Economic IRR and Its Application

Naoki Sunamoto, FIAJ
Fukoku Mutual Life Insurance Company

About the speaker

Naoki Sunamoto, FIAJ

Executive Officer, Appointed Actuary

Acquired Experience in Financial Planning and Actuarial Practice, Currently Serves as General Manager of Corporate RM Dept.

Fukoku Mutual Life Insurance Company

すてきな未来応援します
フコク生命

A mutual life insurance company with a history of over 90 years in Japan, known for its unique “Customer-Centric” approach.

Based on its corporate philosophy, the company acts in the best interests of policyholders and values quality over quantity.

Disclaimer

Note that examples are provided for illustrative purposes only and should not be considered definitive figures. Statements of fact and opinions expressed are those of the author and are not the opinion or position of the IAJ, or its committees. The IAJ does not endorse or approve, and assumes no responsibility for, the content, accuracy or completeness of the information.

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- Economic IRR and Its Features
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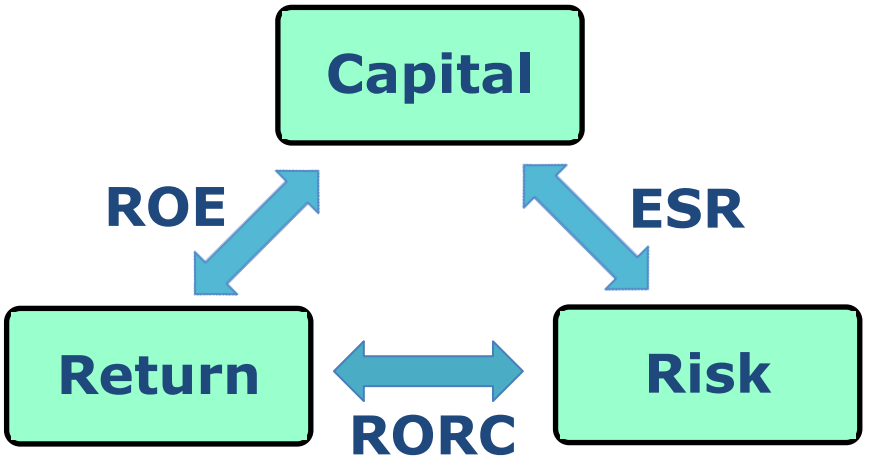
- Examples of Practical Use
- Conclusion

Introduction - Contemporary ERM

Integrated management of capital, risk and return is essential for the contemporary Enterprise Risk Management (ERM).



$$\frac{\text{Return}}{\text{Risk}} = \frac{\text{Capital}}{\text{Risk}} \times \frac{\text{Return}}{\text{Capital}}$$

$$\text{RORC} = \text{ESR} \times \text{ROE}$$

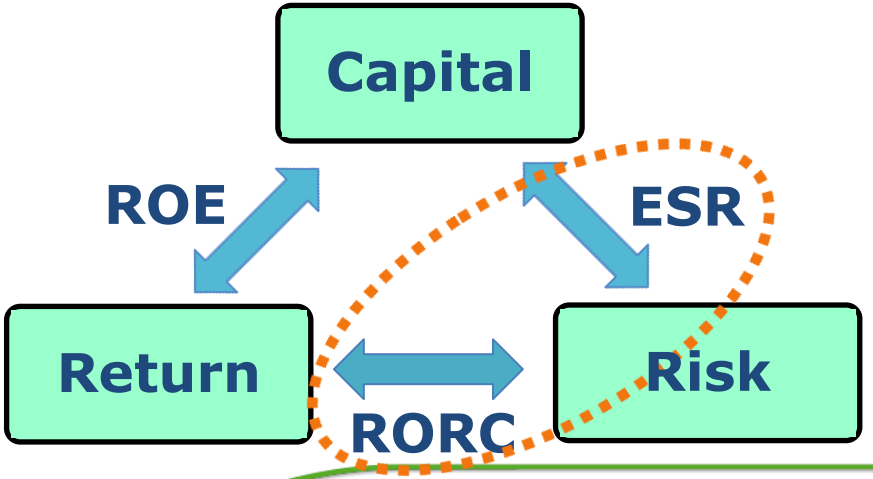
Introduction - Contemporary ERM

The risk-adjusted return metric represented by RORC is popularly used in practice, **but gives little information about ESR.**

$$RORC = \frac{PVFP + Risk\ free\ Return\ on\ Risk\ Capital}{PV\ \ of\ Risk\ Capital}$$

Introduction - Contemporary ERM

We introduce a risk-adjusted return metric called "**Economic** **I**nternal **R**ate of **R**eturn" (Economic IRR) as a complement to RORC.



- **gives much information about ESR.**
- **excels in effectiveness and efficiency and is very useful in decision making.**

Economic IRR and Its Feature

Economic IRR can be defined as a discount rate that equates present value of the future cash flows with the sum of initial investment and initial required capital.

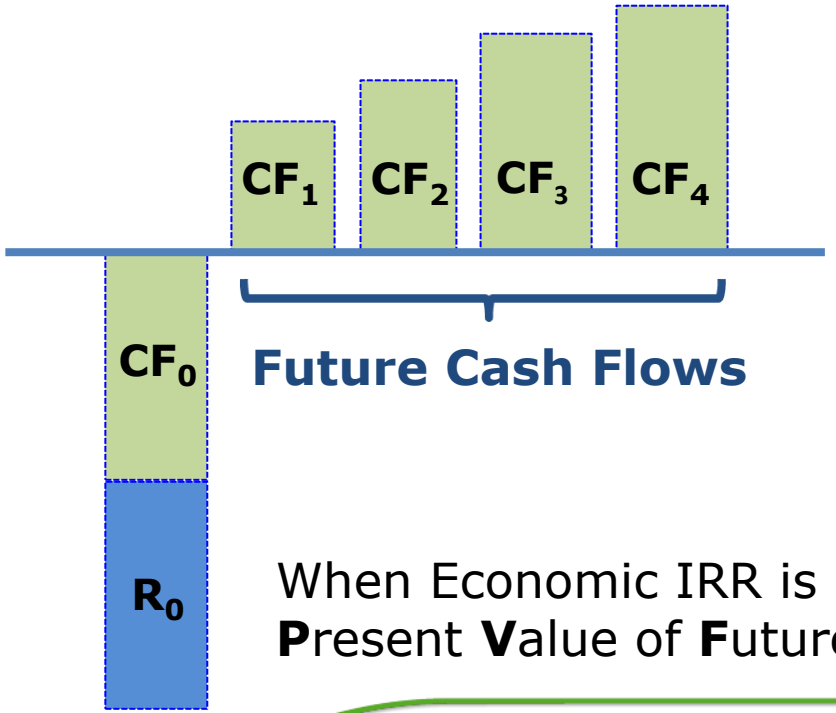
$$\sum \frac{\text{Future Cash Flow}_t}{(1+\text{IRR})^t} = CF_0$$

$$\sum \frac{\text{Future Cash Flow}_t}{(1+\text{Economic IRR})^t} = CF_0 + R_0$$

Initial Capital Investment

R_0 : Initial Required Capital

Economic IRR and Its Feature



Definition

$$\sum \frac{\text{Future Cash Flow}_t}{(1+\text{Economic IRR})^t} = CF_0 + R_0$$

$$\sum \frac{\text{Future Cash Flow}_t}{(1+\text{Economic IRR})^t} - CF_0 = R_0$$

When Economic IRR is equal to ***i,*** the left side is equal to **P**resent **V**alue of **F**uture **P**rofit at time 0 (**$PVFP_0$**).

Economic IRR and Its Feature

Economic IRR = i

$$\sum \frac{\text{Future Cash Flow}_t}{(1+i)^t} - CF_0 = \sum \frac{\text{Future Cash Flow}_t}{(1+\text{Economic IRR})^t} - CF_0$$

$$\mathbf{PVFP_0} = \mathbf{R_0}$$

$$\mathbf{ESR_0} = 100\%$$

i : risk-free rate

ESR_0 = $PVFP_0 / R_0$

Economic IRR and Its Feature

Economic IRR $<$ i

$$\sum \frac{\text{Future Cash Flow}_t}{(1+i)^t} - CF_0 < \sum \frac{\text{Future Cash Flow}_t}{(1+\text{Economic IRR})^t} - CF_0$$

$$\downarrow$$

$$PVFP_0 < R_0$$

$$\downarrow$$

$$ESR_0 < 100\%$$

i : risk-free rate

$ESR_0 = PVFP_0 / R_0$

Economic IRR and Its Feature

Economic IRR > i

$$\sum \frac{\text{Future Cash Flow}_t}{(1+i)^t} - CF_0 > \sum \frac{\text{Future Cash Flow}_t}{(1+\text{Economic IRR})^t} - CF_0$$

$$\downarrow$$

$$\mathbf{PVFP_0} > \mathbf{R_0}$$

$$\downarrow$$

$$\mathbf{ESR_0} > 100\%$$

i : risk-free rate

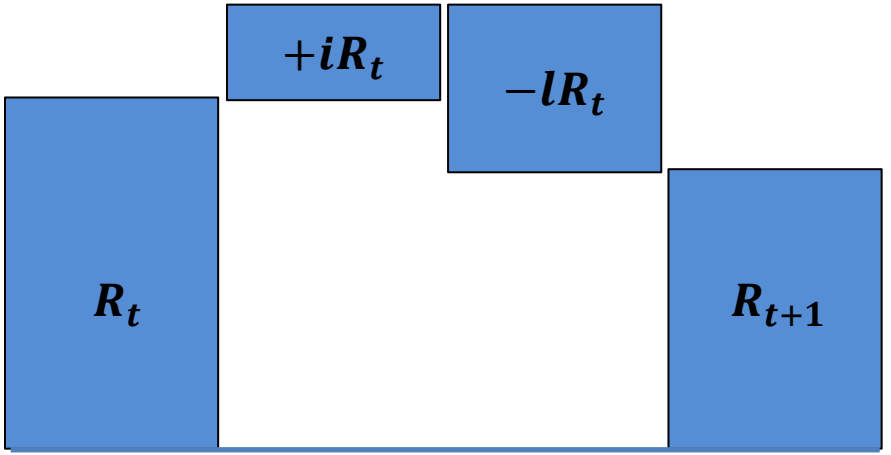
ESR_0 = $PVFP_0 / R_0$

Economic IRR and Its Feature

Economic IRR	$PVFP_0$	ESR_0
Below ***i***	Less than R_0	Less Than 100%
Equal to ***i***	Equal to R_0	Equal to 100%
Over ***i***	More than R_0	More than 100%

Modeling – Discrete Model

We develop a discrete model for Economic IRR by using the concept of "risk release rate". This is the key for the modeling.



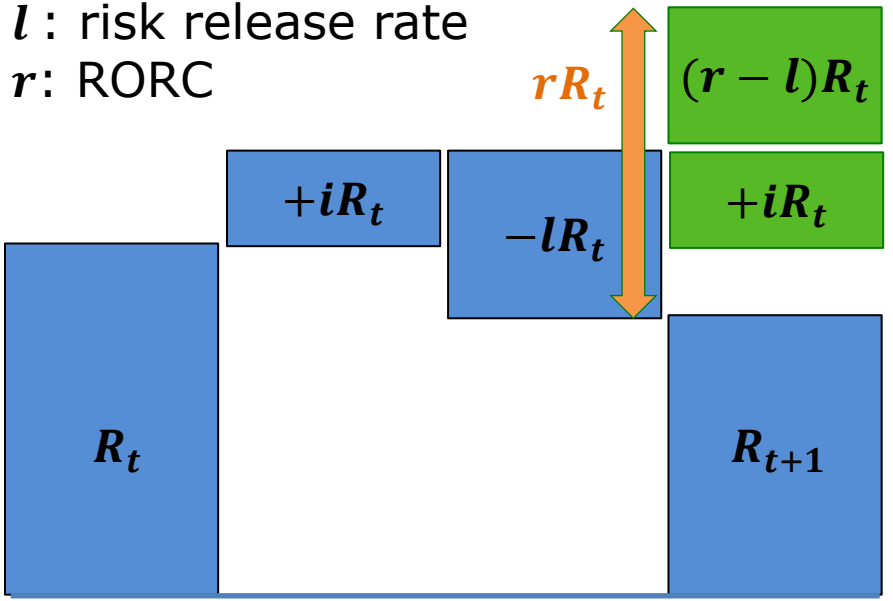
i : risk-free rate
l : risk release rate
r: return on required capital (RORC)

$$R_{t+1} = (1 + i - l) \quad R_t$$

Hereinafter, r stands for $PVFP_0$ / $PVFR_0$

Modeling – Discrete Model

i : risk-free rate
l : risk release rate
r: RORC



Discrete Model
$\frac{PVFP_t}{PVFR_t} = \frac{r}{1+i}$
$ESR_t = \frac{r}{l}$
$Economic\ IRR = r - l + i$
$Risk\ Premium = r - l$

Modeling – Continuous Model

Before developing continuous model, we introduce some notations expanded by those of discrete model.

Discrete Model

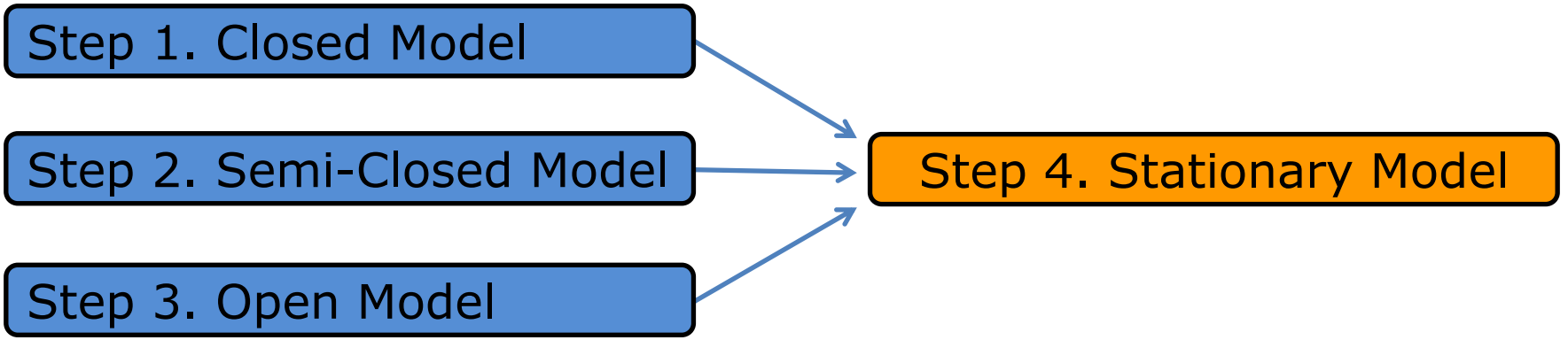
i : risk-free rate
l : risk release rate
r : RORC

Continuous Model

δ: force of risk free rate
θ: force of risk release rate
ρ: force of RORC

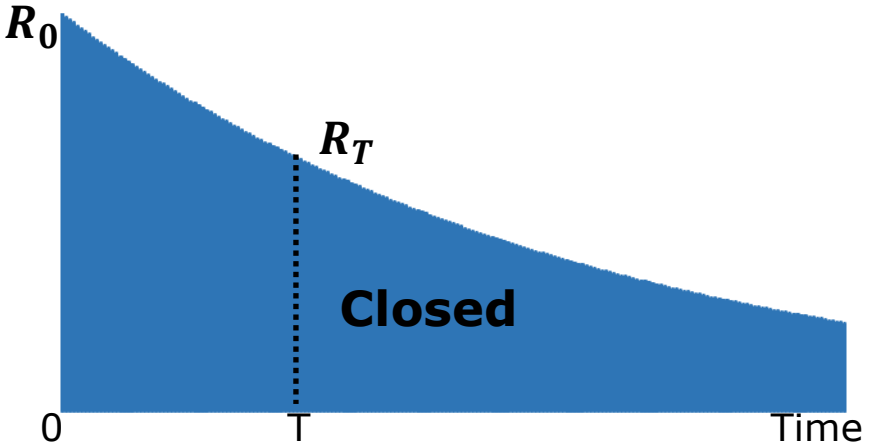
Modeling – Continuous Model

We also develop a continuous model. We need the 4 steps to develop a continuous model in a stationary state.



Modeling – Continuous Model

Step 1. Closed Model

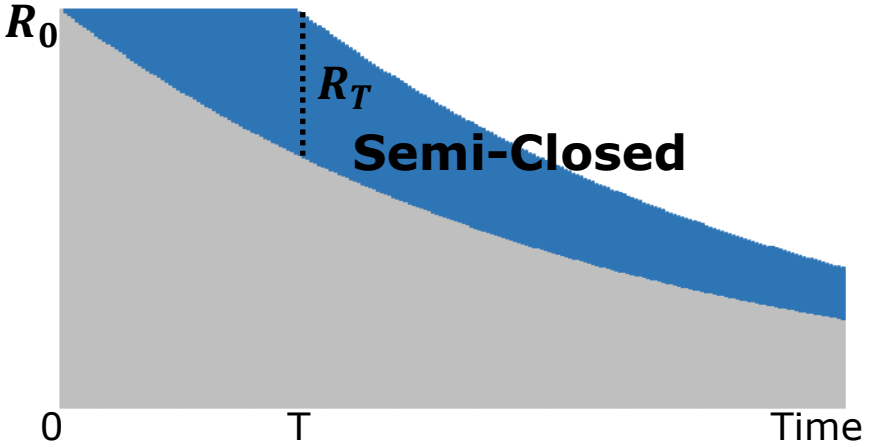


δ: force of risk-free rate
θ: force of risk release rate
ρ: force of RORC

Closed Model
$\frac{PVFP_T}{PVFR_T} = \rho$
$ESR_T = \frac{\rho}{\theta}$
$Economic\ IRR = \rho - \theta + \delta$
$Risk\ Premium = \rho - \theta$

Modeling – Continuous Model

Step 2. Semi-Closed Model

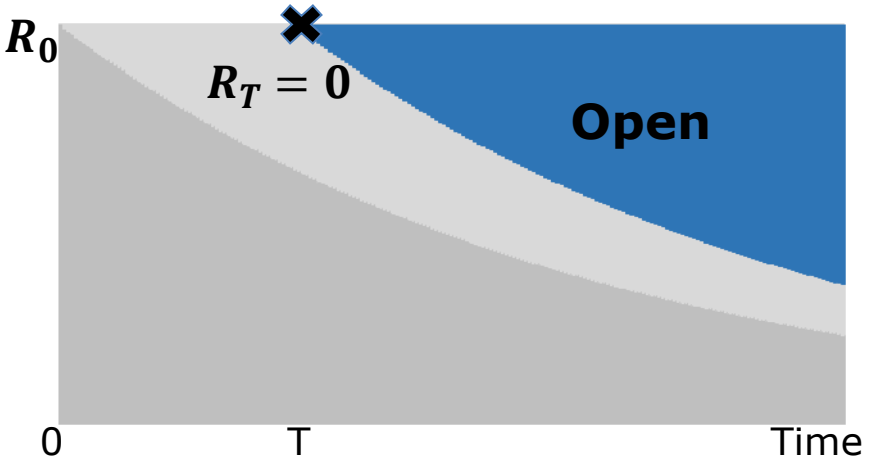


δ: force of risk-free rate
θ: force of risk release rate
ρ: force of RORC

Semi-Closed Model
$\frac{PVFP_T}{PVFR_T} = \rho$
$ESR_T = \frac{\rho}{\theta}$
$Economic\ IRR = \rho - \theta + \delta$
$Risk\ Premium = \rho - \theta$

Modeling – Continuous Model

Step 3. Open Model

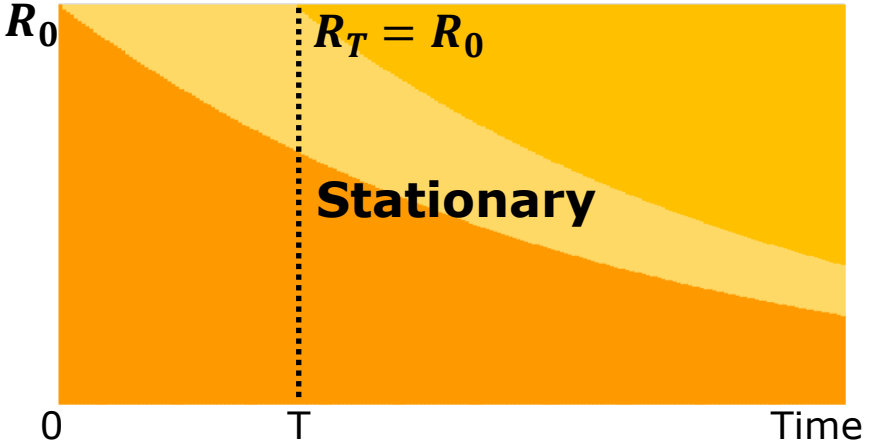


δ: force of risk-free rate
θ: force of risk release rate
ρ: force of RORC

Open Model
$\frac{PVFP_T}{PVFR_T} = \rho$
$ESR_T = \mathrm{N/A}$
$Economic\ IRR = \rho - \theta + \delta$
$Risk\ Premium = \rho - \theta$

Modeling – Continuous Model

Step 4. Stationary Model



δ: force of risk-free rate
θ: force of risk release rate
ρ: force of RORC

Stationary Model
$\frac{PVFP_T}{PVFR_T} = \rho$
$ESR_T = \frac{\rho}{\delta}$
$Economic\ IRR = \rho - \theta + \delta$
$Risk\ Premium = \rho - \theta$

Modeling – Continuous Model

Most Important Feature

Maximize

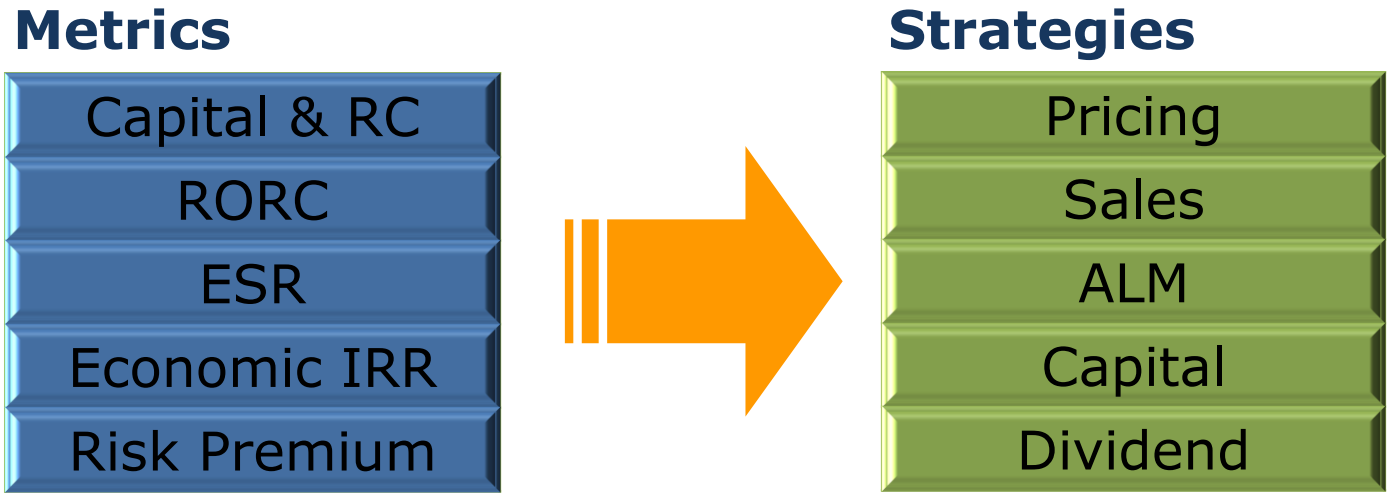
$$ESR_T = \frac{\rho}{\theta}$$

Maximize

$$Economic\ IRR = \rho - \theta + \delta$$

Examples of Practical Use

We will show an example of practical use in Fukoku Mutual Life.
Economic IRR and other metrics are used in our decision making process.



Examples of Practical Use - Pricing

The pricing policy is "conservative but competitive" and an exquisite balance between the two is the key to successful pricing.

	Pricing A	Pricing B	Pricing C	Pricing D
E-IRR*	8.3%	7.0%	0	Below 0
$PVFP_0$ vs. R_0	$PVFP_0 > R_0$	$PVFP_0 > R_0$	$PVFP_0 = R_0$	$PVFP_0 < R_0$
ESR_0	ESR_0 =230%	ESR_0 =200%	ESR_0 =100%	ESR_0 <100%

Hereinafter, E-IRR* stands for the risk premium of required capital and the pricing strategy is basically subject to the risk appetite targeting 230% ESR.

Examples of Practical Use - Pricing

Pricing A : Economic IRR* satisfies the ESR target.

	Pricing A
E-IRR*	8.3%
$PVFP_0$ vs. R_0	$PVFP_0 > R_0$
ESR_0	ESR_0 =230%

- **Sufficiently conservative!**
- **But is it competitive?**
- **If you could successfully develop a unique hit product, the pricing would be possible.**
- **"Product Differentiation" is the key!**

Examples of Practical Use - Pricing

Pricing B : Economic IRR* becomes slightly less than the ESR target.

	Pricing B
E-IRR*	7.0%
$PVFP_0$ vs. R_0	$PVFP_0 > R_0$
ESR_0	ESR_0 =200%

- **Remains conservative!**
- **And competitive in many cases.**
- **Although E-IRR* is less than the target, profit arising from the product will contribute to further risk-taking when it is retained in free surplus.**

Examples of Practical Use - Pricing

Pricing C : Economic IRR* becomes zero.

	Pricing C
E-IRR*	0
$PVFP_0$ vs. R_0	$PVFP_0 = R_0$
ESR_0	ESR_0 =100%

- **Discuss the possibility of ancillary sales.**
- **If E-IRR* could be improved to a satisfactory level by the synergy effect, the pricing would be barely acceptable!**

Examples of Practical Use - Pricing

Pricing D : Economic IRR* becomes below zero.

	Pricing D
E-IRR*	Below 0
$PVFP_0$ vs. R_0	$PVFP_0 < R_0$
ESR_0	ESR_0 <100%

- **Inappropriate!**
- **Because the profitability is not sufficient to cover its own required capital.**

Examples of Practical Use – Sales

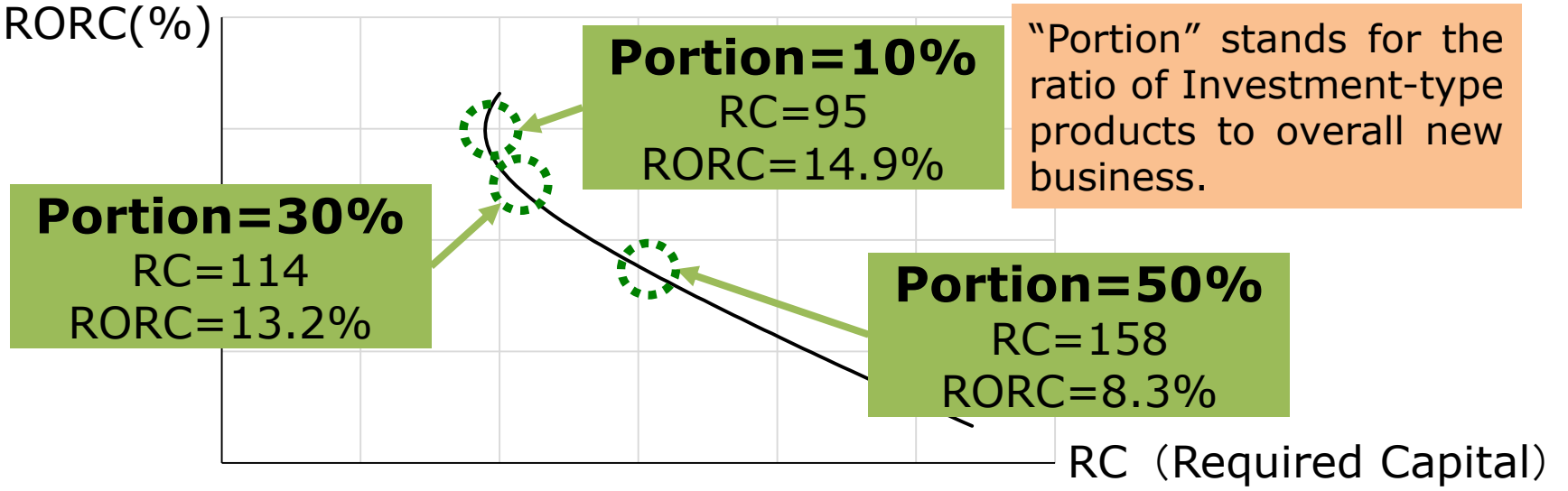
The balance between profitability and ease-of-sale is a challenge. Let us consider the balance, assuming that there are two typical products.

	Investment-type	Protection-type
Profitability (Risk-Return Effectiveness)	Low	High
Ease of Sale (Customers' Preference)	High	Low

What the aggregate RORC will become, if we change the "Investment-type" portion of new business into 10%, 30% and 50%?

Examples of Practical Use – Sales

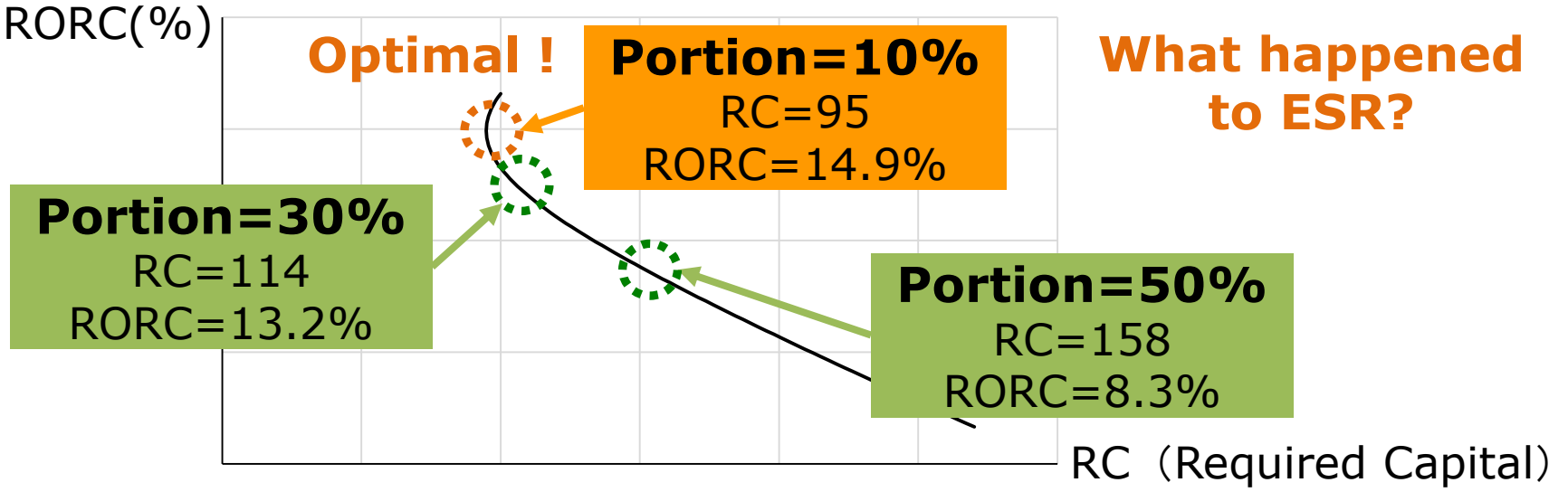
Which is the best among the three?



"Portion" stands for the ratio of Investment-type products to overall new business.

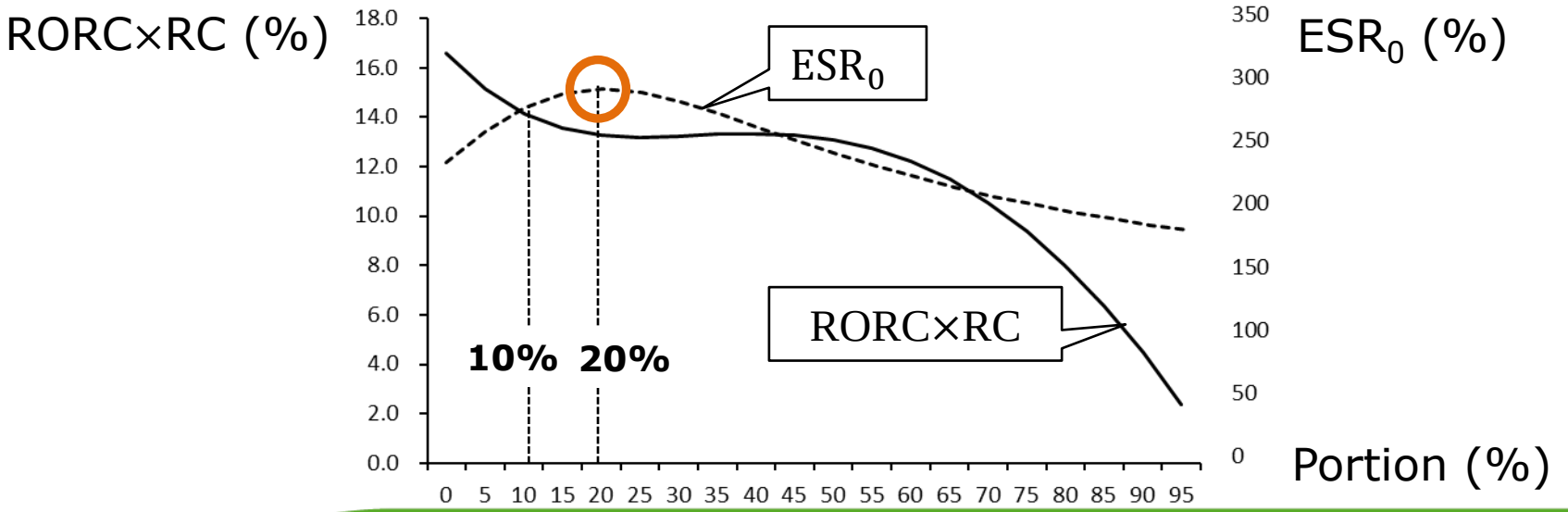
Examples of Practical Use – Sales

RORC and RC are useful to find the optimal portfolio, but…



Examples of Practical Use – Sales

Another approach shows that 20% is also optimal.



Examples of Practical Use – Sales

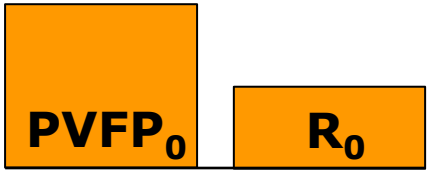
20% is the portion that maximize E-IRR*.

Portion	0%	10%	20%	30%	40%	50%	60%
RORC	16.6%	14.9%	13.3%	11.6%	9.9%	8.3%	6.6%
RC	100	95	100	114	134	158	184
RORC×RC	16.6	14.2	13.3	13.2	13.3	13.1	12.2
E-IRR*	8.3%	10.4%	11.1%	10.7%	9.7%	8.6%	7.7%
ESR_0	232%	276%	290%	280%	260%	239%	221%

Examples of Practical Use – ALM

Japanese life insurers, for more than 20 years, have suffered from the negative spread caused by duration mismatch and interest rate decline.

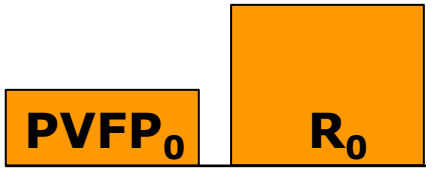
E-IRR*> 0%



Investment-type

Duration Mismatch
&
Interest Rate Decline

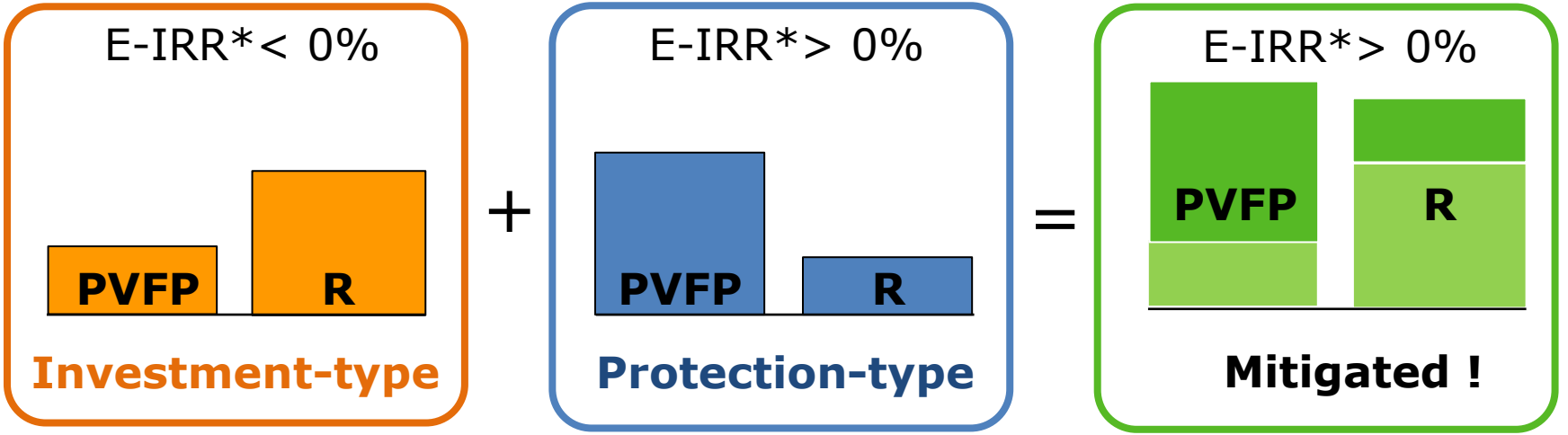
E-IRR*< 0%



Investment-type

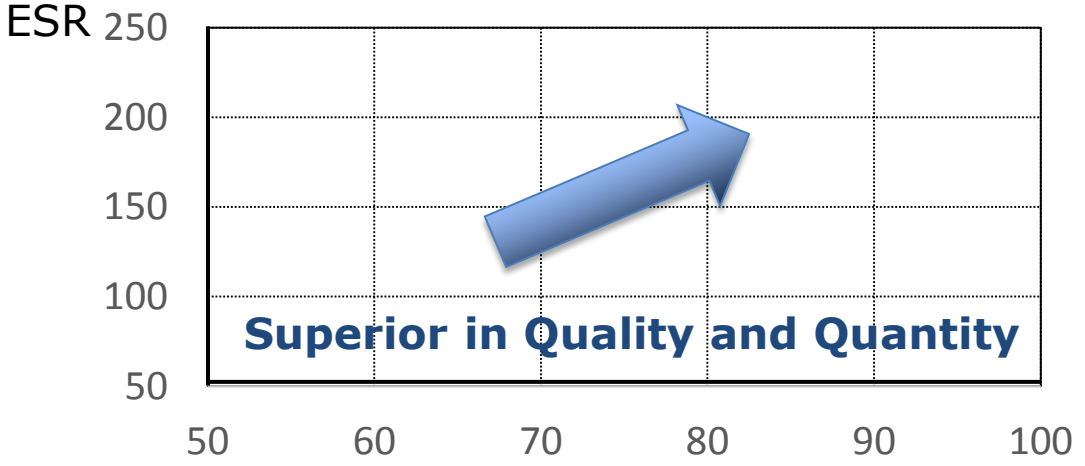
Examples of Practical Use – ALM

Focus on selling Protection-type products which have larger profitability is still an effective way to mitigate the impact of duration mismatch risk.



Examples of Practical Use – Capital

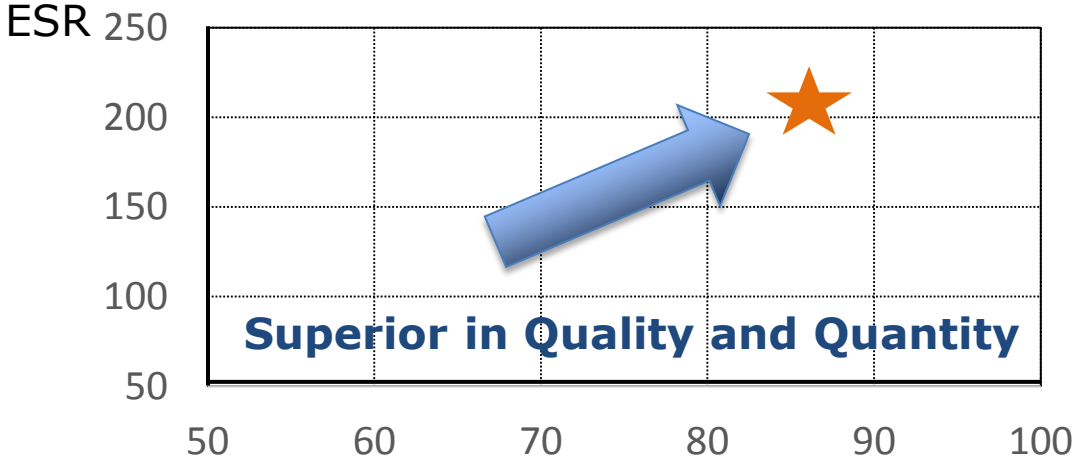
Focus on selling the risk-return effective products contributes to capital, both in quality and in quantity.



The retained earnings contribute the enhancement of Tier1 Capital.

Examples of Practical Use – Capital

Fukoku Mutual Life has increased the retained earnings continuously and has issued subordinated bonds whenever appropriate.



In the fiscal year 2016, ESR has become over 200 %, which can cover the extraordinary risks, such as recurrence of financial crisis, great earthquakes and their consequences.

Examples of Practical Use – Dividend

Economic IRR is very useful in determining whether or not the policy has enough capacity to increase the dividend.

Policy A

E-IRR*=13.3%

Dividend Increased

E-IRR*=12.2%

> 8.3%

8.3% E-IRR* is equivalent to 230% ESR

Examples of Practical Use – Dividend

Increase of dividend is promoted while maintaining balance with the enhancement of surplus.

Policy B

E-IRR*=9.1%

Dividend Increased

E-IRR*= 8.0%

< 8.3%

8.3% E-IRR* is equivalent to 230% ESR

Conclusion

Economic IRR, when it is effectively incorporated into the decision making process,

- ✓ **will enhance the integrated management of capital, risk and return, and consequently**
- ✓ **will strengthen the ability of risk-taking.**

Hotei is one of the Seven Gods of Good Fortune. He carries a big “Tolerance Bag” and puts every unfortunate event and every unpleasant emotion in it.

Japanese proverb says

“Tolerance Bag is torn”

when a man cannot stand something any longer.

Strengthen your bag,
if you want to put more in it!

Thank you!

Any Questions?

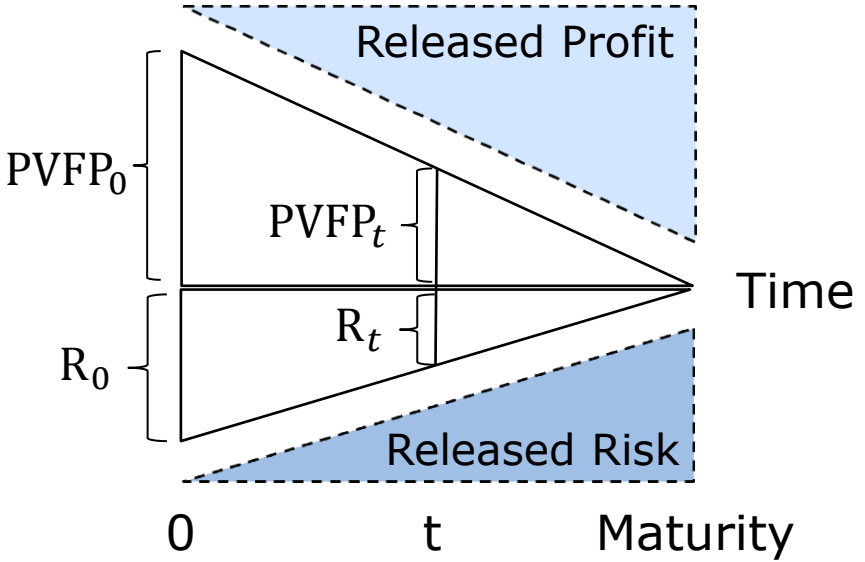
Thank you very much for your attention!

Contact details:

Naoki Sunamoto

address: Saiwai Bldg., 3-1 Uchisaiwaicho 1-chome,
Chiyoda-ku Tokyo 100-0011 Japan
phone: +81/3/3593/7458
mail: naoki.sunamoto@fi.fukoku-life.co.jp
web: www.fukoku-life.co.jp

Appendix 1. Risk and Profit



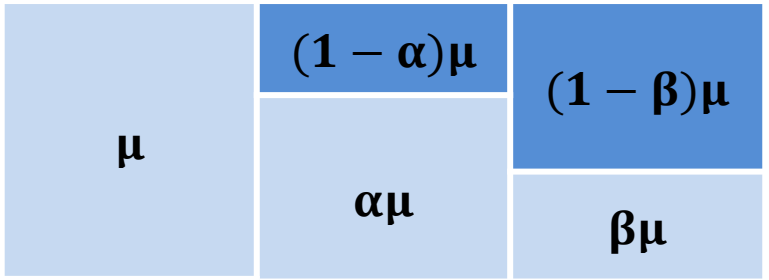
Two Sides of the Same Coin

Risk is released as time goes by, accompanied by the corresponding profit.

Profit is retained in free surplus or is paid out as policyholders' dividend.

Appendix 2. Application to Life & Annuity

Assumptions

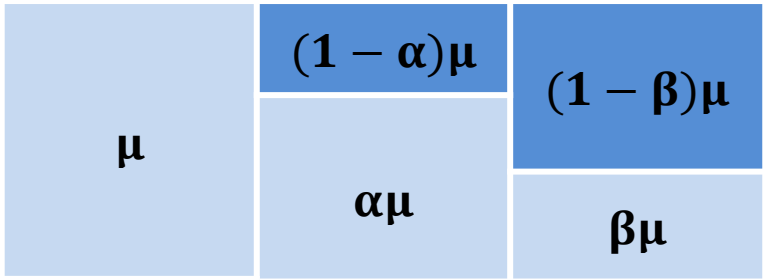


μ : Force of death expected in pricing
α : Crude/Expected mortality ratio
β : Actual/Expected mortality ratio
We assume $0 \leq \beta \leq \alpha \leq 1$

Single Payment Whole Life
$RORC = \left(\frac{1-\beta}{1-\alpha}\right)(\delta + \beta\mu)$
$ESR_x = \left(\frac{1-\beta}{1-\alpha}\right)$
$Economic\ IRR^{*} = \left(\frac{\alpha-\beta}{1-\alpha}\right)(\delta + \beta\mu)$

Appendix 2. Application to Life & Annuity

Assumptions

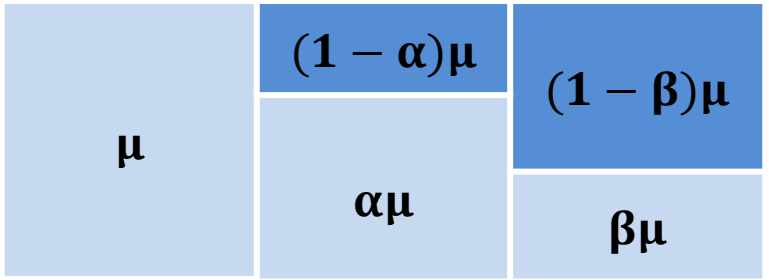


μ : Force of death expected in pricing
α : Crude/Expected mortality ratio
β : Actual/Expected mortality ratio
We assume $0 \leq \beta \leq \alpha \leq 1$

Level Premium Whole Life
$RORC = \left(\frac{1-\beta}{1-\alpha}\right)(\delta + \beta\mu)$
$ESR_x = \left(\frac{1-\beta}{1-\alpha}\right)$
$Economic\ IRR^{*} = \left(\frac{\alpha-\beta}{1-\alpha}\right)(\delta + \beta\mu)$

Appendix 2. Application to Life & Annuity

Assumptions



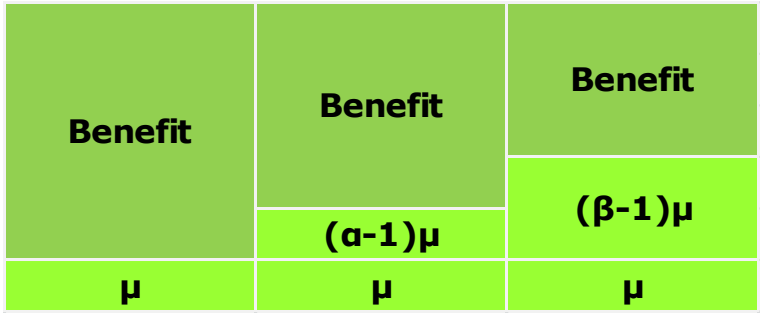
μ : Force of death expected in pricing
α : Crude/Expected mortality ratio
β : Actual/Expected mortality ratio
We assume $0 \leq \beta \leq \alpha \leq 1$

Term Insurance
$RORC = \left(\frac{1-\beta}{1-\alpha}\right)\left(\frac{2}{n}\right)$
$ESR_x = \left(\frac{1-\beta}{1-\alpha}\right)$
$Economic\ IRR^{*} = \left(\frac{\alpha-\beta}{1-\alpha}\right)\left(\frac{2}{n}\right)$

Note that " n" stands for the year of term. When $(\delta + \beta\mu)\ n$ is small enough, the approximation works well.

Appendix 2. Application to Life & Annuity

Assumptions



μ : Force of death expected in pricing
α : Crude/Expected mortality ratio
β : Actual/Expected mortality ratio
We assume $1 \leq \alpha \leq \beta$

Single Payment Immediate Annuity
$RORC = \left(\frac{\beta - 1}{\alpha - 1}\right)(\delta + \beta\mu)$
$ESR_x = \left(\frac{\beta - 1}{\alpha - 1}\right)$
$Economic\ IRR^* = \left(\frac{\beta - \alpha}{\alpha - 1}\right)(\delta + \beta\mu)$