ΟΙΚΟΝΟΜΙΚΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΘΗΝΩΝ
ATHENS UNIVERSITY OF ECONOMICS AND BUSINESS

MSc INTERNATIONAL SHIPPING, FINANCE & MANAGEMENT · WEALTH MANAGEMENT

# Modelling Liabilities & Risk

*“Unless you measure it, you can’t manage it.”*

Lecture 4 · Wealth Management · 2026

KOUBARAS

**Theodore N. Krintas, CIIA, Ph.D.**

Pension Funds | ALM | Risk Adjustment | ERM | Funding Triggers

# The Balance Sheet Equation

*Every institutional balance sheet reduces to one identity — and every risk decision derives from it.*


What the institution owns net of obligations — the risk-bearing buffer

Future cash outflows — pensions, claims, deposits, debt service

Investments held to meet liabilities and grow equity

### Asset risk

Volatility in market value of investments — equity drawdowns, credit losses, manager underperformance.

### Liability risk

Volatility in present value of obligations — longevity, interest-rate moves, inflation.

### Surplus risk

The mismatch between the two — funding-ratio volatility is what actually matters to the sponsor.

# The Risk Management Cycle

*A continuous loop — risk management is a process, not a one-off exercise.*


**1 Identify**
Catalogue risks across asset, liability and operational lines.

**2 Measure**
Quantify exposure with VaR, duration, scenarios.

**3 Manage**
Decide treatment — avoid, transfer, mitigate, accept.

**4 Monitor**
Track exposures and limit usage continuously.

**5 Report**
Communicate to board, regulators, stakeholders.

# Risk Treatment Framework

*Once a risk is identified, four strategies are available — and most exposures use a blend of them.*

## RISK IDENTIFIED

### AVOID

*Don't take the exposure at all*

- Exit the business line
- Decline the mandate
- Restrict counterparties

### REDUCE

*Mitigate the size of the loss*

- Set position limits
- Diversify holdings
- Strengthen controls

### TRANSFER

*Push the risk to a third party*

- Insurance
- Hedging / derivatives
- Reinsurance / SPV

### ACCEPT

*Hold capital and bear the loss*

- Allocate economic capital
- Monitor against limits
- Self-insure

# The Four-Step Risk Process

*Identify → Assess → Control → Review — a self-correcting loop applied to every exposure.*

## 1 IDENTIFY

*Catalogue exposures across asset, liability, operational and strategic dimensions.*

- Risk register
- Workshops & interviews
- Loss data review

## 2 ASSESS

*Quantify likelihood and impact using consistent metrics across the book.*

- VaR / scenario testing
- Probability × impact heat maps
- Stress and reverse-stress

## 3 CONTROL

*Apply a treatment strategy proportional to the exposure and the appetite.*

- Limits and mandates
- Hedging and insurance
- Governance and approvals

## 4 REVIEW

*Re-test assumptions as markets, books and the environment change.*

- Limit-usage reporting
- Periodic re-pricing
- Independent challenge

*Output of Review feeds back into Identify — the cycle restarts.*

# Global Geopolitical Risk


Source: Federal Reserve, IFR, Measuring Geopolitical Risk – Dairo Caldara and Matteo

# Global Geopolitical Risk — May 2026

*BlackRock Geopolitical Risk Indicator (BGRI) · Top risks shaping markets in 2026*

**Key Finding**
Geopolitical risks remain elevated in May 2026 as the Iran conflict becomes a global event, driving the most significant energy crisis since the 1970s and elevating market attention to Middle East and energy-supply risks.

**01** *BGRI: High*

### Middle East Conflict

Iran conflict escalation has become a global event, exposing dependence on energy flows through the Strait of Hormuz. Markets price a persistent risk premium in oil and defence equities.

SENSITIVE ASSETS

▲ Brent crude ▼ EM equities ▲ Gold

**02** *BGRI: Elevated*

### Global Trade Fragmentation

U.S. transactional foreign policy is reshaping economic relationships and exposing fractures in the Western alliance — accelerating supply-chain regionalisation and tariff-driven volatility.

SENSITIVE ASSETS

▼ Global equities ▲ USD volatility ▼ EM FX

**03** *BGRI: Elevated*

### U.S.–China Strategic Competition

Technology decoupling deepens across semiconductors, AI, and critical minerals. Capital allocation increasingly reflects geopolitical alignment rather than pure economic logic.

SENSITIVE ASSETS

▼ Tech equities ▲ Defence ▲ Critical minerals

GPR INDEX HISTORICAL SPIKES

2001 · 9/11 | 2003 · Iraq War | 2014 · Crimea | 2022 · Russia–Ukraine | 2024 · Red Sea / Hormuz | 2026 · Iran conflict

*Source: BlackRock Investment Institute · Geopolitical Risk Dashboard (May 2026); Caldara & Iacoviello — Geopolitical Risk Index (Federal Reserve).*

# Asset–Liability Management at a Glance

*ALM coordinates the management of assets and liabilities along four dimensions — each generates a distinct risk.*

### MATURITIES

**Liquidity risk**

Match the timing of cash inflows from assets with cash outflows on liabilities.

### INTEREST RATES

**Duration risk**

Hedge sensitivity of asset and liability values to changes in yield curves.


### FUNDING

**Roll-over risk**

Secure stable, diversified sources of funding across tenors and counterparties.

### REPRICING

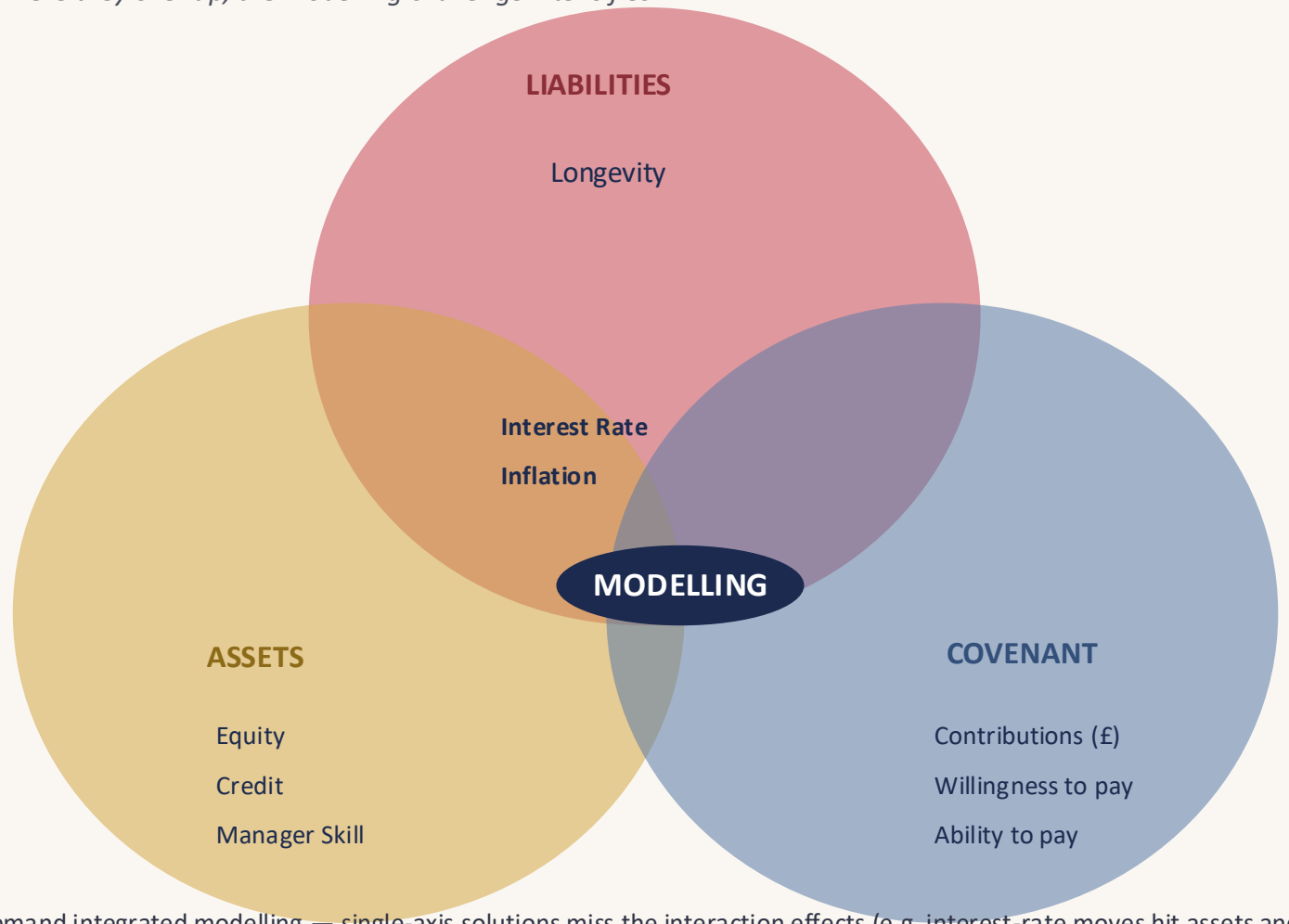
**Basis risk**

Manage gaps between asset yields and liability costs as benchmarks reset.

*Goal: keep funding-ratio volatility within risk appetite while maximising long-term return.*

# Key Risks to a Pension Fund

*Three risk dimensions intersect: where they overlap, the modelling challenge intensifies.*

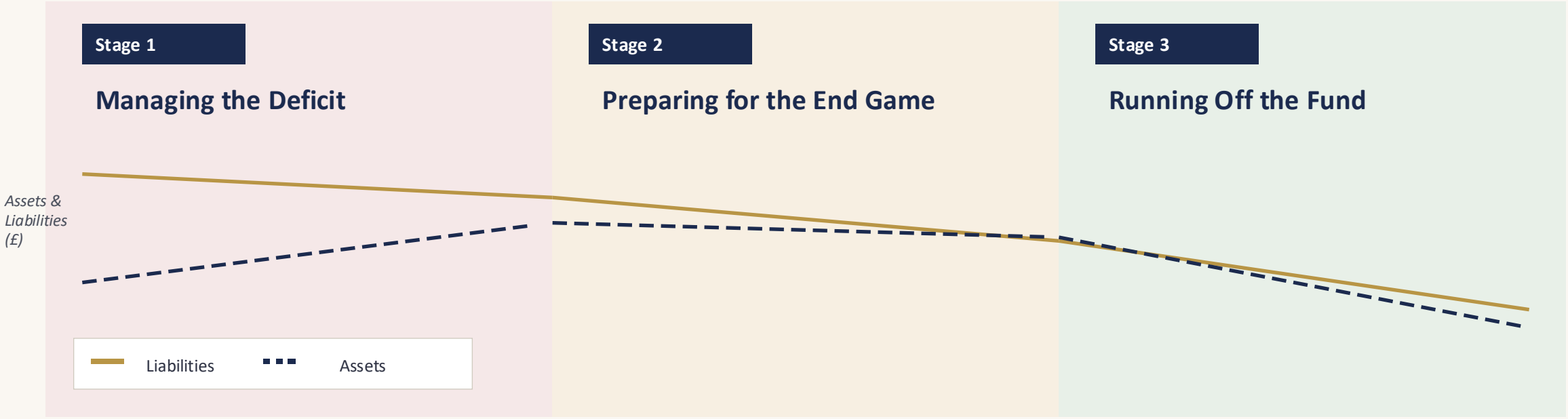



Risks that fall within overlaps demand integrated modelling — single-axis solutions miss the interaction effects (e.g. interest-rate moves hit assets and liabilities simultaneously).

*Source: Redington / Oxford-Man Institute — Understanding Modelling and Defined-Benefit Pension Risk (May 2014); framework remains current.*

# The Three Stages of a Defined Benefit Pension Fund

*As the scheme matures, the objective shifts from return-seeking to liability-matching to runoff — risk and hedge ratio scale accordingly.*




| Stage 1 | |
|---|---|
| *Hedge ratio* | **~35%** |
| *Expected return* | **Gilts + ~225 bps** |
| *Liability risk* | **High** |

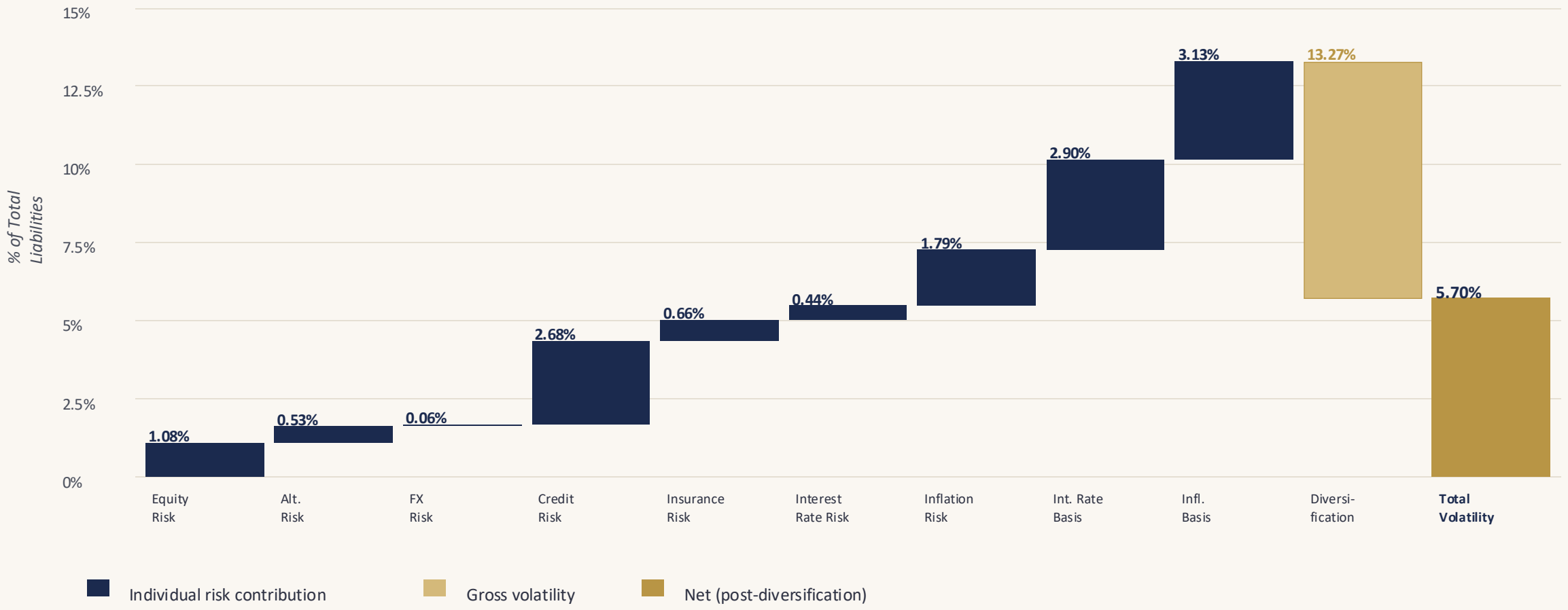
| Stage 2 | |
|---|---|
| *Hedge ratio* | **= Funding ratio** |
| *Expected return* | **Gilts + ~160 bps** |
| *Liability risk* | **Moderate** |

| Stage 3 | |
|---|---|
| *Hedge ratio* | **~100%** |
| *Expected return* | **Gilts + ~25 bps** |
| *Liability risk* | **Low** |

*Conceptual schematic for teaching purposes. Hedge ratios and return assumptions are illustrative — not specific scheme data.*

# Funding Ratio at Risk

*Decomposing total surplus volatility into its risk contributions — with diversification netting back ~24%.*




*Source: Redington — illustrative DB pension scheme; % of total liabilities.*

# On Risk and Foresight

*A reminder that risk management is, at its core, the discipline of preparing for what has not yet happened.*

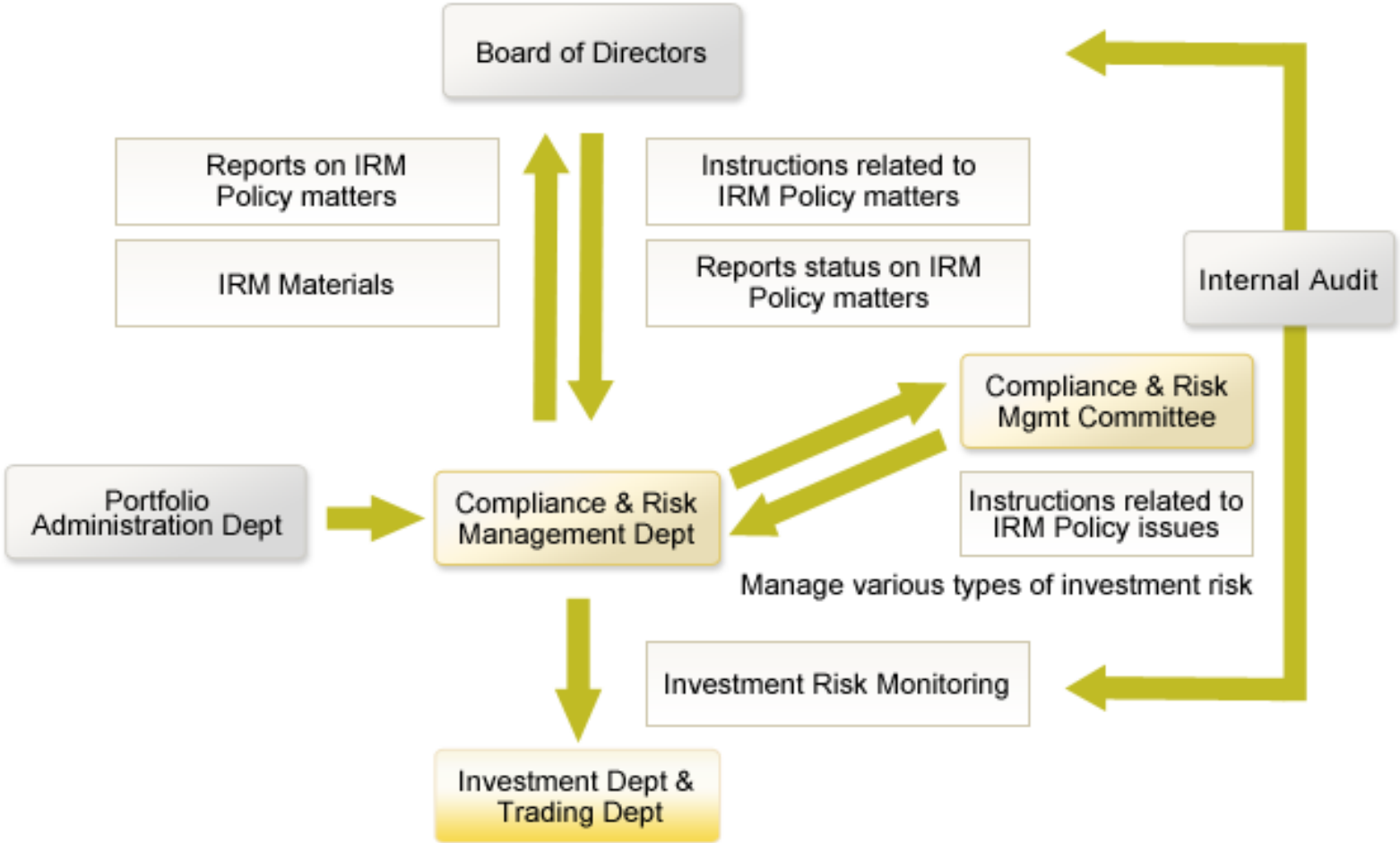
> *If a man knows not to which port he sails, no wind is favourable.*

**Seneca**

*Roman Stoic philosopher, c. 4 BC – 65 AD*

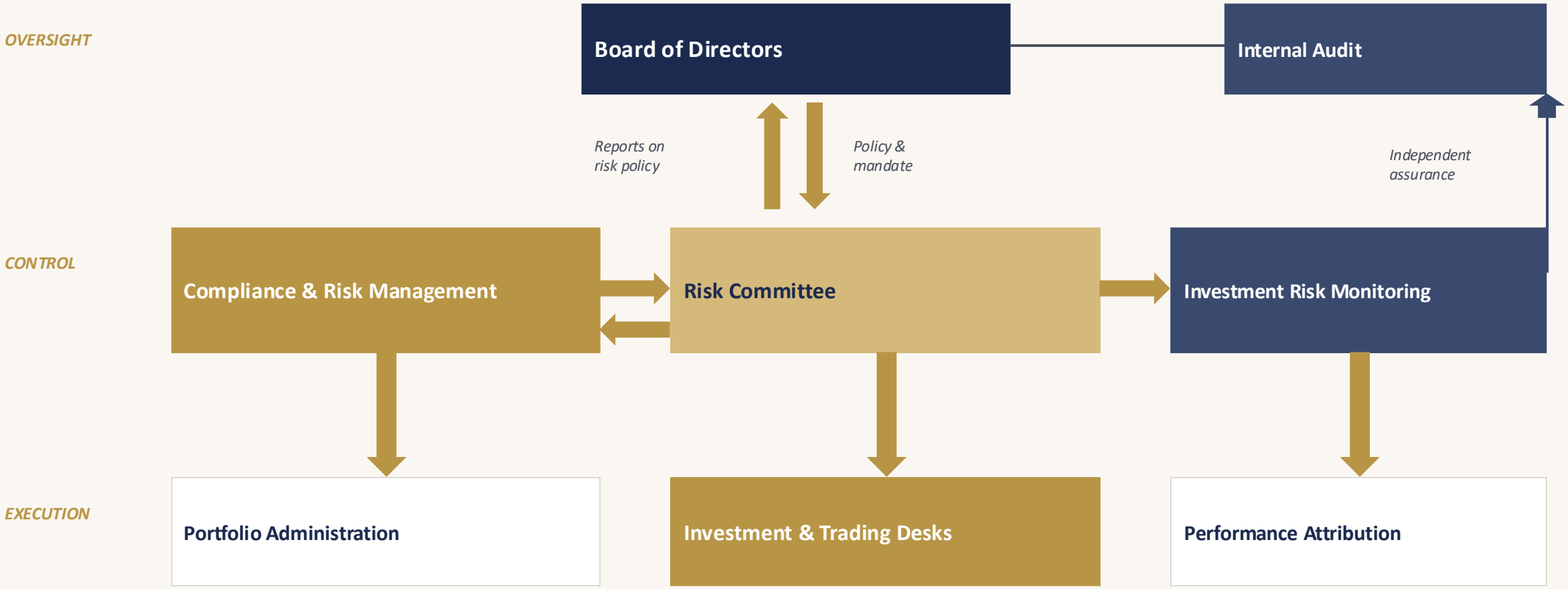
Risk management without a defined objective — funding ratio, solvency, cash-flow stability — has no direction. Define the destination first; the controls follow.

SOMPO HOLDINGS
Sompo Japan Nipponkoa Asset Management



# ERM Governance — Illustrative Investment Risk Framework

*Three-tier governance: Board sets policy; Risk function instruments and monitors; Investment desks operate within mandate.*




Three lines of defence: investment desks own the risk • risk function instruments and limits • internal audit provides independent assurance.

# Risk Adjustment in the Investment Process

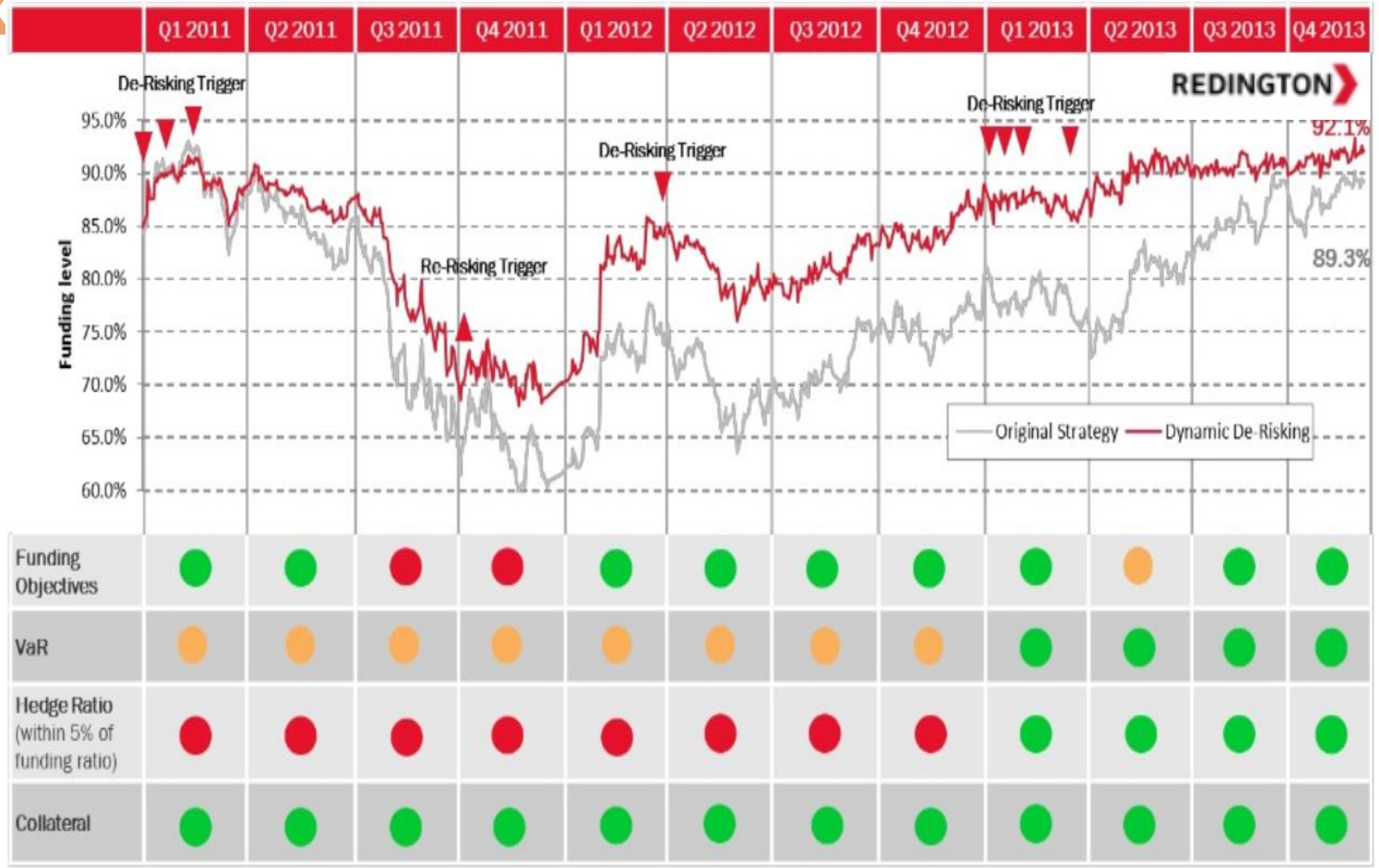
*Three stages × four functions — risk oversight runs alongside every decision, not at the end.*

| | Fundamental Economic Analysis | Valuation Modelling | Quantitative Modelling | Investment Governance & Oversight |
|---|---|---|---|---|
| **Idea Generation** | **Bond Investment Group**<br>▸ Debate ▸ Review ▸ Ratify / Reject | | **Tactical Opportunities** | ▸ Independent Risk Analysis |
| **Selection** | **Portfolio Risk**<br>Position sizing · Diversification measurement · Scenario analysis | | | ▸ Counterparty Risk Management |
| **Implementation** | **Portfolio Management**<br>Strategy implementation · Final position sizing · Execution | | | ▸ Investment Governance |

Risk oversight is a parallel column, not a final gate — independent risk analysis sits alongside every stage of the investment decision.

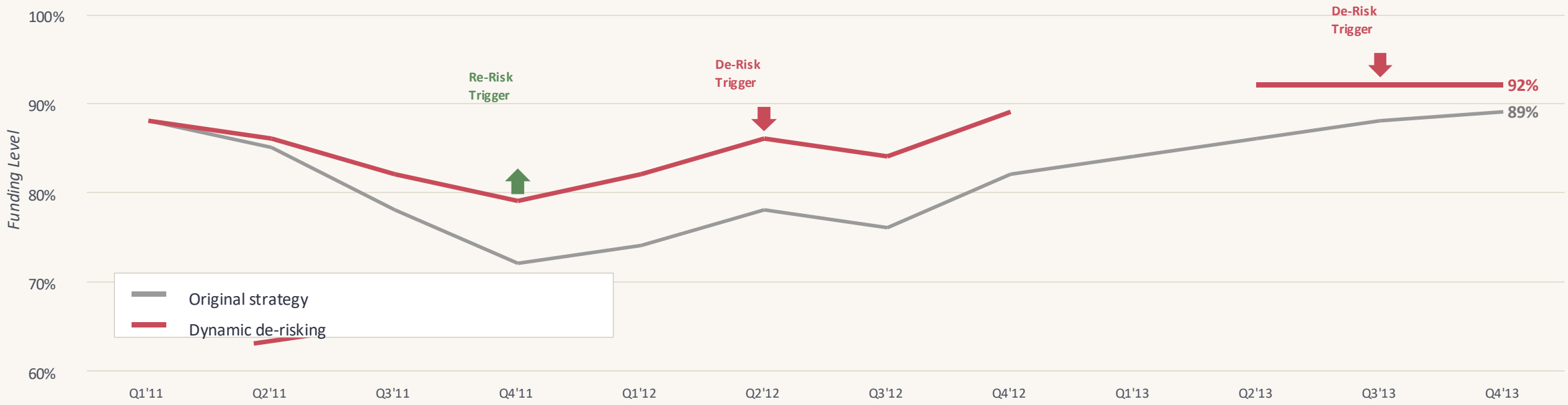
*Source: Redington — Investment Process Framework. Adapted from Lecture 3 working materials.*

# Risk


Q1 2011
Q2 2011
Q3 2011
Q4 2011
Q1 2012
Q2 2012
Q3 2012
Q4 2012
Q1 2013
Q2 2013
Q3 2013
Q4 2013
REDINGTON
De-Risking Trigger
De-Risking Trigger
De-Risking Trigger
Re-Risking Trigger
95.0%
90.0%
85.0%
80.0%
75.0%
70.0%
65.0%
60.0%
Funding level
92.1%
89.3%
Original Strategy
Dynamic De-Risking
Funding Objectives
VaR
Hedge Ratio (within 5% of funding ratio)
Collateral

# Dynamic De-Risking — Trigger-Based Strategy

*Pre-defined triggers convert favourable funding-level moves into permanent risk reduction — ratcheting up the hedge as the position improves.*




***Risk Monitoring Status***

| | |
|---|---|
| **Funding** | |
| **VaR limits** | |
| **Hedge ratio** | |
| **Collateral** | |

Triggers turn favorable market moves into permanent gains — each de-risk step locks in funding-level improvement and reduces residual VaR.

*Conceptual schematic for teaching purposes; series values are illustrative and not real back test results.*

# Dynamic De-Risking — Example 1

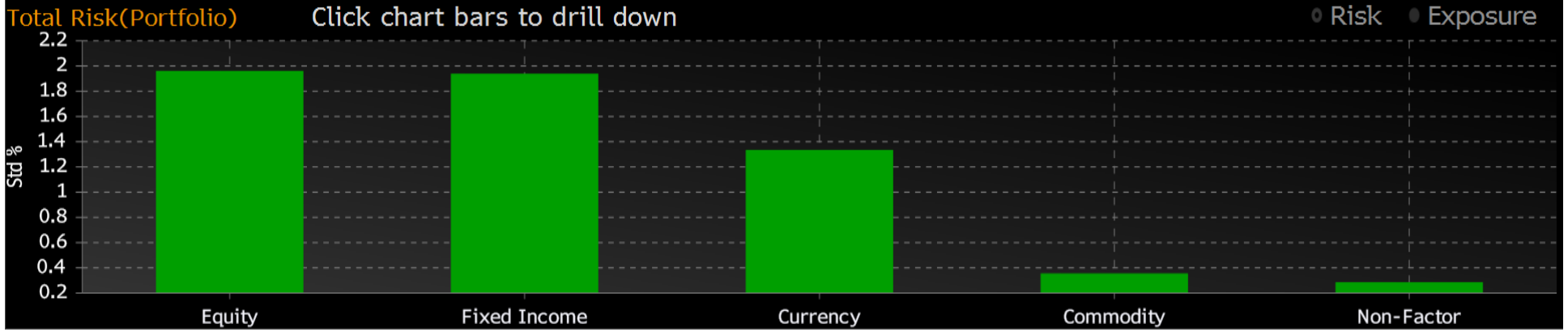
Model Bloomberg Ris | Unit Returns (% | Horizon 1 Year

Portfolio Value 6,288,714.88 EUR (22 name(s), 100% Gross MV) Portfolio Beta(Ex-Ante) NA

| | Risk (Std) | | | Factor Risk (Std) | | | |
|---|---|---|---|---|---|---|---|
| Item | Total Risk | Factor | Non-Factor | Equity | Fixed Income | Currency | Commodity |
| Portfolio | 3.41 | 3.40 | 0.29 | 1.96 | 1.94 | 1.34 | 0.36 |
| Benchmark | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Active | 3.41 | 3.40 | 0.29 | 1.96 | 1.94 | 1.34 | 0.36 |

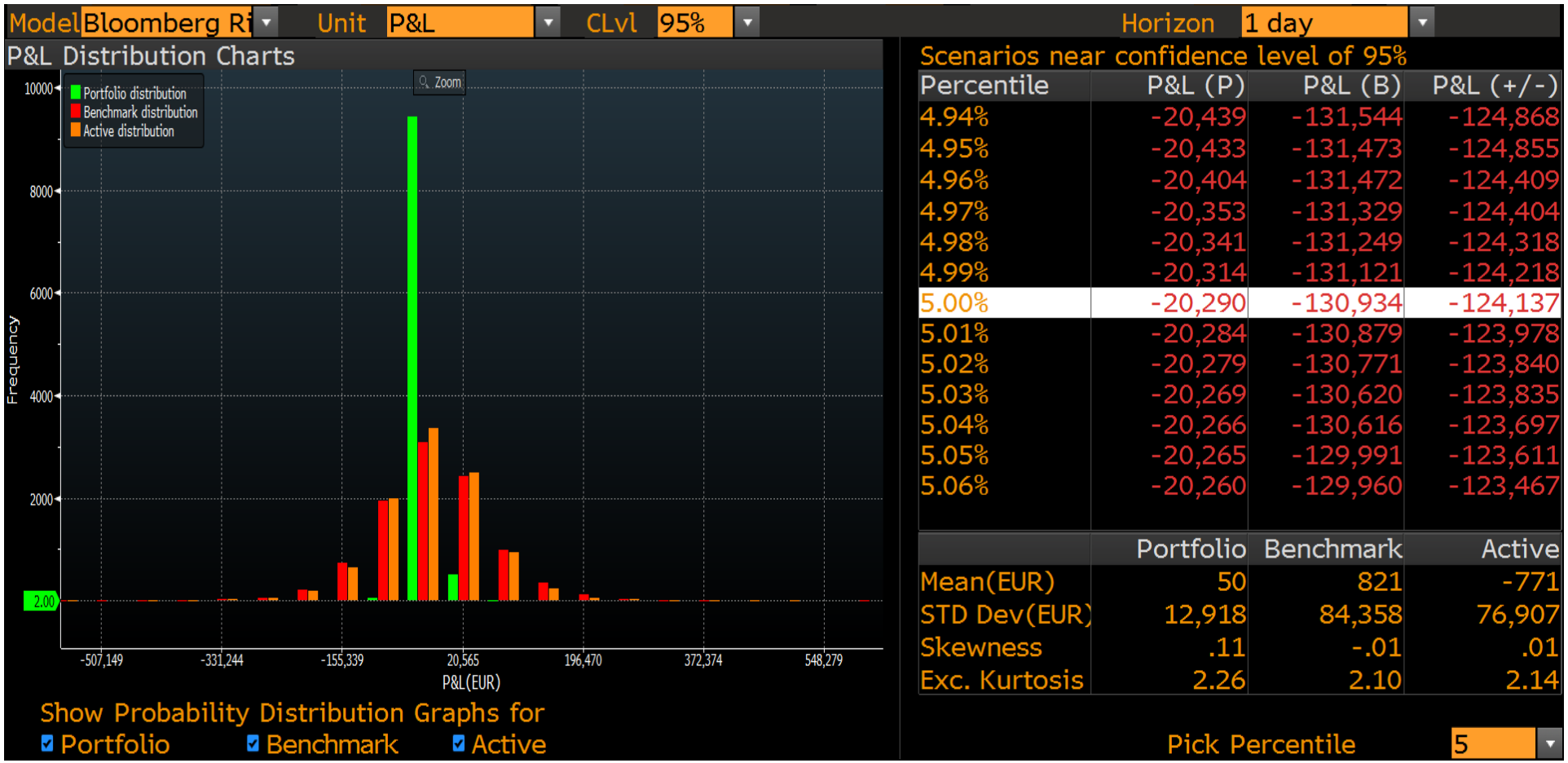
Click a number to see breakdown

| | Risk Contribution (%) | | | Factor Risk Contribution (%) | | | |
|---|---|---|---|---|---|---|---|
| Item | Total Risk | Factor | Non-Factor | Equity | Fixed Income | Currency | Commodity |
| Portfolio | 100.00 | 99.30 | 0.70 | 38.80 | 38.38 | 21.69 | 0.43 |
| Benchmark | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Active | 100.00 | 99.30 | 0.70 | 38.80 | 38.38 | 21.69 | 0.43 |




*Conceptual schematic for teaching purposes; series values are illustrative and not real back test results.*

# Dynamic De-Risking — Example 2




*Conceptual schematic for teaching purposes; series values are illustrative and not real back test results.*

# Dynamic De-Risking — Example 3

11) View | 12) Actions | 13) Settings | 14) Trade Simulation — Portfolio & Risk Analytics

Characteristics | Holdings | VaR | Scenarios | Tracking Error/Volatility | Performance | Attribution

Main View | Summary

Port ATTICA DYNAM vs MSCI EURO (M by Asset Type > in EUR Time Custo 03/31/14 - 04/06/16

Model Total Return Unit Percentage Curve Swap

| Return Summary | |
|---|---|
| Portfolio Return | 9.96 |
| Benchmark Return | 1.44 |
| Active Return | 8.52 |

| Active Return Attribution Summary | | | |
|---|---|---|---|
| Active Return | 8.52 | Currency | 4.21 |
| Allocation | 4.32 | | |
| Selection | 0.00 | | |

| | 3 Months | | 6 Months | | Year To Date | | 1 Year | |
|---|---|---|---|---|---|---|---|---|
| Portfolio Statistics | Port | Bench | Port | Bench | Port | Bench | Port | Bench |
| 2. Return | | | | | | | | |
| Total Return | 1.27 | -6.10 | 2.18 | -7.59 | 1.42 | -9.70 | -1.47 | -17.47 |
| Maximum Return | 0.75 | 3.32 | 0.86 | 3.32 | 0.75 | 3.32 | 0.86 | 4.52 |
| Minimum Return | -0.55 | -3.76 | -1.29 | -3.76 | -0.55 | -3.76 | -1.29 | -5.18 |
| Mean Return (Annualized) | 7.43 | -26.35 | 6.30 | -16.67 | 7.86 | -38.86 | -1.89 | -20.20 |
| Mean Excess Return (Annualized) | 45.81 | | 27.55 | | 76.27 | | 22.93 | |
| 3. Risk | | | | | | | | |
| Standard Deviation (Annualized) | 3.76 | 26.33 | 3.87 | 23.23 | 3.69 | 26.30 | 4.55 | 24.45 |
| Downside Risk (Annualized) | 2.49 | 18.51 | 2.83 | 16.39 | 2.44 | 18.54 | 3.42 | 17.42 |
| Skewness | 0.42 | 0.01 | -0.70 | -0.01 | 0.41 | 0.01 | -0.68 | -0.05 |
| VaR 95% (ex-post) | -0.33 | -2.38 | -0.29 | -2.29 | -0.32 | -2.79 | -0.41 | -2.45 |
| Tracking Error (Annualized) | 23.62 | | 20.75 | | 23.72 | | 22.09 | |
| 4. Risk/Return | | | | | | | | |
| Sharpe Ratio | 1.45 | -0.74 | 1.19 | -0.52 | 1.56 | -1.12 | -0.28 | -0.61 |
| Jensen Alpha | 7.55 | | 6.00 | | 8.79 | | 0.34 | |
| Information Ratio | 1.31 | | 0.92 | | 2.11 | | 0.72 | |
| Treynor Measure | 0.51 | | 0.40 | | 0.56 | | -0.12 | |
| Beta (ex-post) | 0.11 | | 0.12 | | 0.10 | | 0.11 | |
| Correlation | 0.7541 | | 0.6906 | | 0.7347 | | 0.5871 | |
| Capture Ratio | 0.03 | | 0.15 | | 0.04 | | 0.11 | |