ADJUSTED PERFORMANCE MEASUREMENT AT LIFE INSURANCE COMPANY

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Abstract. This is a practice of Risk Adjusted Performance Measurement (RAPM) at Life Insurance Company which is concentrated on Product Developing Stage. This report represents RAPM Project Introduction, Situations to be understood to implement RAPM, Issues to be considered to implement RAPM and Application of RAPM & VBM.

Key-words: RAPM, Risk Capital, Accrual & Value Based RAPM, Accruals & Life Time Average RAROC and Risk Adjusted Embedded Value etc.

1 RAPM Project Introduction

1.1 Developing Risk Capital and RAPM (Risk-Adjusted Performance Measurement) metrics are needed to implement RAPM

1.1.1. Risk Identification and Measurement

In this stage, we identified principal market risk, credit risks. And key risk measurement tools are implemented, although some risk measures was needed refinement. We defined business risk, event risks and improved life risk and redefined market & ALM risk.

Here, we represent definition and decomposition of Risks.

There are many ways to look at risk components within an organisation. By taking a pragmatic approach to risk classification, the risks facing Life Insurance Company can be broken down into five broad categories.

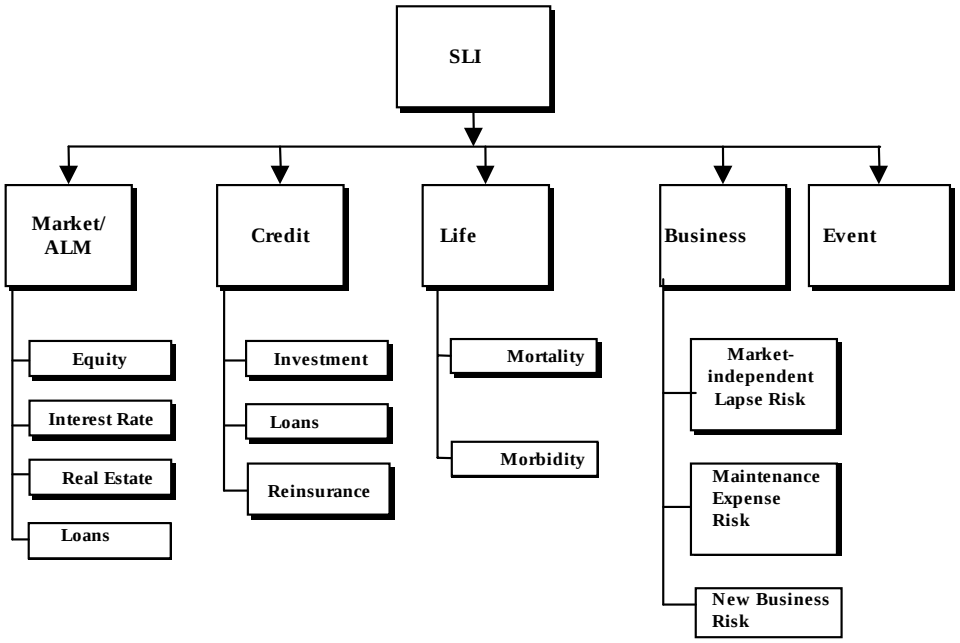
a) Market & ALM risk

b) Credit risk

c) Life liability risk

d) Business risk

e) Event Risk



Market & ALM risk relates to the volatility in Fair Value due to changes in interest rates, equity prices, real estate prices, inflation, foreign exchange rates, and other market factors. It also captures the risk associated with a mismatch in the asset-liability cash flow profiles, called Asset Liability Mismatch (ALM) risk. The focus of the Market&ALM risk methodology is the risk of having less-than-perfect matching between asset and liability cash flows, together with pure market risk for those assets held in excess of liabilities.

Credit risk is the risk of default or credit rating downgrade of a counterparty. The sources of credit risk within Life Insurance Company include

a) *Investment portfolio*: the risk of default or credit deterioration of issuers of securities or counter-parties relating to derivatives contracts, lending portfolio etc.

b) *Reinsurance recoveries*: the risk of reinsurers defaulting on ceded reinsurance due to catastrophic events or other factors.

c) *Lending*: the risk of borrowers defaulting on loans.

d) *Guarantees and other contingent commitments to external parties*

e) *Other receivables*: the inability to collect premium receivables from intermediaries (e.g. agents) when they become insolvent.

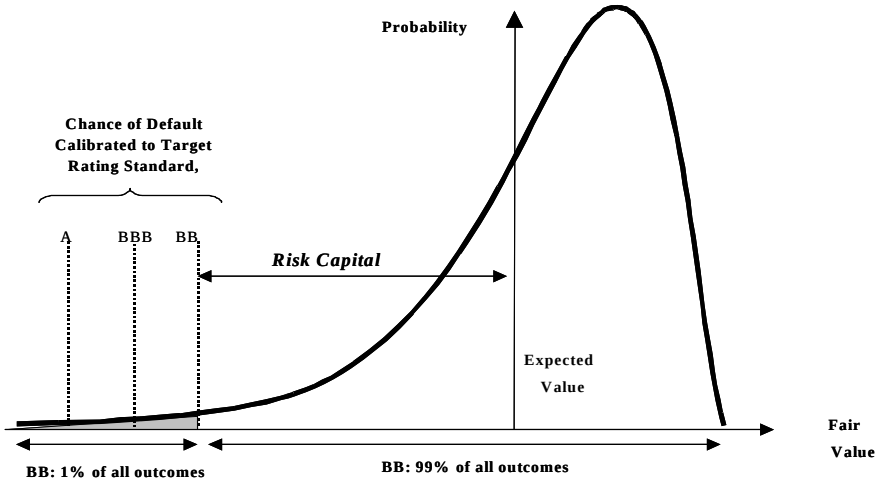
Life liability risk can be defined as those risks exclusively associated with the activities of a life insurer offering protection cover. In other words, this is the risk associated with the variability in liability cash flows due to the (non-)incidence of death (mortality risk) or the incidence of sickness/disability (morbidity risk).

Business risk is the fundamental risk associated with 'being in business' and affects every type of operating entity, financial or non-financial. It captures the exposure to loss of value due to fluctuations in volumes, margins, and costs.

1.1.2. Calculation of Risk Capital

Risk Capital serves as common metrics to integrate various risk measures. And Risk Capital is required to assess true value creation. So it is required for RAPM.

Here, we represent the definition of Risk Capital and how to calculate the Risk Capital. Risk Capital is defined as the capital required to protect against a **worst case** loss over a **one-year** horizon in the **fair value** of Life Insurance Company due to the risks arising from all of its businesses. This definition takes into account Life Insurance Company's **target rating** and any **diversification benefits** that may arise.



[1] *Definition of Risk Capital*

- Is the difference between the expected value and worst case value at the specified confidence interval as defined by the target rating
- Is the capital 'Life Insurance Company' must hold in order to sustain a worst case deterioration in fair value due to all risk factors in order to remain *economically solvent*

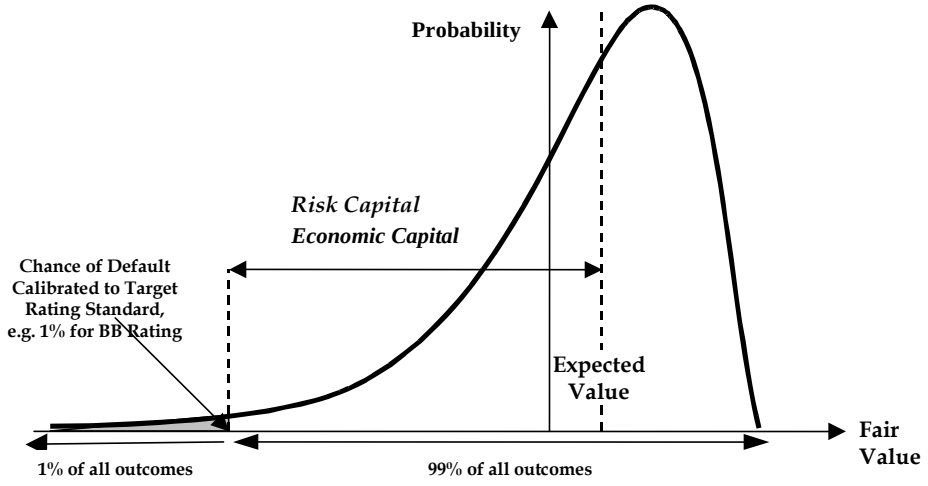
Economic insolvency occurs when the fair value of liabilities exceeds assets, which may or may not trigger legal insolvency e.g. liquidation, receivership, etc and vice versa. A common objective of setting a target rating standard is to capitalise each operating activity to a consistent level of risk. For life insurance operations, issuing an insurance policy is analogous to issuing debt. The debt holder (policyholder) purchases the debt by paying to the debt issuer (insurance company) the nominal value of the bond (insurance premium). A contract is set up between the two parties (e.g. lender and borrower, policyholder and insurance company) which specifies how the debt will be repaid. Borrowers with a lower level of capitalisation will need to compensate the lender for this greater risk.

To anchor the target rating standard to a quantitative measure of risk, we map to the level of default risk implied by senior unsecured debt of corporate bonds. By looking at
historical default rates and severities of rated bonds as published by ratings agencies such as Moody's and S&P, it is possible to attach a probability of default[1] to each rating class as follows:

[2] *Confidence interval by credit rating*

Rating	One-year Default Probability
AAA	1 - 2 bps
AA	3 - 5 bps
A	7 - 9 bps
BBB	15 - 20 bps
BB	80 - 100 bps

For a target standard of say, BB, Life Insurance Company would require an amount of Risk Capital such that the probability of economic insolvency is approximately 1%[2]. In other words, if Life Insurance Company were to hold the BB amount of Risk Capital, one could be 99% (statistically) confident that Life Insurance Company will remain economically solvent over the chosen time horizon. The loss situation that results in the adverse deterioration in value at this 99% confidence interval is referred to as the Worst Case Scenario.



[1] The word 'default' is loosely used here. In particular, it refers to economic insolvency in the context of Fair Value approach to measuring Risk Capital.

[2] Anchoring to a specified target rating does not guarantee that the rating agencies will grant Life Insurance Company that rating, because we are not following the rating agencies' approach to calculating Risk Capital.

[3] *Risk Horizon*

The risk horizon is the period of time over which the economic insolvency for the purpose of setting the target rating is measured. In other words, Risk Capital is held to protect against economic insolvency[3] during the risk horizon only.
It is worth noting that the risk horizon does not dictate the period of time over which future cash flows are projected in valuing assets and liabilities. In other words, the basis for valuing a company, business unit and/or portfolio, such as Accrual, Fair, or Appraisal Value measurement concepts, is independent of the chosen risk horizon.

In general, there are two main approaches to determining the risk horizon over which Risk Capital is measured: One-Year and Multi-Year approaches.
Using a one-year risk horizon, the impact of all risk factors affecting the change in the Fair Value of a company, business unit and/or portfolio over a *one-year* horizon is considered in determining the Risk Capital requirement. In other words, the Risk Capital requirement is the difference between the Expected Value at time=0 and (the present value of) the Worst Case Value at time=1 (that is, the amount of capital to avoid economic insolvency).

The Multi-Year approach, also called the 'Run-off' approach, is based on the concept of Accrual Value. The aim is to capitalise against all risk factors affecting the Accrual Value (or Book Value) of a company, business unit and/or portfolio over the lifetime of the contracts and/or transactions (hence the term 'run-off'). This approach is usually applied only for general insurance, rather than for life insurance or banking products.

The 'one-year' approach is appropriate for Life Insurance Company for the following reasons

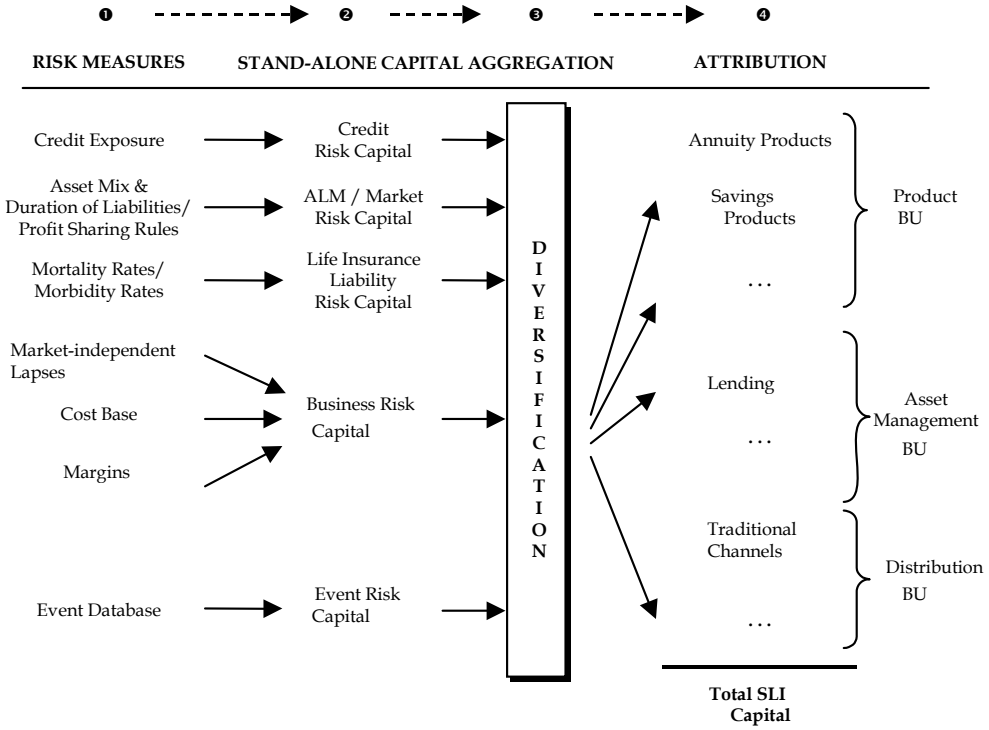
- Capitalisation against a one-year horizon is generally considered adequate, given that other management processes such as reserve testing and financial planning, which are usually conducted annually, surround it.
- This is a period in which an organisation can access the markets for additional capital, if needed.
- Most risks can be effectively hedged or managed over one year so that a multi-year timeline is punitive.
- This approach is considered 'best practice' and is employed by many leading financial institutions around the world that have adopted an internal Risk Capital framework.
- The one-year approach underlies the evolving BIS II guidelines
- The one-year view is consistent with the rating agencies' credit rating assessment.

[4] *Aggregation and Disaggregation*

The Risk Capital framework takes an integrated approach to measuring risks. It identifies risk drivers arising from operating activities. Then, by considering possible risk concentration or diversification, it overlays the standalone capital for each risk type with correlation between them. After having aggregated the

[3] Economic insolvency is defined as the market value of assets dropping below the fair value of liabilities. This differs from regulatory insolvency, when an insurer triggers an intervention due to reserves that do not meet its minimum solvency requirement.

diversified risk capital for the whole organisation, it attributes risk capital to the business units and/or by risk types.



[5] *Incorporating Diversification Benefits*

In moving from the determination of the standalone Risk Capital for specific risk types to the determination of the fully diversified level of Risk Capital for Life Insurance Company as a whole, diversification benefits at all structural levels must be incorporated.

Aggregation of risk is not a trivial exercise. We take a pragmatic, rather than a 'black box' approach to aggregation. A mathematically rigorous approach requires not only the specification of the probability density functions of all risk types but also the correlation between them. In particular, correlation measures and correlation structure need to be carefully examined.

Last but not least, Life Insurance Company Risk Capital will be attributed down to business units and/or sub-business units. The main decision criteria include:

- Capital should be attributed in a way that corresponds to the level at which risk is managed. This will facilitate accountability, manageability and measurement of performance.
- Business units should benefit from the overall group diversification effect so that products can be priced competitively in their respective markets. Diversification is a possible source of competitive advantage.

- Through capital attribution, business units should be incentivised to engage in business activities that will add value to the group. At the same time, it should also encourage management to take appropriate acquisition or divestment decisions.
- Capital should be attributed to the business units in a way that the performance of the business units can be fairly and consistently compared between them.

1.1.3. Accrual & Value Based RAPM

Unlike accounting measures, Accrual & Value Based RAPM are risk-adjusted. And Risk capital is 'denominator' for Accrual & Value RAPM. In this stage, Accrual & Value metrics was developed. And Key challenges at Life Insurance Company are ability of MIS to calculate 'numerator'
Here, we represent the definition of Value and how to calculate Value.

[1] *Fair Value approach for Life Insurance Company*

Accrual Value is a common approach traditionally used by banks due to its simplicity and reporting compatibility with financial statements. However, Accrual Value is unsatisfactory in addressing the value of long-term life products, which often have very high up front acquisition costs. As a result, Fair Value is more commonly used in the life insurance industry. On the other hand, whilst Appraisal Value can be viewed as a proxy for shareholder value, the assumptions in measuring the value of new business are highly uncertain. The measurement of Appraisal Value is contingent upon many intervening considerations such as economic factors, market forces, management strategies etc. Amongst the three valuation concepts, leading insurance companies around the world are increasingly employing the Fair Value definition to measuring Risk Capital. Fair Value has therefore also been adopted for the RAPM project.

[2] *Valuation Methods and Fair Valuation*

The trend in accounting standards in many jurisdictions is to prescribe a marked-to-market valuation of assets in financial reporting. In Korea, meanwhile, unrealised gains are recorded as capital adjustment. in the balance sheet. This closely reflects the 'market value' of assets. However, there is no mirror requirement for the valuation of liabilities. This has created inconsistency in the treatment of the balance sheet. Often this raises the question of whether financial statements remain useful to external parties. Discussions in the financial services industry have emerged concerning the appropriate valuation of liabilities. Very recently, the proposed International Accounting Standards include discussion of fair valuation of liabilities.

[3] *Fair Valuation Approach*

Whilst the market valuation of assets is more widely accepted, such a valuation method for liabilities can be problematic. Actuaries typically calculate the value of liabilities using an indirect method of first determining the Fair Value (i.e. 'Embedded Value') of an insurance company, using a discount rate derived from a combination of the Capital Asset Pricing Model (CAPM) and market practice. This discount rate should accord with the rate implied by finance theory (option pricing theory).

	ACTUARIAL	FINANCE
CASHFLOWS	Deterministic cashflows based on best estimate parameters	Probabilistic cashflows incorporating spectrum of potential asset returns and their impact on liability cashflows
DISCOUNT RATE(S)	For Life Insurance • A company-wide Risk Discount Rate (RDR) based on average expected investment earning rate for assets backing liabilities	Discount rates are explicitly linked to the volatility and optionality of liability cashflows • Different discount rates reflecting the riskiness of cashflows for each product type can be modelled • Alternatively stochastic modeling based on risk neutral valuation can be used

COMBINATION OF ACTUARIAL TECHNIQUES AND FINANCE THEORY TO ESTABLISH THE FAIR VALUE BALANCE SHEET

[4] *Valuation of Assets*

Using the Fair Value approach, publicly traded investments on the stock and bond markets are marked-to-market. This can be easily established by looking at the most recent trading prices on the various stocks and bonds in the respective markets. Assuming an efficient market, these trading prices have taken into account the risk involved with investing in those assets.

For investments that are not publicly traded, or that are infrequently traded, a 'market value' can be derived using a relatively simple model. For instance, a private loan can be marked-to-model by discounting all the cash flows with yield curve rates, after making allowances for the risk of default of that particular loan. Other types of assets may require more complex modeling.

[5] *Fair Valuation of Liabilities*

In general, asset valuation is relatively straightforward whereas liability valuation presents more challenges. The Fair Value of liabilities can be estimated by projecting all future cash flows on a best estimate basis and discounting them. In other words, the Fair Value of liabilities can be viewed as the 'market price' one would have paid to be relieved of the liabilities in an arm's length competitive market.

The liability cash flows are discounted at a rate that reflects the riskiness of the cash flows. For example, fixed liabilities are discounted at a risk-free zero-coupon bond rate matching the duration of the liabilities. Variable cash flows are discounted at a rate that reflects their volatility. A 'replicating' set of assets generating the same cash flows is used to determine the discount rate. In other words, the liability cash flows are discounted at the yield on the matching assets.

For portfolios with embedded options (e.g. guarantee rates) that are not immaterial, the appropriate discount rates to be used are often not apparent. In such circumstances, a stochastic modeling based on risk-neutral valuation is recommended. This circumvents the necessity to speculate on the appropriate discount rates. Since expected returns are risk-free expected returns in a risk-neutral world, cash flows are therefore discounted at risk-free rates.

[6] *Calculation of Available Financial Resource*

Available Financial Resources(AFR) are resources that are at Life Insurance Company's disposal to pay policyholders (and/or other creditors) over and above the expected payable amount (e.g. expected policyholder liabilities), regardless of whether the item has been treated as an asset, liability or equity item in the financial statement. The AFR can be used to buffer against worst case losses arising from Life Insurance Company's business activities.

AFR include:

- Paid-in capital
- Capital surplus
- Retained earnings
- Shareholder capital adjustment (i.e. shareholders' portion of unrealised gains)
- In-force value of the insurance portfolio (i.e. fair value generated from existing insurance contracts)

In addition, AFR should exclude goodwill and deferred acquisition costs (DAC) because intangible assets are not assets which Life Insurance Company can use to pay policyholders (and/or other creditors).

However, in Life Insurance Company, DAC is included in the Net Premium Reserve, as a notional reserve over the surrender value reserve on the liability side. Against this, DAC is also provided for on the asset side. The resulting effect is that DAC is increased or decreased simultaneously for both assets and liabilities. This means that unlike other accounting treatment, DAC is not used to inflate shareholders' capital. Therefore, for SLI, there is no need to subtract DAC from AFR.

Furthermore, there are also other resources that can be used to buffer against losses in case of financial stress.

These include

- Policyholder Equity Adjustment
- Undistributed Earnings Liability
- Lending Fair Value
- Other Excess Reserves

Policyholders Equity Adjustment (PEA). This is policyholders' portion of unrealised gains. The main reason for inclusion in AFR is the fact that SLI has discretion in the use and/or allocation of PEA. For instance, if profits in the current year were inadequate to pay policyholders guarantees, unrealised gains can be realised to pay these claims and the proportion of unrealised gains between shareholders and policyholders would be reallocated.

Undistributed Earnings Liability (UEL). These are earnings reserved for distribution to policyholders. After exhaustion of shareholders capital in insolvency, UEL can be used to pay liability claims.

Lending Fair Value. These are excess margins earned on the loan portfolio over and above the required risk rate. The valuation is described in the Value Based Risk Adjustment Performance Measure Documentation

Other Excess Reserves. This is essentially the difference between Net Premium Reserve and the sum of Surrender Value Reserve and DAC. This is considered non-investment margin which will be released in the future.

Below are some guidelines regarding AFR eligibility:

- Undeclared or unrealised capital gains
- Usually in the form of unrealised gains, these hidden asset gains can be used when there are shareholder losses so that the entire hidden gains are used to shareholder's benefit
- More generally, whenever there is management discretion in terms of timing and scope of realising gains
- Special reserve items that are legally allowed to offset extraordinary losses

[7] *Relationship between In-force Value and Policyholder Equity Adjustment*

Whether or not PEA should qualify as AFR needs to be considered carefully. This is because the in-force value calculation may or may not have included PEA.

The in-force value calculation is based on assets being fully marked-to-market for the entire projection period. Therefore, the PEA comes out of the calculation as a gain that has already been shared with policyholders. This treatment assumes no management discretion as to timing and scope of realising capital gains.

However, in reality, management can choose when and how much to realise capital gains. This can be viewed as an option given to the management to realise gains in favour of SLI. This option is not captured in the in-force value calculation at all, and is considered a viable AFR.

The value of this optional should be almost as large as the unrealised gains because any loss incurred by the company can be immediately offset by a matching realisation of capital gains. This matching liquidation predates the calculation of the overall policyholder distributable earnings. Hence the capital gain can be entirely used to offset overall shocks.

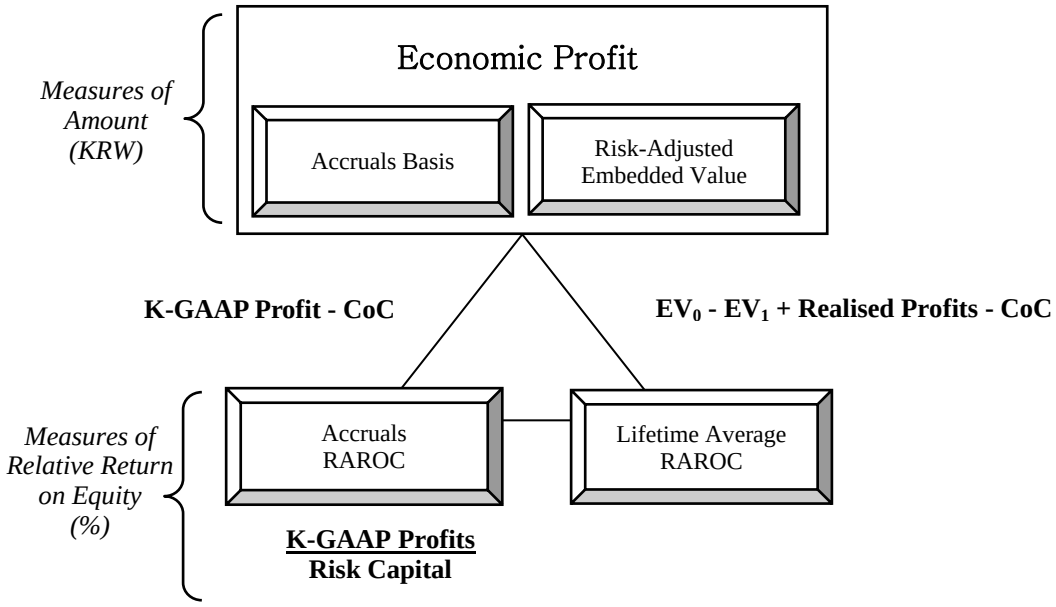
Therefore, there is no conceptual overlap between PEA and the in-force value. The policyholder equity adjustment should be added to the AFR, in addition to the in-force value.

1.1.4. Value-Based Management

It is management process for focusing all management decisions on creation of shareholders value. And Value-Based Management requires RAPM, Integration into strategic planning and budgeting and Integration into management incentives.

1.2 Developing both Value based and Accrual Based Risk-Adjusted metrics are needed to develop to support performance measurement and decision-making, although different RAPM

measures are used for different purpose.



1.2.1. Measures of Amount(KRW)

Accrual Basis and Risk-Adjusted Embedded Value are used as Measure of Amount and Accruals Economic Profit is used as Accrual Basis. and It is Accrual profit(K-GAAP) less cost of risk capital. Risk-Adjusted Embedded Value is Present value of future earnings on risk-adjusted basis.

1.2.2. Measures of Relative Return on Equity (%)

Accruals RAROC and Lifetime Average*1) RAROC are used as measure of relative return on equity. Accruals RAROC is single period measure of risk-adjusted return. And Lifetime average RAROC is average risk-adjusted return based on all future cash flows. And it is multi-period, forward looking measure of relative return.
*1) Average is analogous to 'internal rate of return' concept of Corporate Finance.

1.3 Different RAPM measures are used for different management application purposes

1.3.1. Performance Measurement

Accrual Economic Profit(KRW) and Embedded Value(KRW) are used for primary target setting and performance evaluation metric. And Accruals RAROC(%) and Lifetime Average RAROC(%) are used for secondary target setting and performance evaluation metric.

1.3.2. Strategic Planning/ Resource Allocation

For this purpose, Accrual Economic Profit(KRW) and Embedded Value(KRW) are used for Basis for cascading 'Life Insurance Company' value creation goals to BUs & Products. and it is 'Language of business plans' And Accruals RAROC(%) and Lifetime Average RAROC(%) are used for Basis for prioritization of resources in case of balance sheet constraints.

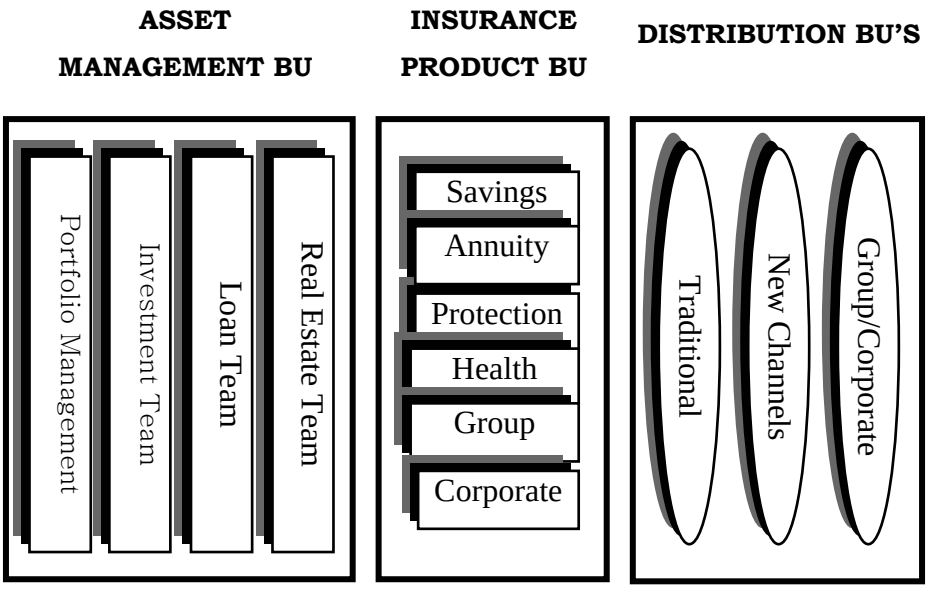
1.3.3. Tactical Applications e.g. Product Planning

For this purpose, Accrual Economic Profit(KRW) is treated mainly as a constraint on product planning, rather than the primary measure. And Embedded Value(KRW) is used as primary measure for informing product planning. In this project Accruals RAROC(%) is not used. Because it needs product lifetime cash flows for tactical decisions. And Lifetime Average RAROC(%) provides ability to compare alternatives on consistent risk-adjusted basis. And it is primary measure for product planning.

1.4 Structure of RAPM at Samsung Life Insurance Company

Structure of RAPM at Samsung Life Insurance Company is consisted of 3BU which are Asset Management BU, Insurance Product BU and Distribution BU. And Asset Management BU is consisted of 4 teams, Portfolio Management Team, Investment Team, Loan Team and Real Estate Team. Insurance Product BU is consisted of 6 segment, Savings, Annuity, Protection, Health, Group, Corporate. And Distribution BU is consisted of 3 sub_channel, Trational channel, New Channels and Group/Corporate channel.

Product EV-based RAPM metrics span all segment of Product BU.



Accrual RAPM

K-GAAP Economic Profit and K-GAAP RAROC are used for Asset Management BU, Insurance Product BU and Distribution BU as Accrual RAPM.

Value RAPM

Risk_Adjusted EV is used for only Insurance Product BU.

Granularity

Granularity for Asset Management BU is key asset type (equities, bonds etc) and Granularity for Insurance Product BU are 6 Product Segments and Granularity for Distribution BU are Sub-BU.

Key Dependencies

Key dependencies of asset management BU are investment return allocation and management accounting and key dependencies of Insurance Product BU are asset allocation on new product basis and EV runs on new product basis. And key dependencies of distribution BU are finalizing conceptual basis for transfer pricing and implementation in management accounting.

1.5 Traditional Life Insurance K-GAAP based RAPM Template

K-GAAP based RAPM is used for only 6 Product Segments

For K-GAAP based RAPM, Net Revenues is needed to calculate

Net Revenues (A)

Net Revenues is calculated as follows
+ Premiums
+ – Claims
– ΔReserves
+/- Investment Return
- Management Fee

And Operating Costs is needed to calculate.

Operating Costs (B)

Operating Costs is calculated as follows
- Amortised DAC
– Direct costs
- Indirect costs

And Profit Contribution Before Tax is needed to calculate

Profit Contribution Before Tax (C)

It is calculated as 'A(Net Revenues)' less 'B(Operating Costs)

And Risk-Adjusted Capital is needed to calculate

Risk-Adjusted Capital (D)

And Pre-Tax ROE is needed to calculate

Pre-Tax ROE

It is calculated as 'C(Profit Contribution Before Tax)' divided by 'D(Risk-Adjusted Capital'

And Tax is needed to calculate.
Tax (E)

And Overhead Allocation is needed to calculate.

Overhead Allocation (F)

And Post Tax Profit is needed to calculate.

Post Tax Profit (G)

It is calculated as 'C(Profit Contribution Before Tax' less 'E(Tax)' less 'F(Overhead Allocation'.

And Post Tax EVA is needed to calculate.

Post Tax EVA

It is calculated as 'G(Post Tax Profit) ' less 'Hurdle Rate multiplied by 'D(Risk-Adjusted Capital)'.

Finally, Post Tax RAROC is needed to calculate.

Post Tax RAROC

It is calculated as 'G(Post Tax Profit) ' divided by 'D(Risk-Adjusted Capital)'

For the 3 channels, Structure and details of P&L is dependent on outcome of Management Accounting work.

1.6 Value Based RAPM Template at Samsung Life Insurance Company

Value Based RAPM is used for only 6 Product Segments

For Value Based RAPM, Value of New Business is needed to calculate

Value of New Business (A)

Value of New Business is calculated as follows

+ PV of future margins
- PV of expenses

- PV of cost of capital

And Δ Value of In-force is needed to calculate.

Δ Value of In-force (B)

Δ Value of In-Force is calculated as follows
+ Unwind
+ Variance – Investment (incl. lapses)
+ Variance – Mortality
+ Variance - Expense
+ Assumption changes

Here, we represent the concept and definition of 'Unwind' and 'Variance'

The concept of 'unwind' refers to the effect on value of 'aging' a portfolio, i.e. of moving a portfolio forward to the end of an evaluation period (typically one year, here 9 months), while keeping all other parameters constant. The effect on in-force value has been schematised in Figure 3 below.

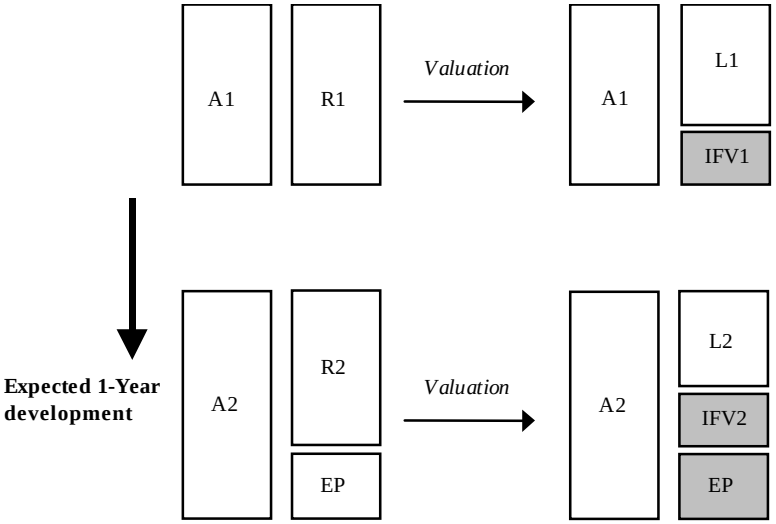


Figure 3. Expected Evolution of In-force Value

The unwind explains the expected evolution of the in-force value and the expected profits (denoted EP in the figure, which also includes interest margins, expense margins and so on).

There are three steps in calculating the unwind:

- Calculate the additional surplus by the following formula

$$\text{Expected profits} = \text{RoA} \times \text{Asset} + \text{Expected net cash flow} - \text{Expected change in reserve}$$

RoA is the expected return on asset

- The expected in-force value ($IFV_2^{'}$) based on the same 3/2001 calculation
  - The ALM model contains the projected liability fair value as of 3/2002, FVL
  - $IFV_2^{'}$ = Reserve as of 3/2002 – FVL
  - Conceptually, FVL is the fair value (i.e. average) of liability value due to cash flow after 3/2002, discounted using the cumulative forward rate to 3/2002 (instead of 3/2001)
- The unwind $\Delta_{\text{unwind}} = IFV_2^{'} + \text{expected profits} - IFV_1$

The 9-month unwind will be calculated by using 75% of the 1-year unwind.

The expected net cash flow and the expected change in reserve are both easy to understand from a conceptual standpoint and they can be obtained from the ALM model. The expected return on asset (RoA) requires additional clarification on

- Inclusion of unrealised gains
- Inclusion of lending margins

The key to both issues is the consistency with respect to the definition of the expected investment return. Since the expected return on asset defined by SLI does not include the unrealised gains but it includes the lending margins, the expected RoA in the unwind should likewise only contain the lending margins.

Interest rate variance explains the change of the in-force value due to the deviation of the end-of-period yield curve from its expectation at the beginning of the period.

There are two steps in calculating the interest rate variance:

- Based on the calculation of 12/2001 in-force value, the in-force value is re-calculated based on the 9-month forward curve from 3/2001.
- The interest rate variance

$$\Delta_{\text{IR}} = IFV_2(\text{Actual yield curve at 12/2001}) - IFV_2(\text{9-month forward curve at 3/2001})$$

The 9-month forward curve is the expected (best estimate) yield curve at 12/2001 based on the yield curve as at 3/2001. Since the time buckets of the yield curve are limited to 1 year, we interpolate the 9-month curve based on a 3:1 weighted average of the 1-year forward curve and the spot curve as at 3/2001.

Investment return variance is to explain the portion of the realised profits that is due to the investment margin. Hence the investment return variance is simply:

$$\Delta_{\text{Invest. Inc.}} = \text{Actual investment return} - \text{Expected investment return}$$

Expected investment return should correspond to the definition of the unwind's return on asset assumption.

Present value of non-interest margins variance explains the portion of the change in in-force value due to the remaining future margin projection.

$$\text{Margin projection at time 1} = [\underbrace{m_1 \quad m_2 \quad \cdots \quad m_n}_{\text{M1}}]$$

$$\text{Margin projection at time 2} = [\underbrace{\quad m_2' \quad \cdots \quad m_n'}_{\text{M2}}]$$

Both M1 and M2 are valued at time 2. Due to the fact that we use a simple top-down approach in including the non-interest margin in the total fair value, both M1 and M2 are readily available from the ALM/ALFA projections.

$$\Delta_{\text{PV Margins}} = \text{M2} - \text{M1}$$

This methodology can be made more granular to show PV margins variance due to mortality, expense and other margins.
Note that this definition of the PV margin variance is driven by both the portfolio size and the assumptions. Further analysis is necessary to break this variance down into two components. However, this is important to attribute the size component to the market independent lapse variance.

Non-interest margin variance explains the portion of the realised profits that are due to the non-interest margins:

$$\Delta_{\text{Non-interest margin}} = \text{Actual non-interest margin} - \text{Expected non-interest margin}$$

This methodology can also be made more granular to show margins variance due to mortality, expense and other margins.

Market independent variance analysis was performed comparing the actual lapse experience over the period 4/2001 – 12/2001 against the expectation from the ALM system lapse model. Recall that the lapse model takes the following functional form:

$$\textit{Lapse Rate} = a + B * \text{Arctan}[m * \{i' - (i - sc)\} - n]$$

Where,

a, b:	max = 1.2*max observed lapse rate
	min = 0.2~0.4*avg lapse rate
	a = (max+min)/2; b = (max-min)/π
m, n:	determined interest rate sensitivity
i':	interest rate (3-year corporate bond)
i-sc:	actual accumulation rate

Lapse expectations for all product segments were calculated for 19 lapse code segments, for which the SLI lapse model is implemented. All parameters remained consistent with actual ALM system assumptions, with the exception of the accumulation rate, which was set to the portfolio average of 7.00% and the corporate interest rate, which was estimated at a level of 8.00%.
Actual lapse rates were provided for 3 months from the period of interest: 4/2001, 7/2001, 8/2001. These rates were collected by lapse code for (monthly) policy ages 1-120.

Nine-month persistency rates were then calculated for both expected and actual data sets. The persistency rate is calculated in the following manner:

$$p_t = \prod_{i=t}^{t+8} l_i$$

Where,

pt = 9-month persistency rate at policy age t
lt = lapse rate at policy age t

The average persistency rate over policy ages t = {10,11,...,121} is used to derive the deviation in persistency expectation on a percentage basis.

$$v_c = \frac{\sum_{t=10}^{120} p_t^{act} - \sum_{t=10}^{120} p_t^{exp}}{111}$$

December In-force Value is allocated across lapse codes and product segments using a reserve-to-lapse code mapping from the ALM system. The persistency variance is then multiplied by the corresponding (mapped) In-force Value to determine overall lapse variance by product segment.

And Embedded Value Profit is needed to calculate

Embedded Value Profit (C)

It is calculated as 'A(Value of New Business)' + 'B(Δ Value of In-Force)'

And Risk-Adjusted Capital is needed to calculate

Risk-Adjusted Capital (D)

And Hurdle Rate is needed

Hurdle Rate (E)

It is calculated as 'C(Profit Contribution Before Tax)' divided by 'D(Risk-Adjusted Capital'

And Tax is needed to calculate.

Tax (E)

And Value-Added is needed to calculate.

Value-Added (F)

It is calculated by 'C(Embedded Value Profit)' less ['D(Risk-Adjusted Capital)' multiplied by E(Hurdle Rate)']

Finally, RAROC is needed to calculate.

RAROC

It is calculated as 'C(Embedded Value Profit) ' divided by 'E(Hurdle Rate)'

While conceptually possible, Samsung Life Insurance Company did not develop In-force value models for Asset Management and Channel BU.

1.7 It took 22 weeks to set up RAPM Infrastructue and to calculate Risk Capital, Accrual Metric and Value Metric in Samsung Life Insurance Company.

1.7.1. Foundation Setting

It took 6 weeks for Foundtion Setting.

In this stage, Existing data, System and Models availability and Readiness for RAPM are evaluated.and we defined the scope of RAPM framework.and we defined key philosophies, methodologies for Risk capital and RAPM framework for Samsung Life Insurance Company.

1.7.2. Risk Capital Calculation

It took 8 weeks for Risk Capital Calculation.

In this stage, we resolved key issues in calculating risk capital for each risk type. and we estimated risk capital requirements across all risk types and business units.

1.7.3. Accrual Metric

It took 5 weeks for Accrual Metric.

In this stage, Accrual RAPM metrics was determined and we outlined usage of accruals RAPM metrics.

1.7.4. Value Metric

It took 4 weeks for value metric.

In this stage, Value-based RAPM metrics for Insurance Products is determined and we outlined recommended transition plan to value-based metrics.

2 Situations To be Understood

2.1 Situations to be considered regarding the Processes, Tools and Analytics currently in use in the Product BU

Current performance measures and KPIs within Product BU

Insurance Products BU consisted of

- Product planning team
- 4 Product teams – Individual (Protection, Health), Variance (Pension, Savings), Corporate / Group
- Produnt Risk Management Team

Product Mix Strategy & Planning

- Approach and philosophy used determining target product mix

- Use of different financial measures – for example, new business margins, new business volumes, IRR, return on capital

- Expectations regarding how RAPM /VBM tools will be used in product mix strategy and planning process

- Interaction with Distribution BU for determining product mix

3 Issues To be Considered

3.1 Summary of Key Issues to be Addressed

Product BU Performance Measurement

Accrual K-GAAP and NPV-based can considered as Product BU Performance Measurement.

Linkage of risk-adjusted measures with key drivers of shareholder value

Experience of Product Bus in other insurers can considered.

3.2 Among the three definitions of value in Life Insurance, Embedded Value is the most widely used return metric in leading Life Insurers and Embedded Value is especially important to measure the amount of Value Added in Product BU

There are three definition of value in life insurance company

Current Period Profit (I)

It is realized value of current contrants in the current 12 months period (plus shareholder equity)

In-Force Business (II)

It is Value of current contracts in the future

New Business (III)

It is value of new sales to new customers and value of cross-sell to existing customers.

So, Accrual Value, Embedded Value and Appraisal Value can defined as follows

3.2.1. Accrual Value

Accrual Value can be defined as 'Current period profit(I)'

The balance sheet and income statement only partially reflect the value and the increase in value of an insurance company. The balance sheet of the insurance company is a reflection of its value, but it only reflects the value deemed admissible by accounting rules.

- The balance sheet does not contain the present value of future profits on the inforce contracts
- Earnings do not consider the cost of immobilisation of capital

3.2.2. Embedded Value

Embedded Value can define as 'Current period profit(I)' plus 'In-force Business(II)'

In most markets, the standard accounting frameworks are not sufficient to measure the true profitability of an insurance company. Given the nature of insurance, the need to measure future profits on the existing portfolio and profitability over a long period is particularly important. Embedded value is a means to achieve that aim.

Embedded value is the intrinsic value associated with the in-force portfolio. In fact, the "value" in "value based RAPM" as covered by the present document refers to this embedded value.

More specifically, the embedded value can be interpreted in two ways:

- Market fair value (or Fair Value). This is the value that an efficient market would price the in-force portfolio at.
- Economic value. This is the value that includes the future cost of capital. (Note that an efficient market does not need to hold extra capital for any instrument.) Depending on the size of the required capital (i.e. how efficiently the company can diversify the risk away), the company may apply an additional adjustment to the fair value.

3.2.3. Appraisal Value

Appraisal Value can define as 'Current period profit(I)' plus 'In-force Business(II)' Plus 'New Business(III)'

Nevertheless, it should be mentioned that, as embedded value is relative to existing business, it still measures only part of the business. Shareholders are really interested in the Appraisal Value of the company or the performance of stock for a listed company, as that measure is a true representation of their investment. An Appraisal Value includes the present value of new sales occurring after the calculation date (Goodwill) as opposed to only the embedded value and it is therefore closer to the market value.

This Appraisal Value is rarely used for performance evaluation.

3.3 Transitioning into EV Metrics took considerable time and resource

Actuarial and Finance need commit resources for EV model creation, maintenance and updating for new products

Under Samsung Life Insurance Company situation, the ALM model was the only possible source of CF data for EV Measurement

But it also requires improvements to become 'industrial strength'

- More granular product modeling

- Linkage to management accounting

The ALFA Model could be the better source of CF data and the foundation for EV measurement in the long run, but it requires significant reworking in order to be used instead of ALM system

- Asset projection model

- Improved customer behavior modeling (dynamic lapse)

- Product modeling for new products

Management comfort is created during a transition period

- Dual reporting of a accrual and EV measures during this period

- Incorporation into management KPIs, eventually becoming the primary KPI for insurance product BUs.

3.4 Embedded Value is not the most common KPI for Asset Management BU and Channel BU even among Leading Life Insurers and Accrual approach is still typical for Channel BU and Mark-to-Market based total return metric is the more relevant metric for Asset Management BU.

3.4.1. SLI Annual Value Added

Embedded Value is used as the predominant approach for managing Corprate value creation and Accounting Profit result is typically treated as a constraint. and Appraisal Value approach is possible, but it is only rarely used to manage aggregate.

3.4.2. Distribution BU Annual Value Added

Embedded Value Approach is possible and it is relevant if transfer price involves multiyear payments, but it is not so common

Accrual approach is typical and it is same as Embedded Value if transfer-price is only paid at arigination

Appraisal Value approach is possible, but it requires development of detailed Customer Lifetime Value measures

3.4.3. Product BU Annual Value Added

Embedded Value is used as the predominant approach for managing Corporate value creation.

Accounting profit result typically treated as a constraint.

Appraisal Value approach is possible, but it is highly assumption-dependent.

3.4.4. Asset management BU Annual Value Added

Market Value makes sense where performance is measured on a Total Return basis

Accrual approach only used for certain asset classes where Market Value is difficult to measure (e.g. Loans)

Appraisal Value does not make sense due to volatility in returns and difficulty in extrapolating outperformance into future

3.5 The following is an illustration of KPIs for the different teams within the product BU and these need to be supplemented by strategic KPIs that are linked to the specific strategy of the product BU

It is Illustration of KPIs for product BU in European life insurer

Product BU
- Product AVA (Embedded Value Basis) excluding investment variances
- Product AVA (K-GAAP basis)
- New business value
- Administration expenses
- Growth in sales of specific products that are strategic priorities.

Product Strategy
- New Business Value
- Product AVA (Embedded Value Basis)
- Growth in sales of specific products that are strategic priorities.

Underwriting
- Mortality margin
- Δ In-force value due to mortality experience
- Expenses / # referred policies

Customer service
- In-force customer lapse rate
- Expenses / customer enquiry
- Customer satification level
- Average response time to customer
- # of compliants

Administration
- Unit administration costs
- Customer satification level
- # of days to process application
- # of compliants

Product Group (A,B,C..)
- New business value
- New business sales
- New business margin
- Marketing expenditure
- Growth in sales of specific products that are strategic priorities.

4 Applications of RAPM / VBM

4.1 Key Applications of RAPM / VBM

Product Mix and Volume growth planning

Product pricing and design

New product development
- Improved capital efficiency
- Innovative ways of improving risk / return mix for Customers

Indentification of key risks within product development & approval process

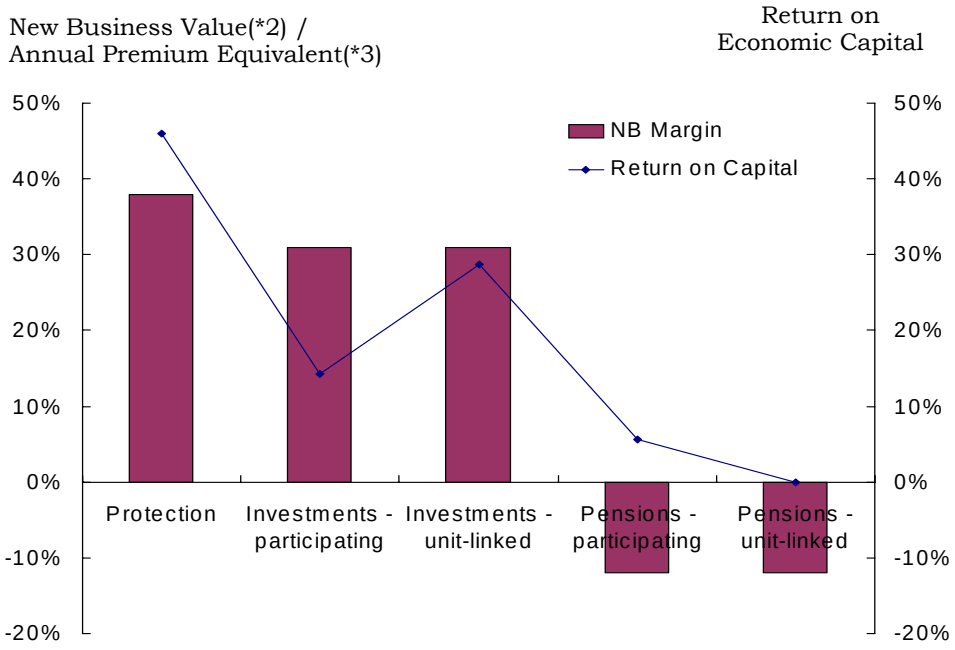
Extending RAPM & Embedded Value concept to value Management

4.2 The optimal product mix dependens on multiple factors, both financial and strategic. and to Illustrate how product strategy is developed, we studied a case study of a UK agent-based life insurer.

Financial factors
- Profitability
- Capital productivity
- Concentrations of financial risk (e.g. over-exposure to interest rates / equities)

Strategic factors
- Size / growth of different product segments
- Company's position in each product segment
- Purchase of different products by different customer segments
- Desired brand / customer segment positioning
- Strategic concentrations

4.3 Initial Analysis suggested that the product mix was suboptimal with too high a share of value-destroying pension products. Moreover, Investment Products were expected to continue to rapidly grow over time relative to both pensions and protection Profit margins was higher on protection and investment products.



- New business value measured after cost of capital
- Annualised Premium Equivalent (APE) =
  New Regular Premium + Single premiums / 10

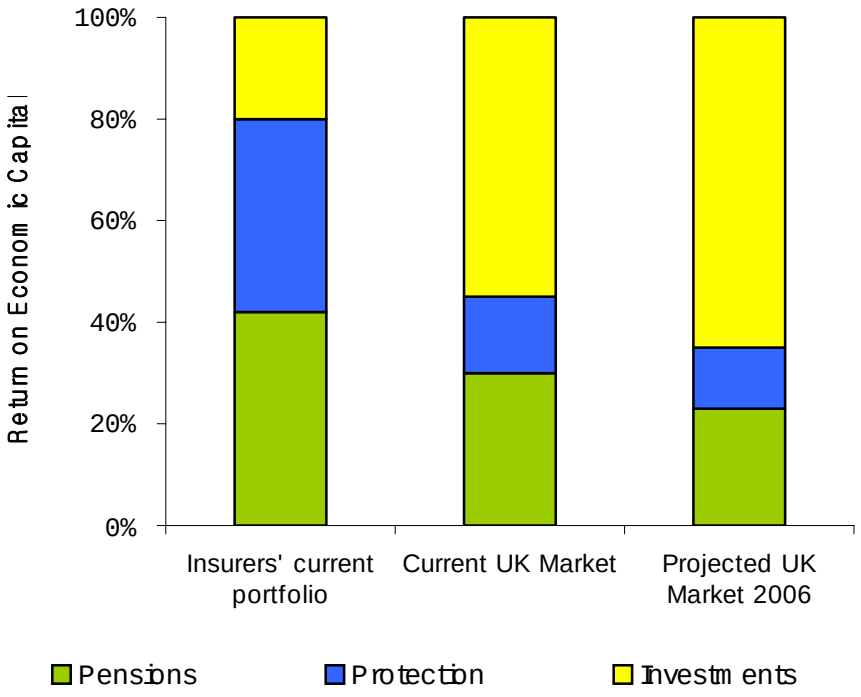
Product mix significantly more oriented to (value-destorying) pensions than market.

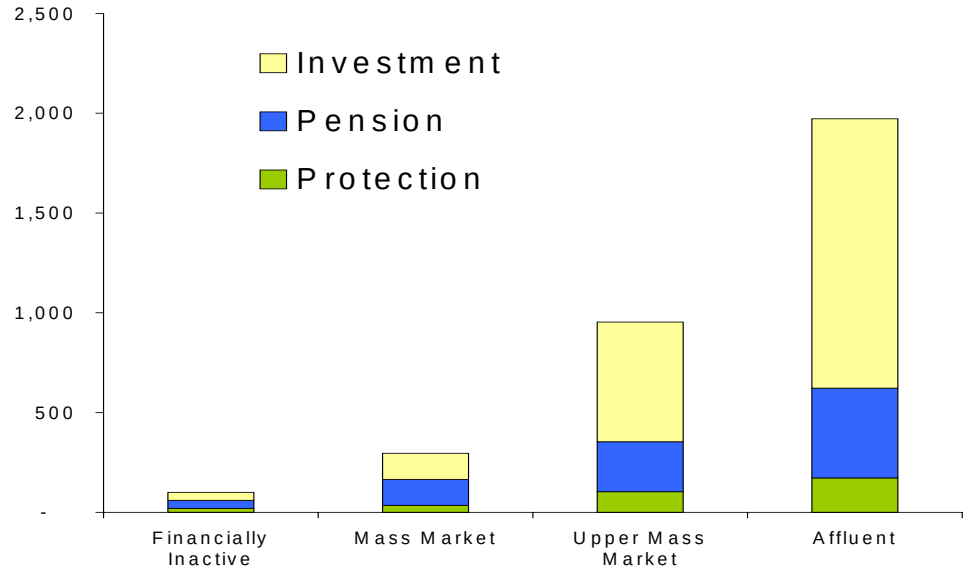
- Over-concentration to pension products (low profit, low growth and subject to possible tax / regulatory change)

- Over-concentration to low-growth protection market

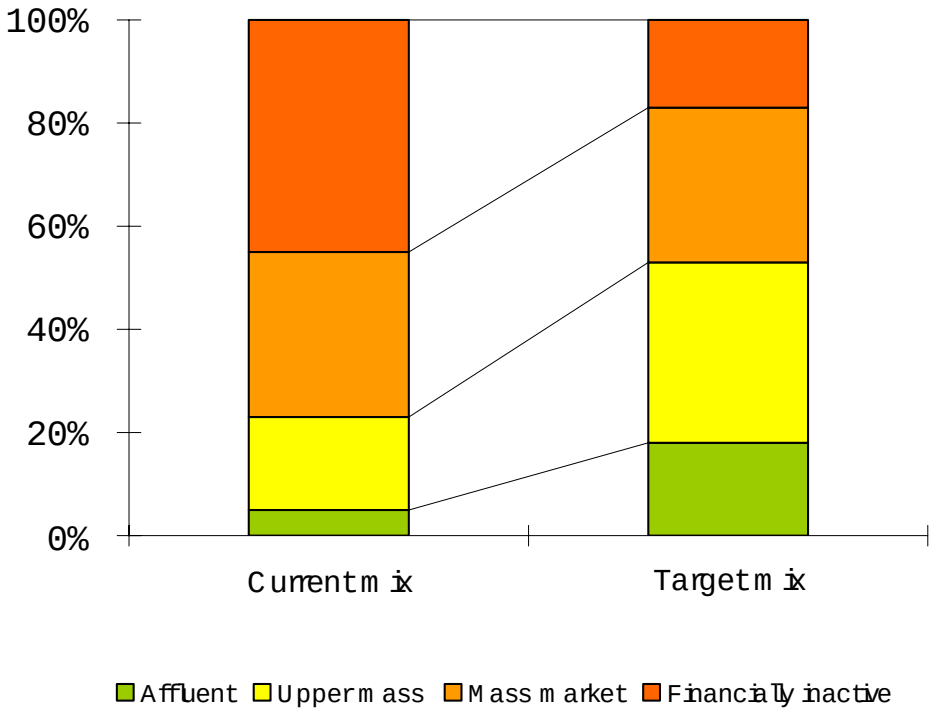
4.4 Achieving the increase in investment product sales required a major shift in custmer focus with implications for branding, marketing, agent recruitment / trading and customer relationship management

Affluent customers buy significantly more investment products than mass market



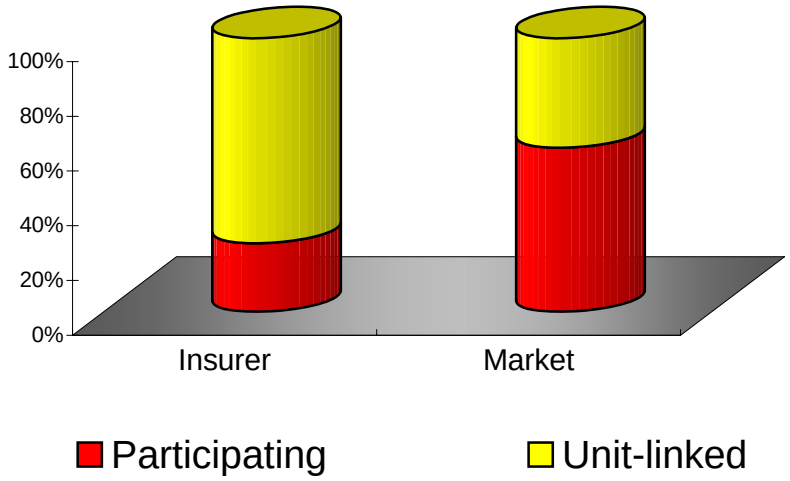


It is implying significant change in mix of target customer segments

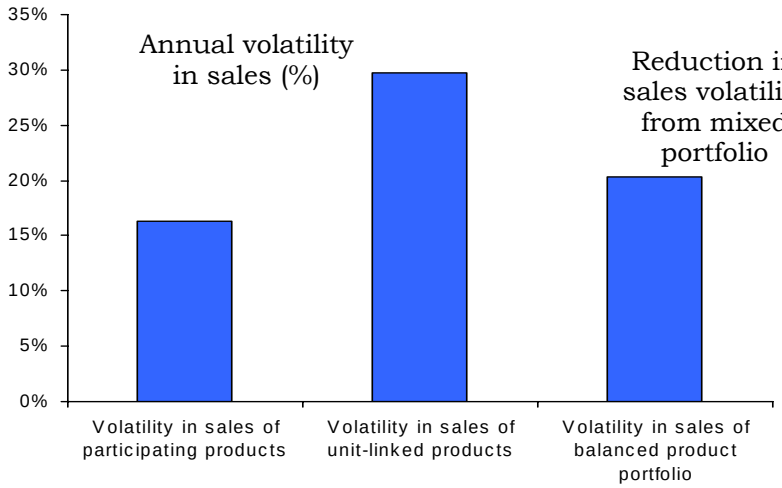


4.5 Within Investment (and pension) products, the insurer had a relatively low proportion of participating profit-sharing products. although more capital intensive, participating products provide more stable sales volumes

Low share of participating products / profit-sharing products

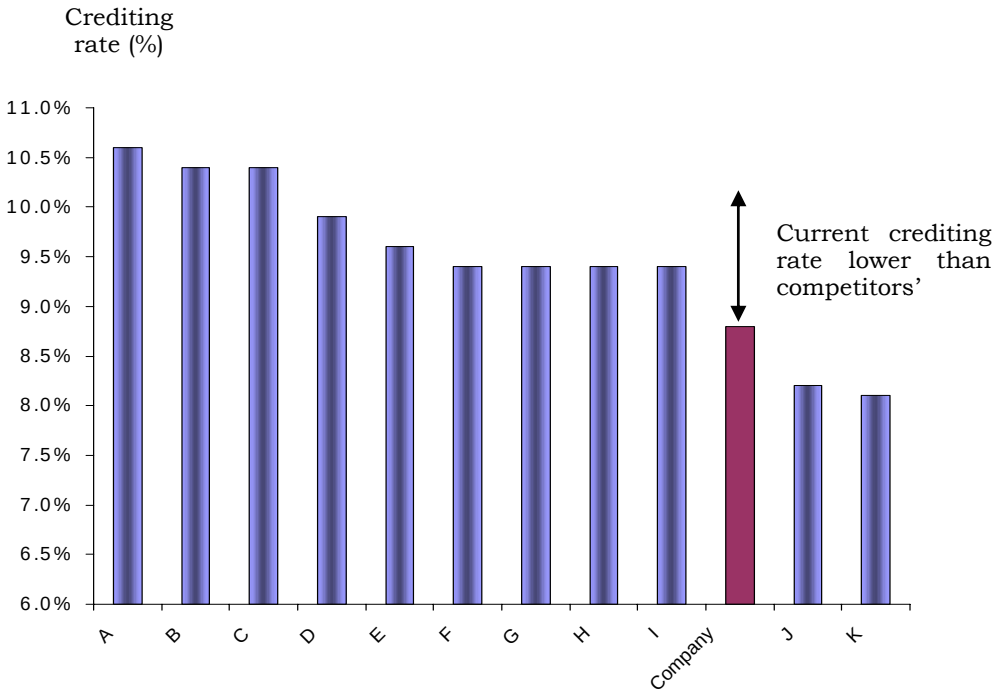


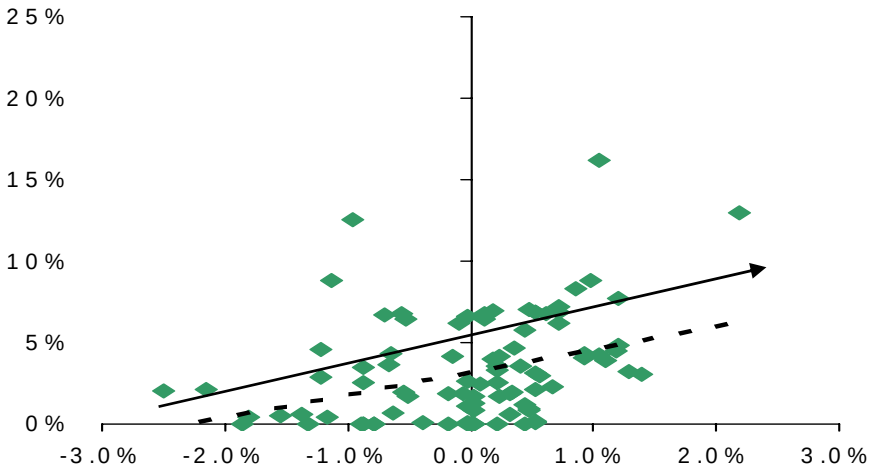
But a balanced portfolio of participating and non-participating products gives more stable sales volumes.



4.6 Increasing sales of participating products could be achieved by increasing the insurer's crediting rates (currently low relative to competitors)

Scope to increse crediting rate relative to competitors increasing market share





4.7 The overall impact of re-focusing the product mix (and mix of new clients sold to) was estimated to be a £25 MM increase in annual new business value added

Impact on new business value

1. Shift product mix towards investment products (bought by upper-mass / affluent customers) £ 16 MM

2. Increase socio-economic mix of new customers towards more affluent customer (who are more likely to buy investment products) £ 4 MM

3. Concentrate cross-selling efforts to affluent existing clients (who buy investment products) £ 4 MM

4. Increase proportion of profit-sharing products relative to unit-linked to reduce strategic risk (at cost of increased capital) Reduced sales volume volatility

Estimated annual new business value improvement - £ 25 MM

4.8 Using the RAPM framework to price life products requires consideration of all the drivers of policy risk-adjusted value

Factors affecting life policy prices

1. Cost of Guarantees
- Guaranteed rate
- Investment mix
- Life Time (Duration)
- Current interst rate level / volatilities

2. Underwriter's embedded options
- Guarantee rate reset frequency
- Market value adjustment options

3. Polycyholders' embedded options
- Surrender
- Paid-up Policies' Annuity Options (e.g. lump sum or life time payment)
- Premium payment options
- Cash value transfer among different policies

4. Cost of Capital

4.9 Using the RAPM framework to price life products requires consideration of all the drivers of policy risk-adjusted value

Example – Product development and approval process in us insurer

1. Idea generation / brain-storming

2. Initial market research

3. Pro-forma economic and feasibility analysis

   - In this stage, role of risk management / RAPM is Tyical subsitute product economics, risk and capital usage.

4. detailed product design

   - In this stage, role of risk management / RAPM is Support in analysising risk / economic of different product designs.

5. Pricing & profit-testing
   - In this stage, role of risk management / RAPM is Support in developing tailored risk/ capital / value model. Evaluate use of risk mitigation

6. Formal business case
   - In this stage, role of risk management / RAPM is Analysis of product-related risks to check within risk tolerance limits. Sign-off on product economic analysis

7. Launch preparation

8. Post-launch

   - In this stage, role of risk management / RAPM is Ex-post risk and performance monitoring