Investment Strategy – Impacting Factors

Investment Strategy (SAA / ALM)

- Low Yield Environment
- Political and Economic Uncertainty
- Changing Regulation
- Min Guarantees, Duration gap...
- Internationalised Business
- Key Negative Interest Rates

Source: Thomson Reuters, U.S. Global Investors
Assessment of Vulnerability In a “Low for Long” Scenario

**VERY HIGH RISK TO PROFITABILITY**
Markets in which investment returns are already below or close to the guaranteed rate and where duration gap is high. The profits of many insurers will deteriorate and the capital of some will deteriorate if interest rates stay low for the next five years.

**HIGH RISK TO PROFITABILITY**
Markets in which investment returns are already below or close to the guaranteed rate but the duration gap is low. The profits of many insurers will deteriorate and the capital of some could progressively deteriorate if interest rates stay low for the next five years.

**MODERATE RISK TO PROFITABILITY**
Markets in which insurers are well matched or are readily able to lower credited rates. The profits of many insurers will progressively deteriorate if interest rates stay low for the next five years, but risk of losses is limited.

**LOW RISK TO PROFITABILITY**
Markets in which guaranteed products have specific features (e.g., ability to claw back bonuses, guaranteed rate linked to performance of assets). The profits of insurers will hardly deteriorate if interest rates stay low for the next five years.

**VERY LOW RISK TO PROFITABILITY**
Markets in which the weight of guaranteed products is low and guarantees are very low. The profits of insurers will hardly deteriorate if interest rates stay low for the next five years.

Circles sized by total value of 2015 Premiums (USD) scale:
- $100 billion
- $10 billion

**MOODY’S ANALYTICS**

Source: Moody’s Investors Service
# Assessment of Vulnerability In a “Low for Long” Scenario

<table>
<thead>
<tr>
<th>Country</th>
<th>Region</th>
<th>Weight</th>
<th>2015 Premiums (USD Millions)</th>
<th>Guaranteed Products as % Reserves</th>
<th>Average Guaranteed Rate</th>
<th>Ability to Reduce Credited Rates</th>
<th>Duration Gap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>Europe</td>
<td>4%</td>
<td>$96,725</td>
<td>&gt; 80%</td>
<td>2.5-3.5%</td>
<td>Low</td>
<td>&gt; 10 yrs</td>
</tr>
<tr>
<td>Norway</td>
<td>Europe</td>
<td>0%</td>
<td>$11,610</td>
<td>60-80%</td>
<td>2.5-3.5%</td>
<td>Medium</td>
<td>&gt; 10 yrs</td>
</tr>
<tr>
<td>Taiwan</td>
<td>Asia</td>
<td>3%</td>
<td>$79,627</td>
<td>&gt; 80%</td>
<td>3.0-4.0%</td>
<td>Low to medium</td>
<td>5-8 yrs</td>
</tr>
<tr>
<td>Japan</td>
<td>Asia</td>
<td>14%</td>
<td>$343,816</td>
<td>60-80%</td>
<td>2.0-2.5%</td>
<td>Low to medium</td>
<td>2-5 yrs</td>
</tr>
<tr>
<td>Netherlands</td>
<td>Europe</td>
<td>1%</td>
<td>$17,785</td>
<td>60-80%</td>
<td>3.0-4.0%</td>
<td>Low</td>
<td>2-5 yrs</td>
</tr>
<tr>
<td>South Korea</td>
<td>Asia</td>
<td>4%</td>
<td>$98,218</td>
<td>&gt; 80%</td>
<td>4.5-5.5%</td>
<td>Low to medium</td>
<td>0-2 yrs</td>
</tr>
<tr>
<td>Sweden</td>
<td>Europe</td>
<td>1%</td>
<td>$24,261</td>
<td>40-60%</td>
<td>2.5-3.5%*</td>
<td>Low to medium</td>
<td>&gt; 10 yrs</td>
</tr>
<tr>
<td>Switzerland</td>
<td>Europe</td>
<td>1%</td>
<td>$33,916</td>
<td>&gt; 80%</td>
<td>1.0-2.0%</td>
<td>Low</td>
<td>0-2 yrs</td>
</tr>
<tr>
<td>Canada</td>
<td>N. America</td>
<td>2%</td>
<td>$49,331</td>
<td>60-80%</td>
<td>2.0-4.0%</td>
<td>Medium</td>
<td>1-3 yrs</td>
</tr>
<tr>
<td>China</td>
<td>Asia</td>
<td>8%</td>
<td>$210,763</td>
<td>&gt; 80%</td>
<td>2.5-3.5%</td>
<td>High</td>
<td>7-10 yrs</td>
</tr>
<tr>
<td>France</td>
<td>Europe</td>
<td>6%</td>
<td>$150,143</td>
<td>60-80%</td>
<td>0.0-1.0%</td>
<td>Medium to high</td>
<td>5-8 yrs</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>Asia</td>
<td>2%</td>
<td>$41,255</td>
<td>60-80%</td>
<td>1.0-3.0%</td>
<td>Medium</td>
<td>N/A</td>
</tr>
<tr>
<td>Italy</td>
<td>Europe</td>
<td>5%</td>
<td>$124,848</td>
<td>&gt; 80%</td>
<td>1.5-2.0%</td>
<td>Medium</td>
<td>1-3 yrs</td>
</tr>
<tr>
<td>US</td>
<td>N. America</td>
<td>22%</td>
<td>$552,506</td>
<td>60-80%</td>
<td>2.0-4.0%</td>
<td>Low to medium</td>
<td>&lt; 2 yrs</td>
</tr>
<tr>
<td>South Africa</td>
<td>Africa</td>
<td>1%</td>
<td>$37,526</td>
<td>N/A</td>
<td>N/A</td>
<td>High</td>
<td>N/A</td>
</tr>
<tr>
<td>Spain</td>
<td>Europe</td>
<td>1%</td>
<td>$28,368</td>
<td>&gt; 80%</td>
<td>N/A</td>
<td>Low</td>
<td>0-2 yrs</td>
</tr>
<tr>
<td>Australia</td>
<td>Pacific</td>
<td>2%</td>
<td>$43,663</td>
<td>&lt; 20%</td>
<td>0.0-1.0%</td>
<td>High</td>
<td>N/A</td>
</tr>
<tr>
<td>Brazil</td>
<td>LatAm</td>
<td>1%</td>
<td>$37,106</td>
<td>&lt; 20%</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Ireland</td>
<td>Europe</td>
<td>2%</td>
<td>$47,416</td>
<td>&lt; 20%</td>
<td>0.0-2.0%</td>
<td>High</td>
<td>N/A</td>
</tr>
<tr>
<td>Mexico</td>
<td>LatAm</td>
<td>0%</td>
<td>$11,462</td>
<td>&lt; 20%</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>UK</td>
<td>Europe</td>
<td>8%</td>
<td>$214,492</td>
<td>20-40%</td>
<td>0.0-1.0%</td>
<td>High</td>
<td>&lt; 0 yrs</td>
</tr>
</tbody>
</table>

*This assessment is made at the country level and mostly focuses on the direct impact of low interest rates on profitability generated by in-force policies. However, and all insurers in each country face the same level of risk. Moody’s insurance financial strength ratings reflect the specific characteristics of each individual insurer. Please refer to moody.com for research on individual insurers.*

Source: Moody’s Analytics
Economic Scenarios
There are many types of ‘Economic Scenarios’

A broad range of tasks in risk and financial management are commonly addressed using *scenarios* describing potential future events for financial, economic and other variables.
3

ALM Framework
ALM modelling - a general scenario-based framework

Scenario 1
Scenario 2
Scenario 3

Economic scenario (market & non-market risk factors)
Business management model
ALM modelling
Zoom in on the business management model

Account for revenues and expenses
- Investment income
- Premiums
- Claims
- Maintenance expenses
- Tax

Update liability portfolio
- Mortality
- Lapses
- New business

Update asset portfolio
- Investment of revenues
- Rebalancing

Calculate Balance Sheet
- Available capital
- Required capital

Account for shareholder cash flows
- Dividends
- Capital injections

(Dynamic) Asset/Liability management actions

Stochastic / Factor Based ?
Strategic Asset Allocation Approaches
Traditional Strategic Asset Allocation (SAA) Approach
Mean Variance Optimisation (MVO)

ASSUMPTIONS +
HISTORICAL DATA

T=0

ASSET 1

T=1 (5y)

ASSET 2

ASSET 3

Limitations
- **Single period** - constant risk & return over planning horizon
- Use **historical data** to calculate correlation, risk and return
- **Risk** is defined as volatility of returns
- Asset correlation defined as single linear relationship
- Assumes portfolio is **instantly restructured to target**
- Assumes portfolio remains at target allocation
- Can't capture **dynamic strategies**
More Effective SAA Construction

Business Stakeholders
Inc Management

Risk based metrics

Consider Liabilities

Full ALM Cash - Flow Model

Policy Data / Scenarios

Management Actions / Stress Scenarios

Moody’s
ANALYTICS
Stochastic Strategic Asset Allocation Approach

Calibration
- Own Capital Market Views
- Current & Historical Market Data
- Forward Looking Model calibrations

Projection
- 5k+ Real World stochastic scenarios
- ASSET 1
- ASSET 2
- ASSET 3
- Liability value / cash flows
- Market Risk factors (structural)
- Insurance Risks (statistical)

T=0
Optimisation / Light ALM

T=5
Initial Portfolio Selection
- Optimiser (MVO)
- Select Candidate Portfolios

Balance Sheet Projection
- Liabilities
- Stochastic Risk Measure
- Analyse & Select Optimal Portfolio (SAA)

Optimisation
- Scenarios
- Policy Data
- Full ALM Cash flow Model

Moody's Analytics
Why are these advanced modelling capabilities important?

Multi time step
- Path dependency
- Reinvestment / rebalancing
- Dynamic management actions / trading strategies
- Changing risk over time is captured

Full distribution of outcomes
- Cash flows in and out, pay-outs, coupons
- Relevant risk metrics (SCR, EC, impairment)

Economic structure & consistency
- Forward Looking, inc market expectations
- Capture A-L interaction
- Incorporate own views
- Realistic dynamic features (stochastic vol, jumps)

Regulation & Accounting Standards
- Dependency structure / joint behaviour
Case Study: Intro
Nature of ESG

Economic structure & consistency

Multi time step

Full distribution of outcomes

ESG is

» Comprehensive mathematical model to project distribution over multiple time steps
  – Economic factors
  – Modelled assets

ESG is NOT

» Crystal Ball
  – We Provide ESG, but there is no way to tell you the future deterministically

» Simple Random Number Generator or Simple Mean-Variance Model
  – It does contains random number generator
  – More importantly, we bring in the realistic economic structure
ESG Economy Model Structure

Structural relationships and correlations ensure plausible dependencies between asset classes.
ESG is Structural Economic Model

- Simple statistical model (mean-variance model) does not have realistic economic structure
  - Single period (either considering 1-year or considering 10-year)
  - No dynamic strategies (reinvestment, HTM, tradable, etc)
  - Correlation, volatility and return does not capture all economic structure (like fat-tail, skew, etc)
  - Correlation in mean-variance model is linear (no tail-dependence)
  - Risk is constant over time (but it should be time-dependent)

Long term bond subject to interest rate risk
Short term bond subject to reinvestment risk
Case Study: Asset & Liability
Case Studies on Participating Business

For ring-fenced participating business, at least 70% of excess return over guarantees belong to customers, let’s consider two cases

» 1-year term participating business (guarantee rate same as Gov’t bond of same tenor)
» 10-year term participating business (guarantee rate same as Gov’t bond of same tenor)

Maturity benefits and maturity dividend are only considered components in cash flow (death benefits & surrender benefits are ignored)

Available assets:

» Equities
» 1-year government bonds and corporate bonds with various ratings (HTM)
» 10-year government bonds and corporate bonds with various ratings (HTM)

Goal is to construct efficient frontier for asset allocation strategy
Methodologies

» Economic Scenarios are adopted
» Using light ALM methodologies here
  – Only consider the profit realized at the end of policy period
  – We don’t consider liability valuation at each time step
  – It’s simple but brings impressive results
» Using 1,000 sample allocation strategies (out of whole allocation space) to construct efficient frontier
» We will try to compare
  – Traditional MVO on asset side only versus
  – Linking liability participation and outgo together and considering tail risk (VaR)
Case Study: Importance of Linking Liability
SAA for 1-Year Business (Only Asset Side)

Based on ESG, applying MVO, considering 1,000 allocation strategies

Return Metric: Mean return (Y-Axis), Risk Metric: Volatility (X-Axis)

It’s very common seen efficient frontier

More risky investment leads to higher return

Higher equity allocation leads to higher return
SAA for 10-Year Business (Only Asset Side)

Based on ESG, applying MVO, considering 1,000 allocation strategies

**Return Metric:** Mean return (Y-Axis), **Risk Metric:** Volatility (X-Axis)

It’s very common seen efficient frontier

More risky investment leads to higher return

Higher equity allocation leads to higher return
SAA for 1-Year Participating Business

Based on ESG, applying stochastic asset and liability interaction model, considering 1,000 allocation strategies

Return Metric: Mean profit of 1-year term (Y-Axis), Risk Metric: Worst 1th percentile loss (X-Axis)

Why it’s so different?

Most efficient point is to hold 1-year high spread IG bonds

» Invest in high-risk instrument (equity), all risk is borne by company (worst 1th percentile), but 70% of upside potential belongs to policyholders

It can be understood under binomial tree:

» Investment return: 50% to get 42%, 50% to lose 20% (mean return is 11%)

» Best scenario to earn 12.6% (only 30% of 42%), while worst case to lose 20% (100% of 20%).
The mean profit is -3.7% (NOT 11%!)
SAA for 10-Year Participating Business

Based on ESG, applying stochastic asset and liability interaction model, considering 1,000 allocation strategies

Return Metric: Mean profit of 10-year term (Y-Axis), Risk Metric: Worst 1<sup>st</sup> percentile loss (X-Axis)

Risky investment benefit from longer horizon

» Diversification
» More chance to recover from loss
» Redline is the capital market line

Higher allocation lower marginal return for risky investment

» Every unit increase on equity investment brings out lower marginal return
Case Study: What Other Factors Matter?
Does the Participating Rule (Sharing Rule) Matter?

Lower policyholder participation leads to more aggressive investment
» Closer to shareholder own fund (return and risk are more aligned)

Higher policyholder participation leads to more conservative investment
» Insurers have to provide guarantees
» Less alignment on return and risk
Does the Asset Position Matter?

Guarantee at the money
Asset = Guaranteed Liability

Lower asset position will make you less aggressive
» When the investment performs well, majority of benefit goes to policyholders, but not the company

Guarantee out of the money
(Asset >> Guaranteed Liability)

Higher asset position will allow insurers to pursue higher return
» Because guaranteed outgo has been met, very low probability for downside
» Hence, return and risk are more aligned
Any Others?

» Quite a Lot!
  – Economic Environment (Interest Rate, Volatilities of Different Assets, etc)
  – Other Features
    » Dividend / Bonus Options (Reversionary Bonus, Cash Dividend, Dividend on Deposit, Terminal Bonus, etc)
    » Surrender Benefits
    » Guarantee Annuitzation Option
  – Management Actions
    » The Actions Management is Willing and Able to Undertake (Cut Bonus / Increase Bonus, etc)
  – Policyholder Behaviours
    » Dynamic Lapse / Surrender Based on Different Market Environment

» It’s important to bring liability and asset & realistic interaction together to make better decision
Summary
Key Point Summary

» Internal business requirements & complicated economic environment are motivating Insurers to enhance their ALM framework

» As emphasized by regulators

» Operational disjoint between Asset and Liability sides of an Insurers business makes investment decisions inefficient (traditional MVO approach)

» An integrated ALM framework using economic scenarios gives Insurers a more realistic ‘Risk Adjusted’ view and results in efficient investment strategies
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