watsonwyatt.com

Using your ALM model to manage capital and risk

Richard English and Daisy Ning

Watson Wyatt Worldwide

Agenda

- Uses of ALM model
- What is capital?
- Risks and how to measure
- Model design
- KPI from ALM
- Case study

Typical uses of ALM models

- Regulatory criteria
  - Projected solvency
  - Dividend / crediting rate determination
- Corporate criteria
  - Identification and understanding of risks
  - Investment strategy
  - MCEV framework
  - Hedging strategies
- Part of a risk management framework
- Don’t try to answer too many questions with one study

Real-life applications

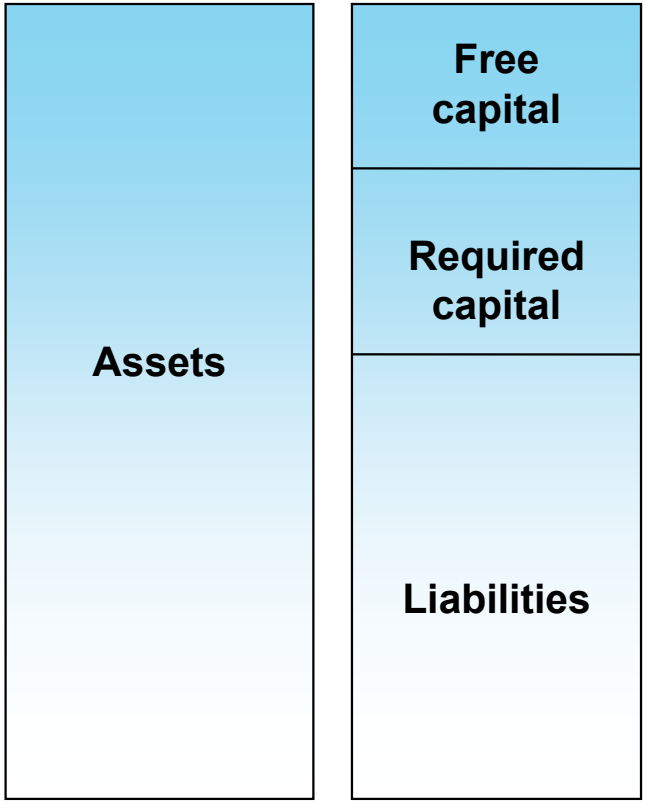
- Asset allocation
- Bonus strategy
- Product development
- Statutory reserving
- Business planning / Financial Condition Reports
- Risk management
- Realistic reporting
- Capital allocation
- Performance measurement

What is capital?

- Statutory basis
- Economic basis
- GAAP basis
- Rating agency model basis

- Might conflict each other when used to manage risks!
  - Example: Deteriorating investments may be held longer than they should because they benefit a key performance indicator even though economically they should be sold

Traditional capital assessment

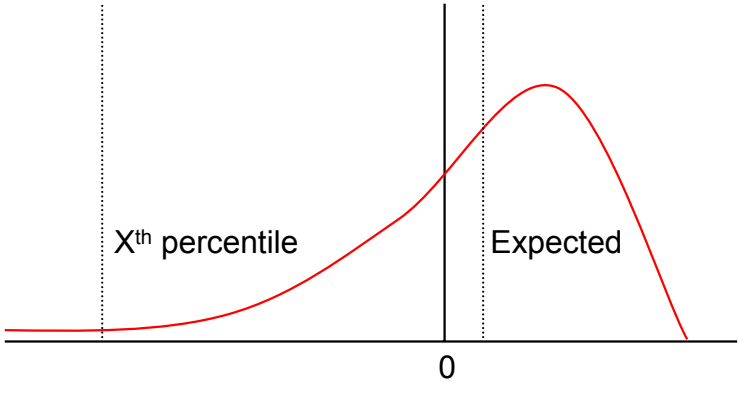


Statutory Required capital

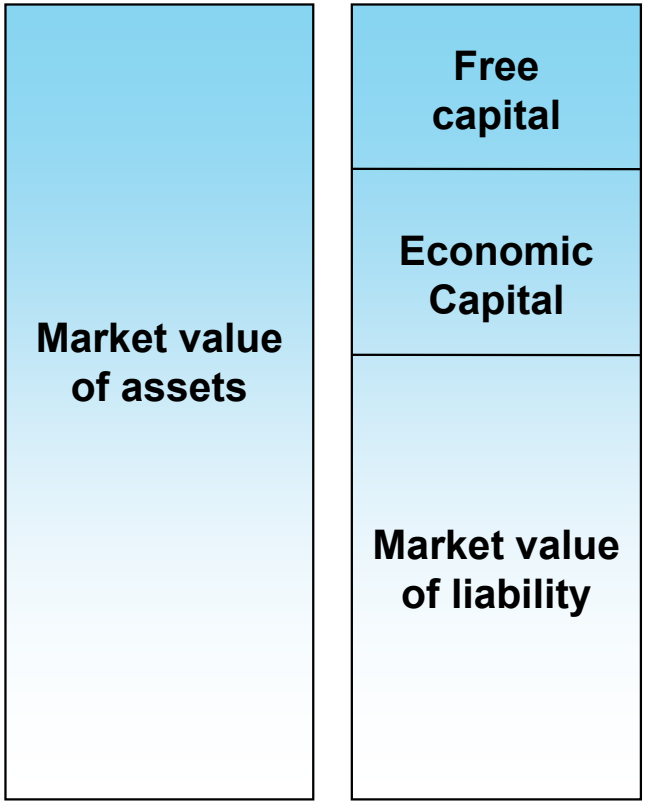
Generally relatively insensitive to the true riskiness of the business

Modern capital assessment – Economic Capital

- Capital that covers the potential value lost, based on the underlying risks in the company at a desired level of confidence over a chosen time horizon
- Self-assessment of the adequacy of financial resources, i.e. to ensure that there is no significant risk that the company can not meet its obligations as they fall due



Modern capital methodology



Economic Capital

Captures true riskiness of the business

Developments in Europe?

- Internal capital models and supervisory measures of required capital are converging
- European Commission has embarked on Solvency II
  - Risk-based regulatory framework for all insurers based in Europe
  - Framework expected to be finalised in 2007
  - Due for implementation in 2010
- Some regulators already adopting risk-based framework in advance, e.g. FSA (UK), BPV (Switzerland), Finansinspektionen (Sweden)…..
- CRO Forum
  - Chief Risk Officers of 13 major European insurance companies and financial conglomerates
  - Technical group focused on developing and promoting industry best practices in risk management

Risks

- Market risks
  - Interest, credit and liquidity risks
  - Mismatching and solvency
  - Guarantees
  - Selective policy discontinuance
  - Achieving target returns
  - Smoothing
- Non-market risks
  - Insurance risks (mortality, morbidity)
  - Operational
  - Business environment, regulatory compliance risks
  - Model risks

Measuring risks

- Economic or statutory capital at risk
- VaR / Tail VaR
- Probability distribution
- Risk budgeting

Risk measures

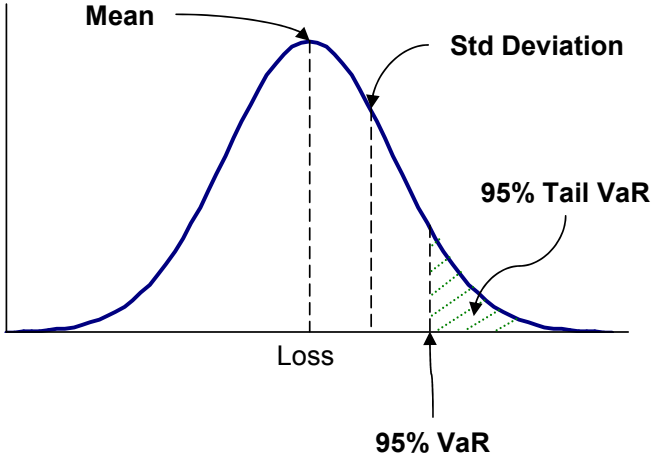
What is the company really concerned about?

- probability of insolvency
- probability of solvency ratio falling below x%
- probability of return on free reserves falling below y% in a year
- probability of economic value of surplus falling by x%
- size of economic loss at a xth percentile over a y year time horizon
- probability of a loss in a year
- volatility of earnings
- probability of a liquidity shortfall
- many other possible risk measures

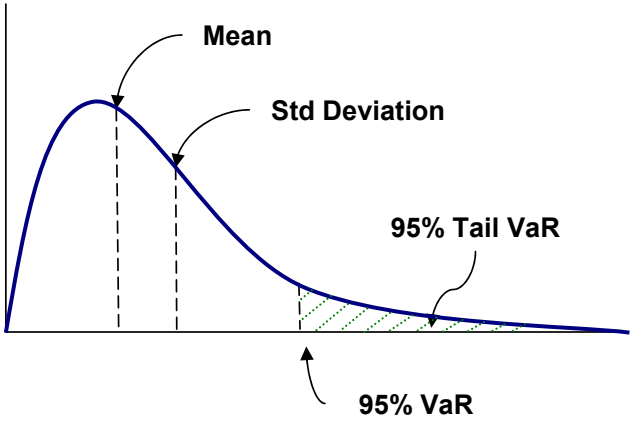
VaR and Tail VaR

- VaR and Tail VaR

Normal Distribution



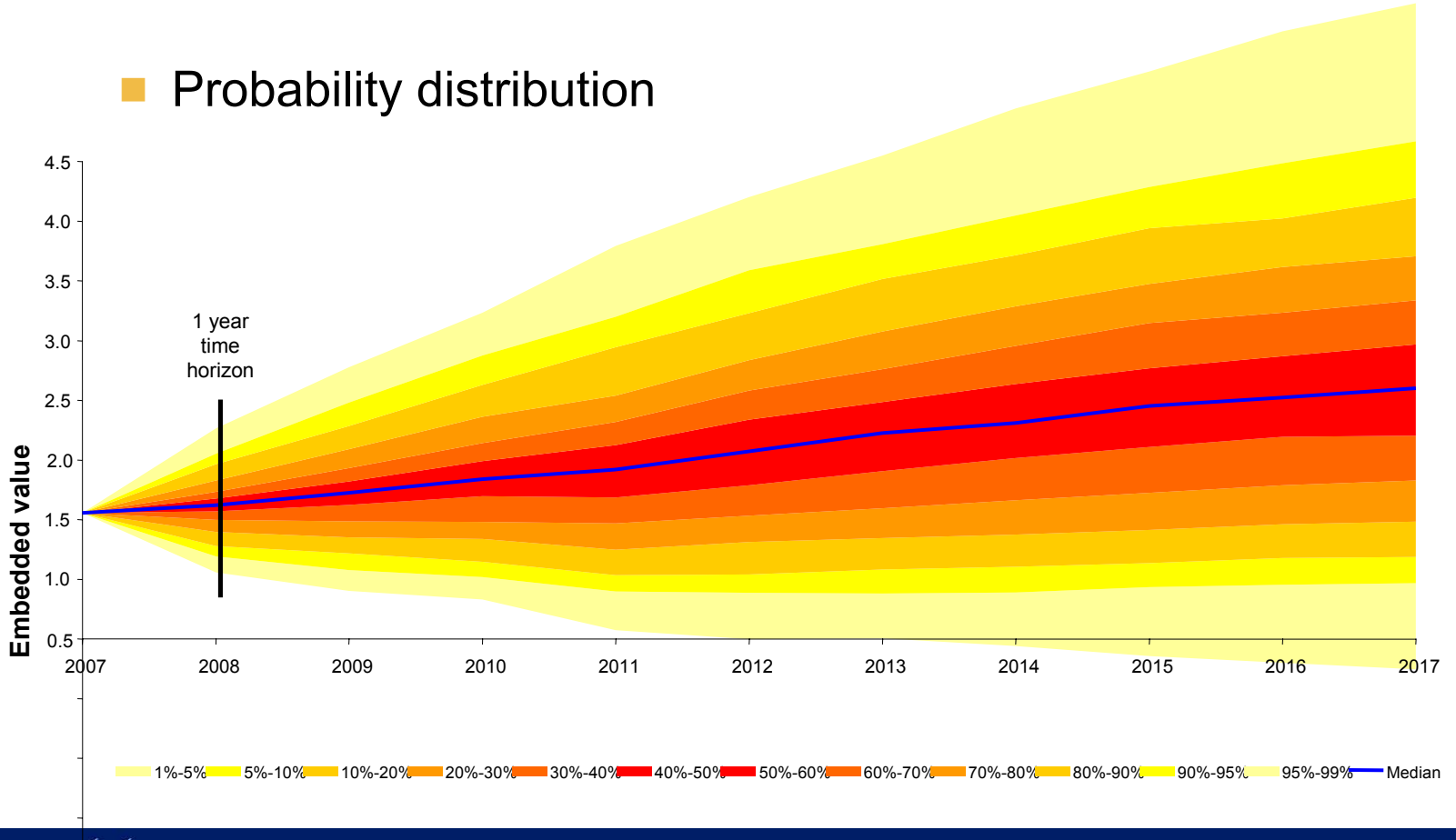
Skewed Distribution



Loss

Probability distribution

- Probability distribution



Risk budgeting

1. Devising a meaningful definition of risk
2. Establishing how much risk should be taken (the budget or appetite)
3. Deciding where risks should be taken to increase returns (how to spend the budget)

- Risk budgets must be assessed relative to a measure for liabilities:
  - returns ~ total returns vs. liabilities
  - risks ~ standard deviation of A/L returns
- Identify the risk of both policy and manager decisions from the same model
- Aim to maximise investment efficiency (= Net Information Ratio) given governance constraints and views on assumption uncertainty

Example ALM decision rule

- Asset allocation
  - 40% equity if solvency > 200% RBC
  - 15% equity if solvency between 100% and 200% RBC
  - 5% equity if solvency below 100% RBC
- Asset buying / selling
  - Bond purchase: buy new bonds with outstanding duration of 15 years from the market
  - Bond sales: sell all AVS bonds in the same proportion, but not HTM bonds
  - Equity purchase and sales: buy or sell all equities in the same proportion

Example ALM decision rule 2

- Buying / Selling strategies
  - When the total cashflow is positive, assets are bought (or sold) in a way such that the post-purchase portfolio will meet a pre-defined target allocation.
  - When the total cashflow is negative and the shortfall is within the current cash balance, no sale is performed.
  - If the shortfall is beyond the current cash balance however, assets are sold in a way such that the post-sales portfolio meets the pre-defined target allocation

Example ALM decision rule 3

- Dividend / Crediting rate determination
  - Linked to current investment environment
  - Linked to company portfolio return
- Dynamic discontinuance rates
  - Formula linking lapse to interest rate

Model design practical considerations

- Practical considerations
  - Established investment mandate
- Approximations made
  - Asset class proxy
  - Asset model approximations (cash flow / valuation)
  - Model point for liabilities
- Simplicity vs complexity
- Time horizon
  - Holding period of ALM risks
  - Views on mean reversion
  - Objectives: long term asset allocation or short term solvency cover

Model design practical considerations 2

- Economic Scenario Generators (ESGs)
  - Complicated!!!
    - Interest rate model
    - Asset return / credit spread
    - Correlation between assets
    - Not within the traditional actuarial knowledge
  - Market consistent or real world?
  - Needs calibration every time before use
  - Need to cover all the assets involved
  - Number of scenarios
  - Interface between the ESG and the ALM model
  - Training on working with ESG files and stochastic projection

KPI from ALM

- Crediting rate / policyholder dividend sustainability
  - Average ratio of dividend rate to portfolio return
  - Probability of dividend rate falling short of certain level
  - Smoothing of policyholder dividend
  - Market value basis or book value basis?
- Solvency
  - Basis: Statutory / GAAP / Economic?
  - Amount of capital injection required or present value
  - Probability of capital injection

KPI from ALM 2

- Profitability
  - Basis again
  - Return on shareholder capital over a specified period (BV / MV)
  - Present value of shareholder distributable earnings
  - Derived profitability margin
- Guarantees
- Volatility in profitability / solvency

Conclusion

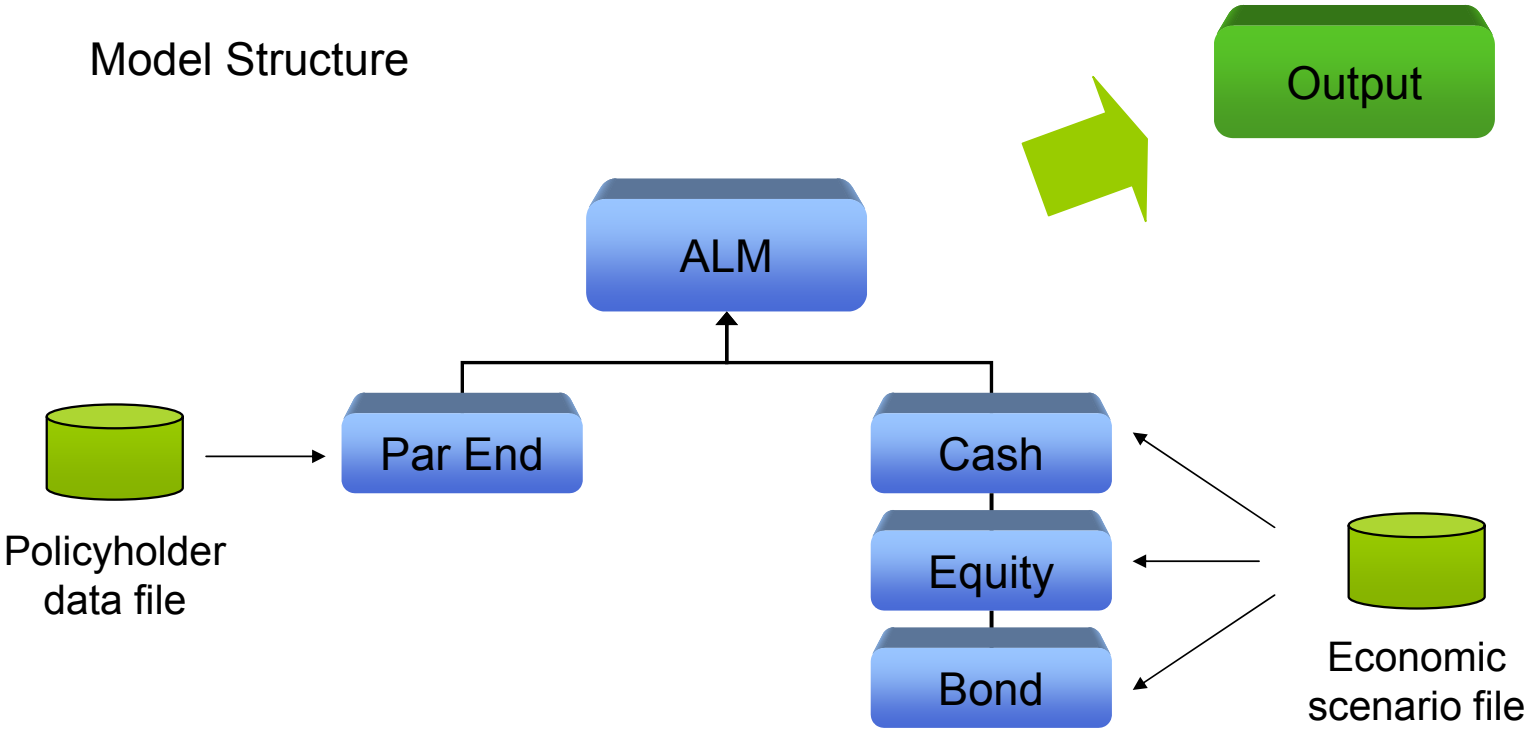
- ALM can achieve multiple purposes
- Managing capital and risk is one of the main purposes
- Definition of capital varies
- Holding of capital is related to the inherent risks of the business
- Market risks and non-market risks
- Ways to measure risks
- Design of ALM model to consider management of capital and risks
- How can the results from ALM model be gauged

Case study – Background

Participating endowment

- Liabilities
  - 5 year pay 10 year term endowment with level benefits
  - Dividend calculated using contribution method in Taiwan
  - Demographic / discontinuance assumptions are deterministic
- Assets
  - Cash
  - Domestic government bonds
  - Domestic equity
  - Stochastic modelling is involved
- Asset-Liability interaction
  - Cash is used to cover shortfall before selling assets
  - Otherwise rebalancing (purchase / sales) is performed
  - Rebalancing assets to a fixed target allocation at each period - 10% equity, 80% bond, 10% cash

Case study – Model



Barrie & Hibbert ESG

- Scenario file from Barrie & Hibbert
- 1000 scenarios for a time horizon of 30 years
- Scenario files covers the following
  - Taiwan government yield curve
  - Taiwan equities
  - Taiwan cash
  - US equities
- Calibrated as of 31 March 2007
- Barrie & Hibbert offers free basic ESG files to Taiwanese companies

Scenario	Timestep	TWD.CashReturn	TWD.EquityReturn	USD.EquityReturn	TWD.GovtYield(1yr)	TWD.GovtYield(2yr)
1	0	0	0	0	0.016700506	0.017376461
1	1	0.016700506	0.410929949	0.207349431	0.018626964	0.020124231
1	2	0.018626964	0.131111776	0.304652872	0.019402584	0.020524995
1	3	0.019402584	0.30687522	0.180632858	0.021246533	0.022915624
1	4	0.021246533	0.175408047	-0.081760664	0.017909478	0.019760982
1	5	0.017909478	-0.204370218	-0.141920799	0.027179364	0.02864347
1	6	0.027179364	-0.479213424	-0.121145625	0.034523767	0.035199019
1	7	0.034523767	-0.368990267	-0.193446274	0.052408341	0.049196048
1	8	0.052408341	-0.029301915	0.113017612	0.053446042	0.051047404
1	8	0.053446042	0.50736747	-0.044448296	0.029458173	0.029170949

Capital Measures

Target capital measures

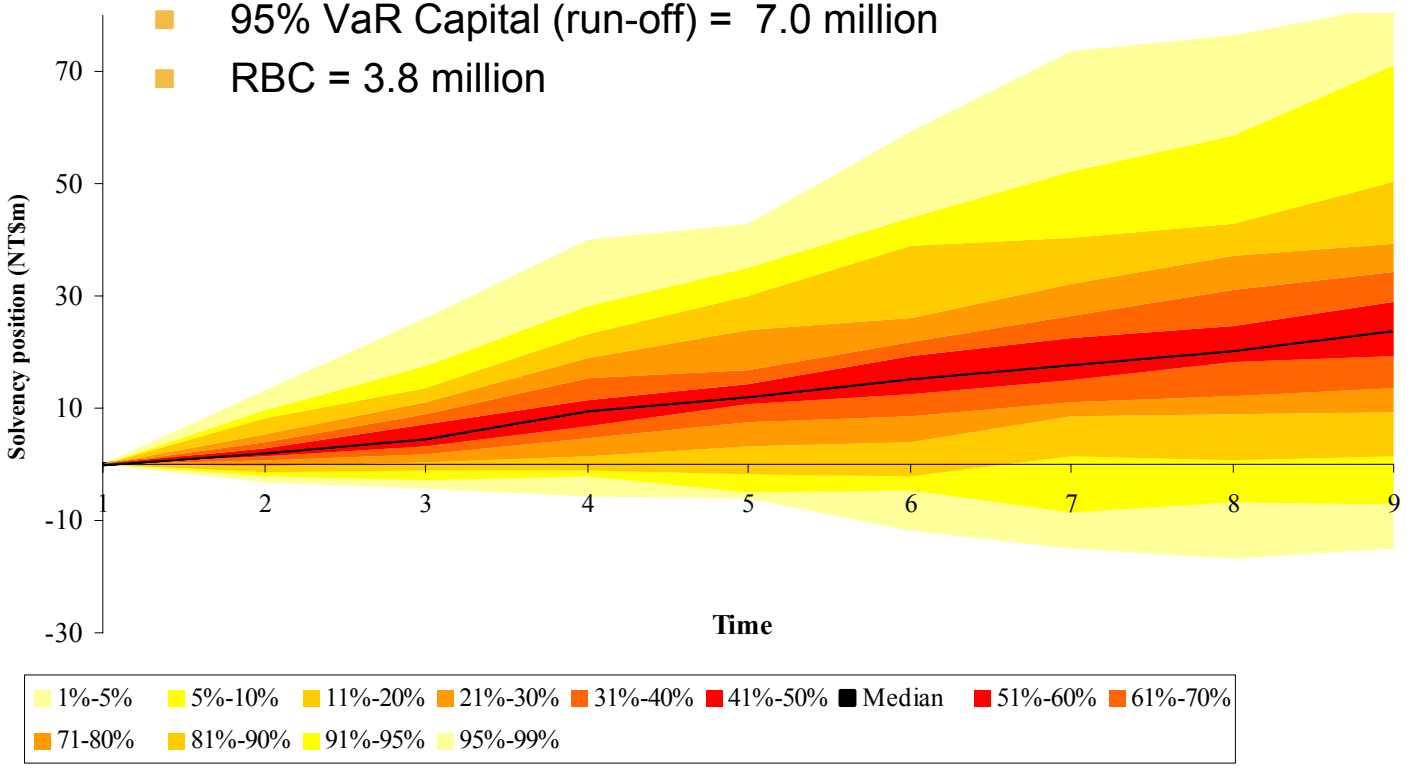
- 95% VaR (run-off)
  $\Rightarrow$ Pr(Asset > Liability after run-off) = 95%
- 99% VaR (1 year)
  $\Rightarrow$ Pr(Asset > Liability in the next year) = 99%
- Compared with statutory formula-based Risk-Based Capital (“RBC”)

$$0.4 \times (C_0 + C_4 + \sqrt{(C_{1O} + C_3)^2 + C_{1S}{}^2 + C_2^2})$$

  - Statutory minimum capital is 200% of risk margin
  - Risk components:
    - C_0 – Asset risks for investment in related parties
    - C_1 – Asset risks for investment in non-related parties
    - C_2 – Insurance risks
    - C_3 – Interest risks
    - C_4 – Other risks

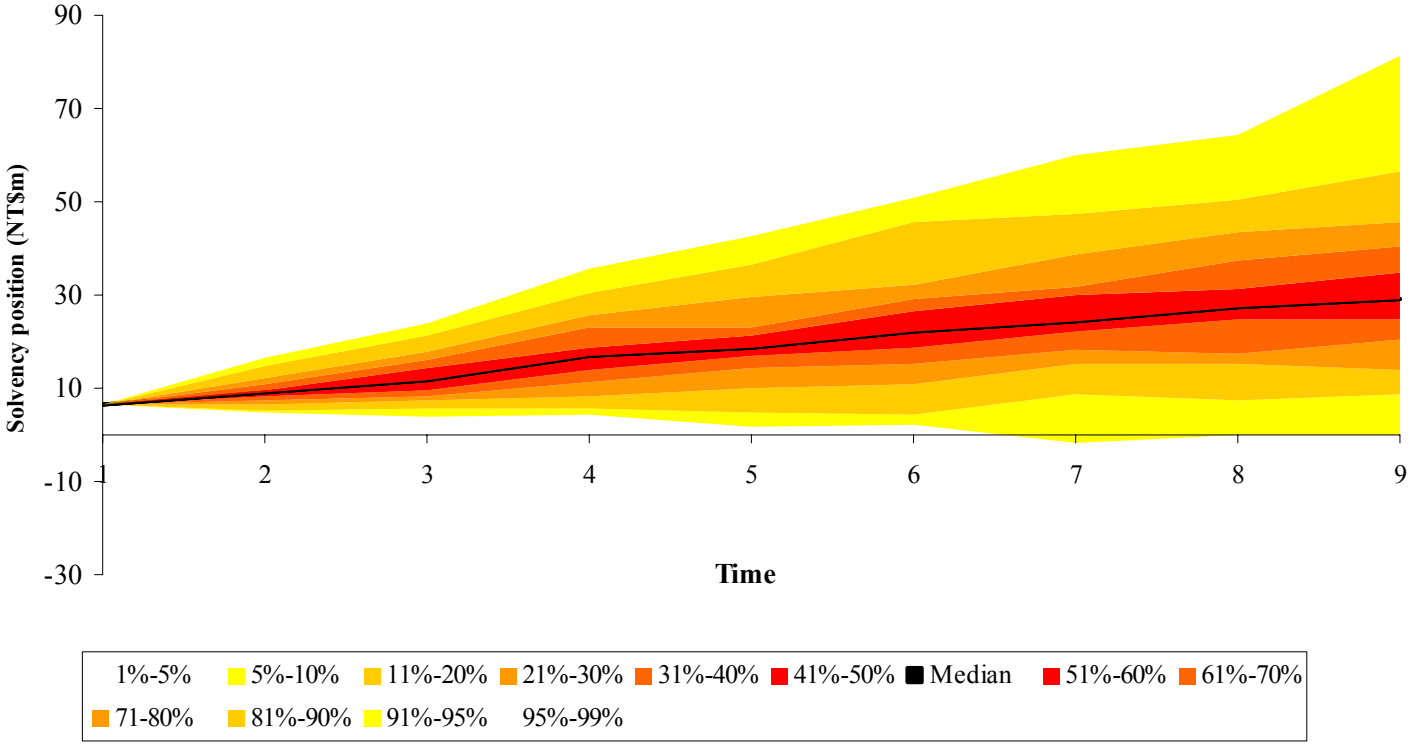
Results

- 99% VaR Capital (1 year) = 3.2 million
- 95% VaR Capital (run-off) = 7.0 million
- RBC = 3.8 million



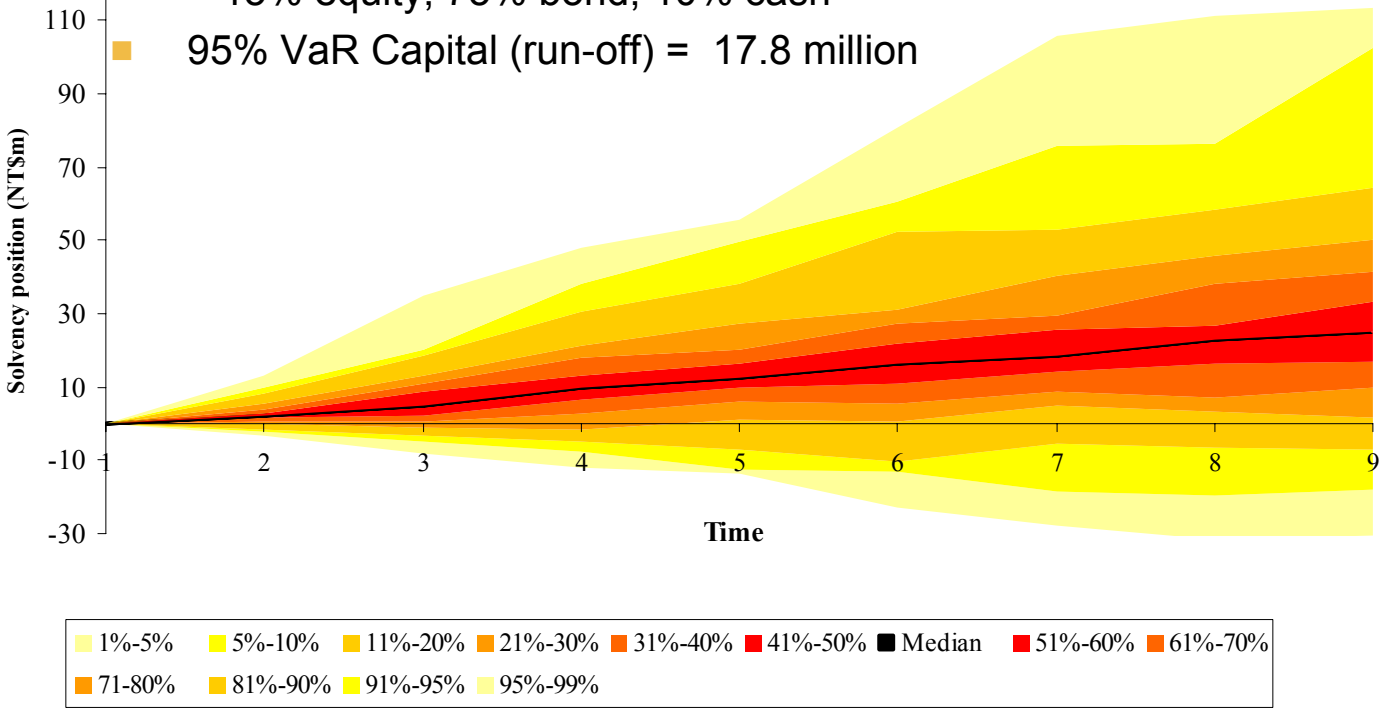
Results

- Capital injection of 6.6 million such that 95% VaR =0



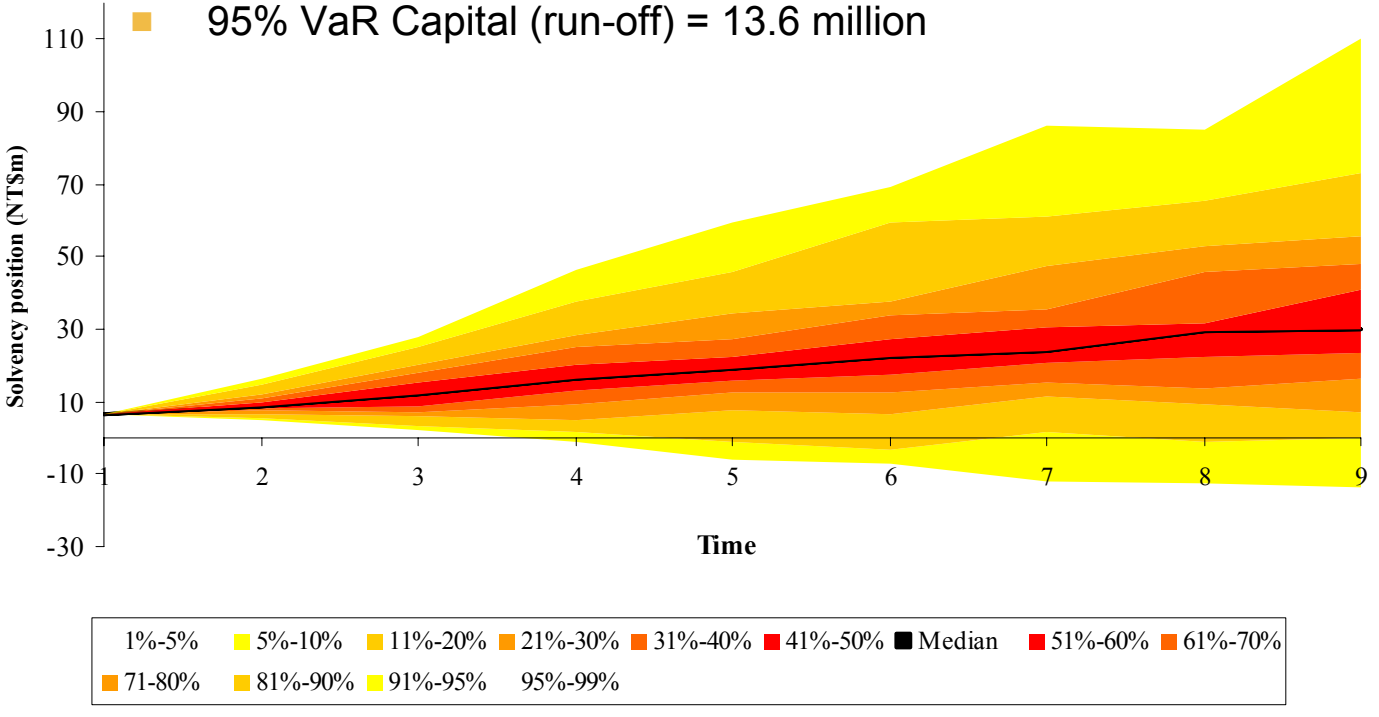
Results with different asset allocation

- Different asset allocation rule
  – 15% equity, 75% bond, 10% cash
- 95% VaR Capital (run-off) = 17.8 million



Results with different asset allocation

- Capital injection of 6.6 million as in base scenario
- 95% VaR Capital (run-off) = 13.6 million



Case Study – Summary

- Amount of capital required to immunize 95% of the risks over the life of the policies > statutory required RBC
- Increasing the exposure of market risks in the asset portfolio increases the amount of capital required
- How can optimal capital be determined?