Funding ratio attribution

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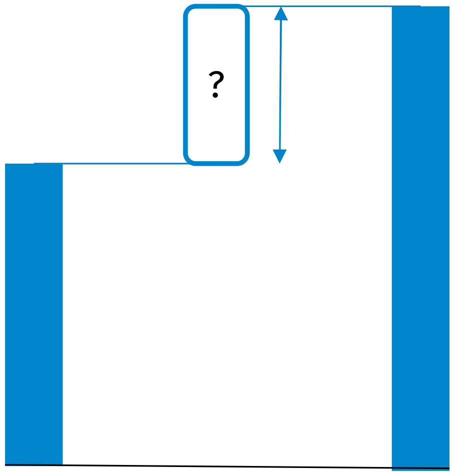
Public

Funding ratio attribution

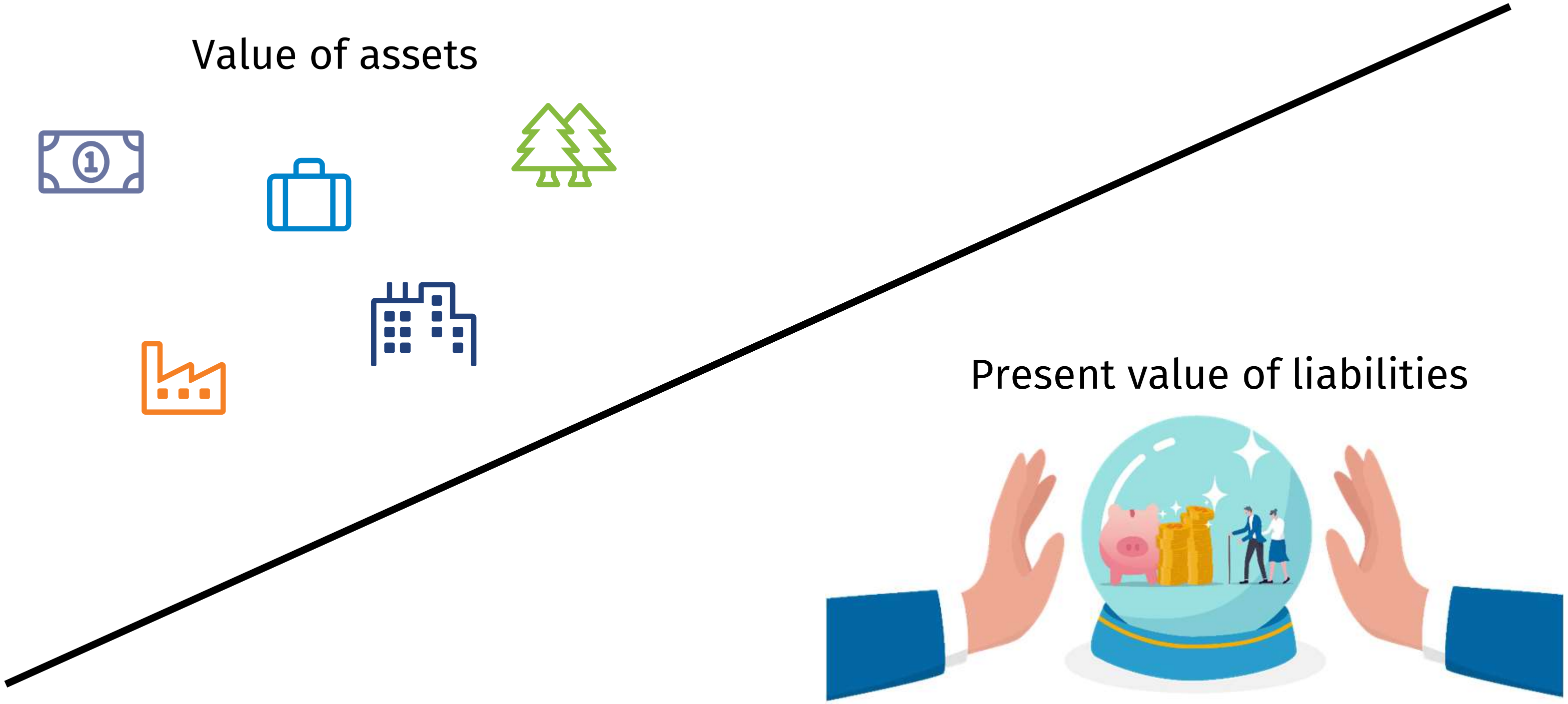
Overview



- Introduction to Funding ratio
- Decomposition of ratio changes
- Details
- Summary

Introduction to funding ratio

Assets and Liabilities



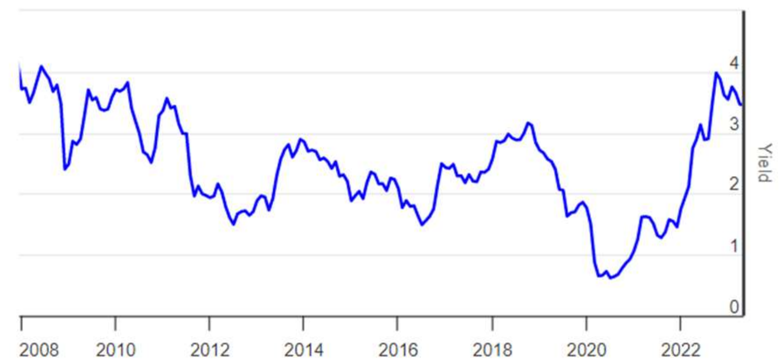
Introduction to funding ratio

Why now?

- Pace of yield changes
  - 12 years down vs 2 years up
  - Faster than actuarial time frames
- Pension reform
- Negative return on assets
  - Need for greater context
- Changes in life expectancy
  - Covid
  - Cost of living
- Road to buyout

German 10 year bond yield:

United States 10 year bond yield:



Source: http://www.worldgovernmentbonds.com

Introduction to funding ratio – Changes

Relation to growth of assets and liabilities

Arithmetic relation

$$\Delta FundingRatio(t, t-1) = \frac{Assets(t)}{Liabilities(t)} - \frac{Assets(t-1)}{Liabilities(t-1)}$$

$$= \frac{Assets(t-1)}{Liabilities(t)} \cdot \left(\frac{Assets(t)}{Assets(t-1)} - \frac{Liabilities(t)}{Liabilities(t-1)}\right) = Scaling\ factor\ \cdot XS\ Growth$$

Allows for use of existing investment performance frameworks

The scaling factor is a linear function, and therefore will not distort the analysis of excess growth

Introduction to funding ratio – Changes

Relation to growth of assets and liabilities

Geometric relation

$$\Delta FundingRatio(t, t-1) = \frac{Assets(t)}{Liabilities(t)} \Bigg/ \frac{Assets(t-1)}{Liabilities(t-1)}$$

$$= \frac{Assets(t)}{Assets(t-1)} \Bigg/ \frac{Liabilities(t)}{Liabilities(t-1)} = Geometric\ XS\ growth$$

Introduction to funding ratio

Solvency ratio and defined contribution schemes

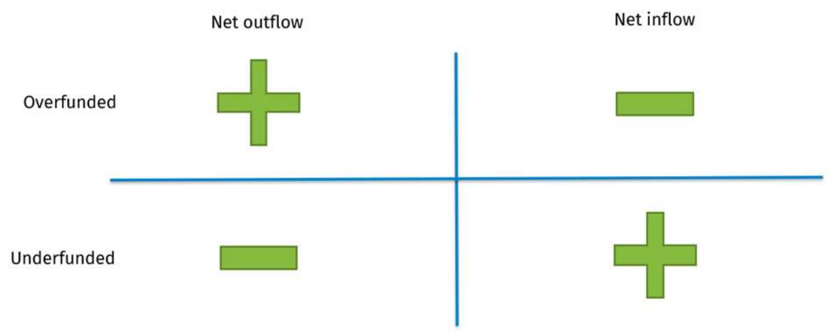
- Main line of presentation is about pension funds
  - Both open and closed schemes
- Solvency ratio from Insurance world is similar
  - Regulatory framework is more proscriptive
  - Regime specific (Fixed vs Variable for Pension funds)
- Defined contribution (DC) schemes
  - Framework not suitable when DC is additive to Defined Benefit (DB)
  - Can be used to compare when DC is substitutive (instead of DB)
    - Assets vs Annuity rates for example

Introduction to funding ratio - Assets

Asset value

Asset value may change with:

- Cash flows
  - Benefit payments out (Pensions for active members)
  - Transfers (Individual)
  - Mergers and Acquisitions (Group)
  - Transfers are not neutral due to a pull towards par value
  - Somewhat discretionary within insurance
- Investment returns
  - Neutral position (Strategic Asset Allocation, SAA)
  - Investment decisions
    - Tactical Asset Allocation, TAA
    - Overlays
    - Manager Outperformance



Introduction to funding ratio - Liabilities

Present value of liabilities

- Present value of liabilities is a function of:

Actuarial life expectancy

x

Promised retirement benefits

x

Discount rate

Introduction to funding ratio - Liabilities

Present value of liabilities – Promised pension benefits

Promised pension benefits may change with:

- Benefit payments and new capital inflows
- Contractual adjustments (e.g. change in retirement age)
- Realized survival rate
- Realized inflation (if promise/aspiration to compensate)
- ...

Introduction to funding ratio - Liabilities

Present value of liabilities – Discount rate

Discount rate may change with:

- Changes in expected future returns on assets
  - Regulatory framework often sets hard/soft limits
  - Expected returns for asset classes
    - Yield curve can be used for Fixed income
    - Equities and other classes are more subjective (mean regression etc.)

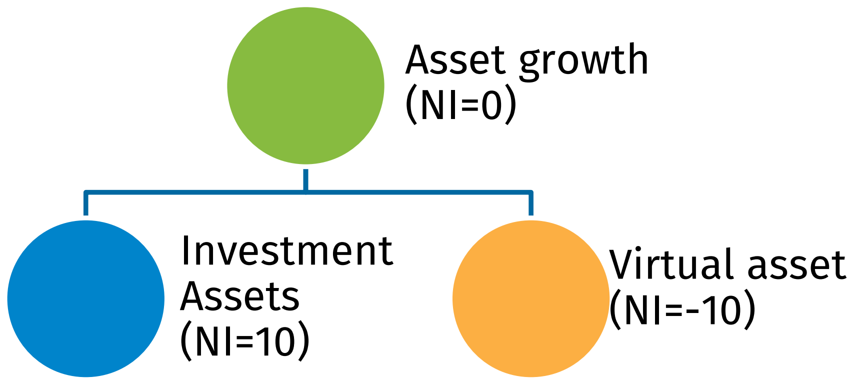
- Expected inflation (if promise/aspiration to compensate)

Introduction to funding ratio – Attribution

Growth is technically the same as an investment return

- Top-down perspective:
  - Treat cash flows as autonomous components of growth/return
- Bottom-up perspective:
  - Correct for the cashflows to have actual investment returns and an investible benchmark
- Leverage existing performance attribution software

Asset value (t-1)	110
Asset value (t)	130
Growth	18.2%
Net cash flow	10
Return	9.1%



Funding ratio attribution

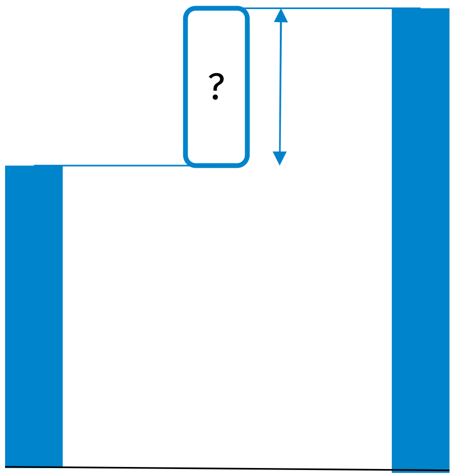
Overview

Introduction to Funding ratio

Decomposition of ratio changes

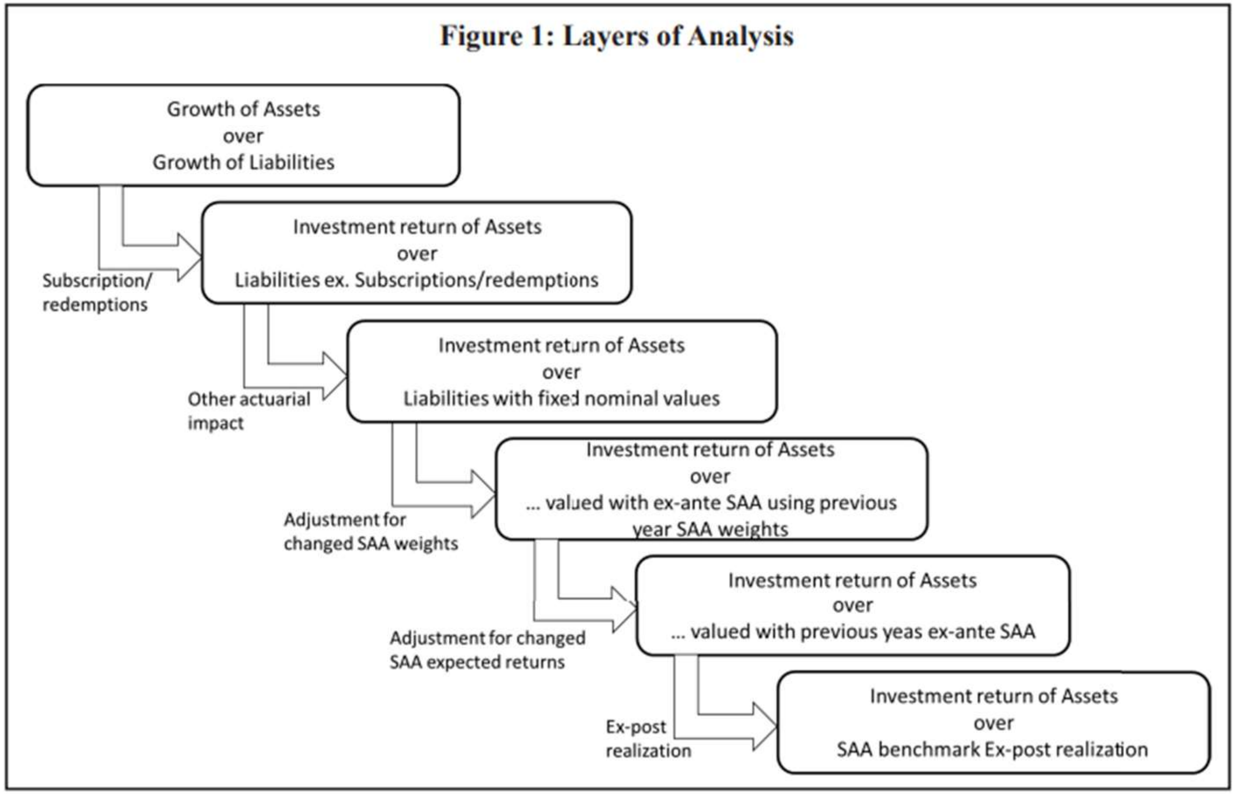
Details

Summary



Decomposition – Example case

Liabilities repricing



Decomposition

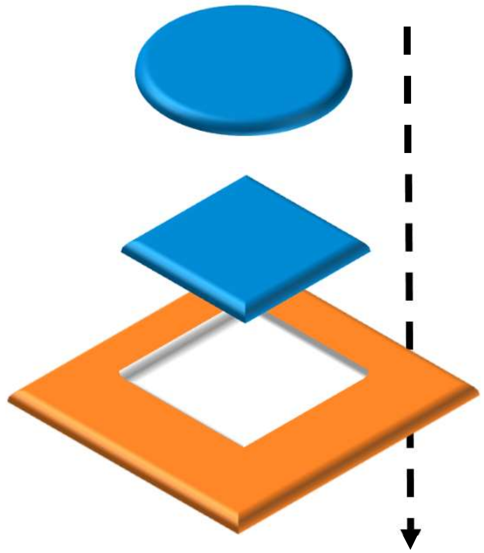
Main decomposition components – and related questions

Funding ratio change can be explained by 3 categories of risk driver:

1. Explicitly not hedged
   - Actuarial factors (typically “unhedgeable”)
   - Prohibitive costs
   - Modelling risk when converting CPI + x --> SAA

2. Desired exposures
   - Adherence to policy decisions (SAA)

3. Investment manager discretionary
   - Manager excess returns
   - Tactical deviations from SAA



Decomposition – Example case

Example case introduction

	Start value	Subscriptions & Redemptions	End value
Assets	110	10	130
Liabilities	80	9	100
Funding ratio	1.375		1.30

- Nominal benefits (no inflation compensation)
- Discount rate is the SAA ex-ante expected return
  - Some fixed income exposure → Some interest rate sensitivity
- Investible benchmark is the SAA ex-post realized return

Decomposition – Example case

Liabilities repricing

- Transform growth in liabilities to an investible benchmark
- Liabilities are repriced for several steps of immunized risk drivers, as per decision attribution

Promised retirement benefits

- Evaluate liabilities under several conditions
  - Normal
  - Corrected for net cash flows (similar to the asset side correction)

Δ Cash flows

Decomposition – Example case

Returns/growth rates to decomposition

	Start	NI	End
Assets	110	10	130
Liabilities	80	9	100
Funding ratio	1.375		1.30

Arithmetic:
(9.1%-13.8%) - (18.2%-25.0%)
= -2.2%

Valuation	Assets	Liabilities	Δ Arithmetic	Δ Geometric
Top for Funding ratio	18.2% = 20/110	25.0% = 20/80		
Corrected for cash flows	9.1% = 10/110	13.8% = 11/80		

Geometric:
(1.091/1.138) / (1.182/1.250) -1
= -1.4%

Decomposition – Example case

Liabilities repricing

- Evaluate liabilities under several conditions
  - Normal
  - Corrected for net cash flows
  - Constant nominal benefits
    - In this case excluding Inflation

Promised retirement benefits

Δ Cash flows

Survival rate

Δ Other actuarial

Decomposition – Example case

Returns/growth rates to decomposition

	Start	NI	End
Assets	110	10	130
Liabilities	80	9	100
Funding ratio	1.375		1.30

Valuation	Value
Liabilities at start	80
With cash flows	89
Actuarial impact	94

Valuation	Assets		Arithmetic	Δ Geometric
Top for Funding ratio	18.2% = 20/110	25.0% = 20/80		
Corrected for cash flows	9.1% = 10/110	13.8% = 11/80	-2.2%	-1.4%
Corrected for Actuarial impact	9.1%	7.5% = 6/80		

Arithmetic:
(9.1%-7.5%) - (9.1%-13.8%)
= -6.3%

Geometric:
(1.091/1.075) / (1.091/1.138) -1
= -5.5%

Decomposition – Example case

Liabilities repricing

- Evaluate liabilities under several conditions
  - Normal
  - Corrected for net cash flows
  - Constant nominal benefits
    - Discounted with start of period SAA asset mix
      - Accounts for intra period SAA changes
    - Discounted with start of period ex-ante SAA return
      - Forecasts are now 1 year “in the future”

Promised retirement benefits

Δ Cash flows

Survival rate

Δ Other actuarial

Discount rate

Δ SAA policy change

Δ Future expectations

Decomposition – Example case

Returns/growth rates to decomposition

	Start	NI	End
Assets	110	10	130
Liabilities	80	9	100
Funding ratio	1.375		1.30

Valuation	Value
Liabilities at start	80
With cash flows	89
Actuarial impact	94
& SAA weights	92
& SAA returns	95

Valuation	Assets	Liabilities	Δ Arithmetic	Δ Geometric
Top for Funding ratio	18.2% = 20/110	25.0% = 20/80		
Corrected for cash flows	9.1% = 10/110	13.8% = 11/80	-2.2%	-1.4%
Corrected for Actuarial impact	9.1%	7.5% = 6/80	-6.3%	-5.5%
& SAA weights	9.1%	10.0% = (8/80)	2.5%	2.3%
& SAA returns	9.1%	6.3% = (5/80)	-3.8%	-3.4%

Decomposition – Example case

Returns/growth rates to decomposition

	Start	NI	End
Assets	110	10	130
Liabilities	80	9	100
Funding ratio	1.375		1.30

Valuation	Value
Liabilities at start	80
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Valuation	Assets	Liabilities	Δ Arithmetic	Δ Geometric
	18.2% = 20/110	25.0% = 20/80		
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Corrected for Actuarial impact	9.1%	7.5% = 6/80	-6.3%	-5.5%
& SAA weights	9.1%	10.0% = (8/80)	2.5%	2.3%
& SAA returns	9.1%	6.3% = (5/80)	-3.8%	-3.4%
Top for investments	9.1%	12.5%		

Remaining XS:
The impact of actual investment decisions

Impact of SAA ex-ante vs ex-post:
The realized investment climate

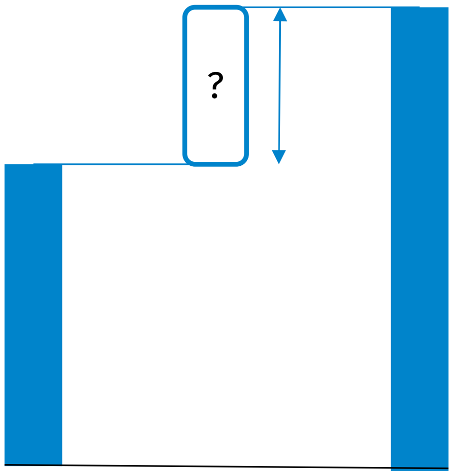
Decomposition – Example case

Final decomposition results

	Arithmetic	Geometric
Total funding ratio change	-7.5	-5.5
Subscriptions redemptions	-2.4	-1.4
Actuarial impact	-6.9	-5.5
Discount rate impact	-1.4	-1.2
Change in SAA policy weights	2.8	2.3
Change in expected returns	-4.1	-3.4
Investment year realization	6.9	5.9
Investment decisions	-3.8	-3.0

Funding ratio attribution

Overview



- Introduction to Funding ratio
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- Details – Liabilities repricing frequency
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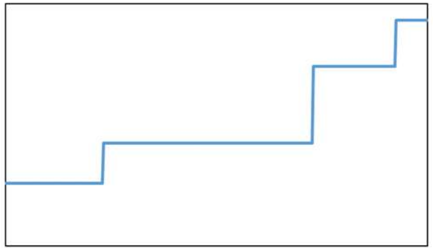
Details – Liability repricing frequency

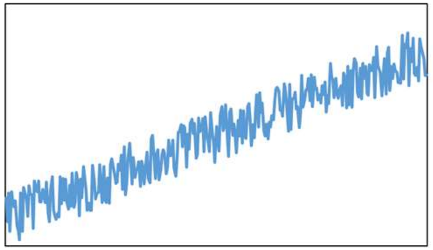
Step change vs continuous change

Growth of liabilities, may come …

Infrequently



Continuously



- Change in expected equity returns (> 1Y)
- Change in SAA asset-mix (> 1Y)
- Realized inflation (1Q-1Y)
- Update in life expectancy (> 1Y)
- Subscription/Redemptions (1M-1Y)
- New/Terminated business (1M-1Y)

- Asset growth is a continuous function
- Change in expected bond returns
- Change in expected inflation

Funding ratio attribution

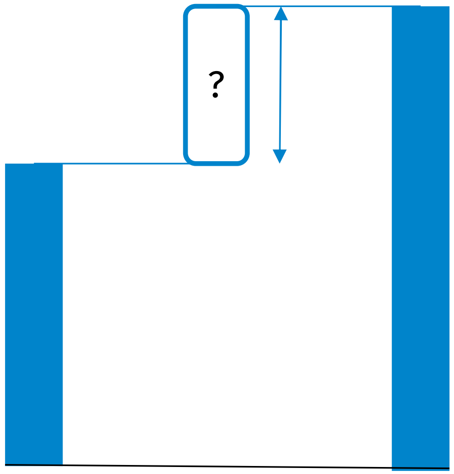
Overview

Introduction to Funding ratio

Decomposition of ratio changes

Details – Integrating investment decision

Summary



Details – Integrating investment decisions

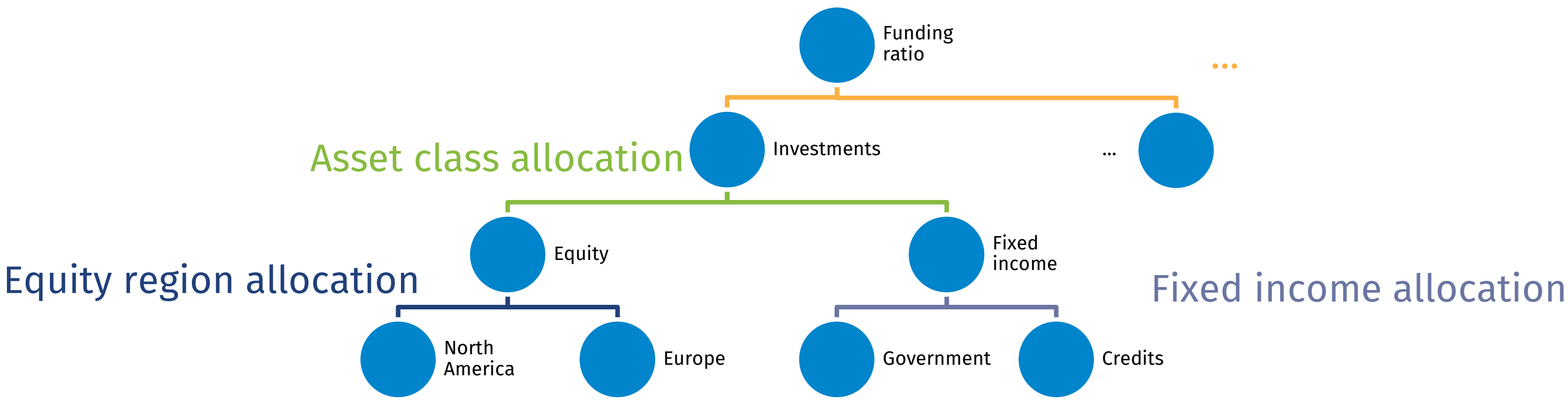
Investment decisions

Typical investment decisions

- Currency management
  - Strategic
  - Tactical
- Interest rate management
  - Strategic
  - Tactical
- Tactical asset mix
- Implementation decisions

Details – Integrating investment decisions

Model structure



Details – Integrating investment decisions

Micro attribution framework

	Actuarial	Asset class	EQ Region	FI Alloc
Top	-3.7	-3.4	0.7	-1.1
...	-3.7			
Investments		-3.4	0.7	-1.1
Equity		-1.9	0.7	
North America			0.5	
Europe			0.2	
Fixed income		-1.5		-1.1
Government				-0.3
Credits				-0.8

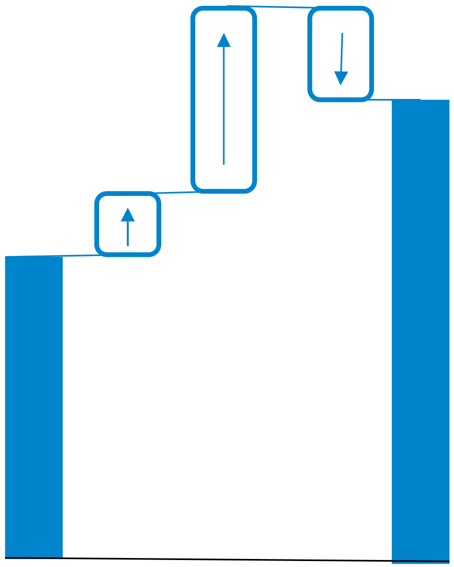
Details – Integrating investment decisions

Transposed

Total funding ratio change	-7.5
Actuarial Impact	-3.7
Investment decisions	-3.8
Asset class	-3.4
EQ Region	0.7
FI Allocation	-1.1

Funding ratio attribution

Overview



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Summary

Summary and time for questions

- Funding ratio attribution by molding data into existing formula sets
  - Treat growth as investment returns
  - Treat risk factors as investment decisions

- Specific circumstances require proper modelling choices
  - Solvency ratio and DC scheme differences
  - Regulatory framework
  - Model to transform discount rate into investible benchmark
  - Liability valuation frequency

- Questions?

Special thanks

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Background

Maarten Niederer, CFA, CIPM holds a Master degree in Computer Science from Utrecht University. Since joining Ortec Finance in 2008, Maarten has held several roles within the Investment Performance department. These roles ranged from business consultant, subject matter expert, to software developer. He is now one of the Chapter Leads for the broader organization.

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