

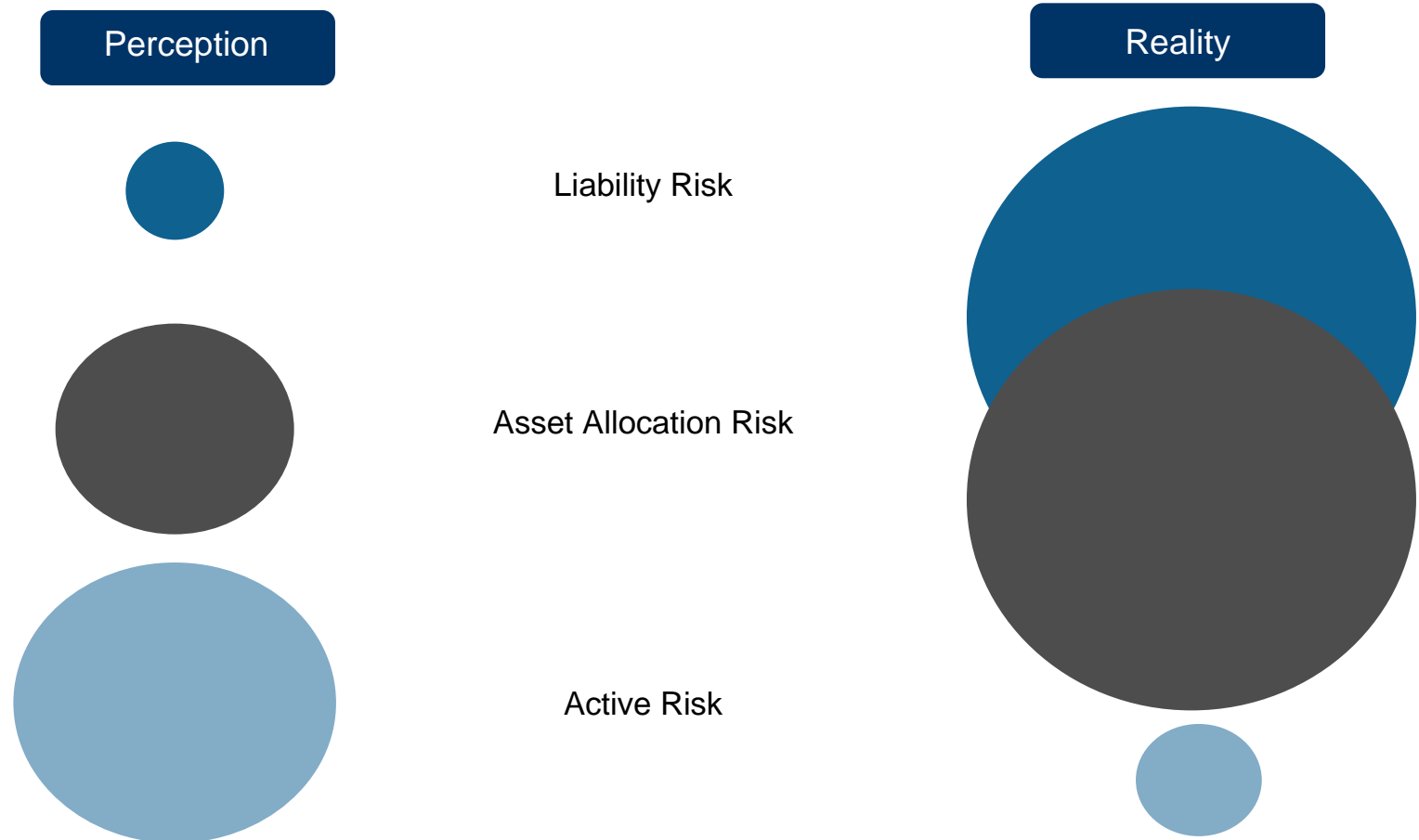
Fortis Investments

Implementing an LDI framework

April 26, 2007 – Alexander van Aken

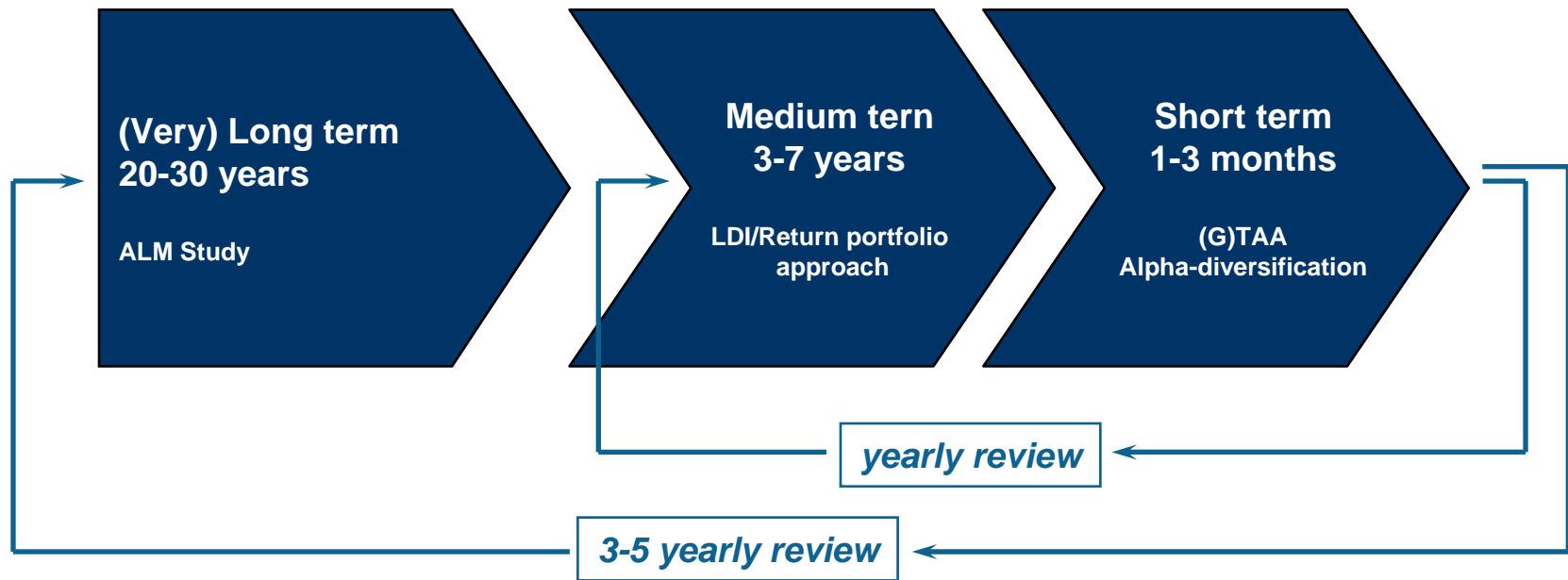


Common Misconceptions of Pension Fund Risks



Source: Leo de Bever, Ontario Teachers' Pension Fund

Strategic framework



From long term to medium term

Portfolio construction

- ALM Study gives optimal long term allocation
 - Most often defined as an optimal asset allocation between bonds, equities and cash
- This ALM portfolio defines the risk budget
 - Risk budget can be tracking error versus liabilities
- Interest rate risk is part of the overall risk budget
 - Interest rate risk is inefficient risk
 - Unless explicit view on (rising) yields
- Define interest rate matching strategy
- Use risk budget while optimising portfolio (matching part and return part) on 3 to 5 years basis

Four General Solutions to Minimise the Duration Mismatch

- Solution 1: Long bonds
- Solution 2: Swaps (usually in combination with bonds)
- Solution 3: Pooled funds without leverage
- Solution 4: Pooled funds with leverage

Solution 1: Long Bonds

Pros

- The expected outflow schedule (liabilities) can be closely matched in principle
- Suitable for virtually all pension fund statutes & investment guidelines/ restrictions
- Comparatively low volatility of funding ratio

Cons

- Very limited availability of bonds with maturity longer than 30 years
- Duration matching requires assets equal to the NPV of liabilities
- Only suitable for fully funded pension funds (i.e. funding ratio > 100%)
- No hedge against inflation and longevity (and limited hedge in the case of surplus)
- Comparatively high long-term funding costs

Solution 2: Swaps

(Usually in Combination with Bonds)

Pros

- Liabilities can be matched by assets worth less than 100% of the NPV of liabilities thus freeing assets for investment in higher yielding asset classes
- Swaps are customisable instruments that can meet any maturity requirement
- Suitable for both pension funds with deficit and pension funds with surplus
- Comparatively low long-term funding costs

Cons

- The pension fund's statutes & investment guidelines must allow the use of derivatives
- Potentially long and expensive set-up required for pension funds, e.g. due to limited instrument knowledge, negotiation of documentation (ISDA and CSA), etc.
- Potential operational issues, e.g. swap execution, confirmation & settlement, valuation, collateral management, counterparty risk management, etc.
- Only large pension funds can ensure efficient management and diversification of counterparty risk

Solution 3: Pooled Funds without Leverage

Similar to Solution 1

Pros

- Increased diversification and cost efficiency (particularly for smaller pension funds)
- Investment funds enjoy simple reporting requirements under IFRS/ IAS

Cons

- Closeness of match between assets and liabilities depends on the available buckets covered by the pooled funds, but will generally be less close compared to solutions 1 and 2

Solution 4: Pooled Funds with Leverage

Similar to Solution 2

Pros

- A pooled solution rather than direct investment in swaps is more easily acceptable for many pension fund boards
- Leverage frees assets for investment in higher yielding asset classes
- No set-up time required (redemptions and subscriptions can be executed anytime)
- No operational issues with swaps (managed within the fund), and simple reporting
- Increased diversification in terms of counterparty risk and maturity

Cons

- Closeness of match between assets and liabilities depends on the available buckets of the pooled funds, but will generally be less close compared to solutions 1 and 2
- Leveraged funds may require special authorisation by pension fund boards

Fortis Investments' LDI Approach

- Division of the assets into two distinct portfolios
 - Customised “**duration matching portfolio**” : minimising duration mismatch and interest rate risk
 - Customised “**return portfolio**” : generating excess return with remaining assets



- Building-block approach for the two portfolios based on pooled funds
 - Customisation based on client's individual requirements
 - Exploiting the investment management efficiency of pooling
 - Possibility for clients to split the “return portfolio” and use different asset managers

¹ Exact allocation depends on the client's risk profile, funding ratio, preferences, covenant, etc.

Bond Funds with Long Duration and Leverage

- A new Luxembourg-domiciled umbrella called “Fortis LDI Solution” and seven duration matching compartments have been created for institutional clients:
 - **FORTIS LDI SOLUTION Duration Matching 0-5Y Euro P**: duration ca. 2.5 years
 - **FORTIS LDI SOLUTION Duration Matching 5-10Y Euro P**: duration ca. 7.5 years
 - **FORTIS LDI SOLUTION Duration Matching 10-15Y Euro P**: duration ca. 12.5 years
 - **FORTIS LDI SOLUTION Duration Matching 15-20Y Euro P**: duration ca. 17.5 years
 - **FORTIS LDI SOLUTION Duration Matching 20-25Y Euro P**: duration ca. 22.5 years
 - **FORTIS LDI SOLUTION Duration Matching 25-35Y Euro P**: duration ca. 30.0 years
 - **FORTIS LDI SOLUTION Duration Matching 35-50Y Euro P**: duration ca. 42.5 years

These pooled duration matching funds are suitable building-blocks for LDI clients that are able to invest in leveraged funds. The leverage is generated purely by the use of derivatives (no borrowing) and frees assets for investment in a “return portfolio”.

Matching portfolio

Construction

Duration buckets	Liabilities per bucket	Relative contribution to total duration	Target duration of investment bucket	Optimal weight per bucket	Investments: relative contribution to total duration	Leverage	Cash Needed
duration 0-5y	22.5%	0.6	2.5	23.3%	0.6	2.8	8.4%
duration 5-10y	20.5%	1.5	7.5	20.3%	1.5	2.8	7.3%
duration 10-15y	17.3%	2.2	12.5	17.2%	2.2	2.7	6.4%
duration 15-20y	13.3%	2.3	17.5	13.2%	2.3	2.5	5.3%
duration 20-25y	10.0%	2.2	22.5	10.0%	2.3	2.3	4.4%
duration 25-35y	11.6%	3.4	30.0	11.4%	3.4	2.1	5.6%
duration >35y	4.8%	2.0	42.5	4.6%	2.0	1.6	2.9%
Total	100%	14.2	14.4	100.0%	14.2	2.5	40.2%

Risk report

Close matching possible

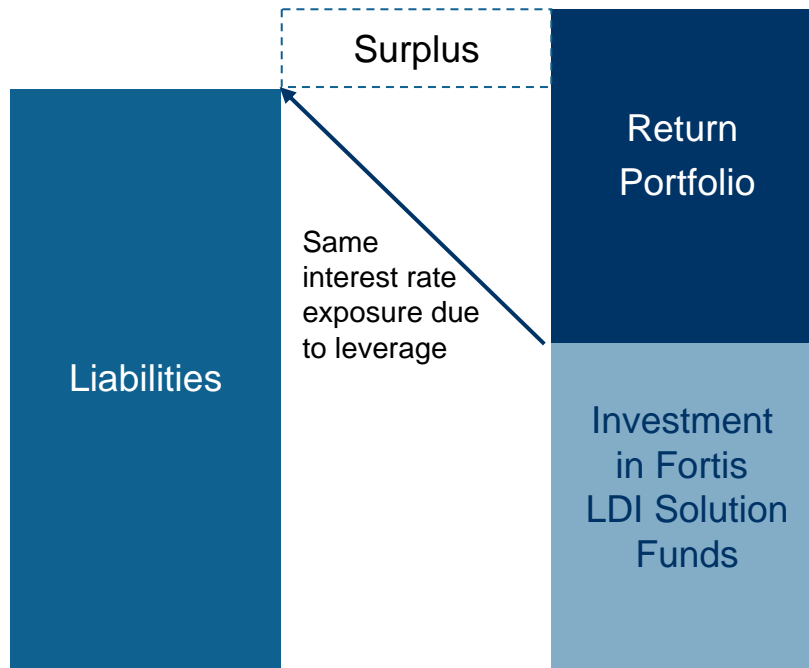
Ex-Ante Risk Figures									
	Annual - daily data		Annual - weekly data		Normal		Empirical		Worst case scenario daily loss
			Daily VAR 95%	Daily VAR 99%	Daily VAR 95%	Daily VAR 99%			
Client ptf volatility (%)	8.04%	9.41%	-8,781,157	-12,422,124	-8,845,554	-12,720,631			-19,932,810
Liabilities volatility (%)	8.02%	9.38%	-8,564,445	-12,115,557	-8,617,472	-12,402,433			-19,368,545
Difference			-216,711	-306,567	-228,082	-318,198			-564,265
Tracking error (%)	0.06%	0.05%							

Stress Test			
	Sept 11 2001	October 1998	February 1994
Client ptf	-0.12%	-7.68%	-9.07%
Liabilities	-0.10%	-7.79%	-9.26%
Difference	-0.02%	0.12%	0.20%

Disclosure

VAR calculations are based on a 2 years history window for the different key interest rates.
 Stress tests are done for three periods :
 September 09/11 : rates went down for the short to 10 years and up for the long end of the curve
 October 1998 (LTCM bankruptcy) : 10 Years + Rates went strongly up by more than 45 bps.
 February 1994 : All the curve moved by around 40-50 bps

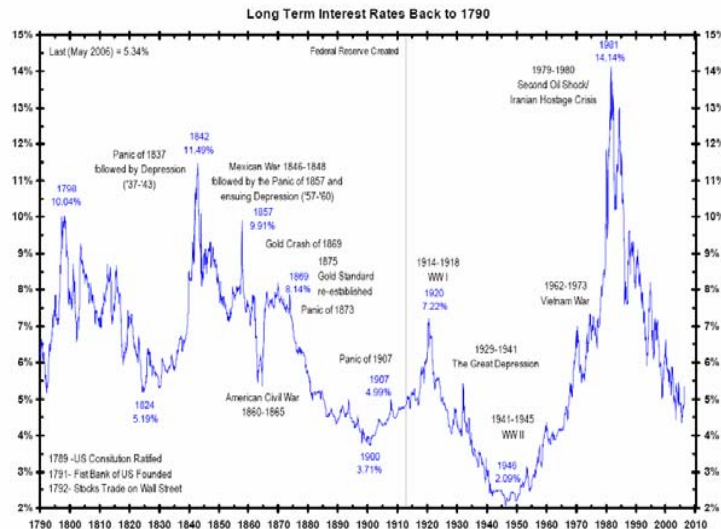
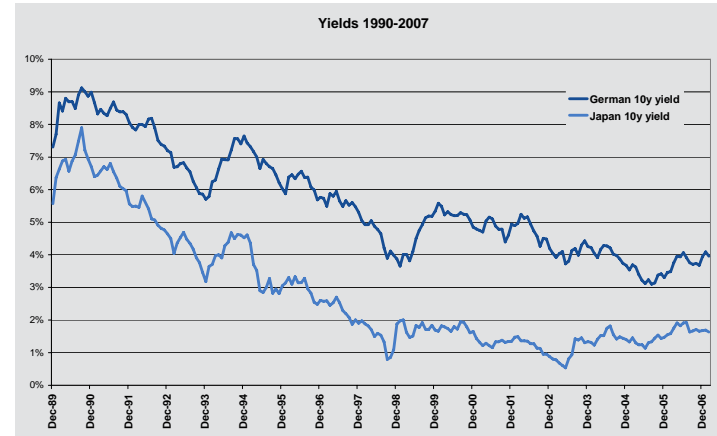
Leveraged Funds: Hedging while Freeing Assets



Advantages

- Leverage will only be used in the duration matching funds, and only for the sake of liability matching
- Keeps assets free for investing in higher yielding asset classes
- No operational issues and set-up time compared to direct use of swaps
- Highly flexible to allow customised solutions
- Cost efficiency and diversification of pooled funds

The Timing Question



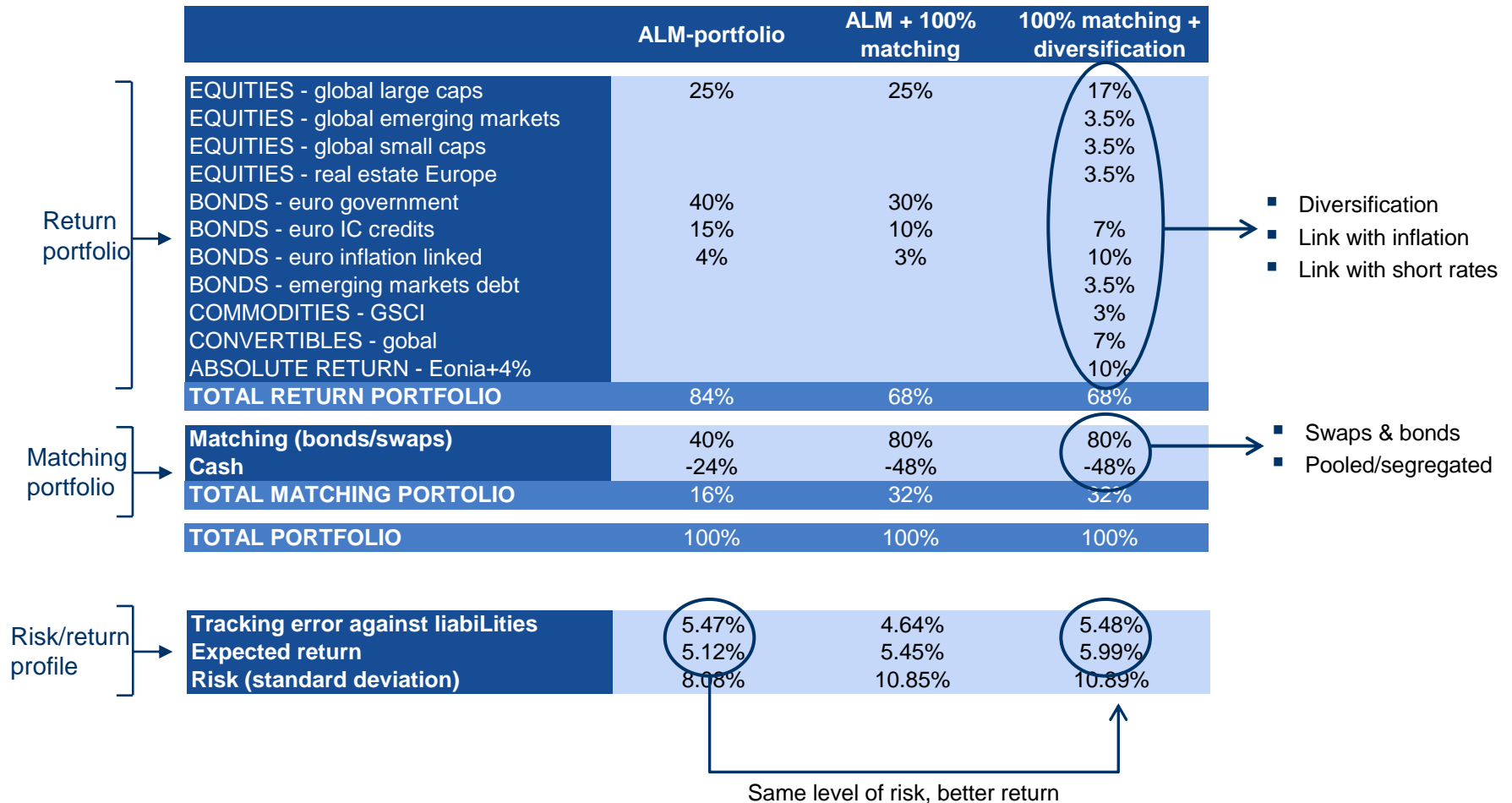
Source: Bianco Research, L.L.C.

- Setting up a matching structure now, means locking in current interest rate levels
- Given the current yields, this might be considered non-optimal
- But:
 - If interest rate will go even lower (Japan-scenario) we run considerable risks
 - Are interest rates really at historical low levels?

The Timing Question

- Tactical timing of strategic decisions is difficult and extremely risky
- Implement strategic decisions without (short term) tactical view
- Matching portfolios should be implemented in several steps
 - In order to spread risk over time
- Steps can be set by
 - Rate triggers, or
 - Date triggers
 - Or combination of both

Example



Return Portfolio

Based on Client's Individual Situation

- Based on the client's individual situation, funding ratio, risk profile, covenant and asset class preferences, the return portfolio usually has a number of aims:
 - Stable, positive returns (in excess of the risk-free rate)
 - Diversification among different asset classes and strategies
 - More or less strong link with inflation (depending on the structure of liabilities)
 - More or less strong link with the short-term rate (in case the duration matching portfolio makes controlled use of leverage)
- Due to the minimised interest rate risk (through the duration matching portfolio), the return portfolio can exploit the largest part of the available risk budget in an efficient way aiming to generate cover for other risks and to reduce funding costs
- It is possible to use a number of different asset managers for the return portfolio (as well as for the duration matching portfolio)

Reporting

Asset Class	Begin Value (000)	Begin Weight (%)	End Value (000)	End Weight (%)	Mandate	Performance		Year to Date	
						Portfolio	Benchmark	Portfolio	Benchmark
Total Portfolio	65,318	100.0%	67,225	100.0%	100.00%	3.05%		7.90%	
1. Return portfolio	45,069	100.0%	42,938	100.0%	100.00%	7.38%	5.45%	11.15%	8.60%
Total equities	19,765	43.9%	21,004	48.9%	45.00%	8.75%	7.06%	19.21%	14.75%
Europe Small Caps	2,945	6.5%	3,102	7.2%	7.50%	15.05%	13.34%	20.94%	19.47%
World	13,420	29.8%	14,209	33.1%	30.00%	6.50%	4.10%	17.55%	7.40%
Emerging markets	3,401	7.5%	3,693	8.6%	7.50%	12.77%	12.97%	17.64%	18.23%
Total fixed income	8,023	17.8%	6,286	14.6%	20.00%	1.39%	0.73%	2.46%	1.44%
Credits (inv. Grade)	3,515	7.8%	1,931	4.5%	10.00%	0.05%	0.05%	0.02%	0.47%
High Yield	2,256	5.0%	2,065	4.8%	5.00%	2.69%	3.09%	4.39%	4.80%
EMD bonds	2,252	5.0%	2,290	5.3%	5.00%	1.71%	-0.28%	5.83%	3.59%
Abs Return Growth	7,256	16.1%	6,335	14.8%	15.00%	3.91%	0.86%	2.40%	1.36%
Convertibles	4,522	10.0%	4,103	9.6%	10.00%	4.87%	4.83%	9.84%	13.57%
Real estate	5,015	11.1%	5,042	11.7%	10.00%	17.44%	15.55%	25.77%	22.74%
Forex positions	0	0.0%	0	0.0%					
Total cash	488	1.1%	168	0.4%					
2. Moneymarket funds	9,357	100.0%	0	100.0%	100.00%	0.24%		0.49%	
3. Matching + Cash (fictive)	10,892	100.0%	24,287	100.0%	100.00%	-1.48%	-1.60%	6.08%	5.82%
Matching Structure	10,892	100.0%	24,287	100.0%	100.00%	-4.16%		12.11%	
LDI 0-5 years	904	8.3%	2,059	8.5%		-0.64%		0.92%	
LDI 5-10 years	1,085	10.0%	2,062	8.5%		-3.75%		2.06%	
LDI 10-15 years	1,249	11.5%	2,312	9.5%		-4.17%		5.91%	
LDI 15-20 years	1,418	13.0%	3,008	12.4%		-4.88%		9.78%	
LDI 20-25 years	1,533	14.1%	3,429	14.1%		-4.67%		13.52%	
LDI 25-35 years	2,632	24.2%	6,014	24.8%		-5.26%		17.41%	
LDI 35-50 years	2,071	19.0%	5,405	22.3%		-3.70%		22.49%	
Liabilities	54,877	100.0%	53,464	100.0%	100.00%	-1.60%		5.82%	
Assets vs. Liabilities	119%		126%						

Thank you

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A presentation *from* **BARCLAYS GLOBAL INVESTORS**

Implementing an LDI framework Portable alpha

Stuart Jarvis

Strategic Solutions Group, Barclays Global Investors

Agenda

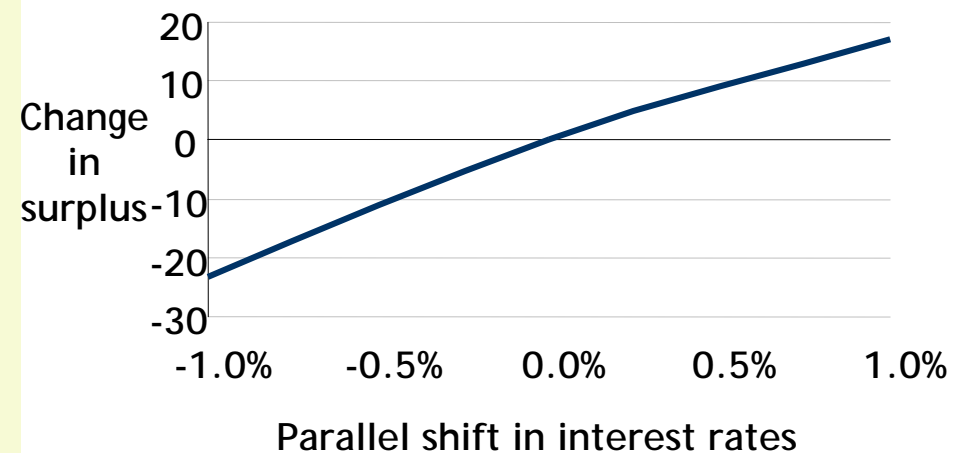
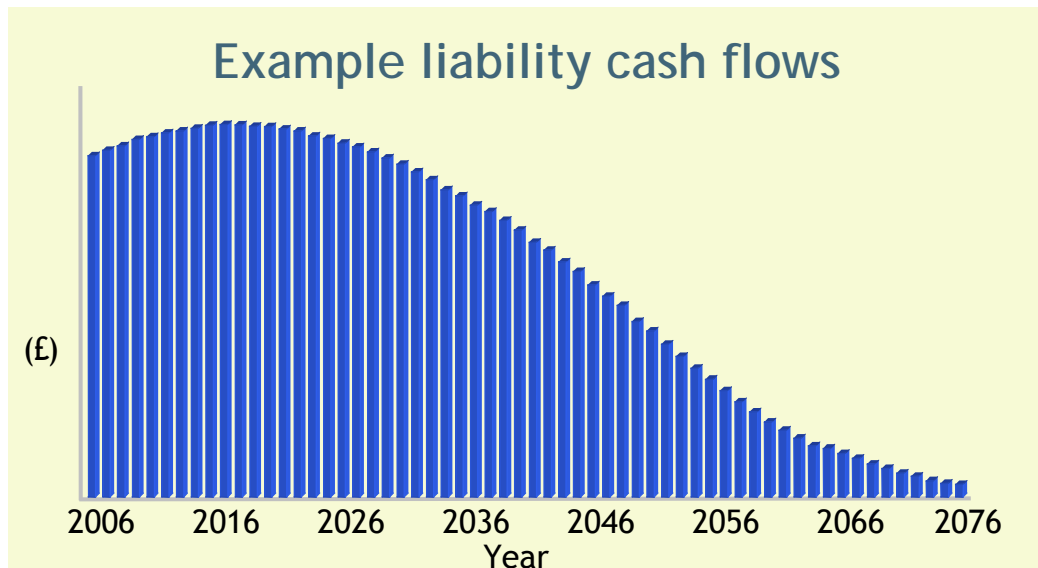
Constructing liability driven investment solutions

- Context
 - Pension plan liabilities
 - Investment risk in context of liabilities
- Risk budgeting
 - Risks to hedge, risks to take
 - Alpha and beta - approaches and products
 - The alpha beta decision revisited

Pension scheme risks

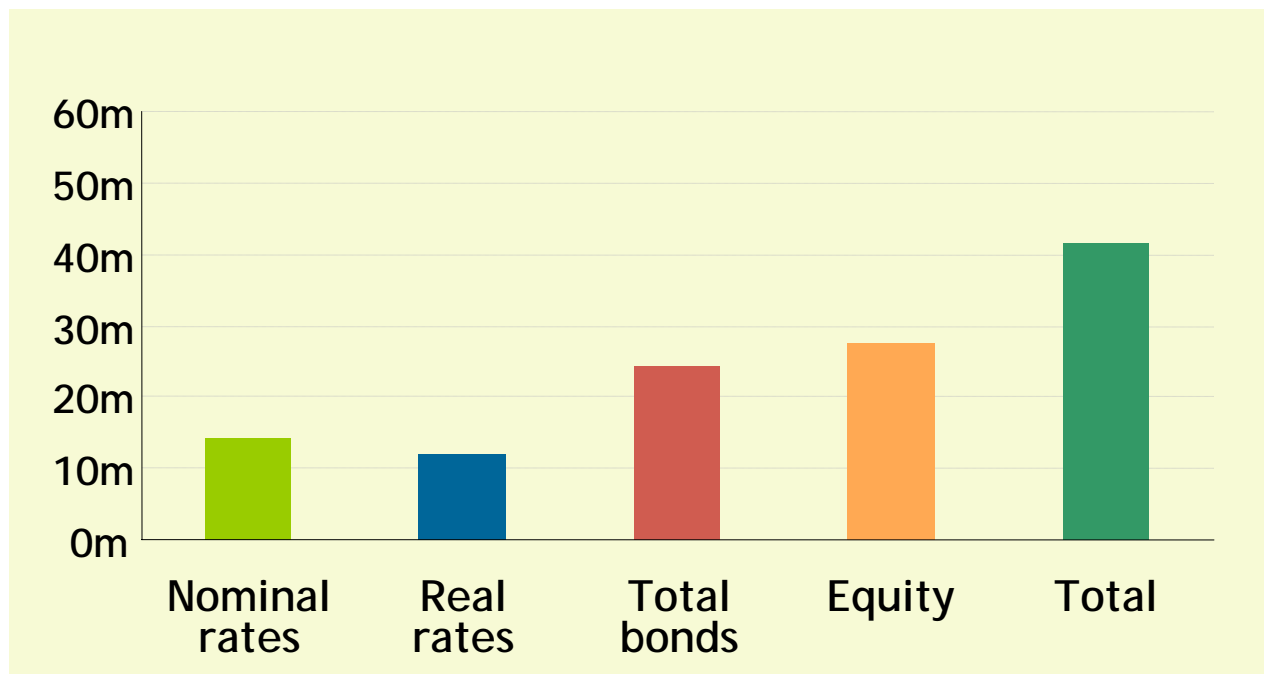
Start with the liabilities

- Liabilities are future cash flows dependent upon:
 - Longevity
 - Inflation
 - Scheme demographics (leaver rates, salaries etc.)
- Value of liabilities also depends on interest rates



Sources of risk – current strategies

- Main risks in portfolio: interest rates and equities
 - Fall in interest rates of 40 basis points* leads to 24m increase in deficit
 - Fall in equities by 14%* will lead to 28m increase in deficit



* Roughly 1 standard deviation, ie approximately a 1 year in 6 event

Corporate finance theory (Black et al)

- Risk & return in pension plan passes through to corporate sponsor
 - So treat plan as part of the corporate balance sheet
 - Liabilities are now like corporate debt
- Efficient investment strategies?
 - Modigliani-Miller tells us to focus on 2nd order effects
 - E.g. Sponsor should maximise value of the tax shelter & value of default option

LDI – practice

- Corporate finance point of view routinely ignored
 - Although wider view does inform the risk budget
 - Seek to trade off return & risk at the scheme level
- Risk / return trade off
 - Markowitz / Sharpe efficient frontier etc
 - ...plus active management

Liability Driven Investment = spending the risk budget wisely

Investment ground-rule #1

Hedge unwanted exposures & target desired exposures



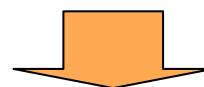
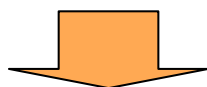
- Some risks *are relatively unrewarded*
 - Currency risk
 - Duration risk
- So don't take these risks unless forced
- Eg investing in foreign equities:
 - Introduces currency risk
 - Full or partial hedging can reduce impact
- Eg having pension liabilities:
 - Introduces exposure to interest rates and inflation
 - Hedge to reduce to a tolerable level

- BUT many risks *are rewarded*
 - Equity investment
 - Property, commodities, credit etc
 - Active management (but pick carefully!)
- Aim is to reduce volatility and retain return

Liability Driven Investment = spending the risk budget wisely

Investment ground-rule #2

To increase investment efficiency, the goal is to increase breadth



“Beta”
returns

- Breadth of sources of return
 - Reduce reliance on ERP by including other sources of economic return
 - Commodities
 - Credit

- Breadth within sources of return
 - Reduce concentration bias
 - Equities
 - Property?
 - Credit?

“Alpha”
returns

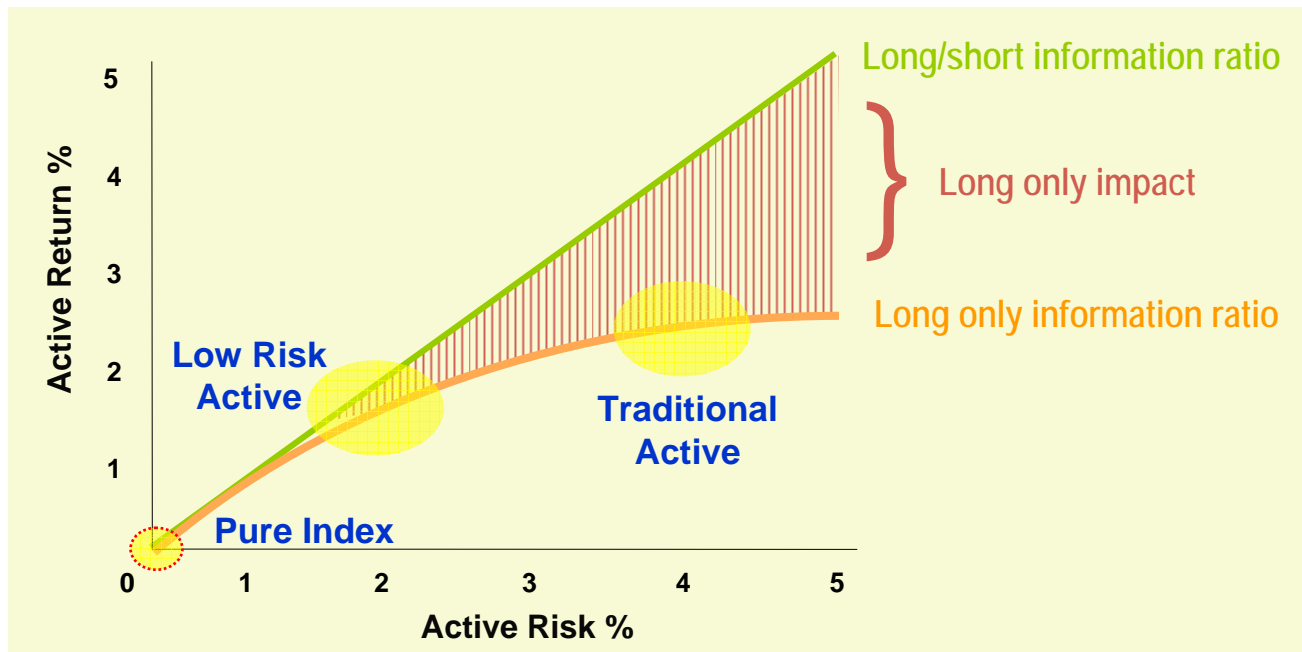
- Add exposure to ‘skill’ - ie active management

- Remove constraints within active management
 - Long only constraint
 - Use of derivatives

Minimising long only impact

Efficient use of risk

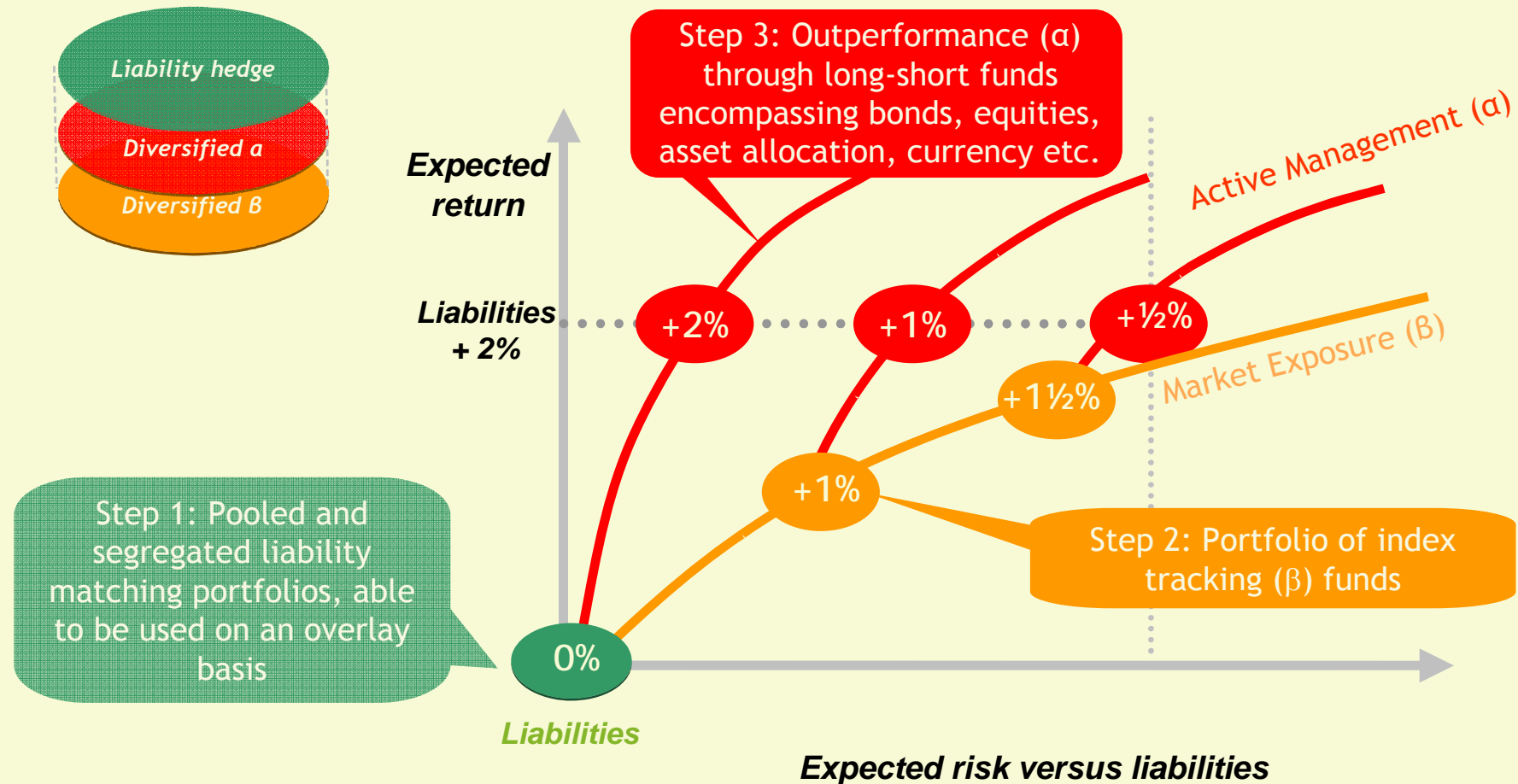
- Taking more risk does not lead to higher returns for long only portfolios
 - Negative views cannot be fully reflected without shorting
 - Only a small number of stocks in the All-Share index have a weight of more than 1%



Low risk strategy has a better information ratio

Investment efficiency in a liability context

Solutions involve a varying split between alpha and beta sources to suit client's preferences



Building block implementations

A full spectrum of solutions within Fixed Income

Govt bond funds + Swap based funds = Duration extension over government bonds

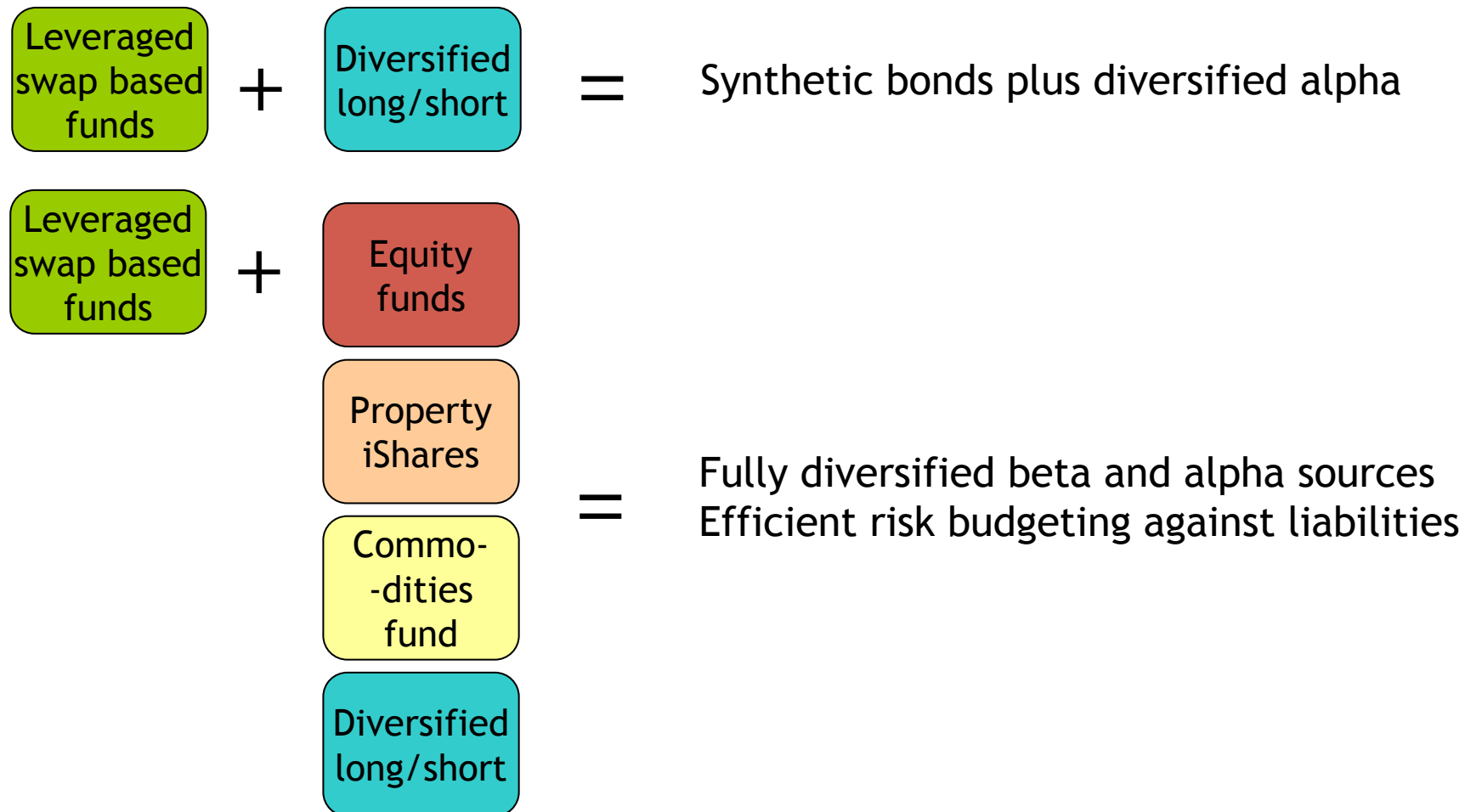
Swap based funds = Replicating liabilities fully with zero-coupon swaps

Swap based funds + Diversified Credit fund = Replicating liabilities with credit spread

Swap based funds + Diversified Credit fund + Fixed income alpha funds = Actively managed long duration

Building blocks for other asset classes

Leveraged swap based funds in combination with non-fixed income assets



Block builder's manual

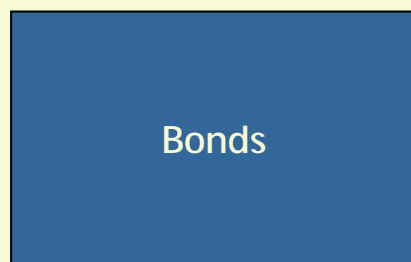
In the absence of portable alpha & beta

- Manager allocation problem can be handled in same way as asset allocation
- Need to determine, for each manager:
 - Style biases (factor exposures)
 - may not equal benchmark
 - Expected residual active risk & return
- Optimise
 - Aversion to active risk needs to be higher than aversion to market risk

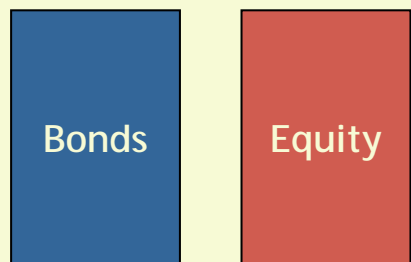
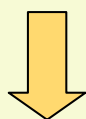
Swaps enable risk control and explicit risk-taking

Separately manage liability risk management and return generation

Without swaps

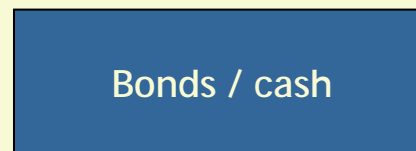
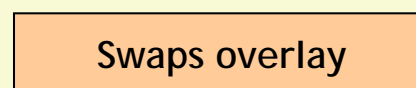


Difficult to hedge interest rate and inflation risks

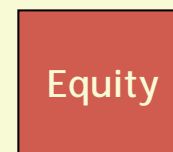
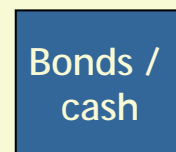
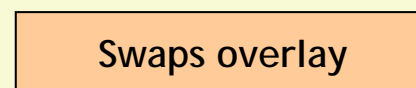


Additional interest rate and inflation risks

With swaps



Interest rate and inflation risks can be hedged

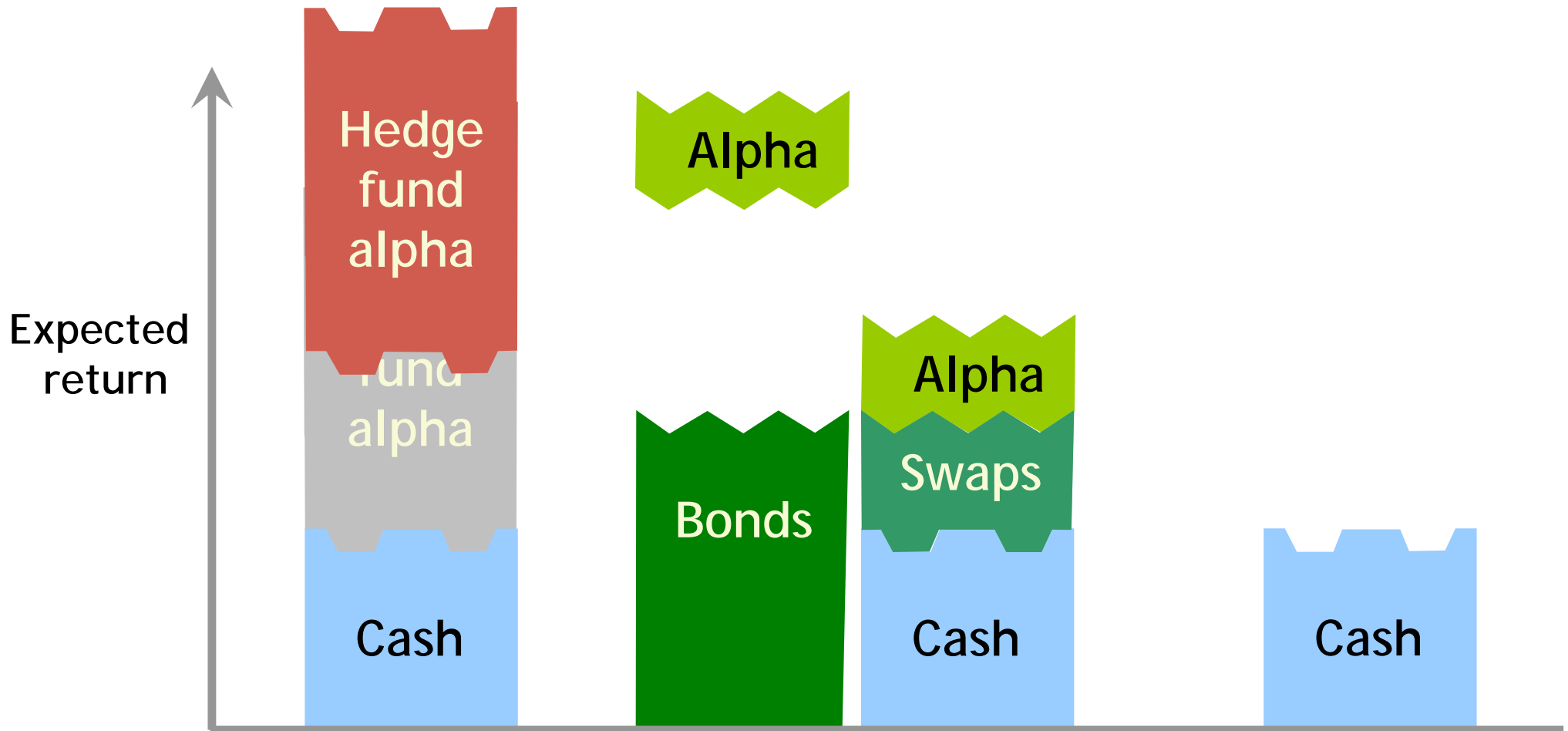


Interest rate and inflation risks still hedged

Same expected return, but less risk

Portable alpha

E.g. transfer alpha from cash benchmark to a bond benchmark



Beware beta masquerading as alpha

Active bond returns: high correlation with 'tilt' into high yield bonds

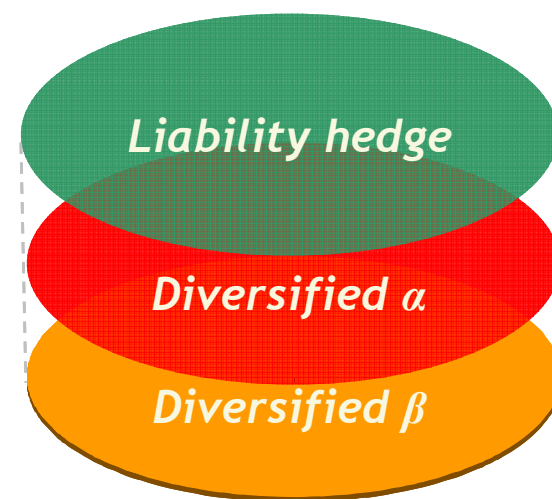


Source: CorePlus Manager Universe, eVestment Alliance.

Summary

Derivatives enable alpha & beta to be separated

- Minimise risk relative to liabilities
 - Match inflation and interest rate sensitivity of the liabilities using appropriate swaps
- Add value through taking investment risk in a targeted and structured manner
 - Use broad range of asset classes (diversified beta)
 - And broad, unconstrained active investment insights (diversified alpha)
 - If you like a manager's alpha but not his beta, then remove the beta - portable alpha



Focus on risk, return and cost relative to liabilities