Insights
**Liability Driven Investing**

**May 2021**

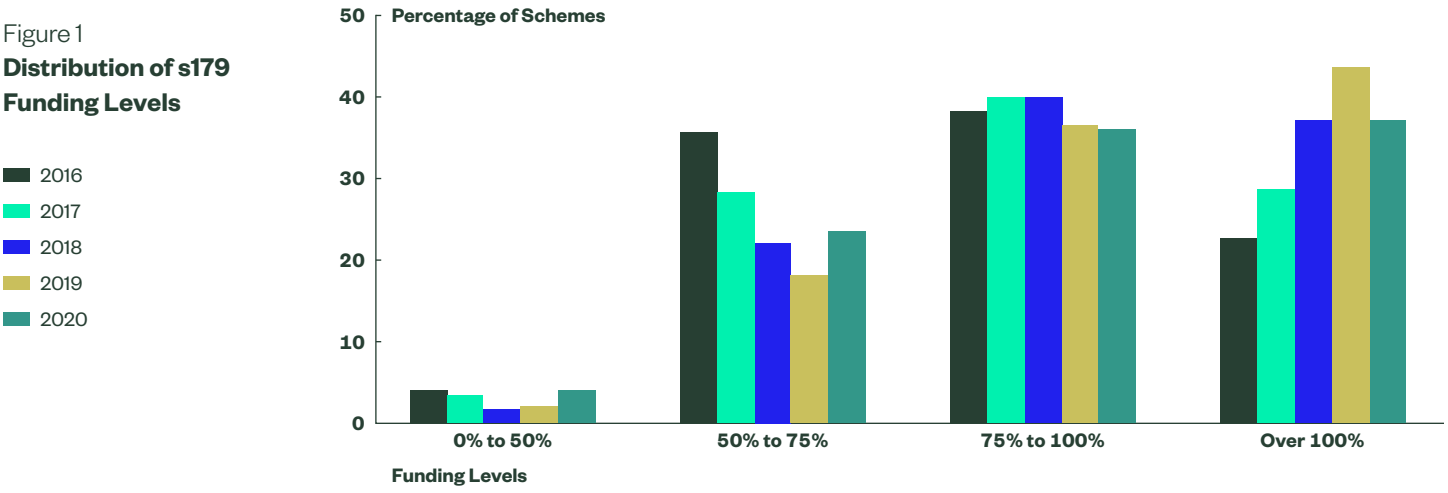
# UK DB Schemes — Capital Efficiency and Leveraging "Growth" in Investment Portfolios

**Daoyu Chen, CFA**
Senior Investment Strategist

Data from the Pension Protection Fund's (PPF) purple books over the past five years show that private sector UK Defined Benefit (DB) schemes in aggregate are progressing further along their journey toward their endgames.[1] Indeed, aggregate funding ratios improved from 85.8% in March 2016 to 94.9% in March 2020, and the latest update for the PPF 7800 Index shows the March 2021 number at 102.0%.

Whilst the aggregate results are encouraging, disaggregating the data reveals that there is significant dispersion in funding ratios. In other words, many schemes are still closer to their opening and middle games than their endgames. This is especially true when we realize that the s179 funding level calculation is based on the compensation that schemes would receive if they were transferred to the PPF, whereas funding levels based on schemes' actual goals such as self-sufficiency or insurance buyout are lower.[2] Thus, figures based on s179 funding levels overestimate the number of schemes nearing their endgames.

Figure 1
**Distribution of s179 Funding Levels**




Note: Funding ratios as of 31 March each year.
Source: The Purple Book 2016, 2017, 2018, 2019, 2020.

## Need for Leverage Apparent for UK DB Schemes

Given this context, the need for leverage becomes apparent for UK DB schemes. One way of defining capital efficiency is changing the form of assets in one part of an investment portfolio to free up capital to be used elsewhere in the portfolio to improve the likelihood of achieving investment goals. For DB schemes this may involve using leverage in the matching portfolio[3] to hedge liabilities in the form of Liability Driven Investments (LDI), whilst maintaining exposure to growth assets, thereby reducing funding level volatility and effectively working both growth and matching assets harder to close the funding level deficit.

In general, leverage is an important part of the toolkit available to trustees of schemes before they reach their DB endgame. Whilst the use of leverage to improve capital efficiency has long been recognized, its need has become more pressing as UK schemes become increasingly cashflow negative and are pressured to free up capital to enable investments in Cashflow Driven Investment (CDI) strategies.

## Conventional Uses of Leverage

Traditionally, leverage was taken in the matching portfolio by way of derivative instruments such as interest rate, inflation and gilt total return swaps or gilt repos. In general, schemes that are at the opening game of their journey — usually at lower funding levels — are the ones that tend to prefer higher leverage. As schemes move along their life cycle and as funding ratios improve, leverage declines too. Eventually, as schemes move to a fully funded status, no more leverage is required in the matching portfolio.

This has led to some asset managers offering highly levered LDI funds to schemes with lower funding ratios. Such schemes in turn may choose to have higher leverage levels as they typically have higher target returns, which necessitate more capital to be allocated to growth assets to meet that target return.

Let us illustrate this through the example of three hypothetical schemes. We assume each scheme has a target time horizon of 15 years to become fully funded and has different initial funding levels. We also assume that the trustees of these schemes are comfortable employing a leveraged LDI strategy to stabilize their funding ratios and are aiming for a target hedge ratio equal to their initial funding ratio.

Figure 2 shows that the scheme with the lowest initial funding ratio has the highest required return requirement, and in order for the scheme to meet the required return, it needs to take on high levels of leverage in its matching portfolio. This introduces a large amount of risk into the matching portfolio.

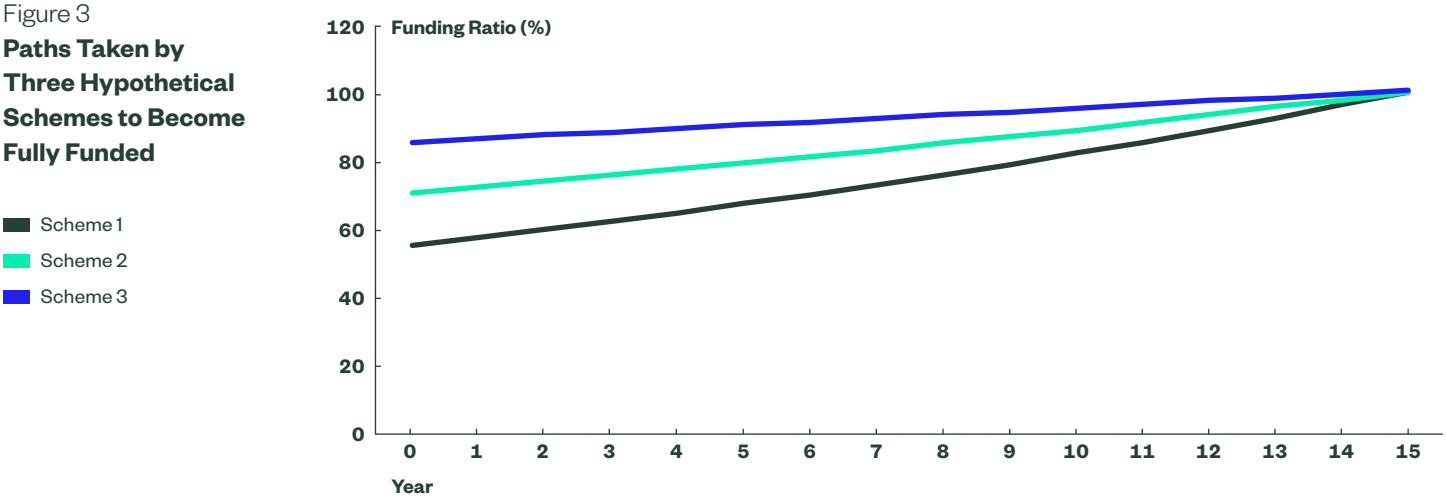
Figure 2
**Hypothetical Schemes With Different Initial Funding Levels But Same Time Horizon**

| Funding Ratio (%) | Target LDI Hedge Ratio (%) | LDI Leverage | Matching Portfolio Allocation (%) | Growth Portfolio Allocation (%) | Required Return (Gilts+ ) (%) |
|---|---|---|---|---|---|
| 55 | 55 | 6.5 | 15 | 85 | 4 |
| 70 | 70 | 2.0 | 50 | 50 | 2 |
| 85 | 85 | 1.3 | 77 | 23 | 1 |

Note: The growth portfolio is modelled using State Street Global Advisors' Q4 2020 long-term asset class forecasts for developed market equities; the matching portfolio is modelled using the yield to maturity of 20-year nominal UK government bonds with cost of leverage modelled using State Street Global Advisors' Q4 2020 long-term asset class forecasts for UK cash.
Source: Bloomberg, State Street Global Advisors, as at December 31, 2020.

Figure 3 illustrates the paths taken by the three schemes to become fully funded.

Figure 3
**Paths Taken by Three Hypothetical Schemes to Become Fully Funded**




Note: The growth portfolio is modelled using State Street Global Advisors' Q4 2020 long-term asset class forecasts for developed market equities; the matching portfolio is modelled using the yield to maturity of 20-year nominal UK government bonds with cost of leverage modelled using State Street Global Advisors' Q4 2020 long-term asset class forecasts for UK cash.
Source: Bloomberg, State Street Global Advisors, as at December 31, 2020.

## Is There a Better Way to Take Leverage?

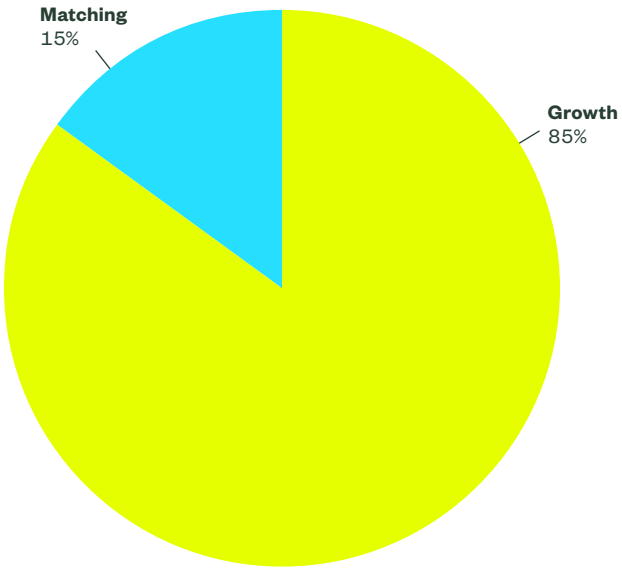
Leverage is usually integral to an LDI strategy employed in a matching portfolio and trustees tend to be familiar with taking leverage as part of an LDI strategy. However, in our opinion, there is room for improvement in the traditional approach to taking leverage, especially if we were to reevaluate *where* leverage is typically taken in a scheme's investment portfolio.

This requires a change of approach and to illustrate this let us get back to our example of the 55% funded scheme, which has a required return of Gilts + 4% (Figure 2). We compare the two approaches of taking leverage only in the matching portfolio (Figure 4a) versus taking it both in the matching and growth portfolios (Figure 4b). In the latter approach, 42% of assets are 3x leveraged, i.e., 9% in the growth portfolio and 33% in the matching portfolio, and 58% are unleveraged growth assets.

By adopting the latter approach, we show that the required return can be achieved using 3x leverage not only in the matching but also in a small part of the growth portfolio. Consequently, the overall leverage of the total investment portfolio (calculated by dividing total exposure by total assets) remains at about 1.8x — similar to that of taking leverage only in the matching portfolio but with the added advantage of needing less leverage in that segment. This essentially means the new approach reduces the risk involved in *taking high leverage only in the matching portfolio and benefits from diversifying leverage into growth*.

Figure 4a

**Leverage Taken Only in Matching Portfolio**

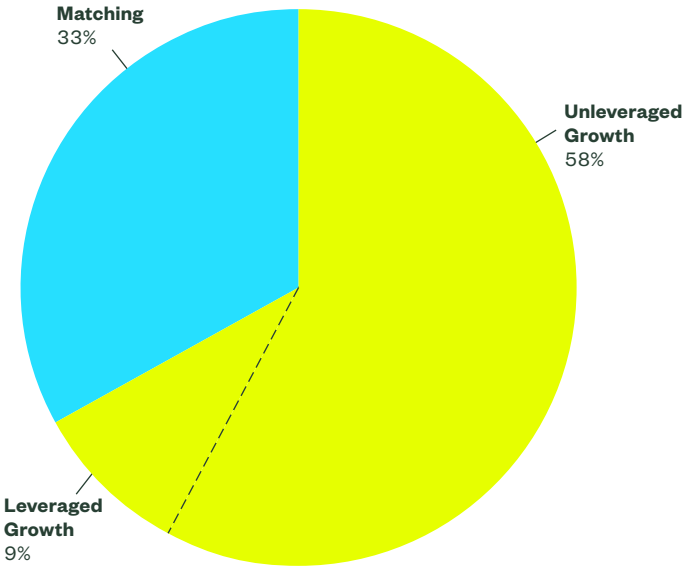



| Segment | Allocation |
|---|---|
| Matching in Total | 15% (6.5x Leveraged) |
| Growth in Total | 85% (Unleveraged) |

Note: The growth portfolio is modelled using State Street Global Advisors' Q4 2020 long-term asset class forecasts for developed market equities; the matching portfolio is modelled using the yield to maturity of 20-year nominal UK government bonds with cost of leverage modelled using State Street Global Advisors' Q4 2020 long-term asset class forecasts for UK cash; for illustrative purposes only.
Source: Bloomberg, State Street Global Advisors, as at December 31, 2020.

Figure 4b

**Leverage Taken in Both Matching and Growth Portfolios**




| Segment | Allocation |
|---|---|
| Matching Total | 33% (3x Leveraged) |
| Growth Total | 67% = 58% (Unleveraged) + 9% (3x Leveraged) |

Note: The growth portfolio is modelled using State Street Global Advisors' Q4 2020 long-term asset class forecasts for developed market equities; the matching portfolio is modelled using the yield to maturity of 20-year nominal UK government bonds with cost of leverage modelled using State Street Global Advisors' Q4 2020 long-term asset class forecasts for UK cash; for illustrative purposes only.
Source: Bloomberg, State Street Global Advisors, as at December 31, 2020.

## Advantages of Taking Leverage via Equity Derivatives

One broad trend among UK DB schemes is the adoption of a group of strategies by larger schemes in segregated mandates, which, after a while, becomes available to other (usually smaller) schemes in pooled fund formats. This was the case with LDI, too, which was first implemented in the early 2000s by larger schemes such as the Boots Pension Scheme.[4]

In a similar vein, more recently, segregated schemes have started looking at synthetic equity strategies in their growth portfolios, which are replacing holdings of physical equities with derivatives such as futures, equity total return swaps, and even options.

### What Explains This Shift

First off, it is important to note that an investment portfolio's overall expected return can remain the same whether leverage is taken in the matching or the growth portfolio. Nevertheless, by adopting synthetic equity strategies, a scheme should be able to free up capital to be used elsewhere in the portfolio even while broadly maintaining the same levels of equity exposure.

Secondly, adding equity derivatives may help in terms of rebalancing costs. Schemes tend to have strategic asset allocations in place, designed with their investment advisor, which can change as their funding ratios evolve with market conditions. But, even if we were to disregard the funding ratios, market movements would mean portfolios will need to periodically rebalance back to their target weights.

In the above context, selling or buying synthetic equities has the advantage of having potentially lower transaction costs than buying or selling physical equity. This is because liquidity in the futures market is very high and the cost of buying a futures contract could be lower than replicating an index by purchasing all its constituent stocks. Furthermore, there is additional potential savings in the form of stamp duty on UK equity when cash settled futures and equity total return swaps are used.[5]

Thirdly, trustees familiar with the use of leverage, be it in gilt repos or swaps, know that since the liquidity and cost of these instruments fluctuate as market conditions evolve, there is a need for diversification via counterparties and expiry dates. By diversifying the source of leverage to equity derivatives, there is the added benefit of reducing one's reliance on repos and interest rate markets.

A fourth advantage is the potential for a reduction in capital calls. When taking leverage, schemes should be mindful of the possibility of capital calls and distributions and plan for those situations, which add to the governance burden of trustees. Diversification between growth and matching assets could mean that taking leverage in both growth and matching portfolios simultaneously results in fewer capital calls compared with taking leverage in just matching alone. This in turn reduces the costs associated with the forced selling of assets to meet capital calls.

In an earlier paper we had shown that reducing leverage used in a matching portfolio by itself could lead to a reduction in capital calls.[6] We reprise a relevant example from that paper below.

## Diversification of Leverage Reduces Likelihood of Capital Calls

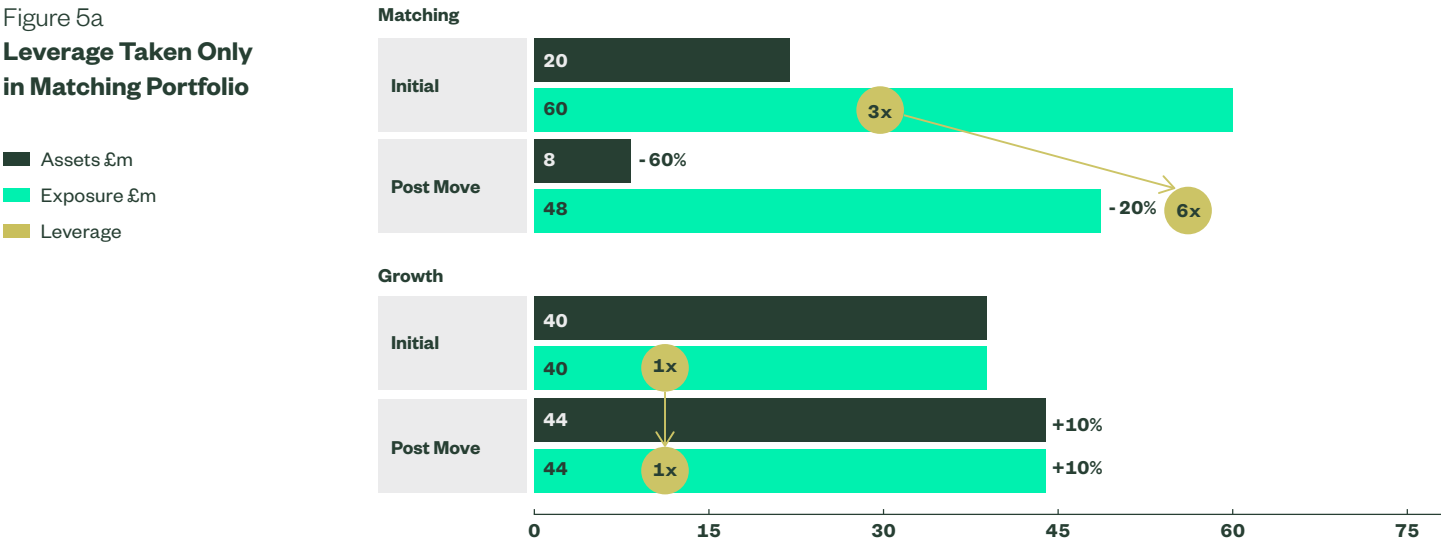
Consider an underfunded scheme with £60 million in assets. With leverage, the scheme has an exposure of £100 million, split between £60 million in LDI (matching portfolio) and £40 million in Equity (growth portfolio). At inception, such a scheme would be 1.7x levered at the overall portfolio level.

We will consider two alternative investment portfolios that this scheme could implement, which use leverage in different ways. Both portfolios are then subjected to a 1% yield increase, which would result in a 20% fall in the value of the matching segment (assuming a 20-year duration), alongside a 10% increase in the value of growth.

### Investment Portfolio 1

Here leverage is used only in the matching portfolio — a leverage of 3x would allow £20 million of LDI assets to achieve £60 million of LDI exposure. The scheme's remaining £40 million of assets are invested in physical equities (the growth portfolio) (Figure 5a).

Figure 5a
**Leverage Taken Only in Matching Portfolio**




Note: For illustrative purposes only.
Source: State Street Global Advisors.

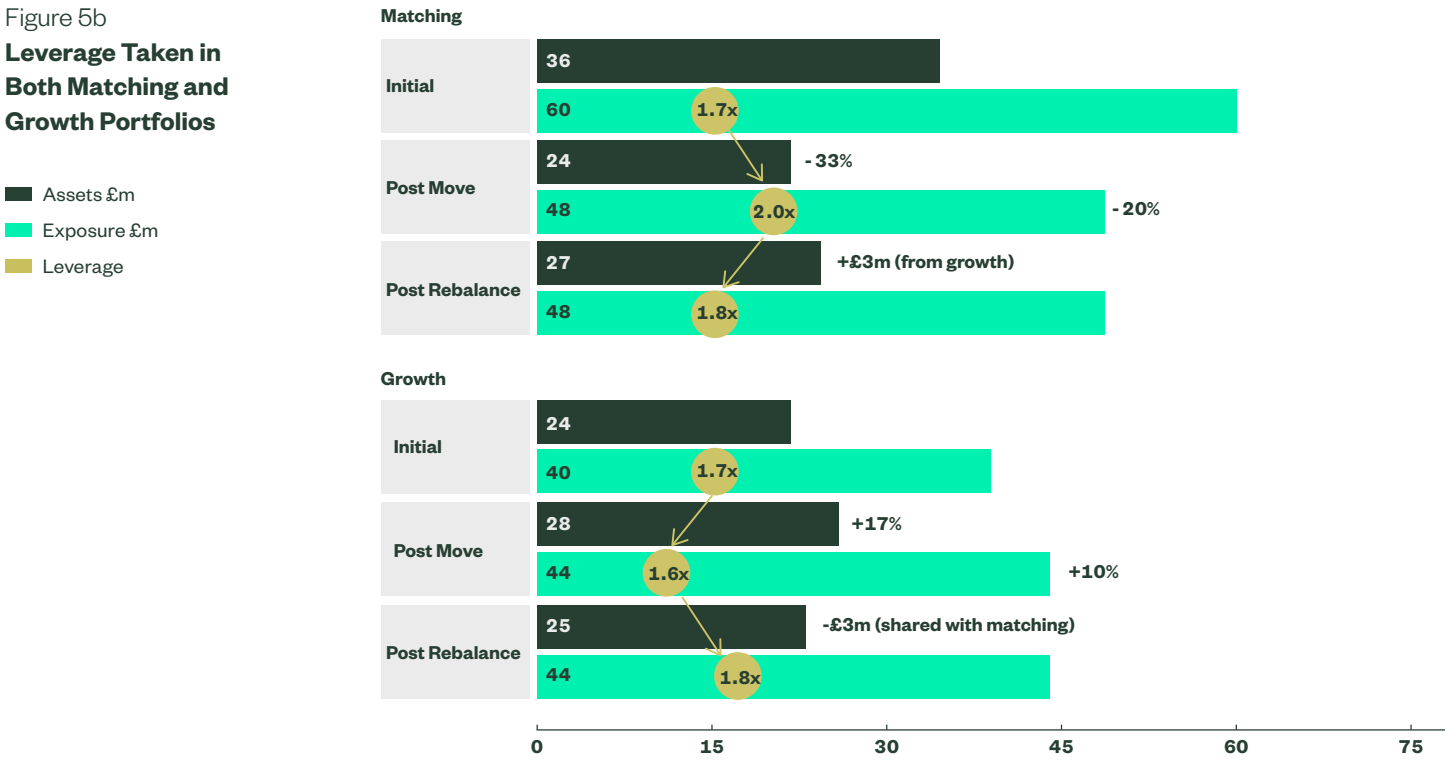
Post the market movement, the matching portfolio is 6x leveraged — such a leverage level would be undesirable for many LDI mandates and additional assets would need to be provided to the matching portfolio to bring leverage back to an acceptable level.

The scheme may therefore be forced to sell physical equities or, instead, have to take leverage in their equity holdings to release assets. Initiating the latter as a reaction to market events may become very challenging under time constraints, especially given the governance burden on schemes that do not have this flexibility in place.

Investment Portfolio 2

Here leverage is taken equally across both the matching and growth portfolios. Leverage at a level of 1.7x would allow £36 million of matching assets to achieve £60 million of matching exposure and £24 million of growth assets to achieve £40 million of growth exposure (Figure 5b).

Figure 5b
**Leverage Taken in Both Matching and Growth Portfolios**




Note: For illustrative purposes only.
Source: State Street Global Advisors.

Post the market movement, the matching portfolio's leverage increases only to 2x — a level at which the scheme may not need to provide additional assets to the matching portfolio (in order to reduce leverage). In turn, the growth portfolio's leverage falls to 1.6x.

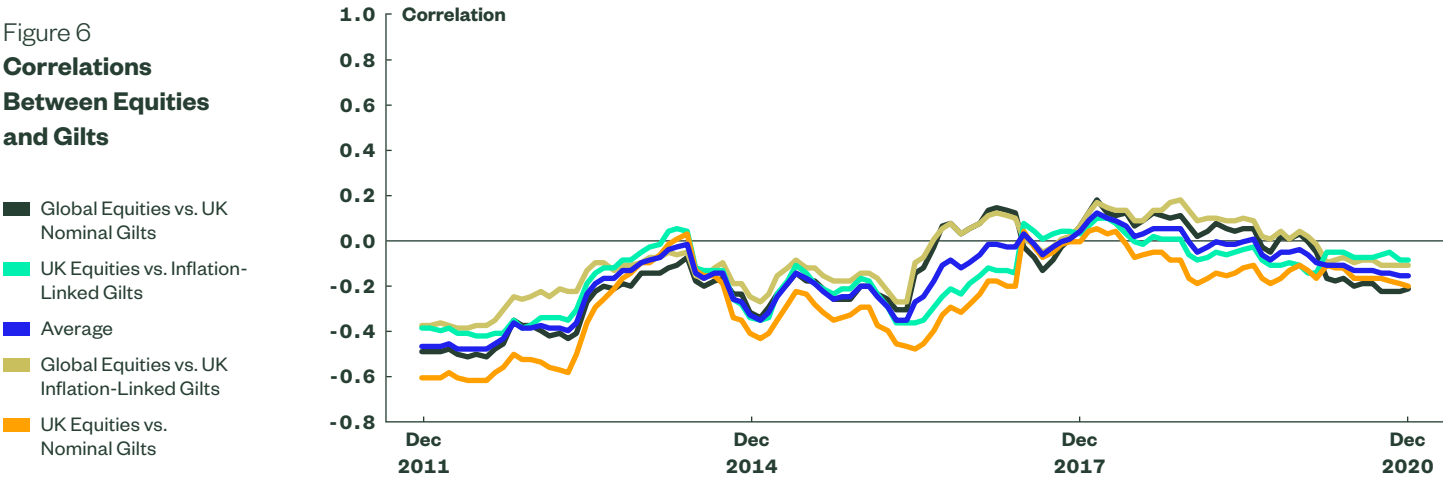
If the scheme can efficiently share collateral between the two portfolios, it would be able to adjust the leverage levels across each asset class. For example, a movement of about £3 million of collateral from the equity portfolio to the matching LDI portfolio would bring the leverage of each to 1.8x.

## Room For Still Further Improvement

What the above example from our earlier paper brings to the fore is that reducing the leverage used in the matching portfolio by itself can lead to fewer capital calls. And if we were to account for the historically low correlation between equity and LDI assets and the ability to share collateral between them, there is room to further reduce the frequency of capital calls as well as the governance burden on trustees.

To be clear, this does not mean the elimination of capital calls. As mentioned earlier, while taking leverage, schemes should be mindful of capital calls and plan for such situations. After all, though the average historical correlations between growth (equities) and matching assets (gilts) have been low in recent history, correlations have been higher over previous periods, and there is considerable debate regarding the future course of these correlations (Figure 6).

Figure 6
**Correlations Between Equities and Gilts**




Note: Past performance is not a reliable indicator of future performance; the indices used for calculating correlations are the MSCI World Net Total Return Index (GBP), the FTSE All-Share Total Return Index, the FTSE Actuaries UK Index-Linked Gilts All Stocks Total Return Index and the FTSE Actuaries UK Conventional Gilts All Stocks Total Return Index.
Source: Bloomberg, as at December 31, 2020.

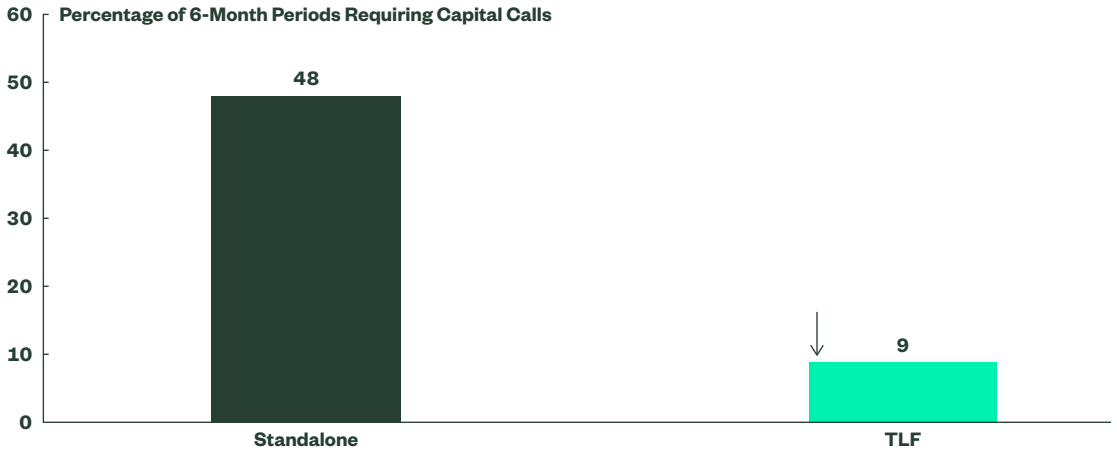
One argument made against adding leverage to both LDI and equities is that adding leverage just to LDI is cheaper. But this is not necessarily true. Indeed, there are times when gilt repo and gilt total return swaps (TRS) are more expensive than equity TRS. The reason for these differences lies in the different dynamics of fixed income and equity TRS markets. For instance, as the two-way flow in equity TRS markets increases, trading desks can make prices while committing less of their bank's balance sheet, allowing UK DB schemes to benefit from the resultant lower cost of funding.

## Pooled Clients May Benefit From Our Target Leveraged Fund Range

We have been hard at work designing innovative solutions that address the chief goals of schemes: capital and collateral efficiency as well as allocational flexibility. The result is our Target Leveraged Fund (TLF) range. Through an innovative bespoke collateral management process, we make efficient use of collateral available *within the solution itself*, thereby reducing the likelihood of schemes having to furnish additional collateral via capital calls.

To illustrate this, we backtested a sample scheme consisting of a 30% allocation to UK equity and a 70% allocation to nominal UK LDI and found that during the 1999–2020 period, capital calls were made during 48% of the total six-month horizons for a standalone leveraged solution. In contrast, we found that, had the assets been placed in our TLF solution, this frequency would have fallen to 9%, reducing transaction costs associated with rebalancing as well as the governance burden borne by trustees (Figure 7).

Figure 7
**30% Equity + 70% Nominal LDI Backtested Allocation Mix**

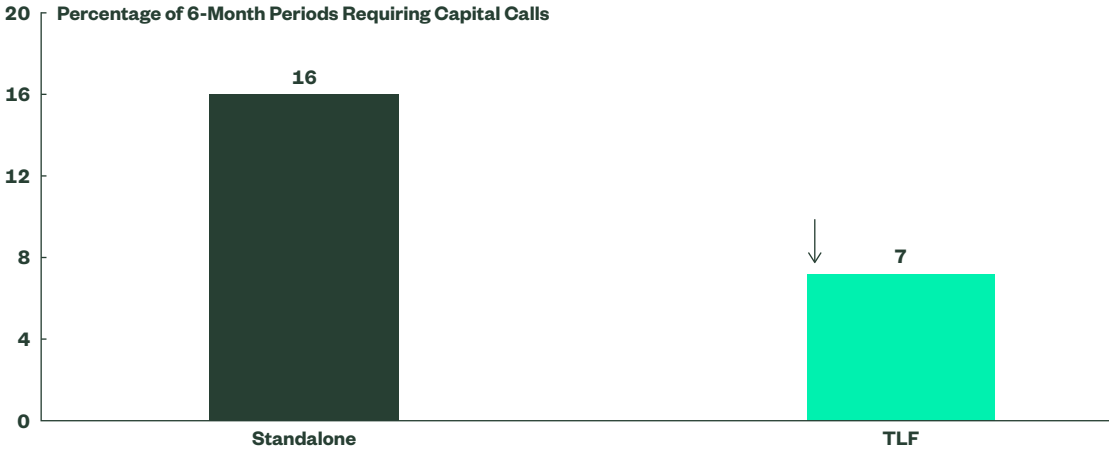



Note: Backtesting based on data from January 7, 1999 to December 31, 2020; the comparison is between TLFs and standalone leveraged funds in terms of the expected frequency of capital call events over 6-month horizons under equivalent target and capital call leverage assumptions; the data displayed for the capital calls backtest is a hypothetical example of backtested performance for illustrative purposes only and is not indicative of the past or future performance of any SSGA product; the portion of results through December 31, 2020 represents a backtest of the capital calls efficiency analysis model, which means that those results were achieved by means of the retroactive application of the model which was developed with the benefit of hindsight. All data shown above does not represent the results of actual trading, and in fact, actual results could differ substantially, and there is the potential for loss as well as profit. Please refer to the Backtested Methodology Appendix for a description of the methodology used as well as an important discussion of the inherent limitations of backtested results. Source: State Street Global Advisors.

Even if schemes were to choose to use leverage only in their matching portfolio, the four LDI profile funds that sit within the TLF range are unique in that they allow collateral sharing between different LDI profile funds.

In Figure 8, we show how a scheme with only its matching portfolio allocated to the TLF range could benefit from lower capital calls. Here there is an even allocation between real and nominal matching funds. Our modelling suggests that the expected frequency of capital calls over 6-month horizons would have halved if schemes were to invest in TLFs versus just investing in standalone leveraged funds.

Figure 8
**50% Nominal Matching + 50% Real Matching Backtested Allocation Mix**




Note: Backtesting based on data from January 7, 1999 to December 31, 2020; the comparison is between TLFs and standalone leveraged funds in terms of the expected frequency of capital call events over 6-month horizons under equivalent target and capital call leverage assumptions; the data displayed for the capital calls backtest is a hypothetical example of backtested performance for illustrative purposes only and is not indicative of the past or future performance of any SSGA product; the portion of results through December 31, 2020 represents a backtest of the capital calls efficiency analysis model, which means that those results were achieved by means of the retroactive application of the model which was developed with the benefit of hindsight. All data shown above does not represent the results of actual trading, and in fact, actual results could differ substantially, and there is the potential for loss as well as profit. Please refer to the Backtested Methodology Appendix for a description of the methodology used as well as an important discussion of the inherent limitations of backtested results. Source: State Street Global Advisors.

Coming back to the question of correlations, even though correlations are changing, and their future direction is under question, we see that the innovative bespoke collateral management process embedded within the TLF range provides collateral efficiency benefits between asset classes every time a correlation falls below 1.

## Conclusion

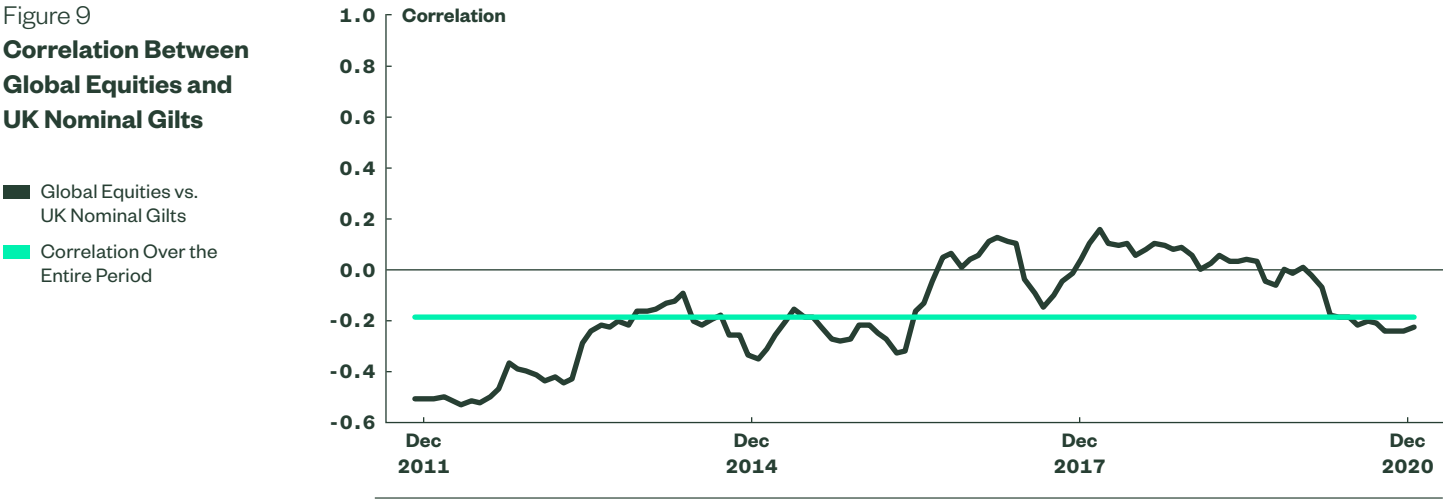
In short, there are several advantages to diversifying the source of leverage in an investment portfolio beyond just LDI into equities, including:

- Maintaining broadly the same growth asset exposure and hence expected return, whilst freeing up capital to be deployed elsewhere
- Potentially lowering transaction costs associated with growth in terms of rebalancing back to strategic asset allocation weights
- Diversifying markets from where leverage is taken, thereby potentially reducing funding costs
- Potential for fewer capital calls and distributions resulting from lower leverage taken in matching portfolios, augmented by low correlations between equity and matching assets

## Appendix 1

Figure 9

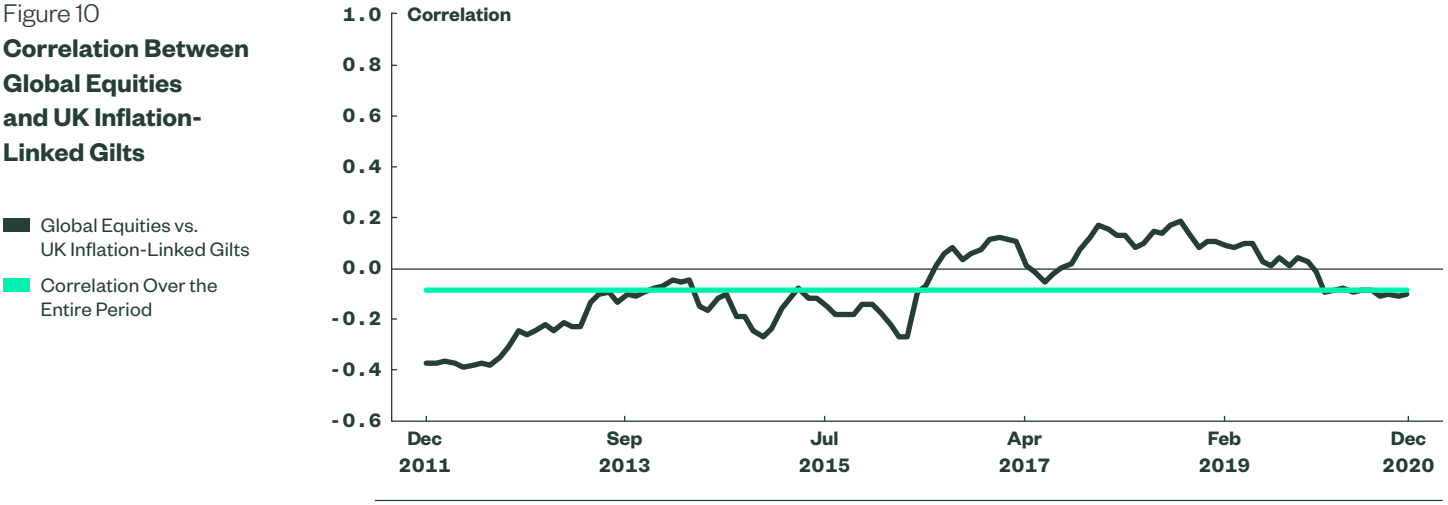
**Correlation Between Global Equities and UK Nominal Gilts**




Note: Past performance is not a reliable indicator of future performance; the indices used for calculating correlations are the MSCI World Net Total Return Index (GBP) and the FTSE Actuaries UK Conventional Gilts All Stocks Total Return Index.
Source: Bloomberg, as at December 31, 2020.

Figure 10

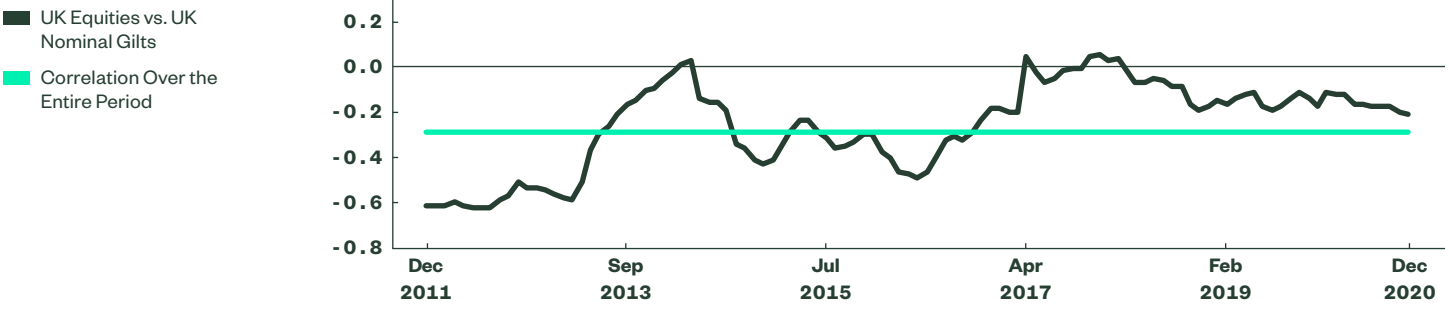
**Correlation Between Global Equities and UK Inflation-Linked Gilts**




Note: Past performance is not a reliable indicator of future performance; the indices used for calculating correlations are the MSCI World Net Total Return Index (GBP) and the FTSE Actuaries UK Index-Linked Gilts All Stocks Total Return Index.
Source: Bloomberg, as at December 31, 2020.

Figure 11

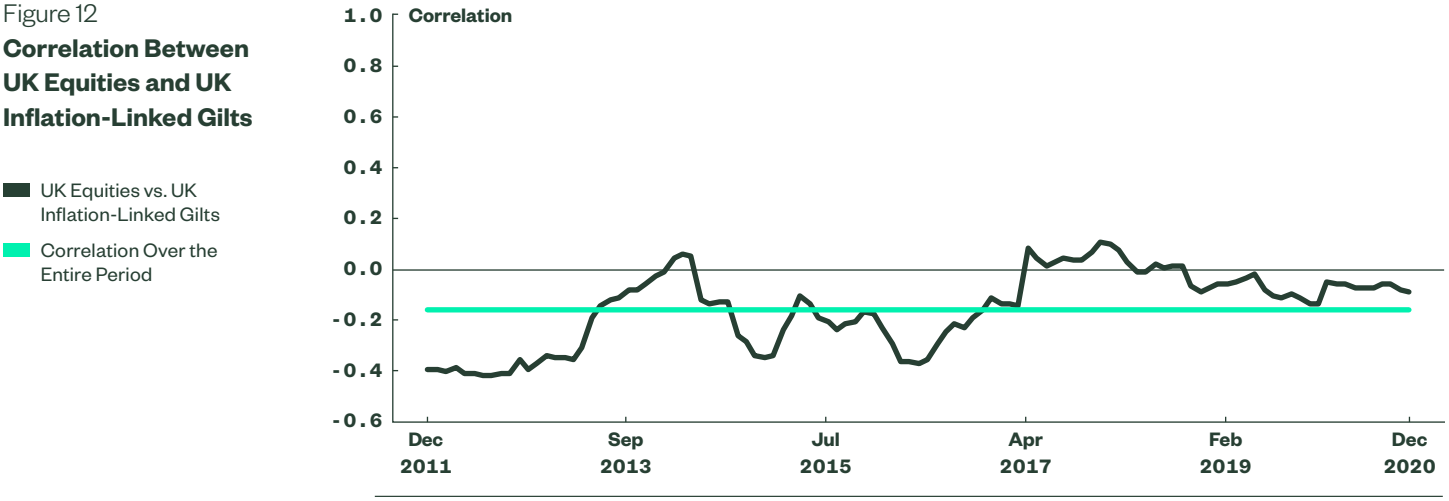
**Correlation Between UK Equities and UK Nominal Gilts**




Note: Past performance is not a reliable indicator of future performance; the indices used for calculating correlations are the FTSE All-Share Total Return Index and the FTSE Actuaries UK Conventional Gilts All Stocks Total Return Index.
Source: Bloomberg, as at December 31, 2020.

Figure 12

**Correlation Between UK Equities and UK Inflation-Linked Gilts**




Note: Past performance is not a reliable indicator of future performance; the indices used for calculating correlations are the FTSE All-Share Total Return Index and the FTSE Actuaries UK Index-Linked Gilts All Stocks Total Return Index.
Source: Bloomberg, as at December 31, 2020.

## Appendix 2

### Backtested Methodology Appendix

The backtesting presented in this paper was undertaken by the State Street Global Advisors' Investment Strategy & Research Group.

The backtested performance results presented here do not represent the results of actual trading using clients' assets but were achieved by means of the retroactive application of capital call triggers (based on leverage levels) against actual historical data. The backtested performance data is reported before management fees and before transaction costs.

This process was designed with the benefit of hindsight, and thus, the performance results should not be considered as indicative of the skill of the advisor or its investment professionals. The backtested performance was compiled after the end of the period depicted and does not represent the actual investment decisions of the advisor. These results do not reflect the effect of material economic and market factors on decision making. In addition, backtested performance results do not involve financial risk, and no hypothetical trading record can completely account for the impact of financial risks associated with actual investing.

Not all products are available to all investors. Please contact State Street Global Advisors for further information regarding this strategy.

### References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## Endnotes

1 Opening, middle and endgame are terms used by investment consultants to refer to stages of the life cycle of a typical DB pension scheme. Please refer to the Redington report cited in References for further details.

2 s179 refers to a valuation under section 179 of the Pensions Act 2004, which relates to the compensation offered by the PPF. A section 179 valuation applies the PPF compensation levels to the valuation and will show whether the scheme would need to call on the PPF if the employer was to enter insolvency.

3 A scheme's investment portfolio can be divided into matching and growth segments, commonly known as the matching and growth portfolios, respectively.

4 See Practical implementation of Liability Driven Investment.

5 Schemes would need to check with their tax advisors to see whether this is applicable in their respective contexts.

6 See Bowkett, Danielle.

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For four decades, State Street Global Advisors has served the world's governments, institutions and financial advisors. With a rigorous, risk-aware approach built on research, analysis and market-tested experience, we build from a breadth of active and index strategies to create cost-effective solutions. As stewards, we help portfolio companies see that what is fair for people and sustainable for the planet can deliver long-term performance. And, as pioneers in index, ETF, and ESG investing, we are always inventing new ways to invest. As a result, we have become the world's third-largest asset manager with US $3.59 trillion* under our care.

* This figure is presented as of March 31, 2021 and includes approximately $60.33 billion of assets with respect to SPDR products for which State Street Global Advisors Funds Distributors, LLC (SSGA FD) acts solely as the marketing agent. SSGA FD and State Street Global Advisors are affiliated.

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