Pensions, Benefits and Social Security

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Appropriate Structures and Mechanisms of Risk-sharing in a Nursery Plan

-- Challenges for the Occupational Pension System of Japan --

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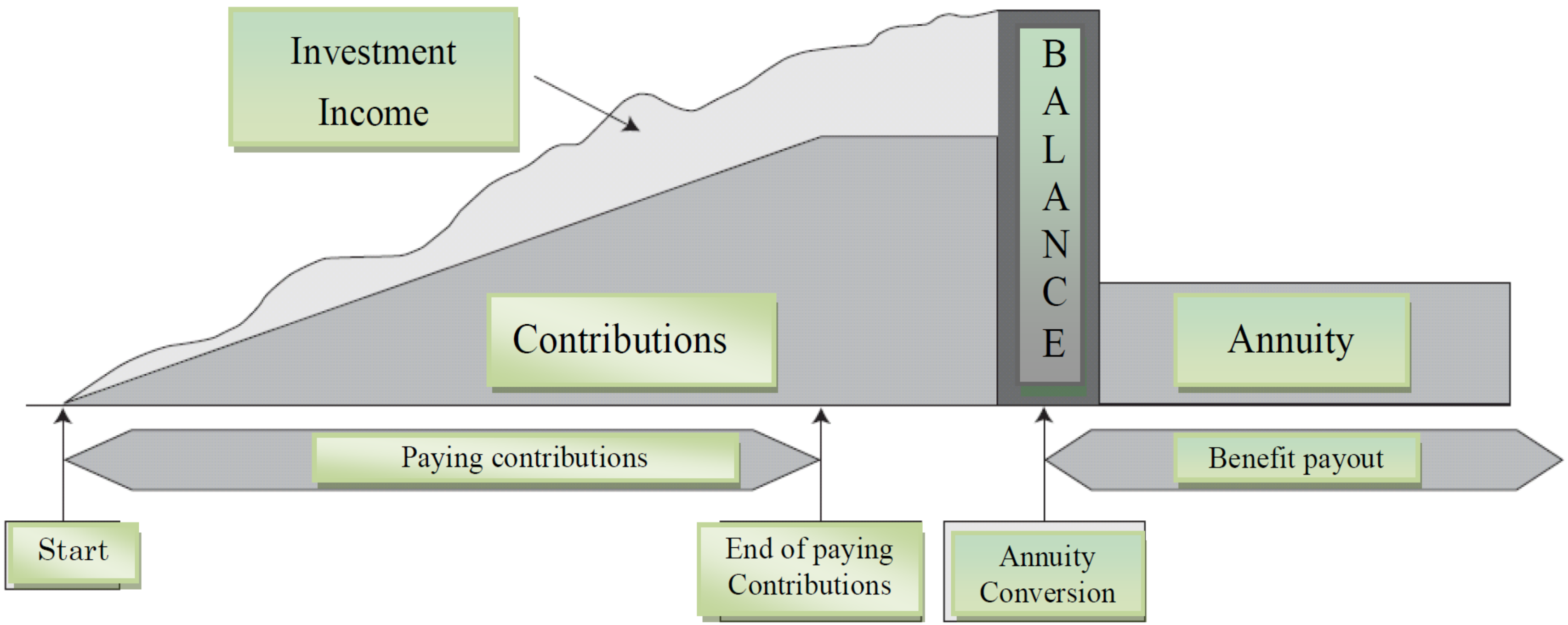
1-1. Characteristics of a stylized Nursery Plan



- **A sequential combination of DC and DB**

1-2. Differences from a CB plan

A) **Negative indexation:**
  - **not** allowed to a CB plan (in the case of Japan)
  - allowed to a Nursery plan

B) **The annuity conversion rates:**
  - may deviate from market interest rates in a CB plan
  - **cannot** deviate in a Nursery plan

C) **The accumulation phase and the payout phase:**
  - financially **not** separated in a CB plan
  - completely separated in a Nursery plan

2-1. Risks in the accumulation phase

- **The funded statuses of individual accounts will diverge significantly.**
  - **Some generations might be lucky, but other generations might not.**
  - **Participants are extremely vulnerable to the market shocks close to the annuity conversion.**
- **So-called *life cycle strategies* provide very limited protection.**
- **In a Nursery plan the possibility of smoothing out the imbalance remains.**
  - **since the accumulation phase has a collective DC feature**

2-2. Risks at annuity conversion

- **It is ruled out to apply smoothed interest rates as the basis of the annuity conversion.**
  - **when intergenerational risk-sharing is precluded**
- **How much risk-margin should be charged when converting to annuity?**
  - **The stronger the requirements on benefit protection are, the heavier the risk margin have to be.**
  - **The risk of so-called *adverse selection* has also to be given proper consideration.**

2-3. Risks in the payout phase

- **Three sources of the risks:**
  1. **interest rate risk**
  2. **the basis risk of the liability hedging strategy**
  3. ***macro* longevity risk**
- **A strict asset-liability matching strategy has to be implemented.**
  - **if the employer does not bear investment risk**
  - **The expected investment return thus tends to become lower than ordinary DB plans.**

2-4. The risk of annuitisation from the standpoint of participants

- **She may die before attaining age 65+m:**

$$\bar{a}_{\overline{m}|} + {}_{m|}\bar{a}_{65}$$

  - **she will then lose the capital invested for covering the *personal* longevity risk**

- **Then, at the time of annuity conversion she will <u>recognize</u>:**
  - **she has lost control of the corresponding capital**

3-1. A levelling-off mechanism (or warranty of the capital)

- **The imbalance in the funded status is beyond the efforts of individual participants.**
- **A possible levelling-off mechanism may be:**

a. construct a special buffer fund (SBF)

b. average RoR > prescribed maximum,

⇒ the surplus shall be left in the SBF

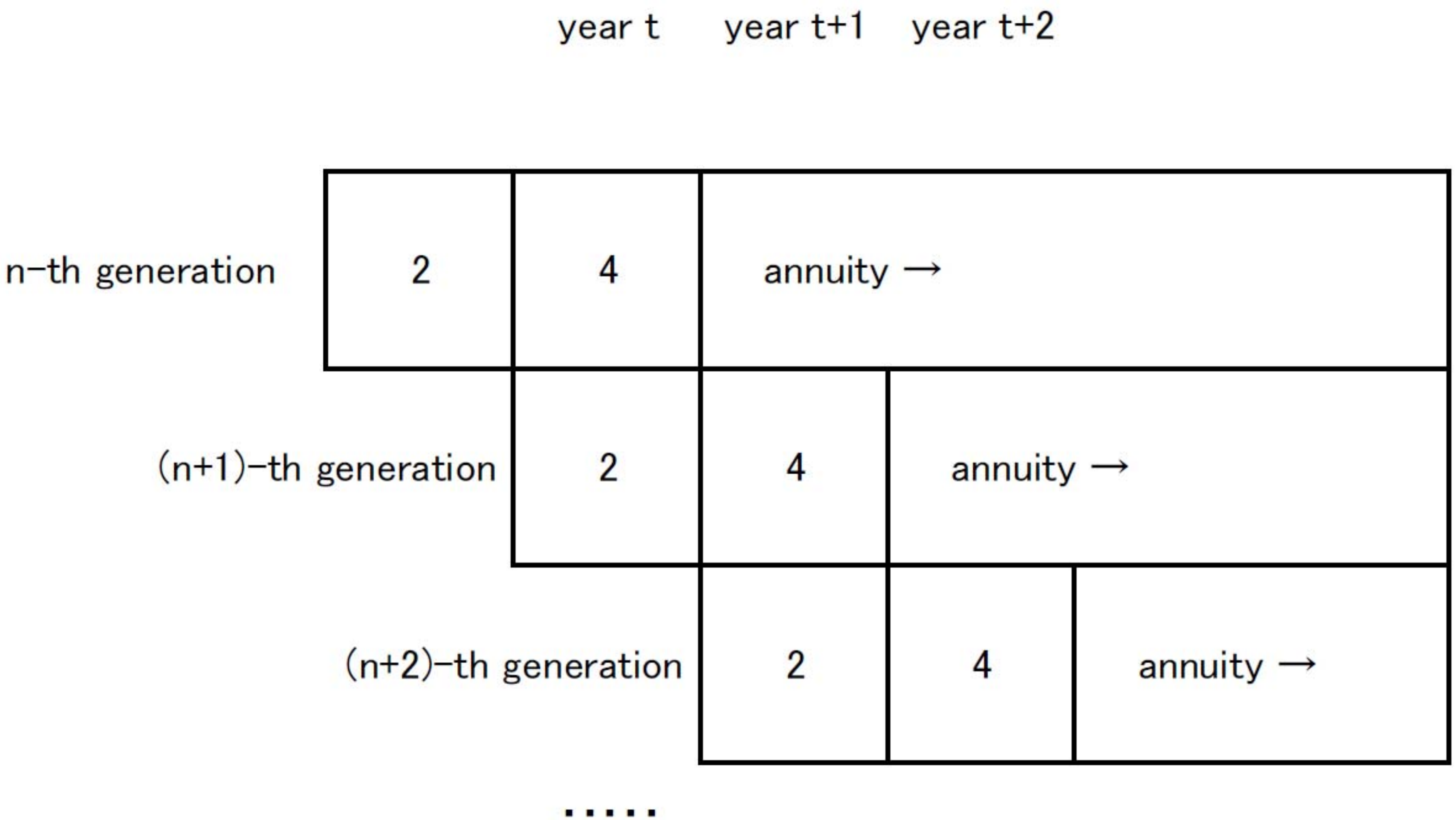
c. average RoR < prescribed minimum,

⇒ the shortfall shall be covered by the SBF

3-2. Cost of warranting the principal

- **The cost of warranting the principal is said to be modest.**
  - **A WG of the JSCPA reported this consideration with some empirical evidence.**
  - **But it holds only when the employer bears the risk in extreme cases.**
- **This mechanism would inevitably lower the expected RoR.**
  - **if the employer did not bear the corresponding risk and there were no chance of arbitrage**

4-1. Significance of the market shocks close to annuity conversion



4-2. The liability-hedging portfolio

- **The liability-hedging portfolio (LHP) is composed of zero-coupon TIPS with appropriate maturities.**
- **Generally, the LHP is age-dependent since:**

$$L_{t+1} = \exp\{-\sum_{k=1}^{65-n} r_{t+k}\}(\bar{a}_{\overline{15}|} + {}_{15|}\bar{a}_{65})$$

- **The most conservative stance on real interest rate risk may be assuming** $r_{t+k} = 0$ **for all** $k = 2, 3, \cdots$.

4-3. Virtual borrowing and lending of the LHP of elder generations

1. **Virtual borrowing and lending of short-term government bonds:**
   A) short positions for younger generations
   B) long positions for elder generations
2. **Younger generations can thus overcome the budgetary constraints.**
3. **No need of actually constructing the GB portfolio.**
4. **This is economically equivalent to the implicit relationship assumed in traditional DB plans.**

5-1. Spending improvement quotient

$$= \frac{\text{Self-insurance cost} - \text{Insurance cost}}{\text{Insurance cost}}$$

$$= \frac{\bar{a}_{\overline{n}|} - (\bar{a}_{\overline{m}|} + {}_{m|}\bar{a}_{65})}{\bar{a}_{\overline{m}|} + {}_{m|}\bar{a}_{65}}$$

- **By investing W in the annuity instead of constructing the self-insurance portfolio, she can release her wealth equivalent to W x SIQ**

5-2. Lost control quotient

$$= \frac{\text{Insurance cost} - \text{PV of the annuity\_certain}}{\text{Insurance cost}}$$

$$= \frac{{}_{m|}\bar{a}_{65}}{\bar{a}_{\overline{m}|} + {}_{m|}\bar{a}_{65}}$$

- **The amount which she has lost control of by converting one unit of wealth into the annuity**

5-2. The optimal age 65+m from which longevity risk is pooled

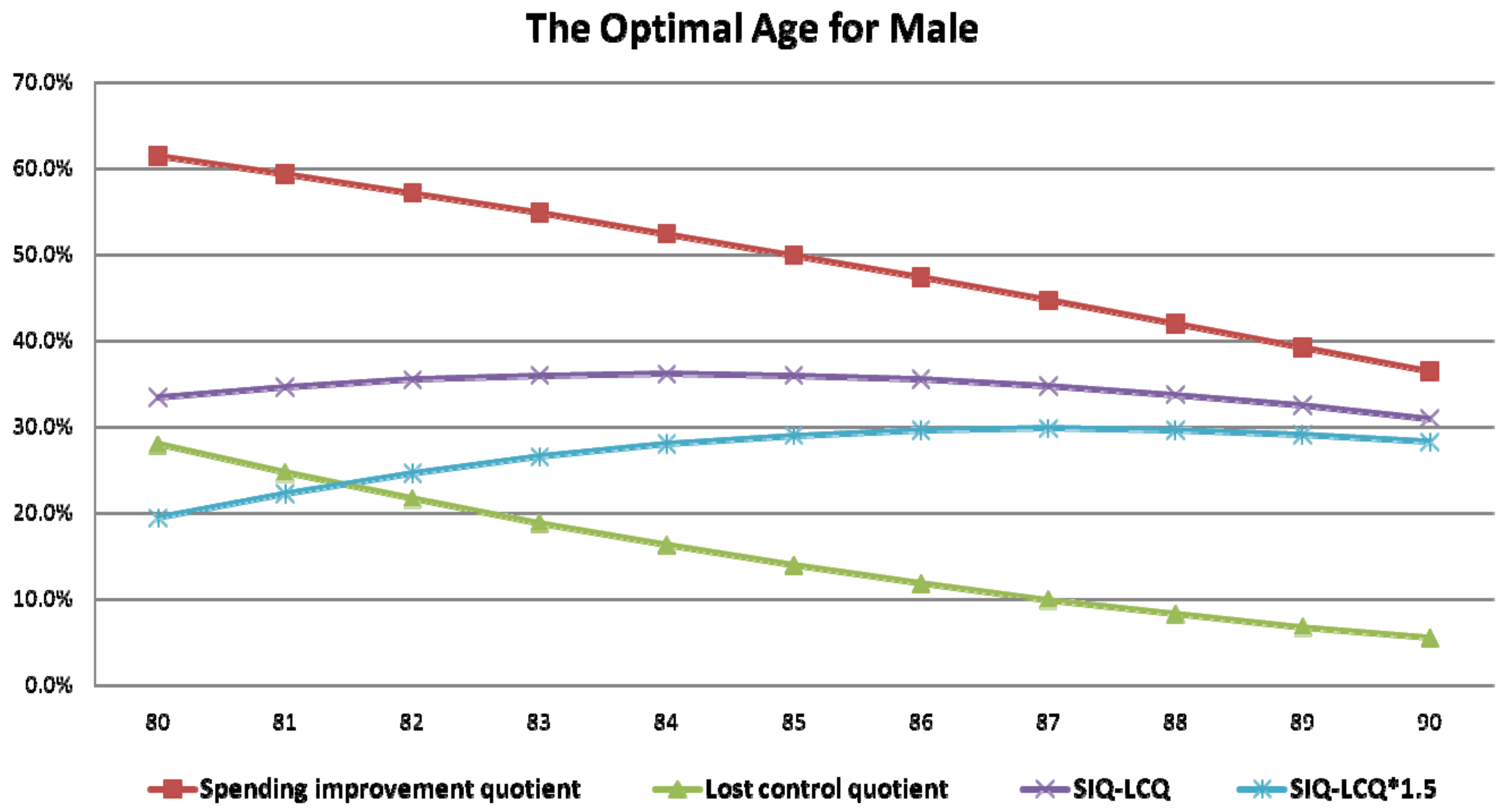
- **Find the optimal m which gives the maximum value of**

$$\mathrm{SIQ} - \lambda \times \mathrm{LCQ}$$

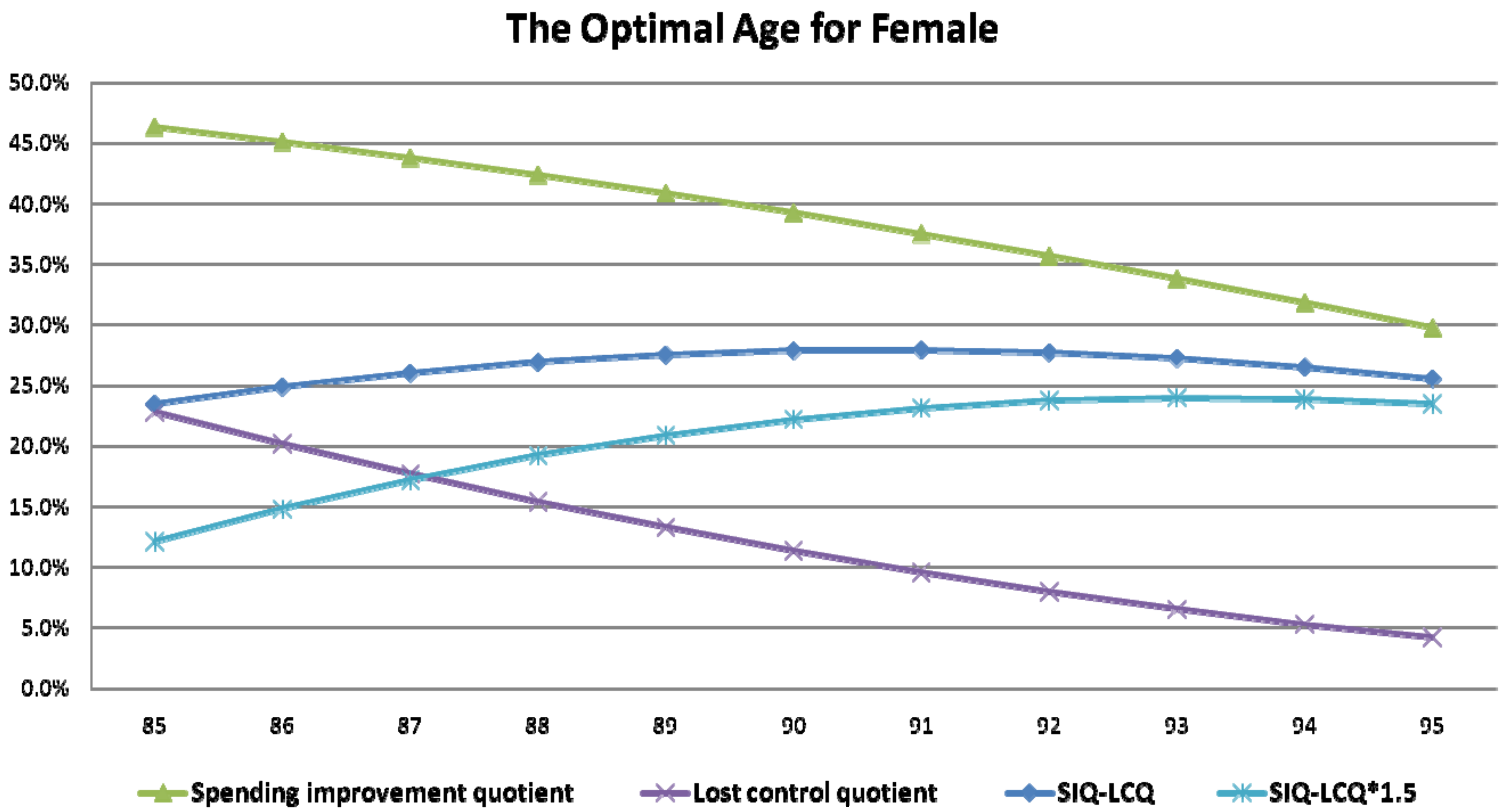
- **λ depends on the level of risk aversion of ordinary participants.**

- **The following graphs show the optimal age 65+m for a Japanese cohort with birth year 1947. Expected life at birth is 80.7 years for male and 88.1 years for female. It is assumed that the discount rate is 1.5% p.a.**

5-3. The optimal age 65+m for Japanese male cohort



5-3. The optimal age 65+m for Japanese female cohort



6. Concluding remarks

- **Well-designed inter/intra-generational risk-sharing can make good the inherent shortcomings of DC-like hybrid plans to some extent.**
- **Welfare of participants is thus enhanced.**
- **If we expect DC-like hybrid plans to play a reliable role in the overall old-age income security system, these plans should be equipped with appropriate risk-sharing structures and mechanisms.**