4th Webinar on Life Insurance

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Dynamic and Integrated ALM and investment management for life insurers

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Definition of ALM for life insurers

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The Society of Actuaries ALM Principles Task Force provided the following definition for ALM:
"Asset Liability Management is the ongoing process of formulating, implementing, monitoring, and revising strategies related to assets and liabilities to achieve financial objectives, for a given set of risk tolerances and constraints"

- While managing the risks associated with the assets and liabilities remains a key focus of ALM, it is not solely a compliance exercise where the only goal is risk mitigation.
- ALM has a more strategic role to achieve the financial objectives of an entity.
- ALM is less concerned with absolute risk than relative risk.
- Consider a highly volatile asset portfolio whose market value is subject to large swings. On a standalone basis, this portfolio may have a high absolute risk. However, if this portfolio is backing liabilities whose value changes by the same amount for a given change in a financial variable, then the relative risk associated with the assets and liabilities is what matters.
- This is the reason why an "asset-only" asset management approach for insurance portfolios is inappropriate

Scope of ALM for life insurers

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The scope of ALM varies from company to company. While historically, at least for the life insurance industry, ALM has been synonymous with interest rate risk management, there are many other financial risks associated with the assets and liabilities.

Interest rate risk

Economic risk associated with PV of cashflows, MTM asset risk, re-investment risk, guarantee risk

Liquidity risk

Lack of access to liquid assets to cover cash shortfalls (claims, lapses, catastrophic events)

Market risk

Risk of market / price movements associated with Equity and non-fixed income asset classes

Credit risk

Counterparty default risk and credit spread / migration risk (Corporate bonds)

Currency risk

FX mismatch between assets and liabilities

Objectives of an ALM function within a life insurance company

Liability-asset management

Design **asset profiles / investment strategies** that reflect nature and volatility of the liability profiles

Manage liquidity risk

Ensure liquidity mis-matches and **cashflow gaps** are with-in acceptable ranges

Manage interest rate risk

Immunize **portfolio** to changes in **interest rates** and **minimize duration** gaps

Satisfy regulatory and internal constraints

Asset allocation needs to be within the **limits / constraints defined by regulators and / or internal stakeholders**

Protect economic value and earnings

Protect economic surplus (networth) and net earnings across various scenarios

Optimize risk-adjusted return on capital

Ensure that the asset portfolio is generating **required return** to compensate for the **risk taken** and **associated capital consumed**, if any

Factors impacting ALM strategy of a life insurer

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Multiple factors impact the investment portfolio construction and maintenance

Availability of instruments

- Availability of investment products allowed by the regulator.
- Availability of derivatives to manage risk and return in the investment portfolio

Environmental factor

Market liquidity

- Liquidity of the instruments available in the market
- Ability to liquidate the holdings in case of a urgent cashflow requirement

Environmental factor

Cashflow variability

- Stability of demand and supply i.e. variability in the cashflow projections vs. cashflow realization
- Frequency of change

Internal factor

Company's risk appetite

- Maximum amount of risk the company is ready to assume, as approved by risk management committee
- Capital allocation

Internal factor

Regulatory constraints

- Regulatory constraints on:
  - Exposure to counterparties
  - Risk assumption
  - Segregation of cashflows

Environmental factor

Return expectations

- Expected return from the investments
- Stability of the expected return
- Return expectation vis-a-vis benchmark return

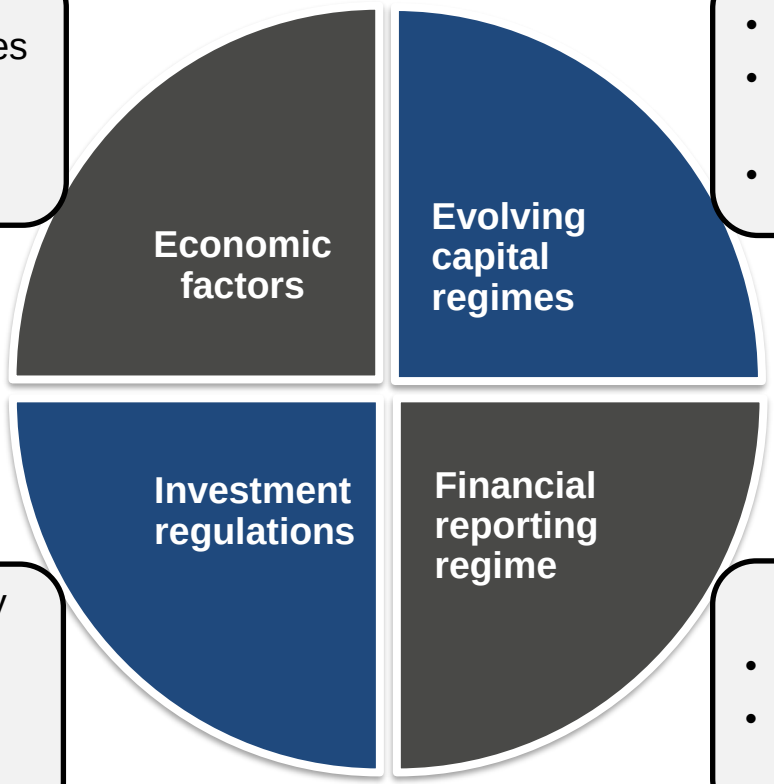
Internal factor

Environmental factor Not in control of management

Internal factors Depends on Company's management strategy and investment objectives

Key drivers behind ALM evolution across the global insurance industry

- Unprecedented interest rate increases and inflation
- Increased equity volatility



- Risk-based capital
- Move from standard to internal models
- Capital allocation

- Solvency II – Liability driven investment
- Local investment regulations become more liberal

- IFRS 17
- IFRS 9

Evolution in ALM risk metrics + **Evolution in ALM framework**

Evolution of ALM risk metrics – Interest rate risk

Metric	Description	Complexity
Macaulay duration	▪ *Time weighted PV of cash flows divided by the PV of the cash flows. Measured in number of years and represents weighted average time taken for cashflows to run-off*	
Modified duration	▪ *Interest rate sensitivity in percentage terms of the present value of a series of cash flows. E.g, if the Modified Duration of an asset is 10, then for a 1 basis point increase in interest rates the market value of the asset will decline by approximately 0.1%.*	
PV01	▪ *Interest rate sensitivity in amount terms of the present value of cash flows for a 1 basis point change in interest rates.*	
Partial PV01 analysis	▪ *Can be calculated by partitioning the yield curve by term to maturity and for each term to maturity shocking the yield to maturity up and down, linearly interpolating to the next term to maturity and the prior term to maturity.*	
Convexity	▪ *Measures the rate of change of duration. Duration only provides an approximation of the price sensitivity to changes in interest rates. The precision of the approximation deteriorates as the change in interest rates increases. Including convexity improves the approximation.*	
Non-parallel interest rate stress testing	▪ *Usage of non-parallel shock scenarios to assess impact on earnings and economic value of balance sheet*	

Evolution of ALM risk metrics – Liquidity risk

Metric	Description	Complexity
Cashflow matching	▪ *Examines how well matched the asset and liability cash flows are and provides insight into the liquidity exposure*	
Cumulative cashflow mismatch analysis	▪ *Projection and bucketing of cash inflows and outflows across various time buckets. Computation of net cumulative cashflows for various time buckets (0-1 year, 1-3 year, 3-5 year etc.) with appropriate limit thresholds*	
Survival horizon	▪ *Survival horizon indicates number of days left for insurance company to sustain business operations without raising additional funding / capital*	
Liquidity coverage ratio (LCR)	▪ *Computing ratio of highly liquid assets to net cash outflows over a short-time horizon under a stressed liquidity scenario*	
Early warning indicators and contingency planning	▪ *Usage of marked-linked and economic indicators which can be tracked to pro-actively identify liquidity risk signals* ▪ *Contingency funding plans covering aspects such as available liquid assets, order of liquidation, estimated haircuts, turnaround liquidation time-horizon etc. under severe stressed scenarios*	

Evolution of ALM frameworks: Traditional vs Dynamic ALM

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Traditional ALM → **Dynamic ALM**

- Focus on short-term earnings and not on economic value
- Subjective and deterministic scenarios based on manual judgement
- Does not capture correlation between various risk factors
- Assumption of static portfolio which does not capture growth forecasts and reinvestment assumptions
- Asset allocation is independent of liability cashflow profiles

- Focus on earnings and economic value
- Objective scenarios based on statistical and stochastic modelling
- Captures correlation between various risk factors
- Dynamic evolution of balance sheet covering growth forecasts, reinvestment and hedging strategies
- ***Asset allocation is driven by liability cashflow profiles and optimization constraints***

Liability driven asset portfolio – Why it is different

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Inputs

Liability pool cashflow data

Expected return (incl. guarantees)

Regulatory constraints

Internal constraints

Market information

Parameters and portfolio constraints

Determine the parameters from the liability pool:

- Expected return
- Expected cash flow
- Liquidity expectations
- Cashflow variabilities

Define the portfolio constraints such as:

- Type of allowed instruments and limits
- Counterparty credit risk limits
- Maximum Liability asset mismatch allowed
- Risk appetite – capital allocated for investment portfolio

- Instrument universe for each type of allowed investments and instrument details
- Market liquidity – average traded volume
- Tradable volume for each security

Investment Objective includes factors other than only return maximization.

Optimization engine for creation of model portfolio

- Start with a **default portfolio** and run the optimization equation with the objective of maximizing return within the constraints defined
- **Expert judgement-driven overlay** to ensure model portfolio is tradable

End-state dynamic and integrated ALM and investment mgmt. framework for life insurers

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8 Performance assessment of overall investment portfolio

- Target return and KPIs
- Allocated funding, opex and capital as per budget
- On-going monitoring and variance analysis
- Re-balanced allocation of assets basis final KPI assessment

7 ALM reporting: Creation and generation of ALM reports for regulatory submission and internal MIS

6 On-going risk measurement: Usage of risk measurement models to quantify risks within each pool

- Liquidity risk
- Interest rate risk
- Market risk
- Credit risk

5 Hedging framework: Selection and usage of hedging instruments such as derivatives to reduce risk within a pool

- Forward rate agreements
- Interest rate futures
- Interest rate swaps

4 Asset allocation and optimization: Purchase and allocation of investment assets based on constraints

- Government bonds
- Corporate bonds
- Treasury bills
- Certificate of Deposits
- Commercial papers
- Equity

3 Constraint Definition: Define Investment constraints for each liability pool and at overall firm level

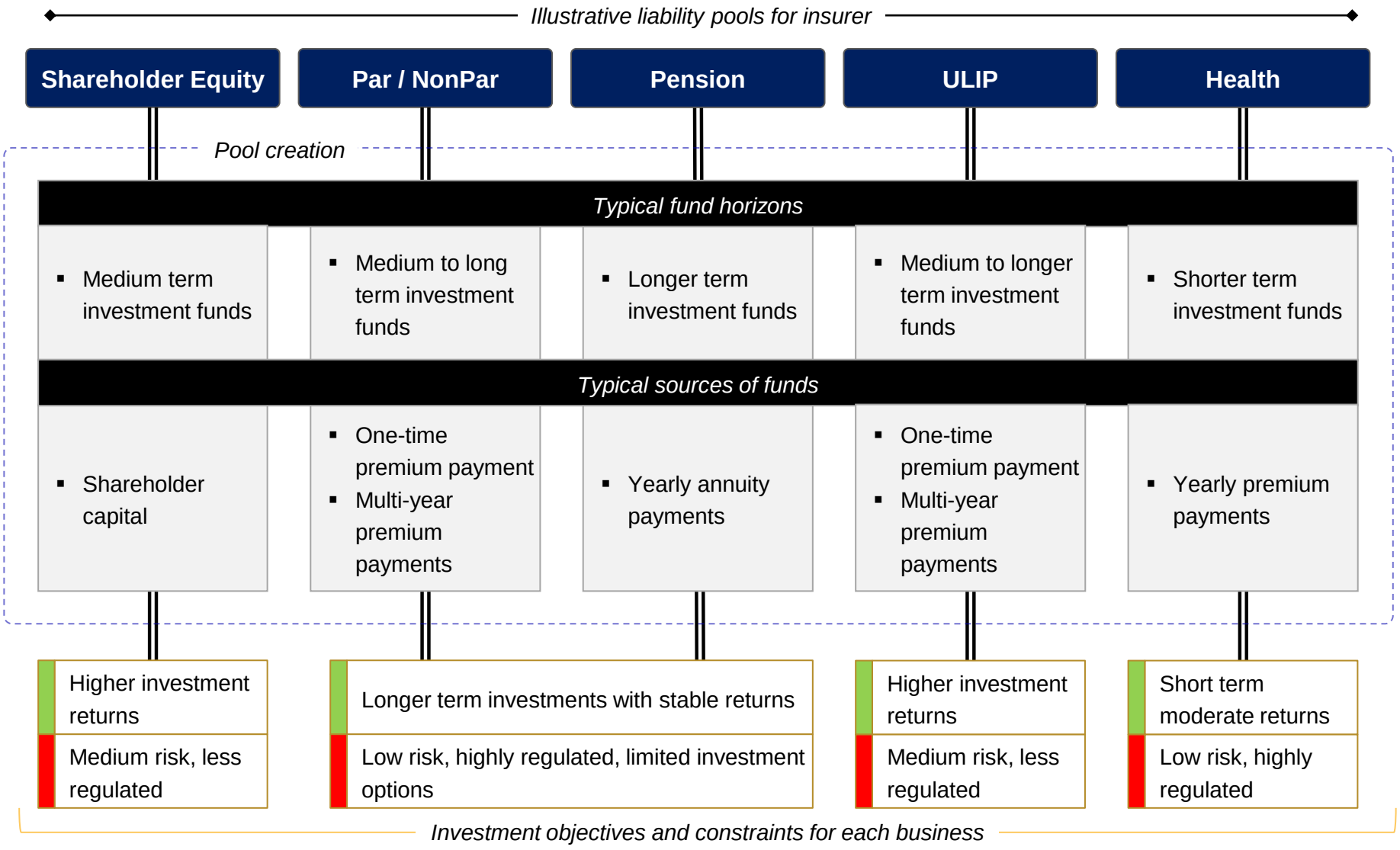
- Asset class
- Industry
- Solvency
- Credit quality
- Liquidity
- Interest rate risk

2 Liability cashflow generation: Use actuarial & cashflow models to forecast and bucket liability cashflows

1 Liability pool creation: Create mutually exclusive and homogenous liability product pools

- Par
- Non-Par
- ULIP
- Health
- Annuity

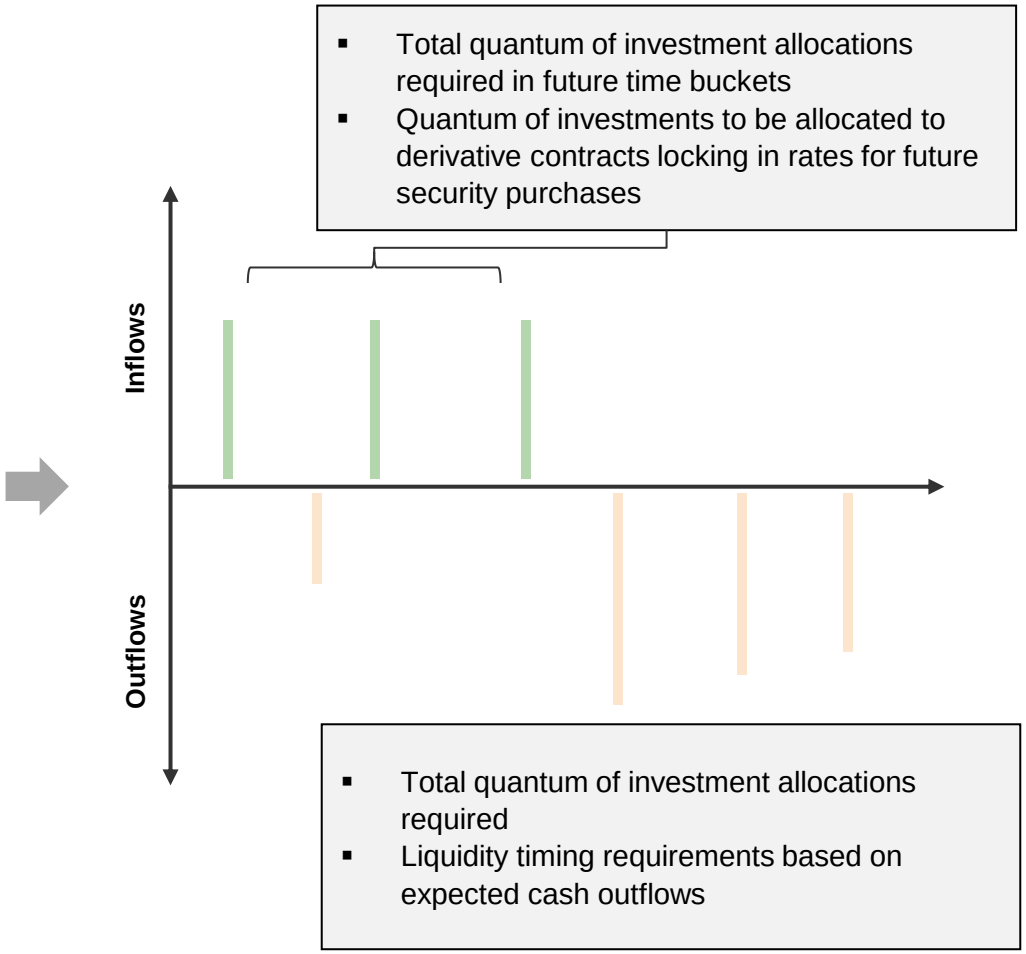
Liability pool identification



Liability cashflow analysis

Liability cashflows will be analysed to derive any cashflow timing requirements given the liability portfolio composition basis which cash inflows and outflows expected is projected by Company's team

Cashflow date	Cashflow type	Amount
7-Jan-2021	Inflow	1,000.00
15-Feb-2021	Outflow	500.00
7-Mar-2021	Inflow	1,000.00
30-June-2021	Outflow	2,500.00
7-June-2021	Inflow	1,000.00
15-July-2021	Outflow	1,500.00
30-Sept-2021	Outflow	1,000.00



Constraint inventory

The investment decisions made by an insurer are governed by regulatory norms and guidelines set forth by management team to ensure prudence and adequate protection of policy holders and share holders from investment risks. *All such regulatorily mandated constraints and internal management constraints are identified through review of applicable regulatory guidelines and insurer's investment and risk policies*

Types of investment constraints considered

- **Product type constraints**
- **Asset class exposure constraints**
- **Credit quality exposure constraints**
- **Industry sector exposure constraints**
- **Liquidity constraints**
- **Interest rate constraints**

Sources of constraints considered

- Insurance Regulatory and Development Authority of India (Investment) Regulations
- Company's Investment Policy
- Company's ALM Policy
- Company's Risk Policy
- Company's Risk Appetite and KRIs

Liability pool constraint mapping

- **Liability pool 1**
- **Liability pool 2**
- **Liability pool 2**
- ....
- ...
- ...
- ...
- **Liability pool n**

Investment option analysis

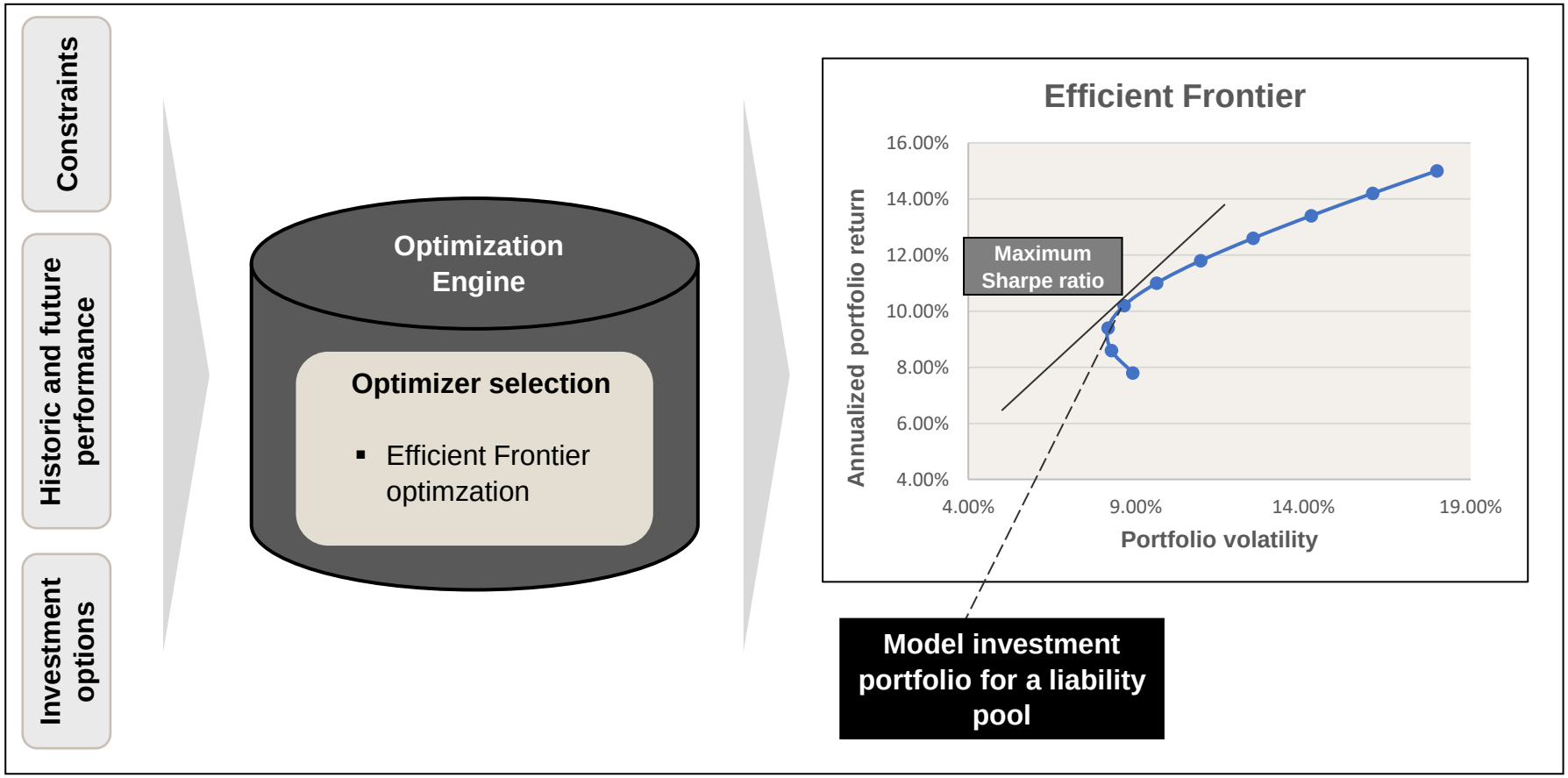
The universe of investment instruments that can be considered for optimal investment portfolio identification for each liability pool are listed down basis Company's investment policy and regulatorily permissible investment securities. These instrument types are then mapped to representative benchmarks for evaluating historic performance and risk characteristics which feed into the portfolio optimization algorithm.

Permissible instrument types*	Proxy benchmarks	Methodology
Government Bonds	FBIL G-Sec Yield Curve	Quoted yields for all liquid tenor points
Corporate Bonds	FIMMDAA Corporate Bond Yield Curve	Quoted yields by sector and rating for all liquid tenor points
Treasury Bills	FBIL Treasury Bill Curve	Quoted yields for all liquid tenor points
Certificates of Deposits	FBIL CD Curve	Quoted yields for all liquid tenor points
Commercial Paper	FBIL CD Curve	Proxy benchmark considered using quoted CD benchmark
Equity	NIFTY 50 Index/ Nifty Bank Index	Broad market indices or sectoral indices adhering with market capitalization requirements
Forward Rate Agreements	FBIL G-Sec Yield Curve	FRA prices imputed from quoted prices for underlying bond

** Illustrative list of instrument types have been considered to depict the methodology being followed. The complete list of permissible securities will be considered for actual analysis*

Optimization model

The optimization model proposed to be considered for optimizing investment portfolio returns is based on Harry Markowitz's 1952 classic paper on portfolio selection[1] which identifies the optimal portfolio sets by the maximum expected returns for a given level of risk measured as portfolio variance.



1 Portfolio Selection, Harry Markowitz, The Journal of Finance, Vol. 7, No. 1. (Mar., 1952), pp. 77-91

Optimization model: Efficient frontier Optimization

As per Markowitz theory, the portfolio optimization problem is to minimise risk subject to a return constraint which can be represented as a convex optimization problem. A convex optimization problem will then be solved using quadratic programming methods available to find a solution to the problem.

Portfolio optimization problem

$$\min_{\omega} \quad \omega^T \epsilon \, \omega$$

subject to $\omega^T \mu \geq \mu^*$

$$\omega^T 1 \geq 1$$

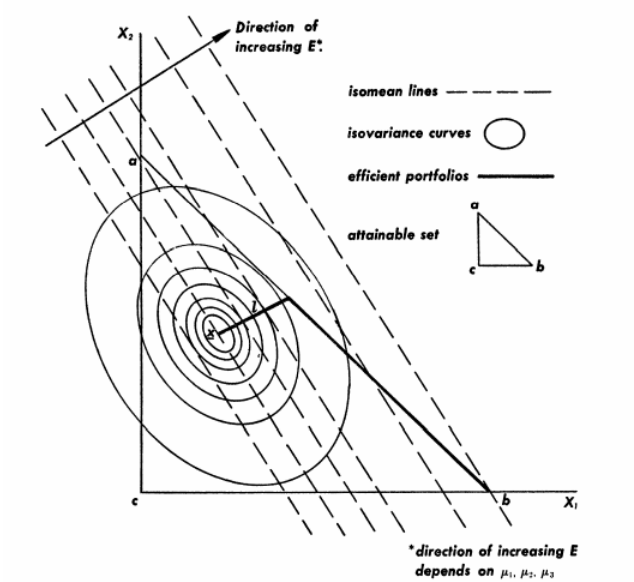
$$\omega_i \geq 0$$

where,

μ: Vector of expected returns

ω: Weight vector of securities

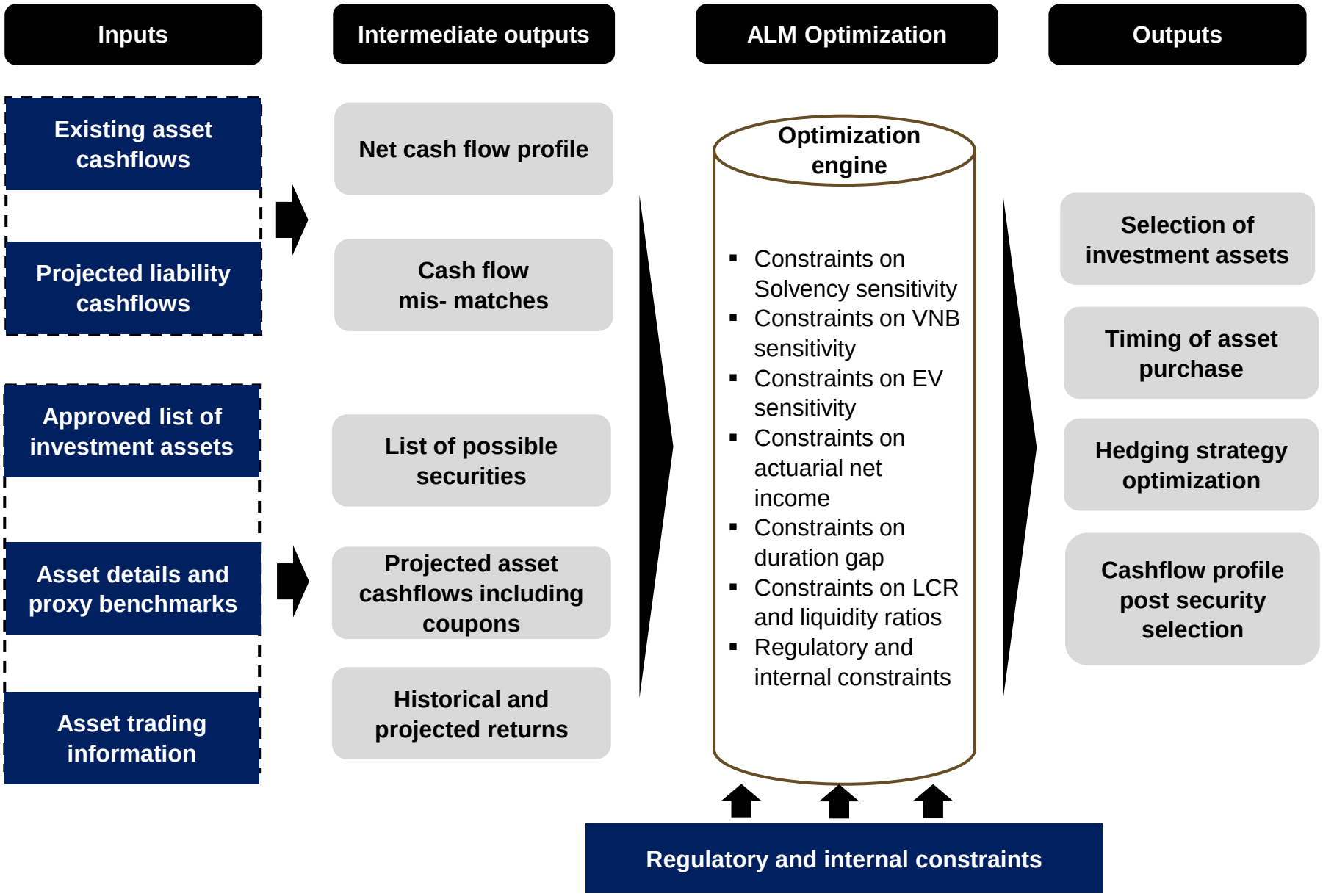
ϵ: Covariance matrix



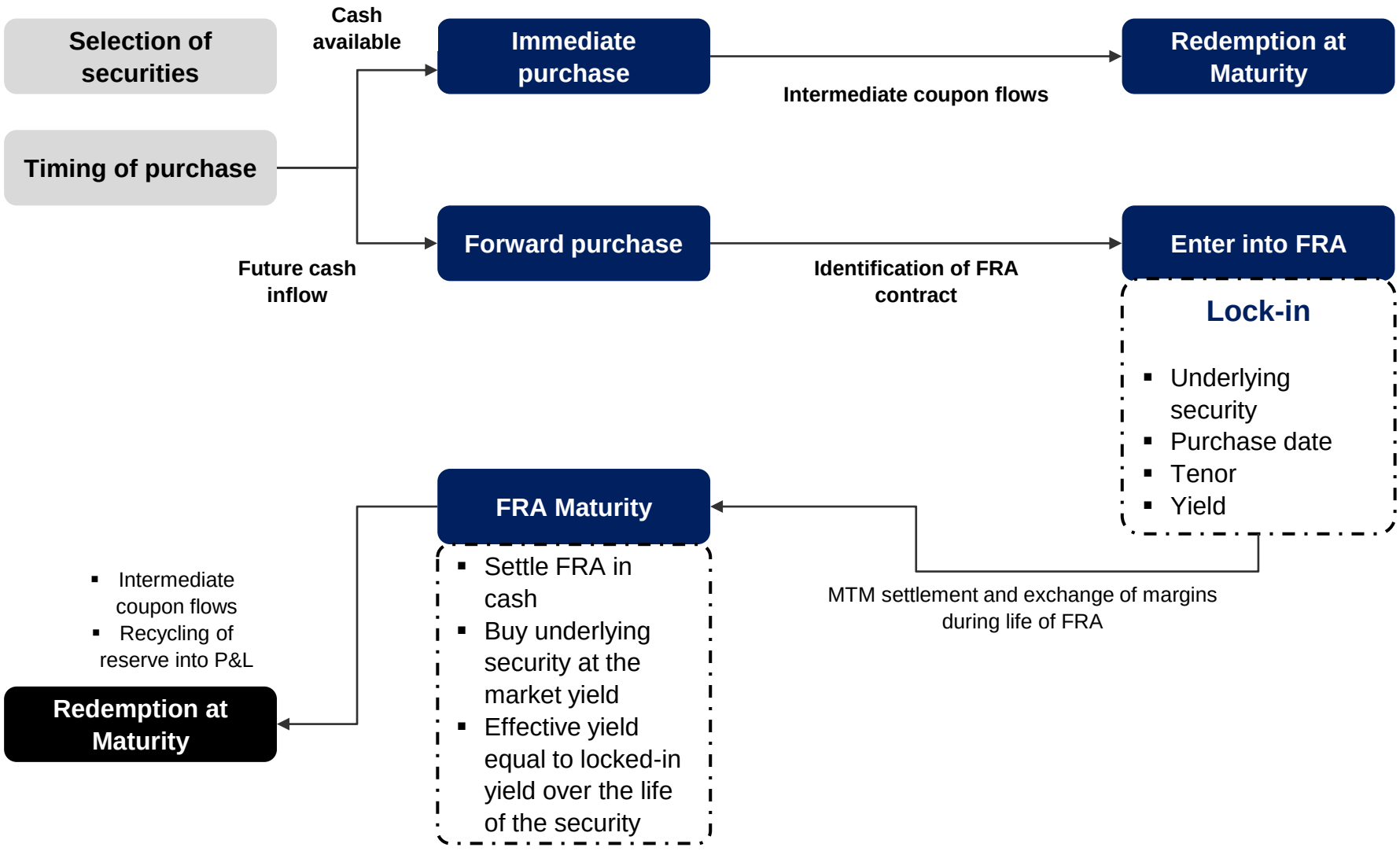
Portfolio optimization problem illustration
(Source: *Portfolio Selection, Harry Markowitz, The Journal of Finance, Vol. 7, No. 1. (Mar., 1952), pp. 77-91)*

The portfolio optimization problem illustrated is a constrained optimization problem with a quadratic objective function.

Optimizing strategic asset allocation



Illustrative example: using forward rate agreements (FRA) to hedge interest rate risk



Investment performance benchmarking flow

One time during the performance period

Ongoing, over the performance period

Select benchmark / define model portfolio

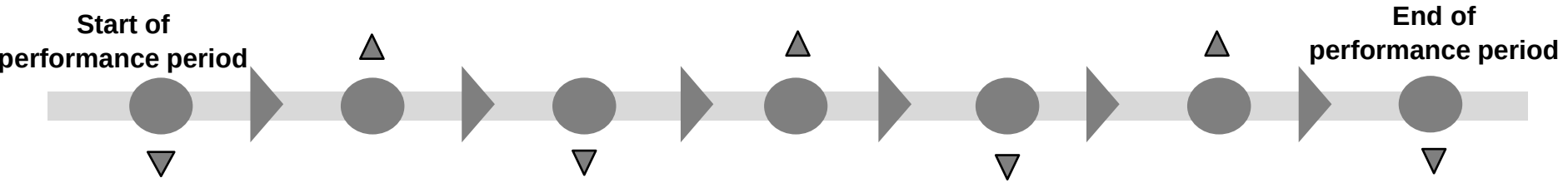
- Select market available benchmark, if available
- Use of optimization engine to define model portfolio for each liability pool
- Validation of model portfolio to ensure adherence to constraints

Actual portfolio

- Get the details of actual portfolio and changes since the start of measurement period
- Calculation of performance measures for actual portfolio

Threshold and limit monitoring

- Threshold set for deviation from model portfolio
- Analysis of attribution and actual portfolio modification reqd. to reduce tracking error



Decide number of liability pools

- Decide number of pools based on the following:
  - Liability profile
  - Guaranteed return level, if any
  - Associated investment fund

Performance measure calculation

- Decide performance measure that can be used for portfolio performance benchmarking
- Calculation of performance measure for the model portfolio

Tracking error

- Computation of tracking error between actual portfolio and model portfolio for each pool.
- Attribution and breakdown of tracking error to find deviation

Re-calibration of model portfolio

- Recalibration of model portfolio is typically done after the end of performance period, which may be one quarter
- It can be done earlier if model re-calibration conditions are met

ALM best practices in other industries such as banking and finance

Listed below are some best practices followed in other industries such as banking, finance and investments from an ALM and investment risk management perspective.

Non-parallel interest rate shock scenarios

Extensive set of non-parallel shock scenarios used to assess impact on both earnings and economic value

Macro-economic modelling

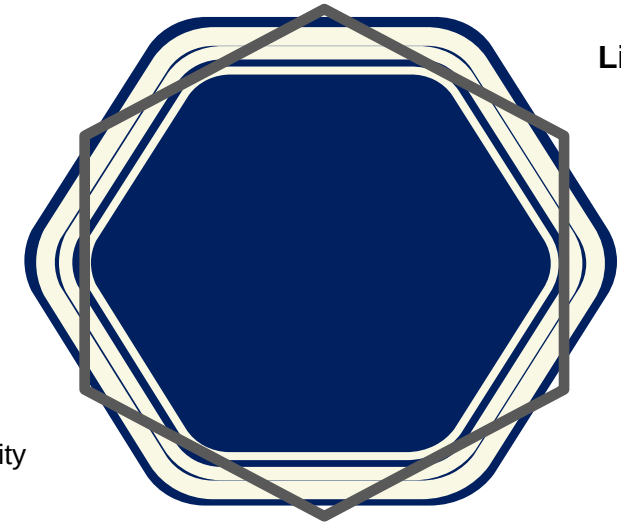
Macro-economic and econometric models used for cashflow projections and ALM modelling

Convexity adjustments

Duration computations adjusted with convexity adjustments for greater degree of accuracy

ALM driven budgeting & planning

Budgeting plans consider impact of ALM mismatches and hedging strategies



Formalized contingency funding plans

Formal and well documented contingency funding plans

Limits on duration and cashflow gaps

Explicit limits on bucket-wise cashflow gaps and duration gaps

Usage of Expected shortfall

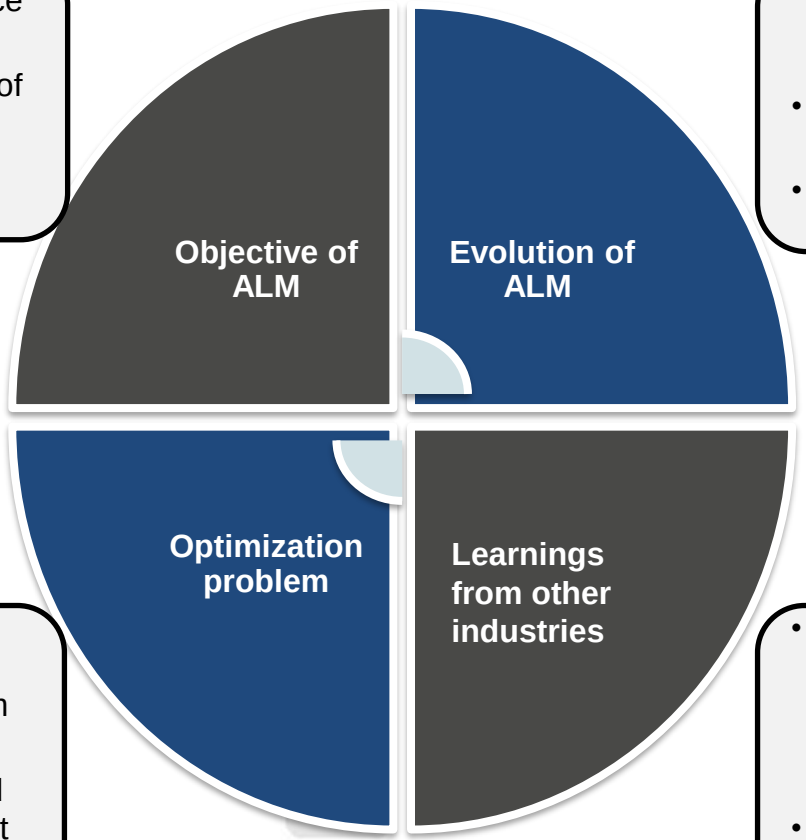
Usage of expected shortfall instead of VaR to better capture tail risk

ALM risk linked with risk appetite

Well defined key risk indicators (KRIs) and thresholds for ALM risk in risk appetite statement

Key takeaways

- Not just a compliance exercise
- Used for protection of earnings, economic value and capital optimization



- Economic factors, regulatory and capital regimes
- Evolution in risk metrics
- Traditional to dynamic ALM

- ALM needs to be seen as an optimization problem statement
- Maximize return and minimize risk subject to constraints

- While business models are different, fundamental methodologies are same
- Best practices should be incorporated

Q/A

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Questions ?

Comments

Thank You

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