Leverage and LDI | **October 2022**

Not a free lunch.

By James Mashiter, CFA®, Portfolio Manager, Traditional Strategies Team

The last few weeks have cast liability driven investing (LDI) into the spotlight for all the wrong reasons. SEI provides perspective on this timely topic:

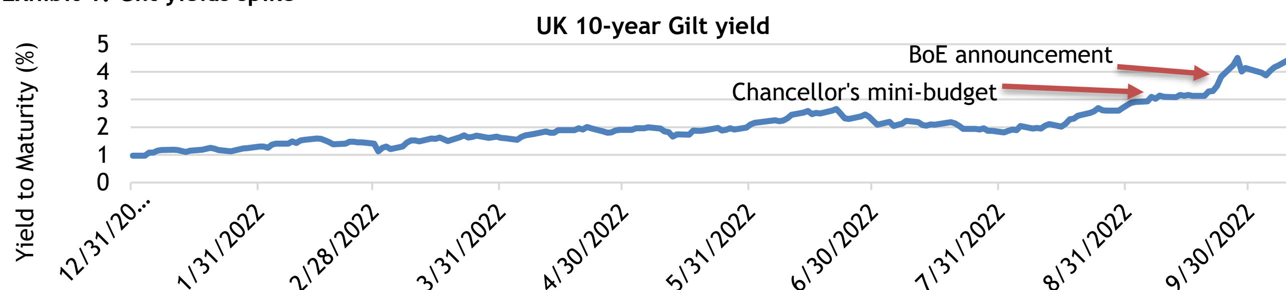
- By employing leverage, an LDI manager can seek to achieve the desired level of interest rate and inflation hedging with a significantly lower capital outlay.
- However, as recent events have shown, it is not a free lunch and involves trade-offs.
- In light of recent events, SEI has reduced the target leverage on our U.K. Ultra Long Duration Gilts and U.K. Ultra Long Duration Index-Linked Gilts Funds from approximately 3x to approximately 1.5x.

The last few weeks have cast liability driven investing (LDI) into the spotlight for all the wrong reasons, exposing vulnerabilities in the system's plumbing. Most LDI funds had already received multiple collateral calls throughout the course of the year because the rise in nominal and real yields meant that leveraged gilt trades incurred losses on the associated derivative positions. This generally didn't cause many issues because orderly markets meant that most LDI funds' 'cure period' (the length of time between the collateral call and the cash arriving) allowed deleveraging to occur before knockout levels (at which hedging has to be reduced) were reached.

However, the Chancellor's mini-budget on 23 September caused a sharp spike in gilt yields, as shown in Exhibit 1 on the following page. This triggered a wave of collateral calls on LDI portfolios' leveraged gilt exposures, leading to a frantic unwinding of positions. This put further downward pressure on gilt prices, which in turn led to more capital calls. Recognising that this chain reaction posed a threat to financial stability, the Bank of England on 28 September pledged to carry out purchases of long dated gilts through to 14 October.

The LDI industry is responding by reducing leverage. This should mean that the average pension scheme is better able to withstand future rates volatility to the extent that rising yields should be less burdensome from a collateral management perspective. However, to achieve the same level of hedging as before, schemes will need to hold more LDI assets, leaving less cash available for investments in growth assets such as stocks and alternative investments.

Exhibit 1: Gilt yields spike



Source: Bloomberg. Data spans 31/12/2021 to 11/10/2022.

In light of recent events, SEI has reduced the target leverage on its U.K. Ultra Long Duration Gilts and U.K. Ultra Long Duration Index-Linked Gilts Funds from approximately 3x to approximately 1.5x. It is important to note that the leverage will still fluctuate around the new 1.5x target as a natural consequence of changes in market yields.

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Why LDI came about

Before the widespread adoption of liability driven investing (LDI) in the early 2000s, pension schemes would typically invest in equities, bonds and perhaps some non-traditional asset classes in the expectation that the long-term returns generated would be sufficient to meet liabilities.

The early 2000s saw the demise of the former pensions Minimum Funding Requirement and the introduction of economic ("bond-like") funding valuations for defined benefit pension schemes, via both the scheme specific funding regime introduced by the Pensions Act 2004 and FRS17/IAS19 accounting disclosures on corporate balance sheets. Both of these developments introduced liability discount rates linked to the UK bond market (**convention** became gilts for the former, and the **requirement** of a discount rate commensurate with the yield on high quality (e.g. AA rated) corporate bonds for the latter). With discount rates pinned to the bond markets, the present value of liabilities became sensitive to movements in these yields (liabilities up if yields down), and led to schemes using LDI investment techniques to introduce similar sensitivities to the assets in order to hedge these "interest rate" risks.

The hedging toolkit

Pension schemes' liabilities increase with rising inflation and falling interest rates. A perfectly legitimate way of hedging interest rate and inflation risks is through investing in physical bonds, i.e. conventional gilts and inflation-linked gilts. By employing leverage through the use of derivatives and other instruments, a LDI manager can achieve the same result but with a significantly lower capital outlay. Leverage can be swap-based or gilt-based. Swap-based leverage uses interest-rate swaps (the scheme receives a fixed rate in exchange for paying floating on an agreed notional amount) to hedge interest rate risk and inflation swaps (the scheme receives variable inflation in exchange for paying a fixed rate) to hedge inflation risk. Combining interest rate and inflation swaps provides index-linked gilt exposure through sensitivity to real rates.

Gilt-based leverage includes total return swaps (TRS), repurchase agreements (repo) and gilt futures. With a TRS, the scheme receives the total return on a gilt in exchange for a floating rate, again based on a notional amount. In a repo transaction, a pension scheme will sell a gilt (typically to an investment bank) and use the proceeds to buy more gilts. The scheme agrees to buy the original gilt back at a fixed priced in the future, and in doing so, retains economic exposure to the gilt throughout the transaction. A gilt future is an agreement (in this case) to buy a government bond at a pre-agreed price on a specified future date. However, gilt futures alone can provide a blunt hedging solution given that the long gilt future contract only provides exposure to 10-year maturity gilts.

The mechanics of leverage

As previously noted, leverage provides capital efficiency because it allows a scheme to hedge liabilities with only a fraction of the outlay that would otherwise be required using physical bonds. For example, consider a pension scheme that has £100 of liabilities with a 20-year duration (Exhibit 2). The scheme could choose not to use leverage by investing £100 in 20-year duration bonds. Alternatively, it might decide that it would like to hedge its liabilities, but also have some spare cash available to invest in growth assets. It could therefore invest instead £50 in bonds with a duration of 40 years, providing in effect the same interest rate exposure as the £100 invested in 20-year bonds. This would equate to 2x leverage because £100 of liabilities is being hedged with £50 of LDI assets. If the scheme decided that it wanted to commit only £33 to LDI assets, then these assets would require a duration of 60 years and would result in 3x leverage.

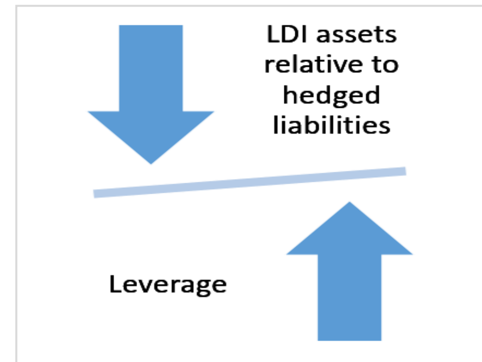
Exhibit 2: Leverage reduces required hedging assets

Leverage (x)	1	1.5	2	3	4	5
Liabilities (£)	100	100	100	100	100	100
LDI Assets (£)	100	67	50	33	25	20
Duration of liabilities (yrs)	20	20	20	20	20	20
Duration of LDI assets (yrs)	20	30	40	60	80	100

Source: SEI. Some figures are rounded for convenience. Note that 1x leverage means the scheme in unleveraged because £100 of liabilities is being backed by £100 of LDI assets. For illustrative purposes only.

Leverage up, risk up

It might seem tempting to increase the leverage further still, as this could allow the scheme to free up even more cash to invest in growth assets. However, there is no free lunch when it comes to leverage. Higher leverage means having to run a longer duration on the LDI assets, which in turn make them more sensitive to movements in rates (rates and bond prices have an inverse relationship).



When rates rise (we'll use the terms *rates* and *yields* interchangeably), the value of the LDI assets should fall by the same £ amount as the hedged liabilities (if fully hedged). However, when using leverage, the LDI assets will fall more than the hedged liabilities in proportionate terms. For example, taking our 2x leverage example above, if a +50 basis point (bps) yield shock causes the liabilities and LDI assets to both fall by £10, to £90 and £40, respectively, the scheme's leverage will automatically increase to 2.3x (90/40). In order to restore leverage to 2x, the LDI assets would require a £5 capital injection (90/45). In the opposite scenario of a -50 basis point yield shock, the scheme's leverage falls to 1.8x, because the liabilities would increase to £110 and the LDI assets to £60.

You will notice that the increase in leverage under rising rates is larger than the corresponding fall in leverage when rates decline. This is important because it means that sensitivity of LDI assets to changes in rates increases with leverage. Accordingly, a scheme with 3x leverage will have higher duration and exhibit greater sensitivity to rates volatility than a scheme with 2x leverage. For schemes that don't employ leverage, the ratio of liabilities to LDI assets is broadly unaffected by changes in yields.

The decision regarding how much leverage to use has implications for the amount of additional collateral that, in the event of a rate shock, would be required to restore the original leverage ratio. Consider the example in Exhibit 3, where the impact of an instantaneous +25, +50, +75 and +100 basis point move in yields on schemes with different starting leverage ratios (from Exhibit 2).

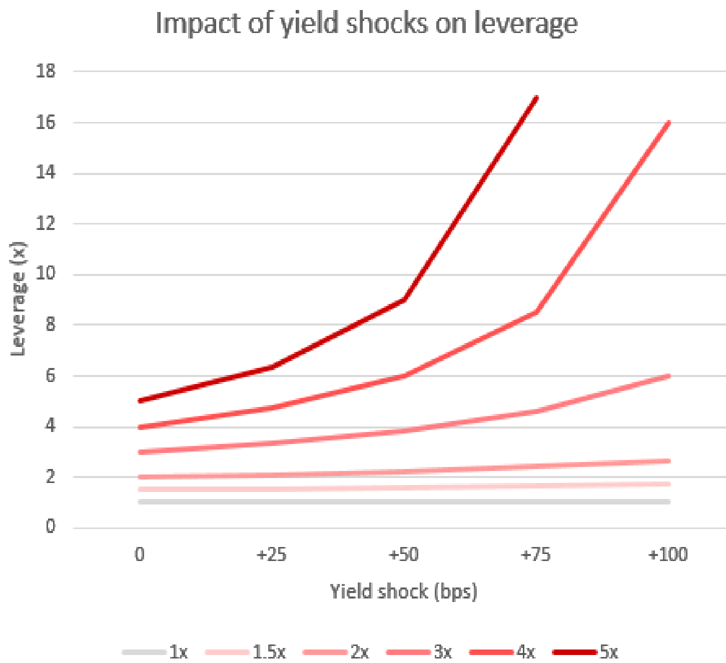
Exhibit 3: Rising yields can trigger collateral calls

Leverage (x) - start	1	1.5	2	3	4	5
			+25 bps yield shock			
Liabilities (£) - new	95	95	95	95	95	95
LDI Assets (£) - new	95	62	45	28	20	15
Leverage (x) - new	1.0	1.5	2.1	3.4	4.8	6.3
% change in leverage	0%	3%	6%	12%	19%	27%
*Required collateral top-up (£)**	0.0	1.7	2.5	3.3	3.8	4.0
			+50 bps yield shock			
Liabilities (£) - new	90	90	90	90	90	90
LDI Assets (£) - new	90	57	40	23	15	10
Leverage (x) - new	1.0	1.6	2.3	3.9	6.0	9.0
% change in leverage	0%	6%	13%	29%	50%	80%
*Required collateral top-up (£)**	0.0	3.3	5.0	6.7	7.5	8.0
			+75 bps yield shock			
Liabilities (£) - new	85	85	85	85	85	85
LDI Assets (£) - new	85	52	35	18	10	5
Leverage (x) - new	1.0	1.6	2.4	4.6	8.5	17.0
% change in leverage	0%	10%	21%	55%	113%	240%
*Required collateral top-up (£)**	0.0	5.0	7.5	10.0	11.3	12.0
			+100 bps yield shock			
Liabilities (£) - new	80	80	80	80	80	80
LDI Assets (£) - new	80	47	30	13	5	0
Leverage (x) - new	1.0	1.7	2.7	6.0	16.0	-
% change in leverage	0%	14%	33%	100%	300%	-
*Required collateral top-up (£)**	0.0	6.7	10.0	13.3	15.0	16.0

Source: SEI. *Required collateral top-up to restore original leverage ratio. Some figures are rounded for convenience. For illustrative purposes only.

A key observation is that, as yields rise, leverage increases at a quicker rate for schemes with higher starting levels of leverage. For example, a +50 basis point yield shock increases the leverage on the 4x leveraged scheme by 50%, compared to only a 13% increase for the scheme with 2x leverage. The 5x leveraged scheme is unable to withstand the extreme scenario of a +100 basis point yield move as the value of the LDI assets would fall to zero. (As shown in the example below - Exhibit 4.)

Exhibit 4: Leverage increases at a faster rate



Source: SEI. For illustrative purposes only.

The implication is that although higher leverage requires a lower initial investment in LDI assets, the resulting higher sensitivity to changes in yields increases the likelihood that additional collateral will be required, which in turn creates a greater liquidity burden on a scheme's growth assets. If there is a delay in raising sufficient cash, the fund may reach its knockout, leaving the LDI manager no option but to cut risk (i.e. hedging), which then exposes the scheme to a subsequent fall in rates.

What about duration?

Another perhaps not so obvious feature of leverage is its relationship with duration. Leverage-free portfolios exhibit positive convexity whereby duration falls as yields rise (portfolios become less interest rate-sensitive at higher yield levels). Leverage reverses this relationship because the amplified negative impact of rising yields on portfolio value overrides the classic yield-duration relationship described above.

Our view

Leverage can be an extremely useful tool, particularly in LDI. It allows schemes to hedge 'unrewarded' interest rate and inflation risks in a capital efficient way, allowing surplus funds to be invested in 'rewarded' risks–i.e. growth assets. However, as recent events have shown, it is not a free lunch and involves trade-offs. Running a higher level of leverage may sound appealing, however schemes need to balance the advantages of capital efficiency against the higher probability of capital calls and the greater liquidity demands this places on a scheme's growth assets.

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