



# Creating a Framework for Risk-Adjusted Performance Measurement

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## Objectives

- Return
- RAPM
- Consistency Across Businesses / Industries
  - RAROC = Embedded Value
- Capital
  - Capital vs. Total Assets Required (TAR)
  - Stranded Capital
  - Free Capital
- Attribution
- Outstanding Issues

## What is Return?

- Return on Equity (under any accounting system):

$$\begin{aligned} ROE &= \frac{Income}{Initial\ Equity} = \frac{CF + \Delta Equity}{Initial\ Equity} \\ &= \frac{Distributed\ Earnings + Retained\ Earnings}{Initial\ Equity} \end{aligned}$$

## What is Risk-Adjusted Return?

- How does “risk” get into the formula?
- Forward view / Pricing
  - “Mean” IRR across multiple scenarios
- Historical Performance Measurement
  - Only one scenario is realized
    - We cannot risk-adjust the numerator
  - How do we allocate realized return among:
    - Wise management?
    - Random outcomes of wisely chosen risks?

## RAROC

- “Risk-Adjusted Return on Capital”
- $$RAROC = \frac{\text{Economic Income}}{\text{Initial Economic Capital}}$$
- Economic Capital reflects Risk
- Actually: “Return on Risk-Adjusted Capital”
- (RA)(ROC) – not (RAR)(OC)

## RAROC – Traditional Calculation

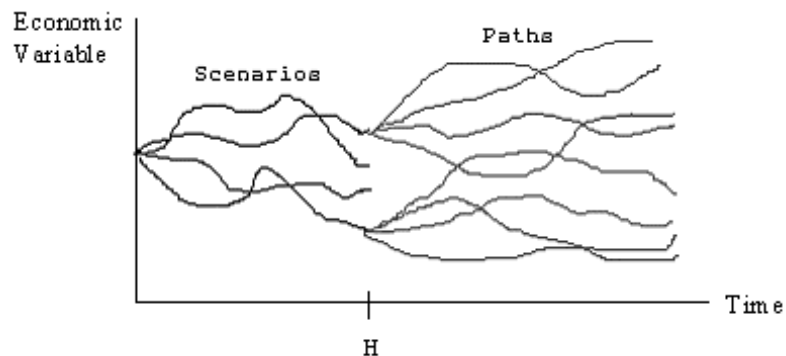
- Numerator:
  - $CF + \Delta MVA - \Delta FVL$
  - This formula assumes that capital is released at the end of the period
- Denominator:
  - Economic Capital (EC)
- Horizon: Typically 1 Year or 1 Quarter

## Traditional RAROC – EC

- P&C Insurance:
  - Additional Amount Needed to pay claims in the tail scenario
  - (Tail – Mean) of Traditional Loss Distribution
- Banks:
  - Amount Needed to remain economically solvent at the end of the period
  - Requires Economic Balance sheet at the end of the period across multiple scenarios

→ Requires “Scenarios within Scenarios”

## RAROC Calculation



## What Does RAROC Mean

- Return / Risk ?
- Actually, it can be shown that RAROC is simply the ROE under an Economic accounting system
  - Strictly speaking, it only works if there is no “Stranded Capital” (more on this later)

## Issues in Applying Traditional RAROC to LICs

- Ignores requirement of holding required reserves and required surplus
- One-year view inappropriate for long-term liabilities
- Numerator / Denominator not consistent
- Severe run-time
- Not well understood by LIC actuaries
- Not usable for other purposes (e.g., product pricing)

## Performance Measurement for LICs

Embedded Value is the most appropriate basis for performance measurement for a LIC:

- Measures economic capital and risk-adjusted returns
- Reflects all financial risks, including embedded options and guarantees
- Reflects the interplay of the assets and liabilities
- Captures the value created or destroyed by new business
- Is consistent with product pricing
- Applies across all products and risk elements
- Consistency: EV is a generalization of Traditional RAROC

## Embedded Value – Key Concepts

- Projection Horizon
  - Determined by the nature of the business
- Present Value
  - Discounted at Cost of Capital
- Total Assets Required (TAR)
  - TAR is the amount of assets needed to ensure “solvency” in x% of the outcomes over the life of the business (e.g., AA rating)
  - $TAR = Reserves + Risk\ Capital$
  - Left-hand side of the economic balance sheet
- Free Cash Flows = Pure Cash Flows –  $\Delta TAR$
- Stochastic Scenarios
  - Stochastic variables for all relevant risks
  - Properly correlated
- Embedded Value = Mean Present Value of Free Cash Flows

## Embedded Value (EV) – Formula

EV = Present Value of Distributable Earnings (PVDE)

$$\begin{aligned} &= \text{PV (Premiums + Investment Income + Fees} \\ &\quad - \text{Benefits – Expenses – Taxes} \\ &\quad - \text{Change in Reserves} \\ &\quad - \text{Change in Risk Capital)} \quad \left. \vphantom{\begin{aligned} &= \text{PV (Premiums + Investment Income + Fees} \\ &\quad - \text{Benefits – Expenses – Taxes} \\ &\quad - \text{Change in Reserves} \\ &\quad - \text{Change in Risk Capital)} \end{aligned}} \right\} = \text{Change in TAR} \\ &= \text{PVFP} + (\text{Risk Capital} - \text{PV Cost of Risk Capital}) \\ &= \text{Risk Capital} + (\text{PVFP} - \text{PV Cost of Risk Capital}) \\ &= \text{Risk Capital} + \text{“Invested Capital”} \end{aligned}$$

[Note: Invested Capital is largely irrelevant for banks and P&C, because neither industry invests much capital beyond pure Risk Capital.]

## Total Assets Required

- TAR is the amount needed to ensure “solvency” in c% of the outcomes over the life of the business:
  - For each TAR calculation path, find the lowest present value of accumulated surplus in any year of the projection
  - Take the (1-c) percentile across all paths
- TAR should reflect:
  - All risk elements
  - The interplay of assets and liabilities including mismatch positions
  - Embedded options and guarantees
- In practice, TAR reflects only the risks which are modeled
- Because the risks of the business are linked to the financial markets, TAR is path dependent
  - As guarantees become more (less) in the money due to changes in the economic environment, TAR increases (decreases)



## EC ↔ EV

### Economic Capital

= Tail Losses – Mean Losses

→ Tail (Net Claims + Exp – Inv Inc) – Mean (Net Claims + Exp – Inc Inc)

→ Tail PV (Net Claims + Exp + Δ Reserves – Premiums – Fees – Inv Inc)

– Mean PV (Net Claims + Exp + Δ Reserves + Δ Risk Capital – Premiums – Fees – Inv Inc)

= Tail PV (– Profit) – Mean PV (– Profit + Δ Risk Capital )

= Risk Capital – (– PVFP + PV Cost of Risk Capital)

= Risk Capital + PVFP – PV Cost of Risk Capital

= PVDE

= Embedded Value

## RAROC: Comparison of LIC and P&C

- Both measure economic return relative to “Capital at Risk”
- P&C Capital at Risk = Risk Capital + Invested Capital  
= Risk Capital
- LIC Capital at Risk = Risk Capital + Invested Capital  
= Embedded Value
- Note: For Banks & P&C, Risk = Capital  
→ Risk / Return has economic meaning

## Let's Generalize Further...

- Types of Invested Capital:
  - Commission
  - Acquisition Expenses
  - R&D
  - Plant / Equipment
  - Inventory
  - Construction Costs
- EV can apply to any industry

## What is missing?

- EV only values in-force business (VIF) plus free surplus (FS)
- Firm Value = VIF + FS + Franchise Value
- Need estimate of Franchise Value, especially for non-financial companies
- We can reasonably estimate Franchise Value using the same tools we use for VIF
- We focus on EV for the present

## TAR – Refinements

- TAR is a General Account concept
  - To reflect Separate Account business:

$$\begin{aligned} \text{TAR} &= \text{Total Reserves (Fixed \& Var)} \\ &\quad - \text{Variable Account Value} \\ &\quad + \text{Risk Surplus} \end{aligned}$$

- Aggregation on non-modeled risks
  - Ops Risk, etc.

### Life Insurance Embedded Value Balance Sheet (Simplified)

Assets		Liabilities	
General Account	$TAR + FS$	Net Liability	$TAR - PVDE$
Invested Assets		EV Equity	$EV = PVDE + FS$

where:  $TAR$  = Total Assets Required (under whatever constraint is driving, e.g. the  $TAR$  required to maintain a Moody's rating of "AA")

$PVDE$  = Mean Present Value of Distributable Earnings (on in-force block)

$Distributable\ Earnings = Cash\ Flows - \Delta TAR$

$FS$  = Value of Free Surplus

## Embedded Value Performance Measurement

$$\begin{aligned}EV ROE &= \frac{DE + \Delta EV}{EV_0} \\ &= \frac{DE + \Delta EV}{Risk\ Capital + Invested\ Capital} \\ &= RAROC\end{aligned}$$

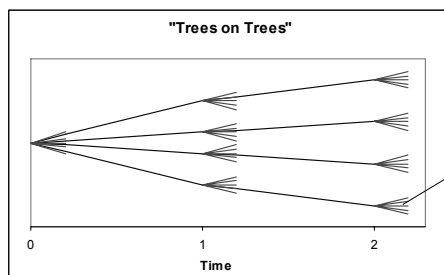
## Performance Measurement – Consistency What If Rating Agencies Require More?

- Report EV Using Two Approaches:
  - (1) Pure Economic View:
    - Economic TAR = Economic Reserves + Economic Risk Capital
  - (2) “Constrained” View:
    - Constrained TAR = Statutory Reserves + Rating Agency Capital
    - “Stranded Assets” = Constrained TAR – Economic TAR

## Wait a minute!

- TAR is the amount needed to ensure “solvency” in c% of scenarios
- Constrained TAR: “Solvency” means positive Statutory Balance Sheet over the horizon
- What does solvency mean for Economic TAR?
  - Enough to pay claims (“Cash Flow Solvency”)?
  - Positive Economic Balance Sheet over the horizon?

## OUCH!



Need to compute MVA & FVL at each time node in each TAR path of each scenario!

Trees on Trees  
on Trees!

(Monte Carlo)<sup>3</sup>

# Free Capital

- Free Capital is the minimum free surplus under three balance sheet views:
  - Statutory, with Rating Agency Surplus
  - Economic EV
  - Constrained EV

Rating Agencies			
TAR	41,256	Reserves	37,799
Free Surplus	1,123	Debt	1,611
		Risk Capital	1,845
		Free Surplus	1,123

Assets 42,378

Economic			
TAR	40,500	Liability	35,581
Free Surplus	1,878	Debt	1,611
		PVDE	3,308
		Free Surplus	1,878

Assets 42,378 EV 5,186

Constrained			
TAR	41,256	Liability	35,898
Free Surplus	1,123	Debt	1,611
		PVDE	3,747
		Free Surplus	1,123

Assets 42,378 EV 4,870

## What to do with Stranded Capital?

- Stranded Capital = Constrained TAR – Reserves
- Two Approaches:
  - (A) Charge Rent on Stranded Capital
    - Charge the Numerator
  - (B) Charge Stranded Capital to Business Segments
    - Increase the Denominator

Target Return (Cost of Capital):		8.0%		
Method A	Line A	Line B	Corp	Total Company
Economically Computed Risk Capital	1,000	1,000	-	2,000
Rating Agency Required Capital	1,000	2,000	-	3,000
"Stranded Capital"	-	-	1,000	1,000
Earnings	120	210	-	330
Return				
Raw Numerator	120	210	-	330
Capital Rent Charge	-	(80)	80	-
Adjusted Numerator	120	130	80	330
Denominator	1,000	1,000	1,000	3,000
Ratio	12.0%	13.0%	8.0%	11.0%



## EV Attribution

	EV
Prev Period	\$XX,XXX.X
Curr Period Effect of New Business	\$XX,XXX.X
Future Effect of New Business	\$XX,XXX.X
Curr Period Experience Effect from Inforce	\$XX,XXX.X
Future Experience Effect from Inforce	\$XX,XXX.X
Future Assumption Effect from Inforce	\$XX,XXX.X
Curr Period	\$XX,XXX.X

## Outstanding Issues

- Solvency Standard
- Diversification Benefit
- Allocating Capital
- Hurdle Rate
- Computation / Technology
- Planning Process
- Bridging Risk-Neutral & Actuarial Appraisal Methods

## Capital Standard

- Time Horizon
- Solvency or Probability of Downgrade?
- If “Solvency” then which type?
  - Cash Flow OR Economic Balance Sheet OR Statutory
- Access to capital – How often can we access more capital?
- Data Source
  - Time Horizon / Historical Period – Which period to use?
  - Consistency with closed block – Historical data is on going concern companies that continue to sell new business. How do we reconcile this data with our effort to measure solvency on a closed block?
- Risk of Too Much Precision & Missing the Big Picture
- Communication of extreme tail standards

## Hurdle Rate

- Constant or Changing with Capital Markets?
- Varying Required Returns by Segment?
- Administering Changing Hurdle Rates?
- Circularity
- Bridging Risk-Neutral & CAPM Methods
- Answer: Start Simple & Monitor

The End