



2019 **ANNUAL
MEETING**
& EXHIBIT

October 27-30
Toronto, Canada

Session 187: A Comparison of Solvency Regimes in Bermuda, U.S., Canada and European Union for Long Duration Insurance Contracts

[SOA Antitrust Compliance Guidelines](#)

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2019 SOA Annual Meeting

Session 187: A comparison of Solvency Regimes in Bermuda, U.S., Canada and European Union for Long Duration Insurance Contracts

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SOCIETY OF ACTUARIES

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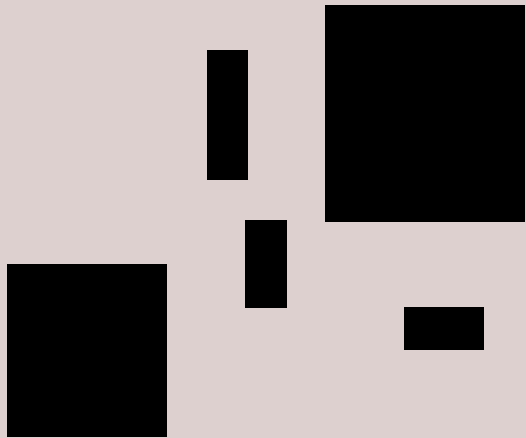
Moderator and Presenters

Moderator / Presenters	Background
 <p>Lisa Giancola FSA, FCIA</p> <p>Director Willis Towers Watson Toronto, ON 416.960.2639 Lisa.Giancola@willistowerswatson.com</p>	<ul style="list-style-type: none">■ Lisa is a director with the Willis Towers Watson’s Insurance Consulting & Technology practice.■ More than twenty-five years of experience at multinational insurance and reinsurance companies.■ Provides consulting services to life and health insurers in a number of areas, including appointed actuary work, actuarial valuations, financial reporting and regulation, financial projections and stress testing, capital and risk management, reinsurance, and peer reviews.■ Advises across various jurisdictions, on multiple valuation and solvency regimes.
 <p>Faisal Haddad FSA</p> <p>Associate Director Willis Towers Watson Bermuda 441.504.0229 Faisal.haddad@willistowerswatson.co</p>	<ul style="list-style-type: none">■ Faisal joined Willis Towers Watson in 2019 and has over 11 years of life actuarial experience.■ He was previously at Allianz SE Re and Mercer (Canada) Limited and has a strong reinsurance, life product design and various Solvency regimes background.■ Provides consulting services to life and annuity re/insurers in a number of areas, including structuring complex reinsurance offerings across different solvency jurisdictions, capital Modelling and pricing of life reinsurance solutions.
 <p>Nick Komissarov FSA, FCIA, MAAA</p> <p>Director Willis Towers Watson Chicago, IL 508.340.9381 Nick.Komissarov@willistowerswatson.com</p>	<ul style="list-style-type: none">■ Nick is a director with the Willis Towers Watson’s Insurance Consulting & Technology practice.■ More than ten years of experience in the insurance industry■ Nick’s main areas of expertise are mergers & acquisitions, Bermuda regulatory environment, financing modeling, and life insurance pricing.

Agenda

- Setting the Scene
- A deeper dive into each solvency regime
- Putting it all together
- Key takeaways

Setting the scene

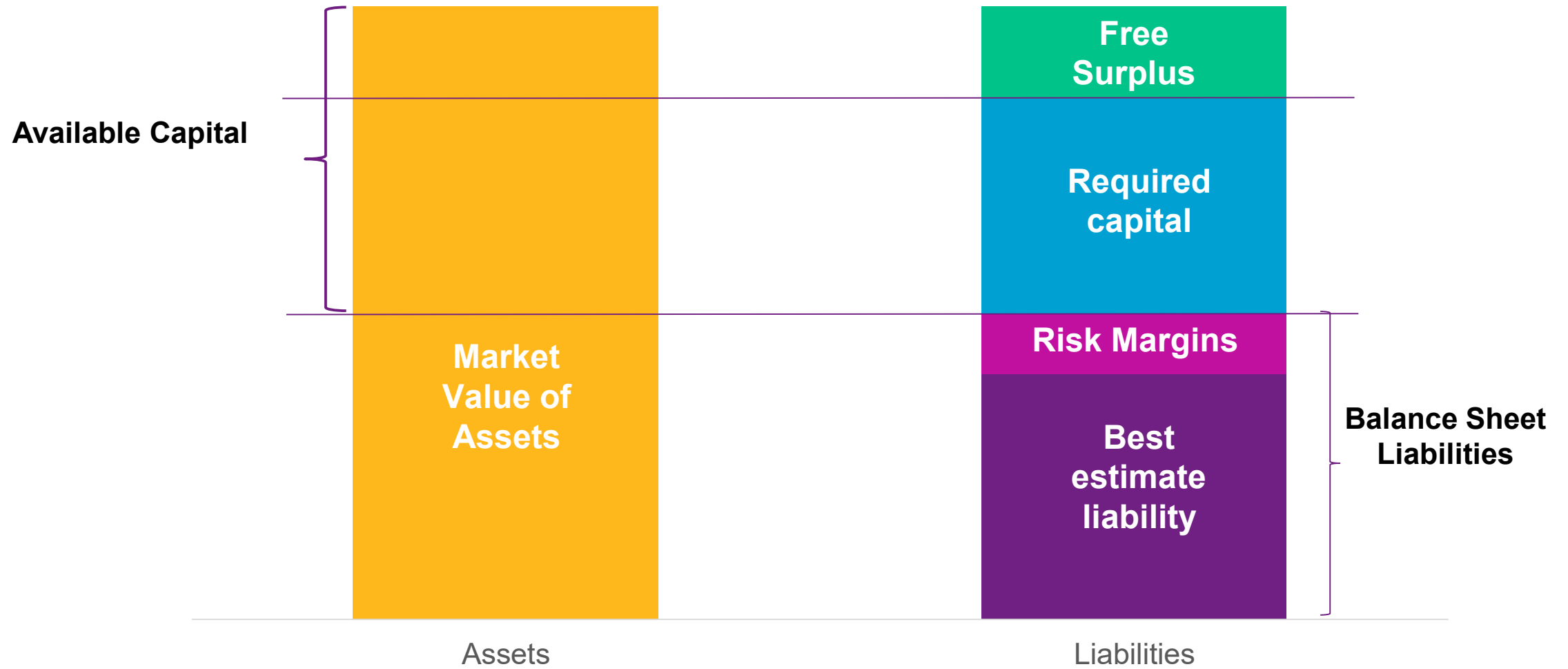


Introduction

Understanding the Insurance Balance Sheet Framework

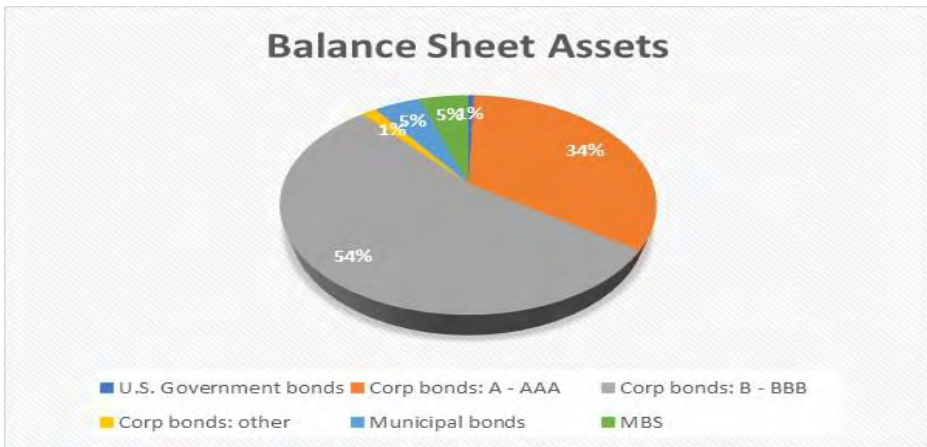
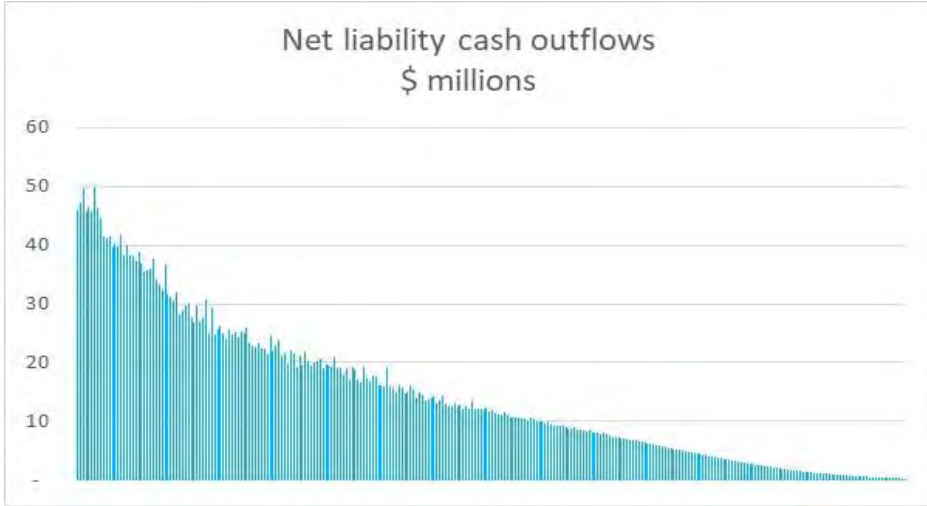
- Across four different regimes (Canada, Bermuda, European Union and U.S.)
 - Valuation bases and methods
 - Capital requirement by risk
 - Total balance sheet requirement
- Why?
 - Manage insurance risks and the volatility of financial markets
 - Stabilize solvency
 - Make more efficient use of capital

The Insurance Balance Sheet framework



Case Study

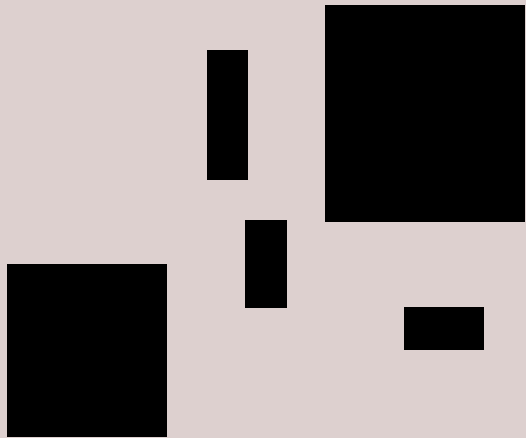
Modeled Business



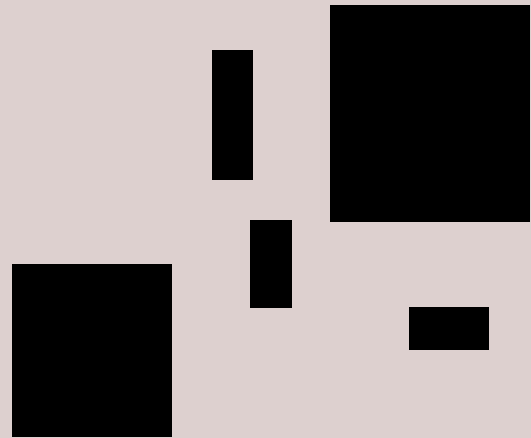
Modeled Business

- Block of in-force, single premium payout annuities
- Supported by fixed income assets
- Well matched
 - Liability duration ~ 10.5 years
 - Asset duration ~ 10.2 years
- No reinsurance ceded
- Main risk factors
 - Longevity
 - Market risk
 - Asset credit risk

A deeper dive into each solvency regime



Canada



Canadian Regime

- Canada is an IFRS reporter
 - IFRS 4 for insurance contracts, i.e., Canadian Asset Liability Method (“CALM”) for valuing insurance contract liabilities
 - Covers most Canadian insurance and reinsurance companies liabilities

=> IFRS 17 will replace IFRS 4 (CALM)
- Currently statutory financial statement = GAAP (IFRS) financial statements
- Regulatory Capital measured under Life Insurance Capital Adequacy Test (“LICAT”)
 - Risk-based measure of life insurer’s specific risks
 - Generally (unless indicated otherwise) based on amounts reported in, or used to calculate the amounts reported in, or information contained in an insurer’s Canadian financial statements
 - Capital requirements are set at supervisory level targeting CTE99% over a one-year time horizon including a terminal provision
 - Capital ratio measured relative to “Base Solvency Buffer” aka Required Capital
 - OSFI supervisory target total ratio of 100%, minimum total ratio of 90%, and other core ratio requirements

=> OSFI is reviewing LICAT for IFRS 17

Balance Sheet Liabilities

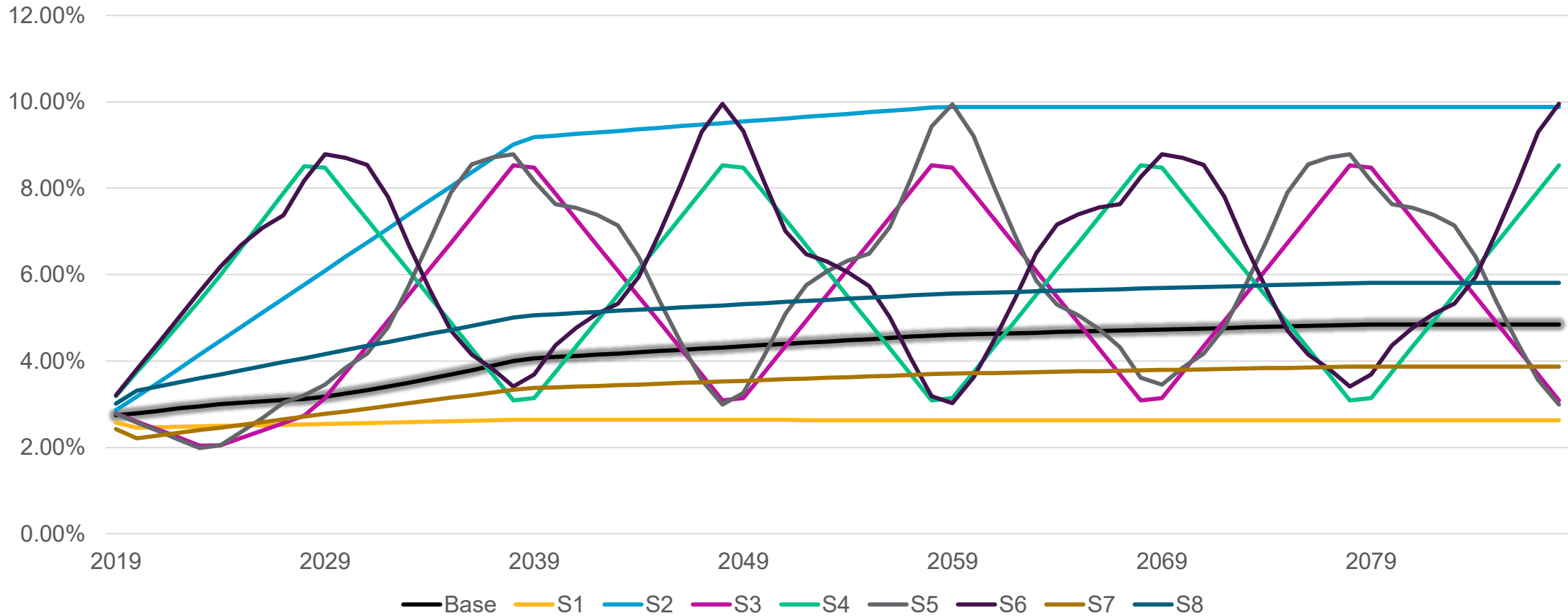
Canadian Asset Liability Method (“CALM”)

- Equal to the amount of supporting assets, at the valuation date, that are forecast to reduce the liability to zero coincident with the last liability cash flow in that scenario, for a particular scenario
 - Project best estimate liability cash flows
 - Take into account permanent and temporary tax differences
 - Include margins for adverse deviations (“MfADs”) for each best estimate assumptions
 - Recommended range of +/-5% to +/-20% mostly, for non-economic assumptions
 - Must increase the liability
 - Interest rate scenarios
 - Base scenario
 - 8 prescribed scenarios
 - Additional scenarios where appropriate to the circumstances of the insurer
 - Reinvestment / disinvestment strategy
 - Asset interest rate = risk-free + spreads – depreciation, and margins (expect in Base scenario)
 - Inflation
 - Ultimate risk-free reinvestment rate promulgated by the Actuarial Standards Board (“ASB”)
 - Stochastic scenarios, where applicable
- CALM liability is that resulting from scenario with largest asset value

CALM Scenarios

As of December 31, 2018

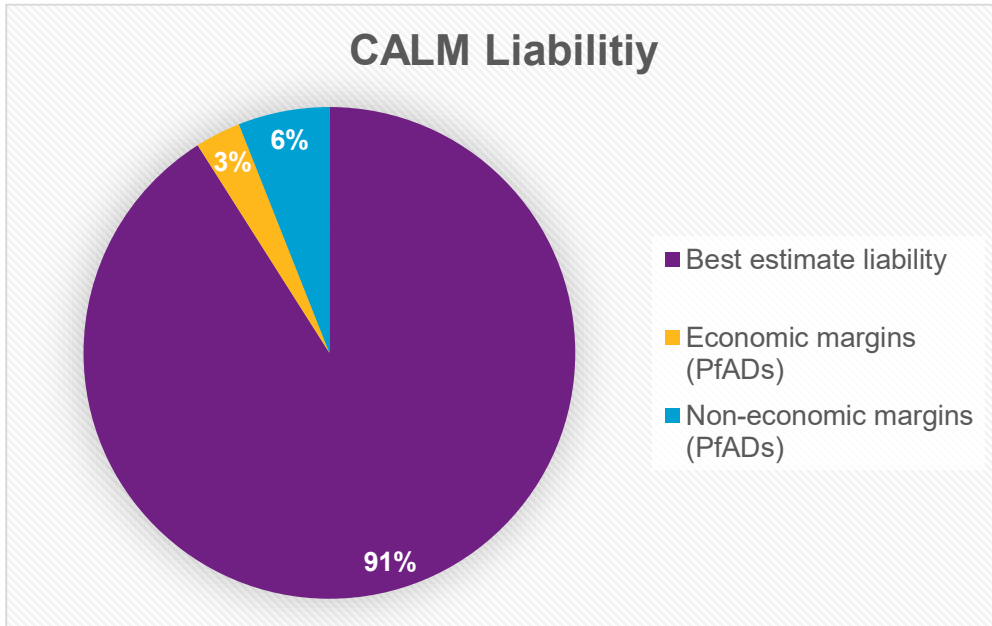
US 10-Year Bond Forward Rates



Annuitant Mortality

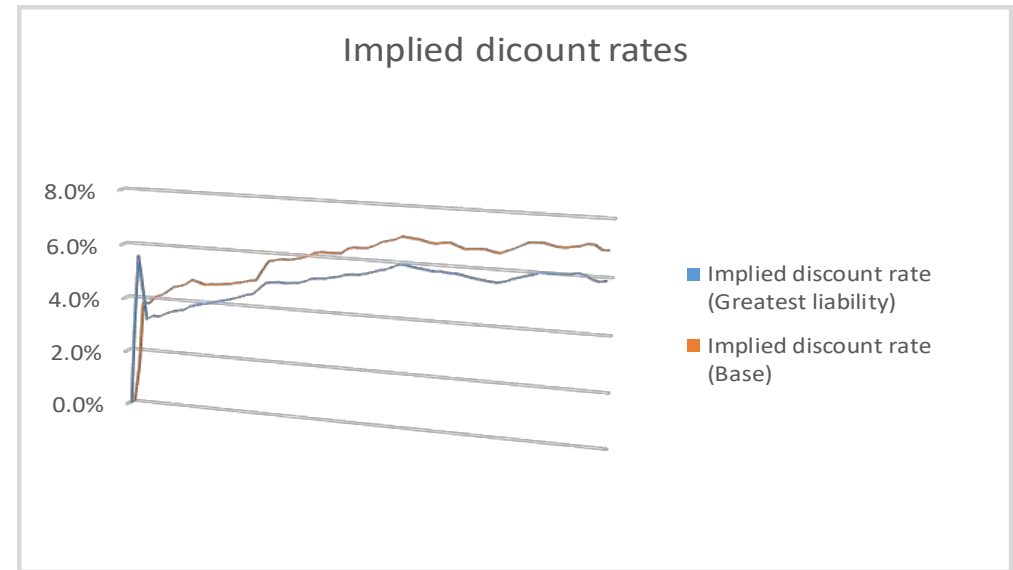
- Best estimate assumption depends on
 - The annuitant's age, sex, smoking habit, health, and lifestyle
 - Size of premium
 - Plan of annuity and benefits provided, and whether registered or not, whether structured settlement, and whether group or individual contract
 - Include the effect of any anti-selection resulting from the annuitant's option to select the timing, form, or amount of annuity payment, or to commute annuity payments
 - Additional significant consideration for the determination of the level of margin for adverse deviations would be the possibility of commuting survival dependent benefits after periodic payments have started
- Low and high MfADs
 - For the mortality rates would be a subtraction of 2% and 8% of the best estimate, respectively
- Mortality improvement assumption and associated margin
 - Would include mortality improvement, which is to increase the insurance contract liabilities, such that the resulting increase would be at least as great as that developed using prescribed mortality improvement rates as promulgated from time to time by the ASB.
 - Not restricted to +5% to +20% range

CALM Liability



Non-economic PfADs mostly mortality (longevity), mortality improvement, some expense

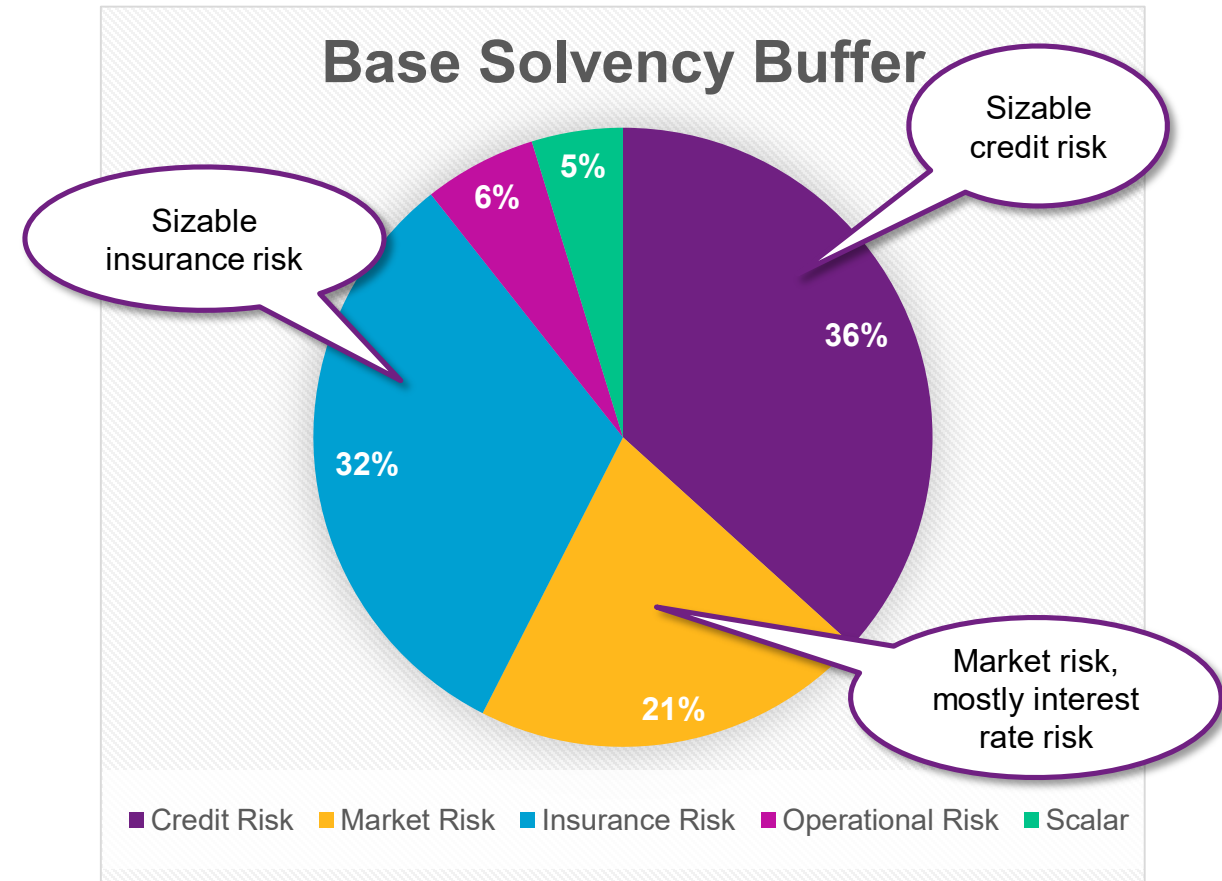
Implied discount rate that present values the liability cash flows to the asset values



Required Capital

Life Insurance Capital Adequacy Test (“LICAT”)

- “Base Solvency Buffer” (required capital) is equal to aggregate capital requirements net of credits, multiplied by a scalar of 1.05
- Aggregate capital requirements comprise five risk components
 - Credit
 - Market
 - Insurance
 - Segregated funds guarantee
 - Operational
 - Risk of loss from inadequate or failed internal processes, people, and systems or from external events
- Credits for participating and adjustable products, risk mitigation and risk transfer, and risk diversification
- Within and between risk diversification credits
- A scalar is applied on the calculated capital requirement (currently at 105%)

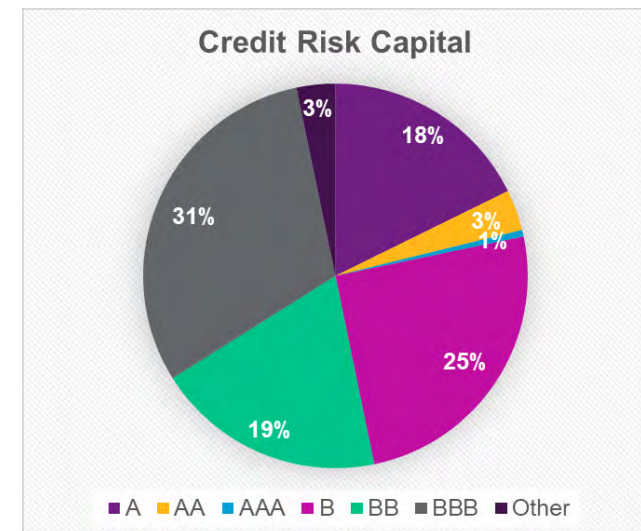
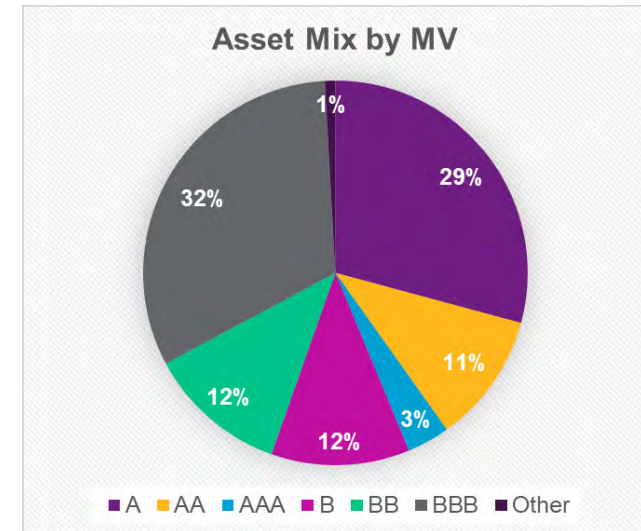


LICAT Credit Risk

Risk of loss from potential default of parties having a financial obligation to the insurer

- Risk of actual defaults and deterioration in credit worthiness
 - Includes reinsurance counter-party risk
- Generally, factors applied to on balance sheet asset values
 - Factors differ by features of underlying assets
- Factors for Bonds differ between credit ratings and effective maturities.

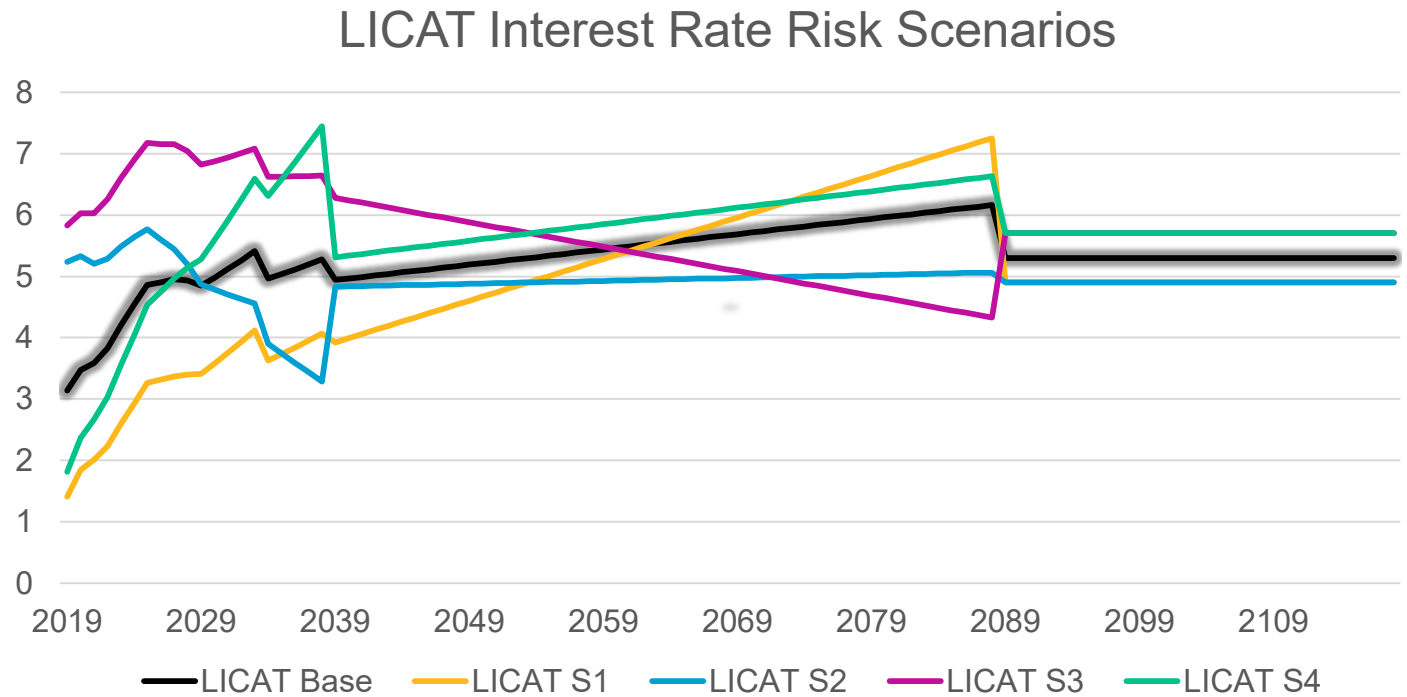
Rating	Effective Maturity in Years					
	1	2	3	4	5	10
AAA	0.25%	0.25%	0.50%	0.50%	1.00%	1.25%
AA	0.25%	0.50%	0.75%	1.00%	1.25%	1.75%
A	0.75%	1.00%	1.50%	1.75%	2.00%	3.00%
BBB	1.50%	2.75%	3.25%	3.75%	4.00%	4.75%
BB	3.75%	6.00%	7.25%	7.75%	8.00%	8.00%
B	7.50%	10.00%	10.50%	10.50%	10.50%	10.50%
Lower than B	15.50%	18.00%	18.00%	18.00%	18.00%	18.00%



LICAT Market Risk

Risk from changes in rates or prices in interest rates, equity, real estate, and currency

- Mostly interest rate risk from bonds backing the liabilities
- Five Prescribed Interest Rate Scenarios
 - 1 “baseline” scenario
 - 4 “stress” scenarios
- Net positions, $PV(\text{Asset CFs})$ less $PV(\text{Liability CFs})$, are calculated for all 5 scenarios
- Compare the net positions for all 4 stress scenarios to the baseline scenario
- Required capital is the difference between the most adverse and baseline net positions



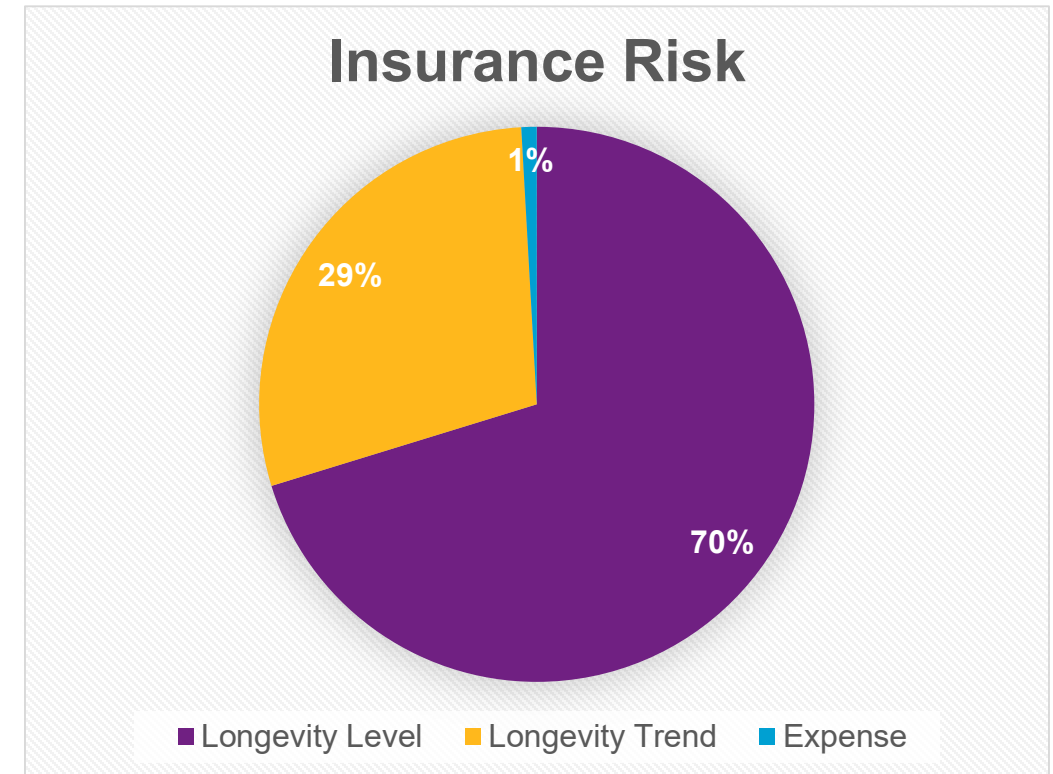
LICAT Insurance Risk

Risk of loss from exposure to mortality, longevity, morbidity, lapse and policyholder behaviour, and expense risks

- Mostly longevity risk on annuities
- Risk capital is the difference between shocked PV(Liability CFs) and PV (BE CFs)
- PV(Liability CFs) are discounted at 5.3%

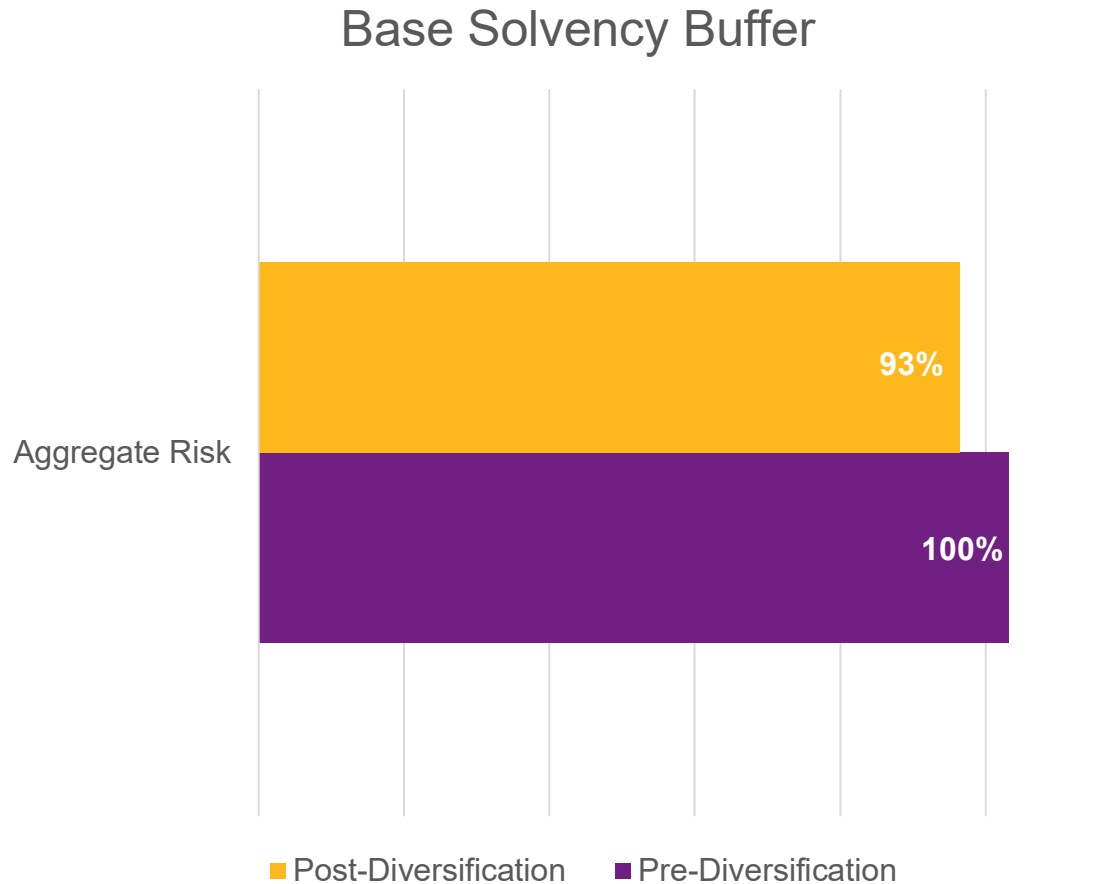
- Level risk is misestimation of best estimate assumptions
 - Shock level varies by type (registered vs non-registered) and geographies; range from -10% to -20%

- Trend risk is misestimation of future trend in best estimate assumptions
 - Shock is a 75% increase in the BE mortality improvement assumption; applied per year of improvement forever



LICAT Diversification Credit

Within-risk and between-risk diversification

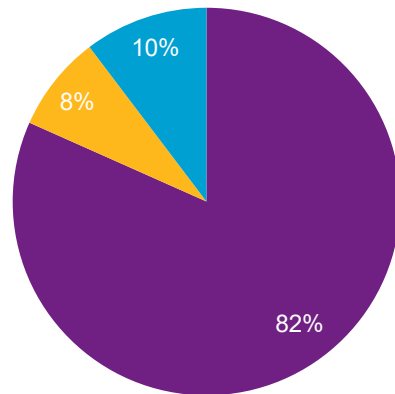


- Allows for within-risk diversification credits of insurance risks, for example, mortality level and trend for life supported and death supported business, and mortality and morbidity risks portfolio volume credit
- Between-risk diversification credits of insurance risks through correlation matrix
- Formulaic between-risk diversification with post-diversified insurance risk and credit and market risks taken into account
- Final diversification credit is applied towards the aggregate undiversified risk capital and not explicitly determined for each risk category

Total Balance Sheet Requirement

CALM Liability + LICAT Solvency Buffer

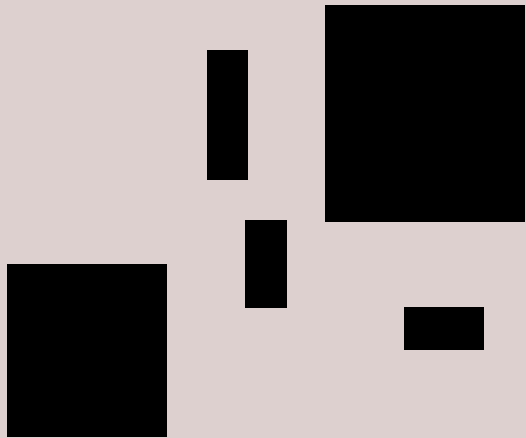
Total Balance Sheet Requirement



■ Best estimate liability ■ Margins ■ Base solvency buffer

- Best estimate liability depends on the backing assets, the economic environment at valuation date, and reinvestment strategy
- Asset liability mismatch measured through interest rate shocks, for both balance sheet liability and required capital
- Liability cash flows reflect future mortality improvement
- Longevity required capital, captures both level and trend risks
 - Other insurance risks (mortality, morbidity, lapse, policyholder behavior) generally capture level, trend, catastrophe and volatility risks

Bermuda



The Economic Balance Sheet framework

Economic Balance Sheet (“EBS”)

- Purpose
 - Basis to determine the capital requirement
- Overarching principles
 - Substance over form
 - Proportionality
- EBS fair valuation hierarchy
 - Market price (with adjustments as needed)
 - Mark-to-model techniques
 - Maximize relevant observable inputs
 - No adjustment for own credit standing for liabilities
- Assets and Liabilities are assessed at fair value
- Insurance liabilities is composed of Best Estimate Liability (“BEL”) and Risk Margin (“RM”)
- The BEL represents the value of the best estimate cash flows discounted using the backing assets, minus the default cost
- The RM is a provision that represents that uncertainty inherent to the underlying cash flows

Best Estimate Liability

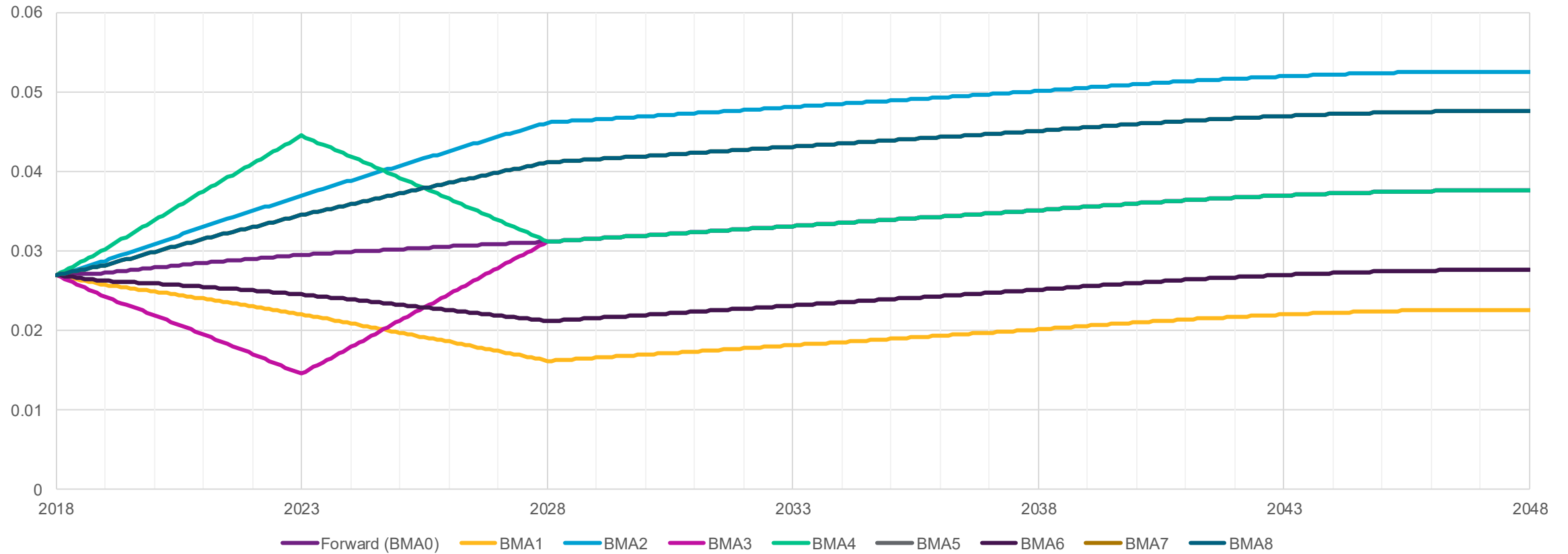
Scenario-Based approach

- The long term nature of the business represented in this case study
- Real world asset and liability cash flows are projected under eight real world scenarios defined by BMA
- The best estimate liability is set equal to the highest asset requirement (or liability cash flows discounted at asset rate) across all scenarios
- Project best estimate liability cash flows
 - The purpose is to capture both the sensitivity to interest rates and the degree to which the assets and liabilities are cash-flow matched
 - Eight real world stress scenarios are provided by the BMA that cover a range of yield curve movements and were calibrated at approximately 1σ from the base scenario
 - Use the asset portfolio and reinvestment guidelines backing the block of business
 - The best estimate liability is set equal to the highest asset requirement (or liability cash flows discounted at asset rate) across all scenarios
- Important considerations
 - Base scenario
 - Reinvestment / disinvestment strategy
 - Asset Liability Matching
 - Underlying asset classes

BMA Scenarios

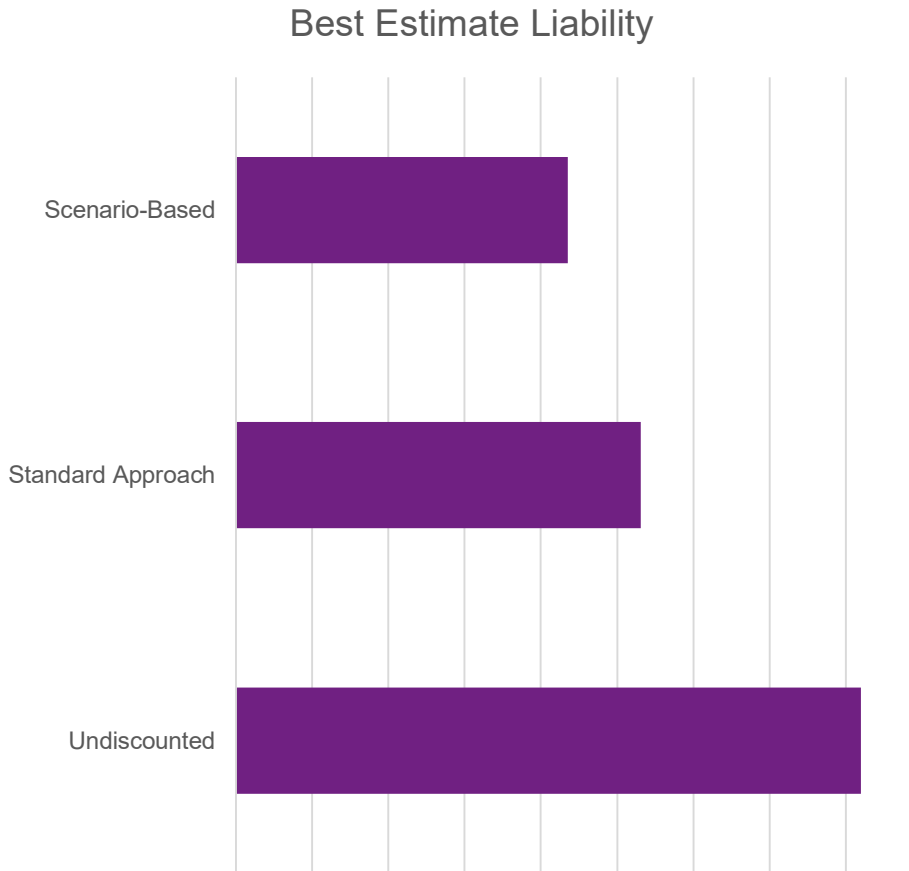
As of December 31, 2018

30 Years Projection of 10-Year Rates



Best Estimate Liability

Scenario-Based approach



- The long term nature of the business represented in this case study
- Discounting using “risk-free” rates may not be the most economical way
- Using prescribed adjustments have a benefit....
- ...but applying your own assets could yield a greater benefit
- Important considerations
 - Type of business
 - Reinvestment / disinvestment strategy
 - Asset Liability Matching
 - Underlying asset classes

Risk Margin

Cost of Capital approach

- Conceptually, this represents the uncertainty the insurer bears with this specific liability

$$RM = CoC \times \sum \frac{ECR_t}{(1 + r_{t+1})^{t+1}}$$

- Reflects the cost of holding its required capital over the lifetime of the obligation, discounted back using risk-free rates and applying a cost of capital of 6% (as currently stated by the BMA)
- The Economic Capital Requirement (“ECR”) is a function of the Minimum Solvency Margin (“MSM”) and the Bermuda Solvency Capital Requirement

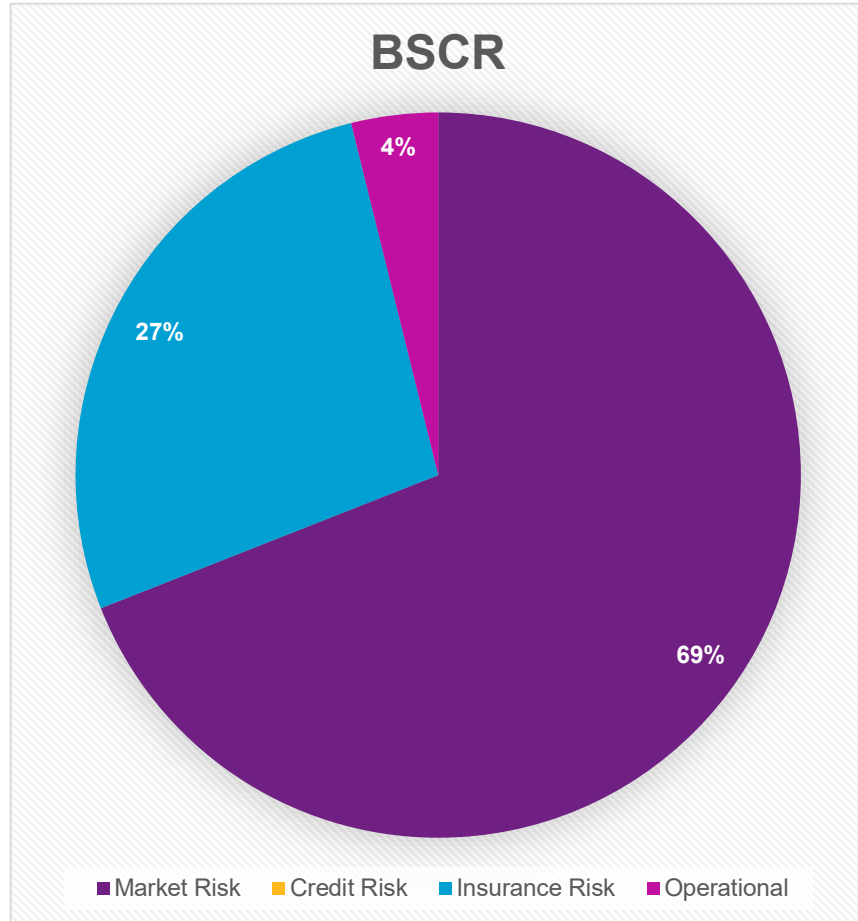
Capital Requirement

Bermuda Solvency Capital Requirements (“BSCR”)

- Risk factors are applied to the Economic Balance Sheet
- Layered covariance matrixes
 - Individual risks are aggregated into Market, Long-Term, and Credit modules
 - Modules are aggregated into Basic BSCR
 - Operational, loss absorbency and regulatory capital add-ons
 - Risk aggregation matrices
- Represents a 99% T-VaR

Capital Requirement

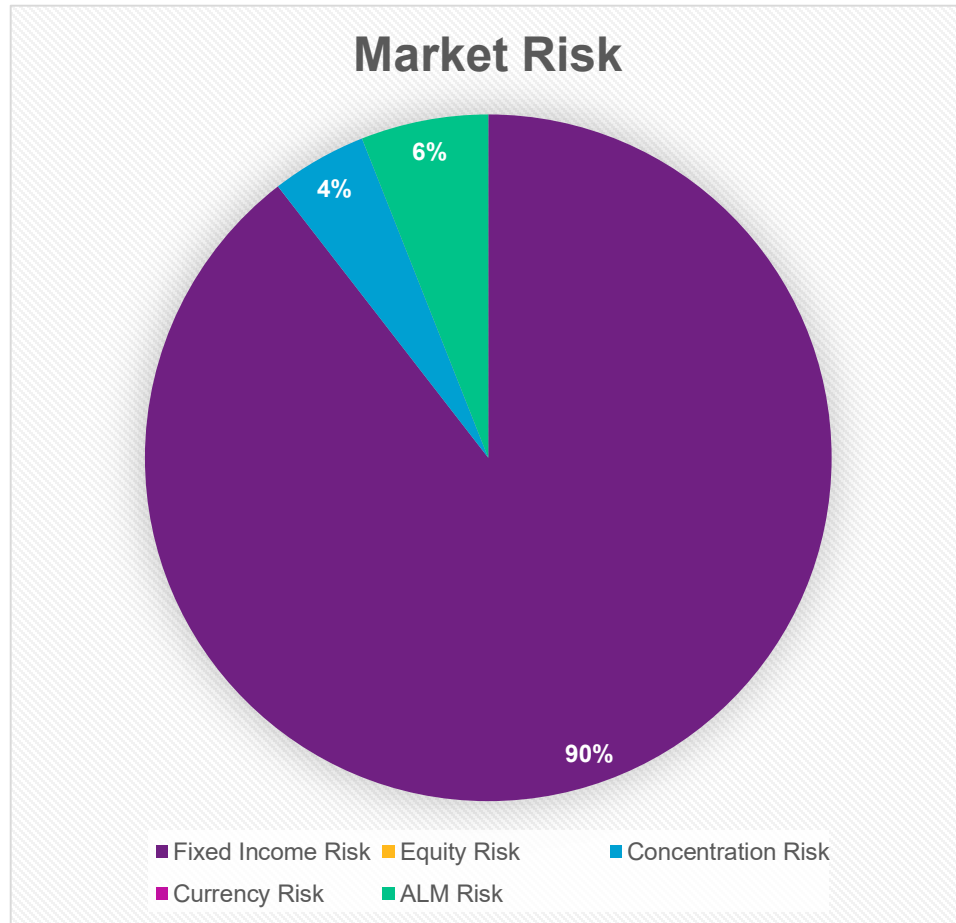
Bermuda Solvency Capital Requirements (“BSCR”)



- Payout annuity business is dominated by the underlying asset risks and the longevity risk
- Market risk is the main driver and that shows the importance of ALM and investment departments in long-term business insurance companies
- Credit risk represents counterparty risk

Capital Requirement

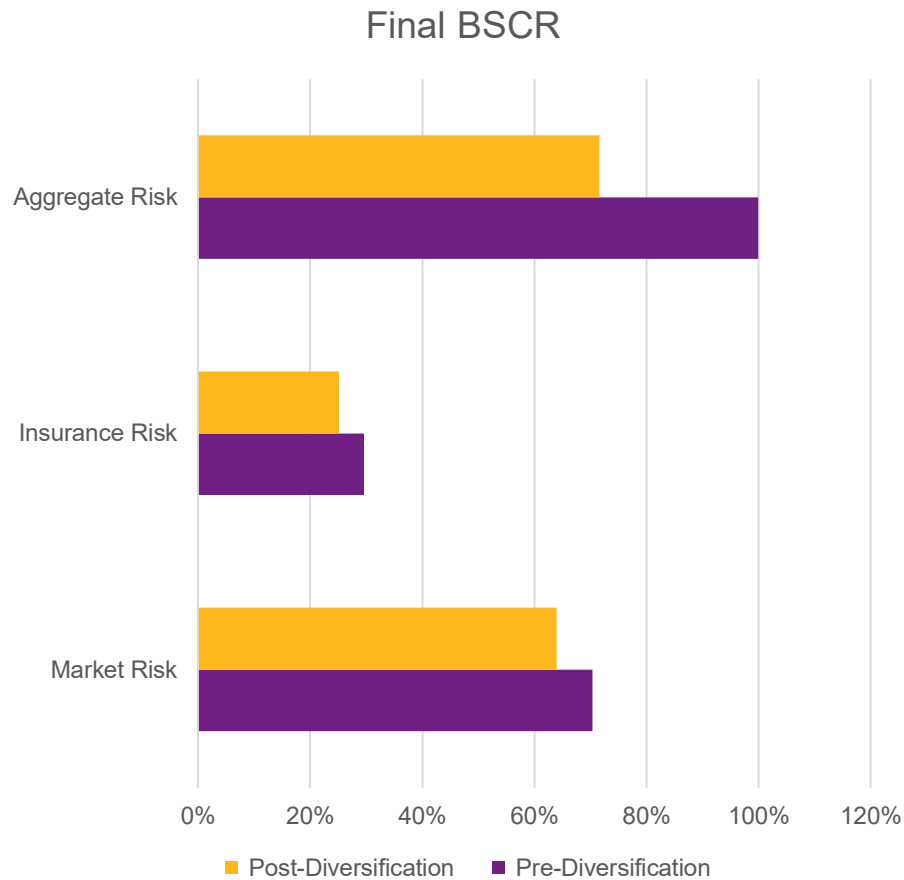
Market Risk



- Fixed Income Risk
 - Based on profile of the different fixed income investments (varying by asset type and credit rating)
- ALM Risk
 - Applying an upwards shock in interest rates to the portion of the insurer's assets related to the duration difference Market risk is the main driver and that shows the importance of ALM and investment departments in long-term business insurance companies
- Concentration Risk
 - Look through concept
 - Represents the risk of losses due to asset concentration

Capital Requirement

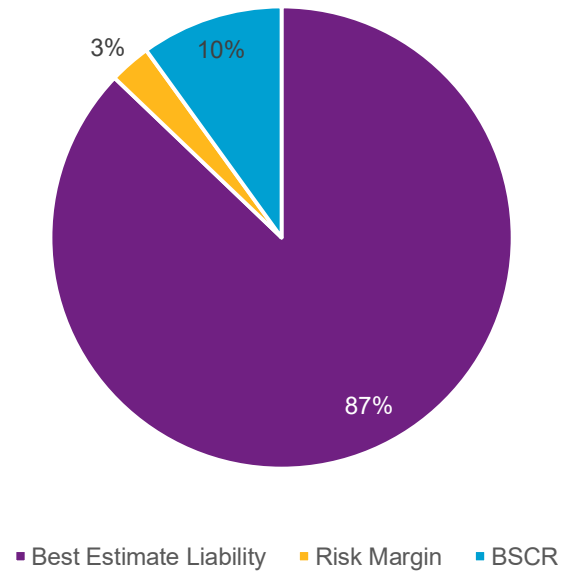
Final Requirements



- Diversification plays a role
- Absolute capital amount is reduced, but proportionality remained similar
- Understanding the diversification benefits both at the risk module level and aggregate levels

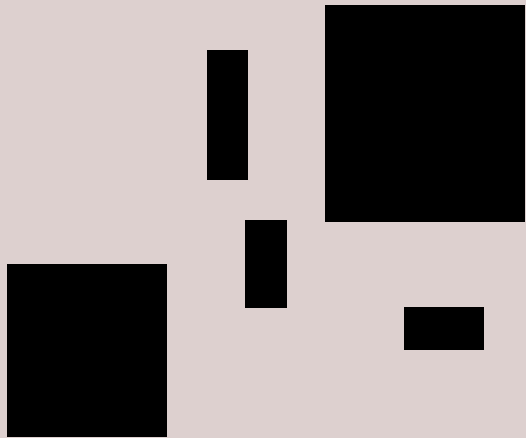
Total Balance Sheet Requirement

Total Balance Sheet Requirement



- Investment strategy is key
- Understanding the interaction between your assets, liabilities and required capital

European Union



The Market Value Balance Sheet framework

Market Value Balance Sheet (“MVBS”)

- What is Solvency II
 - Basis to determine the capital requirement
 - Risk-based system defining the capital requirements with a standard formula
 - Diversification and risk-mitigation effects
 - Integrated approach for insurance provisions and capital requirements and tends to be a comprehensive framework for risk management
- Assets are assessed at market value
- Insurance liabilities is composed of Best Estimate Liability (“BEL”) and Risk Margin (“RM”)
- The BEL represents the present value of expected future cashflows, discounted using a “risk-free” yield curve
- Adjustments are allowed to the “risk-free” curve for certain portfolios
- The RM is the amount that would have to be paid to another insurance company in order for them to take on the best estimate liability

Best Estimate Liability

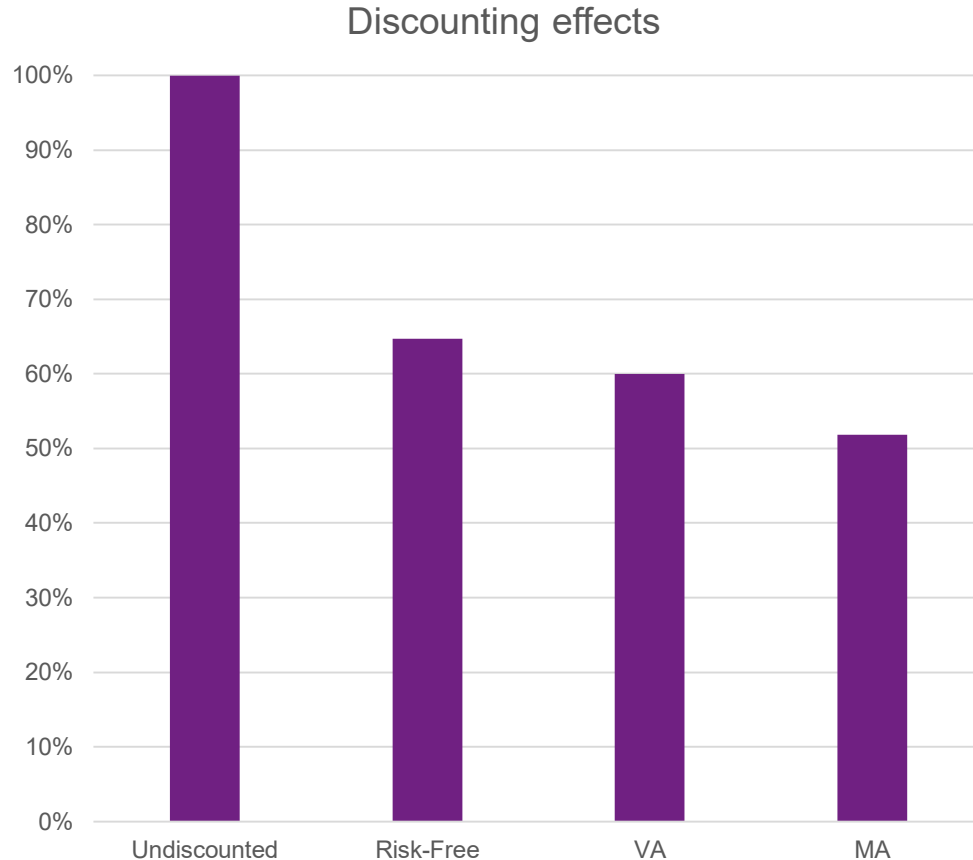
Discounting

- Risk-free discount rates
 - Swap rates where there is a sufficiently deep and liquid swap market, or government bond rates otherwise
 - Adjusted by EIOPA to reflect the risk of default of the counterparty (i.e., credit risk adjustment)

- Volatility Adjustment (“VA”)
 - Based on the spreads of a representative portfolio of assets
 - The VA is added to the liquid part of the risk-free curve, until the Last Liquid Point

- Matching Adjustment (“MA”)
 - Parallel shift applied to the entire basic risk-free term structure
 - The shift is based on the underlying assets’ spread net of the fundamental spread
 - The assets need to be segregated and managed separately
 - Regulatory approval is required
 - ‘Ring-fenced’ assets

Best Estimate Liability Results



- The long term nature of the business represented in this case study
- Discounting using “risk-free” rates may not be the most economical way
- Using prescribed adjustments have a benefit....
- ...but applying your own assets could yield a greater benefit
- Important considerations
 - Flexibility of your general account
 - Eligibility to apply MA
 - Type of business
 - Reinvestment / disinvestment strategy
 - Asset Liability Matching
 - Underlying asset classes

Risk Margin

Cost of Capital approach

- The risk margin is determined using the “cost of capital” method, i.e. based on the cost of holding capital to support those risks that cannot be hedged. These include all insurance risk, reinsurance credit risk, operational risk and “residual market risk”.

$$RM = CoC \times \sum_{t=0}^n \frac{SCR_t}{(1 + r_f)^{t+1}}$$

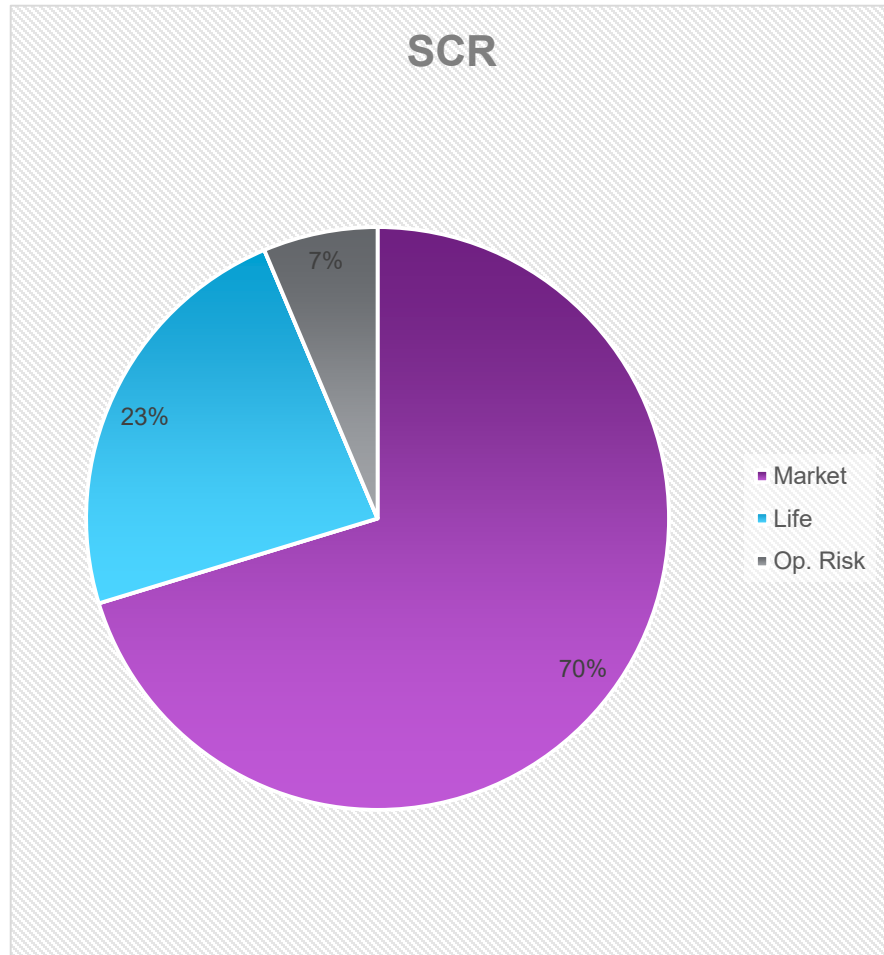
Capital Requirement

Solvency Capital Requirements (“SCR”)

- Value at Risk measure based on a 99.5% confidence interval of the variation over one year of the amount of “basic own funds”
- The SCR for each individual risk is then determined as the difference between the net asset value (for practical purposes this can be taken as assets less best estimate liabilities) in the unstressed balance sheet and the net asset value in the stressed balance sheet
- These individual risk capital amounts are then combined across the risks within the module, using a specified correlation matrix and matrix multiplication
- Operational risk is added on top

Capital Requirement

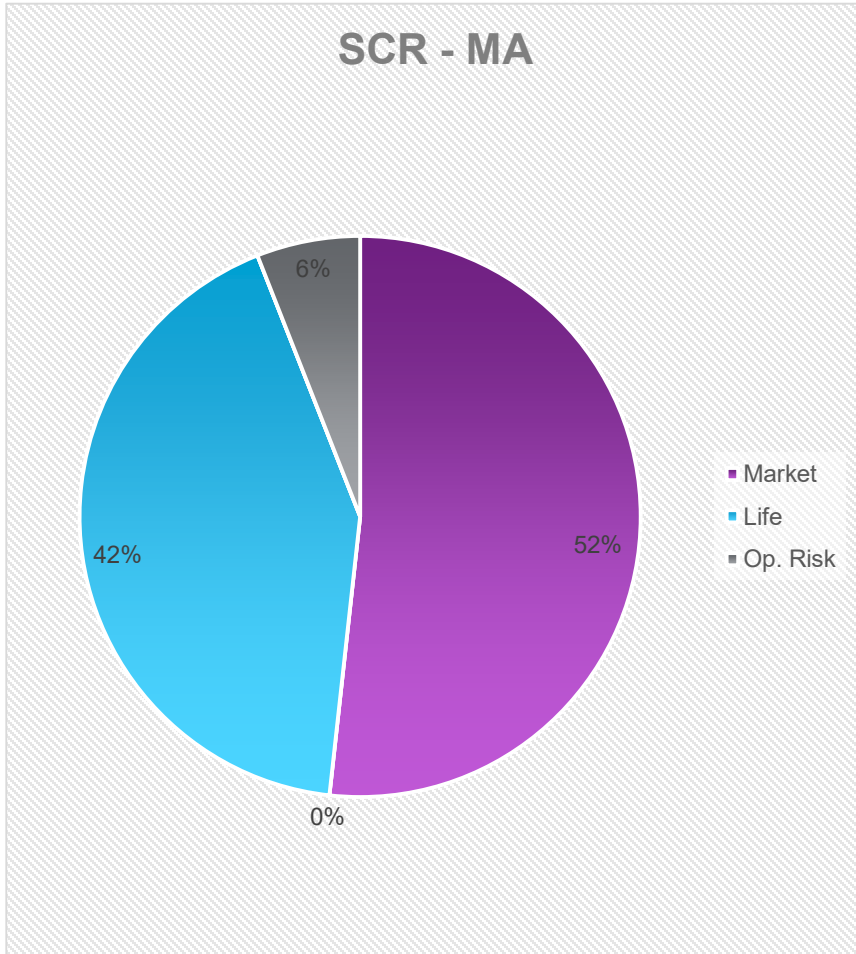
Solvency Capital Requirements (“SCR”)



- Payout annuity business is dominated by the underlying asset risks and the longevity risk
- Important part of the balance sheet – additional required capital
- Market risk is the main driver

Capital Requirement

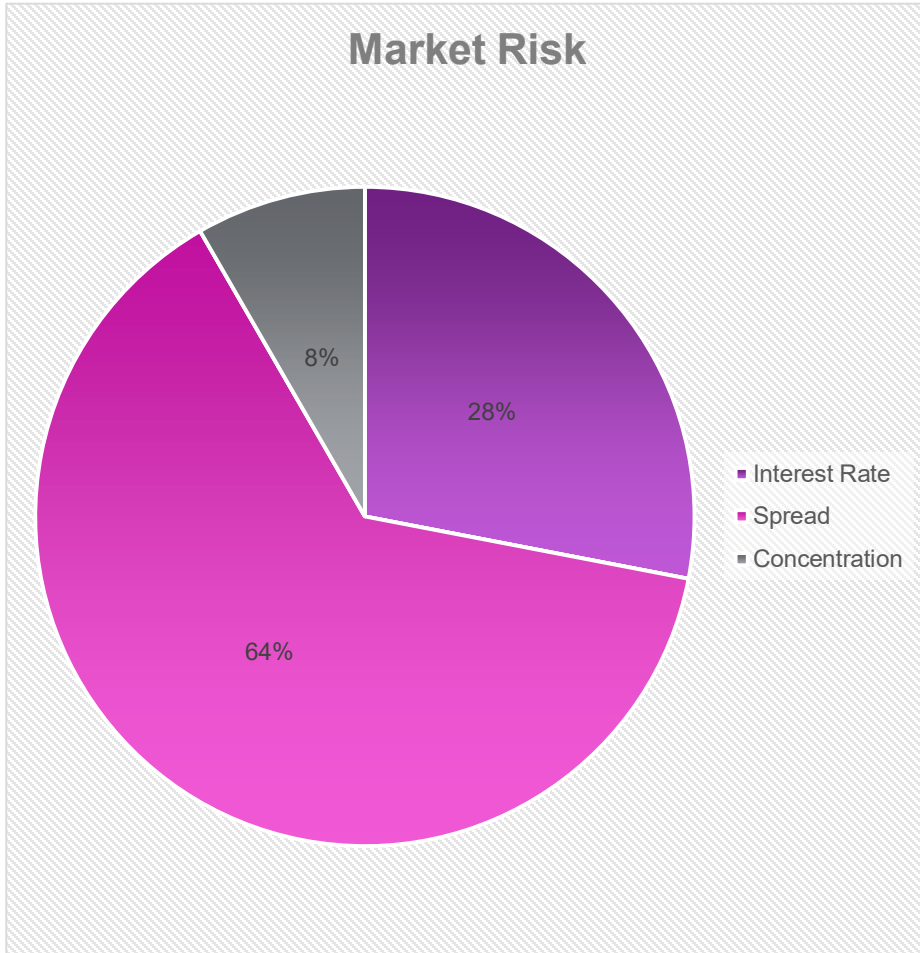
Solvency Capital Requirements (“SCR”) after applying MA



- The composition of the market risk capital has changed
- Allowing the underlying assets to play a bigger role
 - Not only reduces BEL
 - But also reduces market risk capital
 - Therefore, reducing overall capital requirements
 - Market and Life risks are dominating risk capital requirements

Capital Requirement

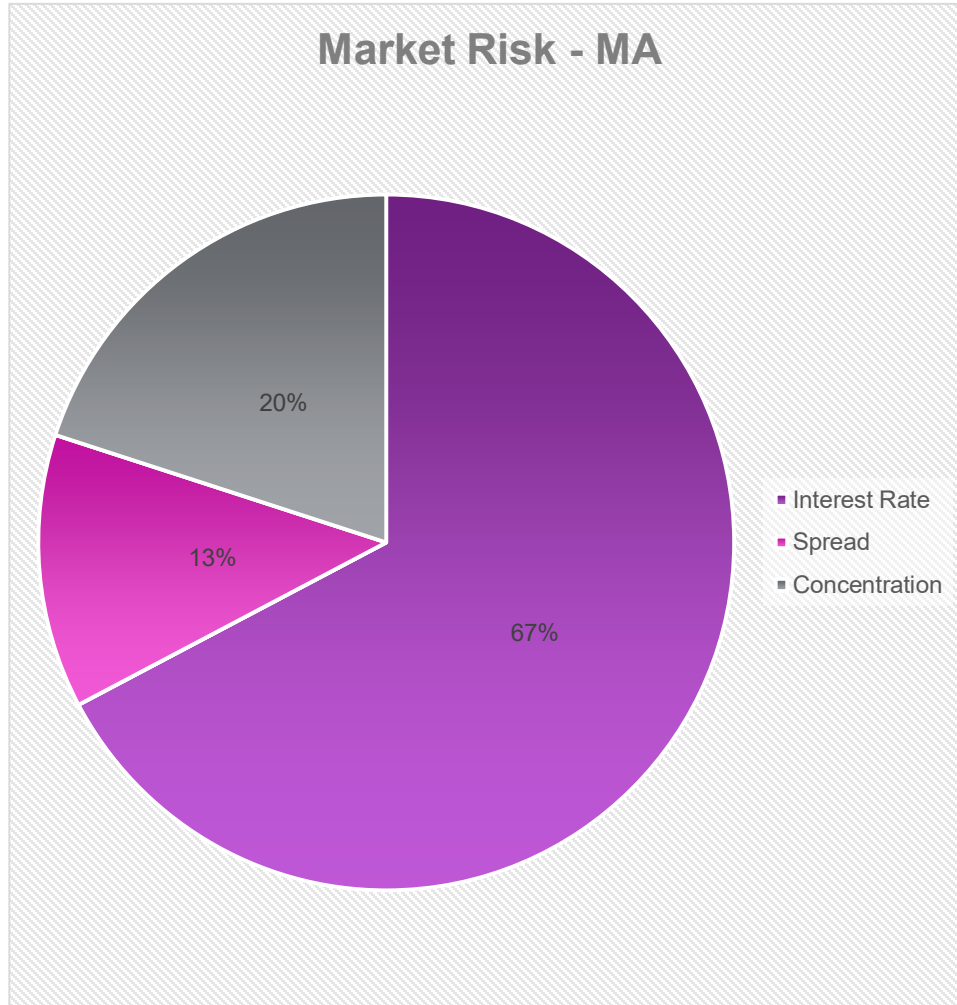
Market Risk (without MA)



- Interest Rate Risk
 - Relative changes in the interest rate curve affect both the liabilities and assets
 - ALM is tested
 - Asset sensitivity to the interest rate movement
- Concentration Risk
 - Look through concept
 - Represents the risk of losses due to asset concentration
- Credit Spread
 - The change in value of net assets due to a move in the yield on an asset relative to the risk-free term structure
 - The spread risk sub-module should address changes in both level and volatility of spreads

Capital Requirement

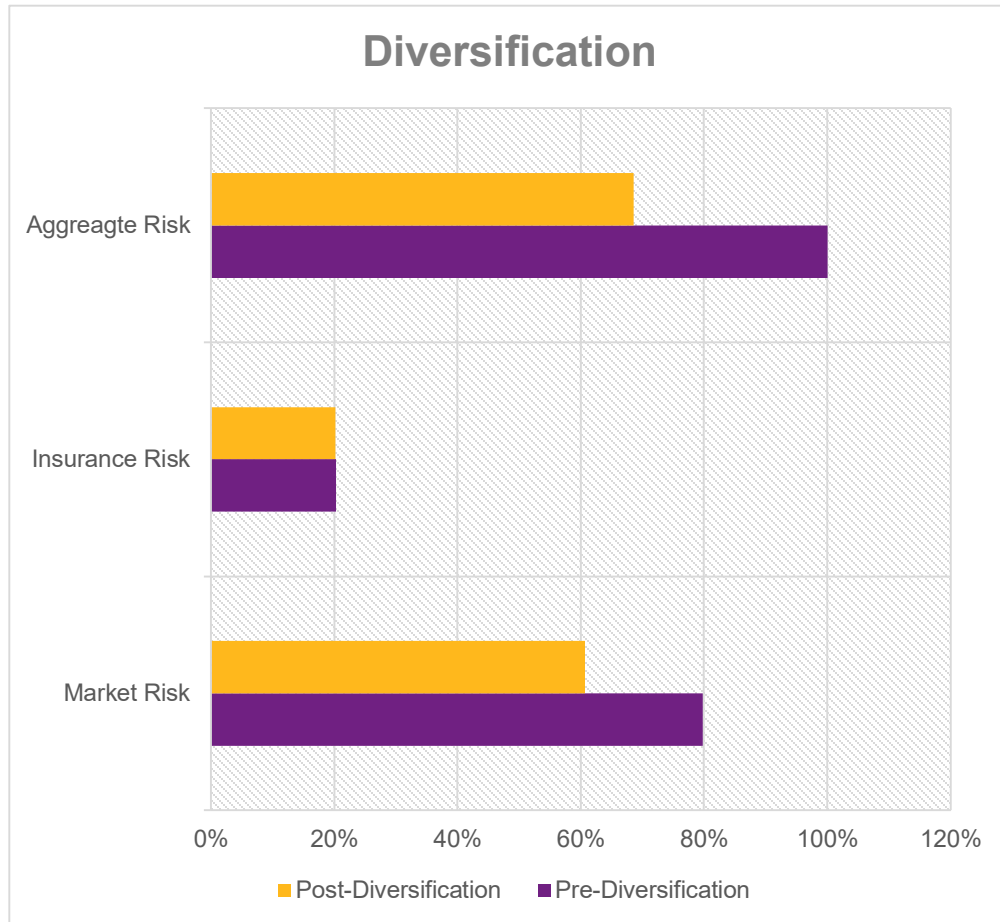
Market Risk – Matching Adjustment



- The overall market risk capital has decreased
- The market risk composition has slightly changed
- Interest rate remains to be the dominant risk
- Testing asset liability matching levels

Capital Requirement

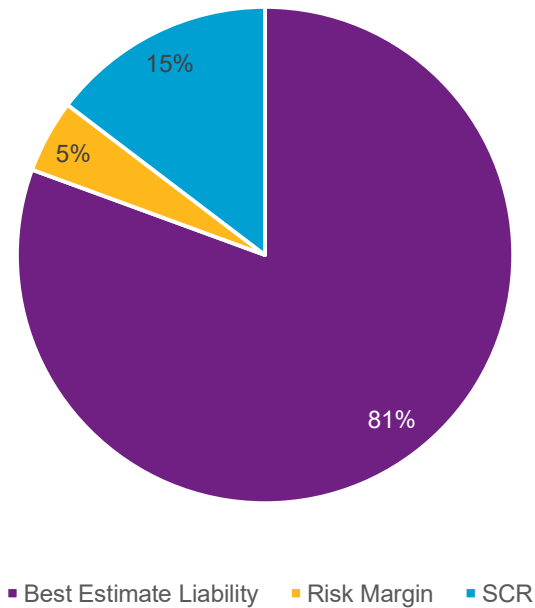
Final Requirements



- Diversification plays a role
- Absolute capital amount is reduced, but proportionality remained similar
- Understanding the diversification benefits both at the risk module level and aggregate levels

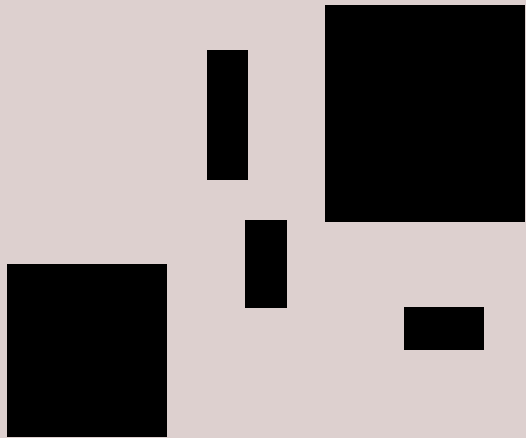
Total Balance Sheet Requirement

Total Balance Sheet Requirement (MA)



- Investment strategy is key
- Understanding the interaction between your assets, liabilities and required capital

U.S.



U.S. Regulatory Environment

U.S. Statutory Balance Sheet – General Account Products

- Book Value Basis
- Reserves
 - Formulaic Requirements
 - Conservative assumptions for some life products (ULSG, Term)
 - Implied PfAD
 - Closer to best estimates (Deferred Annuities)
 - But could be insufficient (Payout Annuities)
 - Discount rate at issue is higher compared to current environment
 - Scenario Requirements
 - Asset Adequacy Testing (Cashflow Testing)
 - Deterministic
 - Stochastic
- Capital
 - Formulaic Requirements
 - Factor based approach (C1, C2, C3, C4)
 - No longevity risk (yet)
 - Scenario Requirements
 - C-3 Phase 1
 - Target Levels
 - Authorized Control Level (“ACL”)
 - Company Action Level (“CAL”) = 2 x ACL

U.S. Statutory Reserve

Formulaic Reserve + Asset Adequacy (Cashflow Testing) Reserve

■ Formulaic Reserve

- Present Value of future cashflows using:
 - Prescribed mortality table
 - 1983 IAM
 - No future mortality improvement (aggressive)
 - Prevailing prescribed interest rate at the time of contract issue
 - 4.00% - 9.50%

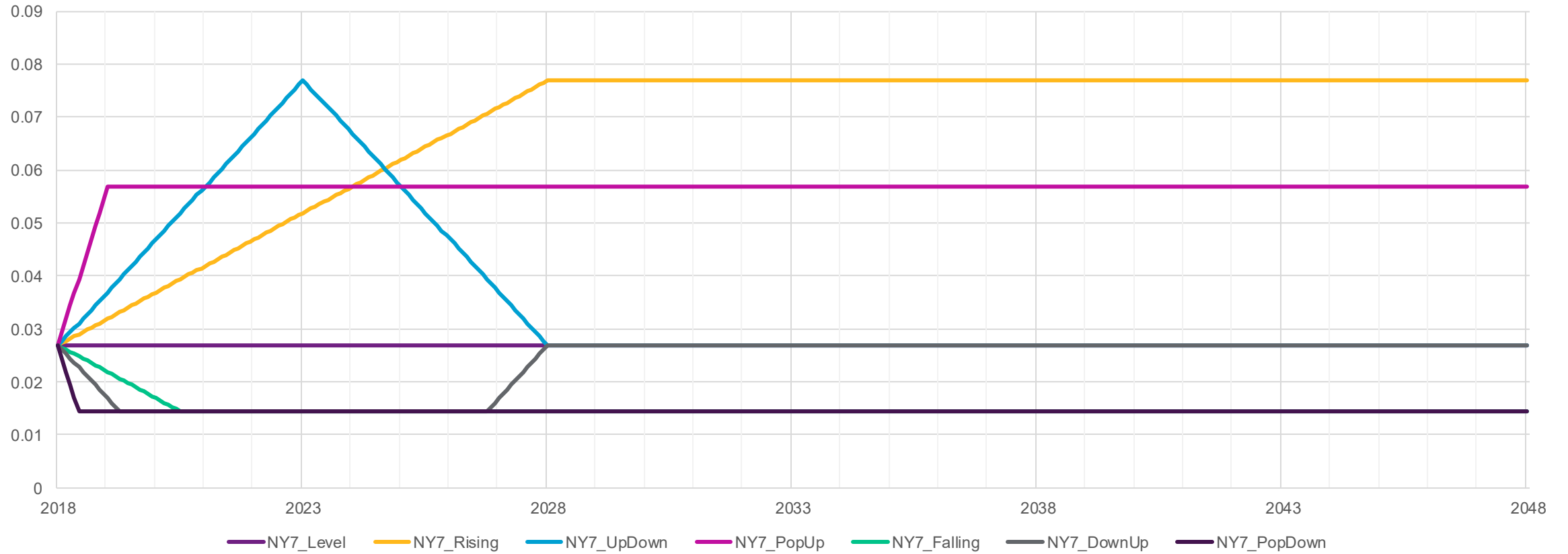
■ Asset Adequacy (Cashflow Testing) Reserve

- Start with Initial BV Assets = Formulaic Reserve
 - Starting Surplus = 0
- Calculate contributions to surplus (post-tax income) using best estimate assumptions with a mortality margin under:
 - Deterministic New York 7 scenarios
 - Set of Stochastic scenarios using American Academy generator or an internal generator
- Accumulate surplus through the end of the projection
- Discount at net investment earned rate back to time 0
- If negative, there is an insufficiency and additional reserves (and assets backing these reserves) are required

“New York 7” Scenarios

As of December 31, 2018

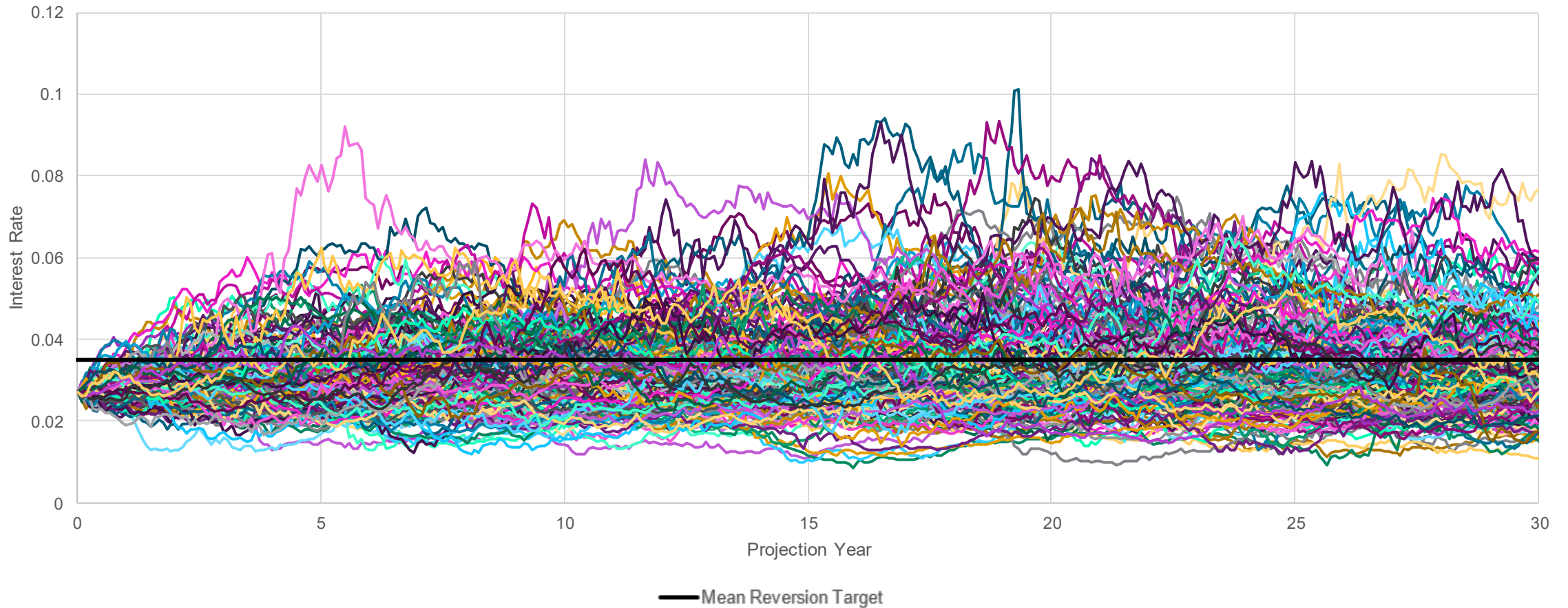
30 Years Projection of 10-Year Rates



Asset Adequacy Testing Stochastic Scenarios

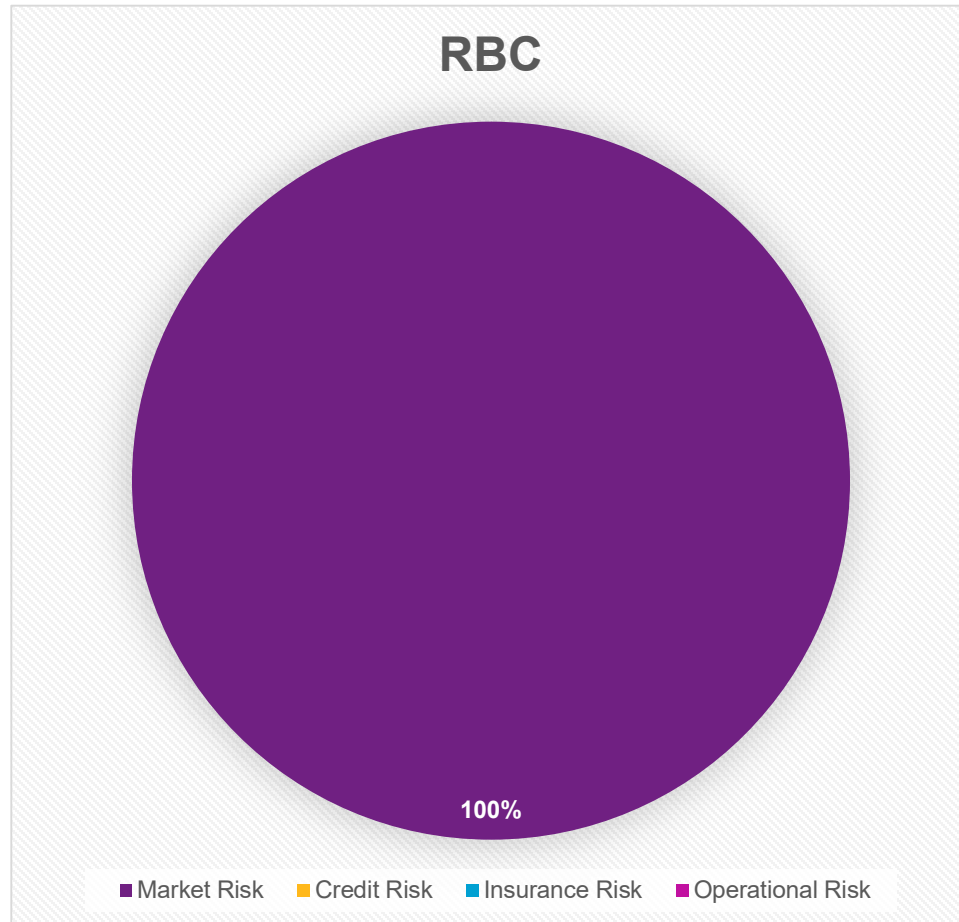
As of December 31, 2018

AAT Stochastic Scenarios (200 Scenarios)



Capital Requirement

Risk-Based Capital (100% CAL)



- Market Risk Only
 - C-1 (asset credit risk)
 - C-3 (interest rate risk)
- No Insurance Risk (C-2)
 - No longevity risk yet
- No Operational Risk (C-4)
 - Measured as % of Premium
- No Credit Risk – no external reinsurance relationships
- No Diversification Benefits
 - C-1 and C-3 are non-diversifiable

Capital Requirement

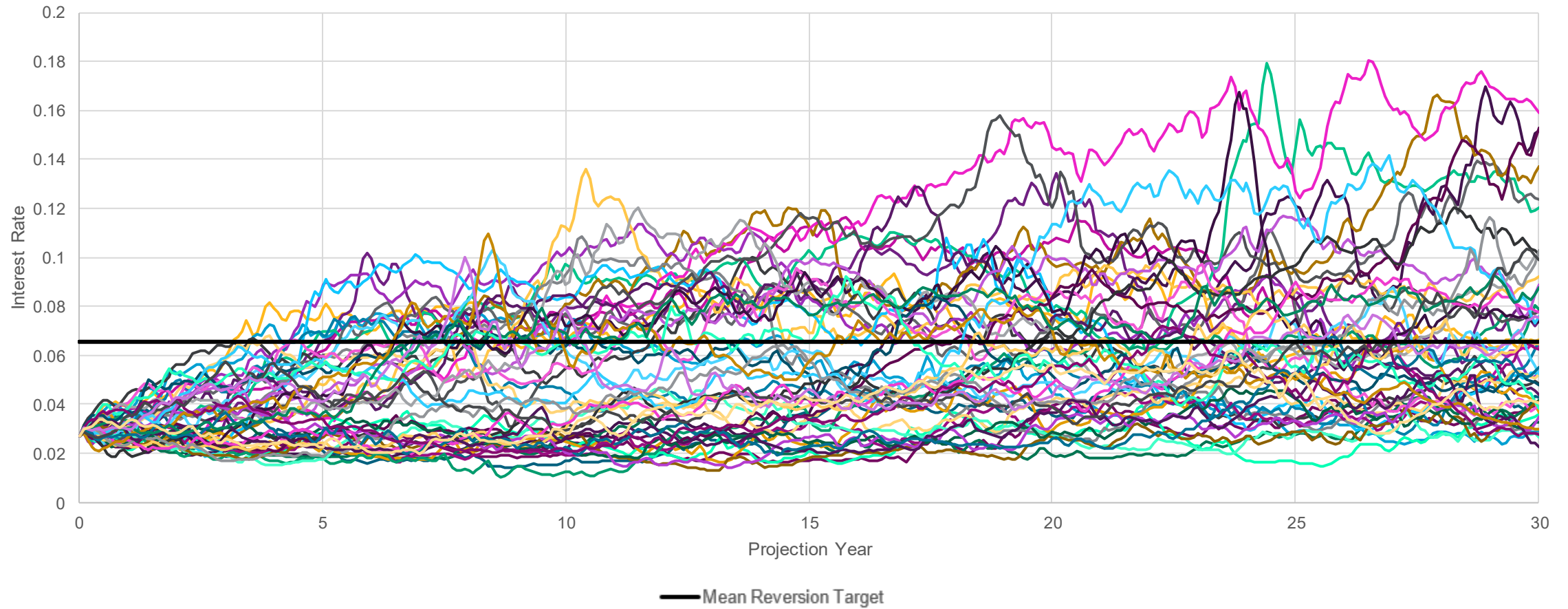
C-3 Phase 1

- Products subject to C-3 Phase 1 testing: Annuities (non-EIA), Single Premium UL
- The purpose of this test is to measure interest rate risk (how the portfolio does with various interest rate shocks)
- 50 prescribed scenarios
- Process is similar to cashflow testing:
 - Start with 0 surplus and project best estimate cashflows
 - Accumulate surplus throughout the projection
- Discount ending surplus to time 0 using 105% of 1-year treasury rate for the scenario
- Take the weighted average of worst 5th to 17th scenarios to get to the final C-3 Phase 1 result
- May require additional C-3 capital requirement if the result is not favorable
 - If the block has CFT Reserves, these may be included in the test

C-3 Phase 1 Scenarios

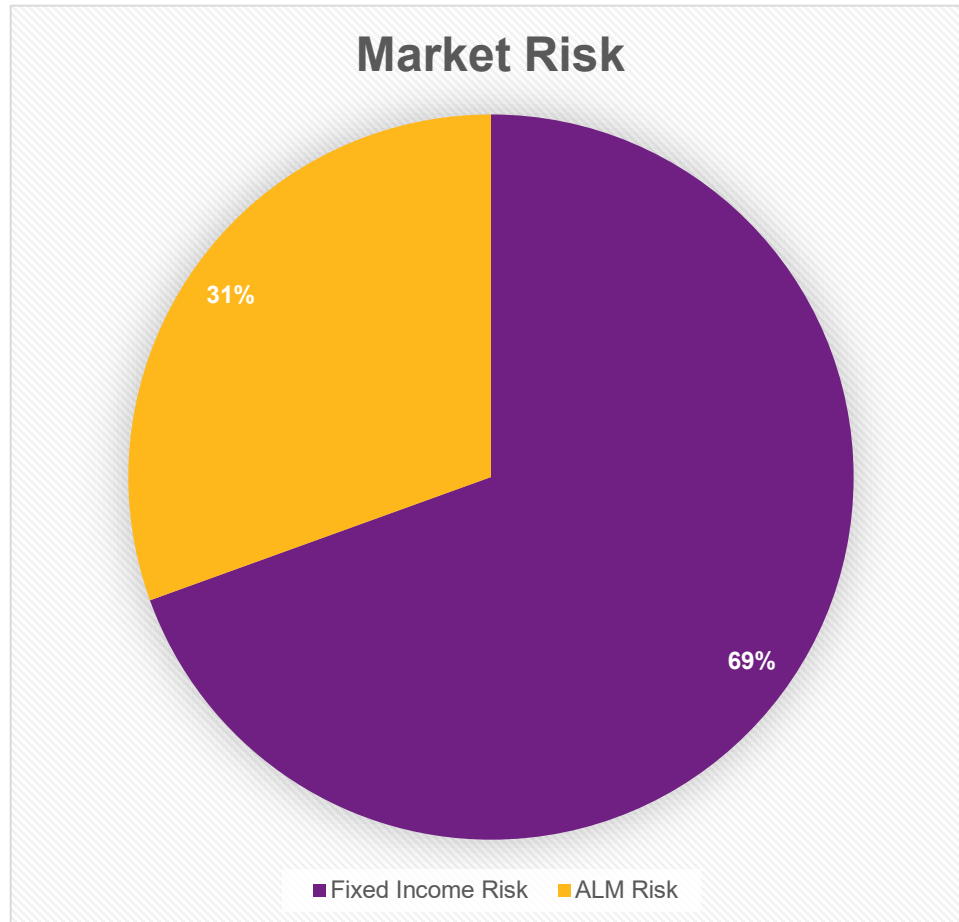
As of December 31, 2018

C-3 Phase 1 (50 Scenarios)



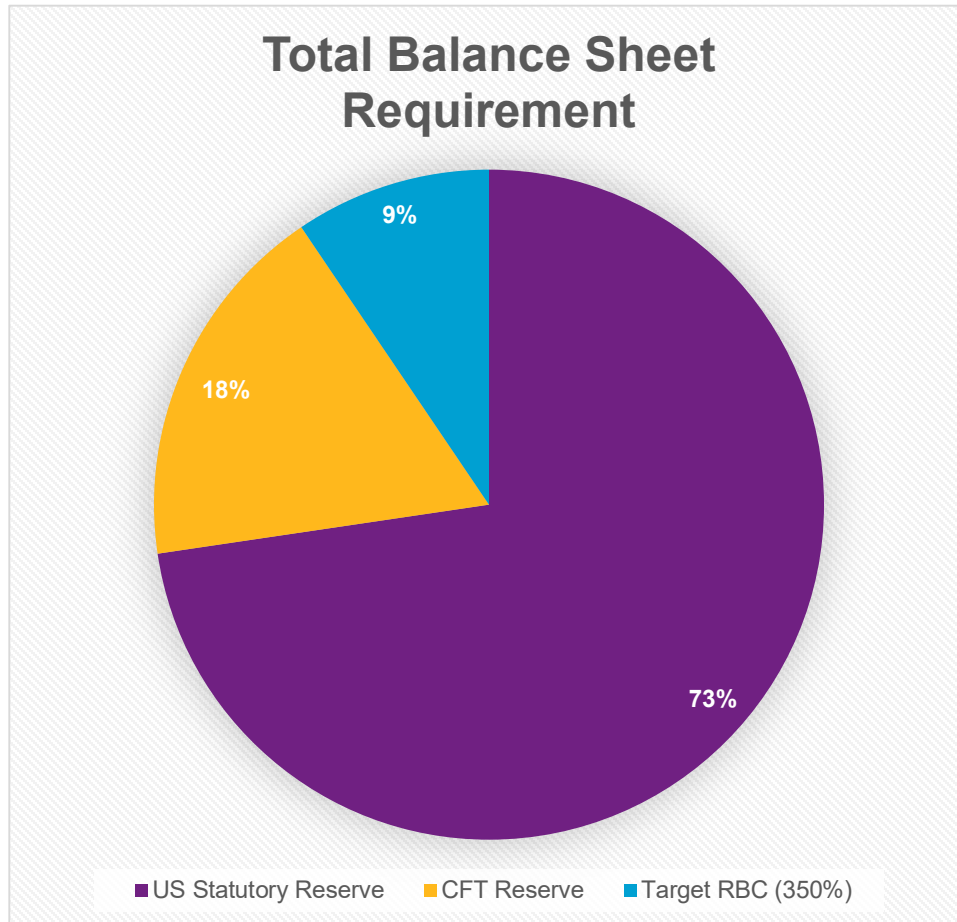
Capital Requirement

Market Risk



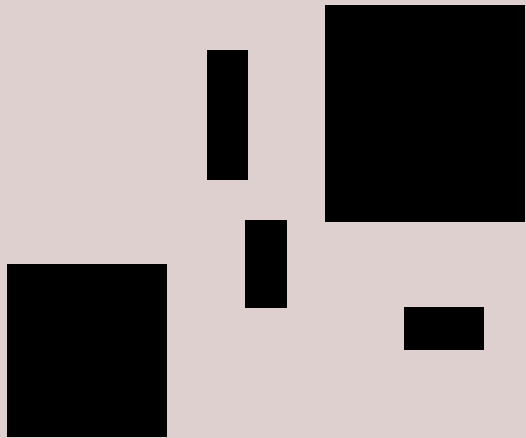
- **Asset Credit Risk (Fixed Income Risk)**
 - Based on profile of the different fixed income investments (varying by asset type and credit rating)
- **Interest Rate Risk (ALM Risk)**
 - Factor based (low risk category = 50bp charge on reserve balance)
 - C3 – Phase 1 credit: 50%

Total Balance Sheet Requirement



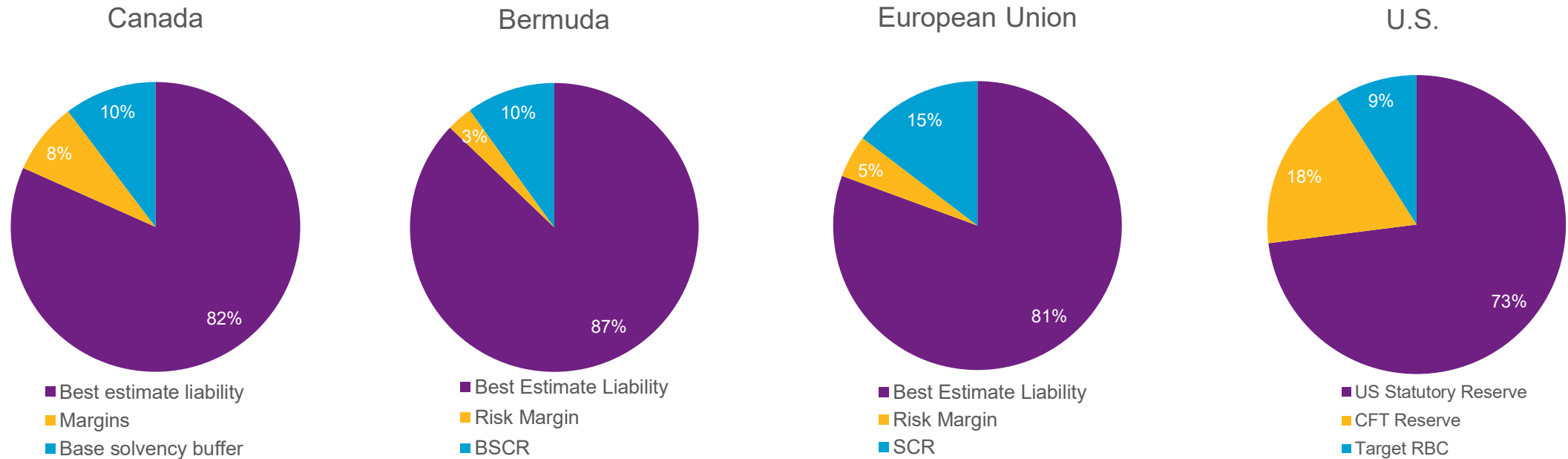
- Statutory Reserve represents most of the requirement
- Cashflow Testing reserve may be zero or represent a bigger percentage of the total requirement than shown here

Key takeaways



Total Balance Sheet Requirements

Economics of the business matter



- Investment strategy and ALM
- Understand insurance risk