Capacity building seminar on Life Insurance

Asset Liability Management

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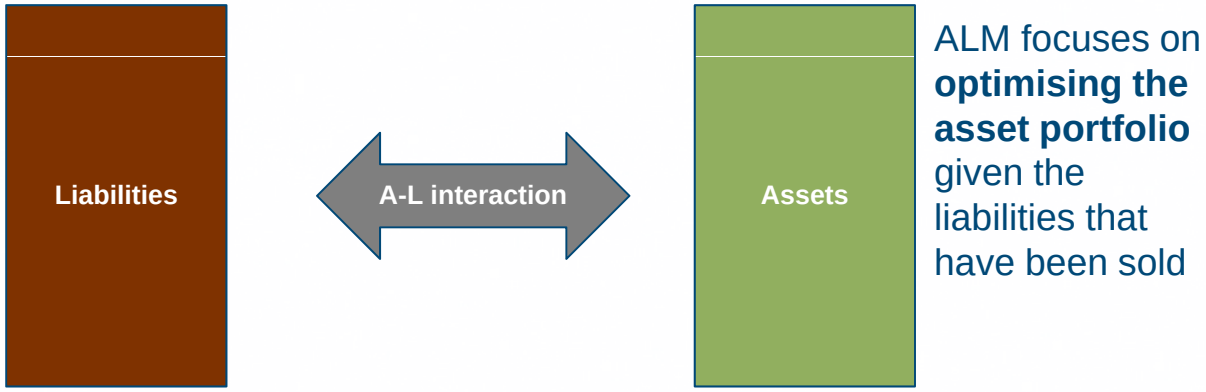
Content

- Introduction to ALM
- A brief introduction to ALM models
- ALM principles and the ALM framework
- Case study
  - Hong Kong based life insurer

The 101 of ALM

- Asset and liability management (ALM) is the practice of managing the **performance** and the **risks** that arise due to **mismatches between the assets and liabilities**.

Liabilities are dictated by competition and customer constraints and **cannot be as easily adjusted as the assets.**



ALM focuses on **optimising the asset portfolio** given the liabilities that have been sold

- But exactly what it means to "optimise" the asset portfolio depends on the question that the company is try to answer…

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The 101 of ALM

Some of the key questions that can be asked when performing an ALM analysis

- Do we have enough cash to pay the liabilities as they fall due?
- What assets optimise the value of the business to shareholders while minimising the risk?
- What assets maximise the return to the policyholders?
- What assets minimise the risk of dynamic policyholder lapses or maximise the future new business premiums?
- What assets minimise the potential loss in certain pre-defined scenarios?
- What assets minimise the interest risk given a target profit margin is achieved?

Even though these issues are in nature different, the same ALM process can be put in place to measure the performance versus risk (under constraints), and provide thorough analysis to the senior management

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The 101 of ALM

- Any ALM process requires 3 key steps :

- This presentation provides of details each of the three of the key steps involved in the execution of an ALM process
- We aim to provide a general framework to the understanding of ALM and how it can be deployed in different situations

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A brief introduction to ALM models

Introduction

- An ALM model can be developed using one of three

Deterministic without asset model	Deterministic with asset model	Stochastic with asset model
• Modelling of assets and liabilities separately • Investment return is a deterministic assumption read from an input table	• Modelling of assets and liabilities together • Use of deterministic economic scenarios	• Modelling of asset and liabilities together. • More complex interactions can be taken into account • Use of stochastic economic scenarios
Excel based	**Excel / Actuarial Tool (Prophet ALS)**	**Actuarial Tool (Prophet ALS)**

- The choice of model is primarily based on the level of complexity of the ALM analysis to be undertaken

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A brief introduction to ALM models

Overview

- The evolution of the ALM framework can be broken down into 3 stages:

Model form	General principles	Advantages / Disadvantages	
Deterministic without asset model	• No interaction between assets and liabilities • No optimisation process – only focus on one dimension	+	• Simple to implement and fast runtime performance • Consistent with approach used for Traditional Embedded Value calculations
		−	• Not a true ALM model
Deterministic with asset model	• Implementation of a simple ALM model to develop and deploy of strategic asset allocation • Detailed cash flow matching taking into account interactions between assets and liabilities • Measurement and management of the duration • Simple scenario analysis, deterministic calculations	+	• Allow to understand ALM position relatively simply • Fast run time performance
		−	• Potential discrepancies with Embedded Value results • Embedded optionality of products is not properly taken into account
Stochastic with asset model	• Complex ALM model with policyholder behaviour and management actions • Stochastic calculations • Cost of options can be correctly integrated • Stress tests, reverse stress tests and stochastic analysis	+	• Allow to understand ALM position as well as complex options embedded in the contracts
		−	• The run time can be much higher • ALM analysis can be much more complex to understand

- In the remainder of the presentation, we focus solely on the last two – the first option is not a true "ALM model"

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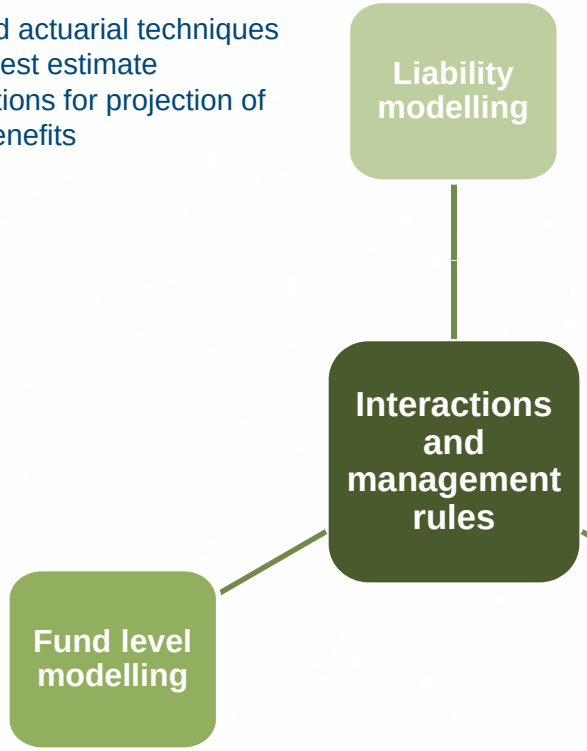
A brief introduction to ALM models

Full ALM models

- The development of a Full ALM model means the development of several key elements :



- Standard actuarial techniques
- Use of best estimate assumptions for projection of future benefits

Vital element of any ALM model

- Bonus and crediting rules including smoothing techniques and target crediting rates
- Dynamic policyholder behaviour : dynamic lapses, dynamic premiums, dynamic fund switching
- Asset strategies : strategic asset allocation, asset purchase / sale strategies

- Regulatory capital requirements
- Capital management practices : capital injections, shareholder profits
- Accounting rules : replication of BS and P&L rules

- Asset modelling should cover main asset classes
  - ✓ Bonds : government / corporate
  - ✓ Equities
  - ✓ Property
  - ✓ Vanilla derivatives
- Some complex asset classes can be difficult to value in typical actuarial sotware

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Content

- Introduction to ALM
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- ALM principles and the ALM framework
- Case study
  - Thailand Life Insurer
  - European life insurer

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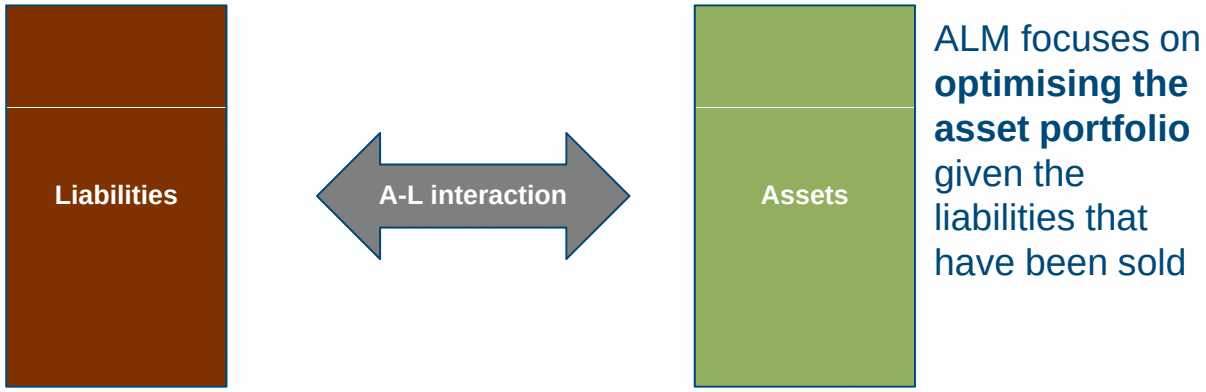
ALM Principles and the ALM framework

Introduction

- Asset and liability management (ALM) is the practice of managing the **performance** and the **risks** that arise due to **mismatches between the assets and liabilities**.

Liabilities are dictated by competition and customer constraints and **cannot be as easily adjusted as the assets.**



ALM focuses on **optimising the asset portfolio** given the liabilities that have been sold

- So how do we go about “optimising” the asset portfolio ???

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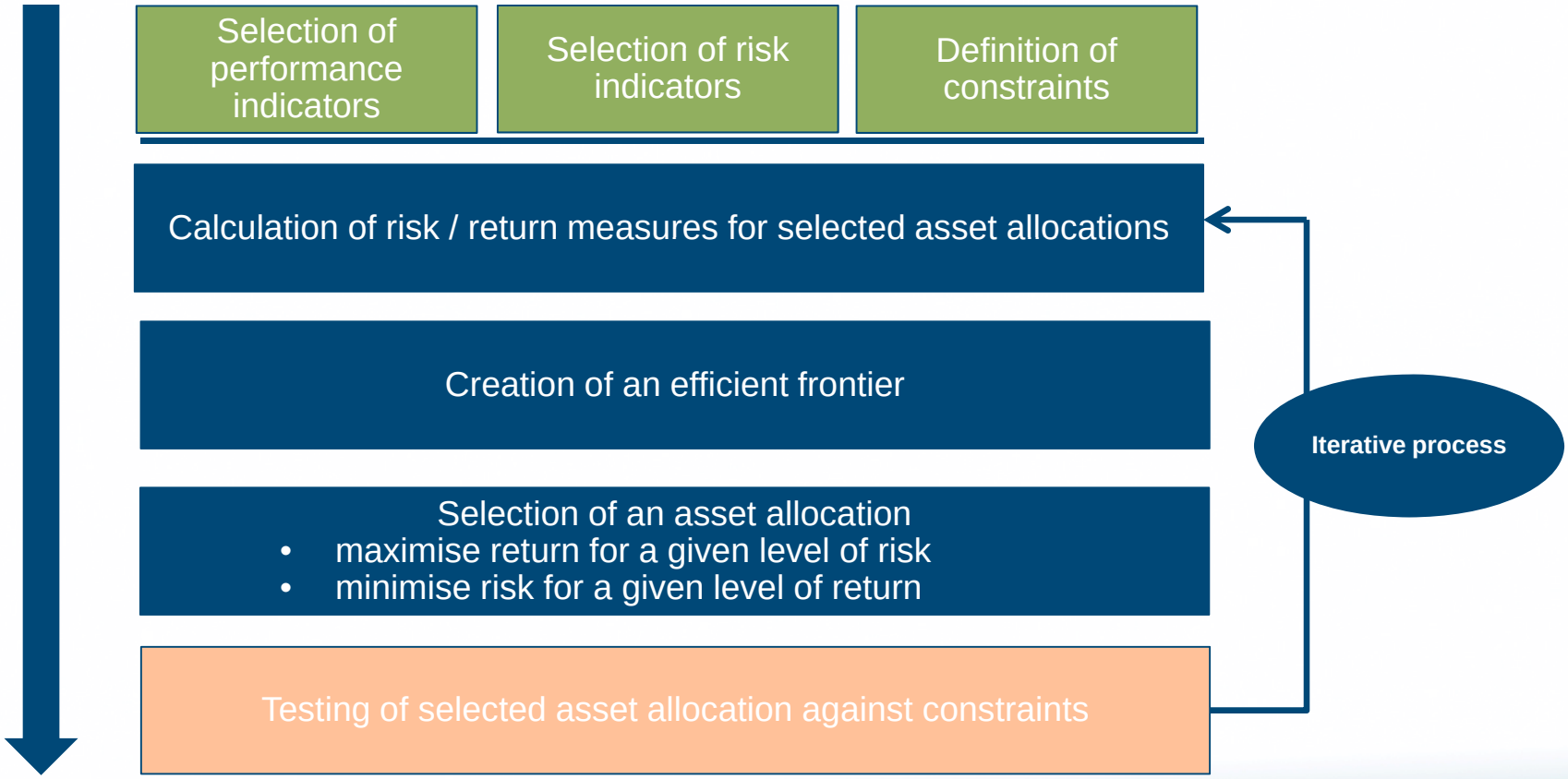
ALM Principles and the ALM framework

The optimsation process

- The optimisation of the asset portfolio is generally based on some variation of the following process:



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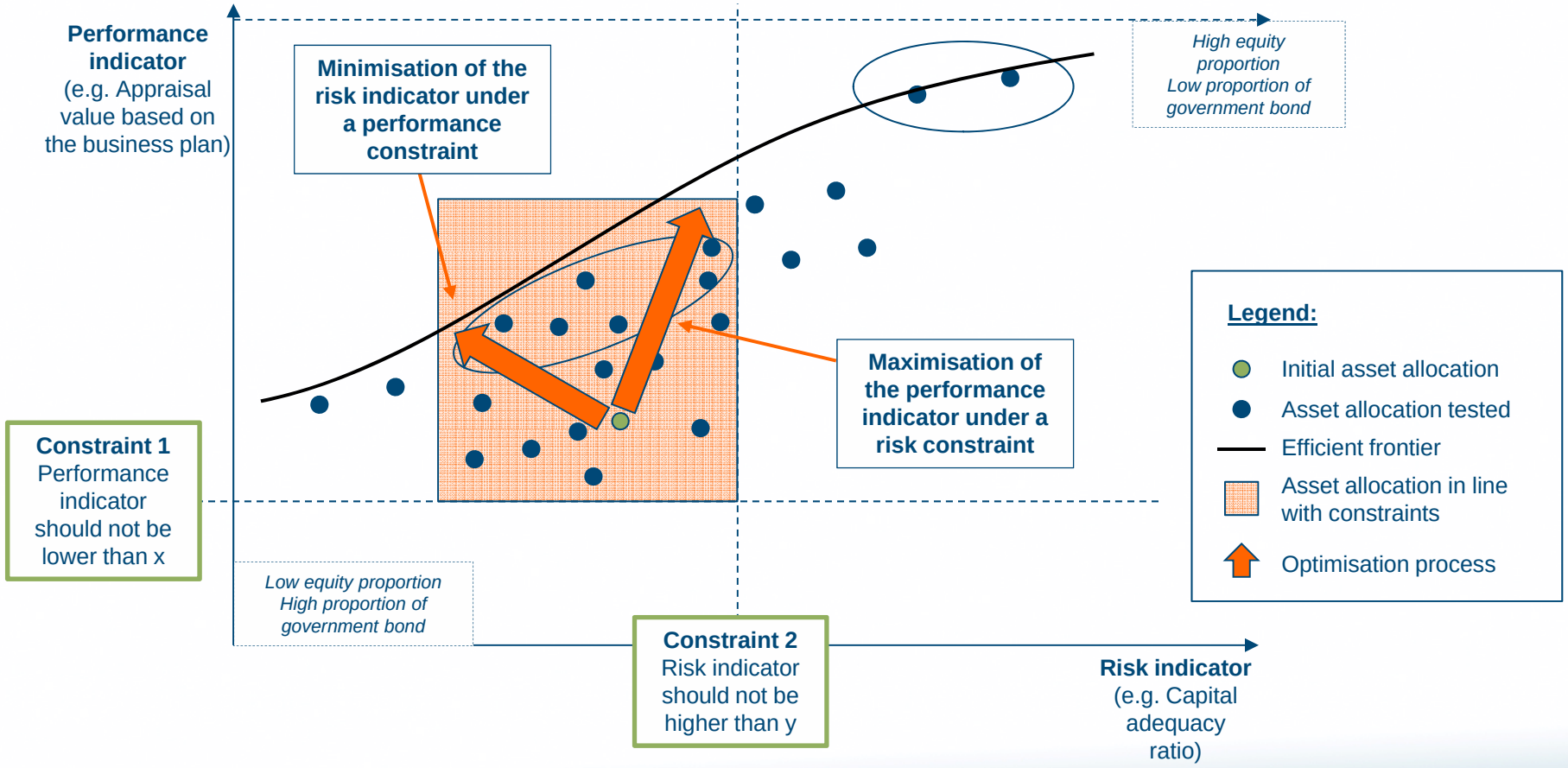
ALM Principles and the ALM framework

The efficient frontier

- Visually this will appears as the following :



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Efficient Frontier

Definition of key elements

- The implementation of the ALM process requires the definition of the 3 key components

- It is important to note that there is no “right” answer to these questions. The most important is ensuring the buy in of management in the selection of these indicators.

- **If the company has an internal risk appetite framework, this will be a significant contribution to how these elements will be defined**

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Selection of Performance Indicators

Overview

Key performance metrics	Key issues and questions
Shareholders' point of view • Present value of statutory profit • Present value of source of earnings (e.g. investment surplus) • Present value of expected investment return • Present value of profit after cost of capital **Policyholders' point of view** • Internal rate of return over a certain future period (savings products) • Total / present value of guaranteed living benefits paid out (savings products) • Total / present value of total living benefits (savings products)	• What are the future investment assumptions to be used ? Should we be considering deterministic or stochastic valuation ? • How many years of future cash flows are taken into account to calculate the present value? • Should the number of years of future cash flows be consistent with the horizon of your business plan? • Which risk discount rate (RDR) should be used to calculate the present value? • Should it be consistent with the RDR used in your embedded value calculation?

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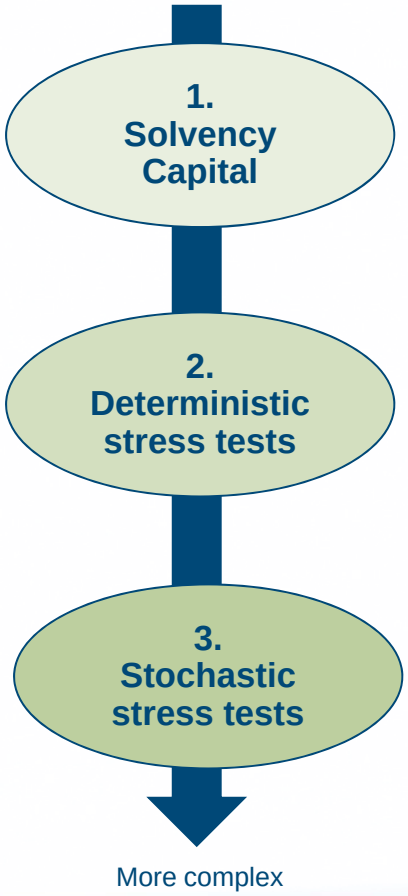
Selection of Risk Indicators

Overview



	Definition	Pros and Cons analysis
1. Solvency Capital	• The level of Solvency I capital is calculated using a simple factor based approach • The Capital Adequacy Ratio (CAR) is equal to the ratio of total capital available divided by the total capital required	• Solvency I is a relatively blunt instrument and doesn't integrate the actual risks being taken by the company
2. Deterministic stress tests	**Risk appetite approach** • The risk appetite is defined as the level of risk that an organisation is prepare to accept, before action is deemed necessary to reduce it • Insurance companies have to come up with their own set of plausible adverse deterministic scenarios and identify possible threats and mitigate the impact if it materialises • This can be done deterministically or stochastically	• Assessment of the key risks specific to the company. • Does not need to be complicated • **Company does not need to have an official risk appetite (although it make it easier!!). However, it is important to get management buy-in to the set of indicators being used**
3. Stochastic stress tests		• More complex to implement • Assessment of the key risks specific to the company, including dynamic and complex risks

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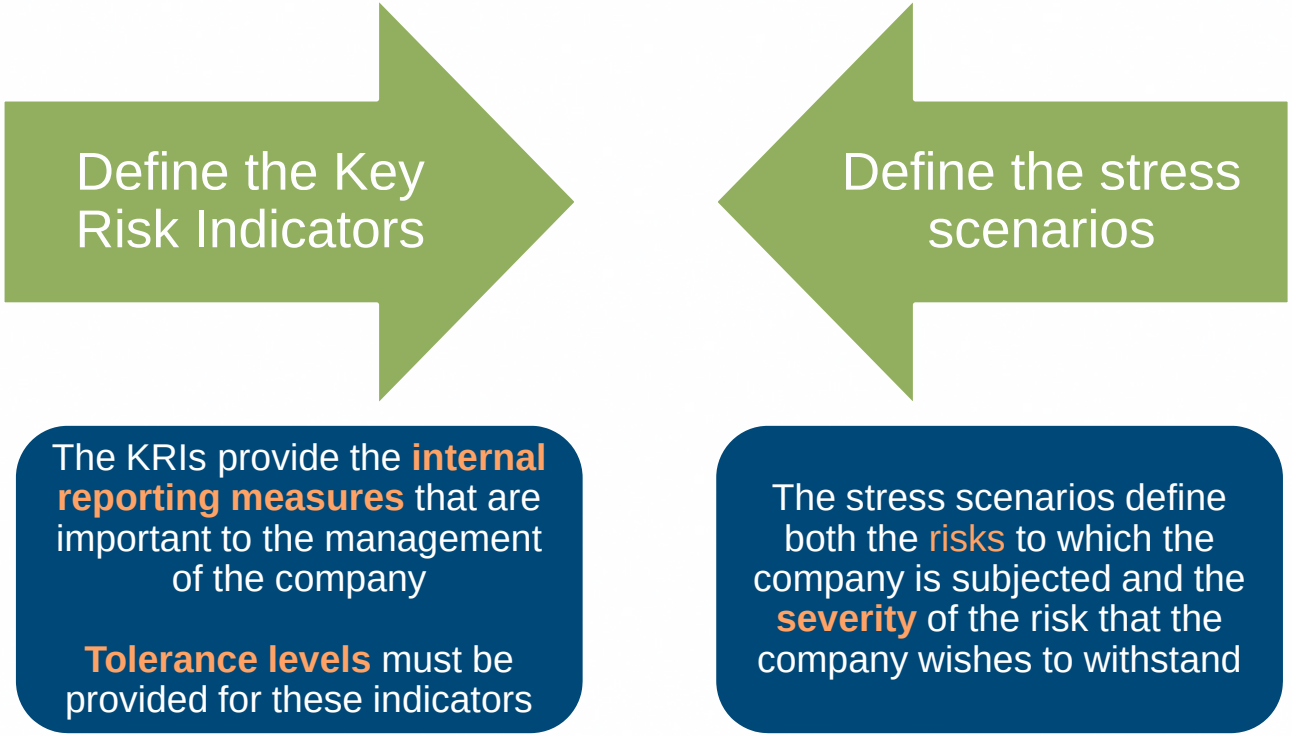
Selection of Risk Indicators

Risk Appetite – Overview (1/2)

- The risk appetite is the framework within which the company will define its risk taking activities. In determining the risk appetite the company needs to :



- Even if the company hasn't implemented an official risk appetite, these elements will need to be defined for the purposes of the ALM studies

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Selection of Risk Indicators

Definition of the key risk indicators

- Below is a benchmark of the key measures that are considered for some large international

Measure	PRUDENTIAL	Standard Life	OLDMUTUAL	AVIVA	BNP PARIBAS	AXA
Capital	X	X	X	X	X	X
Profitability	X	X	X		X	X
Value / EV				X		X
Regulation						
Liquidity	X	X		X	X	X
Concentration		X			X	

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Selection of Risk Indicators

Definition of the key risk indicators

- For each of these measure, we need to define the KPI the management wishes follow. Some typical examples are :

Capital	• Regulatory capital • Internal model capital • Rating agency capital
Profitability / EV	• IFRS profits • Return on equity • Embedded value
Liquidity	• Total cash position

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Selection of Risk Indicators

Definition of stress scenarios

- The Risk Appetite Framework includes qualitative statements as well as quantitative measures expressed relative to earnings, capital, value, liquidity and customer outcomes.

- These measures are generally based on (i) a set of realistic assumptions (investment return, operating assumptions, management expenses, new business sales, etc) projecting the business on an ongoing basis; and (ii) a set of plausible/extreme adverse scenarios / stressed assumptions useful to examine the sensitivities of the different measures.

- The adverse scenarios should not only be based on commonly used and recognised stress tests but also on the company's own sensitivity in terms of earnings, capital, value, liquidity and customer outcomes.

- Different approaches can be used to define these scenarios and are described in more details in the following slides:

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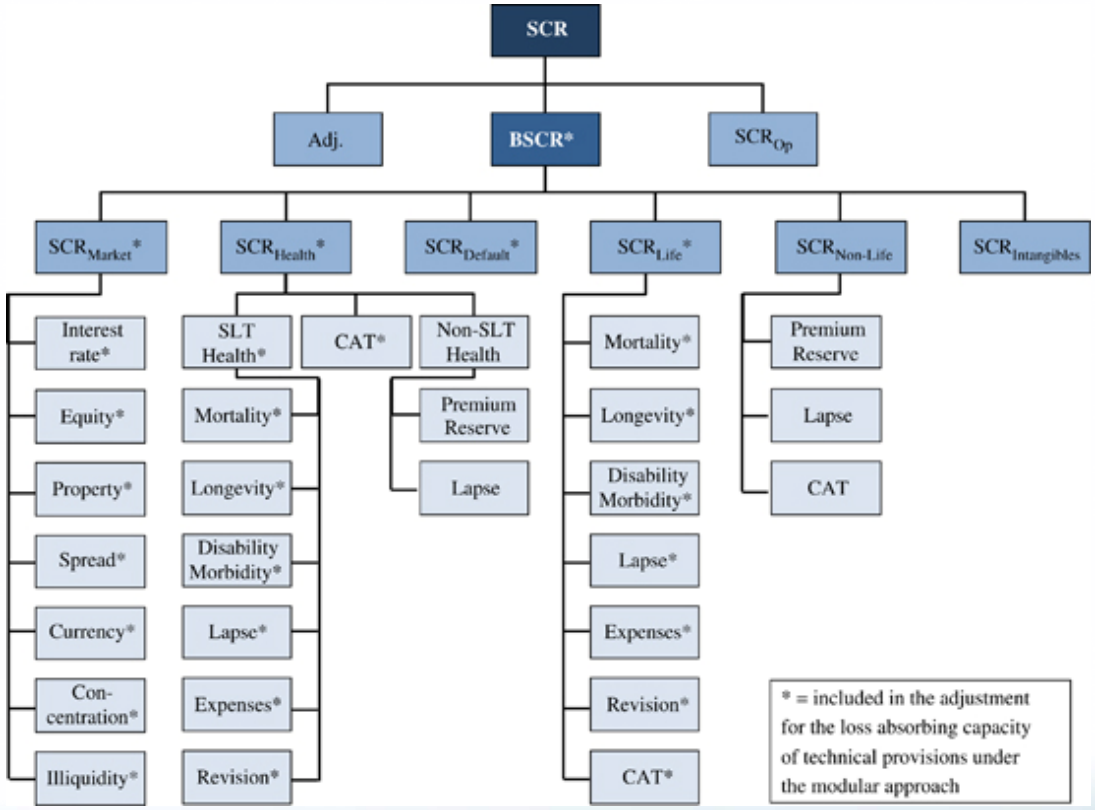
Selection of Risk Indicators

Definition of stress scenarios

- Solvency II includes the following risk categories. When setting up the stress tests, this provides a good reference point for the risks that should be considered.



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Selection of Risk Indicators

Definition of stress scenarios

- Example of potential key stress tests based on international risk capital frameworks which can be helpful to define the adverse scenarios:

Key stress tests	EU Solvency II (99.5% VaR)	Singapore RBC 2 (99.5% Var)
Lapse	MAX (+/-50% stress to lapse rates, Mass Lapse of 40%(1) at time 0)	+/-50% stress to lapse rates
Equity	• Equities listed in regulated markets in countries which are members of the OECD : 46.5% • Other equities: 56.5% • A correlation matrix is then applied	• Equities in Singapore and developed markets:40% stress • Equities listed in other markets: 50% stress • Unlisted equities: 60% stress
Interest rate mismatch	• Interest rate up/down shocks are applied as a % change. • The interest rate up and down shocks are quite symmetrical	• Interest rate up/down shocks are applied as a % change. • The interest rate up shocks are slightly more severe than the interest down shocks
Credit spread	• A factor shock that is based on credit rating and duration is applied on the value of the credit risk exposure	• A factor shock that is based on credit rating and duration is applied on the value of the credit risk exposure

1-in-200 year risks as defined by standard formula.

May be used for extreme stress tests but does not really reflect **plausible adverse scenarios for the company**

(1): 70% applied for 3rd party policies

OECD: Organisation for Economic Co-operation and Development, EU: European Union

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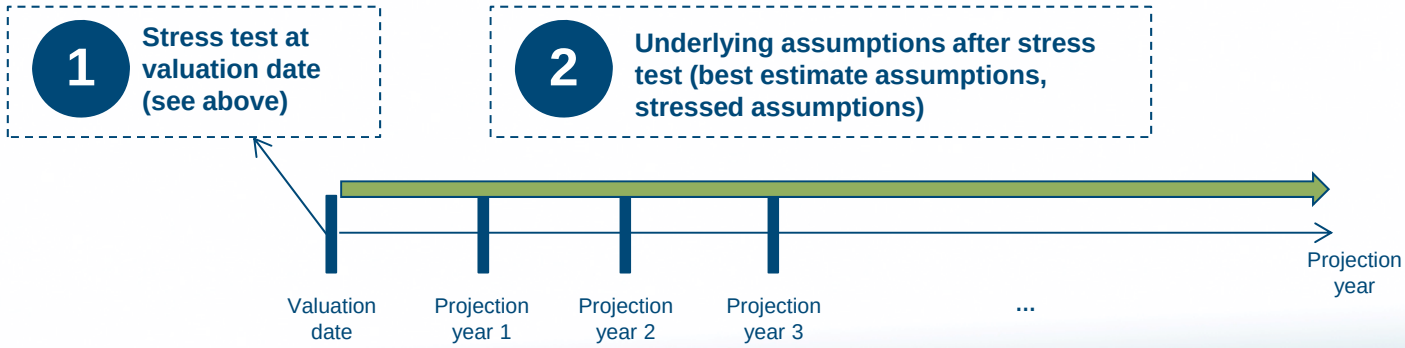
Selection of Risk Indicators

Definition of stress scenarios

- Key stressed scenarios you may want to take into account in the risk assessment. The final risk measure can be then equal to the sum or the maximum or can be aggregated using another approach.

Deterioration in claims experience	Mass lapse	Interests up / Interests down	Fall in equity	Interest up + mass lapse
10% increase in rates of mortality and morbidity and loss ratios (i.e. 110% of the rates of loss ratios)	Mass lapse of 20% at time 0	+2% p.a. in interest rates (i.e. only level is taken into account) -1% p.a. in interest rates (i.e. only level is taken into account)	-25% in equity	+1.5% p.a. in interest rates -20% in equity Mass lapse of 15% at time 0

- Key issues to take into account when defining the stressed scenarios:



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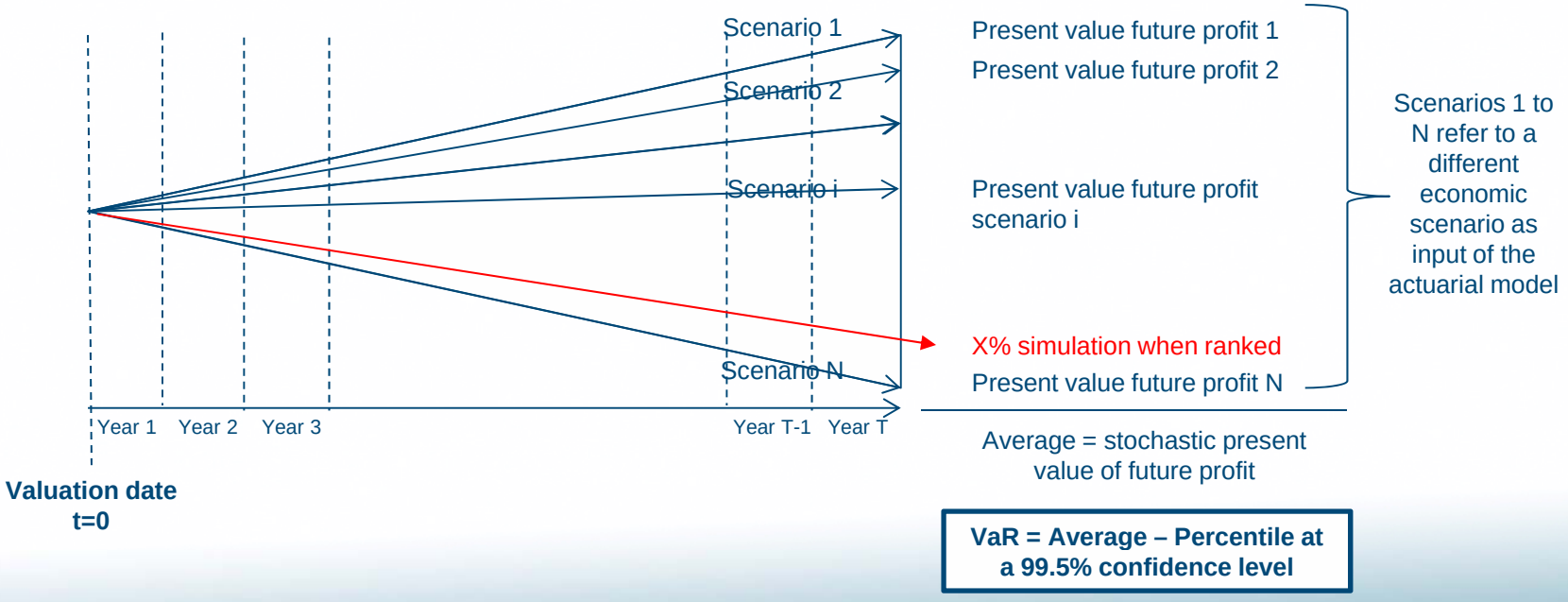
Selection of Risk Indicators

Stochastic Approaches

- VaR indicator is defined as a change in the economic surplus following a stress of key economic and insurance parameters.

- VaR is to be considered on a certain horizon and a certain confidence level, in line with the regulation or the company internal requirements.

- Illustration – VaR of the future profits at X%



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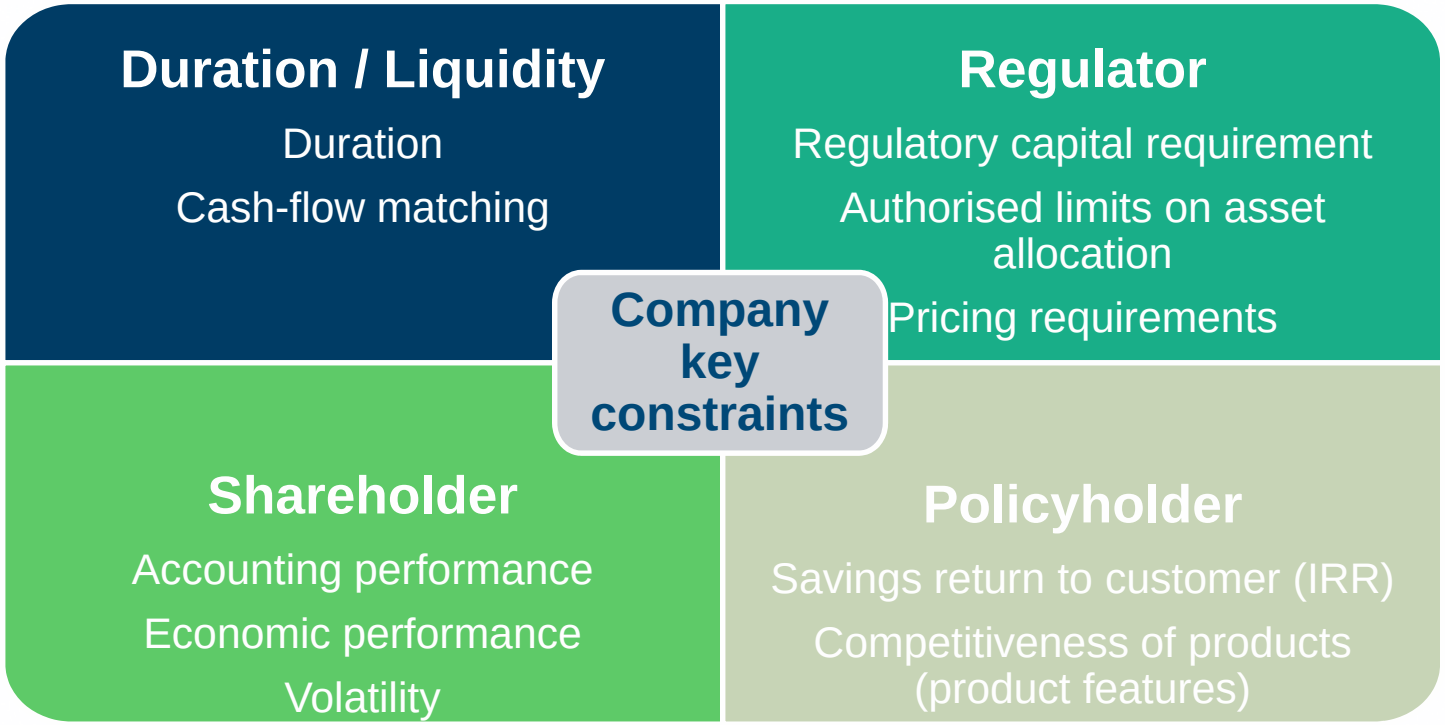
Definition of Constraints

Overview (1/2)



- The different sets of constraints above will act as maximum / minimum limits, as approved by the Board or management. They will restrict the optimisation process.
- **These constraints are often directly linked to the Risk Appetite Framework. More generally, the elements of the Risk Appetite that do not figure in the performance or risk measure should figure in the constraints**

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Definition of Constraints

Duration and liquidity (1/3)

- Duration (and in particular duration gap between asset and liability) is a standard, simple but powerful tool that is used to manage the mismatch between assets and liabilities.
- Duration of assets and liabilities are usually calculated on a regular basis (monthly / quarterly), following different possible approaches:

Relatively simple to calculate

More difficult to calculate

	Methodology	Pros & Cons
Sensitivity approach	Duration = change in MV of assets (or liabilities) due to 1% change in assets	• Very simple to calculate • Doesn't cater for any change in slope of the yield curve • Can't account for any timing issues
Deterministic cash flow approach	$Duration_{Det} = \sum_t \frac{t.PVCF_t}{PVCF_t}$ With PVCF the present value of the cash flow at time t	• Change in slope of yield curve correctly interpreted • Use of stress testing helps understand the ALM effects
Stochastic cash flow approach	$Duration_{Sto} = \sum_s \frac{Duration_{Det}}{s}$	• Most appropriate where options exist (for example minimum guaranteed rates on liabilities) • Requires stochastic models

- In-force premiums are generally taken into account in the duration calculation. However, the treatment of future premiums can differ from one company to another.

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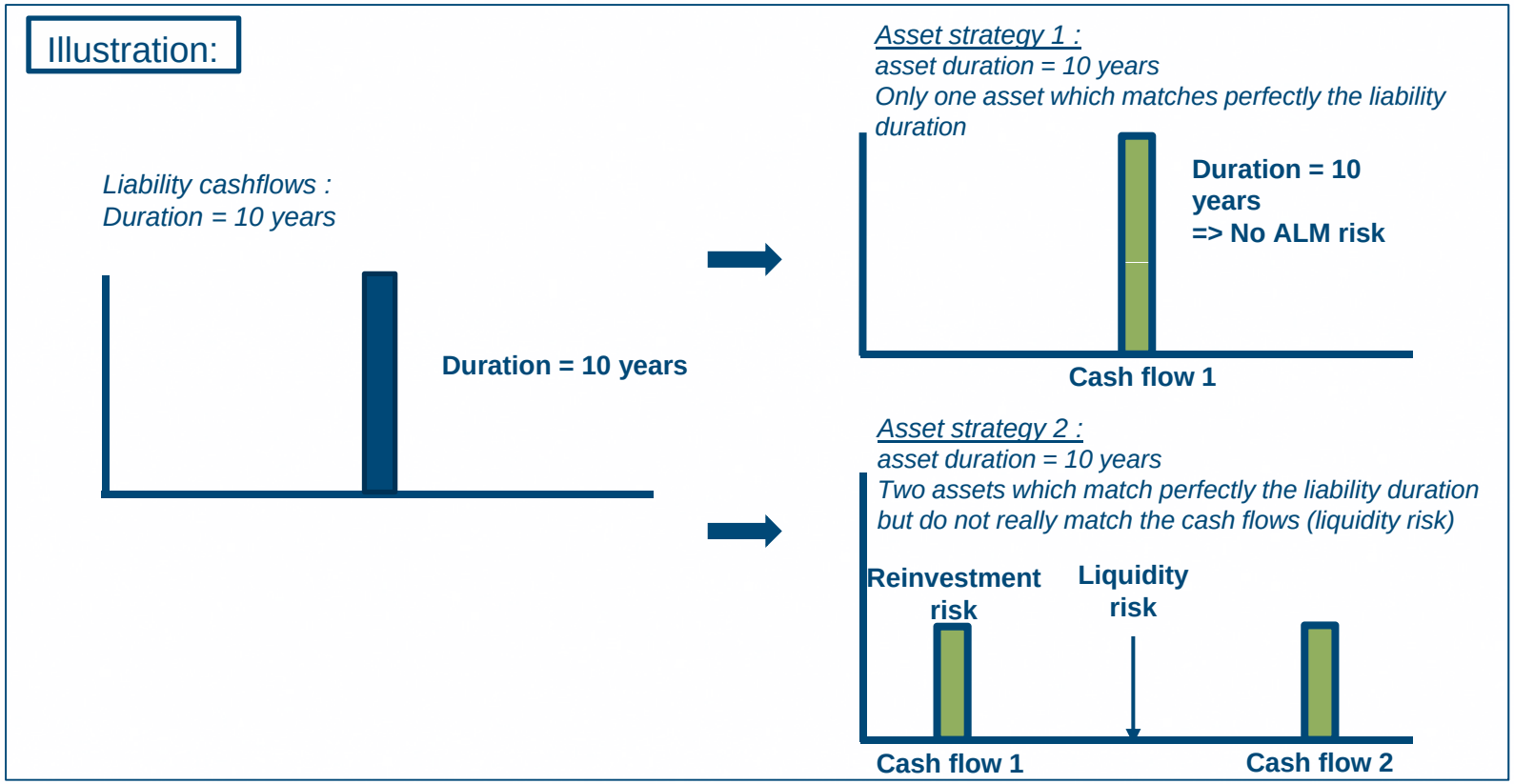
Definition of Constraints

Duration and liquidity (2/3)

- Appropriate use of the duration measure is key since this simple measure can be misleading:



- Other additional measures can be taken into account in order to better understand the liquidity risk. For example, convexity as well as cash flow matching measures can be calculated.

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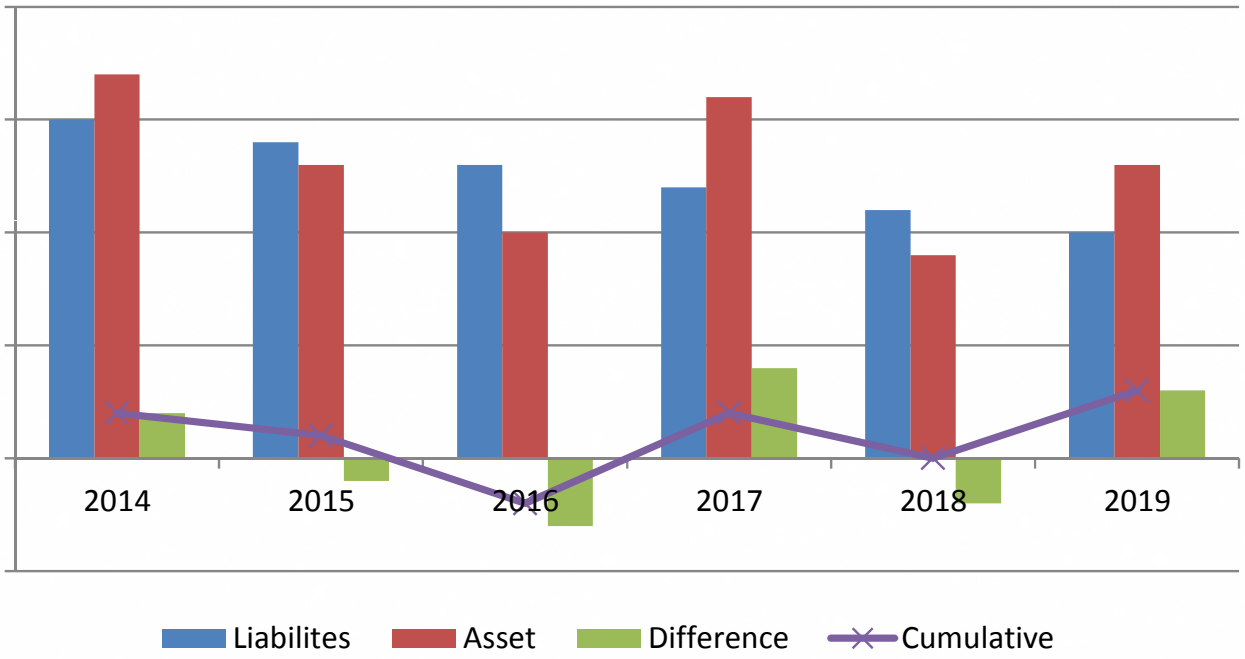
Definition of Constraints

Duration and liquidity (3/3)

- Cashflow matching is another key measure that is used to constrain the overall process



- Some considerations
  - The cashflow matching constraints can be on a year on year basis or on a cumulative basis
  - The cashflows that are included might be only fixed interest bonds or all assets
  - Need to consider whether new business is included in the cashflow matching

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Definition of Constraints

Shareholders' constraints

- Example of shareholders' constraints:

Categories	Measures	Examples
	Statutory profit / profit after costs of capital / return on equity (ROE)	x% growth in statutory profit Statutory profit not reduced by more than y% in stressed scenario
Accounting performance constraints (Cash flow)		ROE > z% for each year of projection
	Investment income / unrealized gains and losses on asset portfolio	Investment return > x%
	Volatility	Proportion of equity should not be higher than x%
Economic performance constraints (Value)	Embedded value / In-force value	x% growth in embedded value Embedded value not reduced by more than y% in stressed scenario
	Appraisal value / New business value / New business margin	New business margin should not be lower than x%

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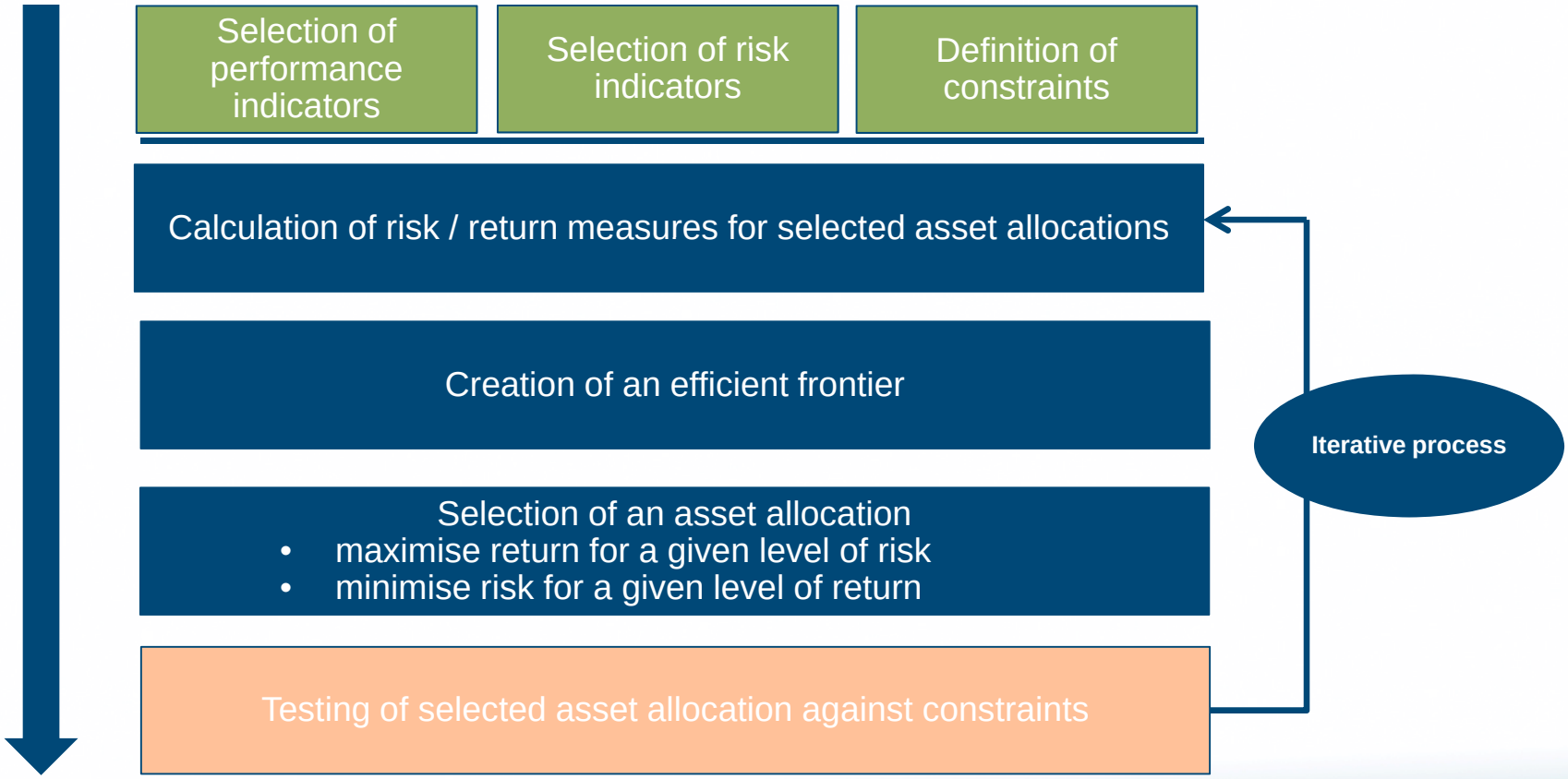
ALM Principles and the ALM framework

The optimsation process

- The optimisation of the asset portfolio is generally based on some variation of the following process:



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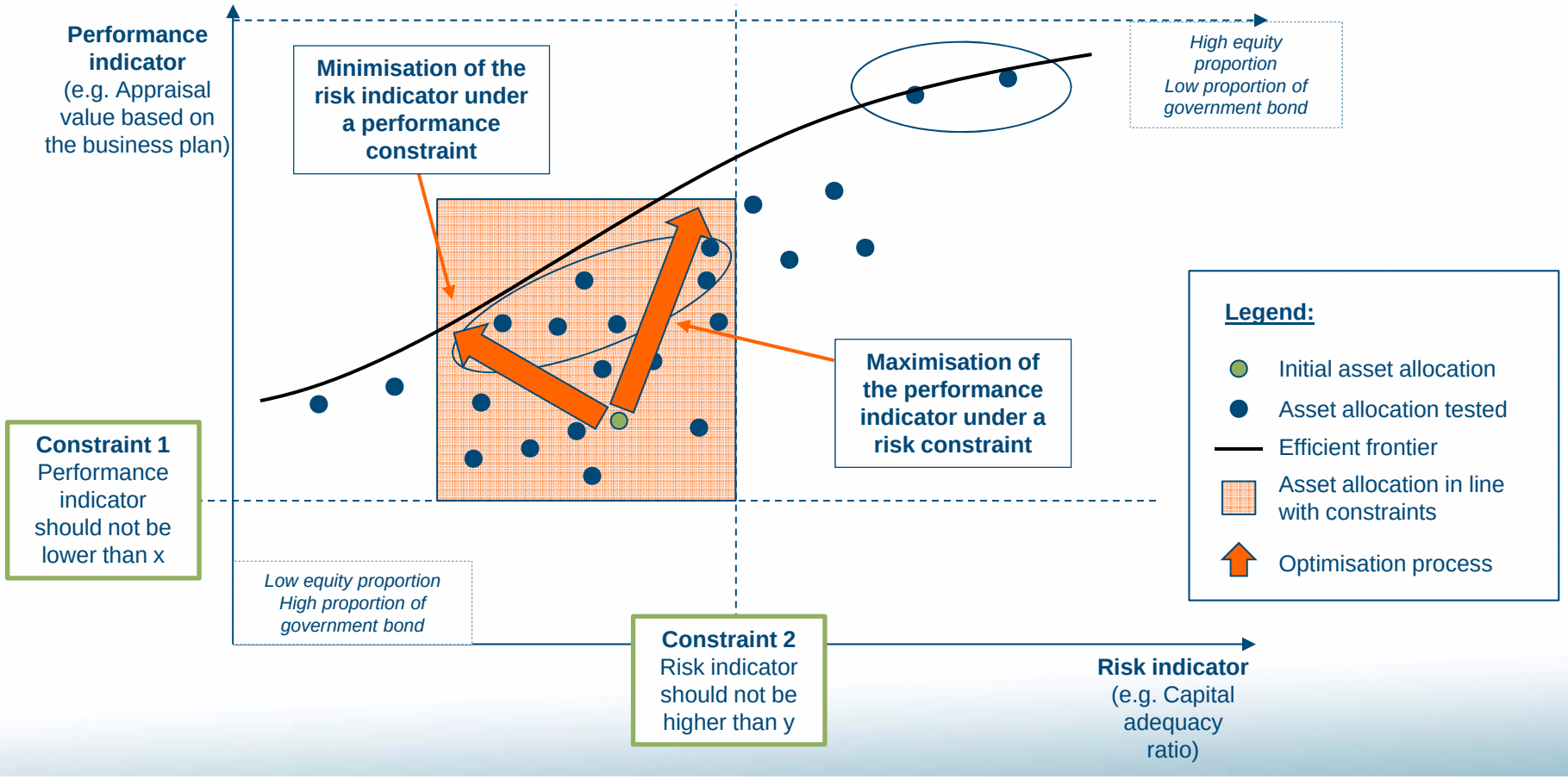
Efficient Frontier

Process

- The efficient frontier is drawn by graphing the risk and return indicators for each scenario tested
- Illustration - Selection of an optimal strategic asset allocation under risk and performance constraints



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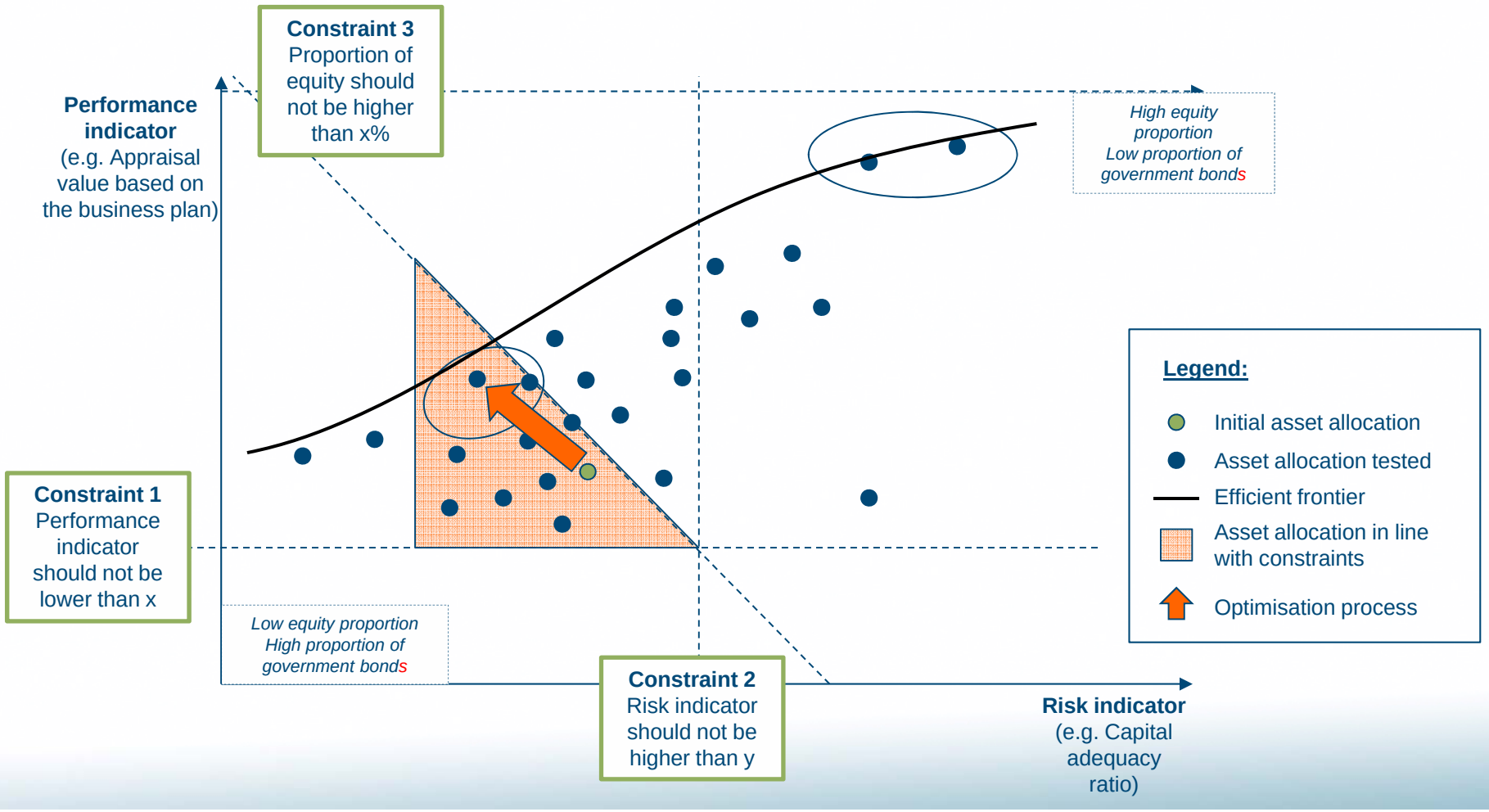
Efficient Frontier

Process

- Illustration. Other constraints not directly linked to risk and performance indicators can be also added as shown below:



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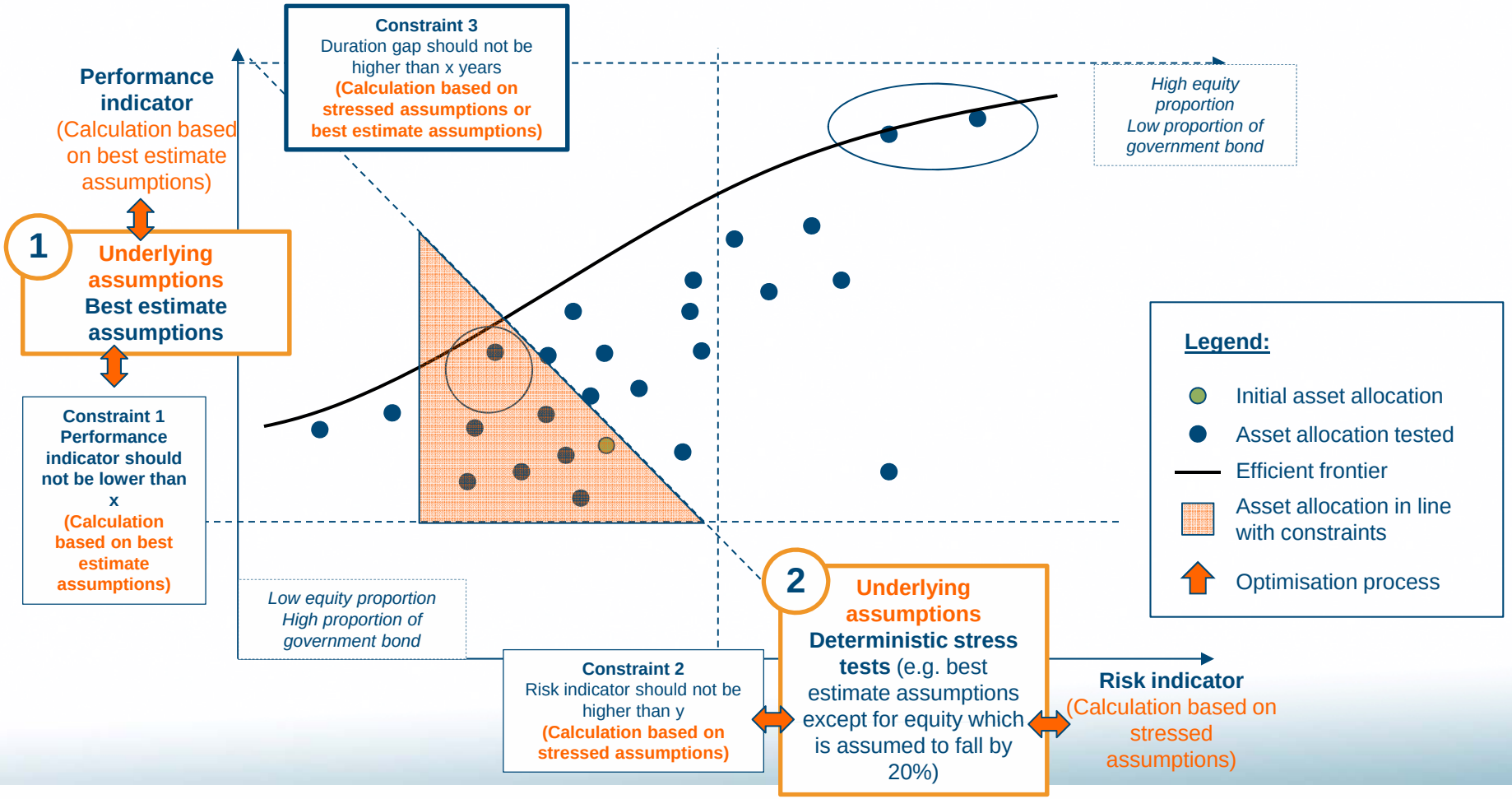
Efficient Frontier

Process

- Different underlying economic assumptions (best estimate / stress) can be used to calculate the performance indicator / risk indicator / constraints as shown in the illustration below:



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  - Hong Kong based life insurer

Case Study – Hong Kong based life insurer

Introduction

- The company posses a large block of primarily endowment participating policies that do not pay any terminal bonuses. Minimum guaranteed rates are very low for the block. The company has total discretion as to the level of bonuses that are padi

- The aim of the study is to find the optimal portfolio of assets between the 4 key asset classes :
  - Equity
  - Property
  - Fixed Rate bonds
  - Floating rate bonds

Case Study – Hong Kong based life insurer

Introduction to ALS

- Prophet ALS (Asset Liability Strategy) is a separate library developed by Sungard for the purpose of projecting both the assets and liabilities simultaneously, while taking into account any potential interactions
  - Dynamic dividends
  - Dynamic policyholder behaviour
  - Dynamic bonus and participation rates

- The ALS module is primarily used for stochastic calculations in order to correctly value the time value of options and guarantees for products with embedded options.
- For products with or without any interactions between assets and liabilities, ALS can be used to get a better understanding of the impacts of the asset allocation of the company.

- The ALS has been designed with an architecture and a coding approach that is optimized to minimize run times. This approach is quite different from that used within Prophet Liability.

Case Study – Hong Kong based life insurer

Introduction to ALS - Why use ALS ? (1/3)

Need ALS library	Don't need ALS library
• Model traditional life products (endowment, whole life, universal life) with participation • Measure impact of different new participating products (define the profit sharing strategy, the level of guarantees, perform some stress tests such as a dynamic lapse rate) • Model the assets correctly (segment approach) • Measure impact of different investment strategies (modifying of the existing asset portfolio, modifying the existing investment strategy) • Perform the calculation of risk-based capital measures	• Project only deterministic cash-flows (death benefits, mathematical reserves, expenses, etc…) • Model investment-linked business, group business, traditional business without participating mechanism (assuming no dynamic policyholder behaviour)

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Case Study – Hong Kong based life insurer

Introduction to ALS - Why use ALS ? (2/3)

- Prophet ALS ’s has many uses :
  - Valuation of book value / market-consistent value / fair-value cash flows (EV, MCEV, IFRS)
    - Including Time value of future options and guarantees
  - Calculation of risk-based capital
    - RBC capital,
    - Solvency II capital,
    - Internal model capital
  - Measure impacts of various strategies
    - Investment strategies,
    - Asset/liability risk surveys,
    - Acquisition of a new portfolio
  - Valuation of new business, incorporating the projection of complete revenue accounts and balance sheets

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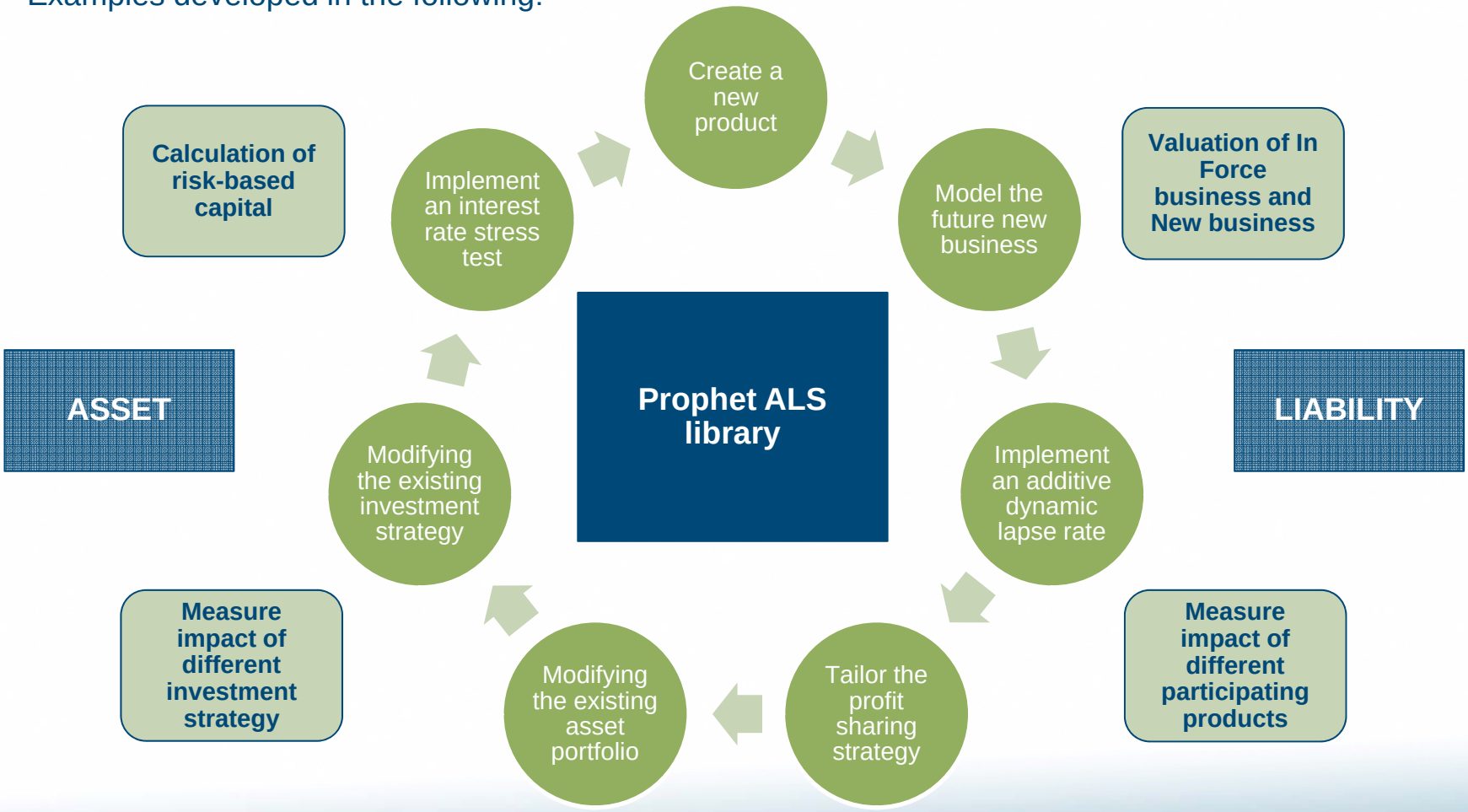
Case Study – Hong Kong based life insurer

Introduction to ALS - Why use ALS ? (3/3)

- Examples developed in the following:



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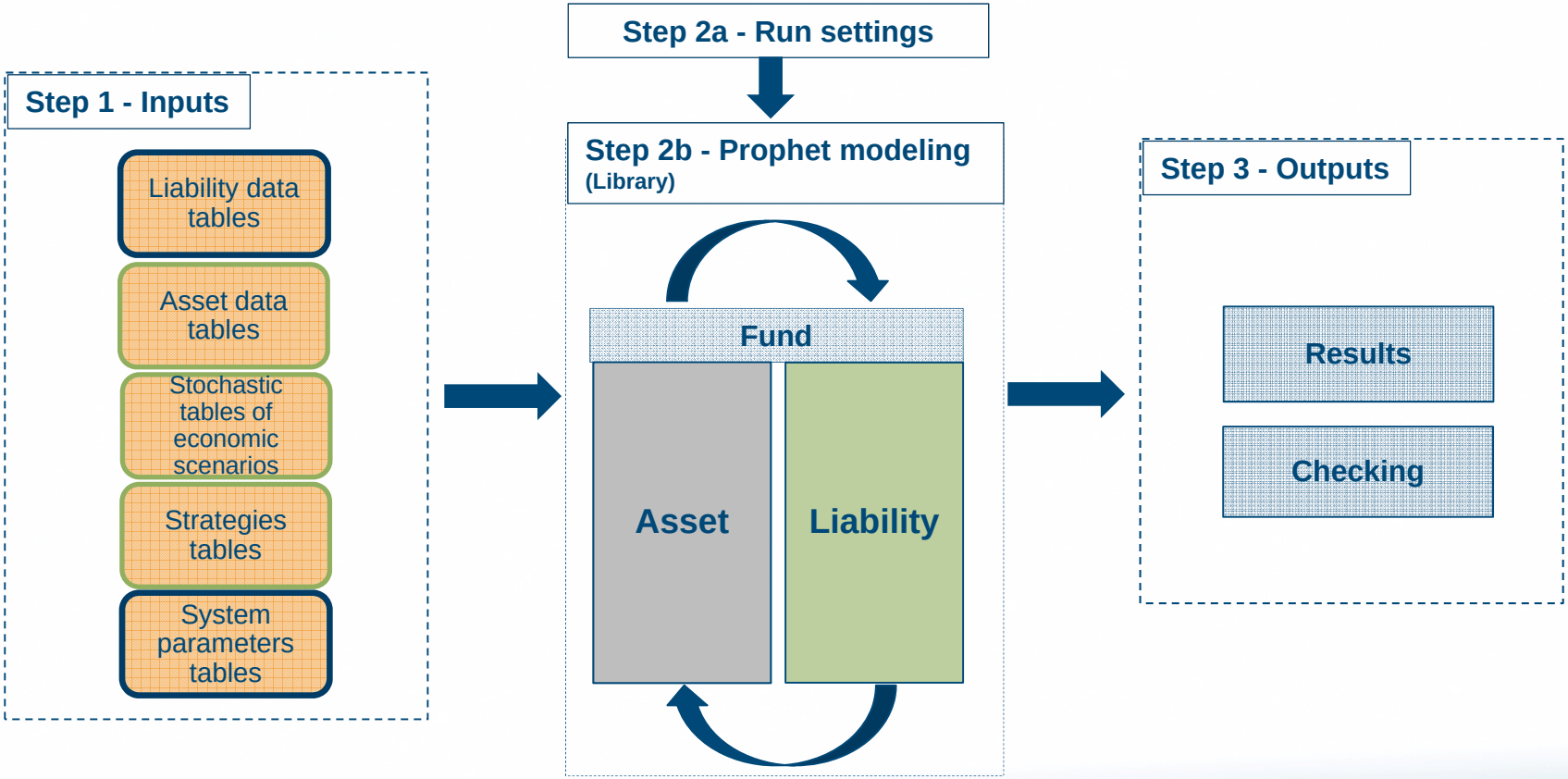
Case Study – Hong Kong based life insurer

Introduction to ALS - Model Architecture

- Prophet ALS architecture can be split into three different levels :



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Case Study – Hong Kong based life insurer

Introduction to ALS - standard Prophet vs ALS

- The model structure and the approach to coding between standard Prophet and ALS is very different

Type	Standard Prophet	Prophet ALS
Indicators	Many indicators to select product features	Very few indicators : all the code is used for every model
Tables	No pre-defined table structure exists	Pre-defined tables structure : Extensive use of parameters to define the model structure
Type of code	Primarily “formula” definitions	Primarily “extended formula” definitions

- The combination of these implies that for ALS, as opposed to standard Prophet,
  - The entry cost is higher as the user must understand the pre-defined table and code structure to be able to make changes
  - Code is less easily debugged (the Diagram View is less useful that for standard Prophet)

- However, the model is very standardised which means that once someone understands ALS that knowledge is easily transferrable to all ALS models

Case Study – Hong Kong based life insurer

Setting up the model – Prophet ALS – Bonus declaration

- The setting up of the model to adequately take into account the bonus is a vital element of any ALM study

- The bonus rules were set up as follows :
  - Asset shares rolls up with the book value of assets
  - Calculation of the adequacy ratio : Asset shares / GPV assuming current bonus levels and base shareholder transfers
  - If the adequacy ratio is between 95% and 110%, then no change is made to the bonus rate.
  - If the adequacy ratio is outside this range, then the bonus rates are increased or decreased to bring the adequacy rate back to 100%
  - The bonus rates can only be decreased by a maximum step of 0.25% per annum (policyholder reasonable expectations). Bonuses can be increased by 0.5% per annum

- Transfers are made to shareholders when bonuses are paid based on the following formula :

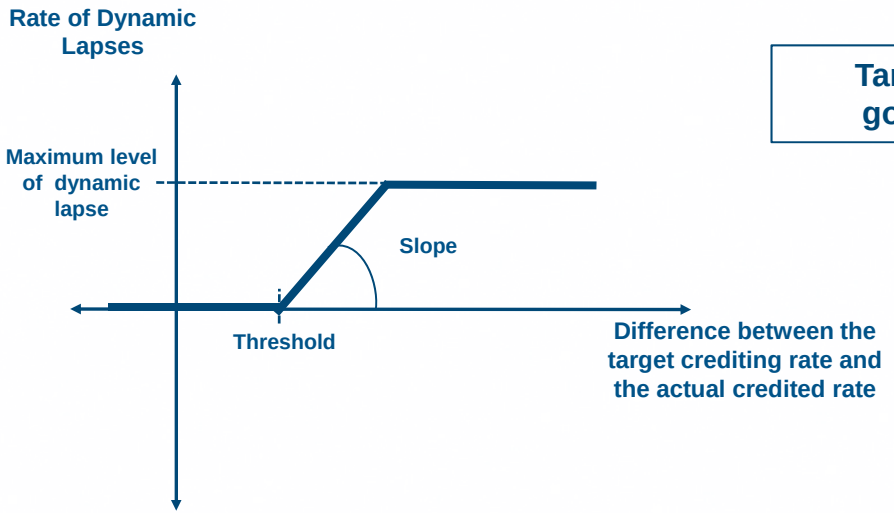
$$\frac{ShareholderShare}{1 - ShareholderShare}$$

- The base shareholder share is equal to 80%.

Case Study – Hong Kong based life insurer

Setting up the model – Prophet ALS

- The dynamic lapse function is the following :



Target crediting rate = 15 year government bond rate - 0.5%

  - Maximum level of dynamic lapses = 30%
  - Slope = 5
  - Threshold = 1.5% + Surrender Penalty / 4

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Case Study – Hong Kong based life insurer

Setting up the model – Prophet ALS

- The asset strategy that is built into the model is the following :
  - The target allocation is defined on a book value basis
  - If at the end of the period, the net cash generated over the period from assets (redemption payments, coupons, dividends) and liabilities (premiums less benefits less commissions and expenses) is :
    - Positive : Assets are purchased as a function of the difference between the current allocation and the target allocation. In this situation, no asset sales are made (avoids
    - Negative : Assets are realigned fully back to the target asset allocation
  - If bonds are to be purchased, a portfolio of two bonds are purchased
    - A 7 year bond, and
    - A 12 year bond

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Risk appetite framework

- Below is the companies risk appetite framework :

Measure	KRI	Stress	Limits
Value	Present value of future profits	95th percentile of stochastic scenarios	Must be positive
Earnings	Accounting profit over first 5 years	Average of scenarios	Greater than previous year's profit
		95th percentile of stochastic scenarios	Maximum loss of 50M
Capital	Solvency I capital	95th percentile of stochastic scenarios	CAR >100% for all years
Liquidity / cashflow matching	A – L gaps in first 10 years	Guaranteed cashflows Fixed interest bonds	No negative values
		All asset classes Combined stress : increase 50% lapses and 50% of expected new business volumes	No negative values

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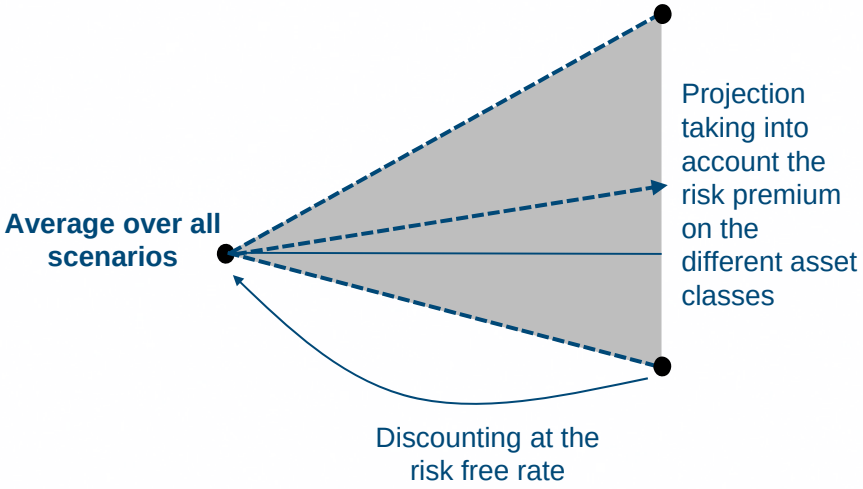
Performance and risk indicators

Performance indicator

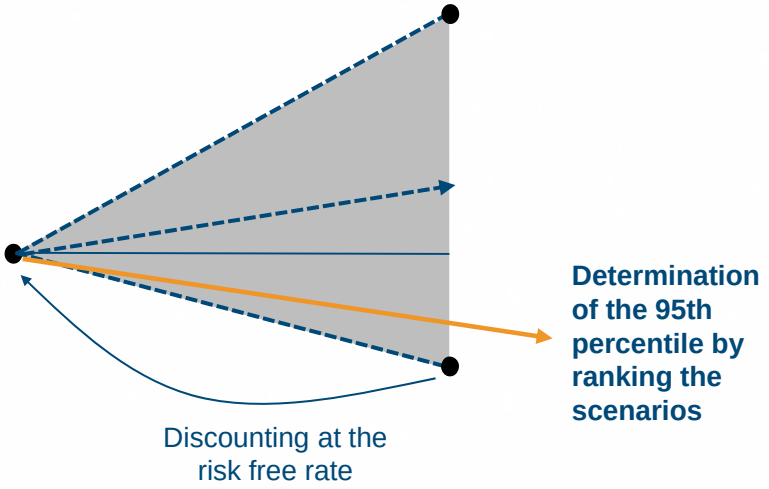
- Average over 1000 stochastic scenarios, the present value of the future projected results over a 30 year time horizon



- This indicator is simlar to an MCEV type indicator except that it includes the risk premium – in other words it is not "market consistent"

Risk indicator

- The 95% percentile of the present value of the future losses over the 10 year projection period



- This indicator gives an understanding of the losses that will accrue to the company in a 5% percentile situation

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- Current asset mix

Asset Class	Book Value	%	Market Value	%
Fixed Interest bonds	47 698.6	*75%*	49 896.6	*75%*
Floating rate and inflation linked bonds	3 094.5	*5%*	3 189.1	*5%*
Equities and equity funds	7 495.0	*12%*	7 390.5	*11%*
Alternative investments	1 327.8	*2%*	1 268.6	*2%*
Property	3 900.3	*6%*	4 304.7	*6%*
Cash	269.4	*0%*	287.8	*0%*
Options	120.4	*0%*	123.7	*0%*
Total	**63 906**	***100%***	**66 461**	***100%***

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Economic assumptions and allocations tested

- Economic Assumptions

	Risk premium	Volatility	Dividend
Equities	400bp	20%	3%
Property	200bp	10%	4%
Others	170bp	1.6%	3.5%

- Asset allocations tested

Asset Classes	Combinations of
Equities	8% - 16%
Property	3% - 11%
Floating Rate Bonds	4% - 12%
Fixed Rate bonds	85% - 61%

Plus additional extreme scenarios
Property = 0%
Equity = 0%
Floating rate bonds = 0%
Equity = 25% and Property = 0%
Equity = 20%, 22%, 30%, 40%, 55%

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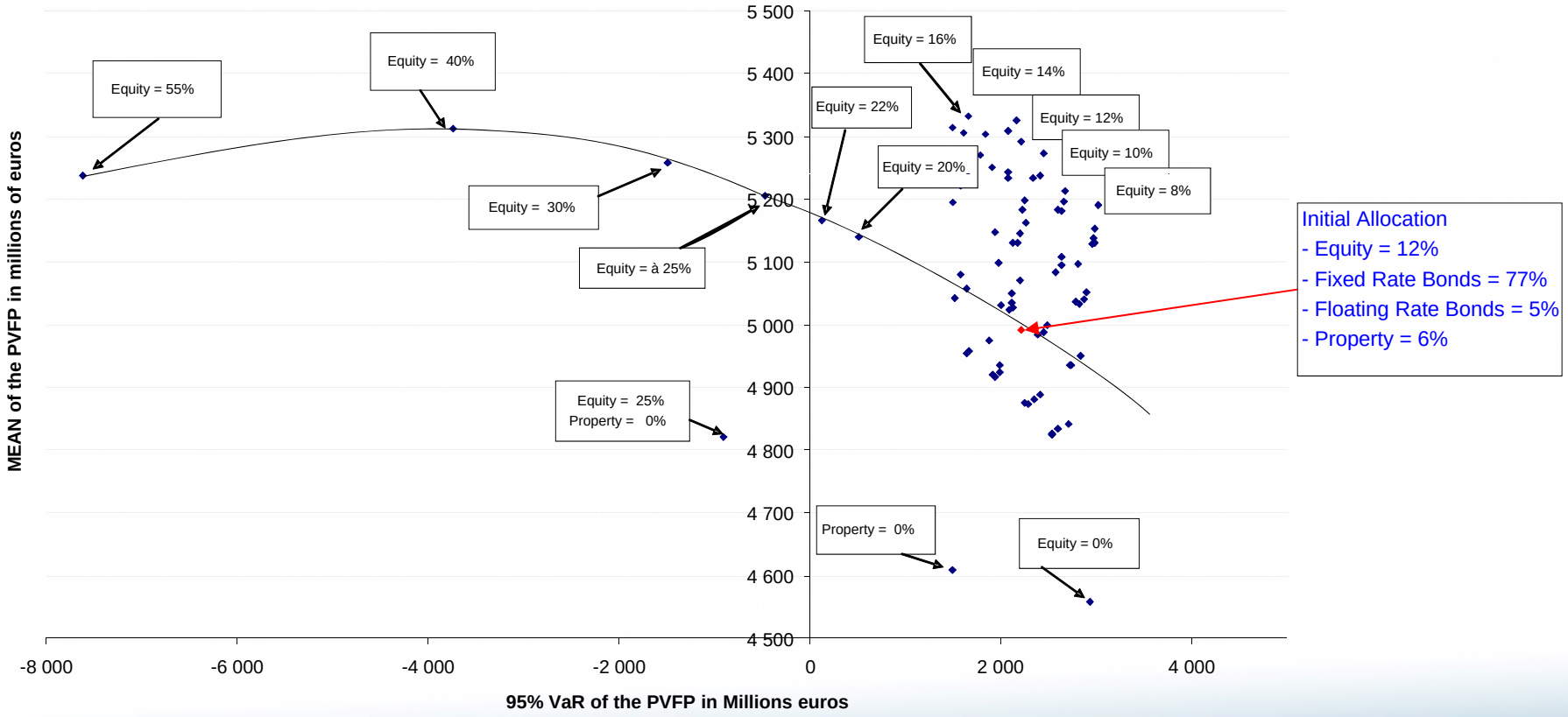
- Presentation of the efficient frontier : 95% VaR vs Mean of the PVFP



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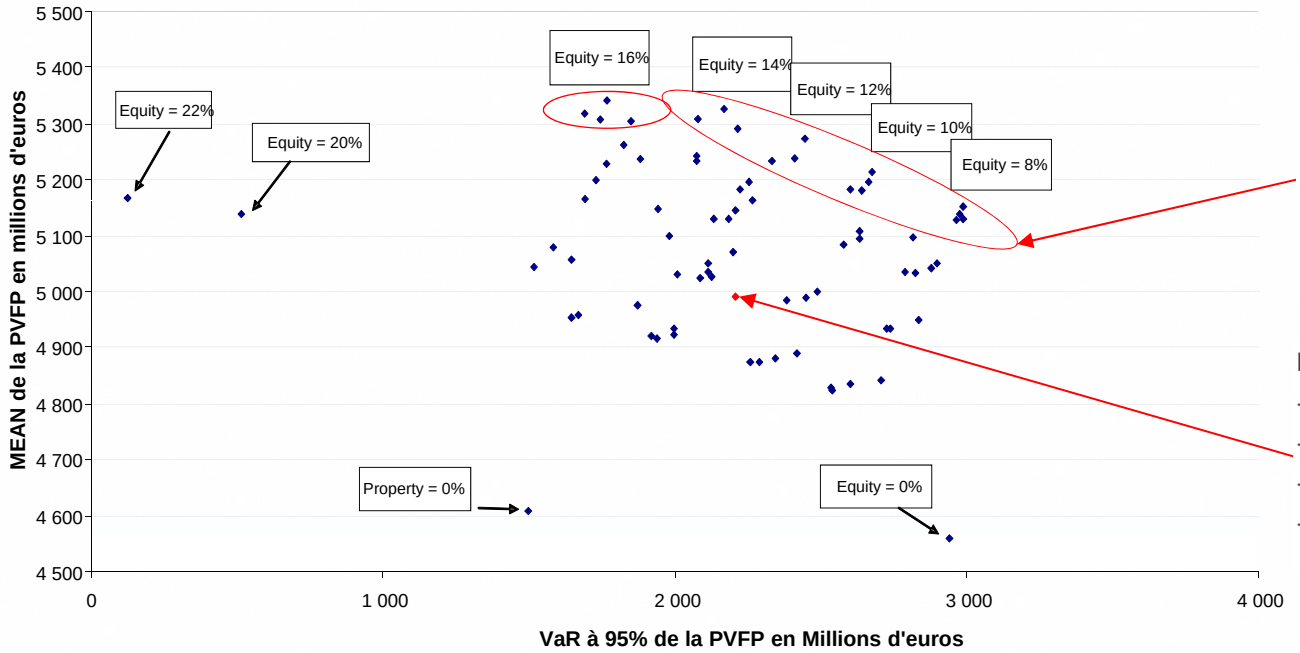
- **Constraint 1** : Risk Measure > 0



Optimal Allocations
- Equity = 8-16%
- Fixed Rate Bonds = 63-71%
- Floating Rate Bonds = 10%
- Property = 11%

Initial Allocation:
- Equity = 12%
- Fixed Rate Bonds = 77%
- Floating Rate Bonds = 5%
- Property = 6%

- **Potential allocations**
  - Efficient frontier : Equity between 8% and 16% - Property increased to 11%, floating rate bonds increased to 10%
  - Equity = 16% although on efficient frontier very little additional upside

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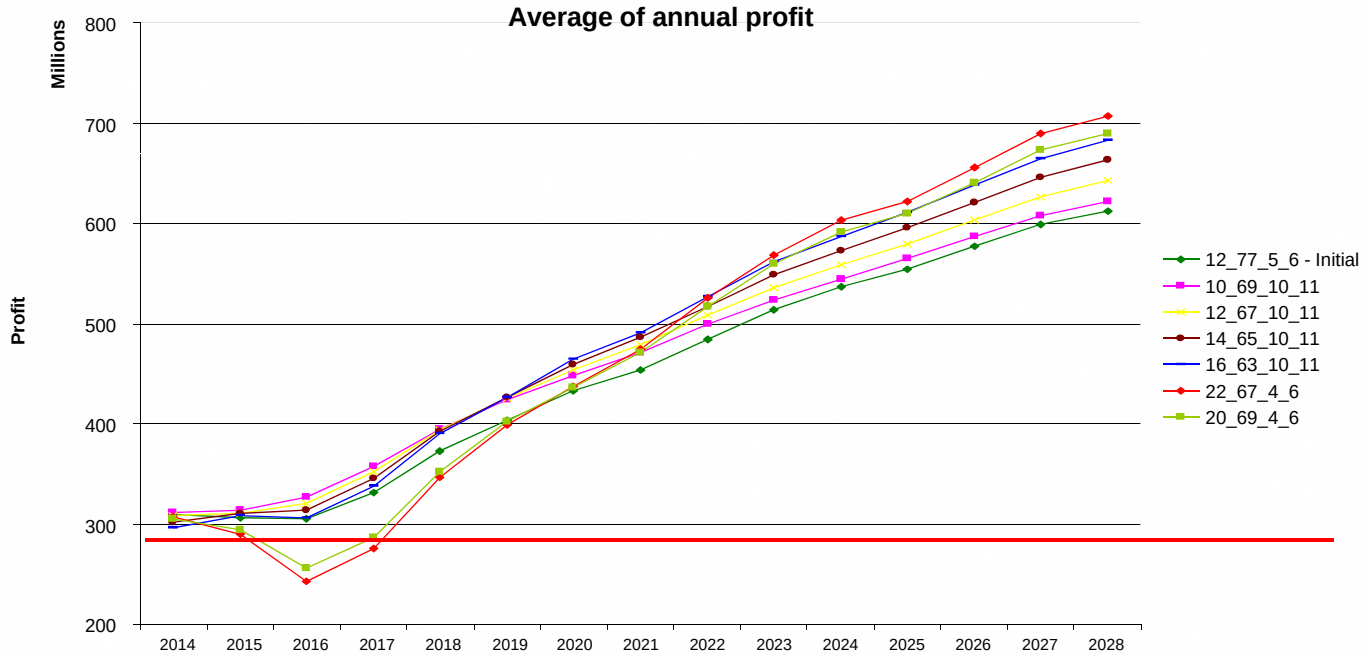
- **Constraint 2** : Average profit does not drop by more than 10% of the previous year's profit



- **Potential allocations**
  - Equity 10% - 16%

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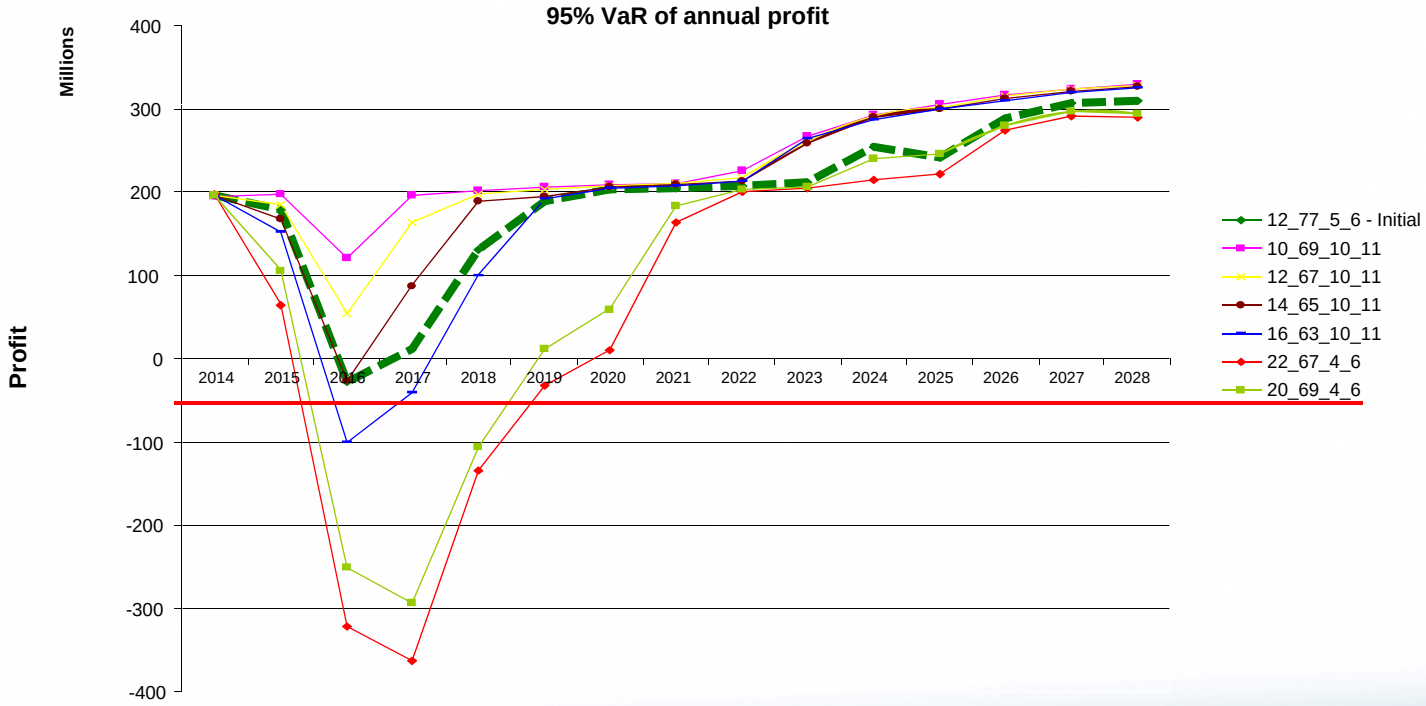
- **Constraint 3** : Maximum accounting loss in any year of 50M in stress scenario
  - The accounting loss is driven by a combination of the mark-to-market on the equity portfolio and widening of credit spreads



- Results : Valid allocations : Equity 10% - 16%

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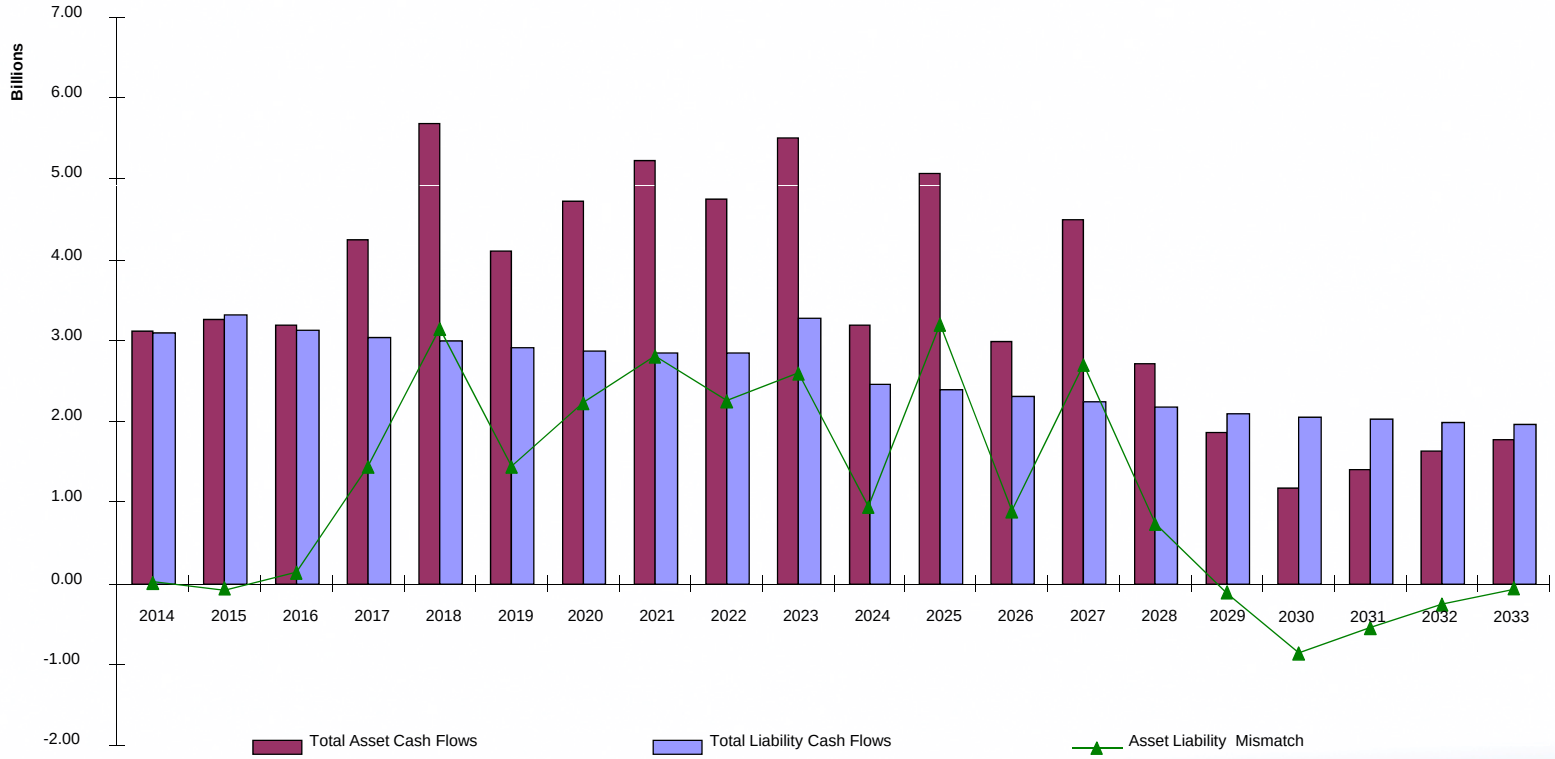
- **Constraint 4** : Cashflow matching – guaranteed cashflows only + fixed income assets (equity = 14% allocation)



- **Result** : OK for equity = 14%

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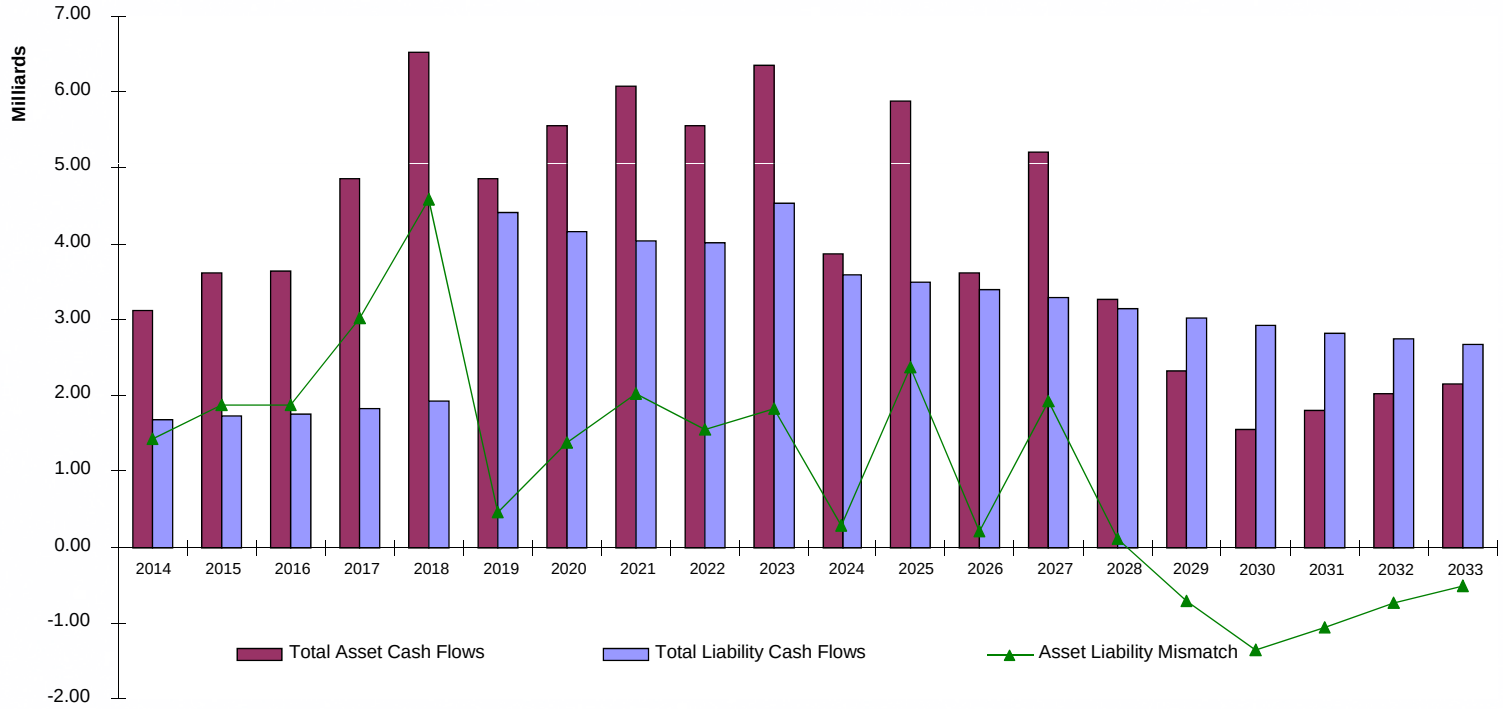
- **Constraint 5** : Cashflow Mismatch – assuming 50% increase in lapses and 50% of expected new business volumes (equity = 14% allocation)



- **Result** : OK for equity = 14%

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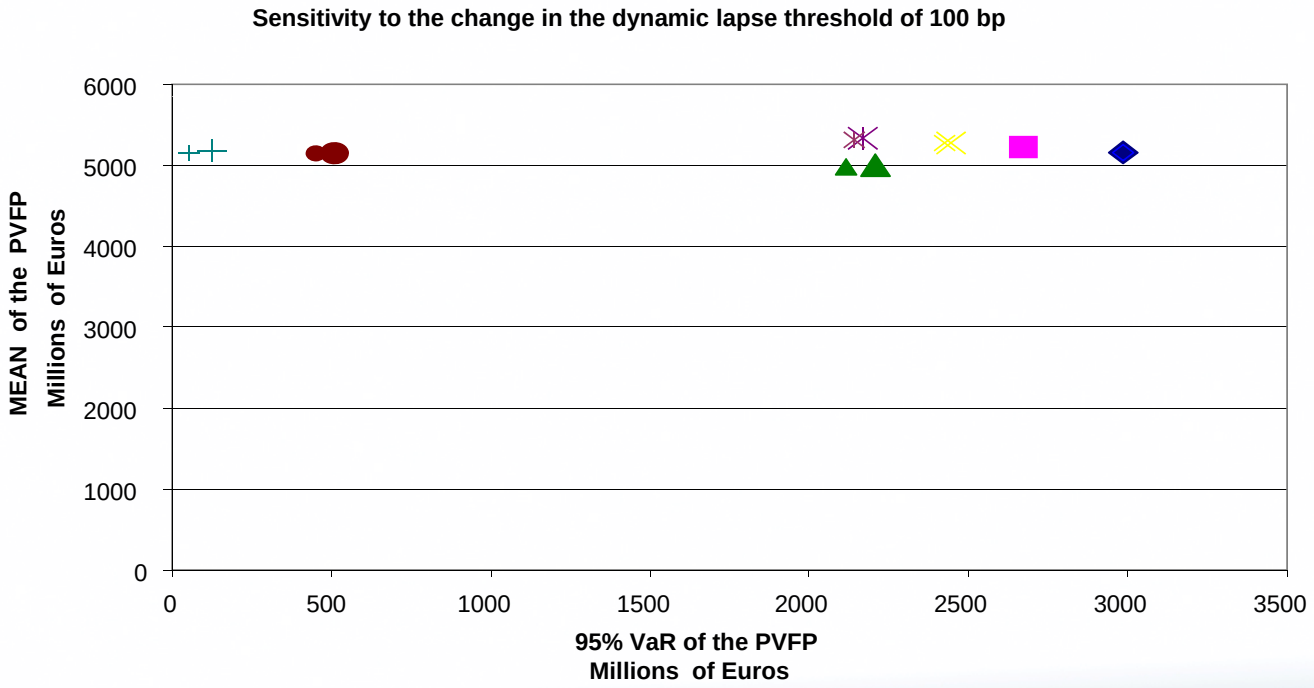
- In addition to the base analysis, it is important to test that the the key findings are not invalid if some of the key assumptions are modified
- Sensitivity 1 : Dynamic lapse parameters



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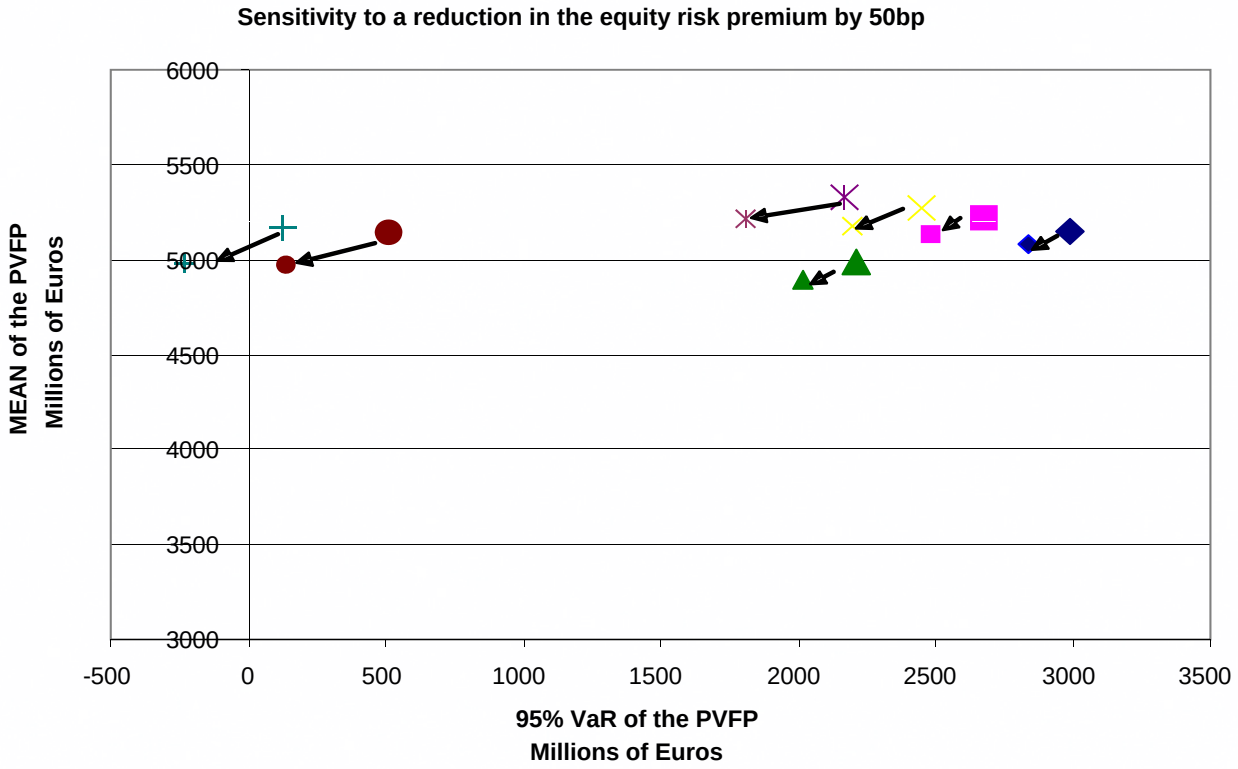
- Sensitivity 2 : Reduction of the equity risk premium



- Both sensitivities show that no significant change occurs to the order and overall conclusion

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- The final recommendation for the asset allocation is :

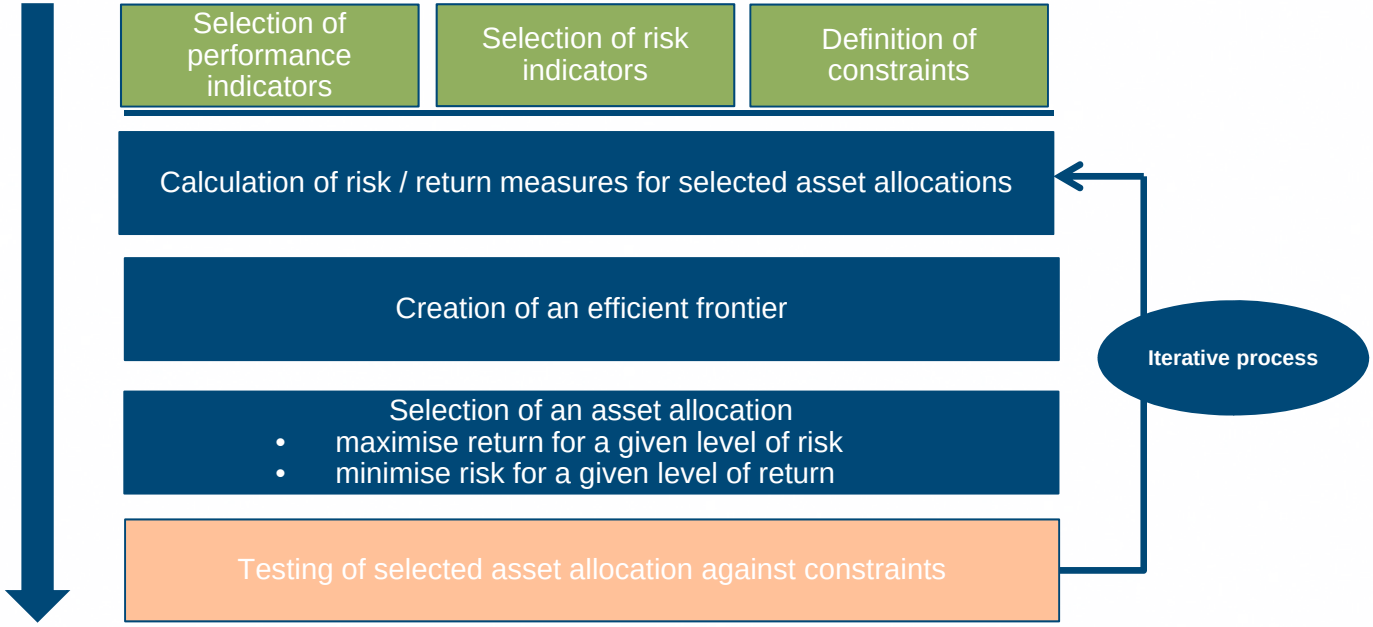
	Initial	Target	Range
Equities	12%	14%	12 - 16%
Property	6%	11%	8 - 11%
Floating rate bonds	5%	10%	7 - 10%
Fixed rate bonds	77%	65%	63% - 72%

- The increase in the risky assets earned significant upside for both the shareholder and policyholder with only a small increase in risk.
  - Low minimum guarantees means increased risk can be taken without significant downside for insurer
  - Improved diversification between asset classes helps improve overall returns and reduce risk
  - Property acts similarly to long term bonds as long as the company faces no liquidity risk
  - Floating rate bonds help provide protection against dynamic lapses and additional liquidity buffer in case of need

ALM Principles and the ALM framework

Conclusion

- This presentation has focused on creating an efficient frontier to select the asset strategies



- In fact, a true efficient frontier can sometimes be difficult to draw, but the approach provides a comparative framework for making any asset related decisions :
  - Evaluation of hedging strategies
  - Duration of asset purchases
  - Corporate versus government bond strategy

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