Pensions, Benefits and Social Security
4TH PBSS Colloquium

Tokyo, Japan
October 4 (Sun) - 6 (Tue), 2009

The Point of Concern about the Implementation of Liability-Driven Investment (LDI) in a Pension Plan in Japan

ARIHIRO OKAMOTO

The Sumitomo Trust & Banking Co., Ltd.

Pension Consulting Department

SECTION SUR LES PENSIONS, AVANTAGES SOCIAUX ET SÉCURITÉ SOCIALE DE L'AAI
IAA PENSIONS, BENEFITS AND SOCIAL SECURITY SECTION
PBSS

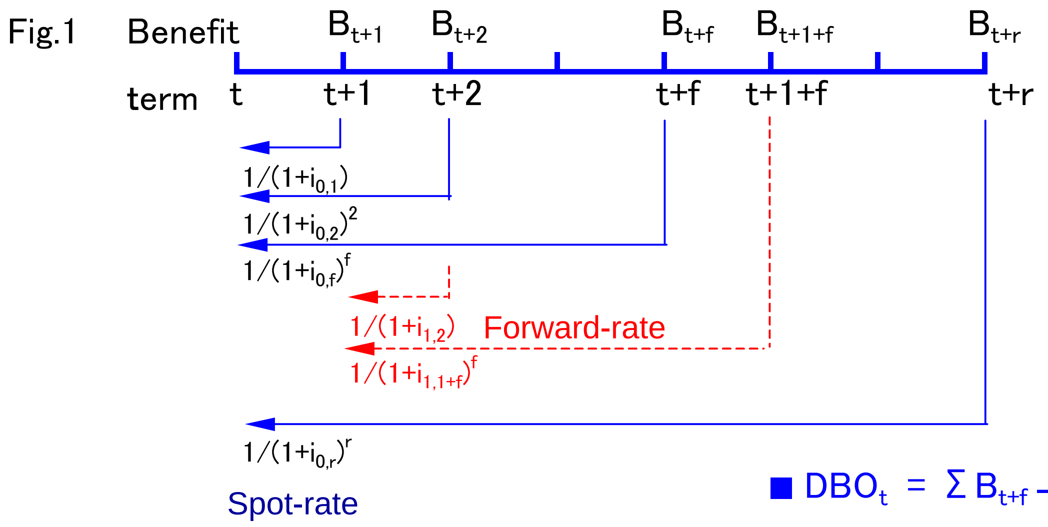
JSCPA

1. Introduction

- The immediate recognition is examined on IFRSs
- LDI would become one of the attractive alternatives of the pension investment strategy
- LDI looks uncommon in Japan, although LDI in frozen pension plans in UK and US are reported
  - ・Few frozen pension plans
  - ・The period of the liability is too long to set the bonds
  - ・The current interest rate is too low and the further bond investment does not look like a wise strategy
- The future accruals might complicate LDI in an active pension plan.
- I discuss the asset allocation method which allows an active pension plan to carry out LDI

2～4. DBO (Defined Benefit Obligation)

2. DBO and a net cash-flow



■ $$DBO_t = \Sigma B_{t+f} \frac{t}{t+f} \frac{1}{(1+i_{0,f})^f} \qquad \cdots\text{(eq-1)}$$

$$DBO_t = B_{t+1} \frac{t}{t+1} \frac{1}{1+i_{0,1}} + B_{t+2} \frac{t}{t+2} \frac{1}{(1+i_{0,2})^2} + \cdots\cdots$$

$$DBO_{t+1} = B_{t+1+1} \frac{t+1}{t+1+1} \frac{1}{1+i_{1,2}} + B_{t+1+2} \frac{t+1}{t+1+2} \frac{1}{(1+i_{1,3})^2} + \cdots\cdots$$

$$= DBO_t(1+i_{0,1}) + DBO_t \frac{1+i_{0,1}}{t} - B_{t+1}$$

$$= DBO_t(1+i_{0,1}) + SC_{t+1} - B_{t+1}$$

$$= DBO_t(1+i_{0,1}) - CF_{t+1}$$

$$DBO_t = CF_{t+1}/(1+i_{0,1}) + DBO_{t+1}/(1+i_{0,1})$$

Net cash-flow ■ $$CF_{t+1} = B_{t+1} - SC_{t+1} \qquad \cdots\text{(eq-2)}$$

■ $$DBO_t = \Sigma\, CF_{t+f}/(1+i_{0,f})^f \qquad \cdots\text{(eq-3)}$$

$$SC_{t+1} = DBO_t \frac{1+i_{0,1}}{t} = \Sigma B_{t+f} \frac{1}{t+f} \frac{1+i_{0,1}}{(1+i_{0,f})^f}$$

Calculated by forward-rate ■ $$SC_{t+2} = DBO_{t+1} \frac{1+i_{1,2}}{t+1} = \Sigma B_{t+1+f} \frac{1}{t+1+f} \frac{1+i_{1,2}}{(1+i_{1,1+f})^f} \qquad \cdots\text{(eq-4)}$$

3. The characteristic of DBO by the examples

Fig.2 Benefit (curve) vs DBO (per person)

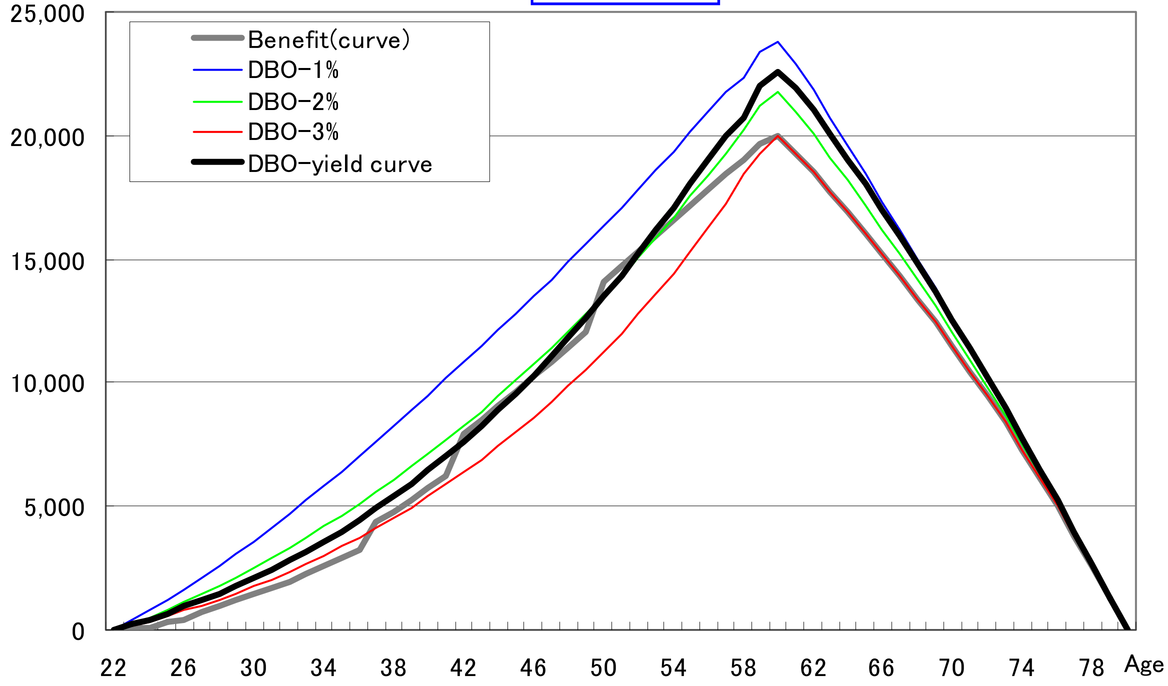
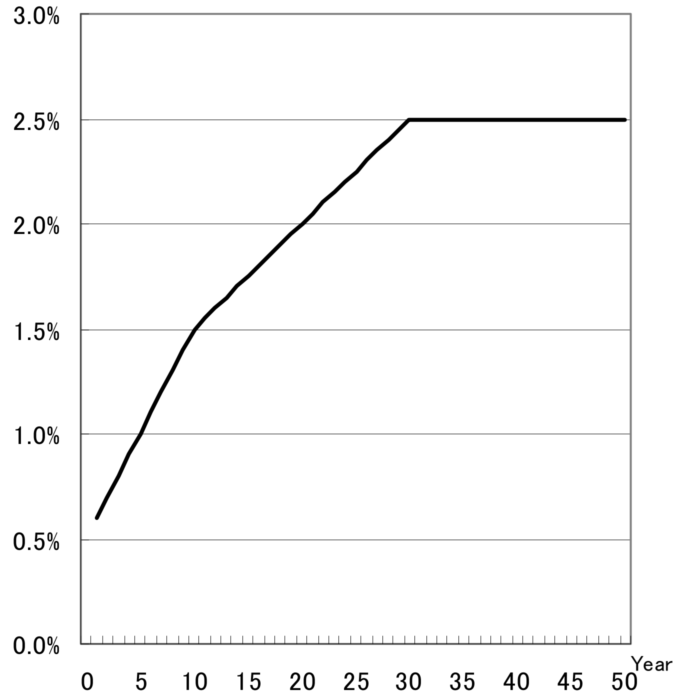


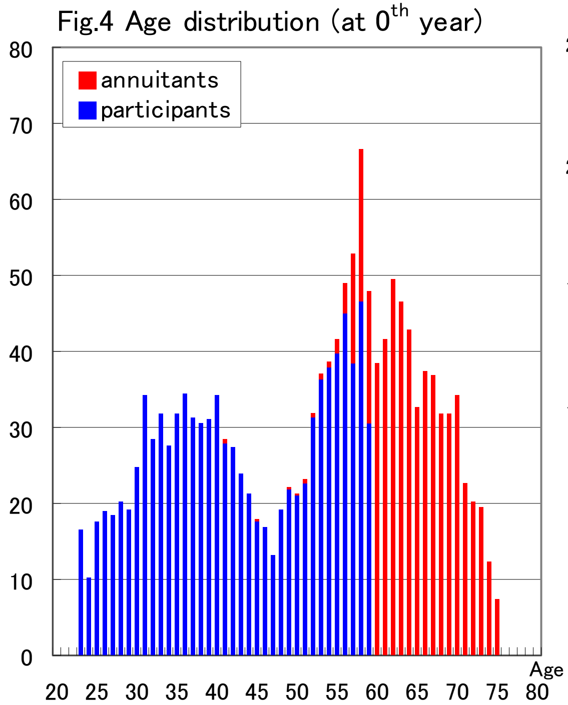
Fig.3 Yield curve

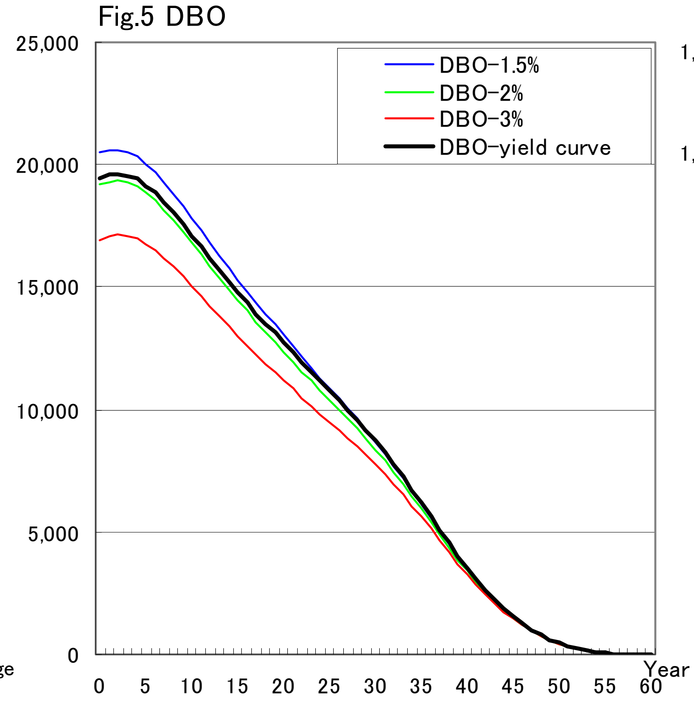


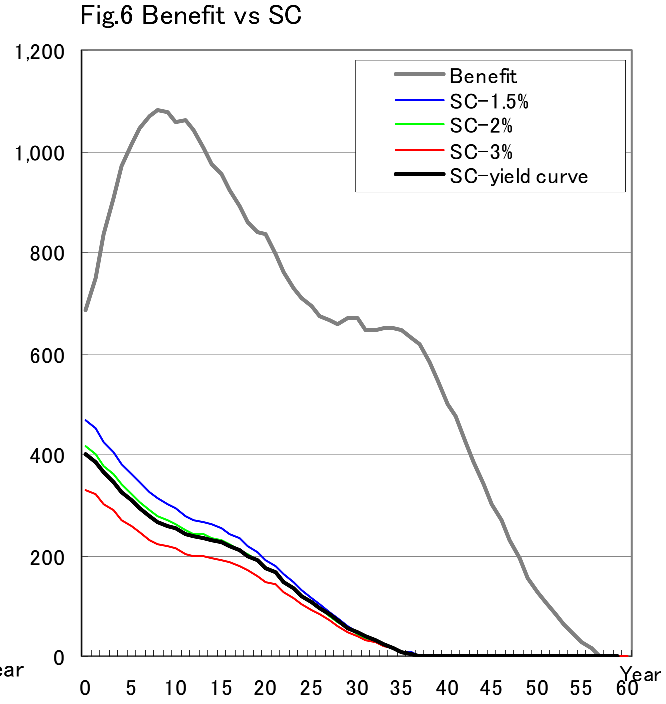
- DBO(by yield curve) ≒ DBO(by 2%)

- Join the plan at age 22
- The pension benefit starts from at age 60 and lasts for 20 years
- Interest rate during annuitant is 3.0%

4. DBO with the pension plan







- DBO(by yield curve) ≒ DBO(by 2%)
- SC(by yield curve) ≒ SC(by 2%)

  - No participant joins
  - Lump sum choice rate 0%
  - The yield curve(fig.3) is used for each year (no change of interest rates)

5. LDI by the bond

5-1 The net cash-flow matching

Fig.7 DBO vs bond price

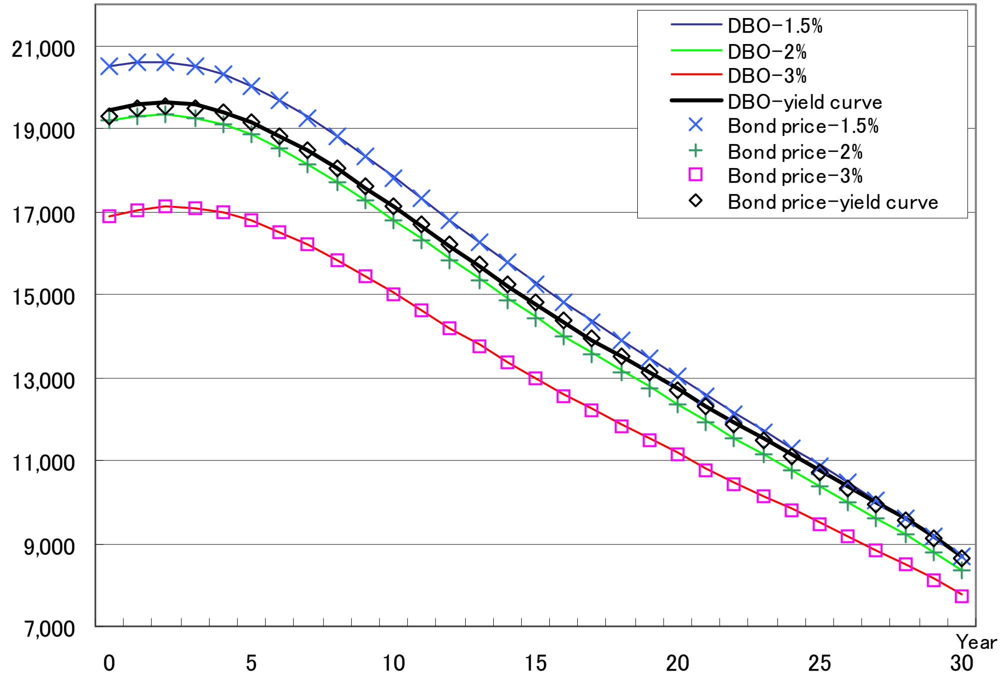
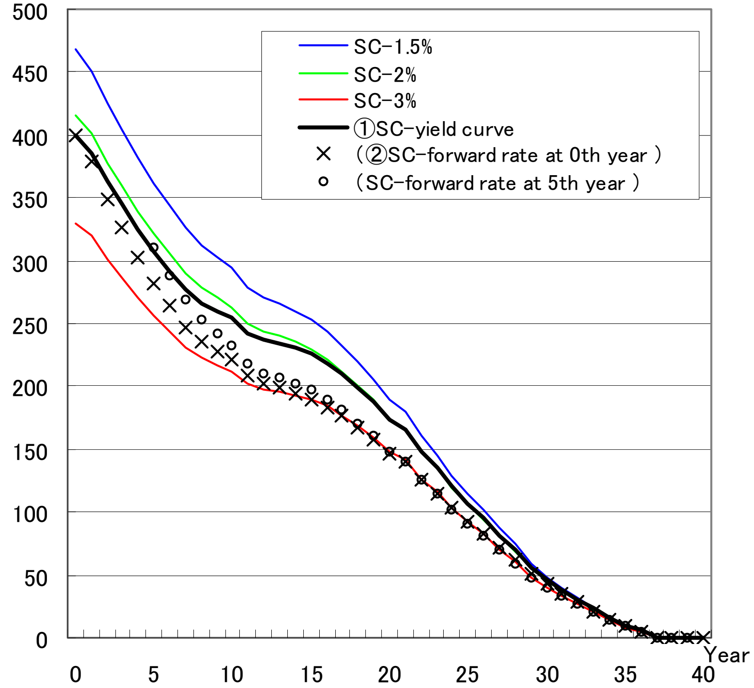


Fig.8 SC

■ Benefit (fig.6)



- DBO = The bond price (making the portfolio which corresponds to the net cash-flow (benefit −SC) of each year)
- DBO(by yield curve) is calculated by SC based on a forward-rate

  - The yield curve(fig.3) is used for each year (no change of interest rates)
  - Contributions of the same amount of SC are injected
  - The bond is interest-bearing securities (government bond)

5-2 The duration

Fig.9 DBO vs bond price

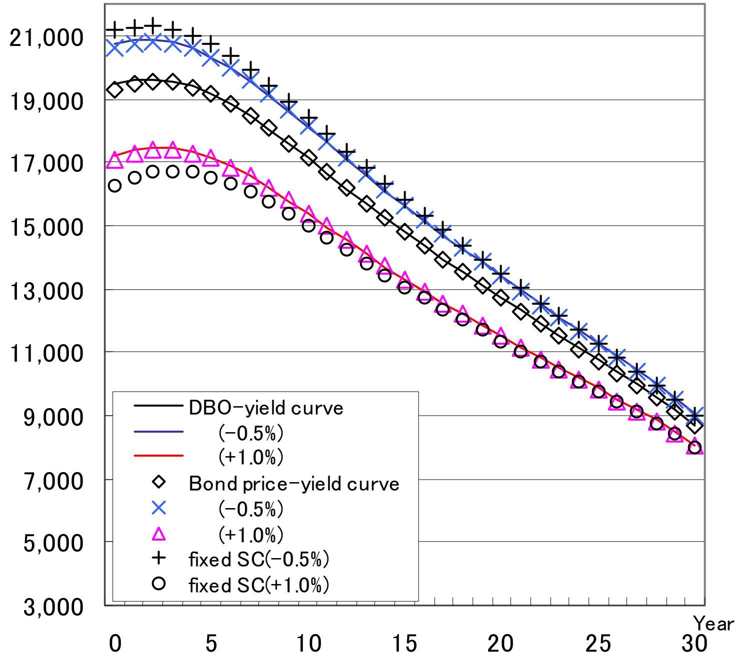
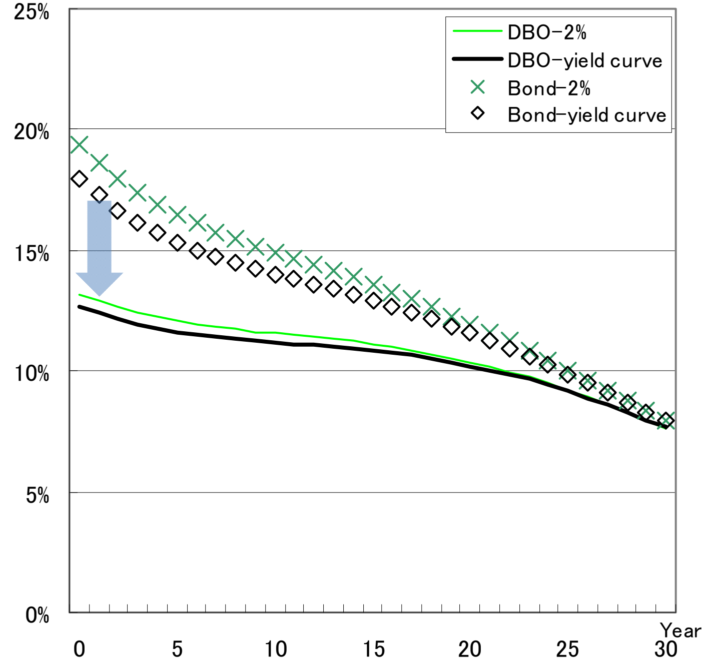


Fig.10 Duration (1/100)



- Duration(DBO) < Duration(Bond)
- DBO= Σ（Benefit - SC）/(1+i)^f

i -up → 1/ (1+i)^f ･･･ down

→ SC ･･･ down → （Benefit - SC）･･･up

DBO down ･･･ restrained

Duration(DBO) ･･･ down

5-3 Bond portfolio for the duration matching

- The net cash-flow matching≠The duration matching (Duration(DBO)<Duration(Bond))
- Two merits to make the duration of the bond smaller

(1) to make a bond portfolio without using the super long-term bond (beyond 30 years)

(2) to increase short-term bonds, to make the portfolio to be prepared for a lot of payments by the lump sum choice

- Bond portfolio

(1) Using the interest-bearing securities of a term equal to or less than 30 years

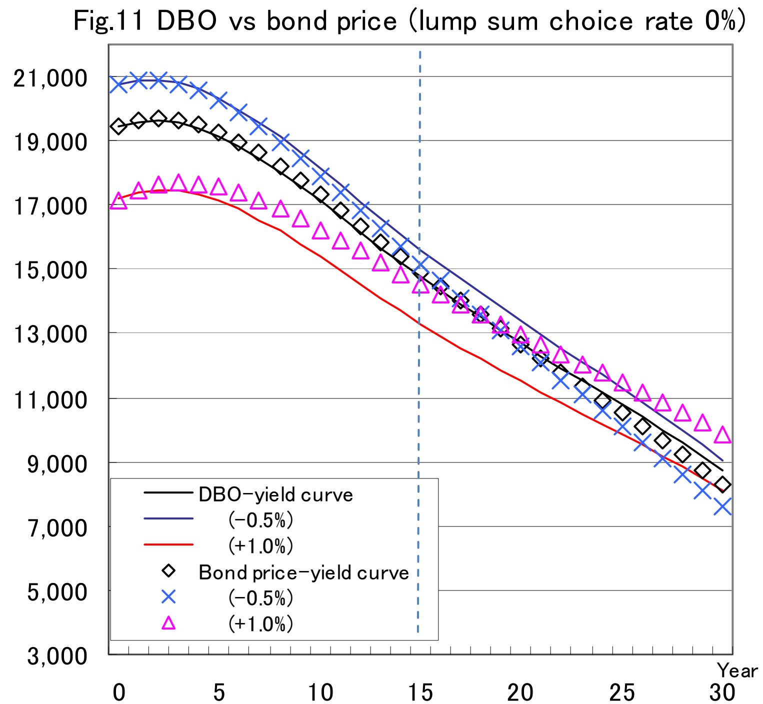
(2) Increasing the short-term bonds to have payment even if the lump sum choice rate becomes 50% for five years

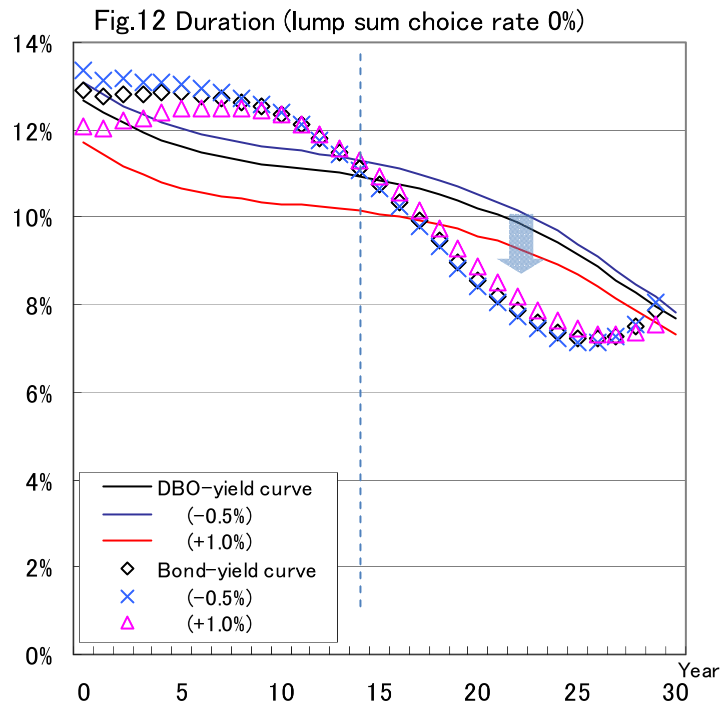
(3) Making the duration of the bond approximately corresponds to the duration of DBO without re-balancing for a period as long as possible

In addition, to reinvest the cash which remains by a coupon and a redemption with 30 years bonds

- I should have a lot of long-term bonds, when I increase short-term bonds to reduce the duration (so-called barbell-shaped)

5-4 LDI (lump sum choice rate 0%, no re-balance)





- [t≦15years] DBO ≒ Bond price (no change of interest rates)
- [t> 15years] DBO > Bond price (no change of interest rates)

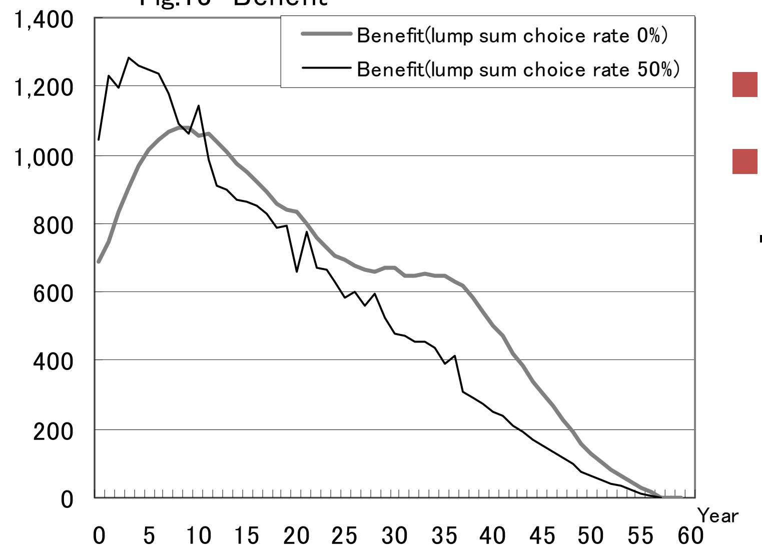
  Duration(DBO) > Duration(Bond)

- [The interest rate rises] DBO ＜ Bond price

  SC(DBO) < SC(Bond)(=SC(no change of interest rates))

5-5 LDI (lump sum choice rate 50%, no re-balance)

Fig.13 Benefit



- [No change of interest rate] DBO < Bond price
- [The interest rate falls] DBO ≒ Bond price
  - The surplus by the lump sum choice (interest rate during annuitant 3%)

Fig.14 DBO vs bond price (lump sum choice rate 50%)

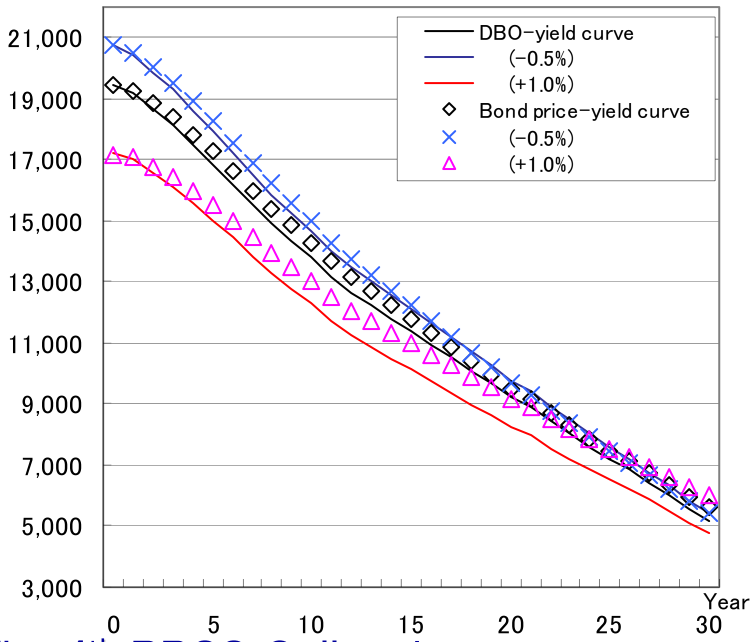
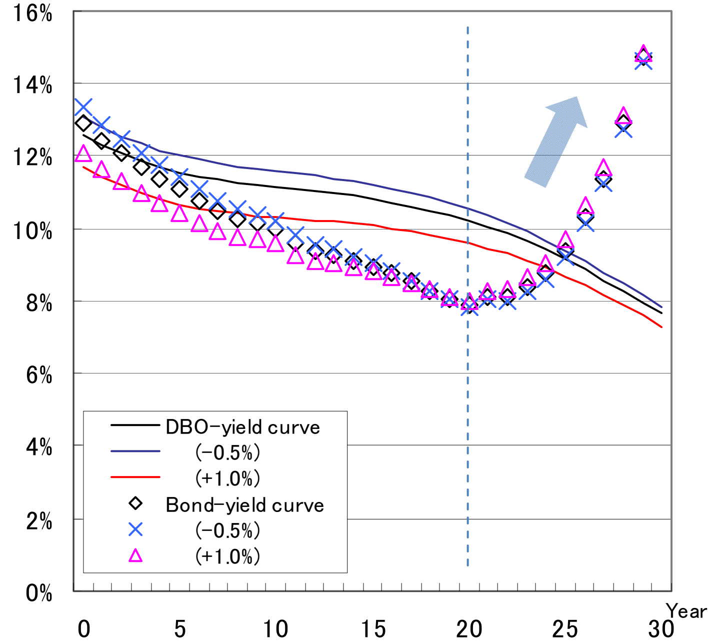


Fig.15 Duration (lump sum choice rate 50%)



5-6 LDI (if re-balance)

Fig.16 DBO vs bond price(lump sum choice rate 0%) re-balance

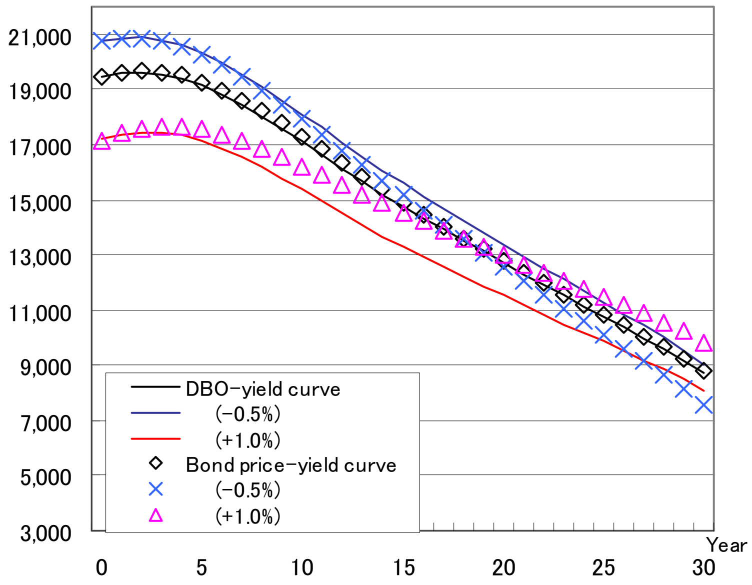


Fig.17 Duration(lump sum choice rate 0%) re-balance

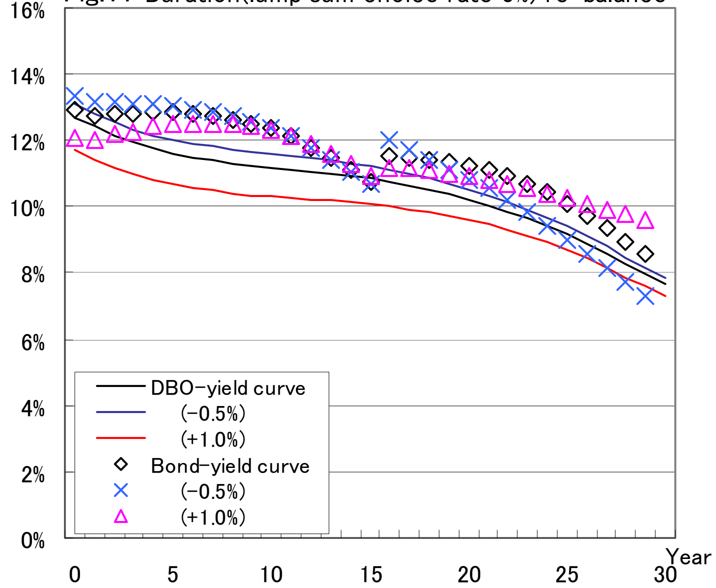


Fig.18 DBO vs bond price(lump sum choice rate 50%) re-balance

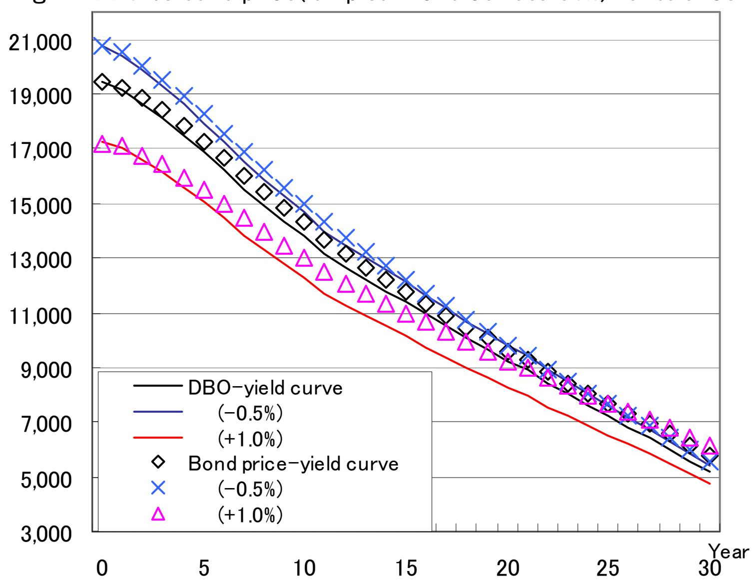
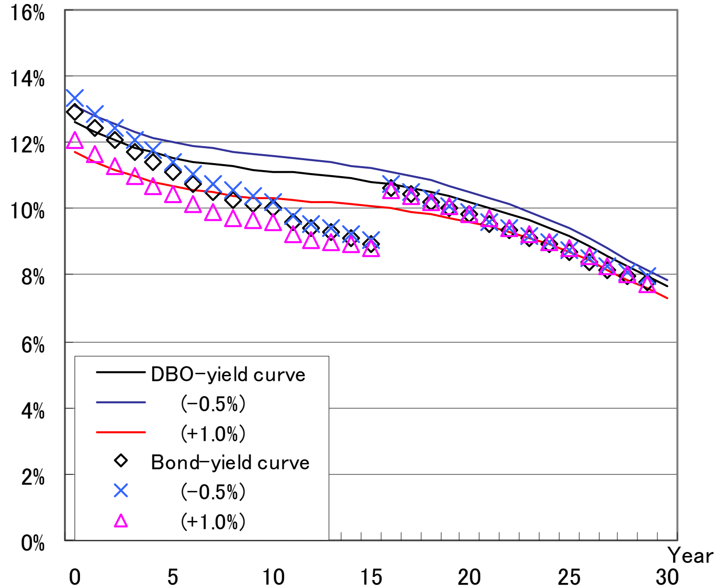


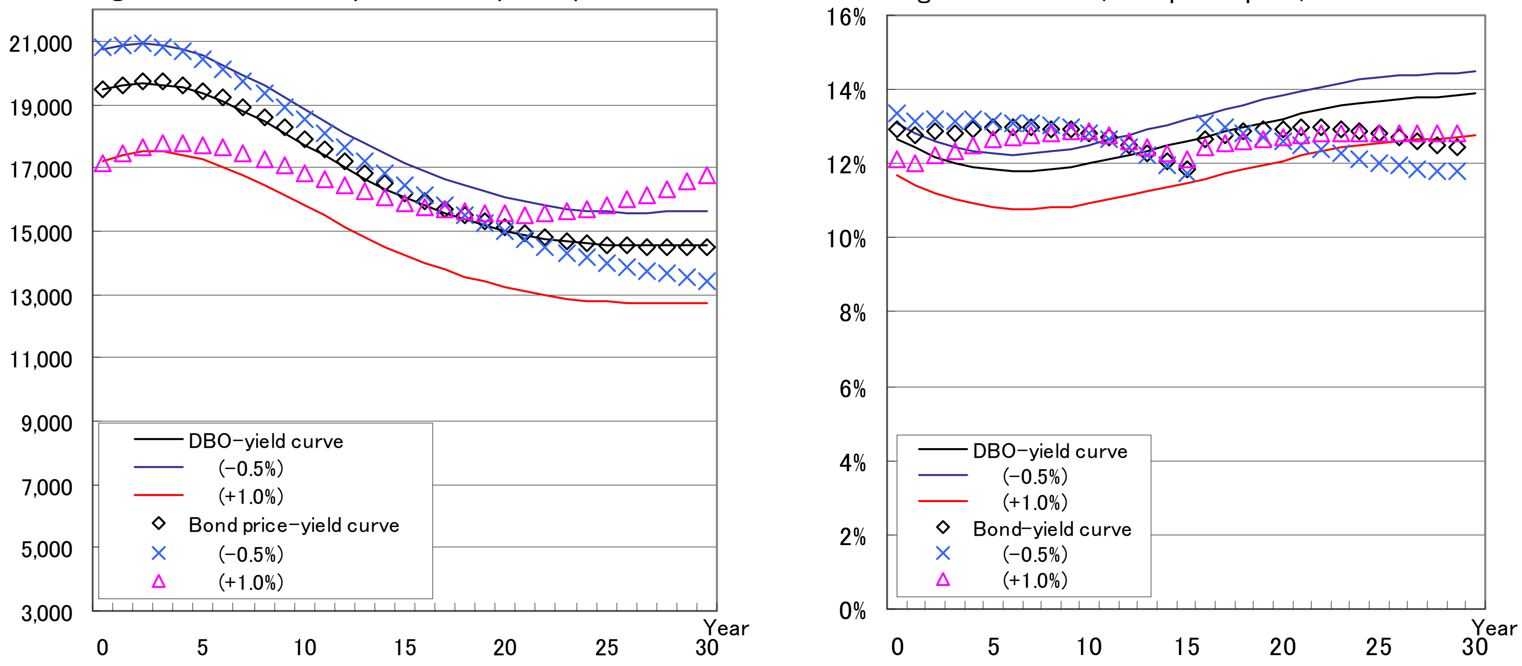
Fig.19 Duration(lump sum choice rate 50%) re-balance



5-7 LDI (new participant)

Fig.20 DBO vs bond price (new participant)

Fig.21 Duration (new participant)



- The surplus hardly has a difference in case of no new participant(fig.16)

  [no change of interest rates]

- Duration(new participant) > Duration(no new participant) ･･･ across the ages

・Join the plan at age 22

・Invest SC(contribution) in 30 years bonds

6. Summary

- The present value of the net cash-flow (Benefit－SC) = the amount of DBO
  [in the active pension plan]
- It is possible theoretically to make a bond portfolio by this net cash-flow
- Net cash-flow matching ≠ Duration matching
  ･･･ Duration(DBO) < Duration(Bond) ⬅ SC changes by the change of interest rate
- It is possible to make a practical bond portfolio which the duration follows DBO under a certain condition
- I aimed to make the bond portfolio (1) in correspondence with changed payment and (2) which evaded re-balance as much as possible to hold down a cost

- Though I had thought that LDI in the active pension plan was difficult, I confirm that it is possible enough for business by the bond investment.
- However, full-scale LDI by the bond investment seems not to be carried out often by the reasons as follows in Japan currently
  - Few for DBO in full funding
  - The current interest rate is too low and the further bond investment does not look like a wise strategy
- When the consciousness of the company would be changed by “immediate recognition” in accounts in Japan, companies' attention to LDI would increase