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14 The Net Pension Debt of the Japanese Government

Tatsuo Hatta and Noriyoshi Oguchi

14.1 Introduction

A public pension system can be viewed as an arrangement by which the government issues IOUs to the currently working population, promising that a specified amount of benefits will be paid out in the future, in return for pension contributions. Under this system, the government accumulates a “pension debt” to the private sector. However, the balance of the existing pension fund represents the government’s loans to the private sector. Thus, the difference between the pension debt and the balance of the pension fund represents the net government debt to the private sector stemming from the pension system, hereafter called the “net pension debt.”

The imaginary pension fund that would exist if a pension system had been started as a fully funded system is called the “full fund” of the pension system. The balance of the full fund is always equal to the pension debt of the government. Hence, we have

$$(1) \quad \text{Net pension debt} = \text{Full fund} - \text{Actual pension fund.}$$

||
(Pension debt)

If a pension system were fully funded, the balance of the pension fund and the pension debt would be equal, and the net pension debt would be zero. In

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1990, however, the net pension debt of the Japanese government exceeded the gross national product (GNP). In other words, the pension debt was much larger than the balance of the pension fund. This difference was distributed to the following two groups: current and past retirees, whose benefits exceeded their contributions, and those current workers who had been promised benefits greater than their past contributions. In other words, the net pension debt has been caused by the government's overcommitment in the past.¹

If the net pension debt continues to expand, the pension fund will eventually be bankrupt. However, even if the balance of the pension fund becomes negative temporarily, the public pension system will be financially healthy as long as a permanent expansion of the net pension debt is prevented.

In this paper, we estimate the net pension debt of the Japanese government that existed in 1990 and predict its future fluctuations under the contribution and benefit schedules set by the government's 1994 Pension Reform Plan.² This analysis will reveal the following:

1. The net pension debt in 1990 was 578 trillion yen, 137 percent of the GDP for that year.³
2. The net pension debt will grow until the year 2045 then start to decline and become zero in the year 2090 (see fig. 14.4 below).
3. The "excess fiscal burden" for the pension system—that is, the fiscal burden that exceeds the actuarially fair contributions—will be spread unevenly over years, peaking at 3.0 percent of GDP in the year 2020 and dropping to less than 1 percent after the year 2080 (see fig. 14.5 below).

These findings show that the most serious problem of the Japanese pension system is not its financial health, but the uneven distribution of the excess fiscal burden across generations.

The paper also considers the effects of the Pension Reform Plan, which maintains the excess fiscal burden at 1 percent of GDP throughout the forecasted period. We show that this reform not only will make the intergenerational distribution of the excess burden uniform but also will give a sufficient fiscal infusion to make the system fully funded in the year 2155.

Section 14.2 explains the various concepts used in the estimation of the net

1. Under a pure pay-as-you-go system, there is no accumulation of the pension fund, and hence the pension debt itself is equal to the net pension debt. The debt is mainly caused by the fact that the first generation of the pension system received benefits without paying any contributions.

2. The estimates given in the present paper differ from those given in Hatta and Oguchi (1993). First, we include the Public Sector Employee Pension in our estimation. Second, our estimates here are based on the benefit and contribution schedule of the government's 1994 Pension Reform Plan, while the estimates in the 1993 paper were based on the schedule of the 1986 Fiscal Reappraisal. Third, the estimates in the present paper are based on 1991 population projections by the Ministry of Welfare, while the estimates in the 1993 paper were based on 1986 population projections. A detailed explanation of the differences between the two estimates is available on request.

3. This value is fairly close to Oshima's (1981) back-of-the-envelope estimate of 460 trillion yen. Note, however, that Oshima's estimate was for 1981 and that the pension system was restructured in 1986.

pension debt. Section 14.3 presents the estimated values of the net pension debts for each of the Japanese public pension systems. Section 14.4 discusses how the net pension debt will grow in the future. Section 14.5 focuses on the excess fiscal burden as a determinant of the growth of the net pension debt. Section 14.6 discusses the economic impacts of the Pension Reform Plan, which maintains the excess fiscal burden at 1 percent of GDP. Section 14.7 runs a few sensitivity analyses, and section 14.8 contains some concluding remarks. The appendix discusses the meaning of the net pension debt.

14.2 Estimation Method of the Net Pension Debt

To calculate the net pension debt at a given point in time, the full fund must be known. The full fund is the sum of the pension debts to all living generations. We first discuss the procedure for estimating the pension debt to the working generations. In section 14.2.4 we discuss the debt to retired generations.

14.2.1 Lifetime Pension Contribution

The sum of the present values of the contributions a person made in the past is called the “past contribution.” The sum of the present values of his or her expected contributions is called the “future contribution.” The sum of the past contribution and the future contribution is called the “lifetime contribution.” Thus,

$$(2) \quad \text{Lifetime contribution} = \text{Past contribution} + \text{Future contribution.}$$

A person’s lifetime contribution is the present value of the pension contributions to be paid throughout his or her lifetime. The person’s past and future contribution profiles can be estimated based on his or her wage profile.

14.2.2 Pension Wealth

We define an individual’s “lifetime benefit” as the present value of his or her expected benefits under the present pension system from the beginning of retirement to the end of his or her life. This is shown by the fine dashed line in figure 14.1. If a pension system is fully funded, the lifetime benefit should be the same as the lifetime contribution as calculated above. Under a pension system that is not fully funded, these two values are not the same.

We define the “pension wealth” of an individual as the present value of his or her expected benefits from a given moment in time to the end of his or her life. This is shown by the heavy dotted line in figure 14.1. For a person who is still working, pension wealth is equal to lifetime benefit, as figure 14.1 shows.

14.2.3 Promised Benefit and To-Be-Earned Benefit

We divide pension wealth into two parts: the portion corresponding to the past contribution and the portion corresponding to the future contribution. The

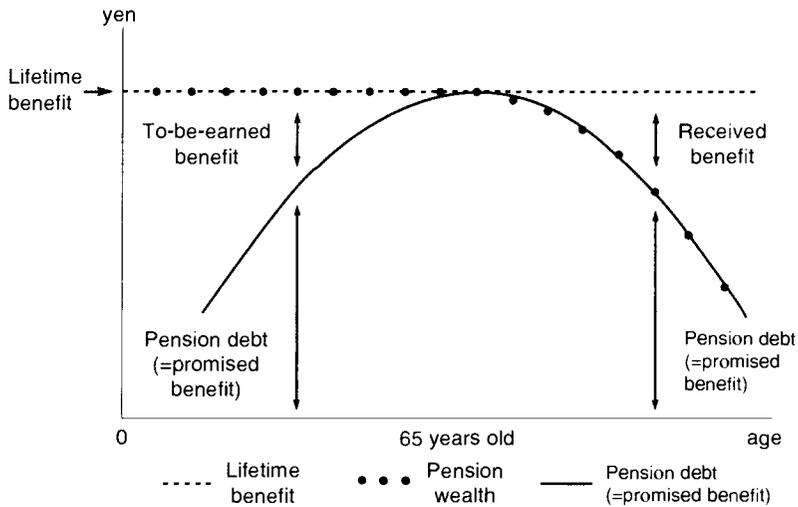


Fig. 14.1 Lifetime benefit, pension wealth, and pension debt

former is called the “promised benefit,” and the latter the “to-be-earned benefit.” Thus,

$$(3) \quad \text{Pension wealth} = \text{Promised benefit} + \text{To-be-earned benefit.}$$

$$\qquad \qquad \qquad \parallel$$

$$\qquad \qquad \qquad (\text{Pension debt})$$

The solid line in figure 14.1 depicts the promised benefit. The to-be-earned benefit is shown as the vertical distance between pension wealth and promised benefit. It is positive only for people under age 65.

In practice, there are various ways of calculating the promised benefit and the to-be-earned benefit. In this paper, we simply divide pension wealth in proportion to the two terms in equation (2) to obtain the estimates of the two terms in equation (3).⁴

If a pension system is fully funded, the promised benefit in equation (3) must be equal to the past contribution in equation (2). Everybody must have accumulated contributions exactly equal to the promised benefit.

If a system is not fully funded, these two terms are not necessarily the same. For example, the promised benefit exceeds the past contribution for a person older than age 50 in the Japanese Private Sector Employee Pension. This person receives a net transfer of income from the government based on his or her past contribution. For a person under 30 years of age, the promised benefit is

4. This implies that the following holds:

$$\text{Lifetime contribution} : \text{Pension wealth} = \text{Past contribution} : \text{Promised benefit.}$$

Table 14.1 Division of Pension Wealth of Working Generations

Pension Wealth (present value of benefits to be received)			
Promised Benefit = Pension Debt (present value of benefit attributable to the past contribution)		To-Be-Earned Benefit (present value of benefit attributable to the future contribution)	
Past Contribution	1. Transfer on the Past Contribution	Future Contribution	2. Transfer on the Future Contribution

less than the past contribution (see, e.g., Takayama 1981; Oguchi, Kimura, and Hatta 1993).

The second line of table 14.1 shows the decomposition of pension wealth by equation (3), and the bottom line shows the decomposition by equation (2). The difference between the first terms on the right-hand sides of equations (2) and (3) is the transfer income one receives from the government based on one's past contribution. This is represented by item 1. The difference between the second terms of those equations is the transfer income based on one's future contribution. This is represented by item 2. If the future contribution is larger than the to-be-earned benefit, item 2 becomes negative; its absolute value is called the "excess contribution."

14.2.4 Pension Wealth of Retired Generations

Pension wealth represents the present value of expected future benefits. For retired generations, the annual benefit is already determined. Therefore, pension wealth is simply the properly discounted product of the annual benefit and the expected number of years retirees will receive this benefit.

Regardless of a person's age, the following equation holds true:

$$(4) \quad \text{Lifetime benefit} = \text{Received benefit} + \text{Pension wealth.}$$

The received benefit is the present value of the benefit received in the past. For working generations, the received benefit is nil and pension wealth is the lifetime benefit. For retired generations, pension wealth is less than the lifetime benefit. This relationship is shown in figure 14.1.⁵

For the retired generations, the to-be-earned benefit in equation (3) is nil, and hence pension wealth is equal to the promised benefit.

5. For working generations, the following inequality holds: Lifetime benefit > Pension debt. The lifetime benefit is necessarily equal to pension wealth, and as table 14.1 shows, pension wealth is greater than the pension debt of the government to these generations.

The inequality holds for retired generations as well. For them, the lifetime benefit is greater than pension wealth, and pension wealth is equal to pension debt.

In sum, only for those who have just retired and are about to receive benefits is the lifetime benefit equal to pension debt. That is, for an individual, the pension debt by the government reaches the maximum on his or her retirement, and the maximum value is equal to the lifetime benefit. The relationship among these concepts is shown in fig. 14.1.

14.2.5 Net Pension Debt

The promised benefit is that part of pension wealth attributable to the past contribution. Hence, it may be considered to have been “promised” by the government. In other words, for the government the promised benefit is the payable pension debt. Therefore, the above discussion holds, with the term “promised benefit” replaced by the term “pension debt.” For retired people, the pension debt of the government is equal to pension wealth. This is shown by the solid line and the heavy dotted line in figure 14.1.

The sum of the pension debt over all participants is the full fund.⁶ The difference between the full fund and the actual fund is the net pension debt.

14.3 Estimation of the Net Pension Debt as of 1990

In this section, we estimate the net pension debt as of 1990 as described in the previous section.

14.3.1 Assumptions for Estimation

In estimation, we followed the government's 1994 Pension Reform Plan (hereafter called the “Reform Plan”) for assumptions regarding economic parameters, benefit and contribution schedules, and population projections. Specifically, the economic parameters were set as follows: nominal interest rate 5.5 percent, rate of nominal wage increase 4.0 percent, rate of increase in nominal basic consumption expenditure 4.0 percent, and inflation rate 2.0 percent. The population projection is the one published in 1991 by the Research Institute of Population Problems of the Ministry of Welfare, which was based on the 1990 census.

We made our own estimation of the following parameters: the number of participants and recipients of benefits of the pension system by age group, and the lifetime wage profile of workers. These parameters were not given explicitly in the reappraisal.

The number of participants by age group in each pension system was estimated based on the data on participation rate by age group for 1985. The number of beneficiaries by age group was estimated based on the data for 1988 published in the Reform Plan.

The lifetime wage profile was estimated from the data in the Wage Census, which includes cross-sectional wage data by age group. We created a lifetime profile by taking the wages for the same cohort from the series of censuses.

The pension contribution and the benefits in the future are given in the Reform Plan. Following the plan, we assumed that the wage-proportional part of the private and public sector employee pensions will continue to be paid from

6. The full fund may be viewed as the “pension debt to the participants.” The net pension debt is, of course, the difference between this pension debt and the actual fund.

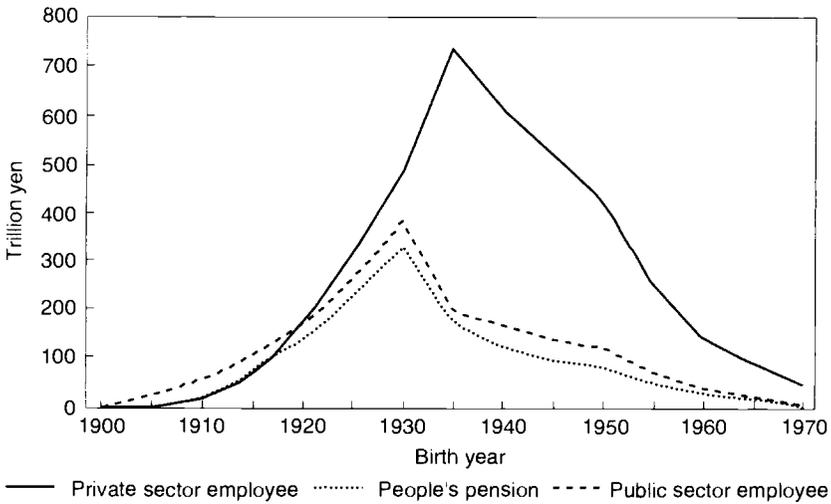


Fig. 14.2 Pension debt as of 1990: case 1

age 60, but the starting age of the fixed portion of the benefit (the basic benefit) will be gradually raised to age 65. Also, the reference wage of the replacement ratio will be shifted from monthly average gross wage to monthly average take-home wage after taxes, pension contribution, and so on.

14.3.2 Estimation Results

Pension debt by age group as of 1990. Figure 14.2 depicts the estimated pension debts owed to different age groups in 1990. The fine dotted line shows the People's Pension, the solid line shows the Private Sector Employee Pension, and the dashed line shows the Public Sector Employee Pension.

For the Private Sector Employee Pension, the largest pension debt is owed to the age group born in 1935 because the people in this age group are just starting to receive benefits. For this group, the lifetime benefit is the pension debt. The pension debt is smaller for each of the older groups because their life expectancies are shorter. For the People's Pension, the pension debt is largest for those born in 1930 because a smaller portion of the younger generations receiving this pension is engaged in agriculture.

For an age group born after 1935, the pension debt was estimated to be the product of its lifetime benefit and the ratio of its past contribution to its lifetime contribution, as explained in section 14.2. Figure 14.3 shows pension wealth (lifetime benefit), past contribution, and lifetime contribution for these age groups.

There are two reasons for the smaller pension debt owed to the younger age groups. First, the younger the age group, the smaller the ratio of past contribu-

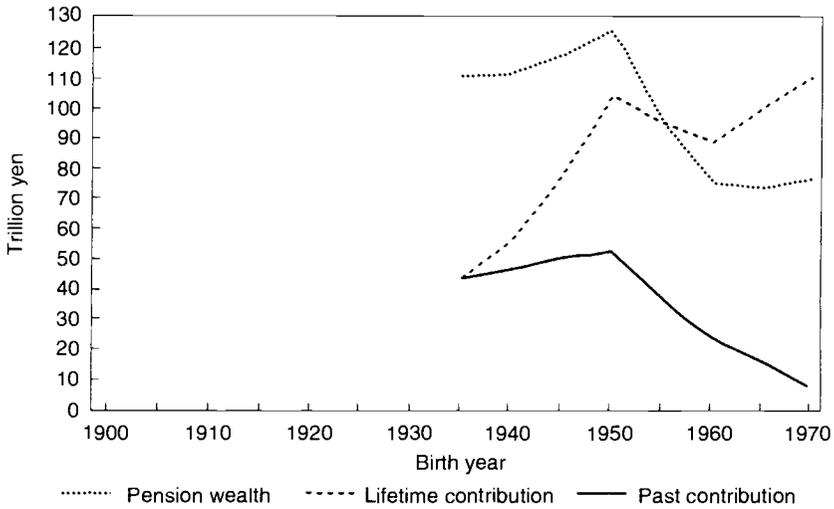


Fig. 14.3 Pension wealth and contributions, 1990: case 1

Table 14.2 Full Fund and Net Pension Debt as of 1990 (trillion yen)

Pension	Full Fund	Actual Fund	Net Pension Debt
Private Sector Employee Pension	387	77	310
People's Pension	133	4	129
Public Sector Employee Pension	171	32	139
Total	691	113	578

Source: Authors' calculations.

tion to lifetime contribution, because the contribution period is shorter. Second, as figure 14.3 shows, the lifetime benefit is smaller the younger the age group. This is due to the schedule, in which the replacement ratio is lower for younger generations. The full benefit of the Private Sector Employee Pension is about 69 percent of the lifetime average of standard monthly pay after taxes and social security contributions, of which 30 percent is the wage-proportional portion and 39 percent is the basic pension benefit (fixed) portion. The wage-proportional portion will decline in percentage as the deductions from wages increase when the pension contribution rate is raised.

Net pension debt as of 1990. The first column of table 14.2 shows the pension debt (full fund) for the Private Sector Employee Pension, the People's Pension, and the Public Sector Employee Pension at the end of 1990. The actual fund and net pension debt also are shown.

As the table shows, the balance of the full fund for all pensions was 691 trillion yen, of which 387 trillion yen was for the Private Sector Employee

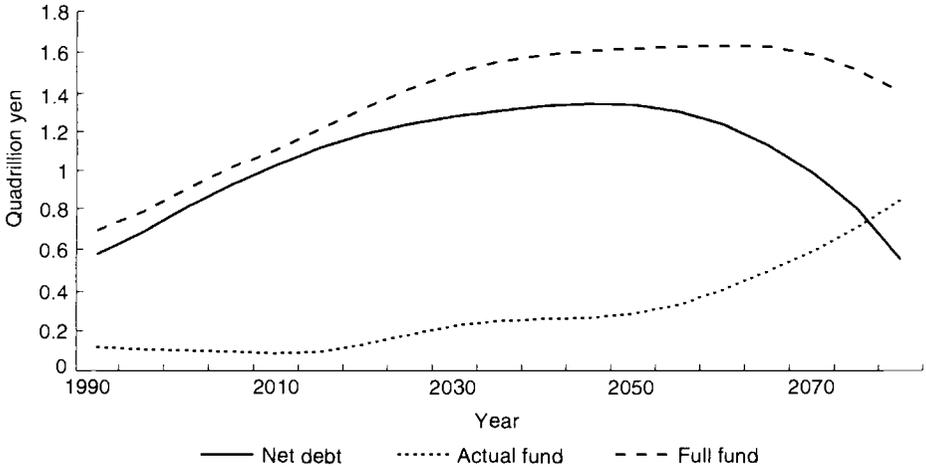


Fig. 14.4 Net debt, actual fund, and full fund: case 1

Pension, 133 trillion yen for the People's Pension, and 171 trillion yen for the Public Sector Employee Pension. The overall balance of the actual fund was 113 trillion yen—77 trillion yen for the Private Sector Employee Pension, 4 trillion yen for the People's Pension, and 32 trillion yen for the Public Sector Employee Pension, resulting in an overall net pension debt of 578 trillion yen.

14.4 Growth of the Net Pension Debt

We now analyze the time path of the net pension debt after 1990. According to equation (1), the net pension debt is the difference between the full fund and the actual pension fund. Here we examine the time paths of the full fund, the actual pension fund, and the net pension debt.

Forecast of the full fund. The dashed line in figure 14.4 shows the future time path of the full fund. First, it expands as the number of retired people increases. It reaches its peak in 2060 then starts to decline.

Forecast of the actual fund. The dotted line in figure 14.4 represents the balance of the actual fund. It starts with 113 trillion yen in the year 1990 and declines slightly until the year 2005. Then it starts to grow slowly and picks up speed after 2060. Thus the actual fund will not be depleted even during the period of rapid aging, as long as the assumptions of the 1994 Reform Plan are realized.⁷

7. The fund can be depleted if the assumptions are not realized. Raising the pension contribution rate and the income tax rate in early years will help reduce this possibility. See, e.g., Noguchi (1986), Ueda, Iwai, and Hashimoto (1987), and Ogura and Yamamoto (1993).

Forecast of the net pension debt. In view of equation (1), the net pension debt is equal to the vertical difference between the dotted line and the dashed line in figure 14.4. This difference is depicted by the solid line in the figure. It grows until the year 2045. After its peak in 2045, it declines steadily and becomes zero in 2090. Thus the public pension system can become fully funded in the year 2090.

14.5 Excess Fiscal Burden

In this section, we examine the determinants of the growth of the net pension debt. We first define the concept of the excess fiscal burden, then use this concept in explaining the growth of the net pension debt.

14.5.1 Definition

The revenue of a general pension fund consists of the following three elements:

- Interest income from the balance of the fund
- Pension contribution (equivalent to the Social Security tax in the United States)
- Subsidy from the general account

The sum of the last two may be called the “revenue from outside the fund.” If this exceeds the actuarially fair level of the pension contribution, the difference is the fiscal burden for the pension beyond the actuarially fair contribution. We will call this difference the “excess fiscal burden”:

$$(5) \quad \text{Excess fiscal burden} = \text{Actual contribution} \\ - \text{Actuarially fair contribution} \\ + \text{Subsidy from the general account.}$$

In other words, the excess fiscal burden represents a net transfer that the working generation in a given year makes to other generations.

14.5.2 Interest on the Net Pension Debt

The revenues of the pension fund under a fully funded system consist of the following:

- Interest income from the full fund
- Actuarially fair pension contribution

These revenues will be used to maintain the actual fund at the level of the pension debt, and hence to keep the net pension debt at zero.

Consider a reform of the current Japanese pension system that equates the pension contribution to the actuarially fair level and abolishes the subsidy. Un-

der this reform, the net pension debt will continue to grow. The reason is that the interest income from the actual fund is much less than the interest income from the full fund. We call this difference the “interest on the net pension debt”:

$$(6) \text{Interest on the net pension debt} = \text{Interest on the full fund} \\ - \text{Interest on the actual pension fund.}$$

The interest on the net pension debt represents the increase in the debt under this hypothetical reform. To keep the net pension debt from growing after this reform, revenues equal to the amount of the interest on the net pension debt must be infused into the pension fund.

14.5.3 Determinants of the Net Pension Debt

We can express the increase in the net pension debt as⁸

$$(7) \quad \Delta \text{Net pension debt} = \text{Interest on the net pension debt} \\ - \text{Excess fiscal burden,}$$

where the interest on the net pension debt is as defined in equation (6). This equation shows that the change in the net pension debt is determined solely by the difference between the interest on the net pension debt and the excess fiscal burden.

The solid line in figure 14.5 represents the interest on the net pension debt in the ratio to GDP. (Throughout this paper we assume that GDP grows 3.5 percent per year, which is equal to the real interest rate.) Before the year 2020, when excess fiscal burden peaks, this interest far exceeds the excess fiscal burden shown by the dashed line. After this peak, the ratio of the excess fiscal burden to GDP declines gradually and falls below 1 percent after the year 2080. Thus this figure indicates the unequal burdens borne by different generations.

Figure 14.6 directly shows the unequal burden and benefit of the public pen-

8. Since the net pension debt is the difference between the full fund and the actual fund, we have

$$(*) \quad \Delta \text{Net pension debt} \equiv \Delta \text{Full fund} - \Delta \text{Actual fund.}$$

The two terms on the right-hand side can be rewritten as follows:

$$\begin{aligned} \Delta \text{Full fund} &= \text{Interest incurred on balance of full fund} \\ &\quad + \text{Actuarially fair pension contribution} - \text{Benefit payment,} \\ \Delta \text{Actual fund} &= \text{Interest incurred on balance of actual fund} \\ &\quad + \text{Subsidy from general account} + \text{Actual pension contribution} - \text{Benefit payment.} \end{aligned}$$

Substitution of these two relations into eq. (*) gives:

$$\begin{aligned} \Delta \text{Net pension debt} &= (\text{Interest on full fund} - \text{Interest on actual fund}) \\ &\quad - (\text{Actual contribution} - \text{Actuarially fair contribution} \\ &\quad \quad + \text{Subsidy from general account}) \end{aligned}$$

This immediately yields eq. (7).

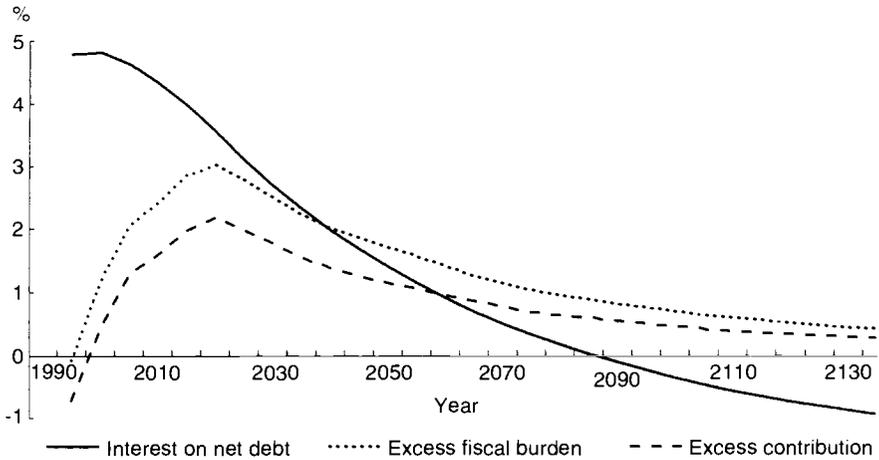


Fig. 14.5 Ratio of debt interest, excess fiscal burden, and excess contribution to GDP

sion system by generation. The lifetime contribution rate, represented by the solid line, rises from below 10 percent for the generation born in 1935 to above 20 percent for the generation born in 1970. In contrast, the lifetime benefit rate, shown by the dashed line, declines from nearly 20 percent to below 15 percent. These two lines cross for the generation born in 1950; for those born after 1950, the pension contribution exceeds the benefits, and the difference becomes larger for younger generations.

14.5.4 Policy Instruments

We now break down the excess fiscal burden into two terms:

$$(8) \quad \text{Excess fiscal burden} = \text{Excess contribution} \\ + \text{Subsidy from the general account,}$$

where

$$\text{Excess contribution} = \text{Actual contribution} - \text{Actuarially fair contribution.}$$

The “excess contribution” is the portion of the actual contribution in excess of the actuarially fair amount.

Let us now examine the future movement of the two terms on the right-hand side of equation (8). First, the time path of the excess contribution in its ratio to GDP is shown by the dashed line in figure 14.5. The excess contribution was -1.7 trillion yen in 1990. It will increase over time and become positive around 2000. This upward trend of the excess contribution reflects the scheduled increase in the pension contribution rate by 2.5 percent every five years

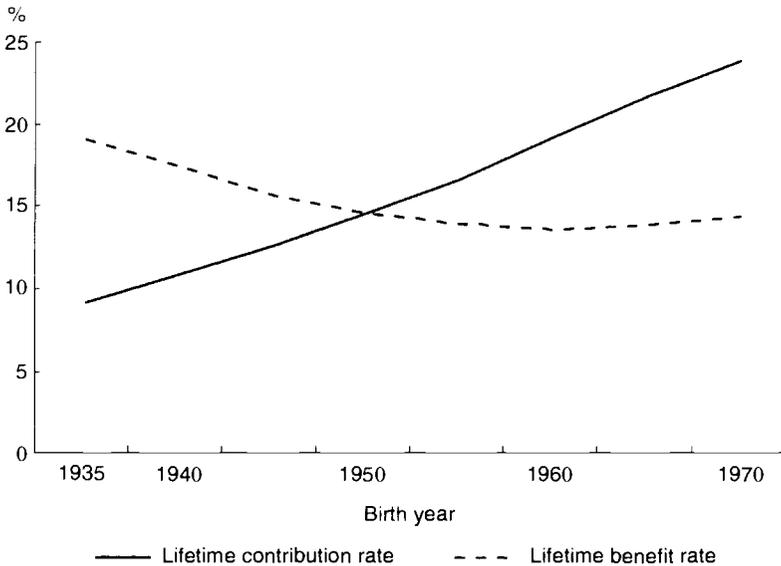


Fig. 14.6 Lifetime contribution rate and benefit rate

from 1995 to 2025, when it will be 29.6 percent.⁹ The fact that the excess contribution is negative now implies that working generations are making pension contributions below the actuarially fair contribution.

Second, the subsidy from the general budget account is found by the vertical difference between the dotted line and the dashed line in figure 14.5 because the excess fiscal burden, depicted by the dotted line, is the sum of the excess contribution and the subsidy from the general budget account. In the present system, one-third of the basic pension benefit is subsidized from the general budget account. This is the only subsidy from the general budget account.

Figure 14.5 reveals that the main cause of fluctuation in the excess fiscal burden is fluctuation in the excess contribution, rather than fluctuation in the subsidy from the general account. In particular, the negative excess contribution at present is mainly responsible for the negative excess fiscal burden.¹⁰

9. The actuarially fair contribution is estimated to be about 14 percent after 2020 from an individual's wage profile and scheduled pension benefits. This is for private sector employees, assuming that they contribute for 40 years and receive benefits for 20 years. For public sector employees, the actuarially fair rate is about 3 percent higher.

10. Suppose that the actual contribution rate is raised to the actuarially fair level. Then the excess contribution will be zero, and hence eqs. (7) and (8) yield

Δ Net pension debt = Interest on the net pension debt - Subsidy from the general account.

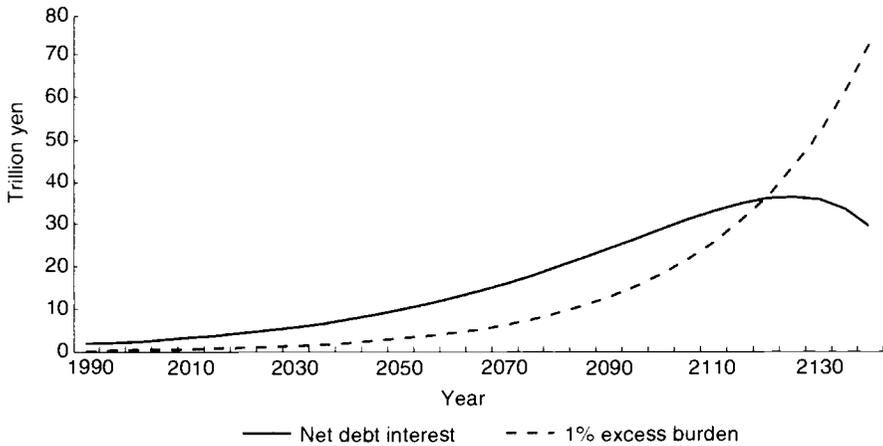


Fig. 14.7 Excess fiscal burden of 1 percent of GDP and interest on net debt

14.6 Pension Reform: Flattening the Excess Fiscal Burden

Let us now consider a pension reform that maintains the excess fiscal burden at 1 percent of GDP throughout the period considered. According to figure 14.5, the ratio of the excess fiscal burden to GDP will be approximately 1 percent in the year 2000. This reform assumes that the scheduled ratio for that year will be maintained throughout the period. Figures 14.7 and 14.8 depict the results of this reform,¹¹ which will make the intergenerational distribution of the excess burden uniform once and for all. It will also eventually make the Japanese pension system fully funded.

The solid line in figure 14.7, representing the interest on the net pension debt, reflects the shape of the net pension debt itself. This curve will intersect with that representing the excess fiscal burden when the burden reaches its peak in 2120. After that year, the excess fiscal burden will exceed the interest on the net pension debt. That is why the net pension debt will start to decline after this year. The solid line in figure 14.7 shows that it will reach zero in 2155. As a result of this reform, therefore, the Japanese public pension system will become fully funded in 2155.

The solid line in figure 14.8 shows that the ratio of the net pension debt to GDP steadily declines until it reaches zero in the year 2155. Since the growth

This implies that the net pension debt will continue to increase as long as the interest on the net pension debt is larger than the subsidy from the general account.

Thus, even if the actual contribution rate had been actuarially fair since 1990, the net pension debt would have continued to grow, for fig. 14.5 indicates that the subsidy to the pension fund from the general account was much smaller than the interest on the net pension debt. See n. 13.

11. The dotted line in fig. 14.8 shows that the ratio of the excess fiscal burden to GDP is 1 percent.

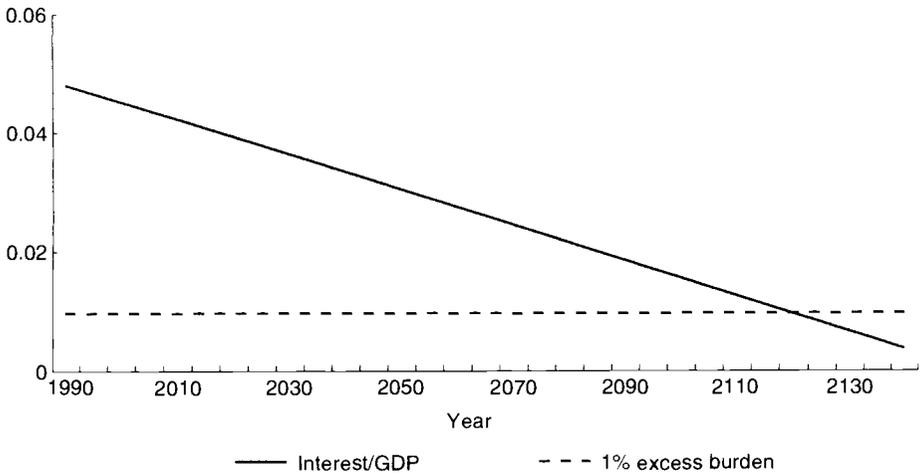


Fig. 14.8 Ratio of excess fiscal burden of 1 percent and interest on net debt to GDP

rate of GDP is the same as the interest rate on the net pension debt, as long as there is an infusion of excess fiscal burden to the pension account, the ratio of the net pension debt to GDP declines. The steady decline in figure 14.8 shows this relationship.

Thus, if the percentage of the excess fiscal burden is maintained at 1 percent of GDP, not only can the intergenerational distribution of the excess fiscal burden be equalized, but also the growth of the net pension debt can be controlled.

14.7 Sensitivity Analyses

We conducted a few sensitivity analyses under the contribution and benefit schedules of the 1994 Reform Plan by changing the assumed economic conditions. First, we changed the assumed nominal interest rate from 5.5 percent to 4 percent and called this case 2. In this case, the net pension debt was about 870 trillion yen as of 1990. This is larger than in the base case because the nominal interest rate is lower. The actual fund will also become negative for certain periods of time as a result of the lower interest rate; but it will start to grow again and eventually turn positive. Finally, the net pension debt will keep growing until 2115, after which time will decline and eventually reach zero in the second half of the twenty-first century.

We also ran another simulation, assuming the same interest rate of 5.5 percent as in the base case but assuming that the growth of the wage rate and basic consumption will also be 5.5 percent. The qualitative nature of the solution in this case was identical to that in case 2.

14.8 Conclusion

The net pension debt has been accumulated as a result of the pure income transfer to the first generation participating in the pension system. Hence, it may be repaid as the war debt was, being financed from the general account by many generations rather than from the pension account.

The revenues of the pension fund from outside sources can be divided into two parts: the actuarially fair part and the excess fiscal burden. The magnitude of the latter determines whether the net pension debt will grow or decline.

We found that the ratio of the net pension debt to GDP will decline under the 1994 Reform Plan and will reach zero in the year 2090. Moreover, we found that the excess fiscal burden will be unevenly distributed across generations and that of current working generations is negative. These generations are not even paying the actuarially fair level of pension contribution.

We considered a pension reform plan that will maintain the percentage of excess fiscal burden at 1 percent of GDP throughout the entire period. We found that this reform will not only equalize the burden across generations but also eventually make the Japanese pension system fully funded. This plan will reduce the fiscal burden of working generations during the early twenty-first century.

Appendix

The Net Pension Debt and Pension Reforms

To illustrate the meaning of the net pension debt, we examine how various hypothetical reforms of a pension system would affect this debt.

The first reform is one that adjusts current and future contribution rates so that they will become actuarially fair to that part of the benefits that corresponds to these contributions.¹² The pension system after this reform will be called an “actuarially fair” system.

If the current Japanese pension system is reformed to be an actuarially fair one, the contributions that flow into the pension fund account will be the same as under a fully funded system. An important revenue of a pension fund is the interest income that the fund itself yields. The actual pension fund, however, yields only a portion of the interest income that a full fund would yield since the balance of the former is lower than that of the latter. This means that even

12. Note that even when contribution rates are reformed this way, the present values of the lifetime contributions and the lifetime benefits are not equalized. In other words, this reform keeps the transfer payments corresponding to the past contributions as the vested interest of each generation. See Hatta (1993), Hatta and Oguchi (1992), and Oguchi et al. (1993) on the actuarially fair pension system.

if our pension system is transformed to an actuarially fair one, the net pension debt may continue to rise and the actual pension fund may become delinquent sometime in the future.¹³

If a sufficient subsidy comes from the general budget every year, the expansion of the pension debt can be contained. We call the interest that has to be paid on the net pension debt the “interest on the net pension debt.” If the subsidies from the general budget account equal the interest on the net pension debt every year, the balance of the net pension debt will be kept constant, and the balances of the full fund and the actual fund will fluctuate in parallel. An actuarially fair system accompanied by such subsidies from the general budget is called an “actuarially fair system in the narrow sense.” Under this system, the balance of the pension fund will not decline endlessly. (In the text, the term “actuarially fair system” is used to mean that current and future pension contributions are related to the benefits attributable to those contributions in an actuarially fair manner, whether or not subsidies from the general budget account are taking place.)

If the subsidy from the general budget to the pension fund is greater than the interest on the net pension debt, the balance of the net pension debt will decline. If the balance of the net pension debt eventually disappears, it will be possible to switch to a fully funded system. Thus, it is useful to know the amount of interest on the net pension debt in designing pension reforms. To estimate the amount of interest, we need to estimate the amount of the net pension debt itself.

The second reform we consider switches the current system to a fully funded system accompanied by an increase in the general tax to immediately establish a full fund. This reform consists of two components: switching to an actuarially fair system and raising tax revenues so as to equalize the actual pension fund and the full fund. In other words, current workers’ actuarially fair contributions will be accumulated to finance their own future benefits. This, however, will deplete the source of benefits for retirees who are currently receiving benefits.¹⁴ This plan necessitates the immediate accumulation of the full fund by means of an increase in revenues so that the benefit payments of both current and future retirees are guaranteed.

To carry out this reform, current workers will have to pay this incremental tax in addition to the actuarially fair contributions for their own future benefits.

13. Note that this means that the contribution rate will be raised now and reduced in the future. In the actual Japanese system, the general budget subsidizes a part of the benefits to the People’s Pension. The fact that this is sufficiently small is assumed. See n. 10.

14. This eliminates the revenue source not only for the benefits of current retirees but also for the benefits corresponding to the contributions that current workers have already made. This is because the contributions they have made have already been used for the benefits of current retirees. In the text, the phrase “the benefits of the first generation of the pension system” is used to mean “the sum of (a) the benefits of current retirees and (b) the benefits corresponding to the contributions already made by current workers;” or equivalently “the pension benefits of the currently living people corresponding to their contributions.”

In other words, this generation will have to bear the burden for two generations.

After this reform, the net pension debt will become zero. The required amount of the incremental tax will be equal to the net pension debt immediately prior to the reform. As we saw in section 14.3, this amount was equal to 578 trillion yen in 1990. It is often said that once a pay-as-you-go system is established, it is difficult to return to a fully funded system. The estimate of the required tax for this reform shows that it is practically impossible to return to the fully funded system immediately by means of an increased tax.

The third reform switches the current system to a fully funded one through the issuing of a public bond rather than raising taxes. The reform is a combination of a shift to an actuarially fair system and the issuing of a government bond in the amount equal to the net pension debt. We call the required government bond "the liquidation bond."¹⁵

Immediately after the reform, the net pension debt will not be affected by the reform and will be equal to the amount of the liquidation bond issued. Let us assume that this bond is redeemed by subsidies from the general budget financed by increased taxes over time. During the redemption period, the balance of the liquidation bond will always equal the balance of the net pension debt.

Under this reform, the government will simultaneously issue a public bond and increase the size of the pension fund. The former is the government debt to the private sector, while the latter is its loan to the private sector. This reform will not change the net pension debt position of the government in relation to the private sector.

The first and third reforms are equivalent from the point of view of the government's indebtedness to the private sector, even though they are different reforms from an accounting point of view. In particular, if, after the third reform, the subsidy from the general budget to the pension fund were set exactly equal to the amount of the interest on the net pension debt, the balance of the liquidation bond would be kept constant over time. The pension system after this reform would be equivalent to the actuarially fair system in the narrow sense from the point of view of the government's indebtedness to the private sector.¹⁶

15. See Hatta (1988) and Hatta and Oguchi (1992) for the liquidation bond.

16. We can interpret the current Japanese pension system as having already issued a government bond equivalent to the liquidation bond.

Under the pay-as-you-go system, the contributions made by working generations are not accumulated in the pension fund but are used to finance the benefits of current retirees in return for a government promise to current workers that the benefits will be paid to them in the future. This implies that the government has issued IOUs to current working generations in return for the pension contributions they make. When these IOUs are repaid in the future, new IOUs will be issued to younger generations to finance the repayment. The pay-as-you-go system can thus be viewed as a system that successively issues IOUs. The fact that the government issues IOUs in return for pension contributions implies that the government has been issuing implicit public bonds. The pay-as-you-go system continuously issues implicit public bonds, but with widely fluctuating

For the purpose of attaining long-run fiscal solvency of the pension system and of equalizing the fiscal burdens across different generations, it is not important whether the system is reformed to a fully funded one or merely to an actuarially fair one. Regardless of the accounting appearance of the system, what really counts is the amount of additional tax revenues needed beyond the actuarially fair pension contributions. The strategic variables that need to be examined in any pension reform are the net pension debt and the interest that has to be paid on this debt.

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tuating rates of return for each generation caused by the demographic composition of different generations.

Thus, switching to a fully funded system while issuing a liquidation bond is equivalent to stopping the issuance of new implicit bonds and making explicit the implicit bonds that have already been issued. Only by making these implicit public bonds visible can the government establish a redemption plan that equalizes the burdens on different generations.