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BlackRock.

Liability Driven Investment

Irish Association of Pension Funds

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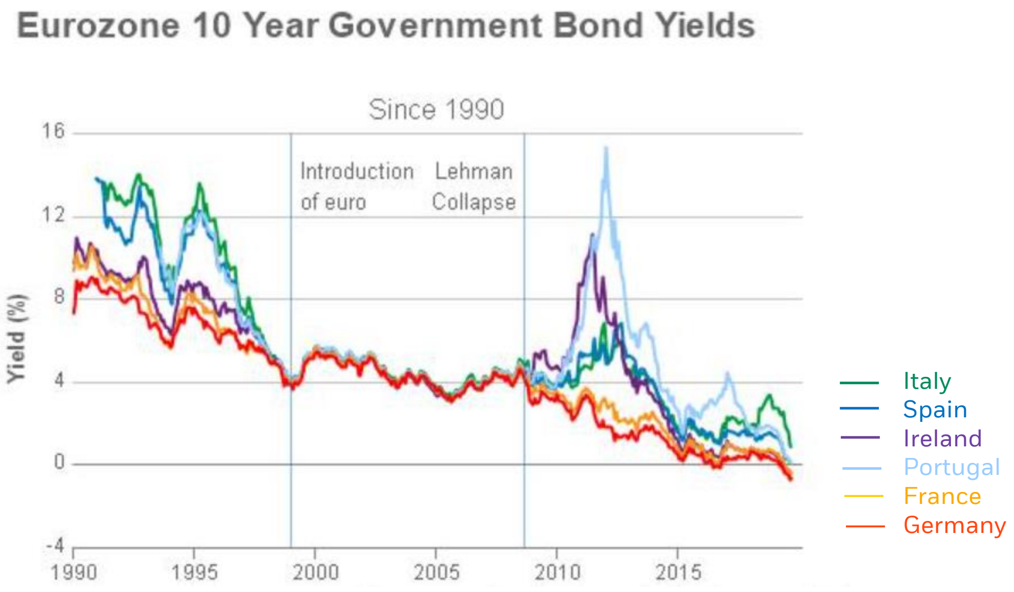
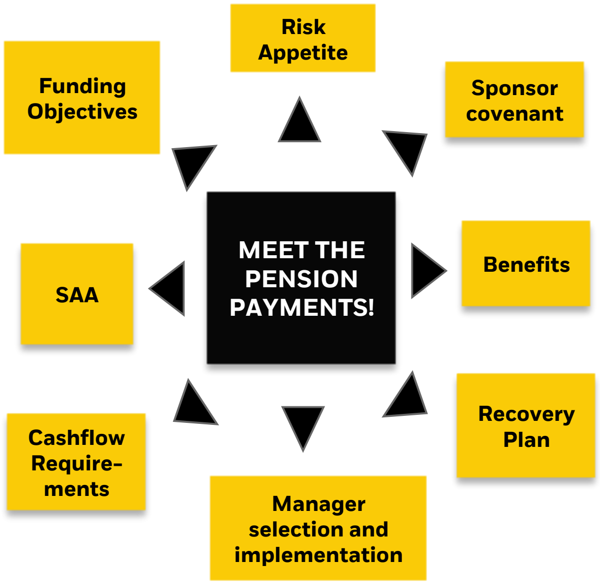
Investing for Liabilities

Delivering on the pension promise

- The key objective for Trustees is paying the promised benefits to members when they fall due
- And while the average schemes' funding level has improved since the 07-09 financial crisis, recovery has been much slower than anticipated due to the sharp and prolonged fall in Eurozone bond yields over the same period.





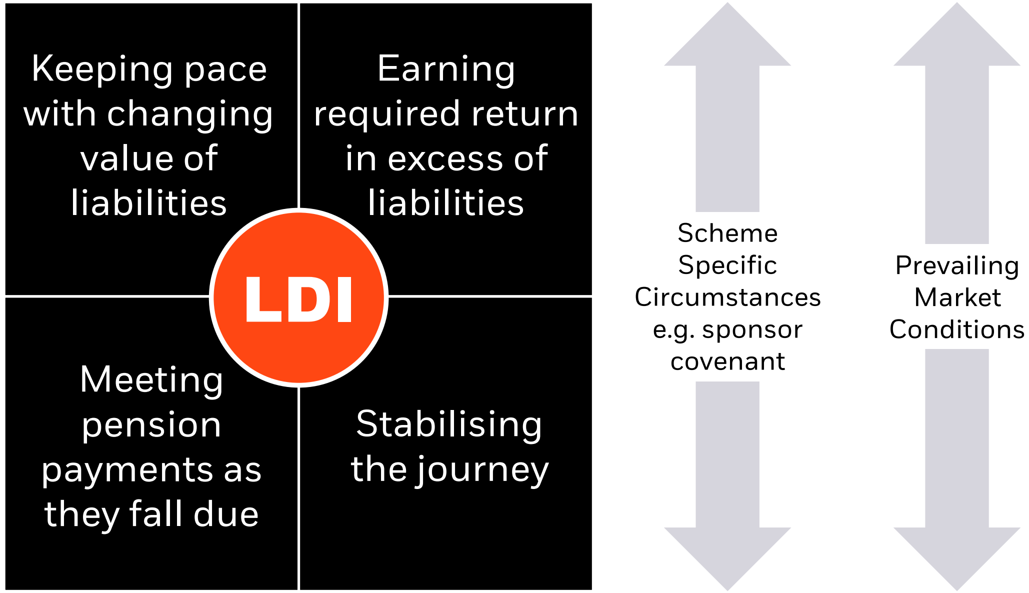
Pensions scheme liabilities are valued by reference to bond yields so when bond yields fall, the value of reported liabilities rise.

As Euro rates have fallen, the value of schemes' liabilities have risen

Source: BlackRock Investment Institute, 28 October 2019. For illustration purposes only.

What is Liability Driven Investing (LDI)?

LDI is a framework for understanding the nature of liabilities and adopting an investment strategy with an overall objective linked to these liabilities



LDI is NOT

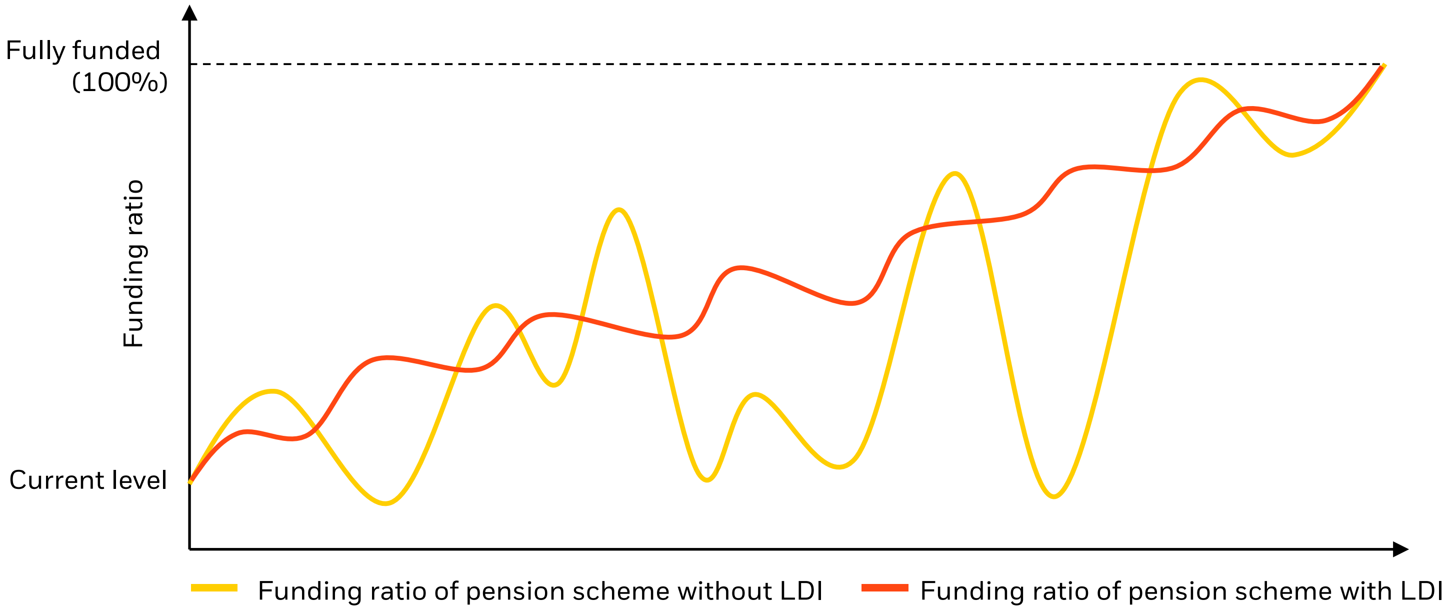
- ✗ A product
- ✗ A one time, ‘implement and forget’ solution
- ✗ A standardised solution for all pension schemes

What is LDI?

What is LDI and how can it help?

LDI:

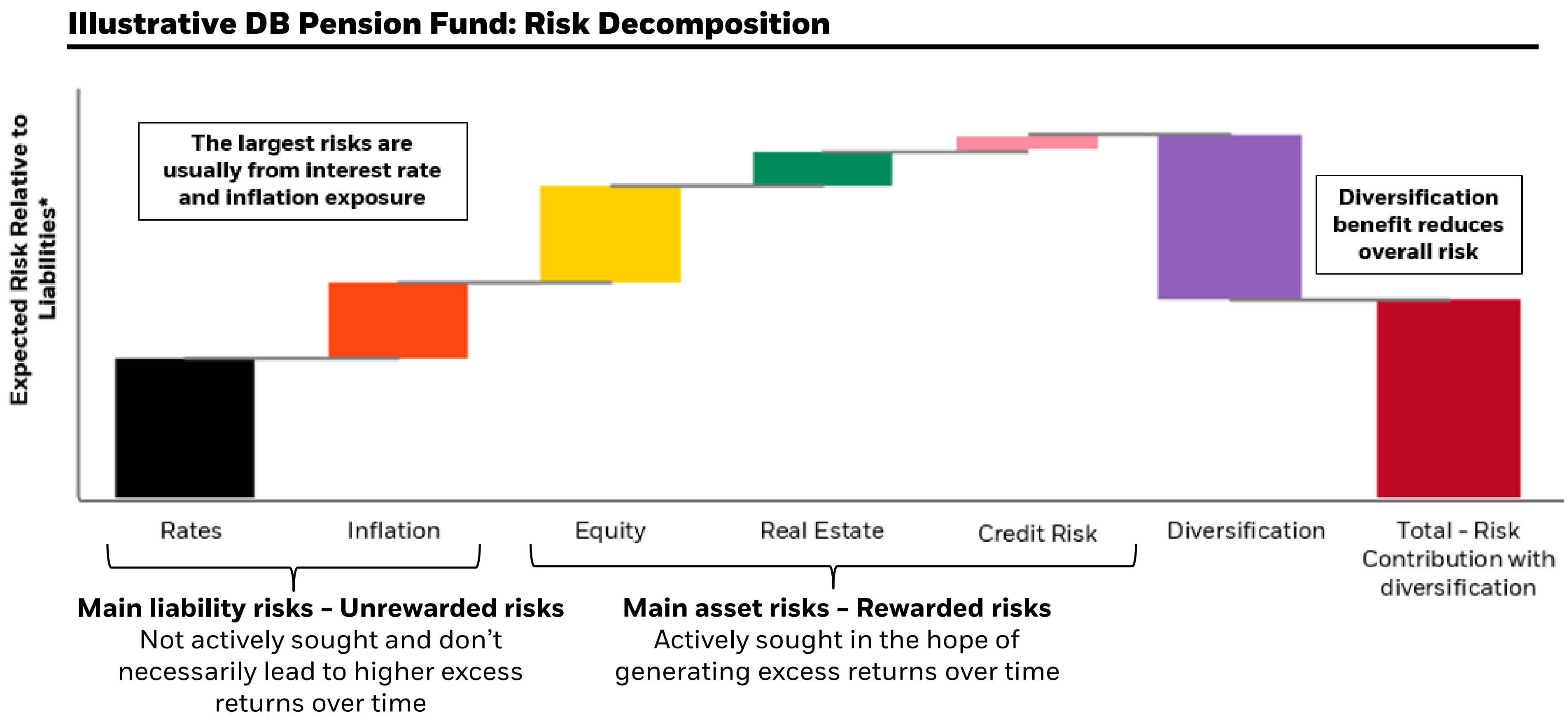
- Is a framework for thinking about how the changing value of liabilities affects pension scheme funding ratios
- Is an investment strategy whose overall objective is linked to liabilities
- Aims to mitigate large risks that cause liability values to change, while helping maintain sufficient assets to improve funding ratios over time



By managing assets relative to liabilities, LDI can help deliver a smoother, more certain path to full funding

Source: BlackRock, 5th November 2019. For illustration purposes only. There is no guarantee that a positive investment outcome will be achieved.

What are the main risks in a pension scheme?



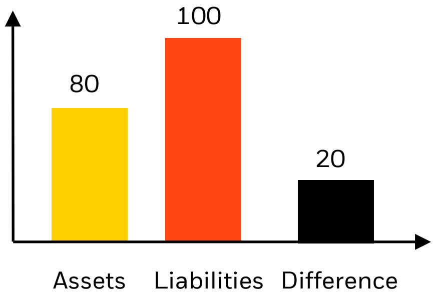
Interest rates and inflation are the largest risks facing DB pension funds

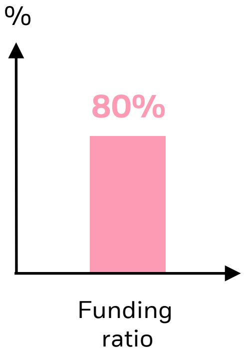
LDI seeks to minimise these unrewarded risks allowing you to focus on the rewarded risks in the pension fund

Source: BlackRock, November 2019. For illustration purposes only. * Expected relative risk is a measure of volatility of the funding ratio of a typical pension scheme that is partially hedged.

The impact of higher liability hedging

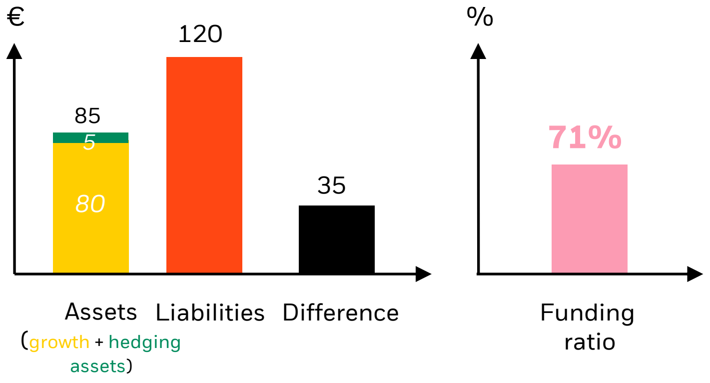
Pension scheme



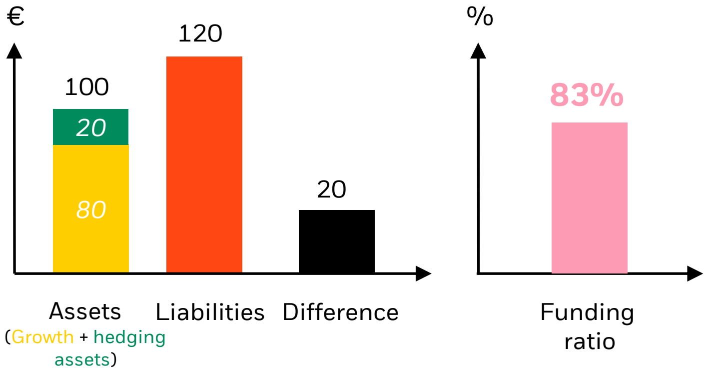


What happens if liabilities **increase by 20%?**

With some bonds[1]



With LDI[2]



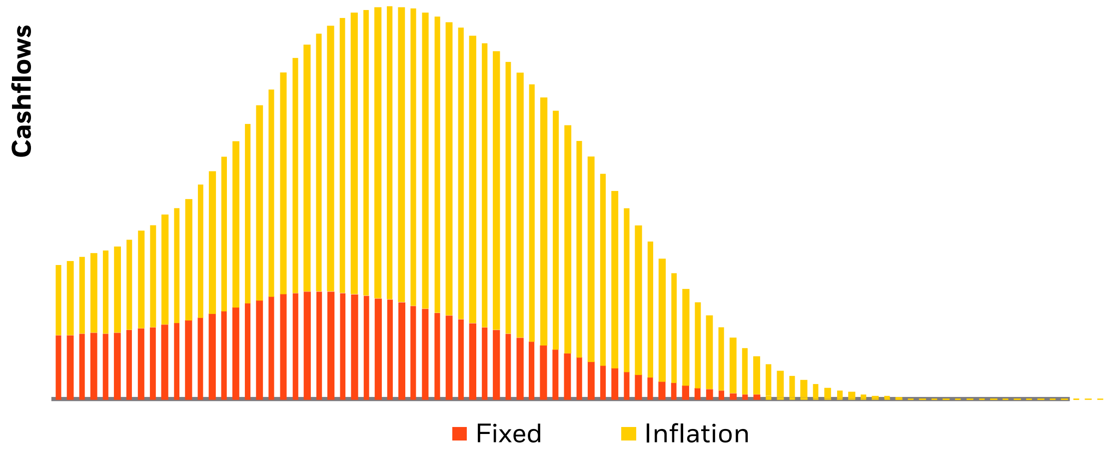
LDI can reduce the impact on pension scheme's funding ratio of adverse moves in liability values

Source: BlackRock, 5th November 2019. For illustrative purposes only. [1] Based on being 25% hedged. [2] Based on being fully hedged.

Understanding your liabilities

- Liabilities are a set of cashflows promised to the members, which are payable in the future
- These cashflows come from the active, deferred and pensioner members expected pension payments
- The “value” of the liabilities is the **Present Value** of the future expected cashflows
- To calculate the present value, the expected future liability cashflows are discounted to today by an appropriate interest rate

Example Pension Scheme – Cashflow split



Rate	Change	Impact on liabilities	Impact on hedging assets
Interest rate	↑	↓	↓
	↓	↑	↑
Expected inflation	↑	↑	↑
	↓	↓	↓

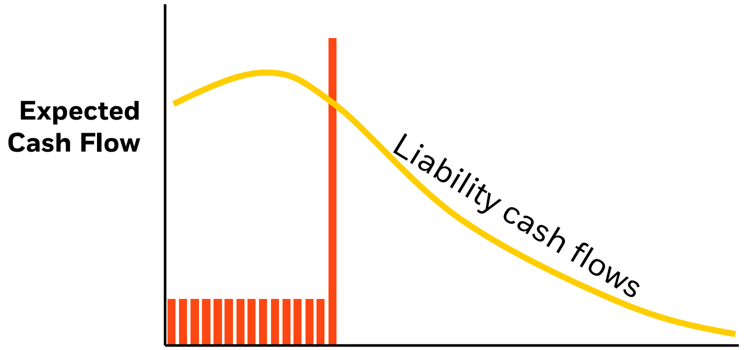
The present value of liabilities is sensitive to interest and inflation rates

Thus, hedging assets must exhibit the same sensitivities to minimise the impact of changes in liability values

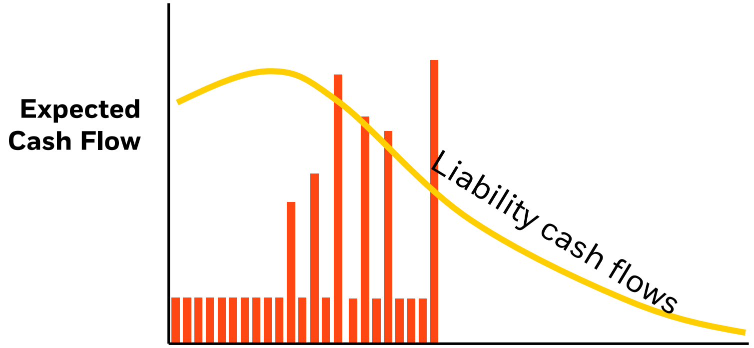
Source: BlackRock, 5th November 2019. For illustrative purposes only.

What hedging assets could I use to match my liabilities?

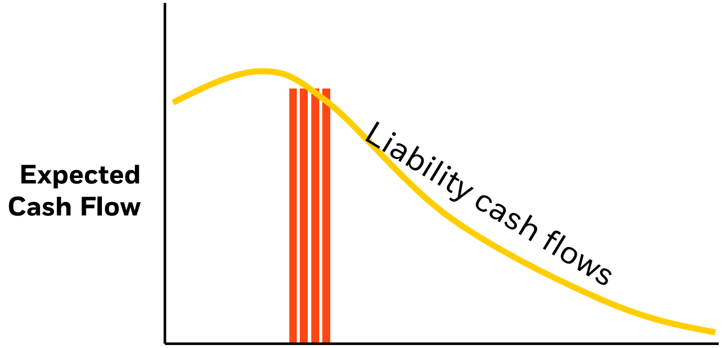
A single bond



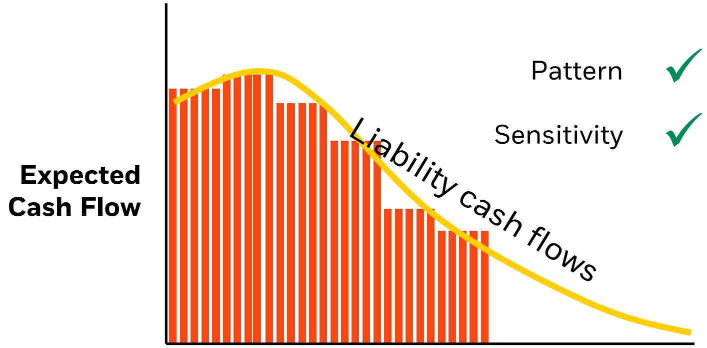
A bond index



What if we could tailor cashflows . . . . . . using swaps



A series of bonds and swaps



Source: BlackRock, 5th November 2019. For illustrative purposes only.
Charts show how using a combination of bonds and swaps can build a portfolio matching the liability cash flows of a scheme.

Quick recap

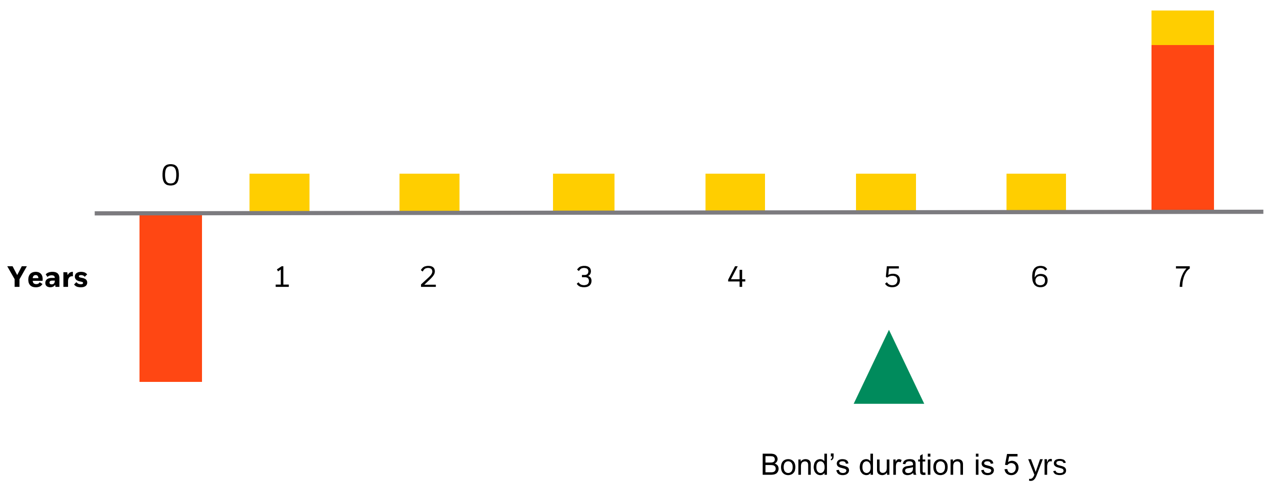
- **LDI can help improve funding ratios and aims to deliver a smoother, more certain path to full funding**
- **Interest rates and inflation represent the BIGGEST risks pension schemes face (*and are the key risks that drive liability values*)**
- **By investing in (more) hedging assets that are sensitive to interest rates and inflation, you can reduce risks in the pension scheme**

The LDI Toolkit

Bonds – the natural hedging asset

- A bond is a loan from the investors (holders) to the borrowers (issuers)
- Periodic, **contractual and known** (coupon) payments are made by the issuer to the bond holder
- Capital repayment is made as a final redemption payment at maturity

Set of Future Cash Flows



There are different types of bonds:

Government Bonds
(e.g. French bonds, German Bunds)

Index-Linked Government Bonds
(e.g. Bonds linked to inflation)

Corporate Bonds
(e.g. debt issued by companies and agencies / supranationals)

Like liabilities, bonds are contractual and known future payments

Bonds therefore have similar risks to liabilities

Source: BlackRock, 5th November 2019. For illustrative purposes only.

A bond's 'duration' measures its interest rate/inflation sensitivity

A bond's Duration is a measure of its price sensitivity to a change in rates

- It's measured in 'years' and is the weighted average time to maturity of the bond's cashflows

Practically, the Duration of a bond (*or portfolio of bonds or liability cashflows*) is the % price change for a +/- 1% change in yield

- Remember that if interest rates goes up the price goes down (and vice versa)
- It gives you an 'Expected' price change

E.g.	Scheme (assets) duration = 5 yrs	Scheme liability duration = 18 yrs	Duration mis-match = 13 yrs
Interest rates fall by 1% ↓	Hedging assets increase by 5% ↑	Liabilities increase by 18% ↑	Deficit increases by 13% ↑

Duration varies with Maturity, Yield and Coupon

- Longer dated bonds have higher durations and therefore greater price volatility for a given change in yields
- High Coupon or High Yielding bonds have lower durations and vice versa, all other things being equal

Duration tells you the % price change of an asset/liability for a +/-1% change in rates

The higher the duration, the more sensitive it is to changes in rates

Source: BlackRock; 5th November 2019. Stylised examples for illustrative purpose only.

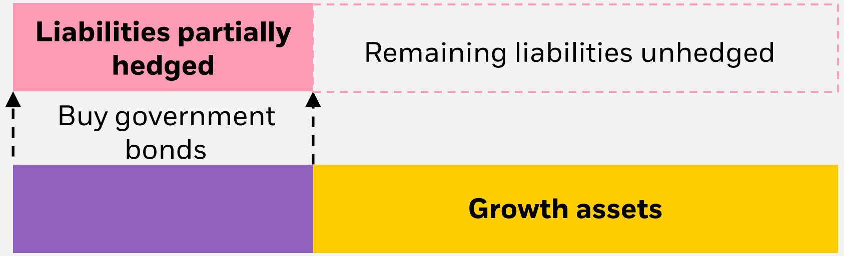
The challenge with bonds

Bonds are capital inefficient

Given that they are a physical asset, €100m must be spent to hedge €100m of liabilities

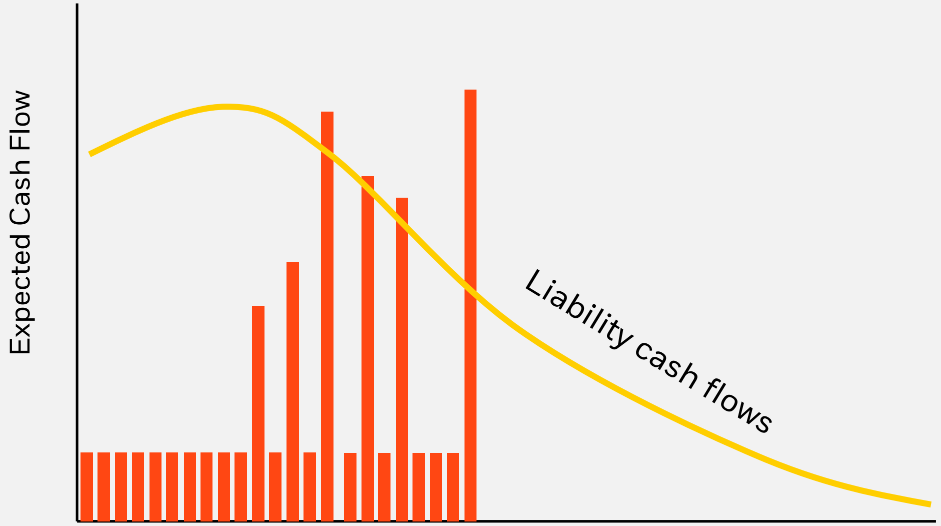
This either constrains a pension scheme's ability to invest in growth assets …

… or only a small partial hedge can be achieved



Bond availability is limited

It is not possible to create a perfect liability match using solely bonds



✗ Not tailored to liabilities

✗ Cannot match all cashflows

Bonds are capital inefficient and have limited availability

Potential solution: Use derivatives to be more capital efficient and more tailored

Source: BlackRock, 5th November 2019. For illustrative purposes only.

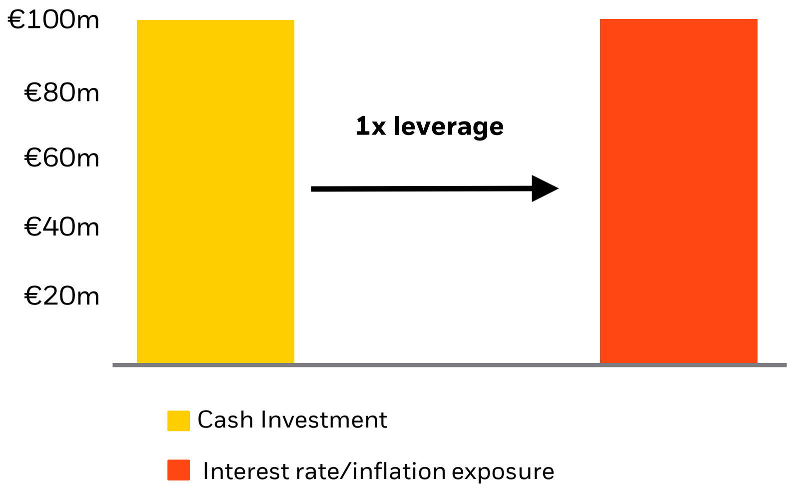
Derivatives – the capital-efficient hedging asset

Derivatives can increase the liability hedge without using additional cash

Scheme has leverage of 1

Need €100m of interest rate/inflation exposure

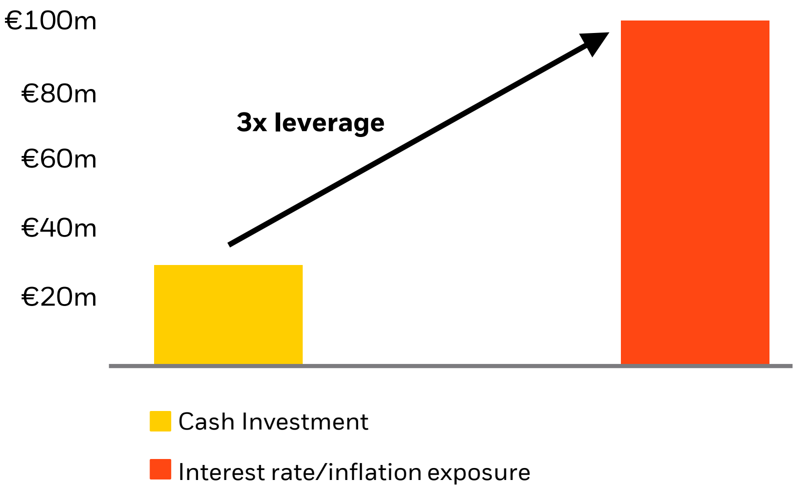
Currently invest €100m in unlevered physical assets



Invest €33m in a 3x leveraged strategy

With 3x leverage, Scheme invests €33m but still gains €100m of exposure

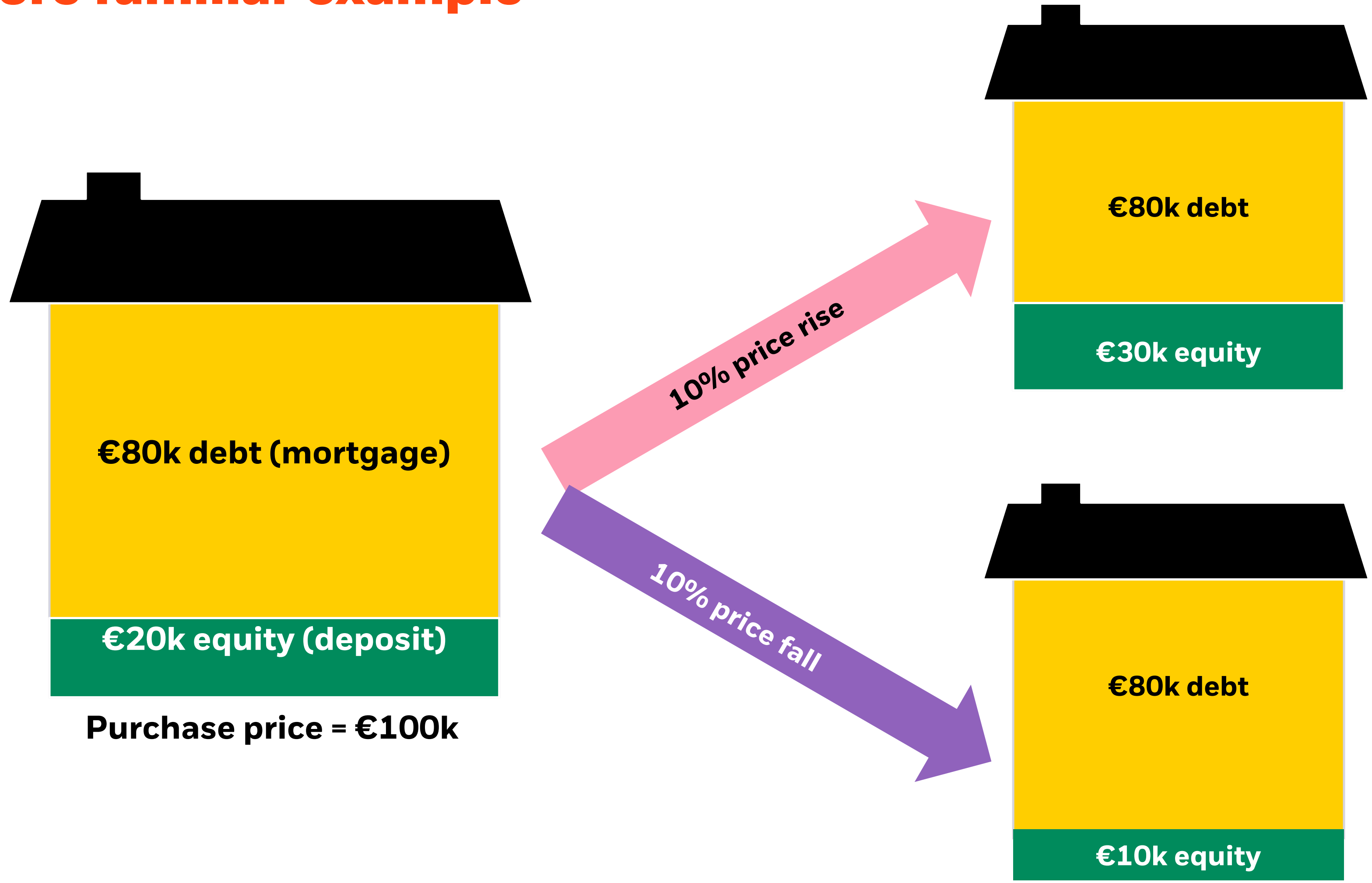
Releases €67m of cash



Leverage doesn't have to be risky – it can be risk-reducing

Source: BlackRock, 5th November 2019. For illustrative purposes only. Investment strategies using leverage can result in even larger losses suffered when the value of the underlying investments fall.

Understanding leverage
a more familiar example



€10k change

New value = €110k

By placing down only 20% of the value of the property (deposit), you are able to gain 100% exposure to the property's change in value

€10k change

New value = €90k

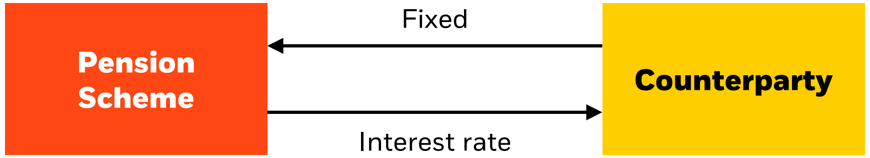
A house bought using a mortgage is a leveraged asset

Source: BlackRock, 5th November 2019. For illustrative purposes only.

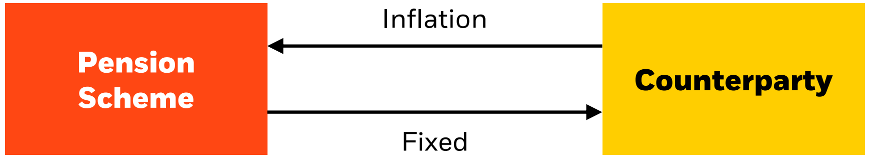
Derivatives: Interest Rate and Inflation Swaps

Swaps are agreements to swap streams of future payments over a period of time

Interest rate swap



Inflation swap



Characteristics

- Minimal cash exchanged at outset
  - **Makes leverage possible**
- Investment risks are minimised through daily collateralisation
  - **To mitigate risk of either side defaulting**
- Can be highly tailored to meet specific cashflows
- Liquidity reasonable
  - Market participants include pension schemes, insurers, banks, corporates

Set of Future Cash Flows

Payments based on fixed interest rate (usually received by pension scheme)

Payments based on floating (or variable) interest rate (usually paid by pension scheme)

Source: BlackRock, 5th November 2019. For illustrative purposes only.

The additional risks to consider with derivatives and how to manage them

Counterparty risk

- Daily high quality collateral
- Ongoing monitoring of creditworthiness

Financing risk

- Dedicated trading deck
- Ongoing monitoring of financing profile

- Diverse counterparty exposure
- Sophisticated portfolio management system

Derivative risks can be managed effectively through counterparty risk management and daily collateralisation

Source: BlackRock, 5th November 2019. For illustrative purposes only.

Quick recap

- **Bonds represent loans that pay regular cashflows over time and offer a way to hedge against liability risk**
    - **BUT every €100 used to purchase bonds means a €100 withdrawal from ‘growth assets’ and their availability can be limited**
- **‘Duration’ is a measure of interest rate sensitivity**

- **A swap is an agreement to ‘swap’ two future payment streams over a period of time**
- **Swaps are capital efficient (*every €100 of swaps purchased could mean a c€33 withdrawal from ‘growth assets*’) and can be highly tailored**
- **Using swaps introduces new risks but these can be substantially reduced through counterparty monitoring and daily collateralisation**

- **Leverage is a key tool to keep LDI mandates capital efficient, allowing pension schemes to continue to meet their return objectives**

* Assuming leverage of x3

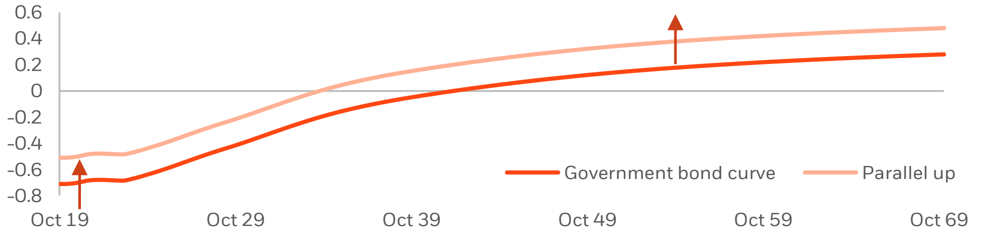
LDI considerations

Which risks matter most?

Increasing potential impact to the Scheme

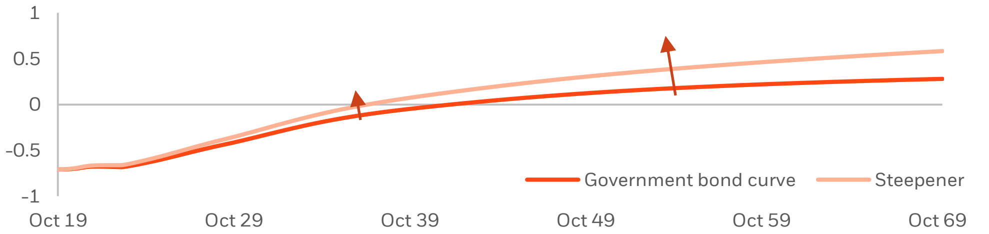
1st Order

Outright: Interest Rate and Inflation Risk
(parallel shifts in the curve)

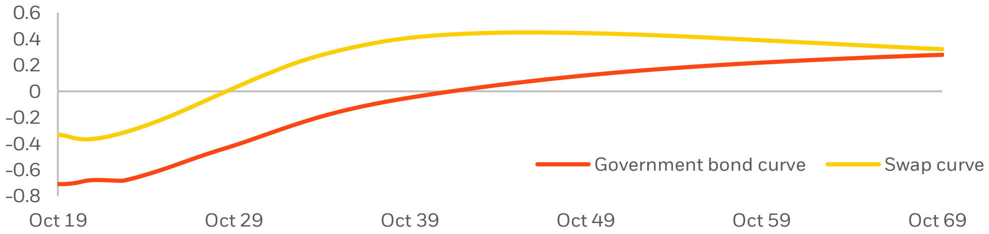


2nd Order

Curvature: Interest Rate and Inflation
(Changes to the slope of the curve)

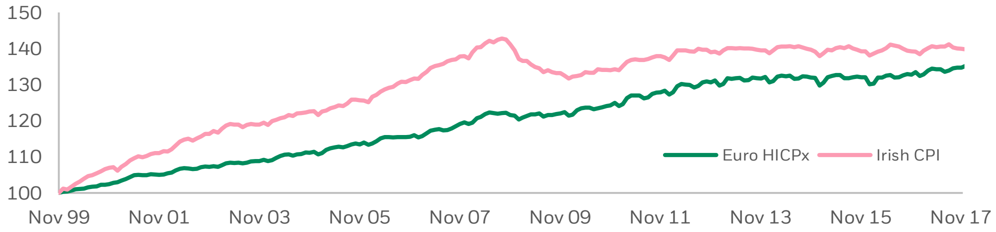


Basis Risk: Interest Rates and Inflation
(changing yields between swaps and government rates)



3rd Order

Inflation Basis
(Changes between Irish CPI and HICPx)



The major risks to funding level volatility and deficit stem from Outright Interest Rate and Inflation Rate exposure

Source: BlackRock, 5th November 2019. For illustrative purposes only.

Determining the objectives of your LDI solution

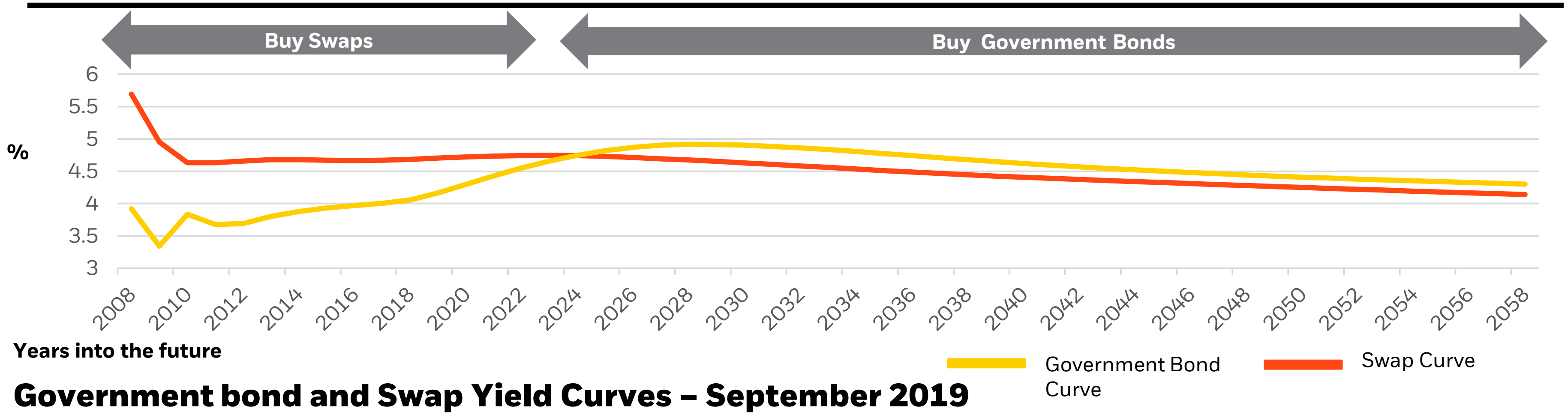
	LDI Levers – Setting 'Hedge Ratio' Target		Observations
1 **Split of Growth vs Matching**	**Low % in LDI** Hard to achieve significant hedge	**High % in LDI** Able to deliver high hedge ratios	As DB schemes continue to mature, a large proportion of assets is allocated to LDI
2 **Maximising Duration vs Curve Accuracy**	**Maximising duration of bonds** • More efficient in terms of exposure relative to capital invested • Doesn't deal with curve risk	**Hedging across the Curve** • More accurate hedge profile relative to liabilities • Less efficient in terms of exposure relative to capital invested	When capital allocation to LDI is low, maximising duration is the main driver of risk reduction
3 **Levered vs Unlevered**	**Unlevered** • Difficult to achieve high hedge ratios • Simple solution	**Levered** • Easier to achieve high hedge ratios • Introduces complexity	Low capital allocations can be leveraged with careful risk management to generate higher hedge ratios, freeing up capital to seeking to generate return

Source: BlackRock, 5th November 2019. For illustrative purposes only.

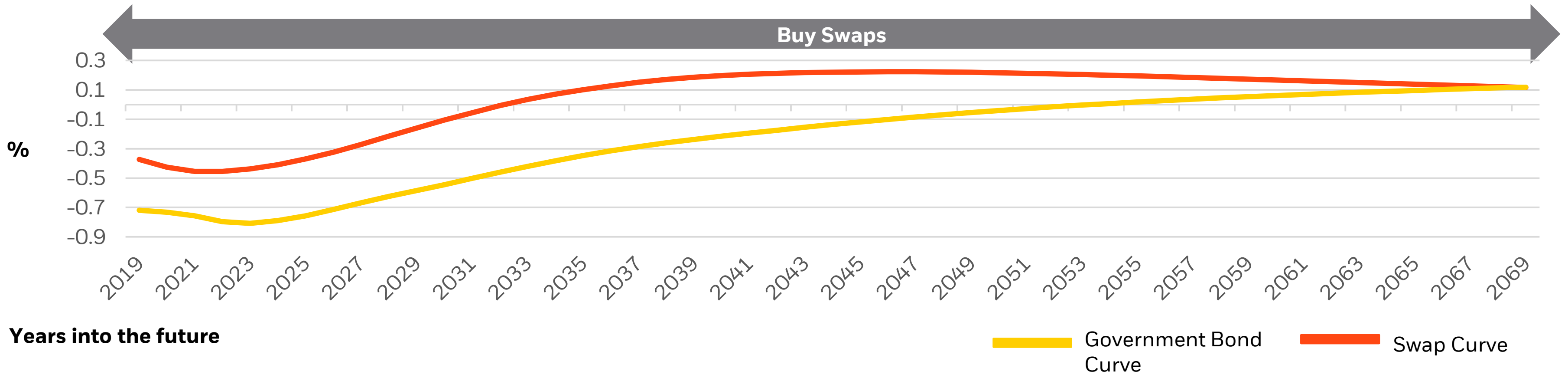
Why do we want both bonds and swaps in our LDI portfolio?

To allow clients to access the most 'efficient' hedging asset at any particular point in time

Government bond and Swap Yield Curves – September 2008



Government bond and Swap Yield Curves – September 2019



At any one time, either bonds or swaps will provide the "cheapest" hedge

A wider instrument set also helps manage cash and collateral

The example above is indicative of past valuations which are not a reliable indicator of future market conditions. For illustrative purposes only.
Source: BlackRock, as at 5th November 2019.

LDI considerations – implementation vehicles

Multi-Client Pooled Fund	Single-Client Pooled Fund	Segregated
Pension Scheme	Pension Scheme	Pension Scheme
Pooled Funds	Bespoke QIF	
Physical assets	Physical assets	Physical assets
Swaps + other derivatives	Swaps + other derivatives	Swaps + other derivatives
+ Lower cost	+ Lower governance	+ Flexibility
– Less flexible	– Additional costs	– Increased costs and complexity

Source: BlackRock, data as at 5th November 2019. For illustrative purposes only and subject to change.

Why consider pooled funds?

Lower Governance Burden

- Offers a straightforward way to implement LDI
- Involves investing in off-the-shelf funds to gain a bespoke hedging exposure
- Funds can be used to achieve the desired hedge ratio without the need for complex analysis
- Does not require schemes to enter into complex and time consuming IMA and ISDAs (swap counterparty agreements)

Capital Efficient
High quality hedging assets

- Achieves capital efficiency through leverage allowing schemes to invest in other assets to help meet overall investment objectives
- Rigorous leverage management process
- Provides access to high quality, liquid assets for a low risk hedge
    - E.g., AAA-AA long-dated European Government bonds and swaps

Cost effective & Transparent

- Pooled funds are more cost effective when schemes start at lower hedging levels - Bespoke pooled or segregated mandates are usually subject to a minimum investment size (€100m — €150m)
- <u>Passive</u> pooled funds attract the lowest fees - and allows you to separate the decision between where to spend your active 'risk budget' from your (risk reducing) LDI strategy
- Pooled funds remove the needs for costly, time consuming analysis and legal & advisory fees
- Typically have a benchmark, so performance can be easily measured

Source: BlackRock, 5th November 2019. There is no guarantee that a positive investment outcome will be achieved.

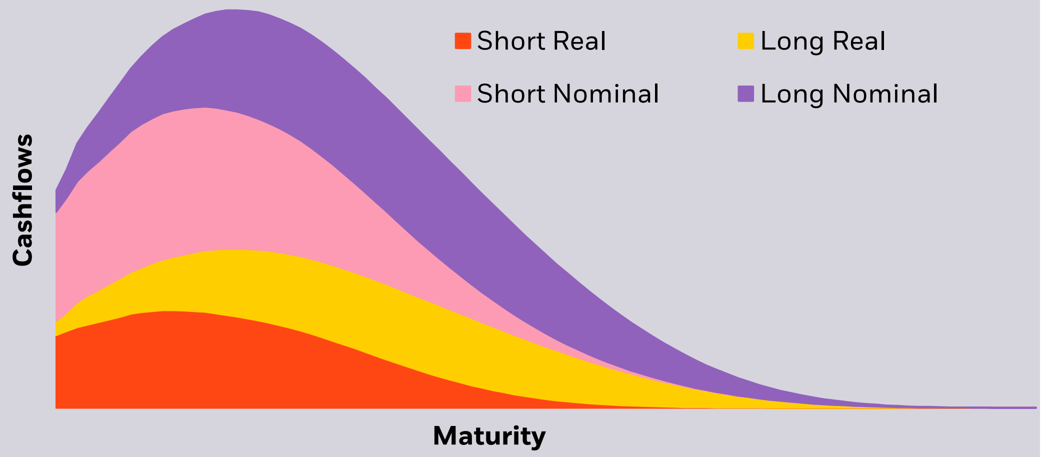
One option: Euro LDI Profile Funds

Seek to provide an efficient liability hedge through a simple, low governance LDI solution

- Combinable building blocks to proxy a Scheme's liability cashflows by mimicking the interest rate (and inflation) exposure of a representative liability cash flow profile[1]
- The Funds can deliver an overall duration of between 12-24 years at the Funds' outset
- The maturity profile of the solution will "roll-down" in-line with a typical pension scheme liability
- Passive solution consisting of high quality long-dated European Government bonds and swaps to provide a capital efficient risk profile
- Achieves capital efficiency through leverage

Euro Profile Funds

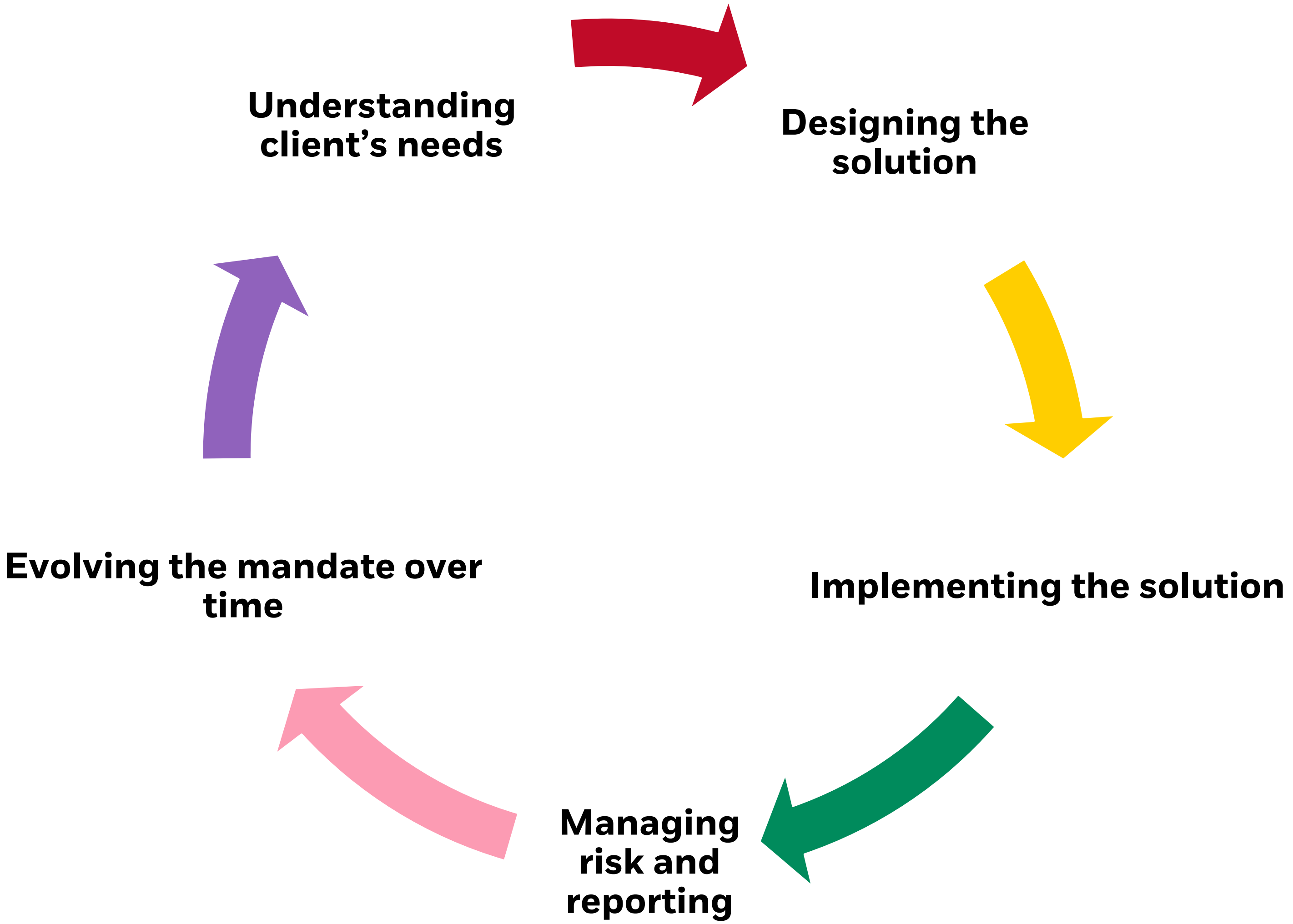
Short Liability Nominal Profile Fund (3.0x)^	**Long Liability Nominal Profile Fund (2.0x)^**
Short Liability Real Profile Fund (3.0x)^	**Long Liability Real Profile Fund (2.0x)^**



For illustrative purposes only.

Source: BlackRock, 5th November 2019. The Funds do not have a static benchmark and their performance is reported versus the internal performance benchmark for comparison purposes only. ^The Funds leverage is set at the outset but will fluctuate over time.

Designing and Evolving the LDI mandate



Source: BlackRock, 5th November 2019. For illustrative purposes only.

Quick recap

- **The major risks to funding level volatility and deficit stem from outright interest rate and inflation rate exposure**
- **Schemes should use an implementation option which suits their objectives and governance budget**
- **LDI is a solution which can be adapted over time as Scheme's objectives change**

Questions?

Risks

Capital at risk. The value of investments and the income from them can fall as well as rise and are not guaranteed. The investor may not get back the amount originally invested.

Past performance is not a reliable indicator of current or future results and should not be the sole factor of consideration when selecting a product or strategy.

Changes in the rates of exchange between currencies may cause the value of investments to diminish or increase. Fluctuation may be particularly marked in the case of a higher volatility fund and the value of an investment may fall suddenly and substantially. Levels and basis of taxation may change from time to time.

BlackRock Liability Matching Funds Range Specific Risks:

Leverage risk – The use of leverage may increase the Fund's volatility, investment risk, internal costs and the adverse impact to which the Fund's investment portfolio may be subject.

Fixed income risk – Two main risks related to fixed income investing are interest rate risk and credit risk. Typically, when interest rates rise, there is a corresponding decline in the market value of bonds. Credit risk refers to the possibility that the issuer of the bond will not be able to repay the principal and make interest payments.

Derivative risk - The Funds uses derivatives as part of their investment strategy. Compared to funds which only invests in traditional instruments such as stocks and bonds, derivatives are potentially subject to a higher level of risk.

Liquidity risk - The Fund's investments may have low liquidity which often causes the value of these investments to be less predictable. In extreme cases, the Fund may not be able to realise the investment at the latest market price or at a price considered fair.

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