



# Risk Management Framework for International Reserves

## Session 4: Risk Management Framework

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**2025 ASIAN REGIONAL FORUM**  
ON INVESTMENT MANAGEMENT  
OF FOREIGN EXCHANGE RESERVES

# Outline

## 1. Foundations of Reserve Management:

- *Objectives and guiding principles*
- *Descriptive overview of Armenia's reserves*

## 2. Governance and Policy Framework

- *Institutional structure and oversight mechanisms*
- *Transparency, accountability, and decision-making processes*

## 3. Strategic Asset Allocation and Long-term Management

- *Estimating the optimal level of international reserves. Tranching of reserves*
- *Balancing risk, return, liquidity and diversification strategies*

## 4. The Future of Risk Management Framework for International Reserves in the Age of AI

- *Forecasting and decision support in reserve management*
- *New risk dimensions AI brings into reserve management*

# Foundations of Reserve Management



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# Objectives and guiding principles

## The objectives of reserve holdings:

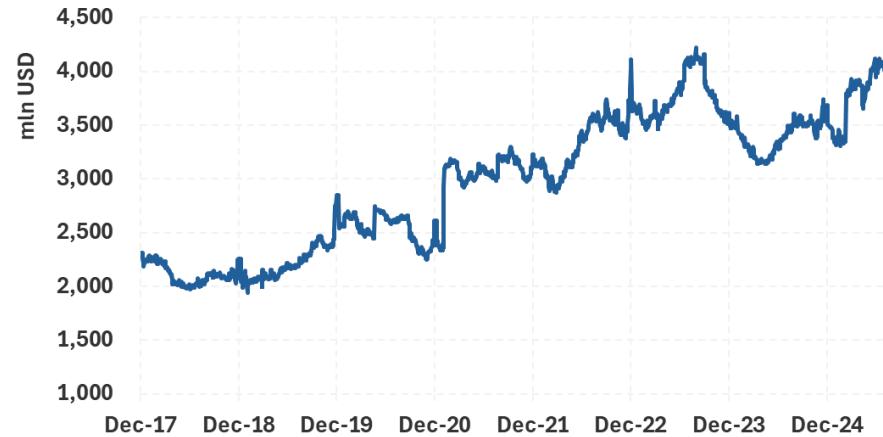
- *support the implementation of monetary policy and financial stability objectives,*
- *ensure sufficient foreign exchange liquidity to absorb potential market shocks and preserve smooth system functioning,*
- *meet all the current and future foreign exchange obligations of the government of the RA and the CBA, and foster greater investor confidence in the country.*

## Reserve management principles:

- ***safety and liquidity, with profitability considered only thereafter.***

# Descriptive overview of Armenia's reserves

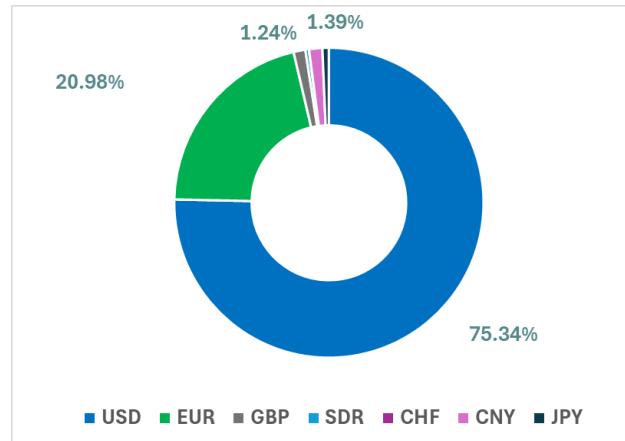
## FX reserves dynamics



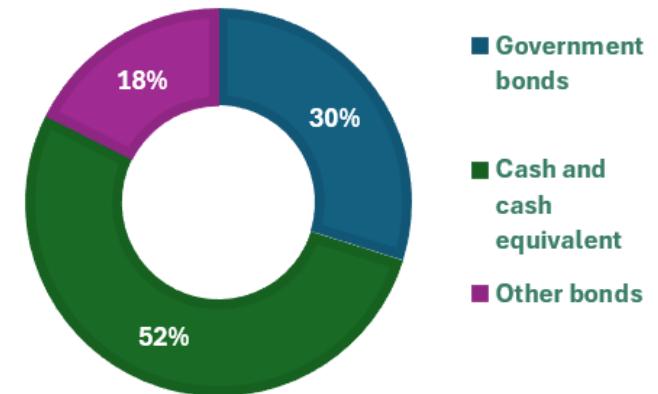
## Rating structure of investments



## Currency composition of FX reserves



## Asset allocation of FX reserves

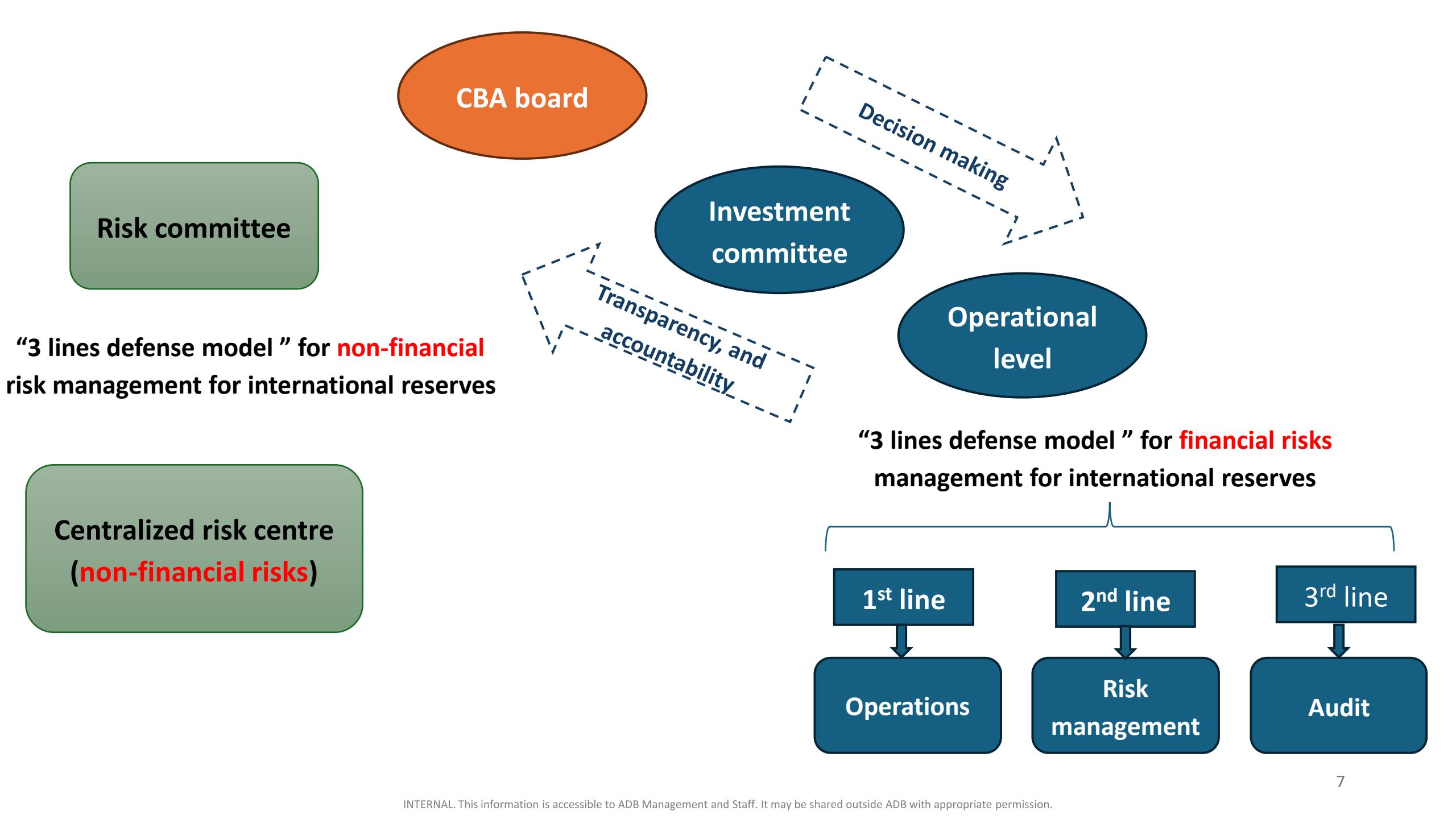


# Governance and Policy Framework



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# Strategic Asset Allocation and Long-term Management



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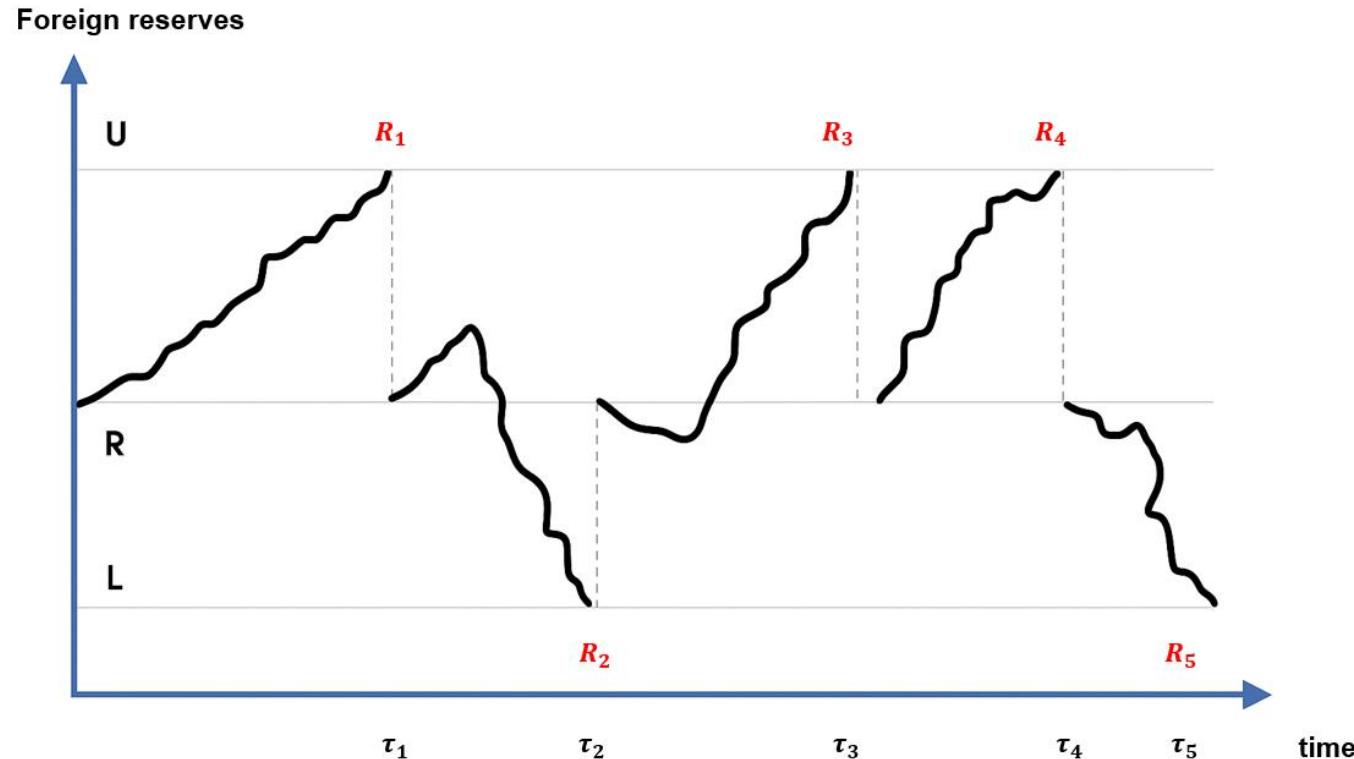
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# Tranching of reserves

Tranching of reserves is guided by the objectives and principles:

- *working tranche*: focused on short-term liquidity needs,
- *policy tranche*: aimed at macroeconomic policy objectives,
- *investment tranche*: allocated for return optimization over longer horizons.

# The optimal level of international reserves



- DGP of reserves follows a GBM characterized by the following SDE:
$$\frac{dR_t}{R_{t-1}} = \mu dt + \sigma dW_t + \sigma dW_t,$$
where  $\mu, \sigma \in R$
- The optimal size of each tranche is derived by minimizing the costs of liquid asset holdings: **opportunity cost**, and **portfolio adjustment costs**

# Strategic Asset Allocation (SAA)

## 1. Base Model: Mean Variance Optimization (Markowitz)

- **Objective:** MVO aims to identify the portfolio with the highest possible return for a specified risk level.

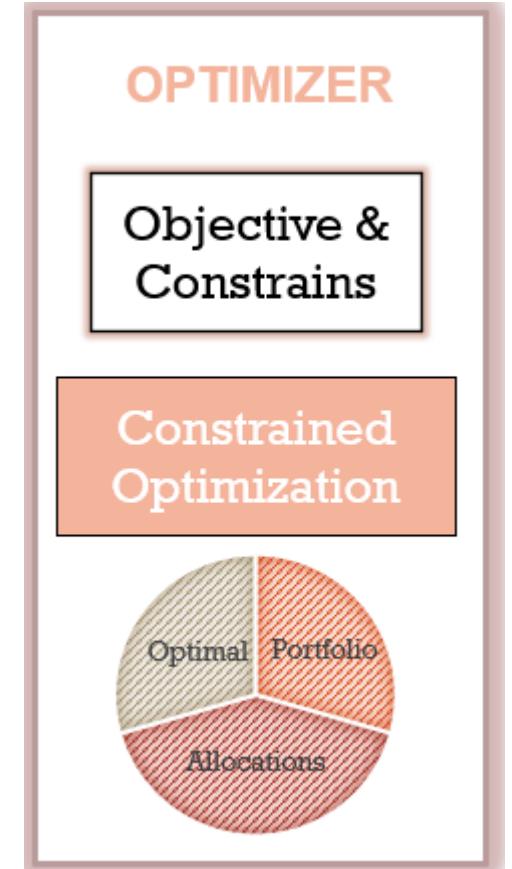
$$\max_{w \geq 0} \mu_p \text{ s.t. } w^T \mathbf{1} = 1, \text{ and } \text{CVaR}_{\alpha\%} \geq \min(0, r_f)$$

## 2. Optimal Hierarchical Portfolio Selection

- **Objective:** Hierarchical methods exploit the underlying structure of asset relationships, leading to more stable and diversified portfolios than traditional optimization methods.

## 3. Regime-Switching Models

- **Objective:** Regime-switching models aim to adapt portfolio strategies to different economic environments by identifying and reacting to structural shifts in the market.



# The Future of Risk Management Framework for International Reserves in the Age of AI



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# Opportunities AI brings into reserve management

- **Enhanced Market Forecasting:** AI models beyond traditional econometric tools.
- **Portfolio Optimization & Scenario Analysis:** advanced analytics support SAA, and stress-testing under multiple market scenarios.
- **Risk Monitoring & Early Warning:** real-time anomaly detection improves surveillance of financial and non-financial risks in reserve portfolios.
- **Operational Efficiency & Automation:** AI streamlined reporting, reconciliations, and trade monitoring.
- **Decision Support & Transparency:** data-driven dashboards enhance oversight, explainability, and accountability for investment and risk decisions.

# New risk dimensions AI brings into reserve management

- **Model risk:** flawed outputs, hidden exposures, difficult to validate and justify to oversight bodies.
- **Data governance and cybersecurity risk:** poor data quality or compromised inputs can corrupt reserve models, information leakage, privacy concerns, cyber-attacks.
- **Third-party dependence risk:** heavy reliance on a limited set of external providers increases concentration risk, makes critical operations vulnerable to vendor disruptions.
- **AI reliance risk:** excessive dependence on automated systems.
- **Systemic risk:** Widespread use of similar AI models and datasets could lead to correlated strategies, amplify market stress, and threaten financial stability.

# Thank You



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