - 1 = r + \frac{rA_0}{P_i}.$$

Thus, it is evident that this method has a higher rate of return than that of the full pay-as-you-go method. Also, since

$$m_i - r = r + \frac{r(A_0 - P_i)}{P_i},$$

the possibility cannot be theoretically denied that this method has a higher rate of return

than the funding method, too, especially in the case where the initial reserves are large enough relative to premiums in each period, and also the increase rate of wage income does not show a large negative value. This means that a shift to the balanced income and expenditure method should preferably be made while reserves are abundantly available.

We should note that if the premium rate is lowered and the scale of public pensions is reduced, the full pay-as-you-go and balanced income and expenditure methods will have substantially the same effects as a change to the funding method. This is because people will be able to operate, at the current interest rate, part of their income that will become available as a result of the reduction in the scale of public pensions.

Next, what will be the rate of return during the transition period of the pension system? In the case of a shift to the funding method, the rate will differ greatly according to how we deal with net pension liabilities. The more generation 1 and subsequent generations are caused to bear the liabilities, the lower the rate for these generations will be. In the case of a changeover to the full pay-as-you-go method or to the balanced income and expenditure method, if the amount of benefits is automatically adjusted, the rate of return will be determined by either ρ (for the full pay-as-you-go method) or μ_i (for the balanced income and expenditure method) for all generations. But, this does not apply if the government has already promised generation 0 to provide an amount of benefits in which the rate of return would exceed ρ and provides benefits according to its promise.

4.4 Change over time of net pension liabilities and reserves

The final comparator is how net pension liabilities and reserves change over time. If premiums and benefits do not increase faster than interest rates, the liabilities and reserves could both avoid diversion and will finally converge as expressed as

Funding method: $N_i^* = N_0,\ \lim_{i\to\infty} A_i^* = -N_0, \lim_{i\to\infty}\left(N_i^* + A_i^*\right) = 0,$

Full pay-as-you-go method:

$$\lim_{i\to\infty} N_i^* = -A_0,\ A_i^* = A_0, \lim_{i\to\infty}\left(N_i^* + A_i^*\right) = 0,$$

Balanced income and expenditure method:

$$\lim_{i\to\infty} N_i^* = 0,\ \lim_{i\to\infty} A_i^* = 0, \lim_{i\to\infty}\left(N_i^* + A_i^*\right) = 0.$$

In all cases, the liabilities and the reserves will offset each other in the long run, but the process will be different. With the funding method, net pension liabilities are fixed at their initial amount and reserves gradually decrease and converge to the value with a sign that is opposite to the sign of the liabilities. The liabilities are the amount obtained by deducting the premiums received so far by the government and reserves from the benefits pledged by the government; if benefits and premiums come to be roughly balanced in the long run in terms of discounted present value, net pension liabilities and reserves begin to offset each other. In the case of the balanced income and expenditure method, both net pension liabilities and reserves will ultimately converge on zero.

5. Evaluation of the current pension systems

5.1 Outlook for income and expenditure

The "Government Balance Sheet" for 2000 (draft proposal) published by the Ministry of Finance in September 2002 provides information on the net pension liabilities of the Employees' Pension Insurance (EPI) at the end of 2000. According to this publication, the "benefits cost corresponding to the past period" of the EPI amounts to 695 trillion yen. Of this amount, 143 trillion yen is reserves, that is, the portion supported by pension funds, while the remaining 552 trillion yen is composed of EPI's net pension liabilities. These liabilities (552 trillion yen) can also be divided into (1) state contributions (97 trillion yen), which to be borne by people in the future as taxes, and (2) additional premium income (455 trillion yen), which to be covered by future raises in the premium rate. Here state contributions are supposed to cover one-third of the Basic pension benefits.

The problem is whether or not the liabilities will continue to increase and place burdens on future generations. It is, however, no easy task to forecast the future of net pension liabilities, because it requires the calculation of premiums to be paid by each generation at each period and of the pension liabilities that would arise according to the premiums to be actually paid.

According to the "Actuarial Revaluation" published by the Ministry of Health, Labor and Welfare in 1999, the EPI's income and expenditure is expected to be basically in the black for 50 to 60 years (see Figure 1 below). If this outlook is correct, an increase in net pension liabilities will be avoided. Intergenerational inequalities seen from generation accounts will not increase further.

However, the "Actuarial Revaluation" is based on the former “median” population projection published in 1997, which showed that the total fertility rate would recover to 1.61 by 2050 (from the 1.33 in 2001). The new “median” population projection announced in 2002 states that the fertility rate would rise to only 1.39 by 2050, which means that to maintain pension benefits at the current level, substantial raises in the premium rate will be needed[7]. Conversely, this indicates that the benefits level established by the 2000 reform is unfeasible, considering the dynamics of population and other factors.

This fact can also be confirmed by replacing the assumptions of pension finance used in the 2000 reform with more realistic ones, and by examining changes in pension income and expenditure. Here, the following three factors should be taken into consideration. The first and most important factor is population estimates, as mentioned above. Here, we use the new median estimate of population published in 2002. The second factor is the estimate of yields on investment, which was set at 4% in the 2000 reform. This figure seems to be a little unrealistic considering the low interest rates in recent years. Thus, we lower the yields on investment to 2.5%. However, if it is supposed that interest rates fall due to disinflation, the rates of wage and price hikes will also drop to 1% and 0%, respectively. Thus, lower yields on investment are unlikely to have very adverse effects on pension finance.

The third factor is the initial value of reserves. The reserves recorded in the actuarial revaluation include the "substitutional part" (*Daiko Bubun*) of the Pension Fund Association, and were 177.2 trillion yen at the end of 1999. However, because of the slower growth in premium income and the worsening fund operation environment due to recessions, the actual amount of reserves at that time was only 163 trillion yen (of which 28.2 trillion yen was substitutional). The lower the initial value is, the lower is the expected yield on investment.

Figures 1 and 2 shows how the estimate in the 2000 reform are affected if the above three assumptions are changed simultaneously, in terms of the fiscal positions and reserves. In the 2000 reform, the fiscal balance is expected to remain generally in surplus, although it will temporarily suffer deficits around 2050 (Figure 1). However, when more realistic assumptions are used, the balance is in the black around the first peak years of population aging, but is in deficit before and after these years, and will consistently remain in the red after the surplus period. The 2000 reform expected that reserve ratios would reach stability at about three times around 2060, but a more realistic estimate shows that the ratios will become about zero around that year, reflecting worsening flow-base income and expenditure.

As stated above, if the assumptions used in the actuarial revaluation are replaced with more realistic ones, the reserves will run out by 2060, which means that no provision for the government's liability to provide benefits will be available in that year (Figure 2) [8]. Although no direct estimate of future net pension liabilities is made here, the above discussion clearly suggests that the 2000 reform has very serious problems from the standpoint of controlling any increase in liabilities.

5.2 Level of pension benefits that can be maintained by the 2000 reform

Now, let us change our point of view and roughly estimate the level of pension benefits that can be maintained without difficulty by the 2000 reform. The following two methods are available for this purpose. First, we can suppose that benefits for each year are provided within the limits of the premium income obtained by the planned raises in the premium rate, which are assumed in the 2000 reform, plus state contributions (which are supposed to cover one-third of the Basic Pension benefits), and examine to what extent the amount of benefits should be reduced (Case I). This means that we assess to what extent problems will arise if the full pay-as-you-go method, which supposes the automatic adjustment of benefits, is introduced.

Second, we can suppose that benefits for each year are provided by yields on investment of reserves in addition to premium income and state contributions, while adopting the plan to increase the premium rate scheduled in the 2000 reform (Case II). In

this case, we examine to what extent benefits should be adjusted when the balanced income and expenditure method, which supposes automatic benefits adjustment, is adopted.

Figure 3 shows the cutback in benefits needed to maintain the existing pension system in Cases I and II. In Case I, where benefits provision relies only on premium income and state contributions, the necessary reduction rate of benefits will be about 10% until about 2020, and will decrease a little around 2025, when population aging is expected to reach the first peak, but will rise again to 20% or so by around 2040. As is evident from this, if benefits are provided only from premium income and state contributions as assumed by the existing system, it is expected at present that a substantial cutback in benefits will be needed for younger generations.

In Case II, where yields on investment of reserves are also used for the provision of benefits, the reduction in benefits required is considerably smaller. In particular, around 2025, it will be possible to increase benefits by about 5%. However, as in Case I, there will arise the need to slash benefits after that.

Cases I and II both suggest that the government will become unable to pay the amount of benefits it has pledged to the people, mainly because the 2000 reform overestimated future birth rates. This shows the possibility that net pension liabilities will continue increasing in the long run, which is consistent with the discussion in the previous section. If benefits are paid according to the assumptions of the 2000 reform and the premium rate is not raised, the burdens of net pension liabilities will be passed onto future generations.

Moreover, if the amount of benefits is cut back, as in Cases I and II, in an effort to avoid an increase in net pension liabilities, intergenerational disparities are likely to increase further. The 2000 reform supposes that the premium rate will be raised from 13.58% at present to 21.6% on a total remuneration basis. If benefits have to be substantially reduced at the same time, the lifetime pension rate of return will be substantially lower.

6. Pension reform plans

6.1 Basic principles

What kind of pension reform plans then can we consider to avoid a further increase in net pension liabilities and to correct intergenerational inequalities? Three theoretical methods are available.

The first method is a changeover to the funding method, or the total or partial abolition of public pensions, which would have similar effects to such a changeover. If the current system is replaced by a funded one, no new net pension liabilities will arise after that. However, the problem is how to deal with the existing liabilities. For example, if the government plans to switch over to a full funding method, it will have to take immediate measures to prepare pension funds amounting to about 30 trillion yen a year. It may cope with this by withdrawing its reserves for some time, but the amount available is far from meeting the needs. One possible strategy is to ask the retired generation to accept a partial cutback in benefits, but the cutback will have no meaning unless it is large, because no pension funds are available, and it will be impossible to make such a large cut in benefits.

The second method is a shift to the full pay-as-you-go method, in which the amount of benefits is automatically adjusted within the limits of premium income and state contributions, without determining the amount of benefits in advance. In this case, a benefits obligation arises formally, but can be controlled well by the government because it can always collect premiums in the same amount as that of the obligation. However, the past premium payment performance of the insured will not be fully reflected on the amount of benefits they receive. In this sense, this method asks the people to make a partial claim renunciation. But, as noted in the previous section, the adjustment in this method will be less than in a changeover to the funding method. Because the sum of premiums and state contributions always agrees with the amount of benefits, reserves will continue increasing in nominal value, but will remain at the initial level in terms of discounted present value.

The third method is a changeover to the balanced income and expenditure method. As in the second method, the amount of benefits is automatically adjusted so that it may become equal to the total revenues, that is, the sum of premium income and state contributions plus yields on investment of reserves. Here, the reduction in benefits is controlled by the amount of yields on investment. In this case, too, the benefits obligation

will be fulfilled successively, and net pension liabilities will not increase. Reserves will be fixed at the initial value in nominal terms and will decline in discounted present value.

All three methods have the effect of checking the diversion of net pension liabilities, but also have advantages and disadvantages. From the viewpoint of transitional measures, the second and third methods ask the retired generation to accept cuts in benefits, but will be easier to introduce than the first method, which will require the immediate redemption of huge liabilities or the issuance of government bonds. In terms of pension rate of return, however, younger generations (who do not face the "double burdens" problem) should prefer the first method.

To make the most of these methods and minimize their defects as much as possible, we have no alternative but to find a compromise plan. More specifically, we can consider the strategy by which the system is based on either the full pay-as-you-go method or the balanced income and expenditure method, where the amount of benefits is automatically adjusted so that it may equal total revenues, that is, the sum of premiums and state contributions plus, where appropriate, yields on investment of reserves, and the scale of public pensions is reduced by lowering the premium rate as much as possible.

6.2 Eight reform plans

Now let us examine eight plans to reform the pension system (see Table 1). Case A adopts the full pay-as-you-go method with automatic benefits adjustment, and raises the premium rate gradually up to 20% (13.58% at present on an annual remuneration basis, which is equivalent to 17.35% on a monthly remuneration basis; total of employers' and employees' shares), with the rate fixed at 20% thereafter. The schedule supposed in the 2000 reform is used for these raises. The premium rate reaches 20% at around 2020, and is fixed at this level after that.

Case B is the same as Case A as to automatic benefits adjustment and the 20% ceiling on premium rate increases, but adopts the balanced income and expenditure method, which also uses yields on investment of reserves, instead of the full pay-as-you-go method. Compared to Case A, the cuts in benefits will be much smaller.

Case C adopts an automatic benefits adjustment and the full pay-as-you-go

method as in Case A, but fixes the premium rate at the current level of 13.58%.

Case D resembles Case C in terms of automatic benefits adjustment and the fixed premium rate of 13.58%, but adopts the balanced income and expenditure method.

All four cases do not provide benefits above the level assumed by the existing system. In other words, should revenues exceed such a level, the surplus is carried forward to the next year (it is added to the reserves). In addition, all of the cases include controls on the premium rate, and so reduce the scale of public pensions to that extent. In this sense, these cases have the common feature of shifting to the funding method, and this will be more obvious in Cases C and D than in Cases A and B.

The four cases mentioned above do not withdraw any reserves. In Cases A and B, reserves continue to yield interest, but none of this interest is utilized for benefits provision. Cases C and D do use the interest on reserves for providing benefits, but aim at permanently holding reserves (at a fixed level in nominal terms). Here, let us adopt a mechanism for withdrawing reserves in each case. More specifically, take out 3% of the reserves at the end of the previous year and apply the amount to the provision of benefits. We name these cases corresponding to the above four cases Case A', Case B', Case C', and Case D', respectively. All of these cases only offer the amount of benefits assumed by the current system and surpluses, if any, are carried forward to the following year.

6.3 Effects of reform (1): reduction rate of benefits and change in reserves

Now let us examine the effects of each case. The first factor for examination is cutbacks in benefits (see Figure 4). Let us begin with comparing Cases A to D, where no reserves are withdrawn (see Figure 4, (1)). In Case A, where the ceiling of premium rate is fixed at 20%, the reduction in benefits is the same as that in Case I until around 2020, but it grows larger after that and ultimately reaches about 25%. Because the amount of premiums is controlled, the benefits to be provided are naturally restrained, too. In Case B, because yields on investments of reserves are available, a cutback in benefits is checked to some extent, and finally rises to about 20%.

As already discussed for Cases I and II, the adjustments until around 2020 pose a problem. In Case A, the amount of benefits should be reduced from about 10% to nearly

15%. In Case B, where yields on investment can be utilized, the reduction rate can be controlled to about 0-5%. Compared to Case II, however, an increase in benefits, which is possible in Case II, is almost unfeasible in Case B, partly because the latter supposes no raises in premiums around 2020 and after.

What is the situation in Cases C and D where the premium rate is fixed at the current rate of 13.58%? Naturally, the amount of benefits supposed by the current system must be cut back substantially. In Case C, which depends on premium income and state contributions only for pension funds, the ultimate reduction rate of benefits is about 45%. In Case D, which also uses yields on investment, the rate increases to nearly 40%. For future generations, tight controls both on premiums and benefits mean a shrinkage in the scale of public pensions.

Next let us have a look at Cases A' to D', where reserves are withdrawn by 3% each year (see Figure 4, (2)). In Cases A' and B', which fix the ceiling of premium rates at 20%, there is no need to cut back benefits until around 2040. This shows up the effect of taking out reserves. Those who have already received or will soon receive benefits would welcome this. The need to slash benefits begins to arise around 2040, but the ultimate reduction rate is 20% or so both in Cases A' and B'.

In Cases C' and D', where the premium rate is fixed at 13.58%, the present level of benefits can be kept by taking out reserves only until around 2010. This suggests that the procurement of pension funds will become difficult as a result of restraints on premium income. This will be a more serious problem with a shift to the funding method.

The second factor for consideration is the outlook for reserves (in discounted present values). Figure 5 shows that the outlook differs greatly according to the reform plan. As shown in Figure 3 above, the 2000 reform will drain reserves by around 2060 if the assumptions are replaced with more realistic ones. However, in Cases A and C, which introduce the full pay-as-you-go method, income and expenditure always equal yields on investment of reserves because the amount of benefits always agrees with the sum of premiums and state contributions. Reserves continue increasing in nominal terms, but are fixed at the initial level in terms of discounted present value. In Cases B and D, where the balanced income and expenditure method is adopted, yields on investment are added to

benefits provision, so reserves are fixed at the initial value in nominal terms, but gradually decrease in discounted present value. As of 2060, there will remain about 40 trillion yen of reserves (in discounted present value), or about 23% of the 1999 level.

By contrast, in Cases A' to D' where reserves are taken out, reserves naturally decrease more quickly. However, as in Cases B and D, the pace of decline is stable in contrast with the non-convergent decrease expected under the current system as shown in Figure 2.

6.4 Effects of reform (2): effects by generation

Next, let us examine what effects the eight reform plans would have on each generation. Here, we define the amount obtained by deducting lifetime premiums paid from lifetime benefits received, which is expressed as a ratio to lifetime wage income, as "net pension benefits ratio." And, we investigate the level of the net pension benefits ratio and changes in the ratio due to reform in the case of average married couples, where the husband works according to the average wage profile and the wife, who is two years younger, is a full-time homemaker, and in the case of unmarried single workers who similarly work according to the average wage profile[9].

The estimate results are summarized in Table 2 and Figure 6. What we can point out from these data first is that even in the 2000 reform, there are great intergenerational inequalities. The net pension benefits ratio is 32.9% for couples of the generation born in 1930, but is minus 14.3% for those of the generation born in 2010. The ratios for unmarried single workers are lower than those for couples, because they cannot receive the benefit of non-working dependent spouses, who are not obliged to pay any premiums in the current system. Both for couples and unmarried workers, however, we can realize that the current system has serious problems regarding intergenerational equity.

What are the results of Cases A and B? In both cases, no significant reduction in disparities can be observed. In Case A, the net pension benefits ratio is lower both for elderly and future generations. While cutbacks in benefits affect the former generation, the fact that the premium rates are not substantially lower relative to the present level has an adverse effect on the latter generation. In Case B, where the use of yields on the

investment of reserves can also be expected, the results are not very favorable, although they are not so bad as in Case A, except for some increases in the ratio for those of the generation born in the 2010s.

Cases C and D, where the premium rate is set at the current level of 13.58%, ask the elderly generation, who enjoy advantages under the current system, to bear additional burdens, but substantially reduce the burdens on future generations. In particular, Case D demands a slightly smaller sacrifice by the elderly generation, and also reduces the burdens on future generation more than in Case C. This is because in Case D, as shown in Figure 4 above, the reduction in benefits is smaller than in Case C, because yields on investment of reserves are added to pension funds.

What are the results of Cases A' to D', where reserves are withdrawn? In all four cases, no great differences are observed for young generations compared to the cases where no reserves are taken out. In Cases B' and C', where account is taken of the withdrawals of reserves, young generations are less fortunate to the extent that they cannot expect yields on investments of reserves compared to Cases B and C, which assume the use of such yields.

On the other hand, additional burdens of the reform on the elderly generation are lessened thanks to withdrawals of reserves. This trend is especially remarkable in Cases A' and C', which adopt the full pay-as-you-go method and do not rely on yields on investments of reserves. This is because taking out reserves controls any increases in the cutbacks in benefits resulting from fixed premium rates.

7. Conclusion

The current public pension system promises the people to provide benefits that are more than the burdens they can bear without difficulty. As a result, it shifts the burdens onto future generations. This means that net pension liabilities, the portion of pension liabilities supported by no cash funds, continue increasing, and that intergenerational inequalities continue to increase.

This paper examines the pension systems that could prevent an increase in net

pension liabilities and correct intergenerational inequalities, and would also be easier for people to understand. The direction of pension reforms proposed by this paper is to keep the amount of benefits within premiums and state contributions plus yields on investment of reserves, where appropriate, and to minimize the level of premium rates. This kind of reform would have substantially the same impact as a changeover to the funding method.

Needless to say, it will be no easy task to carry out this type of reform. This is mainly because the government has to ask the generation that is already receiving benefits and the generation that has paid premiums to accept partial cutbacks in the benefits it has pledged to offer, which is a politically unacceptable measure. One possible method for coping with this problem is to withdraw reserves, which now exceed 100 trillion yen. However, taking out the reserves means a diminishing the possibility of future generations using the reserves and their yields on investments.

Any institutional reform that could achieve a simultaneous increase in economic benefits for all generations is a theoretical impossibility. Unless we can overcome such intergenerational conflicts of interest, we will be unable to go ahead with pension system reform. A politically acceptable reform does not attempt to solve the important problem of these conflicts of interest and maintain benefits at the current level, thereby passing the burdens of dealing with insufficient pension funds onto future generations. However, this sort of reform will only make the problems in the existing pension system more serious.

The government-managed pension system also plays an important role in intergenerational support, and should not be evaluated only from a generation account standpoint. However, we cannot approve of the current pension system because of this. Since the system raises a serious question about intergenerational conflicts of interest, the government should positively disclose its outlook for pension finance, mainly net pension liabilities, as well as information about intergenerational inequalities to provide us with data for objective discussions on better public pensions.

Notes:

1. The discussion here is based on Oshio (2002).
2. For problems related to a shift to the funding method, see the detailed analysis of Hatta and Oguchi (2000).
3. In fact, we can also consider the modified funding method, by which more premiums than benefits are provided initially, and are collected and reserved to lessen the burdens on future generations. This is an intermediate method between the funding method and the full pay-as-you-go method referred to above. The public pensions in Japan are regarded as belonging to the modified funding method, but it is doubtful that premium income (and state contributions), including reserves, is at a level that can cover benefits adequately. This problem is discussed in Section 5.
4. This kind of automatic benefits adjustment mechanism has been adopted by the pension system in Sweden. For an economic evaluation of the Swedish method, see Takayama (2002), the Cabinet Office (2002), etc.
5. Note that yields on investments of reserves are also fixed at rA_0 if the interest rate is constant.
6. This situation is often referred to as the "equivalence proposition."
7. According to the "Effects of the New Population Estimate on the Finance of the Employees' Pension and National Pension" published by the Ministry of Health, Labor and Welfare in May 2002, the ultimate premium rate of the Employees' Pension Insurance should be raised to 24.8% based on the new population estimate, compared to 21.6% based on the former population estimate (both cases assume state contributions for the basic pension are one-third of benefits).
8. However, a change to a lower-level estimate also works to reduce the benefits liabilities of future generations. This effect is not analyzed here.
9. The assumptions about average couples are as follows: the wife was an office worker for six years before her marriage, and the husband has been an office worker since he was 20 years of age. He married at 28 and reached the age limit at 60. The wife was born two years after her husband, and was insured under Employees' Pension Insurance during the six years she worked before marriage. After her marriage, the wife became a full-time homemaker or

Category 3 insured person of the EPI. She was 58 when her husband retired at 60, and so paid premiums for National Pension Insurance for two years. Both husband and wife died after the average life span, i.e., at 79 and 86, respectively. The wife was two years younger than the husband and so received a survivor's pension for nine years when she lived alone.

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