Empowering ALM through Mathematical Optimization

Presenting mathematical tools for ALM optimization to maximize profitability within constraints while managing uncertainty.

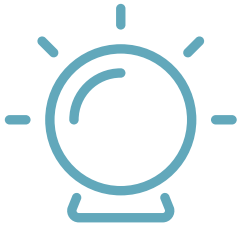
Strategic Importance of ALM in Banking

Balance sheet optimization

Proactively managing the balance sheet as an optimization problem with intentional targets and constraints

ALM empowerment

Providing the ALM unit data, tools and authority to steer the bank's balance sheet



Forward looking origination

Using models and forecasts to guide integrated lending and funding decisions

Taking a proactive, optimization-based approach to balance sheet management empowers the ALM unit and benefits the bank.

Challenges in Implementation

Multidimensional nature

The ALM problem has many interconnected dimensions like liquidity, interest rate risk, etc

Multifaceted stakeholders

Shareholders, regulators, customers have different and often competing interests

Clear articulation

Need for precise definition and description of the problem statement

Role of technology

Advanced analytics and optimization techniques can help solve this complex problem

The ALM problem is intrinsically complex with many moving parts. A systematic approach leveraging technology is key to tackling it effectively.

Articulating the Challenge

Shareholders

Maximize shareholder value through prudent risk management

Regulators

Maintain capital and liquidity ratios to ensure stability

Customers

Provide suitable products to fulfill changing needs

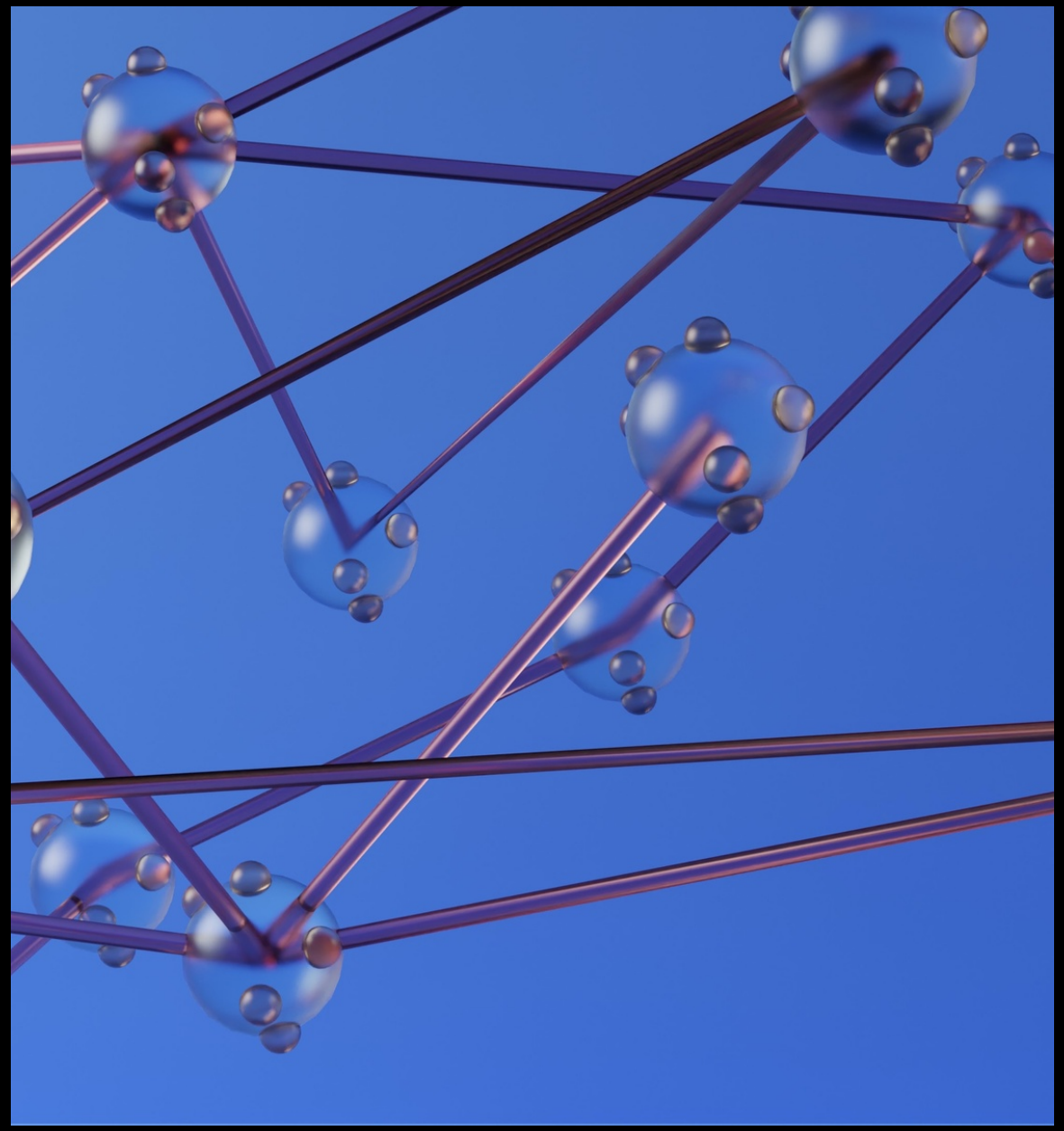
Balancing diverse stakeholder interests requires a multidimensional approach with clear articulation and integrated solving.

“maximize profitability within a specified planning horizon while respecting a wide range of operational and regulatory constraints, while taking into account uncertainty and the possibility of rebalancing portfolios over time”

FROM THE BOOK "ALM MODELING AND BALANCE SHEET OPTIMIZATION"

Multi-Stage Stochastic Optimization Problem

The multi-stage stochastic optimization problem is a mathematical programming technique that optimizes objectives over multiple time periods under uncertainty. It constructs scenarios for future states and optimizes decisions at each stage based on updated information.



Objectives of the Course

Present mathematical optimization models

Introduce mathematical programming methods for ALM optimization

Explore modeling layers

Look at different ways to model the ALM problem mathematically

Emphasize mathematical modelling

Use mathematical language to describe the banking problem

This course will provide a mathematical foundation for ALM optimization.

Additional Benefits of Mathematical Programming

Systematic thinking

Mathematical models induce a systematic and strategic approach to ALM

Governance

Assumptions and responsibilities are explicitly defined, enabling governance

Clarity

Standard terminology provides clarity on objectives

Mathematical programming provides many benefits for strategic ALM thinking and governance.

Further Advantages of Mathematical Models

Aligning treasury with management

Mathematical models facilitate treasury decision alignment with top management strategic objectives

Independent validation

Mathematical models allow quantitative validation of ALM optimization results

Stakeholder alignment

Mathematical modeling verifies asset-liability decisions match stakeholder interests

Mathematical ALM models empower governance through quantified validation and alignment with corporate strategy.

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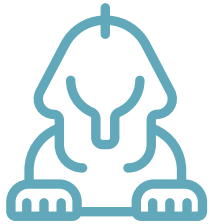


Not a one-size-fits-all solution

ALM models need to be tailored to the bank's specific constraints and objectives

Tradeoff between model complexity and computational tractability

More granular models can become difficult to solve in a timely manner

Long run times on large models

Large, complex models may take a long time to solve optimally

While powerful, mathematical models have limitations that need to be addressed through careful design and testing

Mitigation

- **Simplify business rules**

  Reduce complexity by simplifying assumptions and constraints

- **Aggregate similar entities**

  Group together entities with similar characteristics

- **Apply scenario reduction techniques**

  Use methods like clustering to reduce scenario dimensionality

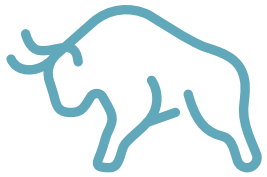
- **Leverage parallel computing**

  Distribute computations across multiple cores/machines

- **Use efficient solver software**

  Take advantage of optimized commercial solvers

Ecosystem of Models



Central balance sheet optimization model

The core model that optimizes the bank's overall balance sheet

Satellite tactical models

Local models for specific business units or portfolios

Share key inputs and outputs

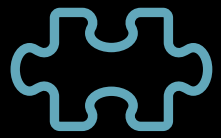
Align assumptions, results and insights between models

An ecosystem of connected models provides a comprehensive approach to balance sheet optimization.

Conclusion

Recap key concepts covered

Importance of mathematical modeling and optimization for asset liability management



Multidimensional and complex nature of ALM

Need for coherent problem definition and structured solution

Benefits of mathematical approach

Strategic thinking, governance, standardization, and validation

With proper articulation and mathematical modeling, ALM can be optimized to align with stakeholder interests and empower the bank's balance sheet.