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掛金の経済価値を制御する方法

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内容

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5. 積立不足を制限する追加的な条件
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- In this presentation, I would like to introduce a new funding standard and consider several measures for mitigating contribution volatility.
- Needless to say, funding standards play an essential role, along with the accounting standards, in determining the contribution volatility especially when the plan is in a financially distressed situation.
- First of all, I would like to show how contribution volatilities affect the economic values of contributions.
- Next, I will introduce a benefit design which can lower the contribution volatilities and thus enable the plan to survive under economically unfavorable environments for pension plans.
- Then, we will consider decomposition of contributions and assets by payout year. Ring-fencing of assets by payout year provides a framework of the new funding standard, which I named as the PYS funding standard.
- Then I will explain the basic ideas of the new funding standard and consider the discount rates for calculating the minimum funding.
- Lastly, I will show several numerical examples and consider their implications to ordinary funding standards and investment policies.

1-1. 共分散価格式

$$q = \frac{E[\mathbf{v}]}{R_F} + Cov[\xi, \mathbf{v}]$$

- 景気悪化時に増加し，景気上昇時に減少するようなペイオフは，状態価格密度と正に相関する．
- そのようなペイオフに関しては，上記共分散価格式の第2項はプラスとなる．

- When we assume that the market is complete, economic value of the payoff vector **v** is given by this well-known **covariance pricing formula**. This formula evaluates **q** using the pricing kernel or the state price density ξ.

- This formula says that the expectation of the payoff vector **v** under the ordinal probability measure have to be adjusted by the second term of the right side, which is the covariance of ξ and **v.**

- The pricing kernel is in proportion to the marginal utility of optimal consumption in the future. The marginal utility thus increases in market downturn and decreases in market upturn.

- The covariance of the pricing kernel and a cashflow increasing in a market downturn and decreasing in market upturn should be positive, which means that the economic value of such a cashflow is evaluated greater than the best-estimate present value.

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1-2. 事業主掛金の評価

- 事業主掛金の経済価値は，その最善の推定値（期待値）の無リスク金利による割引現在価値より大きくなる．
- 事業主掛金のボラティリティが高まれば高まるほど，掛金の経済価値も高くなる（対応して，給付の経済価値も高くなる）．

- The sum of the EV of future contributions and the market value of the reserves should be equal to the EV of future benefits.

- However, here we concentrate on the EV of future contributions. Employer contributions tend to increase in market downturn since employers are often required to pay supplemental contributions to make up for the funding shortfalls.

- On the other hand, in market upturn employers may reduce the contributions .

- Namely, the stream of employer contributions has the characteristic stated in the previous slide and therefore its EV would be evaluated higher than its best-estimate PV.

- It is anticipated that the greater the volatility of employer contributions becomes, the higher the EV would be evaluated, even if its best-estimate PV is invariant.

- Therefore, it is essential to address the issue of how to keep the volatility of employer contributions under control. Innovative and synthetic measures are desperately needed, ranging from benefit designs to funding policies and investment strategies.

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1-3. 給付キャッシュフローの場合

$$q = \frac{E[\mathbf{v}]}{R_F + \delta}$$

- 資産運用のベータ・リスクに起因する給付キャッシュフローのリスクプレミアムはプラス.
- 長寿化リスクに起因する給付キャッシュフローのリスクプレミアムはマイナス.

- By the way, benefits moving in proportion to stock values in the market is evaluated lower than their best-estimate PV. Namely, volatility affects the economic value of benefits in the opposite direction.

- In other words, the risk premium δ in this equation should be positive with regard to the risk of benefits originated from the market volatility.

- On the other hand, the cashflow of a life annuity increases when mortality rates improve. Normally, people have to reduce spending due to budgetary constraints when mortality rates improve beyond the original estimation.

- Then the risk premium δ with regard to the benefit volatility originated from the *macro* longevity risk, namely the annuity risk premium, should be evaluated negative, since there is no financial instruments that hedge the longevity risk.

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2.「ジャパン・シナリオ」でも持続可能な給付設計

$$\text{if } L^{(1)} \le A, \quad \text{then } B = B^{(1)}$$

$$\text{if } A = L^{(0)} + \alpha\left(L^{(1)} - L^{(0)}\right) \quad \left(0 \le \alpha < 1\right),$$

$$\text{then } B = B^{(0)} + \alpha\left(B^{(1)} - B^{(0)}\right)$$

$$\text{if } A < L^{(0)}, \quad \text{then } B = B^{(0)}$$

- **B(0) とB(1) は，共にインフレスライドする.**
- **積立金のうち L(0) を上回る部分が，実質的なリスクバッファとして機能する.**

- On the other hand, sharing part of the risks and accepting benefit fluctuation to certain extent might be a rational choice for plan participants.

- This is because, if the employer has to bear all the risks, then the employer is required to construct a fairly large risk buffer under the present strong trend to mark-to-market valuation and accounting. Such forced frontloading of contributions is often and inevitably accompanied by reduction of benefits.

- At present the most prominent design from the aspect of risk-sharing may be conditional indexation of benefits which is widespread in the Netherlands. The conditional indexation design provides a virtual risk buffer which corresponds the contribution and reserves for the indexation.

- However, when low interest rates, low inflation and salary depreciation persist for decades (Japan Scenario), the virtual risk buffer might be lessened. Therefore, we have to devise a more robust benefit design which enable the plan to survive even under the Japan Scenario.

- This slide presents a candidate of such designs. It is almost same as the conditional indexation, but both the minimum benefit B(0) and the maximum benefits B(1) are indexed to inflation.

3-1. 現行給付建て制度の問題点

- 積立金と個々の給付債務との間に，個別具体的な対応関係が無い.
- その結果,
  - 制度存続中は，常に受給者の利益が優先される.
  - 現役加入者のリスクを制御する効果的な仕組みが設けられない.

- Here I would like to point out a serious structural deficiency in present DB plans. Namely, there is no specific correspondence between individual liabilities and plan assets.

- Pension benefits are paid out each year. Benefits to be paid out next year are never paid out this year. However, assets are not divided by each payout year. Then the amount to be kept for the next year's benefit disbursement might be used for the benefit disbursement of the year.

- Put it in another way, the interests of present beneficiaries are given the most privileged status.

- Under such an environment, it is very difficult to incorporate a mechanism of protecting the interests of present active participants in an effective and timely manner.

3-2. 支払年度別(PYS)積立基準の枠組み

- 掛金を支払年度別に分解する.
- その分解した掛金を「直列に数珠繋ぎされたコンテナ」に積む.
- 各コンテナに対し，次の2つを指定する.
  - 支払年度
  - 許容最低積立比率

• I believe that there should be some proper mechanism of dealing with the interests of active participants fairly and protecting the interests of present active participants.

• Partial ring-fencing of assets is one of such mechanisms. It will serve as a pre-requisite of the new funding standard which I will explain later.

• The mechanism is as follows. Firstly, divide the contributions by future payout year. Then naturally the reserves are also divided by payout year through this decomposition of contributions.

• We can imagine that the decomposed contributions are loaded on a train of 'sequentially chained containers'. Each container is assigned a specific payout year. The contributions loaded on a container and their investment income can only be used for benefit disbursement in the year assigned to the container.

• Thus we can identify the amount to be allocated to benefit disbursement in each specified year by calculating the terminal value of the decomposed contributions respectively.

• Here the most important point is that a minimum permissible funding ratio should also be assigned to each container.

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3-3. 資産の部分的な使途限定

- 特定のコンテナに積載された資産は，原則として，そのコンテナに指定された年度の給付支払にのみ使用可能．
- 各コンテナで生じた積立剰余は，他のコンテナの積立不足の補填に使用可．
  - *異時点間の*リスク分担の一種
- ただし，積立不足を悪化させて，他のコンテナの積立不足を補填することは不可．

- This means that assets are ring-fenced by payout year. Of course, any surplus in a container may be used for making up for the funding deficiencies of other containers.

- This can be regarded as a kind of intertemporal risk-sharing.

- It should be reminded that when there is no container with a funding surplus, you cannot make up for the funding deficiencies of a container using the assets loaded on other containers.

- Then, there may be a question of how to decompose contributions.

3-4. 掛金の支払年度別分解

- 発生給付の流列を，支払年度別に適切な割引率を用いて割り戻すことにより，掛金は支払年度別に自然に分解される．
- では，各コンテナ（つまり支払年度）別の予定利率を，どのようにして決定すればよいか？
- 支払年度別(PYS) 積立基準（積立基準の支払年度微分）の要点はここにある！

- It is naturally given by discounting back the accrued benefit cashflows using appropriate discount rates. The sum of the discounted amounts should be equal to the amount of ordinal contributions.

- So, you can find that the question is reduced to the problem of how to determine the appropriate discount rate for each container. The rest of my presentation is devoted to this issue.

3-5. 予定利率として,現実のポートフォリオの期待収益率を用いることは，慎重な対応とは言えない

$$dA_u = rA_u du + \sigma A_u dW_u \quad u \in [t, T]$$

$$A_t = L_T \exp\{-r(T-t)\}$$

すると,

$$P(A_T > L_T) = N\left(-\frac{1}{2}\sigma\sqrt{T-t}\right)$$

- First of all, it is not prudent to use directly the expected rate of return on investments of the actual portfolio.
- This example on this slide shows this point quite clearly.
- Let us suppose that the portfolio value follows the standard geometric Brownian motion with constant drift **r** and constant diffusion σ. And we consider that the initial value of the portfolio value is just equal to the discounted value of the benefits to be paid out in year **capital T**, using the expected rate of return **r**.
- Then the probability that the asset value at time **T** is not less than the amount of benefits is given by this formula. Here **N** denotes the distribution function of the standard normal distribution.
- Clearly, this probability is less than 0.5. To make matters worse, this probability decreases as the time to maturity **T-t** extends and the volatility σ increases.
- Then, should we only use the risk free rates? I do not think so.

4-1. PYS積立基準の基本的考え方 (1/2)

P1= ポートフォリオ時価が給付支払年度までのいずれかの時点で(その時点の)給付債務額に到達する確率

P0=ポートフォリオの時価が給付の支払時点で給付債務額(支払額)を上回る確率

当然,

$$P1>P0$$

- We assumed that the portfolio value follows the geometric Brownian motion, which includes incontrollable white noise.
- Then it is anticipated that the probability that the portfolio value will attain the liability value at some time until the year of maturity is greater than the probability that the portfolio value will surpass the liability value at the year of maturity **T**.
- We are going to evaluate the probability **P1** since it will serve as the foundation of determining the discount rate of the new funding standard.

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4-1. PYS積立基準の基本的考え方 (2/2)

- 支払年度を待つことなく，ポートフォリオ時価が「上方バリア」に達した段階で，給付債務の100%ヘッジ戦略に移行すると仮定.
- <u>ポートフォリオの期待収益率が与えられたとき</u>,期初の許容最低積立比率は，前記 **P1** に係る次の条件を満たす最小の率とする.
  - **P1 > p1 (最低水準として外部から与える)**
- これにより，予定利率に含められる期待超過収益率の割合が決まる.

• Firstly, we assume a hypothetical investment strategy that switches to a complete liability-hedging strategy immediately when the portfolio value attains the liability value corresponding to the maximum benefits.

• According to the anticipation stated on the previous slide, this strategy should be superior to the simple strategy of just holding the strategic portfolio (SAA) until the year of maturity.

• Here we consider the condition that the probability P1 is not less than a predetermined constant p1. p1 may be, for instance, 70% or 80%.

• But it should not be 100%, since excessive risk aversion is not beneficial for participants, as I have pointed out before.

• Evaluation of probability **P1** is given by applying a result on the **running maximum process** as follows.

4-2.「上方バリア」に吸収される確率 (1/4)

$$dA_u = rA_u du + \sigma A_u dW_u \quad u \in [t, T]$$

$$A_t = L^{(1)} \exp\left\{-\left(\mu\theta_t + r_F\right)\left(T-t\right)\right\}$$

$$\mu = r - r_F$$

$$dB_u = r_F B_u du \quad u \in [t, T]$$

$$B_t = L^{(1)} \exp\left\{-r_F\left(T-t\right)\right\}$$

- Our interest lies on the initial portfolio value **At** in comparison to the liability value **Lt** which is obtained by discounting back the maximum benefit **L1** at time capital **T** using the risk free rate **rF**.

- Here we assume that the liability value follows the process with constant drift **rF** .

- And we assume that proportion *θ* **t** of the portfolio excess return is taken into account in the discount rate for calculating the minimum funded ratio.

- We can consider the process of log funded ratio when the initial log funded ratio is equal to the minimum log funded ratio given from outside and evaluate the probability **P1**.

- From this evaluation we can set a condition on the initial minimum funded ratio.

4-2.「上方バリア」に吸収される確率 (2/4)

$$X_u = \log \frac{A_u}{B_u}$$

すると,

$$dX_u = \left(\mu - \frac{1}{2}\sigma^2 \right) dt + \sigma dW_u$$

ここで, スタート時の積立水準を αt とする.

$$X_t = \alpha_t = -\mu\theta_t \left(T - t \right) < 0$$

- Using the Ito's quotient formula, we can show that the process of log funded ratio **X**, which is the ratio of the portfolio value **A** to the value of thα αe maximum liability **B**, follows this Wiener process.

- The initial minimum funded ratio **α t** should take a negative value since the we have taken into account a proportion of the portfolio excess return in the discount rate.

- Then we can calculate the probability **P1** utilizing the result on **the running maximum process**.

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4-2. .「上方バリア」に吸収される確率 (3/4)

次の *running maximum* 過程を考える:

$$M_X(u) = \sup_{t \le s \le u} X_s$$

$F_{M(u)}(x)$: **分布関数**

すると，確率 P1 は次により与えられる:

$$P_1 = 1 - F_{M(T)}(0)$$

- The running maximum process **Mx** of a process **X** is the process of the supremum of the process **X**.

•If **FM** denotes the distribution function of the running maximum process, then the probability **P1** is given by this formula.

- Next slide shows the expression of the **FM**.

4-2.「上方バリア」に吸収される確率 (4/4)

$$F_{M(u)}(x) = N\left(\frac{(x-\alpha_t) - \left(\mu - \frac{1}{2}\sigma^2\right)(u-t)}{\sigma\sqrt{u-t}}\right)$$

$$-\exp\left\{2\frac{\left(\mu - \frac{1}{2}\sigma^2\right)(x-\alpha_t)}{\sigma^2}\right\} N\left(-\frac{(x-\alpha_t) + \left(\mu - \frac{1}{2}\sigma^2\right)(u-t)}{\sigma\sqrt{u-t}}\right)$$

5. 追加的な条件 (1/6)

- 制約条件 P1 > p1 は，期待超過収益率 $\mu = r - r_F$ が与えられたとき，その最大何割 θ_t を予定利率に含められるかを決めるのみ．
  - つまり，期待超過収益率とそのボラティリティの組み合わせに応じて決まる．
- たとえば積立不足の規模を制限する観点などから，ボラティリティに関する追加の条件を導入する必要がある．
  - 予定利率を一意に決めるためには

- Thus for any combination of excess return and its volatility we can determine the maximum proportion θ of the excess return that can be taken into account for calculating the minimum funded ratio, depending on the period until the year of maturity.

- If the funding standard is scheme-specific, there is no need to introduce additional conditions.

- However, If we want to determine a unique discount rate depending on the period to maturity, then we have to introduce another condition, which restricts the level of the volatility from the aspect of controlling the severity of underfunding risk.

- A rational ground of introducing another condition may be that in such a case the pension regulator cannot say to the participants, "How unfortunate for you. But you have to give it up thinking that you have met with misfortune."

- One possible idea is restricting the severity of loss when the portfolio value could not attain the liability value at **any** time until the year of maturity.

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5.追加的な条件 (2/6)

(1) ポートフォリオ時価が，*どの時点でも*債務評価額を下回っていた場合における，支払時点の積立不足の規模に制約を設ける.

(2) ポートフォリオ時価が*支払時点で*債務額(給付支払額)を下回っている場合における，支払時点の積立額に制約を設ける:

$$\frac{E[A_T \mid A_T < L^{(0)}]}{L^{(0)}} \geq q, \quad 0 < q < 1$$

- However, evaluating this severity of loss is not always easy.

- Therefore, instead of considering the case that the portfolio value could not attain the liability value at **any** time until the year of maturity, here we consider the case that the portfolio value **at the time of maturity** is less than the liability value corresponding to the minimum benefits.

- And we introduce the condition that even in this case the funded ratio in comparison to the minimum benefits is not less than predetermined constant **q**. As you know, this is a condition on the loss given default.

- This condition can be introduced even if the minimum benefits are not separated from the maximum benefits, which I have explained previously in slide 6.

- When the minimum benefits are separated from the maximum benefits, we can introduce another condition.

5. 追加的な条件(3/6)

(3) 積立比率(の対数)が(「上方バリア」に吸収されることなく) *いずれかの時点で*「下方バリア」に吸収されてしまう確率 **P2** が(外部から与えた)上限 **p2** より小さい.

$$dC_u = r_F C_u du \quad u \in [t, T]$$

$$C_t = L^{(0)} \exp\left\{-r_F\left(T-t\right)\right\}$$

- Namely, in such a case, we can set up a lower barrier on the funded status.
- The lower barrier is the value of the liability corresponding to the minimum benefits, which is denoted by **C**.
- We assume a dynamic investment strategy that automatically switch the portfolio to a complete liability hedging portfolio immediately when the portfolio value hits the lower barrier.
- Then, let us consider the probability **capital P2** that the log funded ratio in comparison to the minimum liability value is absorbed into the lower barrier **0** at **some** time until the year of maturity. It may be desirable that this probability is less than constant **p2**.
- Like the process **X**, let us consider the process **Y** of the log funded ratio in comparison to the minimum liability **C**.

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5. 追加的な条件(4/6)

$$Y_u = \log \frac{A_u}{C_u}$$

$$dY_u = \left(\mu - \frac{1}{2}\sigma^2 \right) du + \sigma dW_u$$

$$Y_t = \beta_t = -\mu\theta_t \left(T - t\right) + \log \frac{L^{(1)}}{L^{(0)}} > 0$$

- Then the process **Y** also follows the Wiener process with constant drift and constant diffusion.

- The initial funded ratio β should be positive since we want to keep the portfolio value not being less than the minimum liability value at **any** time until the year of maturity.

- Namely, the **log L1 over L0** should be greater enough to make the value of β positive. In other words, the gap between the maximum and minimum benefits should be large enough.

- In such a case, we can utilize the result on the probability of **the running minimum process** to calculate the probability **capital P2**.

- As explained in the previous slide, **P2** is the probability that the log funded ratio in comparison to the minimum liability value is absorbed into the lower barrier **0** at **some** time until the year of maturity.

5. 追加的な条件(5/6)

次の *running minimum* 過程を考える:

$$m_Y(u) = \inf_{t \le s \le u} Y_s$$

$F_{m(u)}(y)$: 分布関数

確率 P2 は，次により与えられる:

$$P_2 = F_{m(u)}(0)$$

- Running minimum process **mu** of the process **Y** is the infimum of **Y** until time **u**.
- If the distribution function of the running minimum process **mu** is denoted by **Fmu**, then the probability **P2** is given by **Fmu zero**.
- The next slide shows the formula of **Fmu**.

5. 追加的な条件(6/6)

$$F_{m(u)}(y) = N\left(\frac{(y-\beta_t)-\left(\mu-\frac{1}{2}\sigma^2\right)(u-t)}{\sigma\sqrt{u-t}}\right)$$

$$+\exp\left\{2\frac{\left(\mu-\frac{1}{2}\sigma^2\right)(y-\beta_t)}{\sigma^2}\right\}N\left(\frac{(y-\beta_t)+\left(\mu-\frac{1}{2}\sigma^2\right)(u-t)}{\sigma\sqrt{u-t}}\right)$$

6-1. 期待超過収益率の許容範囲 --- 制約条件(2)

$L^{(1)}/L^{(0)}$	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
$T-t$	10	10	10	20	20	20	5	5	5
p_1	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
q	0.80	0.90	0.95	0.80	0.70	0.60	0.80	0.90	0.95
w_t	0.74	0.35	0.17	0.57	0.91	1.26	0.94	0.46	0.23
θ_t	0.49	0.50	0.51	0.44	0.40	0.40	0.69	0.62	0.60
r_P	7.40	6.29	5.66	6.97	7.81	8.45	7.88	6.63	5.85
$\exp\{-(r_P-r_F)(T-t)\}$	0.79	0.88	0.94	0.67	0.57	0.50	0.87	0.92	0.96
$\exp\{\alpha_t\}$	0.89	0.94	0.97	0.84	0.80	0.76	0.90	0.95	0.97

- This table shows some numerical examples for the traditional case that the maximum benefits are equal to the minimum benefits. The period until the year of maturity is **10** years, **20** years or **5** years.

- I fixed the condition on probability **p1**. Namely, it is assumed that the portfolio value will attain the maximum liability value at **some** time until maturity with **70%** probability.

- The condition on **q** varies from **0.6** to **0.95**. Namely, the conditional funded ratio at the year of maturity is not less than **60%** or **95%** of the benefits.

- Here we have assumed that the risk free rate is **5% p.a.** and the yield curve is **flat**. It is also assumed that the excess return of the speculative portfolio is **3%** and its volatility is about **14%**.

- You can see, for instance, in the far right column that under these conditions on **p1** and **q**, we can take into account **49%** of the excess return of the actual portfolio, where the weight of the speculative portfolio is **74%**.

- If we take into account **100%** of the excess return of the total portfolio, then the initial funded ratio becomes **79%** of the liability value. But the minimum funded ratio should be **89%**, since we can include only half of the excess return in the discount rate.

6-2. 期待超過収益率の許容範囲 --- 制約条件(3)

$L^{(1)} / L^{(0)}$	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
$T-t$	10	10	10	20	20	20	5	5	5
p_1	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
p_2	0.20	0.30	0.40	0.20	0.30	0.40	0.20	0.30	0.40
w_t	0.68	0.80	0.92	0.48	0.56	0.64	0.92	1.09	1.27
θ_t	0.49	0.49	0.50	0.46	0.44	0.43	0.69	0.73	0.79
r_P	7.25	7.55	7.84	6.68	6.91	7.14	7.84	8.18	8.47
$\exp\{-(r_P - r_F)(T-t)\}$	0.80	0.77	0.75	0.71	0.68	0.65	0.87	0.85	0.84
$\exp\{\alpha_t\}$	0.90	0.88	0.87	0.86	0.84	0.83	0.91	0.89	0.87
$\exp\{\beta_t\}$	1.34	1.32	1.30	1.29	1.27	1.25	1.36	1.34	1.31

- In the previous slide, you can also see that the initial minimum permissible funded ratio increases gradually as the acceptable risk with regard to **q**, that is a risk measure on the severity of default, increases.

- However, it should be noted that the maximum permissible proportion θ is almost stable and does not increase along with the acceptable risk **q**.

- It should also be noted that the maximum permissible proportion θ diminishes as the time horizon extends. As a result, the possible mark-up to the risk free rate also diminishes gradually as the time horizon extends. The proportion of the possible mark-up to the excess return of the speculative portfolio is roughly evaluated by the product of **w** and θ.

- The table on slide 25 shows several examples when the maximum benefits is **50%** greater than the minimum benefits. This table also justifies the argument that a certain proportion of the excess return can be included in the discount rate of the funding standard.

- However, as in the previous slide, the maximum permissible proportion θ diminishes as the time horizon extends.

- You may feel that these examples are counterintuitive. But we should be fully aware that long-term investments do not assure high return with greater certainty than short-term investments.

6-3. 予定利率（割引率）に関する示唆

- 上記により設定した割引率は，期待超過収益率の一定割合を含む．
- 支払年度までの期間が長ければ，期待超過収益率のうち割引率に含めて良い部分は大きくなる．
  - ただし，支払年度までの期間に応じ，許容できるリスクが大きくなる場合*のみ*
- 期待超過収益率のうち割引率に含めて良い部分の割合は，コブ状になっている可能性がある．
  - 支払年度までの期間にかかわらず，許容可能なリスクに上限がある場合

- We can bring out several implications from these examples, although these examples are based on very simplified assumptions. First is the implications on the discount rates.

- Before I prepared this paper, I had anticipated that the proportion of the excess return that can be taken into account in discount rates will increase as the time to maturity extends.

- However, it has become clear that in order to obtain such results, we have to accept greater risks as the time to maturity extends.

- Of course, as the time horizon extends, we can accept greater risks since we can spend longer periods to correct the funding deficiencies.

- However, there should be a due limit on the acceptable risks irrespective of the period until maturity. Then it is anticipated that the graph of the proportion θ might be hump-shaped.

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6-4. 積立基準に関する示唆

- 年金基金は，投資ホライゾンが拡大すれば，より大きな資産運用リスクをとることができると言われる.
  - ただしそれは，投資ホライゾンに対応して，積立不足をより長期間で段階的に償却できる場合に 限られる.
- 積立基準は，次の二つの間の適切なバランスを確保するものでなければならない.
  - A) 理にかなった経済コストのもとで，掛金拠出者の掛金負担の安定性を確保すること
  - B) 理にかなった高い確率で，目標とした給付が支払われるよう確保すること

- The examples in the previous slides assumes the hypothetical dynamic investment strategy and a new funding standard which requires partial ring-fencing of assets and specifies a sequence of minimum funded ratios for each payout year.

- However, from these examples we can bring out several implications for traditional funding standards.

- The most important implication might be that the common understanding that a pension fund can take large investment risks when it has a long investment horizon holds **only when** it is allowed to correct funding deficiencies gradually spending long periods.

- Thus the funding standards play a important role in determining the general risk level that pension funds can take in investments.

- Put it in another way, any funding standard should strike a very **delicate** balance between the two purposes of funding standards, namely, assuring stable contributions and ensuring adequate protection of benefits.

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6-5. 運用戦略に関する示唆

- 年金資産のポートフォリオは，目標年ファンド(TDFs)の合成（コンポジット）と考えることができる.
  - 積立基準によらない
- ポートフォリオを支払年度別に分解することで，投資ホライゾンに関する議論を著しく透明化することができる.
- 給付キャッシュフローの見込みやリスク回避度に変化があったときは，本来，ポートフォリオのリバランスが必要である.
  - 市場に対する見方に変化がないとしても

- We can also bring out implications on investment strategies of pension funds.

- Needless to say, any portfolio can be understood as a composite of about 80 target date funds. We can make the considerations on the investment horizon extremely transparent by decomposing the assets and contributions by payout year.

- Each target date fund has its own year of maturity and needless to say its strategic asset allocation depends on the time to maturity.

- Then if there were changes in the estimation on the benefit cashflows, it would affect the relative weights of individual target date funds and thus affect the composition of the total portfolio. Therefore, the portfolio should be rebalanced even if the prospect on the market is invariant.

- Similarly, if the funded ratio of individual target date funds worsened or improved at the year-end, then it would affect the degree of risk aversion of the pension plan. Therefore, the portfolio should be rebalanced along with the changes in the funded ratio.

- Finally, I would like to conclude my presentation by giving my views on the funding standards.

7. おわりに

- 積立基準は，年金資産の運用に関わる問題を十分に考慮しなければ，持続可能なものとならない．逆も真である.
- 支払年別（PYS）積立基準は,財政運営の課題と資産運用の課題を有機的に連携させる基本的な考え方を示している.