AVON PENSION FUND

WORKSHOP: MANAGING LIABILITIES THROUGH THE INVESTMENT PORTFOLIO

8 MARCH 2016

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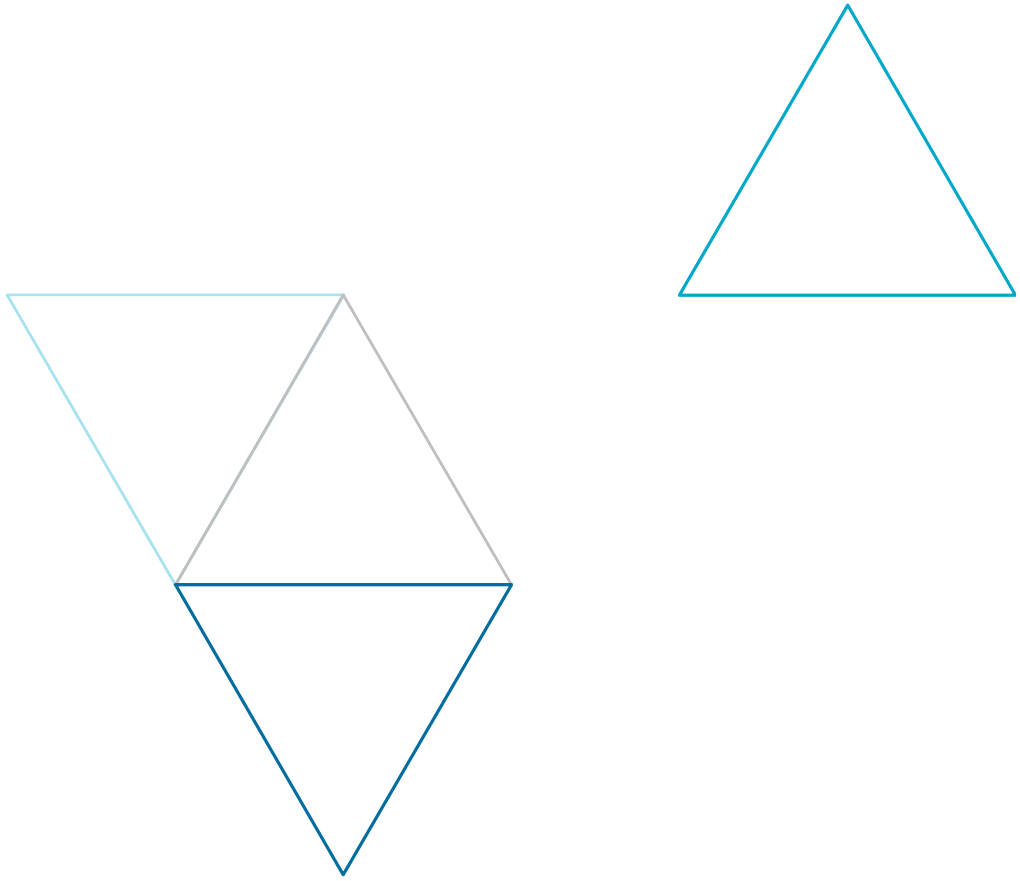
AGENDA

- Introduction *APF*
- Concepts *Mercer*
  - Risk management framework for liabilities
  - Identifying main risks
  - Interaction with valuation
- Coffee break
- Risk management *Mercer*
  - Market aware risk management
  - Use of leverage & synthetic instruments
- Next steps *APF*

CONCEPTS



RISK MANAGEMENT FRAMEWORK FOR LIABILITIES

Stable and affordable contribution rate

versus

Achieve investment returns required under funding arrangements

Objectives are two-fold but conflicting

- Risk needs to be taken in order to achieve returns but risk does not guarantee returns

Need to ensure a reasonable balance between the two objectives

- No need to take the same level of risk when 70% funded (say) than when 100% funded

RISK MANAGEMENT FRAMEWORK FOR LIABILITIES

Strategic Rationale

- Will help reduce deficit volatility which is high (as is the case with most LGPS funds), through better alignment of investment strategy and funding basis (i.e. greater certainty of achieving required returns)
- Overall return on the investment policy is expected to remain broadly the same given proposed initial structure (i.e. no reduction, which is needed to help reduce the deficit over the long-term)

Forward Looking

- Initial emphasis on putting in place “the plumbing” to facilitate future de-risking in a timely fashion, following improvements in the funding level and / or increases in market yields

IDENTIFYING MAIN RISKS

Risk	Manage, reduce or monitor?	How?
Equity and growth asset risk	Monitor (and potentially reduce) We expect to be rewarded for this risk but could reduce if we get ahead of funding plan	Performance monitoring + de-risking if affordable
Credit risk	Monitor (and potentially reduce) We expect to be rewarded for this risk but could reduce if we get ahead of funding plan	Performance monitoring
Active manager risk	Monitor We expect to be rewarded for this risk	Performance monitoring
Real return risk (generating above inflation returns)	**Monitor and look to manage over time when market conditions are more favourable**	**Use index-linked gilts initially and LDI techniques later**
Longevity risk	Monitor	As part of the actuarial valuation
Covenant risk	Manage and monitor	Develop employer specific investment strategies

INTERACTION WITH 2016 VALUATION

Covenant (Affordability)

	£m	
	31 March 2013	31 March 2010
Total assets	3,146	2,459
Liabilities:		
Active members	1,528	1,300
Deferred pensioners	749	451
Pensioners	1,745	1,260
Total liabilities	4,023	3,011
Past service surplus / (shortfall)	(876)	(552)
Funding level	78%	82%

Funding Strategy

Investment Policy

All three aspects are interlinked

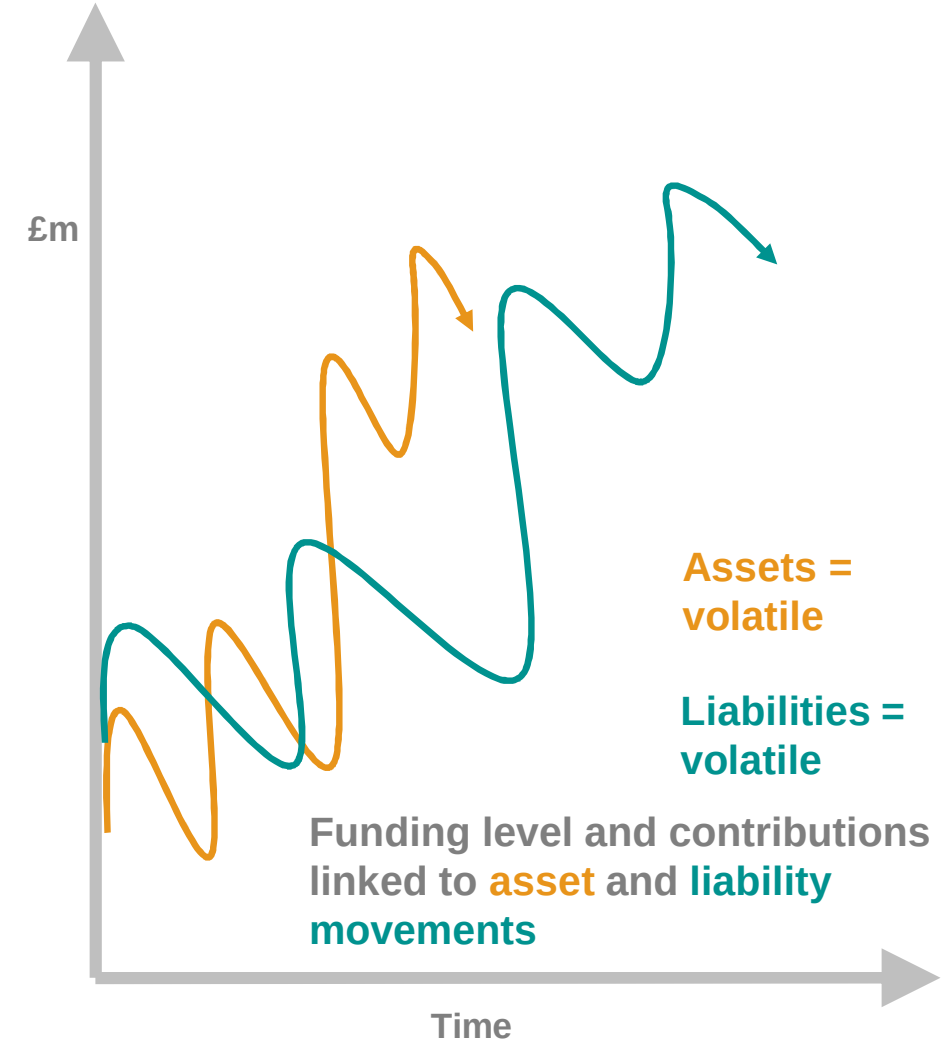
More certainty of outcomes (e.g. around deficit volatility and contributions) can be achieved by investing in a more liability aware manner

INTERACTION WITH 2016 VALUATION
COMPARISON OF MEASUREMENT

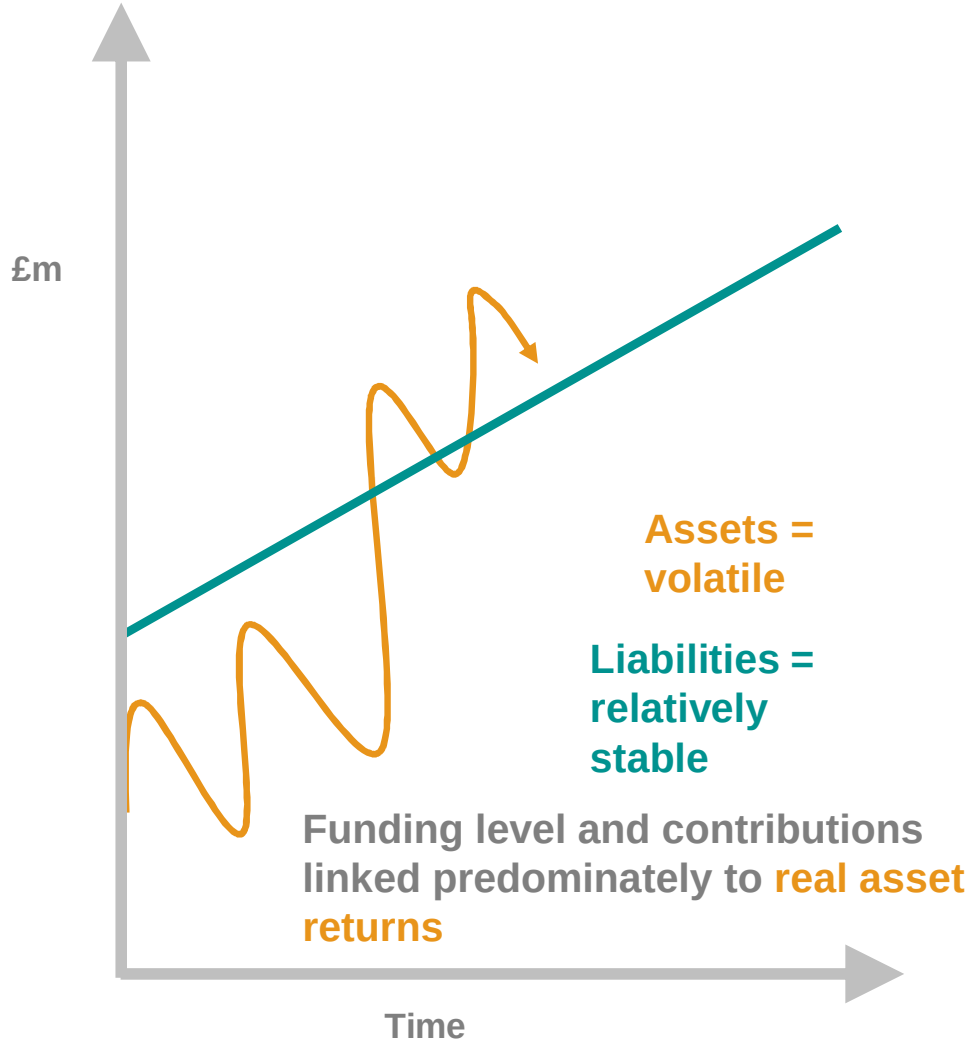
	Gilt + Fixed AOA	CPI+ (Fixed) Real Return	Comments
Assets	Based on market value of assets	Based on market value of assets	No smoothing, to maintain transparency
Liabilities	Directly Impacted by changes in real gilt yields Level of prudence critical	**Not** directly impacted by changes in real gilt yields Level of prudence critical	Ultimate goal of generating real returns vs CPI is unchanged but measurement of liabilities more stable in between valuations
Funding level	**Impacted by:** Investment performance (assets) Gilt yields and future expectations of returns (liabilities)	**Impacted by:** Investment performance (assets) Future expectations of real returns (liabilities)	**Direct and measurable link to the real returns on the assets relative to observed and expected CPI**
Contributions			
Investment strategy	Can reduce funding level and deficit volatility by hedging real interest rates (i.e. buying index-linked gilts)	Can increase certainty of achieving the required real return by buying index-linked gilts (for example) at the right price	**Emphasis not focussed on short-term volatility from gilt yields but on "locking in" to attractive inflation plus returns**

INTERACTION WITH 2016 VALUATION
IMPACT OF MEASUREMENT

Gilts + fixed AOA based discount rate (no hedging)



CPI + fixed real return based discount rate (no hedging)



INTERACTION WITH 2016 VALUATION
FOCUS ON REAL RETURNS

	Illustrative Expected return	Generate a long term real return?	Volatility of real returns
Equities	CPI + 4%	Yes	High
Property	CPI + 3%	Yes	Moderate
Corporate Bonds	CPI + 1%	No	Moderate
Index-Linked Gilts	CPI + 0%	Yes	Very low

Ideally want high and stable real returns

Some assets are more real than others

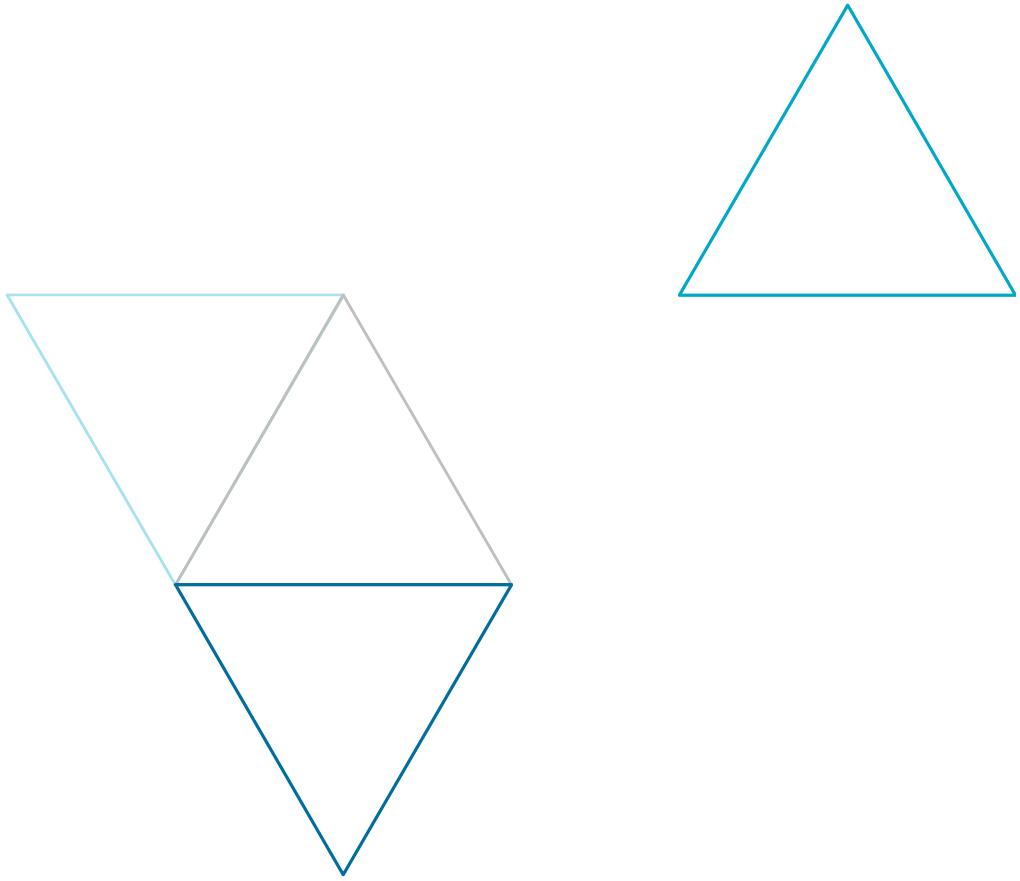
Challenge will be to balance return requirement with desire for certainty

Liability Driven Investment ("LDI") techniques can be used to add inflation protection to increase certainty – particularly to assets that aren't naturally real in nature. LDI techniques can also be used to increase certainty by "locking in" to attractive low risk real returns but there is a need to be "market aware"

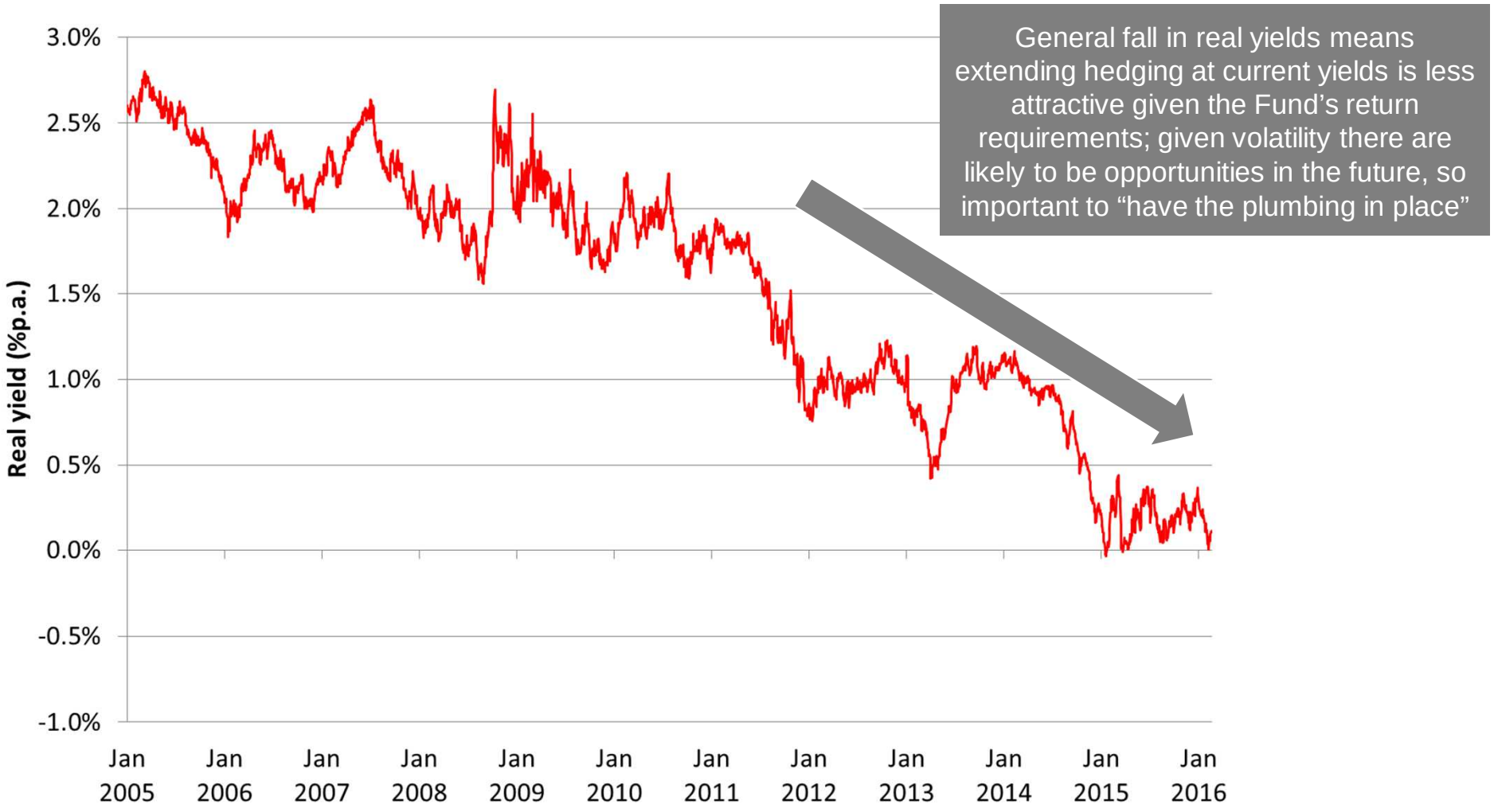
INTERACTION WITH 2016 VALUATION

- The proposed CPI basis will reduce short term volatility and places reliance on the assets to generate the required long term level of real returns (which is true of the current approach as well). Ultimately the only way to increase certainty in the long term is to invest in assets that generate the required level of return in a low risk manner.
- If we adopt a "CPI+" basis, then the hedging focus is more towards generating a certain level of real return with a lower level of volatility. In practice, there will be a degree of uncertainty for a considerable period of time as the Fund will need to take risk to generate the required level of returns. Even then the Fund will want to take some risk to manage costs.
- LDI therefore remains appropriate as it can increase certainty in two ways:
  1. By allowing us to "**add inflation**" to non-real assets such as corporate bonds
  2. By allowing us to "**lock in**" to low risk inflation linked returns
- In both cases above it will be important to take a market aware approach to implementing LDI. We would support the adoption of triggers to add inflation and lock into attractive CPI linked returns. **This is likely to mean adopting both inflation and interest rate triggers at appropriate market levels.**
- We look at how this could be achieved in the next section.

RISK MANAGEMENT



CPI REAL RETURNS*
ESTIMATE BASED ON INDEX-LINKED GILTS



*ANALYSIS ASSUMES CPI IS 1% P.A. LESS THAN RPI

CPI REAL RETURNS
CAPTURING AN ATTRACTIVE REAL YIELD

IMMEDIATE EXECUTION

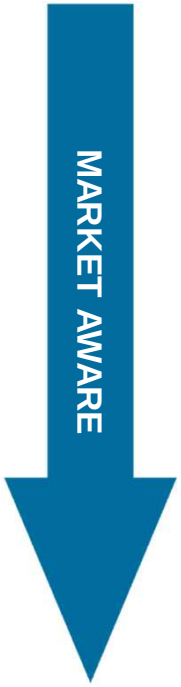
Immediate switch from the current to the target strategy, irrespective of the price (e.g. yield levels)

PHASED OVER TIME

Phase the switching over time by splitting the trade into tranches. The switches are done irrespective of price.

TRIGGER BASED

Set minimum pricing criteria (e.g. real yield trigger level or levels) which, once satisfied, will action switches towards the target strategy.



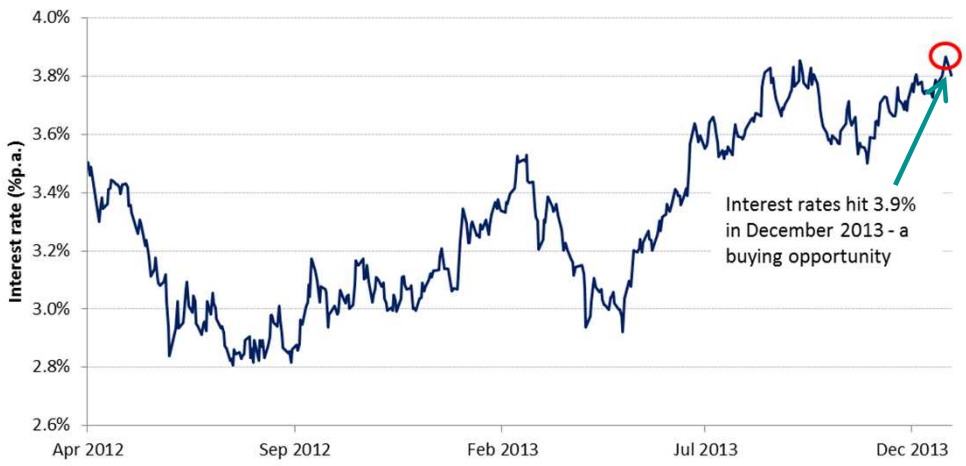
Using triggers allows us to increase certainty of achieving the required real return by locking in to real yields when considered attractive

CPI REAL RETURNS
TYPES OF TRIGGER

Type of Trigger	Pros	Cons
Yield based	• Protection is increased when the price of hedging assets becomes more attractive • Increases in yields are likely to result in improvements in the funding level, so broadly expected to result in de-risking when the funding level has improved (although not always the case) • Can set real interest rate triggers, or split into interest rate and inflation triggers (see overleaf)	• Possibility of triggers not being achieved and no risk reduction • Work to set up and monitor (but less complex than funding level approach); can be delegated to manager.
Funding level based	• Level of protection is increased as the funding level improves, helping to "lock in gains" • Potential to increase protection earlier than expected if funding level improves	• Could lead to missed opportunities in some scenarios (e.g. if yields rose but equity market falls meant the funding level did not improve to the same extent) • Work required to set up and monitor • More naturally suited to setting triggers for switching from growth to stabilising assets than increasing level of protection from existing stabilising assets

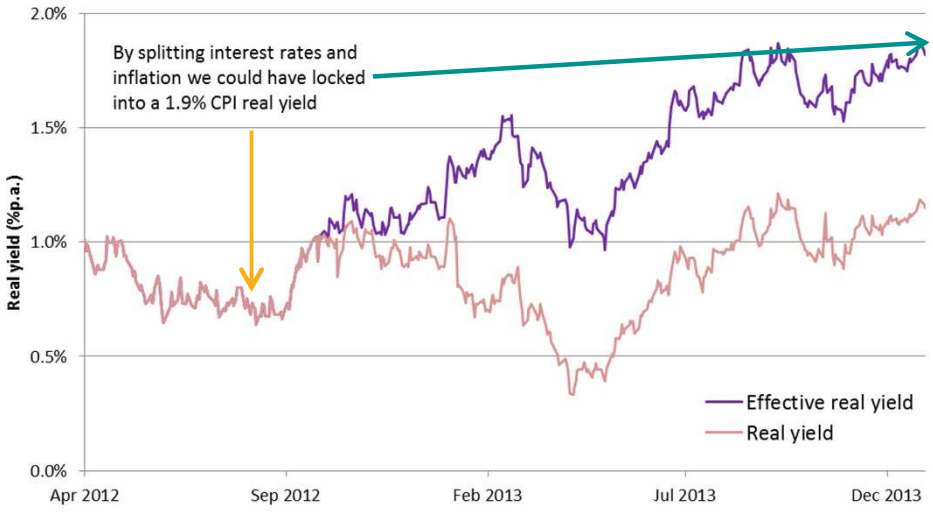
CPI REAL RETURNS
CAPTURING AN ATTRACTIVE REAL YIELD

Long dated gilt interest rate



Long dated swap inflation (converted to CPI)

Capturing an attractive CPI yield



Comments

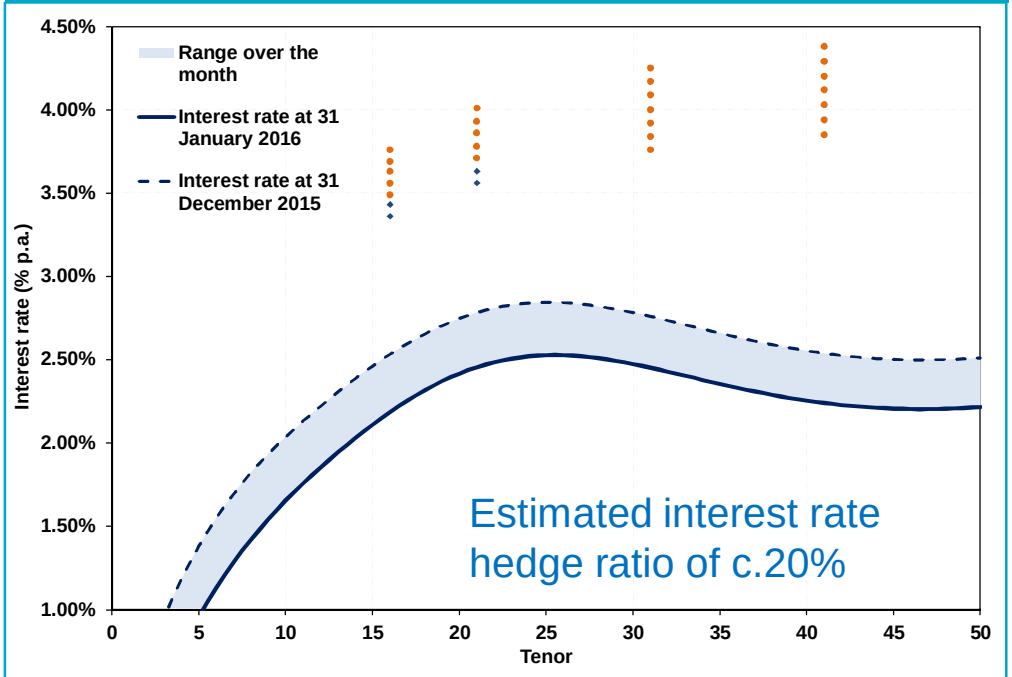
A real return can be split into two parts – interest rates and inflation. By splitting the two components we can increase the range of potential hedging opportunities.

Example shows we could have locked into a real yield of c.1.9% by taking advantage of interest rate and inflation markets that occurred at different times. This shows splitting triggers into interest rate and inflation components increases the opportunity set but also increases the level of complexity in the overall structure.

An alternative is to set “real yield” triggers but as shown on the previous page there have been fewer opportunities to hedge at attractive levels in the recent past.

EXAMPLE LGPS STRATEGY

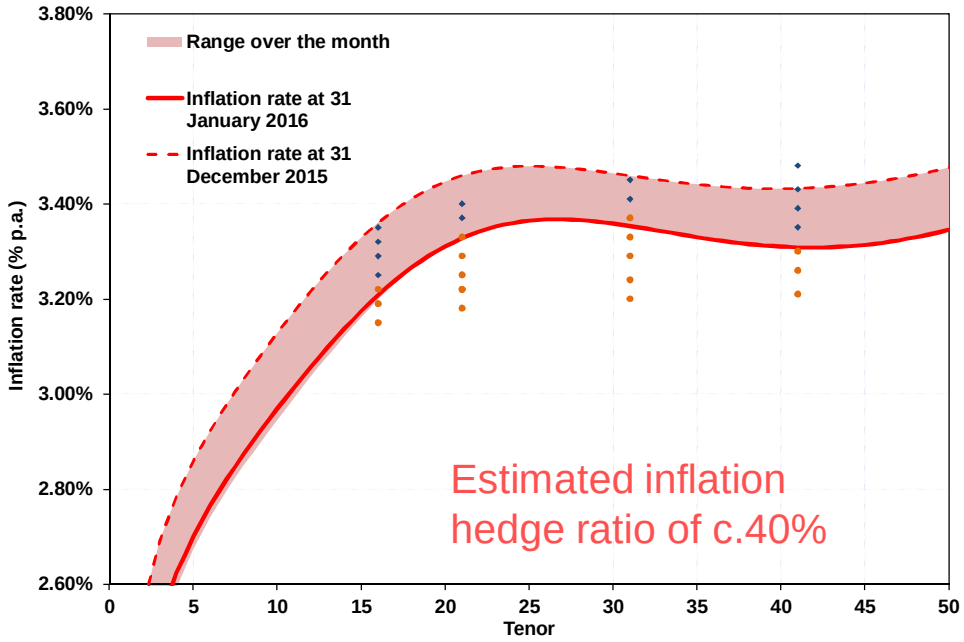
Interest rate hedging activity



♦ Triggers transacted ● Triggers not transacted

	Band 1	Band 2	Band 3	Band 4
Hedge ratio at 31 January 2016	36.8%	33.0%	13.0%	13.0%

Inflation hedging activity (note: different scale)



♦ Triggers transacted ● Triggers not transacted

	Band 1	Band 2	Band 3	Band 4
Hedge ratio at 31 January 2016	51.1%	30.0%	30.0%	50.0%

By splitting the interest rate and inflation triggers this Fund's deficit is £70m lower (i.e. the Fund is better off) than if the strategy had been implemented with "just" real yield triggers

HEDGING INSTRUMENTS

Physical Instruments ***(1:1 exposure)***

- Physical instruments require a capital investment at outset (i.e. funded)
- Liquidity varies by instrument
- Pricing is typically transparent and standard instruments are traded
- Commonly held by pension schemes and generally well understood

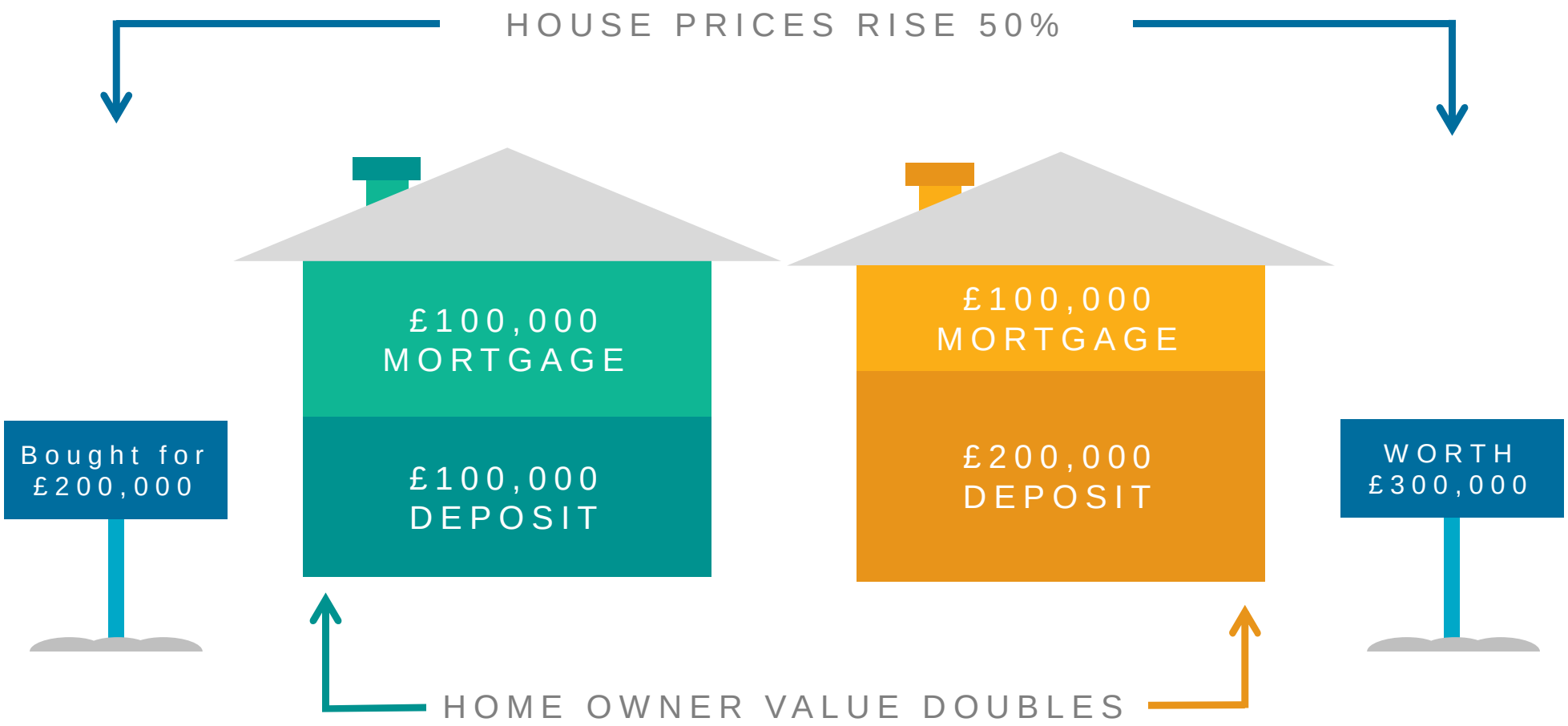
Fixed-Interest Gilts | **Corporate Bonds** | **Index-Linked Gilts**

Synthetic / Derivative Instruments ***(allows leveraged exposure)***

- Can be funded (i.e. capital commitment is made) or unfunded (i.e. geared or leveraged)
- Typically these are Over the Counter ("OTC", i.e. bespoke) although some exchange traded versions also exist
- Liquidity varies by instrument and within each type, some are highly illiquid and could be more illiquid than physicals
- Less transparency on pricing for OTC contracts, although some standard contracts address this
- Can offer more efficient hedging – i.e. more liability hedging per pound invested

Interest Rate Swaps | **Inflation Swaps** | **Gilt repos**

EVERY DAY EXAMPLE OF LEVERAGE



Exposed to £200,000 of movements in house prices, but only requires £100,000 of investment – "two times leveraged"

LEVERAGE EXPLAINED

Funded vs Unfunded exposure

Funded exposure

- It is said that the position is funded (or unleveraged) if the amount of assets (i.e. collateral*) invested in the hedging portfolio is backing the same amount of risk exposure
- e.g. £100 of collateral is backing £100 of risk

Unfunded exposure

- If amount of collateral invested is less than the amount of liabilities being hedged then the hedging portfolio is said to be levered
- e.g. £100 of assets hedging £300 of risk

Why use leverage? To "free up" assets to use elsewhere in the portfolio, i.e. for return seeking purposes

*Collateral: a term used to describe the underlying assets invested in the LDI funds. The assets are typically high quality and liquid assets such as cash instruments and government bonds, and are "on deposit" as security. These assets would be used to offset the potential loss should either counterparty default on its obligation under a swap or gilt repo.

LEVERAGE EXPLAINED

What if?

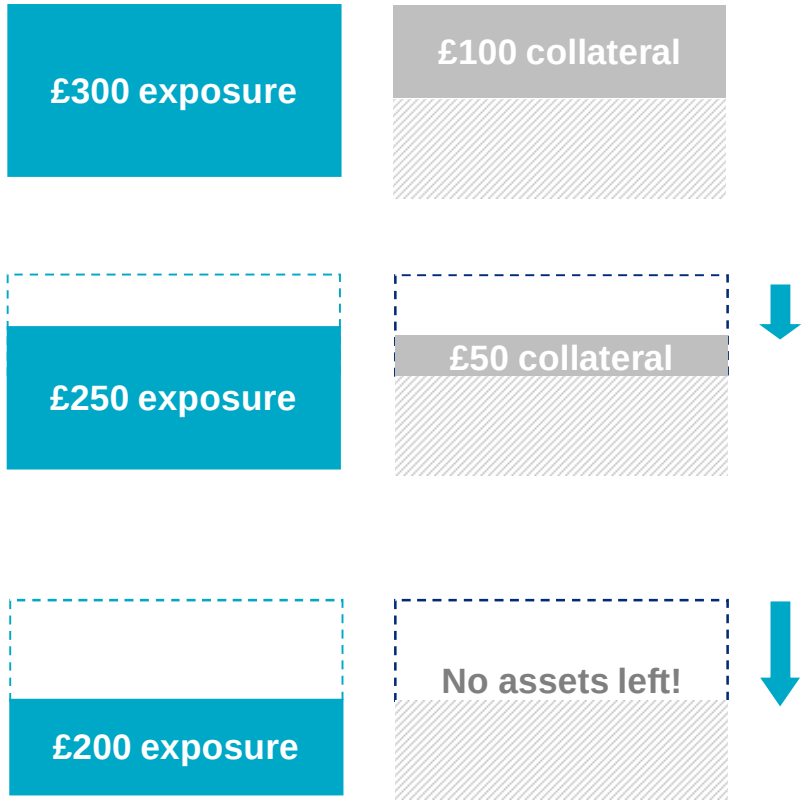
- Starting position: £300 of interest rate exposure
- Obtained using £100 of collateral (e.g. cash)
- i.e. **3** times levered (i.e. 3 times more sensitive to movements in rates)

If yields rise by 1%, it increases leverage

- Loss on interest rate exposure of £50
- So value of collateral drops from £100 to £50
- Leverage is £250 / £50 = **5** times (up from 3)

If yields rise by 2%, collateral extinguished(!)

- Loss on interest rate exposure of £100
- Value of collateral drops from £100 to zero
- More collateral required or close position
- In practice, collateral should be replenished long before this point is reached.



Leverage will rise / fall as net interest rates rise / fall

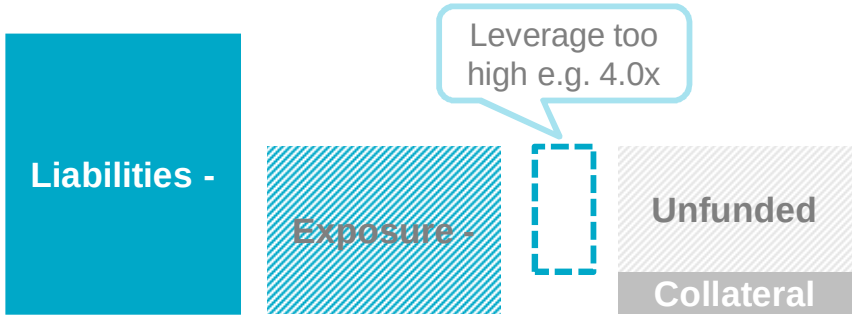
RECAPITALISATION / RE-LEVERAGING EVENTS

If yields rise or fall beyond certain points the leverage may be too high or low to be managed efficiently. Once certain levels are breached a **recapitalisation** or **re-leveraging** event may be triggered.

Recapitalisation

An increase in yields means that leverage levels increase.

If this level becomes too high, the value of the fund may be too volatile as increasingly small changes in yields can decrease the level of collateral materially.



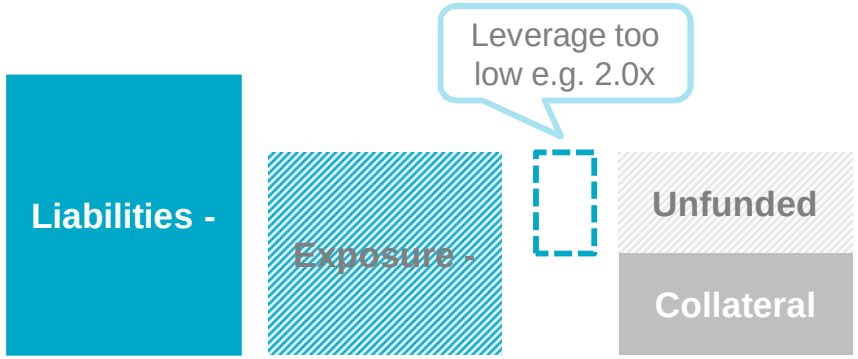
A manager may require that collateral be "topped up" within a particular timeframe. This additional money decreases the unfunded exposure.

This additional capital would have to be funded from the Fund's holdings in growth assets or corporate bonds, which would reduce the expected return on assets. However, in this scenario yields have risen and so the funding level of the Fund has improved. All else being equal, less risk needs to be taken to achieve the existing funding objective

Re-leveraging

A reduction in yields means that leverage levels fall.

If this level becomes too low, the LDI portfolio may be seen as inefficient as additional liabilities could be hedged with the same level of collateral.



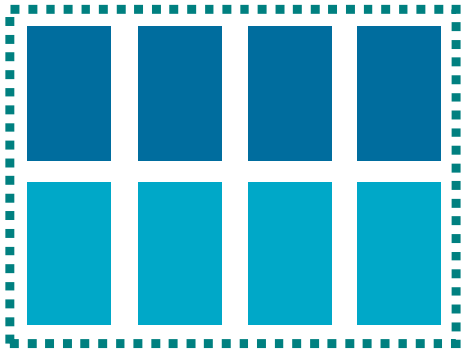
A manager may "return" to the Fund cash to invest, whilst maintaining the level of liability matching.

BASICS OF IMPLEMENTATION

Increasingly bespoke

Client-specific Pooled Fund

- A Fund specific, tailored 'pooled fund for a single investor'.
- Only an IMA is required. Other documentation is done by the manager.
- Typically set up as Dublin registered Qualified Investor Fund ("QIF").



Multi-client Pooled Funds

- LDI providers offer a variety of ranges of pooled funds. These include
  - Gilt-based LDI funds (real and nominal, various durations)
  - Swap-based LDI funds (real and nominal, various durations)
  - Dynamic LDI funds (instrument selection / curve positioning)

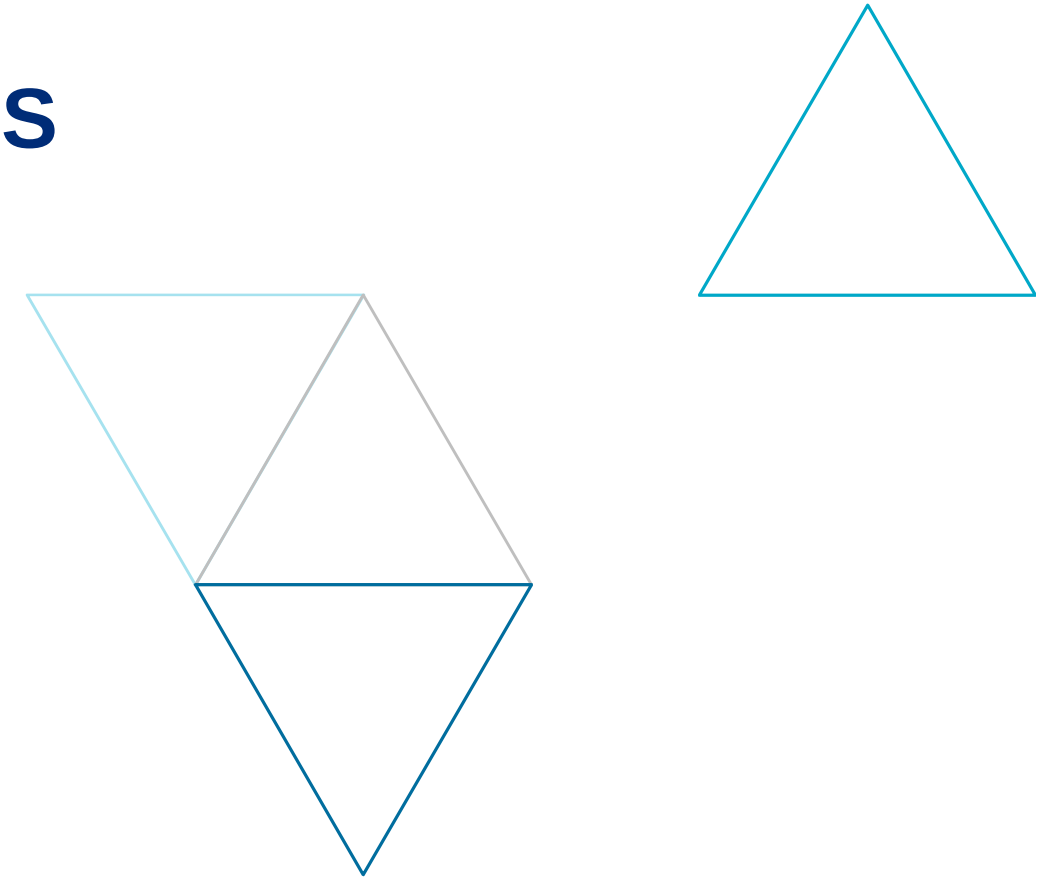
Simplicity

Can be comfortably implemented using pooled funds, but more bespoke options are also worth considering

Not concerned over manager concentration risk at these levels and initially using 12% of assets (currently all held with one manager anyway); re-evaluate this if and when increasing further (and consider if a bespoke pooled fund is more efficient)

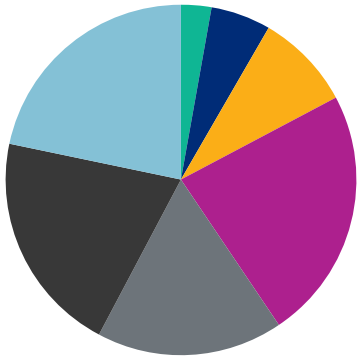
Currently use income on segregated bond holdings to pay benefits; this will not be available from pooled leveraged funds, and so disinvestments from elsewhere will be needed

ALTERNATIVE RISK MANAGEMENT APPROACHES FOR SPECIFIC EMPLOYERS



ALTERNATIVE RISK MANAGEMENT APPROACHES
EMPLOYER SPECIFIC STRATEGIES

EMPLOYERS



KEY EMPLOYER FEATURES:

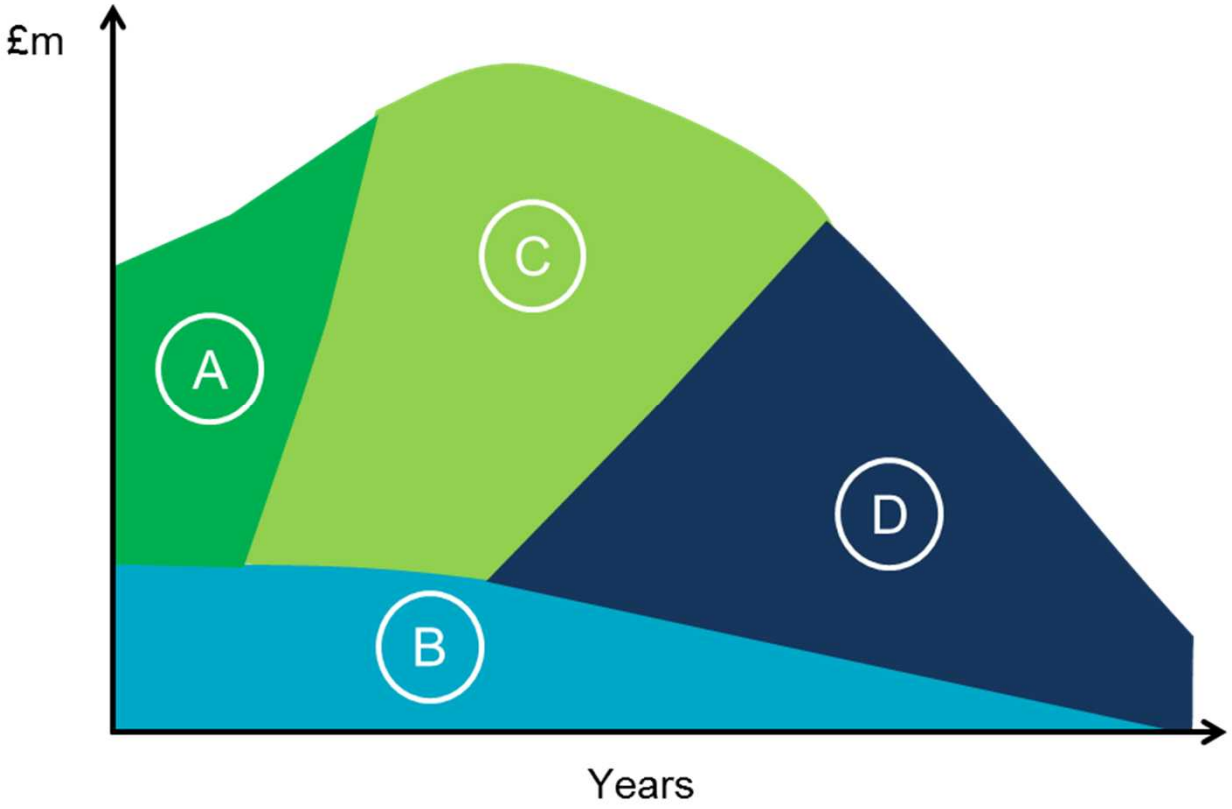
- FUNDING LEVEL
- SIZE & MATURITY
- COVENANT
- EMPLOYER OBJECTIVES

HIGH RISK

MEDIUM RISK

LOW RISK

EXAMPLE LOWER RISK INVESTMENT STRATEGY
ORPHAN LIABILITIES, FULLY FUNDED EMPLOYERS



A : Higher yielding credit

B : Income-producing illiquid assets

C : Investment grade corporate bonds

D : Gilts & hedging instruments

Cashflow Matching

- Strategy would aim to match actual cashflows by investing in income generating investments
- Total return limited, but income known in advance (assuming no defaults)
- Emphasis is on income generation – consistent with expenditure requirements
- Existing "real" assets (infrastructure and property) could fit in to strategy
- Segregated accounts and custodian necessary for accurate cashflow matching
- Significant proportion of assets "locked up" for an extended period of time – aim is to benefit from the illiquidity premium
- Funding position very stable if discount rate linked to yield on assets held
- Residual risks remain including: re-investment risk, default risk and mortality risk
- Some implementation challenges that would need to be addressed

EXAMPLE LOWER RISK INVESTMENT STRATEGY
ORPHAN LIABILITIES, FULLY FUNDED EMPLOYERS

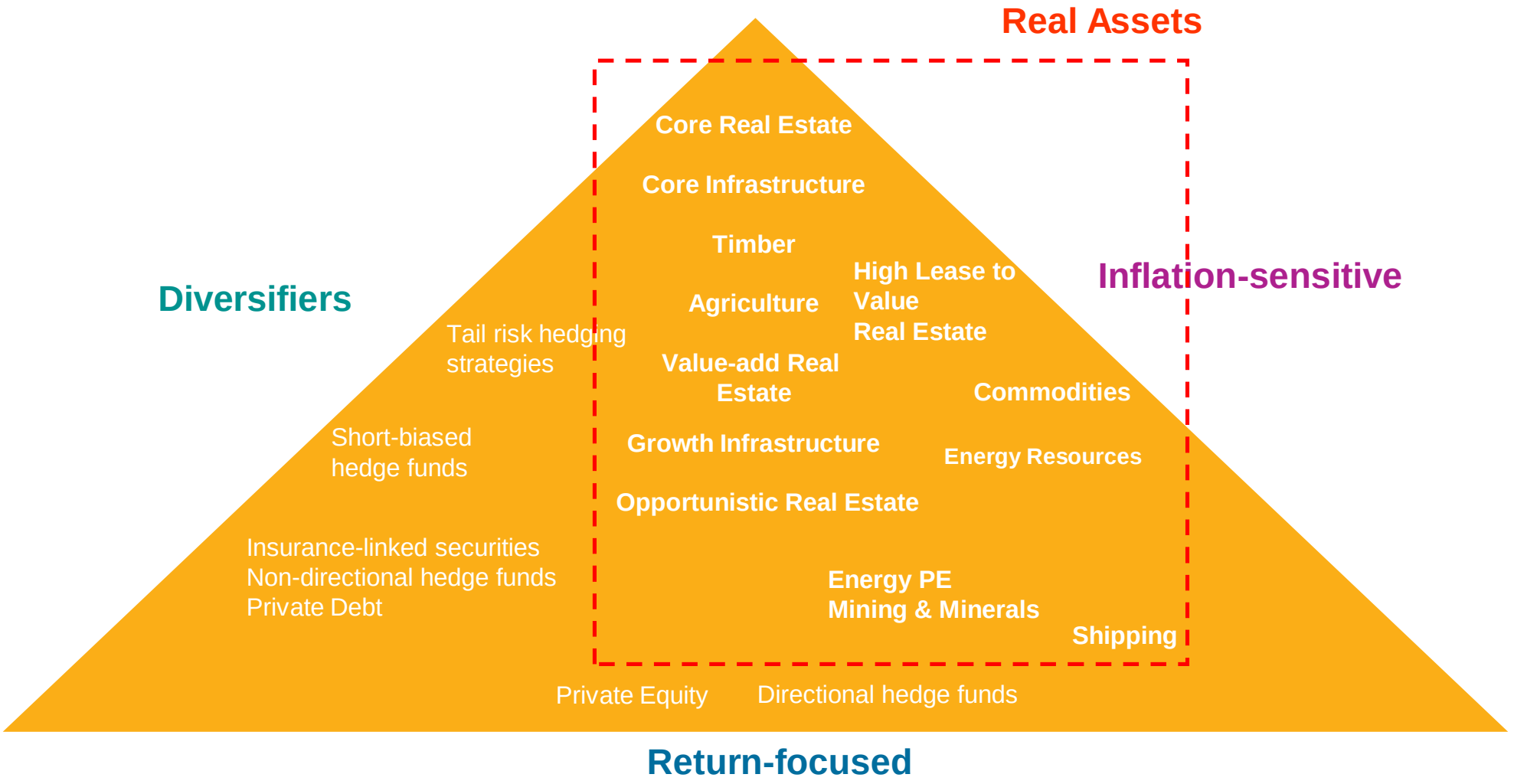
Current Investment strategy

- Growth portfolio aims to provide sufficient return for recovery plan
- Matching portfolio aims to reduce risk by matching characteristics of liabilities
- Total returns unconstrained since dependent on success of growth assets
- Assets invested in diversified range of asset classes with a range of return sources
- De-risking possible for specific tranches of liabilities given prudence in funding basis
- Funding position can be volatile hence a greater need for prudence to control outcomes

Cashflow matching

- No real growth portfolio – all investments in bond-like instruments
- Strategy would aim to match actual cashflows by investing in income generating investments
- Total return limited, but income known in advance (assuming no defaults)
- Emphasis is on income generation – consistent with expenditure requirements
- Segregated accounts and custodian necessary for accurate cashflow matching
- Significant proportion of assets “locked up” for an extended period of time – aim is to benefit from the illiquidity premium
- Funding position very stable if discount rate linked to yield on assets held

EXAMPLE LOWER RISK INVESTMENT STRATEGY
"REAL ASSETS"



QUESTIONS?

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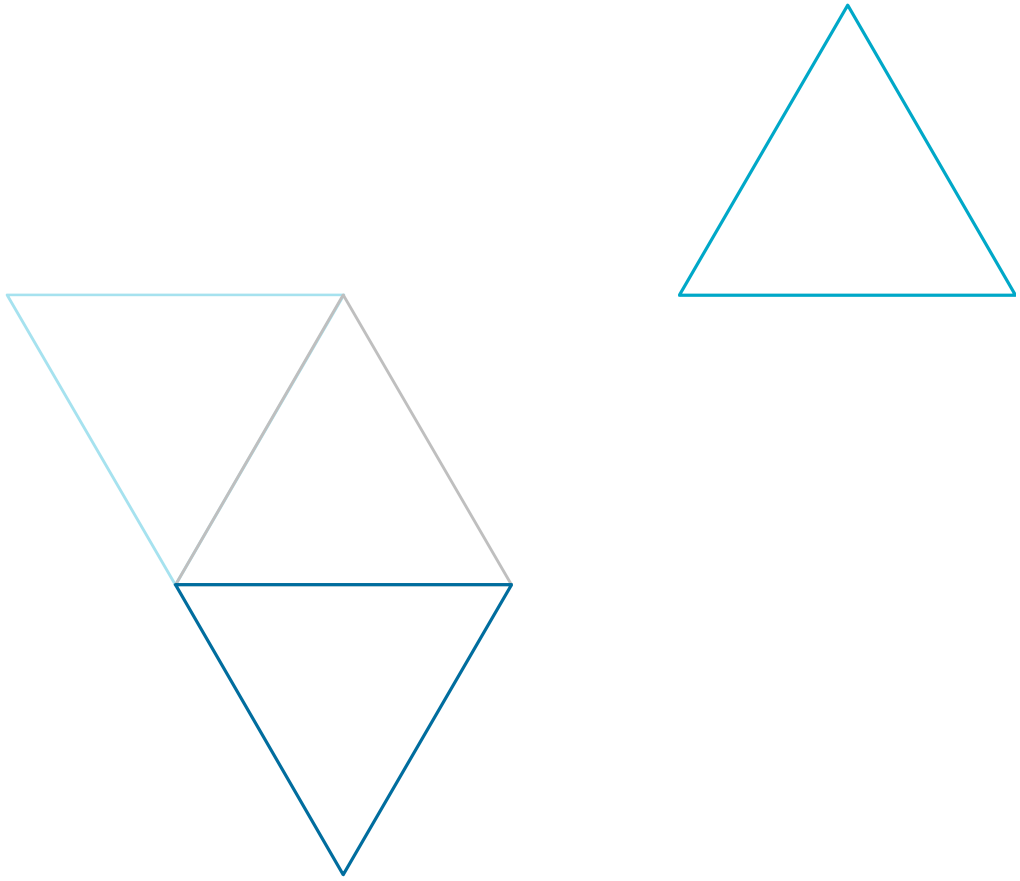
APPENDIX



IMPORTANT TERMS

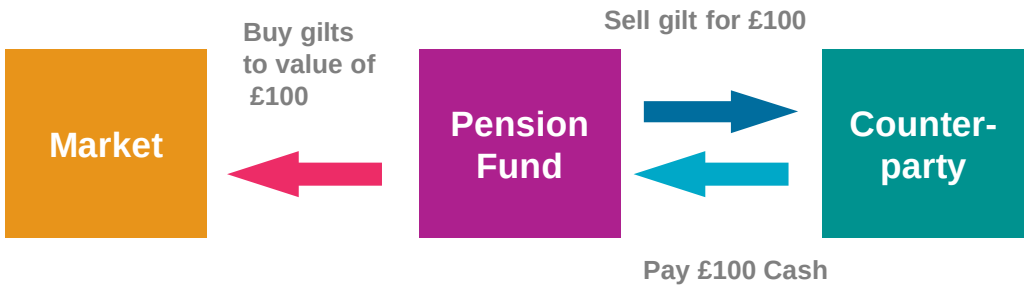
- **Interest Rate Swap** – Two parties exchanging two sets of cashflows, usually based on one party paying a “fixed” rate (e.g. 3% p.a.) and the other paying a “floating” rate (e.g. Bank of England Base Rate + 2%)
- **Repurchase Agreement (Repo)** – An agreement to sell a security (usually a bond) to another party with the promise to buy it back at a specified date and price
- **Repo Rate** – The interest rate charged to the seller of the security in a repo
- **Basis Risk** – Risk that arises when an investor aims to hedge a position using an instrument that has an underlying security whose risk is being hedged. For example, a pension fund using bonds to hedge liabilities they do not perfectly match

WHAT IS A GILT REPO? (1)

A gilt repurchase agreement is a liability hedging instrument which allows investors to employ leverage, that is to hedge a higher level of liabilities than the value of the underlying assets.

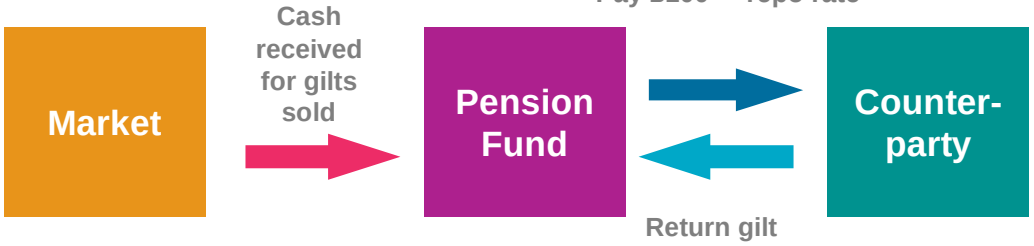
Gilt repo contracts work as follows

Day of the trade



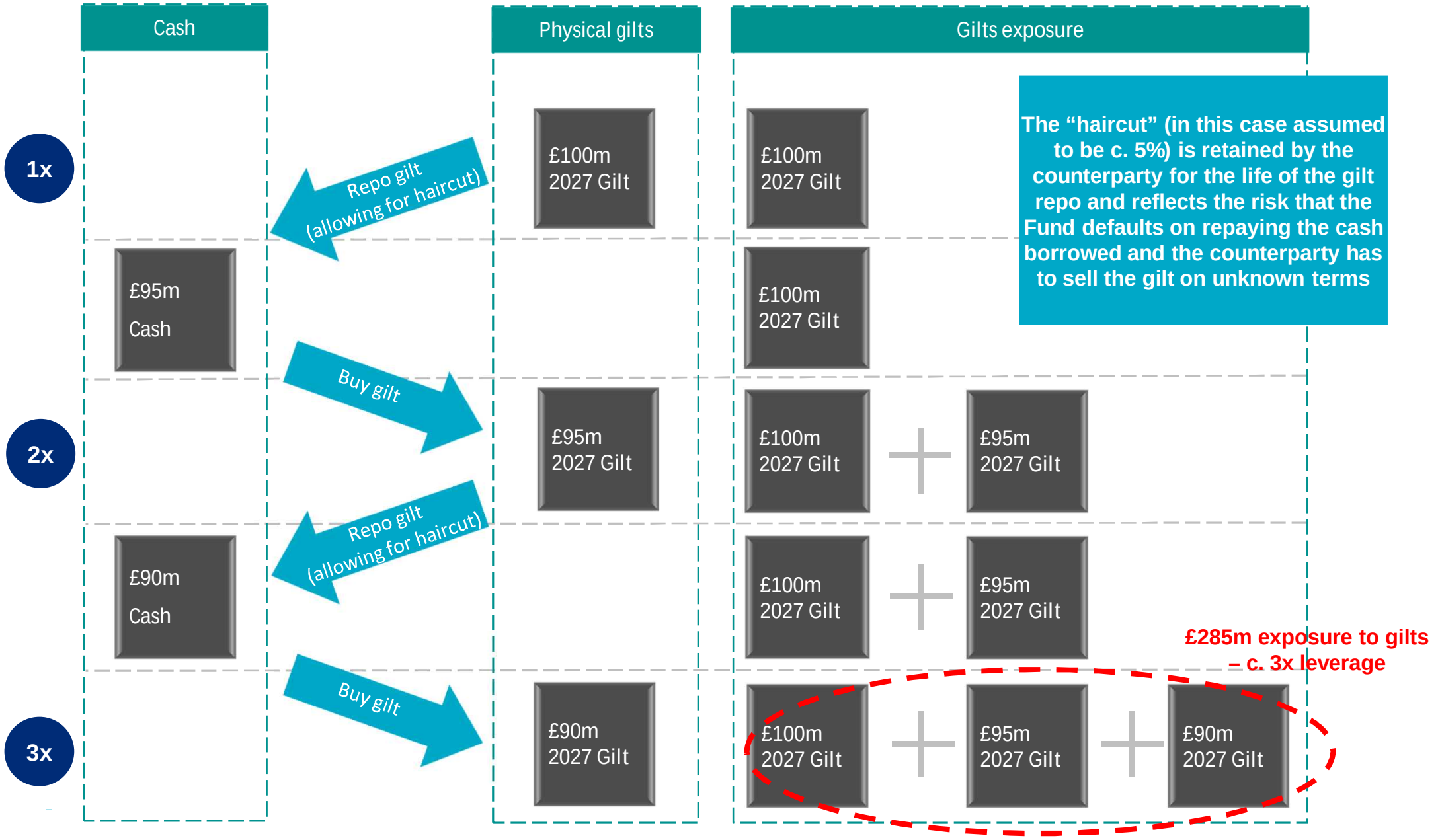
- A pension scheme buys a gilt and subsequently "sells" it to a counterparty.
- The pension scheme agrees to repurchase it ("repo") at a pre-fixed price in the future. The cash received may be subject to a "haircut" retained by counterparty.
- The pension scheme can use the cash to purchase another gilt (and use repo again if desired).
- Exposure to the changing value of the gilt is retained.

End of contract



- The pension scheme re-purchases the gilt at the pre-determined price.
- Gilt coupons received during the term of the contract are passed to the pension scheme.
- The pension scheme benefits/loses from increases/falls in the market value of the gilts.
- At the end of the contract a repo arrangement can occur again.

WHAT IS A GILT REPO? (2)



KEY RISKS ASSOCIATED WITH REPO

	Challenges	Mitigants
Roll/liquidity risk	Roll risk is the risk that it becomes either: • very/too expensive to re-transact the position (i.e. repo rates rise); or • it becomes impossible to roll the position (i.e. counterparties refuse to transact); and there is insufficient liquidity available to purchase the gilt securities outright to preserve the hedge – **see overleaf for more detail**	This risk can be partially mitigated through laddering the repo maturity dates, reducing gilt repo exposure in favour of using other (potentially less efficient) instruments and/or ensuring that there is sufficient access to liquidity to purchase the gilts outright.
Counterparty risk	The risk that the investment bank on the other side of the repo transaction defaults on its obligation.	This risk can be mitigated (but not removed) by regular collateralisation of the repo position. We note that since repo contracts can be short term in nature, exposure could be moved away from counterparties with deteriorating credit quality (but this clearly would not work in a jump-to-default situation).
Collateral adequacy risk	Most market participants trade gilt repo under documentation that specifies that collateral be posted in the form of either cash or gilts. Collateral needs to be posted to cover any mark-to-market losses on the gilt repo positions and collateral adequacy risk is the risk that sufficient eligible collateral is not available (forcing sales of other assets).	The more cash/gilts retained as collateral, the lower collateral adequacy risk will be.

WHAT IS ROLL RISK?

Why do gilt repos need to roll?

Although the maturity of gilts are many years in to the future, gilt repurchase agreements often have terms of up to 12 months. If a pension scheme uses gilt repo as a liability hedging instrument the gilt exposure may have to be rolled many times during the life of the hedge. This introduces roll risk.

Examples of roll risk

- Supply of gilt repurchase agreements can reduce if banks lose the desire to lend cash against gilt collateral
- The trading costs for gilt repo could increase. Impact of changes in bank regulation.
- During economic downturn, liquidity in the bond markets can decrease (although gilt repo market held up well in 2008)
- In a pooled arrangement, the pooled fund sits between the pension fund and the counterparty.

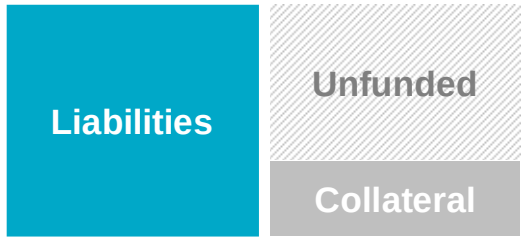
What happens if repo cannot be rolled?

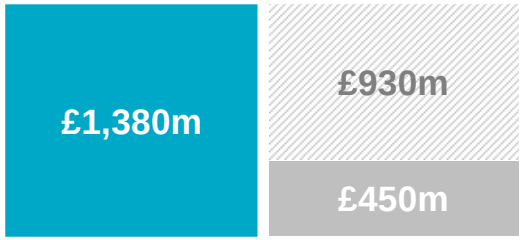
- Reduce level of liability hedging until market more attractive
- Replace gilt exposures with swaps when required
- Diversify initial hedge with gilts and swaps
- Reduce leverage by investing in physical gilts if funding position improves
- Reduce leverage by synthesising growth assets (e.g. equity total return swaps) and investing in gilts

RECAPITALISATION EVENT – WORKED EXAMPLE

STARTING POSITION

- Assume that the Fund invests £450m in the BlackRock 2032 Leveraged Index Linked Gilt fund (currently **3.07x** leveraged, i.e. effectively hedging approximately £1,380m of liabilities).
- In practice, the Fund would invest in a number of LDI funds rather than just one.

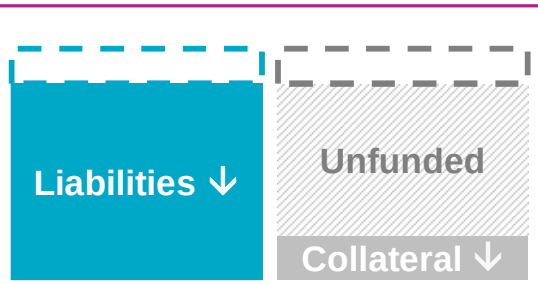


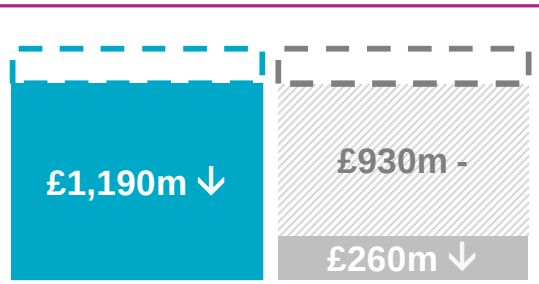


RATES RISE

INITIAL IMAPCT – LEVERAGE INCREASES

- Gilt yields rise (by 0.94%*), and the value of the leveraged fund falls by £190m to £260m
- The value of the liabilities hedged also falls to £1,190m
- Net result, the leverage increases from 3.07x to **4.6x** (at BlackRock's limit for the fund).

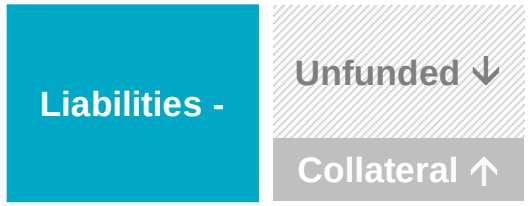




MANAGER REQUIRES £115m

"RECAPITALISATION" EVENT OCCURS

- Manager requires £115m within an agreed timeframe (to be taken from pre-agreed source).
- The level of hedging provided by the fund remains unchanged, while the collateral in the fund is increased.
- Leverage moves from 4.6x to **3.2x**

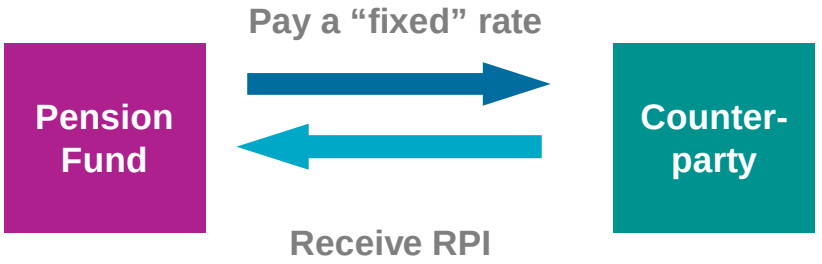


Summary: liabilities have fallen, and so have matching assets; collateral is reduced and so additional assets required to replenish capital.

*Based on recent market conditions – the actual rise in yields to trigger a recapitalisation event will depend on the specific funds invested in, and market conditions at the time of investment.

WHAT IS A "SWAP"?

- An Over-The-Counter ("OTC") transaction between a pension fund and counterparty bank.
- Using an inflation swap as an example:
- One party (usually the pension fund, but not always):
  - pays a fixed "swap" rate
  - receives a floating Retail Price Index (RPI) rate.
- The other party (usually the bank) pays the floating RPI and receives the fixed rate.
- The fixed rate varies by maturity and rates are quoted by many banks.
- Creates *inflation rate exposure* similar to that of a bond
- Fixed and floating cash flows have equal value (apart from transaction costs) at outset – no initial payment required.



For LGPS funds, swaps typically not held directly but through pooled funds.

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