

Rt Hon Sir Stephen Timms MP
Chair
Work and Pensions Committee
House of Commons
London
SW1A 0A

02 February 2024

Dear Sir Stephen,

Review of the impact on defined benefit (DB) pension schemes following the Liability-Driven Investment (LDI) episode

The Pensions Regulator (TPR) welcomed the Work and Pensions Committee's inquiry into '*Defined benefit pensions with Liability Driven Investments*' and is committed to working with our regulatory partners and the industry to ensure the robust protections are in place for DB savers and to mitigate systemic risks.

TPR's key priorities as a regulator are to **protect** savers' money by making sure trustees and employers comply with their duties; **enhance** the system through effective market oversight, influencing better practice; and to support **innovation** in savers' interests.

We recognise the role that pension schemes play in the complex financial services ecosystem, particularly as schemes continue to evolve in size. That is why we are making sure that our capable people are deployed in the right way, with appropriate focus on financial stability issues, and that our systems and processes support this. Improving capacity is also driven by better collaboration between regulators, improving relationships with market participants and enriched data capture.

In this letter I am responding to your recommendation to produce a detailed analysis of the LDI episode and providing an update on our ongoing work to ensure that pension schemes are resilient to economic shocks

Committee recommendation

In its report following the LDI inquiry, the committee recommended that:

DWP should work with TPR and the PPF to produce, by the end of 2023, a detailed account of the impact on pension schemes of the LDI episode. This should:

- i) look at the impact on funding levels, detailing how the value of their assets and liabilities changed, showing the results disaggregated by whether the fund used LDI and, if so, whether in a pooled, segregated or bespoke arrangement; and*
- ii) include analysis of the factors which contributed to scheme funding improving or deteriorating, including the role played by LDI strategies.*

The Government's November 2023 response to the Committee's recommendations, set out that TPR was working to produce a further report in respect of Recommendation 1 specifically.

Please find attached the resulting report: '*Review of impact on the DB landscape following the LDI episode*'. It details how the value of the DB pensions landscape changed and includes analysis of the factors which contributed to scheme funding improving or deteriorating, including the role played by LDI strategies.

The vast majority of schemes are now in surplus:

Our modelling shows aggregate funding levels of DB schemes improved over 2022 on a variety of measures:

- Funding levels improved for 87% of schemes on the statutory 'technical provisions' (TP) basis.
- Only 5% of DB schemes experienced both a deterioration in their funding level and either an increase in their existing funding deficit, or a movement from surplus to deficit, over 2022.
- By the end of 2022 our analysis suggests that broadly 80% of schemes were in surplus on a TP basis.
- On a buyout basis, about 4 in 10 schemes are estimated to be fully funded as at the end of December 2022 compared to less than 10% at the end of December 2021.

The primary reason for the improvement in funding levels is due to the fall in the value of liabilities exceeding that of the value of assets.

TPR's Ongoing Work in this area:

We recognise that, whilst unprecedented, the market turmoil in September 2022 has raised concerns related to the impact of DB investment strategies, in particular the use of leveraged LDI, on financial stability.

In response we have focused on three areas:

1. Building partnerships with the wider national and international regulatory family.

TPR is working more closely with other regulators recognising the role pensions play across borders and the complex financial ecosystem. These include the Financial Conduct Authority, Bank of England, Central Bank of Ireland and the Commission de Surveillance du Secteur Financier in Luxembourg in the monitoring of fund managers who provide LDI style investments.

2. Improving operational processes within schemes so they can respond more effectively to market events.

In April 2023 we published guidance that specified the resilience regime, a minimum 250bps stress buffer plus an operational buffer to manage day to day volatility, and expectations around recapitalisation, stress testing and governance.

This means that pension schemes are now more resilient to shocks. Funds have maintained overall levels of resilience consistent with the minimum levels recommended and have initiated recapitalisation at higher levels of resilience than previously (300-400 basis points).

3. Improving our data picture and bolstering our market-facing expertise to anticipate and mitigate risks on a system-wide level.

We have in place a data strategy to provide us with a more robust picture of the resilience of both pooled and segregated LDI funds, the liquidity levels of DB schemes and the governance and operations of DB schemes enabling them to respond quickly to a similar situation in the future. This is achieved by having regular flows of data from the five UK fund managers that between them hold almost 90% of the DB market in leveraged pension investment assets, and by including additional questions regarding LDI strategies into our annual DB scheme return starting from 2024. These questions will seek to understand the level of leverage used by schemes, the degree and deliverability of liquidity in the overall asset portfolio, and the trustee governance around collateral transactions. This will also allow us to distinguish between schemes which used pooled funds, and which have segregated funds.

This data will allow us to better understand individual scheme situations and schemes' ability to deal with any future gilt market volatility. We will also look to build this into our future modelling where possible.

Over the last 18 months we have also doubled the number of investment consultants. We are bolstering this with the recruitment of a senior economist and seeking access to senior market participants to better gather market intelligence and understand potential wider market risk which could impact pension investments.

Furthermore, the anticipated introduction of the funding and investment (FIS) regulations in early 2024, will result in TPR receiving richer scheme valuation data from trustees. This will be provided irrespective of whether a scheme is in deficit or surplus.

I would like to thank the committee for their interest in LDI episode. We hope you find this report and letter informative. We would be happy to discuss the details of the report with any of the committee members if you so wish.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Nausicaa Delfas', with a horizontal line underneath.

Nausicaa Delfas
Chief Executive
The Pensions Regulator



Review of impact on DB landscape following LDI Episode

Date: 31 January 2024

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EXECUTIVE SUMMARY

Background

1. Following the Growth Plan of 23 September 2022, financial markets reacted by selling UK government bonds (gilts), resulting in large falls in the value of gilts over a very short period of time. The fall in the value of gilts had significant impacts for pension schemes with “Liability Driven Investment (LDI)” strategies, in particular, for those which had used leverage to increase their exposure to long term gilts.
2. The sharp fall in gilt values led to large levels of collateral calls from the leveraged LDI investment managers to meet the loss in value. For some pension schemes, their governance and processes were not sufficient to meet these calls. This, in turn, led to a further large sale of gilts, creating a spiral of further falls in gilt values and greater collateral calls leading to further gilt sales. To alleviate the dysfunction in the gilt market, the Bank of England stepped in to restore stability.
3. In the pensions industry this was commonly labelled the “LDI episode”.
4. For pension schemes, there are a number of impacts that arise from the LDI episode, including but not limited to:
 - A fall in asset values in respect of gilts (and other bond holdings), affecting the value of assets held for DB scheme and also affecting DC savers whose pots were invested in gilts;
 - For DB schemes, a fall in the calculated value of scheme liabilities (due to the increased gilt yields associated with the fall in the value of gilts);
 - The selling of liquid assets to cover the collateral calls, leading to a proportional increase in illiquid assets;
 - A potential fall in the level of LDI, so lower levels of hedging going forward;
 - Higher collateral holdings/liquid assets required to cover leveraged gilt holdings; and
 - Increased governance arrangements to cover collateral requirements.
5. The report by the Work and Pensions Committee (WPC) into the LDI episode, [Defined benefit pensions with Liability Driven Investments \(parliament.uk\)](https://www.parliament.uk/publications/2023/23-06-23-wpc-report-ldi-episode), published 23 June 2023, sets out at paragraph 65:

“DWP should work with TPR and the PPF to produce, by the end of 2023, a detailed account of the impact on pension schemes of the LDI episode. This should:

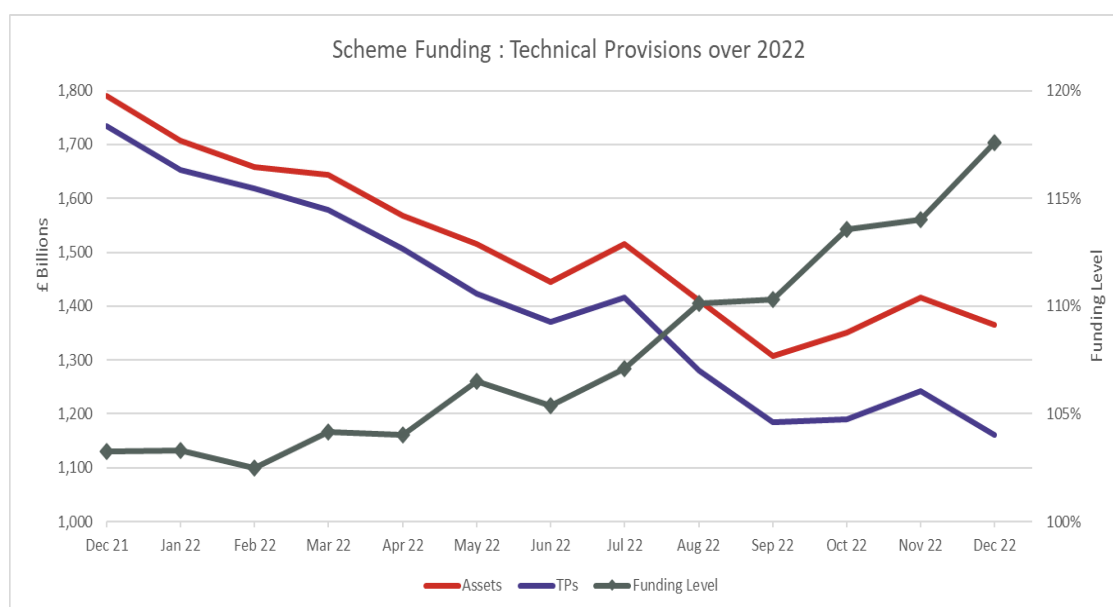
 - (i) look at the impact on funding levels, detailing how the value of their assets and liabilities changed, showing the results disaggregated by whether the fund used LDI and, if so, whether in a pooled, segregated or bespoke arrangement; and*
 - (ii) include analysis of the factors which contributed to scheme funding improving or deteriorating, including the role played by LDI strategies.”*
6. This report concentrates on a review of DB scheme funding over the calendar year 2022 and the role of LDI. However, it is important to note that the impact is felt more widely by DC savers, including a fall in the value of savers’ pots for those who had invested in gilts, but also through improved pricing for annuities (due to the higher gilt yields) for those approaching retirement. Therefore, for individual DC savers, there will be a wide range of impacts which are member-specific depending on their investment portfolio, their age and decumulation option adopted.
7. This report sets out the results of TPR modelling of the DB universe and analysis including:
 - Our analysis on the impact on scheme funding levels over 2022, given the changes to both the value of both assets and liabilities. We have undertaken this analysis on a variety of bases;

- Our analysis on the factors that have contributed to changes technical provisions funding levels;
 - Our explanation of the different situations that arose as part of the LDI episode that may have meant schemes experienced deteriorations in funding levels that were not anticipated, and how they practically responded during the LDI episode. We have made it clear which of these situations we model in our universe estimates and which we do not. There are worked examples to show the potential situations noted and the subsequent impact on asset values, funding levels and investment strategy;
 - Our explanation of the differences between the results we have presented here and those implied from other published data; and
 - A summary of the changes TPR are undertaking in these areas going forward.
8. Whilst this analysis is likely to be the most comprehensive available, there are data limitations, caused by both legal and practical restrictions. TPR is the only organisation which collects data from all registered DB schemes subject to scheme funding regulations. Summarised scheme valuation data is submitted to us by schemes in deficit on a technical provisions basis at least every three years and membership numbers and asset splits are collected annually in the DB scheme return. However, the level of information provided within the restrictions does not enable us to provide the analysis and results disaggregated at the level requested.
9. To undertake such a detailed review would require a significant amount of data to be provided by trustees, and would require an extensive amount of resource from trustees, their advisors and TPR to undertake the analysis, such that the level of burden and cost would be disproportionate, especially in the context of the improvements in scheme funding presented in the remainder of this report.

Scheme Funding Results

10. **Aggregate universe scheme funding levels improved over 2022 on a variety of measures, as the value of liabilities fell by a greater percentage than those of the scheme assets.**
11. The following chart and table set out our estimate of the movement in aggregate assets, liabilities and funding level over the period 31 December 2021 to 31 December 2022:

Chart 1 – Scheme funding on a Technical Provisions basis over 2022



Source: TPR

Table 1 – Scheme funding on a Technical Provisions basis over 2022

Date	31 December 2021	31 March 2022	30 June 2022	30 September 2022	31 December 2022
Assets (£Bns)	1,791	1,644	1,445	1,307	1,365
Liabilities (£Bns)	1,734	1,579	1,372	1,185	1,161
Surplus/(Deficit) (£Bns)	57	65	74	122	204
Funding Level	103%	104%	105%	110%	118%
% of Schemes in Surplus	52%	57%	59%	70%	79%
% of Schemes in Deficit	48%	43%	41%	30%	21%

Source: TPR

Commentary

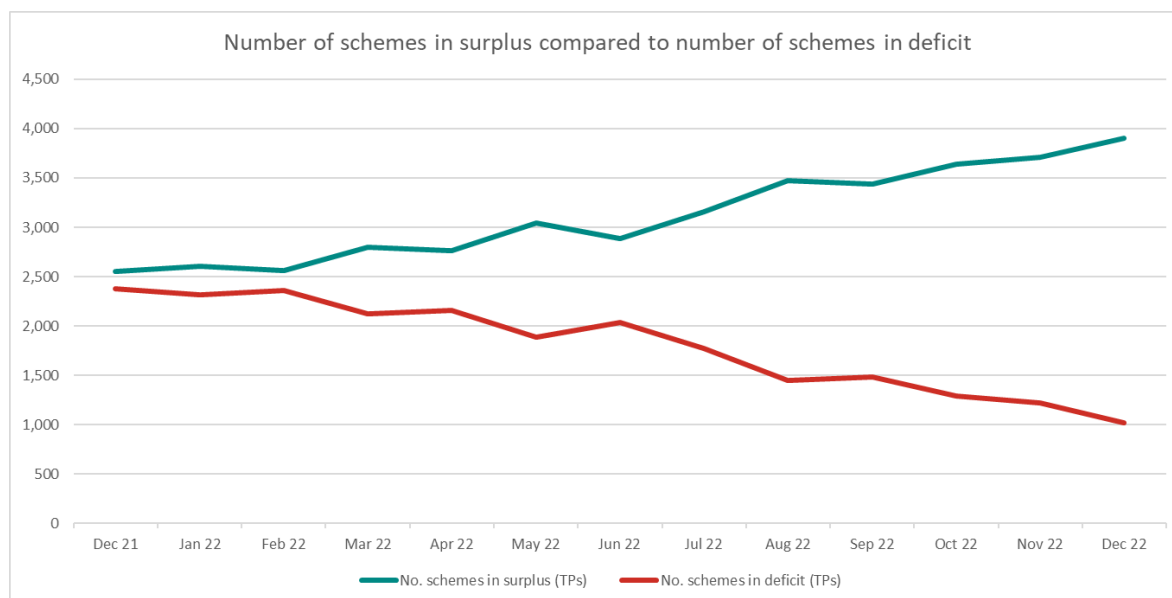
12. At a high level, the results from our modelling show:
 - i. **Scheme funding on a technical provisions basis improved significantly over 2022**, with an overall increase in the aggregate funding level from 103% as at 31 December 2021 to **118%** as at 31 December 2022, an improvement of funding levels by **c.15%**.
 - ii. **This has led to a material change in the number of schemes estimated to be in surplus on a technical provisions basis**, from an estimated 52% of the universe (by number of schemes) as at 31 December 2021 to an estimated **79%** of the universe as at 31 December 2022.
 - iii. **The primary reason for the improvement in funding levels is due to the fall in the value of liabilities exceeding that of the value of assets.**
 - iv. We estimate **liabilities** fell by **c. £575 Bn**, from an estimated value of £1,734 Bn to £1,161 Bn over 2022, a fall of **33%**. The fall in the value of liabilities is primarily due to the increase in gilt yields, which itself is a function of the material fall in the value of gilts over 2022.
 - v. We estimate that the value of the **assets** fell by of **c.£425 Bn** over 2022, equivalent to a 24% fall in the overall value of scheme assets. This fall in assets is primarily due to the loss in value of gilts, corporate bonds and property.
 - vi. The above figures imply that the overall hedging ratio of the scheme universe was less than 100% of the value of the liabilities, given that liabilities fell by more than the value of assets.
13. There has also been **an improvement in funding levels on both a buyout and low dependency basis**, with the percentage improvement in funding on these levels even greater due to the higher starting liability values and the greater impact that higher gilt yields has on reducing those liabilities. On a buyout basis c.40% of schemes were estimated to be fully funded as at the end of December 2022 compared to less than 10% at 31 December 2021. Further details regarding the alternative funding measures are set out in the section: *Scheme Funding over the period 31 December 2021 to 31 December 2022*.
14. The results from our modelling illustrate the overall position for the DB scheme universe in aggregate. The positions for individual schemes will differ from this overall position and will depend on factors including the level of hedging and LDI-style assets held at an individual level.

15. The LDI episode following the September 2022 mini-budget was a short-term phenomenon observed within the wider economic landscape of increasing gilt yields and increased global interest rates seen throughout 2022. **As such, even without the LDI episode, our expectations are that much of the improvement of funding seen across the DB universe would likely have occurred over the timeframe covered in this analysis in any event.** In other words, the outcome for gilt yields by the end of 2022 (and thereafter) it is supposed would have been broadly the same, irrespective of the LDI episode.

Individual schemes performance over 2022

16. **Whilst the overall scheme funding universe improved in aggregate, the position will be scheme dependent, primarily based on a combination of the asset strategy adopted, including the level of hedging (and leverage) undertaken combined with the initial funding level.**
17. For the majority of schemes, there was an improvement in funding and in particular a significant number of schemes were estimated to be in surplus on a technical provisions basis by the end of 2022. The movement in the number of schemes moving from deficit to surplus over the year can be seen in the following chart and table.

Chart 2 – Number of schemes in surplus/deficit on technical provisions over 2022



Source: TPR

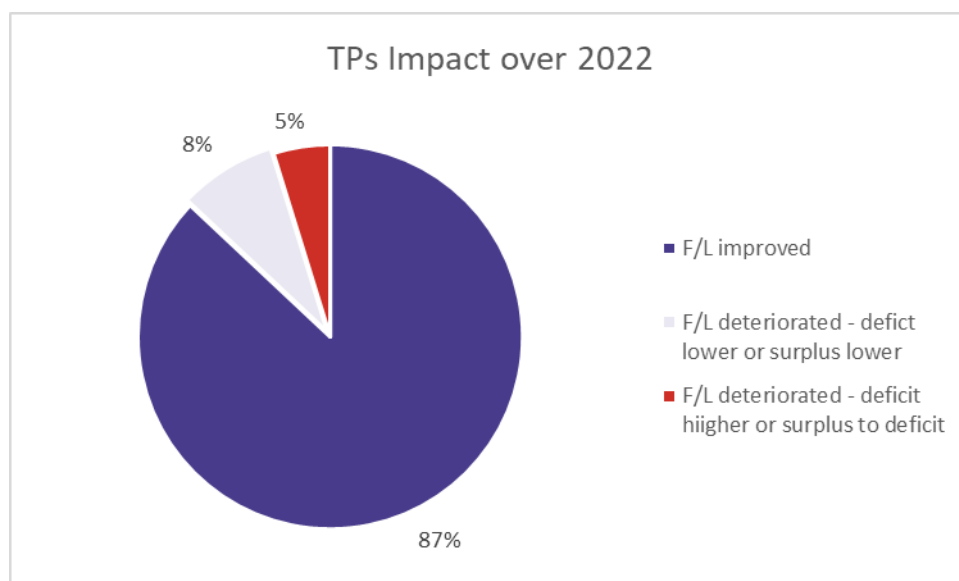
Table 2 – Percentage of schemes in surplus over 2022

Date	31 Dec 21	31 Mar 22	30 Jun 22	30 Sep 22	31 Dec 22
% of schemes in surplus – Technical provisions basis	52%	57%	59%	70%	79%
% of schemes in surplus – Buyout basis	8%	8%	15%	25%	41%
% of schemes in surplus – Low dependency basis	23%	21%	33%	46%	65%

Source: TPR

18. There were however some schemes for which our modelling shows funding deteriorated over 2022 as can be seen in the following chart:

Chart 3 – Movement in funding level (“F/L”) over 2022 on a technical provisions basis



Source: TPR

19. The **vast majority (87%) of schemes are modelled to have experienced improved funding levels over 2022**, with only 13% showing a funding level deterioration on a technical provisions basis. Of those that showed a funding level deterioration, nearly two thirds were either still in surplus at the end of 2022 or had a fall in the size of their deficit over 2022. Therefore, **only 5% of the DB scheme universe had both a deterioration in their funding level and either an increase in their existing deficit or a movement from surplus to deficit over 2022.**
20. We have broken down funding level impacts further in the scheme funding results section, including splitting the figures between those schemes that started the year in surplus and those in deficit and the impact on the surplus and deficit over the year.
21. Reviewing the characteristics (which contributed to the funding level movement) of the schemes that saw funding level deteriorations and ended the year with higher deficits, or a movement from surplus to deficit, we note:
- (i) From the data provided, their implied hedging level was in excess of 100% of the scheme assets (obtained by implementing a leveraged hedging strategy), as the value of the assets fell by more than the value of the liabilities; and/or
 - (ii) For certain schemes which have used leveraged LDI, we have assumed that they have sold equities and then, if there are insufficient equity holdings, sold gilt holdings in order to meet collateral calls. The subsequent market movements, and in some cases the loss of hedging levels, were then detrimental over the remainder of 2022.
22. The results presented here are based on the modelling undertaken by TPR and the assumptions that underlie those models. In particular, these include assets achieving index returns, estimated levels of leverage in the LDI portfolio and estimates on collateral calls. As such it should be noted that whilst we do not expect a pronounced systemic bias in the model, results may be inaccurate at a scheme specific level where the actual experience may differ materially from the assumptions used for these modelling purposes.
23. Furthermore, there are some situations that will have occurred for individual schemes, for which we do not have the data required to model the impact. This includes circumstances such as any discounted selling of assets to meet collateral calls or where schemes lost and

reapplied hedges (potentially at inopportune, or even at opportune times). Later in this report we have provided worked examples which set out additional details regarding these specific situations and furthermore explain why we do not believe it reasonable to undertake any further investigation on these specific issues.

24. Our modelling confirms that those schemes which were “on-risk”, i.e. **those with higher levels of growth assets and lower levels of hedging, observed the greatest improvements over 2022**. This is because these schemes have benefited from the significant fall in the value of liabilities linked to higher gilt yields whilst their asset values remained resilient.

Conclusions

25. The situation in late September 2022 and early October 2022 brought into sharp focus the size and scale of DB pension schemes’ overall investments in leveraged LDI. However, overall the movement in gilt yields over 2022 led to a significant improvement in DB universe scheme funding over the year.
26. It is not possible to generalise as to the impact of LDI upon scheme funding as each hedging strategy will be dependent on the risk the trustees are mitigating against. The purpose of LDI (including leveraged LDI) is to reduce the risk of assets moving differently to liabilities, rather than to achieve certain investment returns. For example, a scheme that was 100% funded, with 100% of its assets hedged against technical provisions would be implementing a hedging strategy such that it removes the risk of its technical provisions funding level changing based on changes in financial markets. Such a scheme would have seen its technical provisions funding level remain unchanged over 2022 (ignoring any changes in actuarial assumptions/methodology). The impact over 2022 will therefore depend in part on the purpose of the LDI strategy in the first place and the situation for individual schemes will vary.
27. The analysis presented is based on the most complete data set available in respect of the DB universe, however it should be recognised that there are data limitations, caused by a combination of legal and practical limitations. That said, we are not complacent, and we continue to enhance the data that we collect and build working relationships with other bodies to understand how and where we can share data. We expect to obtain more information on leveraged investments in future annual DB scheme returns and improved information for scheme liabilities through proposed changes in scheme funding regulations. This will enable us to improve our ongoing monitoring and evaluation of scheme funding.
28. The true impact of the events of 2022 for the whole universe will not be known in full for several years, as each scheme goes through their tri-annual valuation process establishing the ultimate impact on their own scheme funding position. The first schemes required to undertake a valuation post September 2022 are due to complete this work shortly, i.e. primarily those schemes with a valuation date of 31 December 2022. TPR will start to receive valuations for those schemes required to submit a recovery plan to us. From a regulatory perspective, we will continue to engage with trustees on a scheme-by-scheme basis, for whom the valuation poses the greatest risk to savers. We will continue to reflect the updated data we receive from schemes throughout this time, be it through scheme returns, valuation submissions or through third party sources.

Scope

29. The WPC published its report into LDI on 23 June 2023; [Defined benefit pensions with Liability Driven Investments \(parliament.uk\)](https://www.parliament.uk/publications/54447/1/defined-benefit-pensions-with-liability-driven-investments). The WPC recommend at paragraph 65 of the report:
“DWP should work with TPR and the PPF to produce, by the end of 2023, a detailed account of the impact on pension schemes of the LDI episode. This should:
 (i) *look at the impact on funding levels, detailing how the value of their assets and liabilities changed, showing the results disaggregated by whether the fund used LDI and, if so, whether in a pooled, segregated or bespoke arrangement; and*
 (ii) *include analysis of the factors which contributed to scheme funding improving or deteriorating, including the role played by LDI strategies.”*
30. The purpose of this report is therefore, where possible, to provide the necessary analysis in respect of the WPSC request. To this end, this report will:
 - (i) Undertake our best endeavours to estimate the changes in scheme assets, liabilities, and funding levels over 2022 and accompanying analysis, based on the data we hold and the models that we have developed; and
 - (ii) Provide worked examples of the types of situations that schemes with LDI strategies could have experienced.
31. This report is a separate version of the internal TPR report that has been prepared on the basis that it will be shared externally, in particular, that a copy of this report will be provided to the Work and Pensions Committee.
32. Whilst TPR has undertaken the modelling and analysis, the PPF has reviewed this report and have no material comments regarding the content.
33. The report will show at a high level, our estimate of the change in scheme funding positions over the period, and the number of schemes modelled as having improved funding positions compared to worsening funding positions.
34. TPR is required to collect data, including data that are as set out in legislation plus further data that TPR considers is necessary for the purposes of our functions. In respect of DB funding and investments, the data is provided either annually as part of the annual scheme return or tri-annually as part of the valuation process. This data is determined with reference to specific snapshots in time and is high level in nature. This data enables TPR to undertake a desk-top review of a scheme's funding and investment strategies and enables TPR to model estimated changes in funding levels over time.
35. Where, having undertaken our high-level risk assessments, TPR has concerns with the risk in respect of either the funding or investment strategies, then TPR will engage with the trustees to understand the decision-making process undertaken as to how they arrived at those positions. This approach has been designed to be cost-effective and with a limited burden to trustees (and employers). Alternative approaches may entail either significantly more detailed and/or possibly more frequent data from all schemes. There is clearly a balance as to these competing demands.
36. Due to restrictions in the data that we collect, we are unable to provide the analysis and results disaggregated at the level requested in respect of pooled leveraged LDI, segregated or bespoke LDI arrangements.
37. From the data we have available we have made evaluations as to whether a scheme has leveraged arrangements in place. From this we can make assumptions regarding the amount of hedging, leverage and collateral required and we can model estimated impacts based on these assumptions.
38. There are also many situations that we cannot model from the data we have available, and hence we will not be able to provide full details of scheme specific impacts (and nor can the PPF or any other body) on all the issues faced over the period. This includes information regarding how matters such as collateral calls were undertaken on an individual scheme

basis during that period and/or regarding which schemes reduced hedges during volatile markets. Indeed, it is important to note that such data is not even apparent from individual scheme's accounts, rather it would require each scheme to procure a bespoke report from their advisors which would need to include details of all the transactions and hedging positions over the period.

39. Given the above, we do not think it will ever be practical to obtain the level of data required to be able to do the full historic assessment requested. The analysis would be overly complex in nature, and it would consume a disproportionate level of resource both from within TPR but also from our regulated community in providing us the necessary information and follow-up queries that would result from ensuring the correct interpretation of thousands of data items.
40. It is also important to note that moving forward we are collecting significantly more data granularity in this area in our annual scheme return, and we would, in the future, be in a better position to address the committee's request should a similar episode occur. However, even with the additional data we expect to collect in future, we must add a word of caution: it is unlikely we would be able to isolate losses from the general movements in interest rates and other financial markets, due to the annual nature of the data returns we receive.
41. The report has been prepared by Jack Shearing (Lead Actuary) and Fiona Etheridge (Lead Actuary) and has been subject to independent peer review by Sarah Tune (Head Actuary) and Fred Berry (Lead Investment Consultant).
42. The work is subject to and complies with Technical Actuarial Standard (TAS) 100 as published by the Financial Reporting Council (FRC) and effective from 1 July 2023.

Data

TPR Scheme Data Sources

44. To enable TPR to monitor DB scheme funding, we receive scheme funding and asset information from two key sources on an annual and tri-annual basis respectively:
 - Annual scheme returns; and
 - Recovery plan submissions.
45. TPR is the only organisation provided with the asset and liability values for all occupational DB schemes, which we share with the PPF. Estimates from other commentators, or the ONS, is based on only partial data, extrapolating to the whole universe from schemes which shared data with them.

Annual Scheme Return Data

46. From the annual DB scheme return, we receive the following data that we use for our scheme modelling purposes:
 - Market value of assets (based on the date of last effective valuation).*
 - Technical provisions (based on the date of the last effective valuation).*
 - Buyout liabilities (based on the date of the last effective valuation).*
 - S.179 (PPF) liabilities (based on the date of the last effective s.179 valuation).
 - Summary of the financial assumptions used to calculate the technical provisions for those schemes in surplus on the date of the last effective valuation.
 - Summary of mortality assumptions used to calculate the technical provisions on the date of last effective valuation.*
 - Summary of the asset allocation (based on scheme's most recently audited accounts).
 - Summary of Asset Backed Contributions (ABCs).
 - Liability and asset hedging information using PV01 and IE01 (voluntary).

** For those schemes in deficit on a technical provisions basis at the date of last effective valuation this is the same information as provided through the recovery plan submission.*

Recovery Plan submissions

47. Schemes which were in deficit on a technical provisions' basis at the date of the last effective valuation need to provide the following data at the date of that valuation:
 - Market value of assets.
 - Technical Provisions.
 - Buyout liabilities.
 - S.179 (PPF) liabilities.
 - Summary of the financial assumptions used to calculate the technical provisions.
 - Summary of mortality assumptions used to calculate the technical provisions.
 - Annual Deficit Repair Contributions (DRCs) over 20 years from the effective date of the valuation.

Data used in this modelling and its limitations

48. To produce the results included in this report we have used the scheme funding data for the DB scheme universe on our systems as at 30 September 2023. This data is based on the information provided to us from the 2023 annual scheme return and recovery plan

submissions received up to that date. This is equivalent to a total DB scheme universe of 4,927 schemes.

49. For the purposes of this report, we have assumed a consistent scheme population across 2022 based on this data. In other words, the results included in this report are based on our analysis of those 4,927 schemes only over the calendar year 2022.
50. We have also used market indices data obtained from London Stock Exchange Group (LSEG) and yield curve and market implied inflation information from the Bank of England (BoE) in order make assumptions and to estimate assets and liabilities at consistent dates.
51. The raw data and model outputs have been subject to actuarial data checks which look to highlight key outliers and adjust as necessary.
52. Furthermore, it is important to note that:
 - (i) The data is historical. Schemes have up to 15 months to complete a valuation and need to only undertake a valuation every 3 years. As such, the valuation data held is generally between 1 year and 4 years out of date. This is shown in the following table:

Valuation Date	No. of schemes	Assets at 31 Dec 2022 (£bn)	Liabs at 31 Dec 2022 (£bn)
Before 6 April 2018	58	16	17
Between 6 Apr 2018 and 5 Apr 2019	59	17	16
Between 6 Apr 2019 and 5 Apr 2020	1,306	354	301
Between 6 Apr 2020 and 5 Apr 2021	1,633	562	467
Between 6 Apr 2021 and 5 Apr 2022	1,540	353	306
After 6 Apr 2022	331	62	54
Total	4,927	1,365	1,161

- (ii) Similarly, the asset breakdown is based on the last audited accounts over the scheme return year. Schemes have up to 7 months from the year end to complete their audited accounts. As such, the asset breakdown is generally around 2 years out of date. This is shown in the following table:

Effective date of asset split	No. of schemes	Assets at 31 Dec 2022 (£bn)
Before 6 Apr 2021	72	5
Between 6 Apr 2021 and 5 Apr 2022	3,901	1,161
After 6 Apr 2022	954	199
Total	4,927	1,365

- (iii) The data is a high-level summary of the results of the valuation i.e. we do not have individual member data that schemes have access to.
 - (iv) We only have a high-level summary of scheme benefit structure i.e. we do not have access to the Trust deed and rules that determine the actual scheme benefits.
 - (v) Although we are provided with URLs for Statement of Investment Principles for schemes where there are over 100 members, which may include some of the WPC requested information, on a universe level we do not collect details of the investment funds that schemes' assets are invested with, nor currently do we have details of schemes' collateral waterfalls i.e. which assets are intended to be used for LDI or collateral purposes.
 - (vi) In the Scheme Return we ask for data breakdown at a high level for asset classes. A review of the asset information was conducted in conjunction with the PPF in 2021 and following a review of that consultation, the DB scheme return was updated in 2023.
 - (vii) A summary of the asset allocation recorded in the 2023 scheme return is shown in Appendix 4, alongside the indices we use when adjusting asset values to different dates.

- (viii) We estimate the level of leverage that schemes have based on the breakdown of the scheme assets and/or the PV01 data and estimate how this may have changed over time.
 - (ix) Likewise, we do not hold data on which assets trustees choose to sell to meet any cashflow needs or collateral calls, or which assets they choose to invest in if they have funds to invest.
53. We are content that the data used in the modelling is appropriate to provide results regarding the potential universe impacts in aggregate over 2022 and updated funding positions into 2023. However, as the data has not been verified on a scheme-by-scheme level, the model should not be used to draw conclusions for individual schemes.
54. Furthermore, as the purpose of this report is to provide the results of our modelling to an external body i.e. the WPC, it is not possible to provide information at a scheme-specific level. If further requests are sought on a scheme-specific basis, then legal advice will need to be sought regarding the extent that such requests can be accommodated.

Upcoming improvements to the data we collect

55. Following the recommendations of previous select committee hearings, we are now working with other regulators, in particular the FCA, BoE, Central Bank of Ireland and the Commission de Surveillance du Secteur Financier in Luxembourg in the monitoring of fund managers who provide LDI style investments.
56. We are now in receipt of weekly summaries from the five UK fund managers, that between them hold almost 90% of the DB market in leveraged pension investment assets.
57. The data summaries that we receive from the fund managers include, amongst other information, for each separate fund:
- (i) The nature of the fund; multi-client pooled, single client or segregated;
 - (ii) The Net Asset Value (NAV) of underlying assets;
 - (iii) The nature of the assets held i.e. fixed interest gilt, index-linked gilts interest rate swap, inflation swap, real swap or mixed.
 - (iv) The amount of leverage;
 - (v) The maturity of the fund (based on duration); and
 - (vi) The size of the buffer i.e. the level at which a rise in gilt yields can be met by the buffer.
58. We are currently in the process of developing a dashboard with the above information which will enable us to monitor the LDI market on an ongoing basis. We are working with the FCA in liaising with the relevant fund managers in order to resolve some final inconsistencies with the data that we receive.
59. We are also seeking to add additional questions regarding LDI strategies into our annual DB scheme return starting from 2024. These questions will seek to understand the level of leverage used by schemes, the degree and deliverability of liquidity in the overall asset portfolio, and the trustee governance around collateral transactions.
60. We will be able to use this data to better understand individual scheme situations, their ability to deal with any future gilt market volatility and we will also look to build this into our future modelling where possible.
61. Furthermore, the proposed introduction of the funding and investment (FIS) regulations in 2024, will provide changes in legislation regarding the amount of data and information that trustees are required to provide to TPR regarding the output and results from the latest effective valuation. This will be provided irrespective if a scheme is in deficit or surplus.
62. This will involve greater granularity of the assumptions adopted for the valuation as well as the provision of future estimated cashflows. We anticipate that this greater granularity of data will enable us to refine and enhance our actuarial models and improve the accuracy of our scheme funding estimates.

Modelling Methodology

63. Based on the high-level data, as set out above, we have adjusted the assets and the liabilities from the last effective valuation date for each scheme, to a consistent date across all schemes. This provides an illustration of the potential overall funding position of the DB scheme universe at a particular date.
64. Given the high level and limited data that we hold, our calculations use broad assumptions and approximations combined with general actuarial methods and techniques. We cannot take account of all scheme-specific characteristics and the actual position of individual schemes will vary, depending on a number of individual factors not covered in our data or methodology.
65. The key assumptions underlying our model include:
 - Trustees do not make any changes to the funding methodology/approach due to changing market conditions (or any other reason), when adjusting liabilities;
 - Trustees do not take any management action in regards of buying/selling assets or changes to the investment strategy over time;
 - Discount rates are set with reference to a premium above gilt yields;
 - Liabilities are adjusted in line with changes in gilt yields, market implied inflation and longevity expectations over time; and
 - Assets are adjusted in line with market indices, plus deficit repair contributions.
66. There are many more simplifications and approximations in the methods we use to estimate aggregate and individual funding positions, compared with the more robust calculations carried out for formal valuation and recovery plan reporting by scheme actuaries and trustees. Additionally, the greater the magnitude of change in market conditions, the less reliable the simplified method and data will be in illustrating the impact. It should be noted that this is not a TPR-specific issue, but a global actuarial issue when using the approximate 'roll-forward' methodology to estimating assets and liabilities at alternative dates.
67. That said, we believe the data and method we have adopted is appropriate to be able to satisfy the scope of the work as laid out in Section 6 of the Executive Summary. Similarly, in Section 6 we are clear that there are limitations around the data we can readily obtain and certain analysis that cannot be undertaken as a result.
68. Furthermore, it should be noted that results are always approximate in nature and whilst we do not expect a pronounced systemic bias in the model, results may be materially inaccurate at an individual scheme level where experience differs to those of our key assumptions. This could be because of any of the following:
 - Trustees adopting different funding methodologies (relative to our simplified assumptions);
 - Trustees taking positive management action to change investment strategies, which are not reflected in our current data set due to time lag issues; and/or
 - Actual asset returns are materially different to index returns or scheme experience materially differs from that assumed.
69. Further details on the assumptions used are provided in Appendix 4 of this report.
70. Further information regarding the methodology of our modelling for the different funding bases and asset values are set out as follows.

Technical Provisions

71. We estimate these liabilities to a common date by taking the technical provisions results reported to us following a scheme's last valuation and adjusting them in line with changes to BoE gilt rates and market implied inflation changes.
72. Further adjustments to the liabilities are applied by considering how discount rates may have changed as a result of changes in expected returns on return-seeking assets since the previous scheme valuation, for which we have based it on a variety of industry views. For the purposes of this analysis, we have assumed that as at 31 December 2022 the discount

rate premium above gilts would be lower than as at 31 December 2021, and this can be seen in the results “analysis of surplus” in paragraph 112.

73. We also make broad adjustments for changes in longevity expectations, by adjusting scheme liabilities in line with changes to the core CMI model over the period since a scheme's last valuation.
74. We acknowledge and are aware that some schemes use other methods to derive their discount rate, such as by reference to inflation, but we have not allowed for this in our analysis. The extent to which our estimates will differ to these schemes will depend on the relative sensitivity to how discount rates change in line with market conditions to the approach we have adopted (as above). If the alternative method were to result in higher discount rates (following changes in market conditions) for the calculation of technical provisions than we have assumed, then the estimated liabilities and deficits are likely to be lower than those modelled in this analysis, and vice versa.

Buy-out:

75. We estimate buy-out liabilities by taking the buyout results reported to us following a schemes last valuation and adjusting them in line with changes to Bank of England gilt rates, market implied inflation changes and our estimate of changes in buyout pricing relative to gilt yields.
76. We make broad adjustments for changes in longevity expectations, by adjusting scheme liabilities in line with changes to the core CMI model over the period since a schemes last valuation.
77. Finally, we retain an expense allowance, using the same percentage in line with the buyout results reported to us.
78. Our buy-out estimates are approximate and the true cost of buying out a scheme is only known by approaching the market and obtaining quotes from insurers.

Low Dependency:

79. For the purposes of this report, we have assumed a low dependency basis with a discount rate of gilts plus 50 basis points (0.5%p.a.) for every scheme.
80. We acknowledge that there are a range of low dependency bases that can be appropriate, and these are likely to vary by scheme. The basis outlined below is an example basis for the purpose of this report.
81. We estimate the low dependency liabilities for each scheme by taking the Technical Provisions results and assumptions reported to us following a schemes last valuation, and then adjust them to a basis that assumes a discount rate broadly equivalent to the gilt curve plus 0.5% pa, with a Retail Price Index (RPI) inflation assumption equal to the 20-year market implied inflation spot rate with no adjustment for an inflation risk premium. For Consumer Price Index (CPI) inflation we make a 0.4% pa deduction to our RPI assumption as a broad approximation of all future pricing differentials for the difference between RPI and CPI.
82. We make broad adjustments for changes in longevity expectations, by adjusting the liabilities in line with changes to the core CMI model over the period since a schemes last valuation. In addition, if a scheme has a mortality assumption which shows their assumed life expectancies are within the bottom quartile, we uprate the liabilities to allow for a stronger mortality assumption equal to the 25th percentile life expectancy from our universe data.
83. Finally, we include a broad expense allowance of 2% of liabilities.

Asset values:

84. We adjust the asset value from the latest triennial valuation in line with changes in market indexes, using the asset allocations included in the DB scheme return. This lets us estimate investment returns on a scheme basis. The indexes used are shown in Appendix 4.
85. We add onto the assets any deficit repair contributions expected to be paid over the period (assuming that annual contributions are paid on average halfway through the year).
86. We do not take account of any benefits paid out being deducted from the assets (or from the liabilities) as we do not have the data. Similarly, we do not allow for any benefit accrual or contributions in respect of this. As both these items are subtracted (in the case of benefit payments) or added (in the case of accrual) to both the assets and liabilities equally, the overall net impact on funding levels is expected to be broadly equal at the aggregate level.
87. With the data we hold, the model estimates levels of LDI leverage based on a combination of asset allocations, in particular through, identifying negative cash holdings and using PV01 data. These estimates might differ to the level of hedging and leverage actually being adopted at the scheme level over time.
88. We assume that assets are not rebalanced except for where needed to maintain the leverage ratio implied from the asset splits and PV01 data.
89. Where we have modelled leveraged LDI holdings, we have made assumptions regarding the assets sold to meet collateral calls. In particular, we have assumed that trustees will retain the same level of both leverage and hedging (following movements in gilt yields) and will first sell quoted equities to meet collateral calls. If this is not possible, we assume they sell gilts to meet collateral calls, which will have the impact of reducing the level of hedging (but we have assumed that they maintain the same level of leverage). Purchases are assumed to operate in the same way.
90. Note that on all bases, including that of buy-out, the asset figures exclude the value of buy-in policies if these are excluded from the asset value submitted on a technical provision basis. Similarly, all liability bases exclude the value of buy-in policies where these have been excluded from the asset value. This enables all assets (and liabilities) to be measured on a consistent method with those on a technical provisions basis.

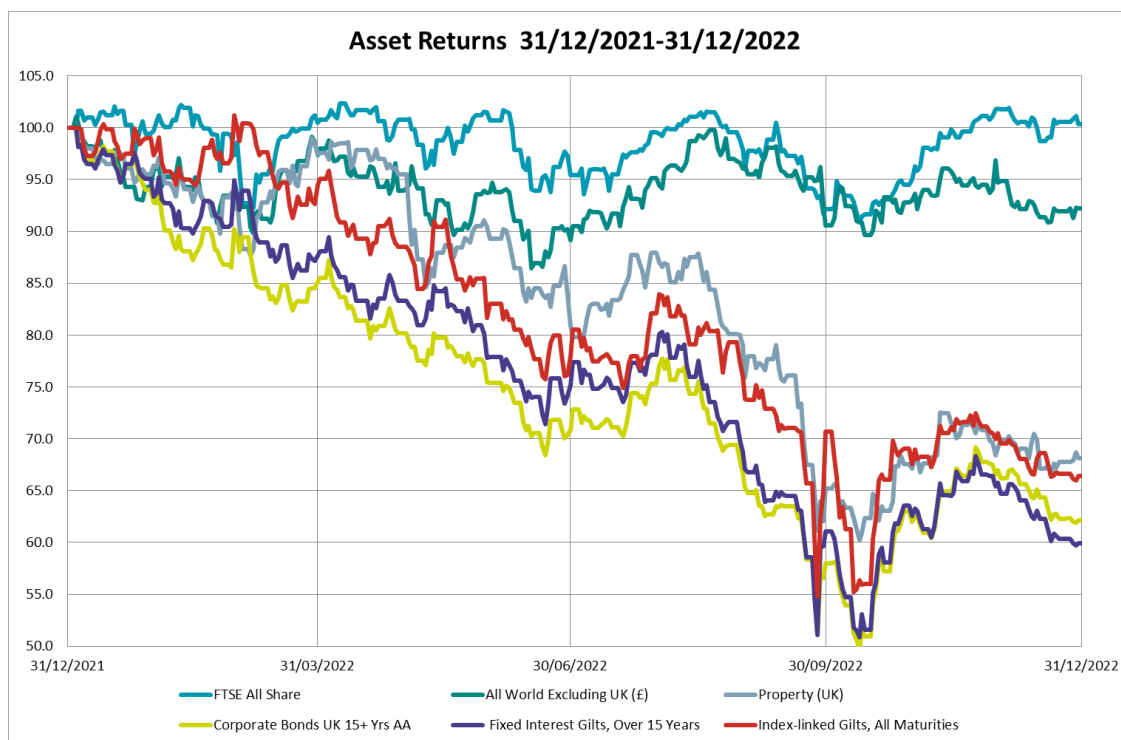
Financial Markets over the period 31 December 2021 to 31 December 2022

Background

91. Whilst movements in financial markets have a direct impact on the value of scheme assets, it is important to note that they also have a direct impact on the value of the liabilities, as liabilities are calculated by reference to market yields. Most importantly any reductions in the value of gilts are typically reflected by reductions in the value placed on liabilities. Furthermore, when considering scheme funding it is important to consider the relative movement between assets and liabilities rather than any absolute movement in assets only.
92. Investment returns over the calendar year 2022 in general were disappointing for all asset classes, with large observed falls in the overall portfolio for the majority of pension schemes.
 - For bonds, there was a consistent decline in values (rise in yields) over the whole of the year, with particular large falls in the value of gilts observed at the end of September 2022 (following the Growth Plan, or “mini-budget”).
 - Whilst bond values fell, the extent of the size of the fall was highly dependent on both the term of the bond as well as the type of bond held: fixed interest, index-linked, investment grade or sub-investment grade. For some bond classes, these were significant with losses of c.40% over the year.
 - Equity returns were also weak over 2022. The FTSE All-share total return index just about provided a positive return, whilst the FTSE World excluding UK (£) index also showed a negative loss, albeit significantly lower than that of bonds.

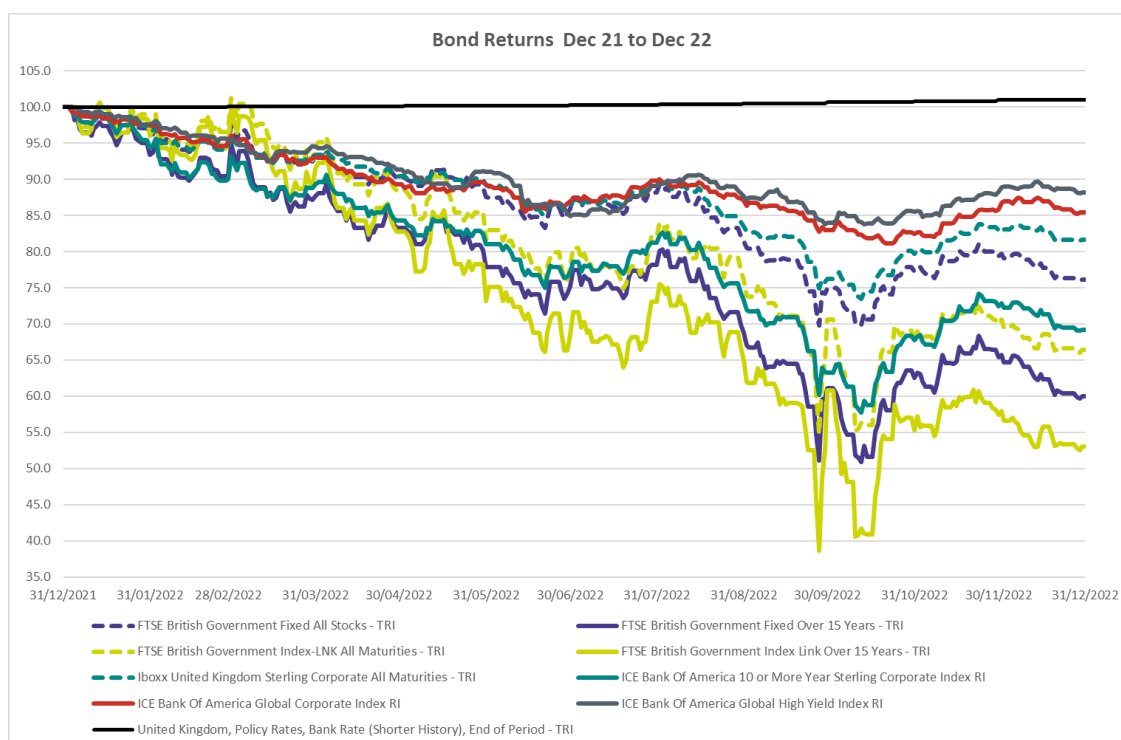
The indices in the followings charts 4 and 5 have been re-based to 100 at 31 December 2021, so the chart shows the relative change up to and from that point.

Chart 4 – Asset returns over 2022



Source: LSEG

Chart 5 – Bond returns over 2022



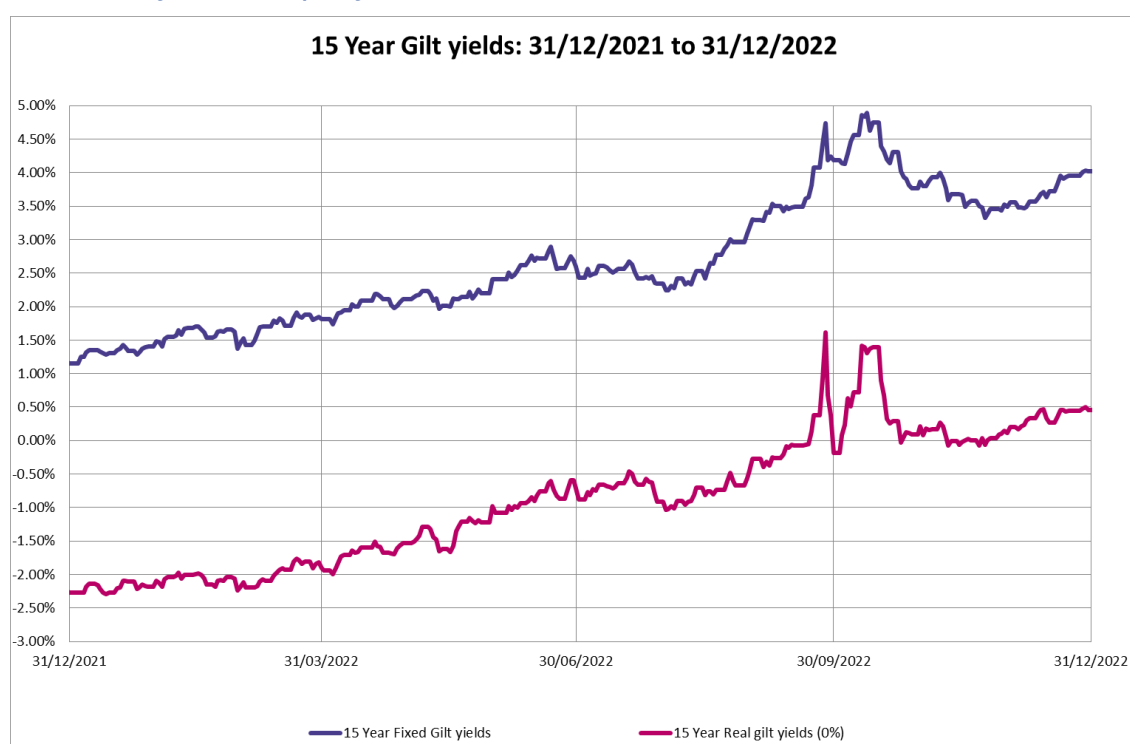
Source: LSEG

93. In summary:
- i. Growth assets (equities and sub-investment grade corporate bonds) significantly outperformed matching assets over 2022, although overall returns were still slightly negative apart from the United Kingdom FTSE All Share.
 - ii. Matching asset values (gilts and investment grade corporate bonds) fell in value by somewhere between 20% to 50%, depending on the term of the gilt/bond.
94. Therefore, schemes with the highest proportion of growth assets and lowest allocations to matching assets would have observed the best investment performance over 2022.

Gilt markets

95. In response to the increase in both base rates and observed inflation over 2022, the yield on both nominal and inflation linked gilts increased significantly over 2022. This can be seen in the following table, which shows this increase in the nominal and index-linked 15-year spot gilt yield over 2022.

Chart 6 – 15-year Gilt spot yields over 2022



Source: Bank of England

96. Associated with the increase in gilt yields, the value of gilts fell significantly over the year. The following table shows how the value of assets fell over the year, with over 50% of the reduction observed over the first 6 months of 2022, with an overall total decrease expected to be in the region of 20% to 50%, depending on the term of the gilts held.

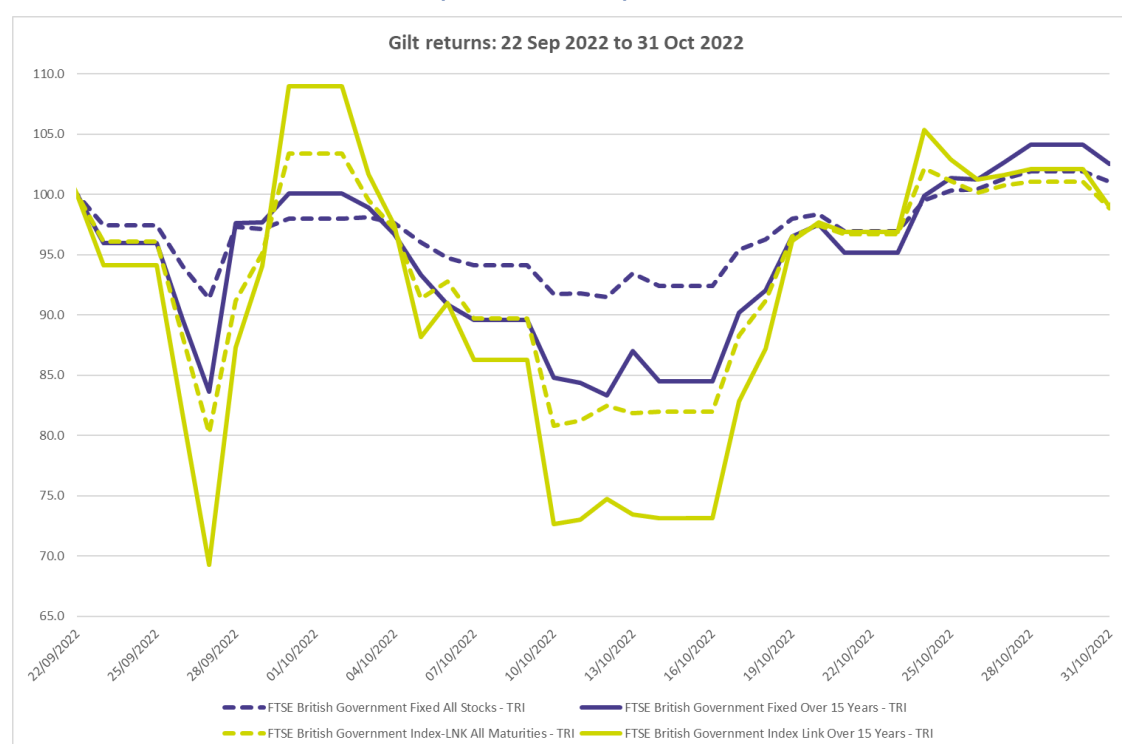
Table 3 – Gilt Return over the period 31/12/2021 to 31/12/2022

Total Return for the period:	Period	Fixed Interest, All Stocks	Fixed Interest, Over 15 Years	Index-linked, All Maturities	Index-linked, Over 15 Years
31/12/2021 to 31/03/2022	3 months	-7%	-12%	-5%	-9%
31/12/2022 to 30/06/2022	6 months	-14%	-25%	-22%	-32%
31/12/2022 to 30/09/2022	9 months	-25%	-39%	-29%	-39%
31/12/2021 to 31/12/2022	12 months	-24%	-40%	-34%	-47%

Source: LSEG

97. However, the above table hides the daily volatility that was observed, especially over the period 23 September 2022 to 31 October 2022, following the mini-budget and the large increase in yields observed over this short period, with the corresponding large falls in gilt values over this period.
98. These can be seen in the following chart which tracks the investment return on gilts of varying durations during this period.

Chart 7 – Gilt returns over the period 22 September 2022 to 31 October 2022



Source: LSEG

99. The change in the value of gilts was very dependent on the term of the gilts. As can be seen from above, the fixed interest, all stocks index was the least volatile, with the largest fall in value over the whole period of around 9%, compared to over 30% for the index-linked over 15 years index.
100. It should also be noted that these are the end of day values, whereby intra-day volatility over this period would have been even higher.
101. This highlights how difficult it is to determine scheme specific experience, which will depend on the exact gilt holdings that would have been used for LDI purposes, the day (and hour) which any gilts trades took place.
102. That said, schemes that invested with pooled funds (generally the smaller sized schemes), are more likely to have similar experiences, given the fund manager would have made sales from pooled funds. Instead, for these schemes, it is the spread of their exposures across different funds which would have differed, causing different levels of experience.

Scheme Funding over the period 31 December 2021 to 31 December 2022

Introduction

103. When looking at the position over 2022 it is important to consider not only the performance of the assets but to also consider how the value of the liabilities has also changed. If the value of the liabilities has fallen by more than the value of the assets, then funding will have improved and vice versa. It is the relative movements of assets and liabilities compared to one another which matters the most. Looking at either in isolation does not give the complete picture.
104. For DB pension schemes, gilts are seen to offer a secure form of providing members benefits and as such, in general most pension schemes value the schemes liabilities by reference to the yield on gilts, plus some premium dependent on their asset strategy. This is not a universal approach, but, in general, this approach is adopted by a significant majority of pension schemes.
105. Such an approach is similar for buy-out pricing, which is often determined by reference to gilts and similar assets which produce known, predictable cashflows. Likewise, low dependency liabilities are also typically calculated by reference to gilts.

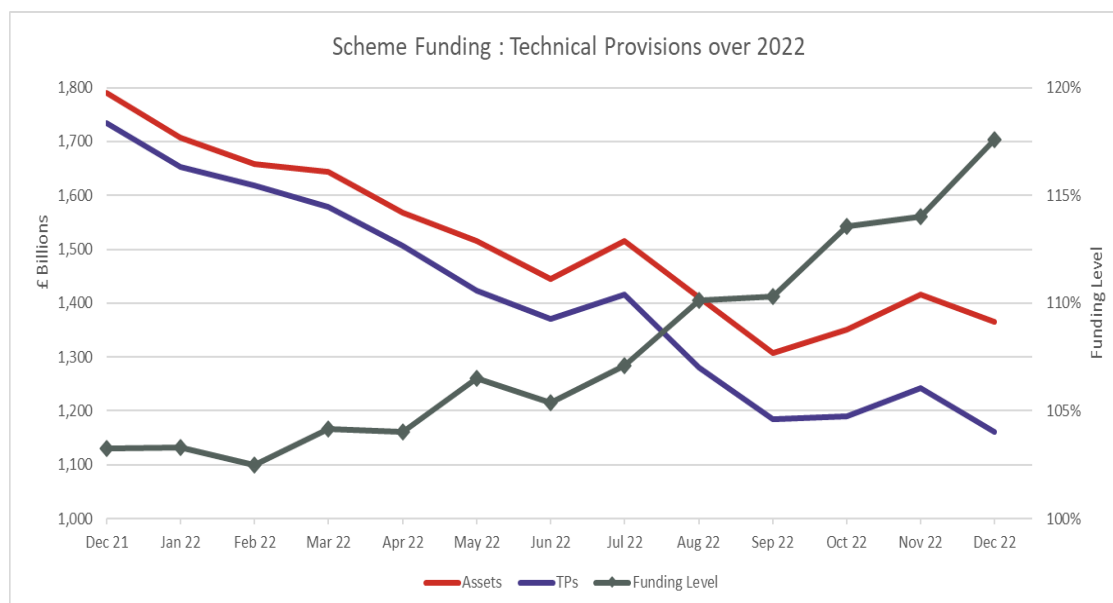
Results – Technical Provisions

Aggregate results

106. As set out in the Scope section, TPR have modelled the DB scheme universe over the period 31 December 2021 to 31 December 2022, to estimate the movement in both the value of the assets and the value of the liabilities. In this section we are referring to funding levels based on the technical provisions assumptions.
107. The results of our modelling, in general, reflect the following factors:
- (i) Rising gilt yields led to a reduction in both assets and liabilities, with the associated impact of a reduction in £ amounts for both surpluses and deficits.
 - (ii) Because most schemes hedged less than 100% of their assets (other things being equal), this has led to an improvement in funding levels (as has been well publicised).
 - (iii) For a small minority of schemes which chose to hedge more than 100% of their assets, their funding levels will have reduced (other things being equal).
- Furthermore, whilst some schemes will have had issues with their hedging strategies over September/October 2022, the outcome is uncertain and the impact could have gone either way, depending on the scheme specific circumstances.
108. Overall scheme funding improved significantly over 2022 with an overall increase in the aggregate funding level from 103% at the beginning of the year, to 118% by the end of 2022. Furthermore, 30% of schemes moved from being in a deficit on their technical provisions basis at the start of 2022 to being in surplus by the end, with only 3% moving the other way. C.80% of schemes were estimated to be in surplus on a technical provisions basis by the end of 2022.
109. This improvement in funding occurred consistently throughout the year, with improvements in scheme funding observed at the end of each quarter compared to the previous quarter-end. Whilst improvements built up over the year, the largest improvement was during the last quarter of 2022.

110. Further details regarding the change in scheme funding, by reference to the month end, are set out in the following chart and table.

Chart 8 –Scheme funding over 2022 – Technical Provisions



Source: TPR

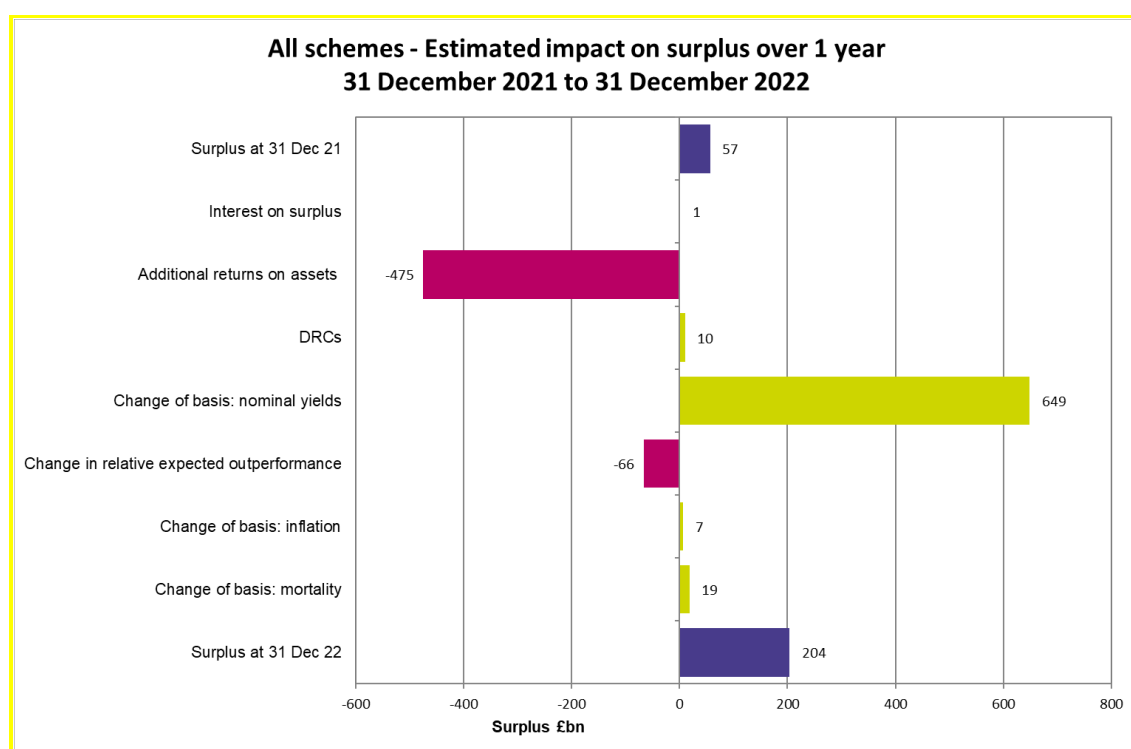
Table 4 –Scheme funding over 2022 - Technical Provisions

Date	31 December 2021	31 March 2022	30 June 2022	30 September 2022	31 December 2022
Assets (£Bns)	1,791	1,644	1,445	1,307	1,365
Liabilities (£Bns)	1,734	1,579	1,372	1,185	1,161
Surplus/(Deficit) (£Bns)	57	65	73	122	204
Funding Level	103%	104%	105%	110%	118%
% of Schemes in Surplus	52%	57%	59%	70%	79%
% of Schemes in Deficit	48%	43%	41%	30%	21%

Source: TPR

111. As can be seen in the above table, the key driver for the improvement in funding positions is the value of the liabilities reducing by a greater amount than the fall in the value of the assets. The estimated universe assets fell over 2022 by £426bn. However, the estimated value of the liabilities fell by £573bn resulting in an aggregate increase in funding surplus of £147bn. Therefore, only looking at the asset movements does not provide a complete picture. Instead, the key issue is the relative movements of the assets and liabilities, rather than looking at absolute figures in isolation.
112. The following chart highlights the key factors for the change in the aggregate surplus over the period for the DB landscape.

Chart 9 – Analysis of Surplus over 2022*

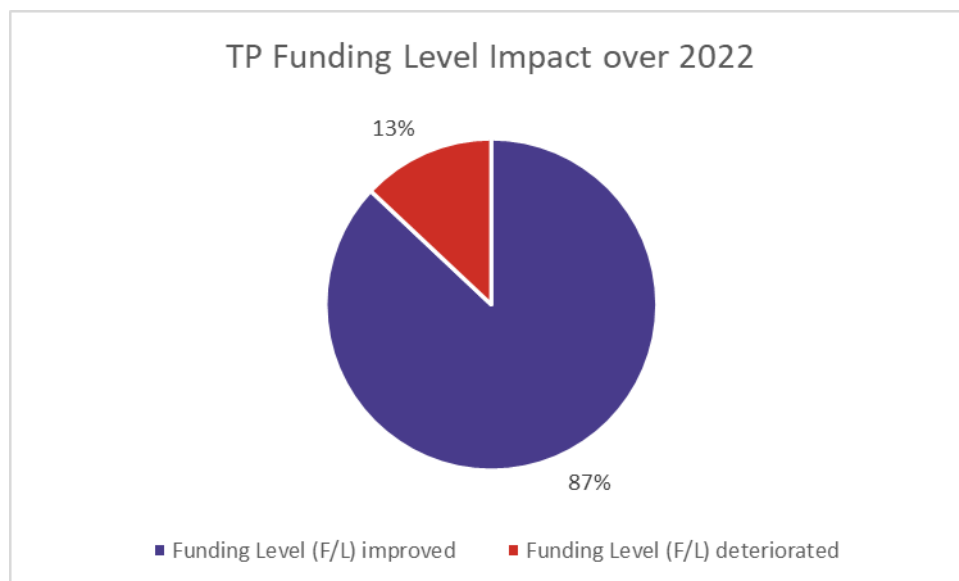


* Figures may not sum due to rounding

113. As shown in the chart, the biggest contributing factor to the movement in surplus was the change in gilt yields reducing the value of liabilities. This improvement to funding was partly offset by the large overall negative asset returns over the year (due primarily through the fall in bond and gilt prices).
114. The other factors in the chart are dwarfed by the change in gilt yields and asset returns. The remaining components, in order of size are:
- Change in discount rate assumption - expected outperformance above gilts (negative).
 - Change in mortality assumption (positive).
 - Deficit Repair Contributions (DRCs) (positive).
 - Change in long term inflation assumptions (positive).
 - Interest on surplus at start of the year (positive).
115. The discount rate assumption used in technical provision calculations are driven by assumptions around gilt yields, the expected return on growth assets and the overall asset proportions that the DB scheme universe is broadly invested in. Based on evidence from external consultancies, our modelling makes allowance for a reduction in the premiums over gilts on return seeking assets at the year-end compared to those at the start of the year. This is partly due to the rise in gilt yields over the year.
116. There are two key aspects that determine the mortality assumptions, current expected mortality rates and future improvements in longevity. The positive impact on scheme funding is related to a fall in expected longevity expectations at the end of the year, compared to the start of the year, with the reduction in liabilities associated with higher assumed mortality. Our modelling makes no further amendments to changes in the underlying current mortality rates.
117. The final three points, whilst all positive, are minor components of the reconciliation of the overall change over the year. These include payments of DRCs into schemes, the change in future expectations of long-term inflation over the year and interest on the initial surplus.

Winners and losers

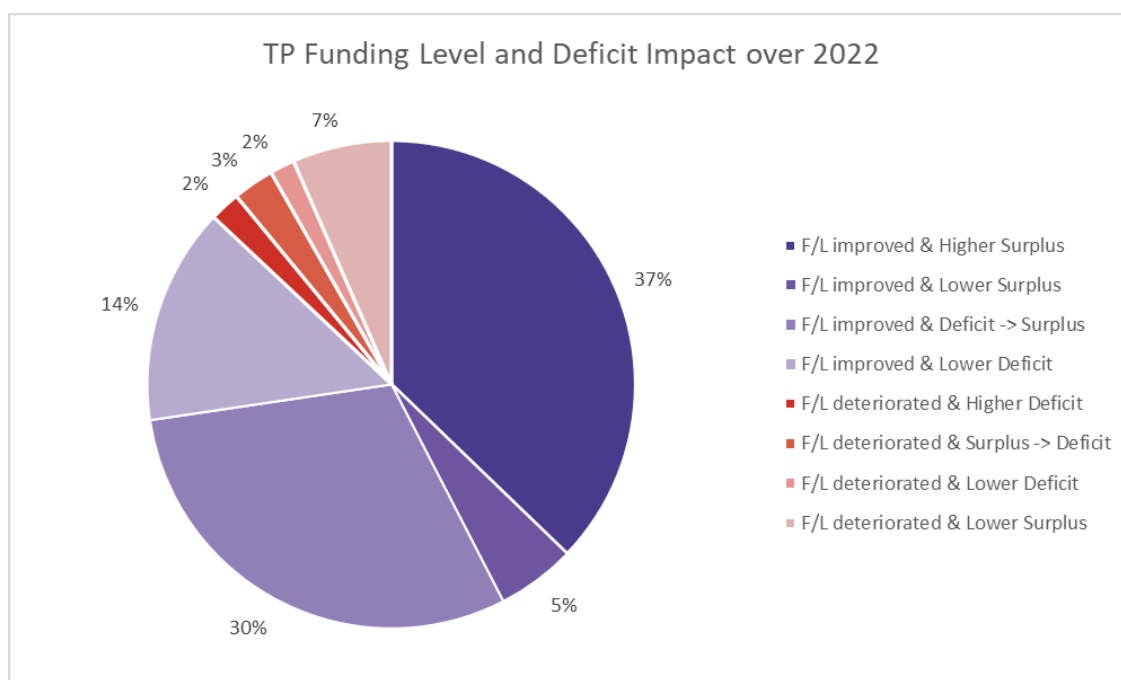
Chart 10 - Number of schemes observing an improvement in scheme funding



Source: TPR

118. The vast majority of schemes are modelled to have experienced improved funding levels over 2022, with only 13% showing a funding level deterioration on a technical provisions basis.
119. However, it should be noted that around half of the schemes that showed a funding level deterioration were in surplus at both the start and end of 2022. These schemes experienced a fall in funding level and reduced surplus at the end of the year, as both their assets and liabilities fell, with, in these cases, the assets falling by more than the liabilities,
120. We have broken down the funding level impacts further, split between those schemes that are in surplus and those in deficit below.

Chart 11 - Further breakdown of impact on scheme funding (technical provisions):



Source: TPR

121. Whilst 13%* of the DB scheme universe saw their funding level decrease, our modelling estimates that only 5% of the DB scheme universe had both a deterioration in their funding level coupled with either an increase in their existing deficit or a movement from surplus to ending the period in deficit. Taking each of the 4 sub-groups of schemes who saw their funding level decrease, we make the following observations:
- * Total from the 4 sub-groups in the chart sums to 14% due to rounding.*
122. The 2% of schemes that showed a deterioration in their funding level but an improvement in their deficit, from the data provided these schemes appeared to have a hedging strategy in place which hedged in excess of 100% of assets. As previously mentioned, the improvement in deficit is a result of the reduction in both assets and liabilities, with the £ reduction in liabilities outweighing the £ reduction in assets.
123. The 7% of schemes that experienced a funding level deterioration and reduced surplus at the end of the year, are modelled as having their assets falling by more than the liabilities (in £ amounts). This in part is due to starting assets being higher than starting liabilities, and, therefore, an equivalent percentage reduction will lead to a higher nominal fall in £ value for the higher starting figure.
124. Regarding the 5% of schemes that saw funding level deteriorations and ended the year with higher deficits, or a movement from surplus to deficit, we note:
- (i) From the data provided, their implied hedging level is in excess of 100% of the scheme assets, obtained by implementing a leveraged hedging strategy; and/or
 - (ii) For certain schemes which have used leverage, we have assumed that they have sold equities and then, if insufficient equity holdings, sold gilt holdings in order to meet collateral calls. The subsequent market movements, and in some cases the loss of hedging levels, were then detrimental over 2022.
- In both of the above scenarios, this has led to the reduction in the value of assets being greater than the reduction in the value of liabilities. For the second scenario it is the timing of the reduction in hedging levels modelled, that has created this impact.
125. The results presented here are based on the modelling undertaken by TPR and the assumptions that underlie those models. The actual experience at an individual scheme level may differ materially from the assumptions used for these modelling purposes. There are some situations that will have occurred for individual schemes which we have not been able to model such as any discounted selling of assets to meet collateral calls or where schemes lost and reapplied hedges (potentially at inopportune, or even opportune times). We have gone into more detail about these situations later in the report.

Distribution of schemes

126. Whilst there are c.5,000 occupational DB pension schemes, the aggregate figures are skewed significantly to the performance of the larger DB schemes. This can be seen in the following chart which tracks the movement in estimated assets over 2022. We have not shown the chart for liabilities, but it shows a very similar pattern.
127. For the purposes of the chart, we have used the estimated size of the schemes' assets as at 31 December 2021 and split the results into those schemes that have assets in excess of £1 billion (6% of schemes), those between £100 million and £1 billion (23% of schemes) and those with assets lower than £100 million (71% of schemes).

Chart 12 - Scheme size distributed by number of schemes

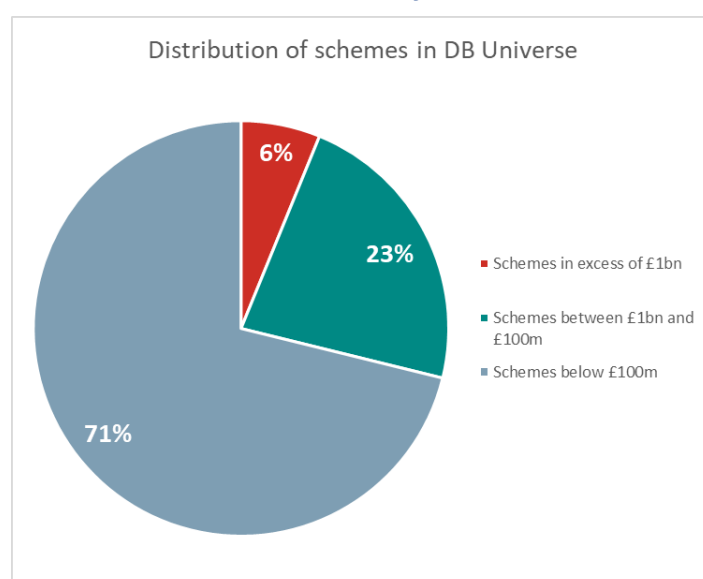
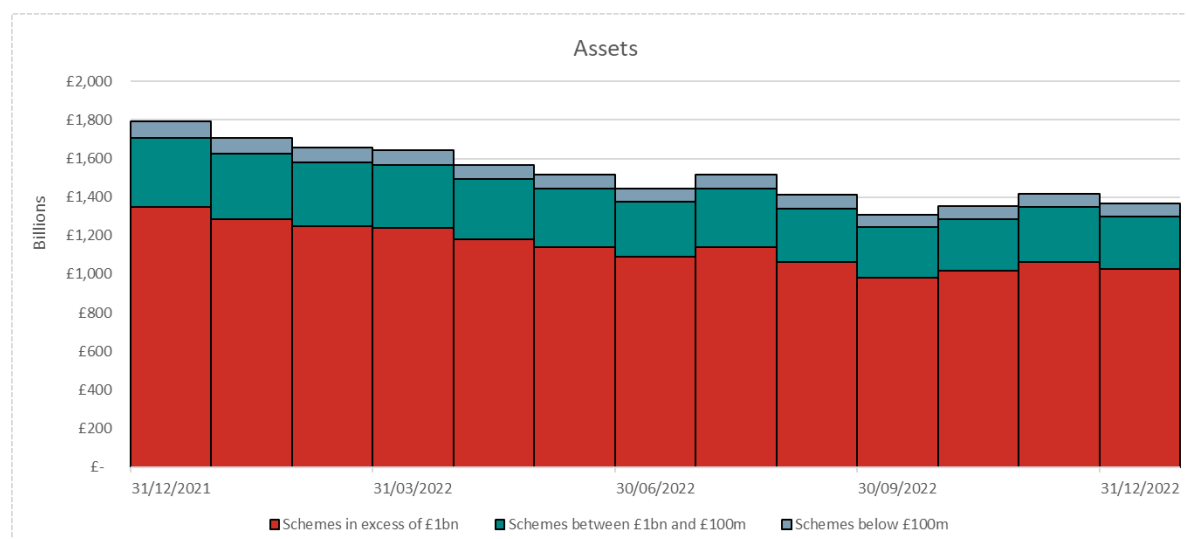


Chart 13 - Assets distributed by scheme size



Source: TPR

128. As the chart illustrates, our universe results are heavily skewed by the assets and liabilities of those schemes in excess of £1bn, which account for just 6% of schemes by number but c.75% of aggregate universe assets. Similarly, the 71% of schemes with estimated assets at 31 December 2021 of less than £100m account for less than 5% of the aggregate universe assets.
129. Whilst the overall change in funding over the year was broadly consistent irrespective of scheme size, we saw a marginal larger percentage reduction in asset values for the larger schemes than for the small schemes, suggesting that the larger schemes had higher levels of hedging in line with our data.

Results – Buyout and Low Dependency

130. We have also undertaken analysis of the funding positions on both a buyout basis and low dependency basis to provide an illustration of how scheme funding positions have changed on other metrics. This helps illustrate the broader market picture of the DB universe over the year and also the sensitivities of the results to the basis being modelled.

Aggregate results

131. The table and chart below show the estimated movement of DB universe funding on a buyout basis over 2022.

Table 5 – Buyout funding – Movement over 2022

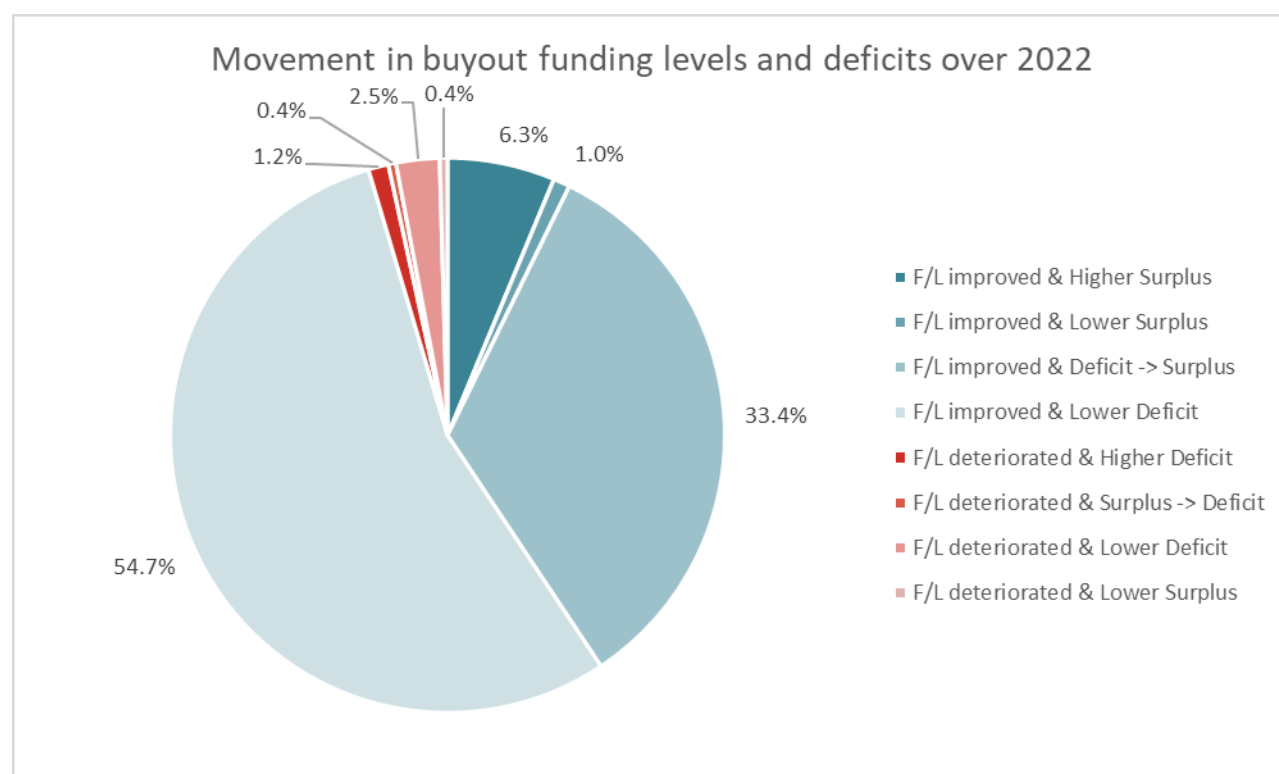
	31 December 2021	31 March 2022	30 June 2022	30 September 2022	31 December 2022
Assets (£Bns)	1,791	1,644	1,445	1,307	1,365
Liabilities (£Bns)	2,294	2,108	1,709	1,461	1,375
Surplus/(Deficit) (£Bns)*	(503)	(464)	(263)	(153)	(10)
Funding Level	78%	78%	85%	90%	99%

Source: TPR

**may not sum up due to rounding*

132. Buyout funding levels improved significantly over 2022 with an overall increase in the aggregate funding level from 78% at the beginning of the year, to 99% by the end of 2022. Scheme liabilities on a buyout basis were estimated to have fallen more than the scheme assets. Liabilities reduced by c. 40% over the year, driven by the increase in gilt yields and slightly improved estimated pricing terms.

Chart 14 - Further breakdown of impact on buyout funding (buyout):



133. Less than 5% of schemes are estimated to have worsened funding levels on a buyout basis, with less than 2% of schemes estimated to have higher buyout deficits or lower buyout surpluses than at the start of the year.
134. This implies that some of the schemes that experienced technical provisions funding level deteriorations over the year were likely to have been hedging their liabilities on a stronger basis, such as buyout, or low dependency, say.
135. Of course, we appreciate that not all schemes will be targeting buyout and trustees may consider that running on the pension scheme is a better option for their members or look to alternative end-game arrangements. For completeness, we have also shown in the table below the estimated movement of DB universe funding on a low dependency basis over 2022.

Table 6 – Low Dependency funding – Movement over 2022

	31 December 2021	31 March 2022	30 June 2022	30 September 2022	31 December 2022
Assets (£Bns)	1,791	1,644	1,445	1,307	1,365
Liabilities (£Bns)	2,036	1,910	1,560	1,349	1,260
Surplus/(Deficit) (£Bns)	(245)	(266)	(114)	(42)	104
Funding Level	88%	86%	93%	97%	108%

Source: TPR

136. As with the other bases (technical provisions and buyout) the low dependency funding levels also improved significantly over 2022 with an overall increase in the aggregate funding level from 88% at the beginning of the year, to 108% by the end of 2022 for the same reasons as noted before in the “aggregate results” section at the beginning of this chapter.

Differences from TPR estimates to those published elsewhere

137. TPR is the only organisation which collects data from all registered DB schemes subject to scheme funding regulations. Summarised scheme valuation data is submitted to us by schemes in deficit on a technical provisions basis at least every three years, according to legislative requirements to submit triennial valuations. Annual data is also collected in DB scheme returns, which provides information such as membership and the asset splits at the date of the latest trustee report and accounts.
138. Our data is shared with the PPF, and they use it for their modelling and publications such as the annual PPF Purple Book.
139. The Office for National Statistics (ONS) is the main other organisation that collects DB scheme data on a frequent basis. It surveys c.10% of the universe on a quarterly basis, including all DB schemes over 10,000 members and a selection of smaller schemes (c. 6% – 7%). As the ONS does not have full coverage with smaller schemes, it extrapolates their results in order to make an estimate for the whole of the DB market.
140. At the end of December 2022, our estimate of assets for the universe of larger schemes appears to be more consistent with those from the ONS and its survey figures, than our estimate for the universe of smaller sized schemes. However, it is not easy for us to directly compare the numbers, because, although the ONS carries out its survey on an individual basis using the Pension Scheme Registration (PSR) number (a unique identifier for each scheme and section), it adjusts the results to combine sectionalised schemes, where possible, to look at the scheme as a whole (i.e. they combine their membership and assets).
141. We do not know how many schemes are surveyed where these adjustments are made as we have not been able to obtain the ONS data for individual schemes to enable us to undertake such comparisons.
142. It is therefore difficult to know with certainty where the differences lie, though we suspect in part it is with the extrapolation of some of the smaller scheme data and part of it is through actual experience being different to that assumed. Examples of where experience may differ to the assumptions we have adopted include actual investment returns, the application of when trustees are buying and selling assets, or if trustees make strategic changes to their asset portfolio.
143. We would also highlight that TPR and the ONS collect data for different purposes. TPR has a statutory duty to collect data, some of which we can change and have discretion over, and some of which is set out in legislation. Our universe data is collected from all schemes to enable risk-based regulation in an appropriate way. Where we have concerns and engage with an individual scheme we may request additional information at that time in order to understand the issues in greater detail and understand the trustees' decision-making processes. The ONS surveys are more frequent for the purpose of their statistical publications, however they do not engage with schemes for other purposes.
144. TPR continues to be focused on what we can do going forward to improve the data available to us to better be able to understand and respond to risks to market stability and address the recommendations of the BoE financial policy committee.
145. We want to be as joined up as possible with other regulators and public bodies. We would like to have access to the underlying data used by the ONS in its publications, but it has not been able to provide this to us so far - for legitimate reasons around what data it is able to share with third parties. We continue to meet regularly and discuss this with the ONS.

Schemes that observed TP funding deteriorations in respect of LDI impacts during September 2022

146. As set out above, the impact of the market turmoil in September 2022 has led to material improvements in DB universe funding as falls in liabilities have outstripped falls in asset values. However, there are certain circumstances where individual schemes may have observed technical provision (or other basis) funding deteriorations during September 2022.
147. In general, these are likely to be a consequence of one, or more, of the following three factors:
- (i) High levels of hedging – where the overall level of the interest rate hedge (exposure) exceeded 100% of the value of the assets. Sometimes, this can be due to a scheme applying a hedge against a low dependency or buyout funding target, often in line with the trustees longer term strategy.
 - (ii) Discounted selling of assets – where to meet collateral calls a discount had to be applied to the market value of the asset in order to complete a sale quickly.
 - (iii) Losing and re-applying hedges – where a scheme reduced its level of hedging and then re-instated the hedge at a later date at a loss i.e. liability hedges were re-purchased at higher prices than they were sold for.
- Further explanation of the above factors is provided later in this section of the report.
148. The modelling we have undertaken:
- Allows us to account for the situation outlined in (i) above, based on the data that schemes have provided us regarding their asset split or hedging levels.
 - Does not allow for the situation outlined in (ii) as we do not have the data to model this, as this would require data for every individual asset sold during this period, including the dates and prices of each individual asset sales. However, discussions with industry stakeholders have generally pointed to this not being a material issue for many schemes (though clearly it will be scheme-specific).
 - Allows for some loss and re-application of hedges as outlined in (iii) above, but only where schemes did not appear to have sufficient liquid assets (assumed to be equities) to maintain their hedge and leverage during market volatility. We have assumed the leverage is maintained where possible and so where equities are not available to sell, we have modelled selling/buying gilts if needed.
 - Finally, given the difficulty to predict trustee behaviour, we have not allowed for any tactical behaviours such as looking for opportune times to reinstate hedges, or indeed deciding not to reinstate them in some instances.
149. Further details and examples of the circumstances mentioned above, where individual schemes may have observed funding losses during September 2022, are set out below.

Hedging against other metrics than assets

150. There would have been some schemes for whom the value of the hedge exceeded the value of the assets. There are several reasons why a scheme would have undertaken such an investment strategy, which include, hedging with respect to the scheme liabilities with the aim of reducing the deficit volatility (for schemes in deficit) or applying a hedge against a different funding target than technical provisions, for example buy-out or a gilts flat funding basis.

151. This can be seen in the following examples, which show an example scheme (with a liability duration of 20 years) which is under-funded (80% funded) on a technical provisions basis, with hedging levels of 80%, 100%, 60% and 120% of scheme liabilities. We also illustrate the % hedge relative to the assets for each scenario. For these purposes we have assumed that the assets used for hedging purposes have the same duration as those of the liabilities on a technical provisions basis. We model the impact of an increase in gilt yields of 75 basis points. This increase is broadly equivalent to size of the increase observed during late September 2022.

Table 7: Impact on scheme funding levels with alternative hedging ratios

	Scenario			
Starting Position	(i) Hedging 100% assets	(ii) Hedging 100% liabilities	(iii) Under Hedging both assets and liabilities	(iv) Over Hedging assets and liabilities
Strategy	Hedge funding level	Hedge deficit	Partial hedge of funding level and/or deficit	Hedge stronger basis
Assets	80.0	80.0	80	80
Technical Provisions (TPs)	100.0	100.0	100	100
Deficit	20.0	20.0	20	20
Funding Level	80%	80%	80%	80%
Hedge as % of Assets	100%	125%	75%	150%
Hedge as % of TPs	80%	100%	60%	120%
End position after 75 basis points increase in gilt yields				
Assets	69.3	66.6	72.0	63.9
Technical Provisions	86.6	86.6	86.6	86.6
Deficit	17.3	20.0	14.6	22.7
Funding Level	80%	77%	83%	74%
Outcome	Funding level same	Funding level worse	Funding level improved	Funding level worse
	TP deficit improved	TP deficit same	TP deficit improved	TP deficit worse

Source: TPR

152. Depending on the original purpose of the investment strategy for example to hedge against funding level remaining the same (example (i)), the deficit remaining the same (example (ii)) or hedging against a stronger funding basis e.g. buyout/low dependency (example (iv)), it can be seen from the outcome that it met the intended purpose, following the change in interest rates.
153. However, what the above example also demonstrates is that it is not possible to be able to undertake a strategy that hedges fully against both funding level and deficit, when the scheme is underfunded. It is important to understand the impact on all aspects of funding when implementing a hedging strategy.
154. In the example shown above, schemes which have 'over-hedged' the assets and technical provisions would have observed both a deterioration in their technical provisions funding level and technical provisions surplus or deficit. Again, however this is not to say that the strategy did not work as intended if the purpose was to protect the funding position for example on a buy-out basis.

155. This can be shown in table 7a below, which replicates scenario (iv) and includes the buyout liabilities. The purpose of the hedging strategy, which hedges 150% of assets, is aimed at protecting the buyout deficit. As can be seen, the buyout deficit remains at 40 irrespective of the movement in gilt yields.

Table 7a: Impact of hedging buyout deficit

	Scenario	
Starting Position	(iv) Over Hedging assets and liabilities	(iv) Over Hedging assets and liabilities
Strategy	Hedge buyout deficit	Hedge buyout deficit
Assets	80	80
Technical Provisions (TPs)	100	N/A
Buyout Liabilities	N/A	120
Deficit	20	40
Funding Level	80%	67%
Hedge as % of Assets	150%	150%
End position after 75 basis points increase in gilt yields		
Assets	63.9	63.9
Liabilities	86.6	103.9
Deficit	22.7	40
Funding Level	74%	62%
Outcome	TP Funding level worse	Buyout Funding level worse
	TP deficit worse	Buyout deficit same

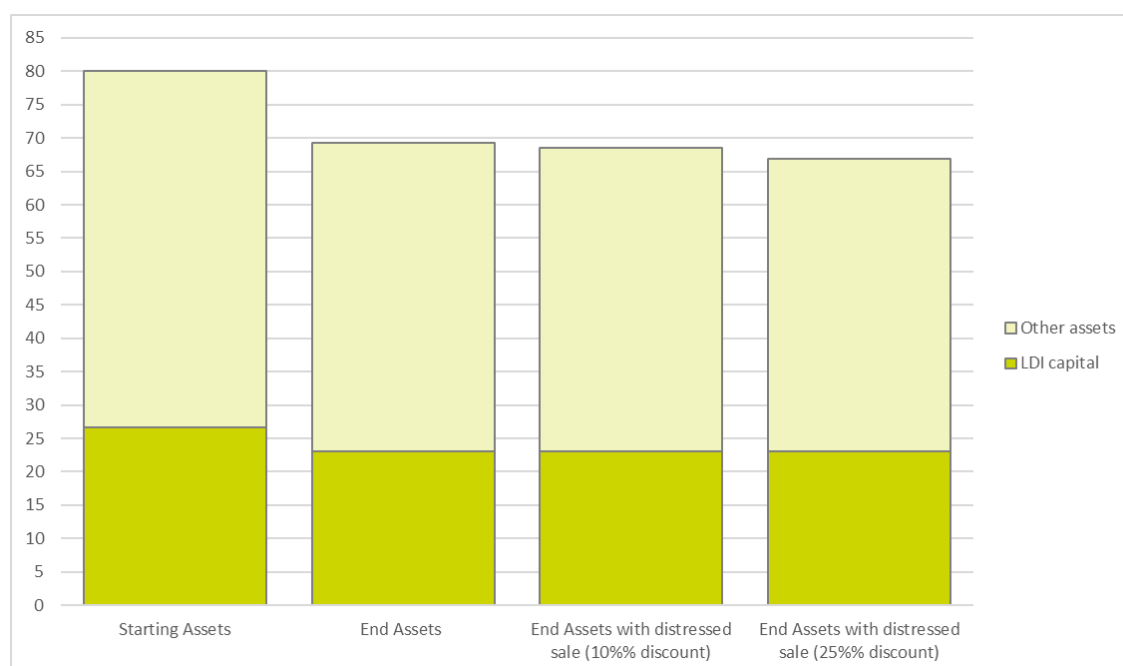
156. In respect of the scheme funding analysis presented previously, given we have estimates of the level of hedging implied through the investment strategy, our modelling incorporates all of the four scenarios shown here.

Discounted selling of assets

157. For some schemes to meet their collateral calls at short notice, they may have been required to sell assets at a discount relative to their recorded market value of that asset.
158. In general, we would expect such assets to have been less readily tradeable than more liquid assets. Furthermore, it is also noted that some discount may have applied to gilt sales, whereby the BoE purchased gilts at lower than market price (in order to ensure the liquidity of the gilt market).
159. Using the above example (i), i.e. a scheme which is 80% funded and which has a hedging strategy equivalent to 100% hedging of assets, the following sets out the impact on the movement in asset values based on an assumed leverage of 3x (both pre- and post-interest rate increase), split between the LDI assets and the other assets. Again, assuming a 75 basis points increase in gilt yields, this would have required c.9% of the starting assets to be sold to meet the collateral calls for the LDI portfolio. We have then shown the impact on the overall asset value of assuming either a 10% discount or a 25% discount is applied to those assets sales in order to meet collateral calls.

160. Note that these discounts are for illustration only, rather than our understanding of any actual discounts applied. Our illustrations used relatively large discounts to asset values in order to be able to show the impact clearly.

Chart 15 - Asset values including discounted asset sales



Source: TPR

161. The results above show that:
- i. For a 10% discount on all asset sales to meet collateral calls, there is a further loss of over 1% in the value of the assets; and
 - ii. For a 25% discount on all asset sales to meet collateral calls, there is a further loss of over 3% of the value of the assets.
162. Therefore, the extent of any loss observed where assets were sold at discount will depend on the size of the discount provided, as well as clearly both the level of hedging and the level of leverage adopted.
163. We do not have any data regarding the extent and scope of discounted sales, and so the scheme funding figures from our internal modelling make no allowance for where this may have occurred. Furthermore, it is also difficult to make any estimates regarding such potential losses, given it will be very scheme-specific depending on levels of liquid assets, levels and types of illiquid assets, or whether schemes reduced the level of hedging instead.

Loss of Hedging

164. The final example sets out the potential impact on scheme funding from reducing the amount of the hedging in place.
165. In respect of the figures presented in this report, our modelling makes allowance for some application of hedges being reduced and subsequently re-instated. However, we only make allowance for this scenario in circumstances where schemes do not appear to have sufficient liquid assets to maintain their leverage. Our modelling assumes that the leverage is maintained where possible and so where other liquid assets are not available to sell, we have modelled the selling of gilts if needed (and hence this will cause a change in the level of hedging) and vice versa.
166. Where schemes did reduce the level of hedging, the subsequent impact on scheme funding will depend on various factors, including the date the hedge was reduced, the amount of any

reduction, the date the hedge was re-introduced and the movement in financial markets over the period of time for which the hedge was lost. Indeed, the key point here is that it is what happens to gilt yields during the 'under-hedged' period that causes any potential funding gains or losses, rather than the act of replacement of the hedge itself.

167. In particular, if gilt yields rise following a reduction in hedging this would lead to an improvement in funding, whilst a fall in gilt yields will lead to a deterioration in funding (relative to the position if the hedge had been retained).
168. This can be seen in the following table which sets out an example of a reduction in the level of hedging from 80% of liabilities to 50% of liabilities and the subsequent change to scheme funding over time from either an increase or a decrease in gilt yields. This example is based on example (i) in the previous section i.e. a scheme with an initial hedging strategy aimed at maintaining the funding level following movements in interest rates with an initial funding level of 80%. This example shows:
- Time 0 - the initial starting position;
 - Time 1 - the position post a 75 basis points increase in interest rates, at which point the scheme reduces their hedge to 50% of liabilities; and
 - Time 2 - the final position assuming:
 - (i) Gilt yields subsequently reduce by 75 basis points; and
 - (ii) Gilt yields subsequently increase by 75 basis points.

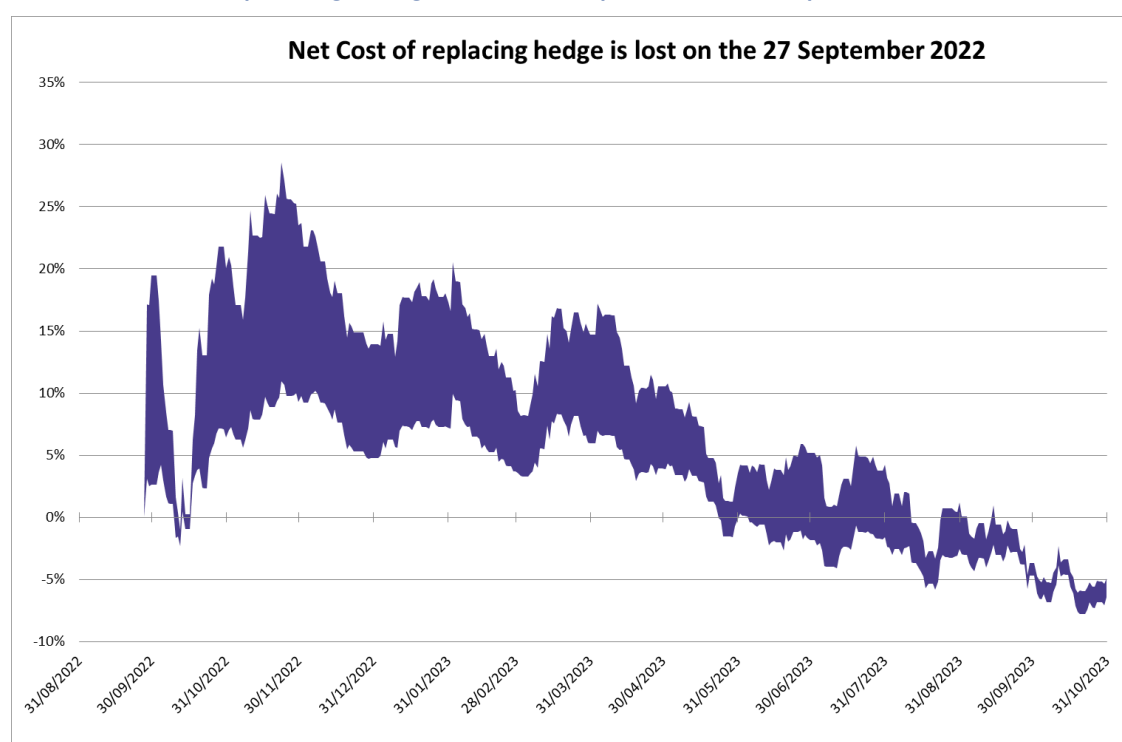
Table 8 - Impact on scheme funding levels with lost hedging ratios

	Starting Position	End Position	Reduce Hedge	Post reduction (i)	Post reduction (ii)
Time	0	1	1	2	2
Change in interest rate	N/A	0.75%	N/A	-0.75%	0.75%
Hedge (liabilities)	80%	80%	50%	50%	50%
Assets	80.0	69.3	69.3	76.0	63.5
Liabilities	100.0	86.6	86.6	100.0	75.1
Funding Level	80%	80%	80%	76%	85%
Deficit	20.0	17.3	17.3	24.0	11.6

Source: TPR

169. The above example shows that a reduction in hedging leads to a fall in funding levels (76%) if gilt yields subsequently fall, whilst an improvement in funding levels (85%) if gilt yields increase. This compares to the counter-factual position that if the hedge had been maintained at 80% the funding level at time 2 would always be 80%, irrespective of the movement in interest rates.
170. The impact on scheme funding therefore depends on the movement in gilt yields, either negatively or positively before re-instating the hedge compared to the counter-factual position of maintaining the original hedge consistently.
171. The next chart shows the impact of market movements post 27 September and the net cost of purchasing LDI protection relative to the price of purchasing LDI protection as at 27 September 2022. The date of 27 September 2022 is chosen here as this is the date that gilt yields peaked during September 2022. The graph shows a range of LDI protection with different durations, i.e. shorter and longer dated gilts and also assumes that over the period any assets held to purchase LDI protection are invested in cash which accrued interest in line with the BoE base rate. Where the net cost is positive, this means it would have been more expensive to replace the hedge, whilst where the net cost is negative, this means it would have been cheaper to replace the hedge (relative to the 27 September 2022).

Chart 16 - Net Cost of replacing hedge relative to price on 27 September 2022



Source: TPR, BOE

172. As can be seen from the above figures, if LDI protection was lost on 27 September 2022 and then replaced during the remainder of 2022, apart from a very short period in early October 2022, there would have been a net cost to the scheme. However, from around June 2023 to October 2023, the scheme would have observed a funding gain as the net cost of replacing the hedge would have been negative. Since the end of October 2023 to the end of December 2023 we have observed a subsequent fall in gilt yields, leading to a reversal of the downward trend observed above.
173. In due course valuation submissions and annual scheme return asset data will reveal the extent of changes to funding levels and asset allocations following September 2022 and will be incorporated into our modelling following these submissions. However, this is expected to play out over several years depending on the dates of the next triennial valuation.

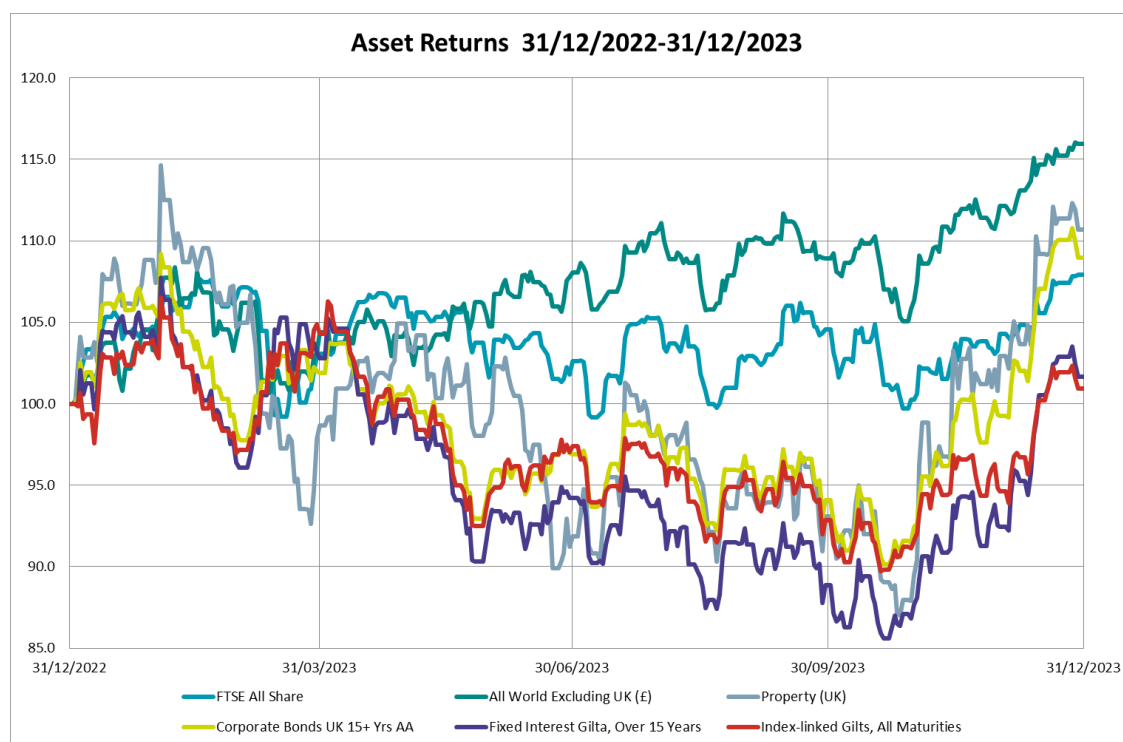
Changes to Scheme Funding: 31 December 2022 to 31 December 2023

Market movements over the period 31 December 2022 to 31 December 2023

Background

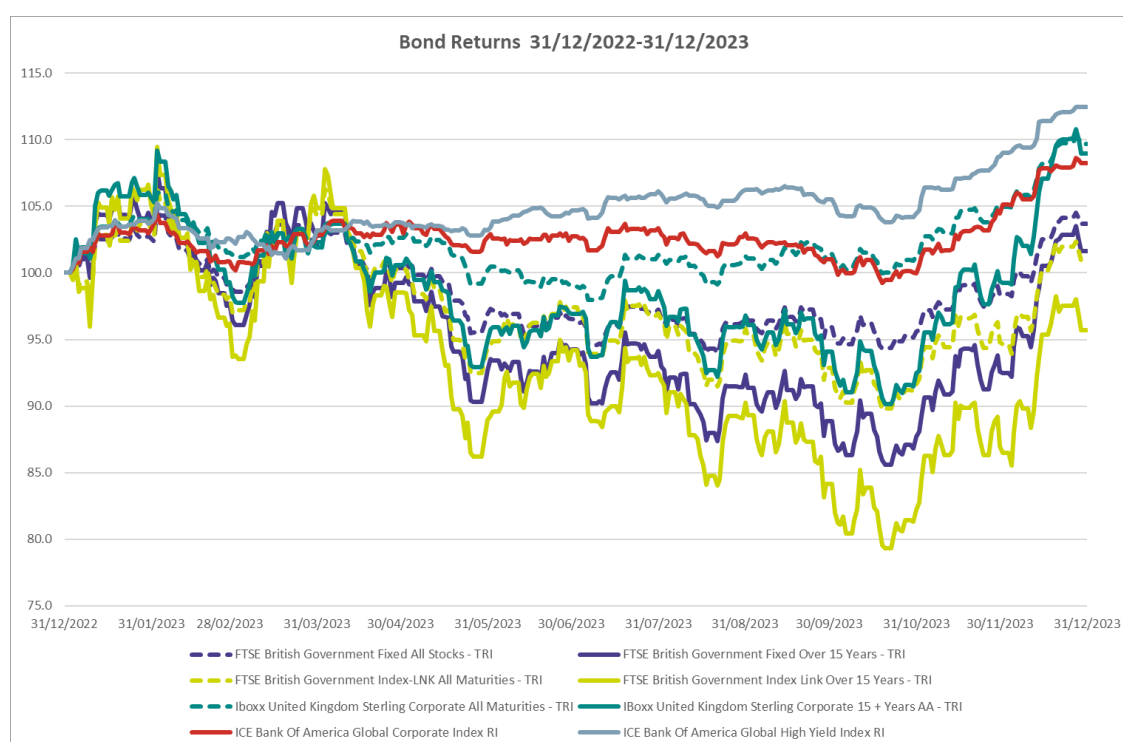
174. Investment returns over the calendar year 2023, have in general followed a similar pattern to that of 2022 with growth assets materially out-performing matching assets.
175. Similarly to 2022, the return on bond assets depends on the term of the bond and whether they were fixed, index-linked, gilts or corporate bonds and investment grade versus sub-investment grade.

Chart 17 – Asset returns over 2023



Source: LSEG

Chart 18 - Bond returns over 2023



Source: LSEG

Table 9 - Bond returns over the period 31 December 2022 to 31 December 2023

Index - Total Return	Total Return
FTSE British Government Fixed All Maturities	3.7%
FTSE British Government Fixed Over 15 Years	1.6%
FTSE British Government Index-Link All Maturities	0.9%
FTSE British Government Index Link Over 15 Years	-4.3%
Iboxx United Kingdom Sterling Corporate All Maturities	9.7%
ICE Bank Of America 10 or More Year Sterling Corporate Index	11.1%
ICE Bank of America Global Corporate Index	8.2%
ICE Bank of America United States High Yield Index	13.4%
United Kingdom, Policy Rates, Bank Rate	4.5%

Source: LSEG

176. In summary:

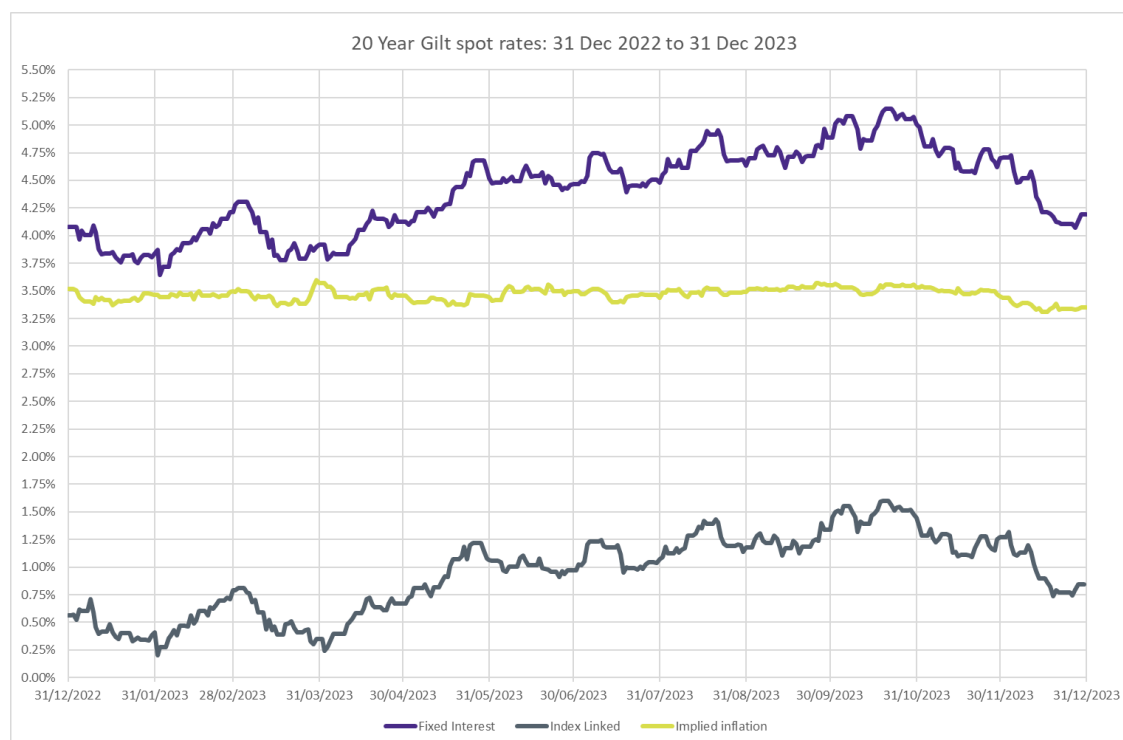
- i. Growth assets produced a positive performance over the 2023 calendar year with overseas returns (in sterling) producing the highest return of c.16% over the period.
- ii. Matching assets (gilts and investment grade bonds) produced a range of returns between c.10% to a loss of around c.5%, dependent on the term and type of bonds held.

177. As per the general trend over 2022, schemes who were “on-risk” i.e. those with growth assets would have observed the best investment performance over the calendar year 2023. Furthermore, schemes associated with higher growth portfolios would, by definition, be expected to have lower levels of hedging.

Gilt Markets

178. Gilt yields rose over the first three quarters of 2023, before reducing again over the last quarter of 2023. The yield on nominal gilts was c.10 basis points higher at the end of 2023 to that at the start, with index linked gilts ending the year c.30 basis points higher. The impact on long term market implied inflation over the period shows that this was generally consistent at 3.5% p.a. before falling by c.20 basis points over the last quarter. This can be seen in the following table, which shows this the nominal and index-linked 20-year spot gilt yield over 2023, combined with the 20-year market implied inflation.

Chart 19 – 20 year Gilt spot yields and market implied inflation over 2023



Source: Bank of England

Technical Provisions funding level movements since 31 December 2022

179. As seen from the following table, ONS

Table 10 – Technical Provisions - Movement over 2023

Date	31 December 2021	31 December 2022	31 March 2023	30 June 2023	30 September 2023	31 December 2023
Assets (£Bns)	1,791	1,365	1,415	1,385	1,372	1,518
Liabilities (£Bns)	1,734	1,161	1,203	1,124	1,077	1,192
Surplus/(Deficit) (£Bns)	57	204	211	261	296	326
Funding Level	103%	118%	118%	123%	127%	127%
% of Schemes in Surplus	52%	79%	80%	84%	87%	88%
% of Schemes in Deficit	48%	21%	20%	16%	13%	12%

Source: TPR

180. The primary reasons for the improvement in funding over 2022 are due to the increase in scheme assets over the period, whilst liabilities are broadly similar at the beginning and end of 2023.

181. This has seen a further improvement in the number of schemes estimated to be in surplus on a technical provisions basis, with only 12% of schemes now estimated to be in deficit on a technical provisions basis.

Buyout and low dependency funding level movements since 31 December 2022

182. Similar improvements were also observed on a buyout and low dependency funding basis again primarily due to higher estimated asset values at the end of 2023.

Table 11 – Buyout funding – Movement over 2023

	31 December 2021	31 December 2022	31 March 2023	30 June 2023	30 September 2023	31 December 2023
Assets (£Bns)	1,791	1,365	1,415	1,385	1,372	1,518
Liabilities (£Bns)	2,294	1,375	1,441	1,328	1,273	1,383
Surplus/(Deficit) (£Bns)	(503)	(10)	(26)	57	99	136
Funding Level	78%	99%	98%	104%	108%	110%
% of Schemes in Surplus	8%	41%	39%	51%	56%	58%
% of Schemes in Deficit	92%	59%	61%	49%	44%	42%

Source: TPR

Table 12 – Low Dependency funding – Movement over 2023

	31 December 2021	31 December 2022	31 March 2023	30 June 2023	30 September 2023	31 December 2023
Assets (£Bns)	1,791	1,365	1,415	1,385	1,372	1,518
Liabilities (£Bns)	2,036	1,260	1,314	1,214	1,166	1,265
Surplus/(Deficit) (£Bns)	(245)	104	101	171	206	253
Funding Level	88%	108%	108%	114%	118%	120%
% of schemes in Surplus	23%	65%	64%	73%	77%	80%
% of schemes in Deficit	77%	35%	36%	27%	23%	20%

Source: TPR

Closing remarks

184. Whilst the situation in late September 2022 / early October 2022 brought into sharp focus the size and scale of DB pension scheme overall investments in leveraged products for gilts (LDI), the movement in gilt values (and yields) led to a significant improvement in scheme funding over 2022, due to the larger reduction in liabilities than that of asset values.
185. TPR continues to enhance the data that we collect, particularly in respect of leveraged investments via the DB scheme return and for scheme liabilities through proposed changes in scheme funding regulations. This will enable us to improve our ongoing monitoring and evaluation of scheme funding in the future.
186. Furthermore, we are building on the working relationships with other public bodies, including the ONS, BoE and FCA to seek to understand how and where we can share data. This includes sharing results from the separate modelling undertaken by each organisation and working through the potential impacts that the data or modelling presents.
187. Regarding LDI fund manager data, we are working with the BoE to introduce stochastic modelling to enable us to estimate of the probability of a collateral call being required in a specified future time period for any specific fund in response to potential future increases to gilt yields. This will enhance our regulatory capability to determine whether there are any funds, specific maturities, or fund managers for whom issues might arise, so that combined with the other public bodies we can address potential future risks.
188. The precise impact of the events of 2022 for the whole universe will not be known for several years, as each scheme goes through their tri-annual valuation process, and the ultimate impact on scheme funding becomes known. The first schemes required to complete valuations following September 2022, i.e. those with a valuation date of 31 December 2022, are due to complete these shortly. TPR will start to receive valuation submissions from those schemes required to produce a recovery plan. From a regulatory perspective, we will continue to engage with those schemes, on a scheme-by-scheme basis, where valuations pose the greatest risk to savers.
189. Where appropriate, we will also consider whether further guidance or statements are relevant and required for particular risks and issues. For instance, we published LDI guidance in April 2023 to enable trustees to manage risk when using leveraged LDI in light of the events in late 2022.
190. Finally, we continue to engage with both industry and other public bodies on a regular basis, to monitor the position and to raise awareness of any risks that may arise.

APPENDIX 1 – GLOSSARY

This glossary sets out the key definitions of the terms used with-in this report:

Term	Definitions
Technical Provisions (TPs)	The liabilities of the scheme calculated using assumptions set by the trustees, following actuarial advice. The assumptions used are scheme specific to the actual scheme but have to be “prudent”. As the assumptions vary from scheme to scheme so the risk in the technical provisions funding basis can vary materially between schemes. Technical provisions valuations are required by legislation (Pensions Act 04) and need to be undertaken at least every 3 years. Technical provisions liabilities are used to calculate the deficit for determining whether a recovery plan needs to be prepared.
Buyout	A buyout transaction is one where the liabilities of the scheme are transferred to an insurance company for a lump sum premium. The cost of buyout is not known until the actual transaction is completed. However, there is a requirement for the Scheme Actuary to provide an estimate of the cost of buyout as part of the valuation process. This is generally based on the Scheme Actuary’s knowledge of buyout conditions. Generally, buyout is the most prudent basis, given that insurance companies need to reserve in line with Solvency II regulations. This basis is also sometimes referred to as Section 75, as this is the valuation basis used to calculate the debt on the employer in the event of employer insolvency (S.75 PA95).
Low dependency	This basis was proposed as part of the funding and investment regulations 2023. This is a set of assumptions such that once a scheme is fully funded on this basis, in combination with a low dependency investment strategy there is minimal reliance on the employer covenant to provide further support. For the purpose of this report this basis has been set with reference to a discount rate adopting gilt yields plus an addition of 50bps (Gilts + 0.5% pa).
Hedging	Hedging is a strategy aimed at ensuring that the value of the assets move in the same way as the value of the liabilities. The main focus is hedging the interest rate (i.e. the gilt curve) and inflation (i.e. the real gilt curve) risks, but some schemes hedge other factors such as longevity. Different schemes hedge different levels of assets and liabilities, and they will work with their investment consultants to define their strategy and the basis they are trying to hedge against, as it is not the case that all funding bases will move in the same way or to the same degree.
Liability Driven Investment (LDI)	Liability driven investment (LDI) is the implementation of a trustees’ hedging strategy. This typically results in the purchase of gilts, or swaps, at different durations along the gilt curve, in order to hedge the movement in asset values to those of the movement in liability values. Often, LDI involves the leverage of gilt investments, which can be called both leveraged LDI or sometimes just LDI for short. The application of leverage means that it is possible to achieve 100% of interest rate and inflation hedging but without needing to have the whole asset portfolio in gilts. Leveraged LDI

	requires the provision of collateral to counterparties as security, which brings additional liquidity risks and requirements as these collateral demands can change over short periods when gilt yields change (as the value of the underlying leveraged assets change). TPR, in combination with the FCA has issued guidance regarding the setting of minimum collateral buffer levels in respect of changes to underlying gilt yields: Using leveraged liability-driven investment The Pensions Regulator Leveraged LDI does not have a set level of leverage. The appropriate level of leverage for each individual scheme is dependent on a range of factors such as the maturity of the liabilities, the funding level of the scheme, and the availability of liquid assets amongst other things. LDI can also be implemented with no leverage. LDI is a generic term and as such each LDI portfolio needs to be considered separately on its own merits to understand the level of hedging and levels of leverage.
Funding Level	The value of the assets (A) divided by the value of the liabilities (L) i.e. (A/L).
Fully funded	A scheme is fully funded when the assets of the scheme are equal or greater than the liabilities of the scheme (also known as being 100% funded (or above)).
Under funded	A scheme is underfunded when the assets of the scheme are less than the liabilities of the scheme.
Surplus / (Deficit)	A scheme is in deficit where it is underfunded, and its funding level is less than 100%. A scheme is in surplus where it is fully funded, and its funding level is more than 100%.

APPENDIX 2 – Background on Hedging: Liability Driven Investment

Hedging

- 191. A hedge is an investment that is made with the intention of reducing the risk due to adverse price movements in an asset, or liability.
- 192. Another way of considering a hedge is that it is analogous to taking out an insurance policy to protect against adverse price movements.
- 193. Hedging is a common financial practice that is used by many different institutions around the world to lock into fixed prices, which then allow those institutions to plan forward with known fixed rates and not have to worry about market fluctuations, for example many food producers take out hedging on food prices to enable them to fix prices at current prices.

Gilts

- 194. Gilts provide known fixed or inflation-linked payments (depending on the type), with very low credit risk, so as an asset class are a very good match to the characteristics required by pension schemes to meet pension payments.
- 195. It is therefore possible to construct a portfolio of gilts or different durations such that the payments from the gilts exactly match the expected payments of all future pension payments.
- 196. Given the above, for many pension schemes, long-term planning in principle reflects a desire to invest in a portfolio of gilts (or similar assets). Therefore, to value the scheme liabilities on a consistent basis, scheme liabilities are measured using a discount rate derived from the yield on gilts
- 197. As the payment from gilts is known, there is therefore a direct inverse relationship between price of gilts (i.e. the value) and the yield (discount rate) of gilts. Hence, if the price of gilts rises, the yield reduces and vice versa.

Hedging: Pension Schemes and LDI

- 198. For pension schemes, hedging essentially involves ensuring that movement in the value of the liabilities is matched by a corresponding movement in the value of scheme assets, such that the funding level (assets / liabilities) stays constant irrespective of market movements.
- 199. For pension scheme funding purposes, one of the key risks which leads to a change in the value of the scheme liabilities, is the adverse movements in the price of gilts (due to reasons as set out above). Therefore, pension schemes hedge to ensure that movements in the prices of gilts, and therefore liabilities, are matched by the movement in the value of the assets. This is known as Liability Driven Investment (LDI), i.e. it is the value of the liabilities (or potential change in the value of the liabilities) that drives the requirement to seek gilts of a similar profile to that of the liabilities.
- 200. LDI often uses “leverage” in order to increase exposure to gilts, whilst retaining a proportion of the asset portfolio in “growth” type assets.

Measuring Hedging

- 201. When determining the extent of hedging that schemes have in place, there is no standard way of how these are measured. Whilst the theoretical reason for hedging would be to

measure them as a percentage of the liabilities that are being hedged, they are more commonly measured as a percentage of the assets.

- 202. To determine the amount of interest rate hedging that schemes have undertaken these are calculated using the “PV01”. PV01 is the present value of the change in the value of the liabilities and the value of the assets from 1 basis point movement in interest rates.
- 203. Where the PV01 of the assets and liabilities is the same then this means that schemes will be 100% (of fully hedged) against interest rate movements. In other words, the asset value and liability value will move identically to any increase or decrease in interest rates (gilt yields) such that the funding level (A/L) is unchanged.
- 204. To determine the amount of inflation hedging that schemes have undertaken we can similarly use “IE01” information. IE01 is the present value of the change in the value of the liabilities and the value of the assets from 1 basis point movement in inflation rates. Where the IE01 of the assets and liabilities is the same then this means that schemes will be 100% (of fully hedged) against inflation movements.

Risks and Other Issues

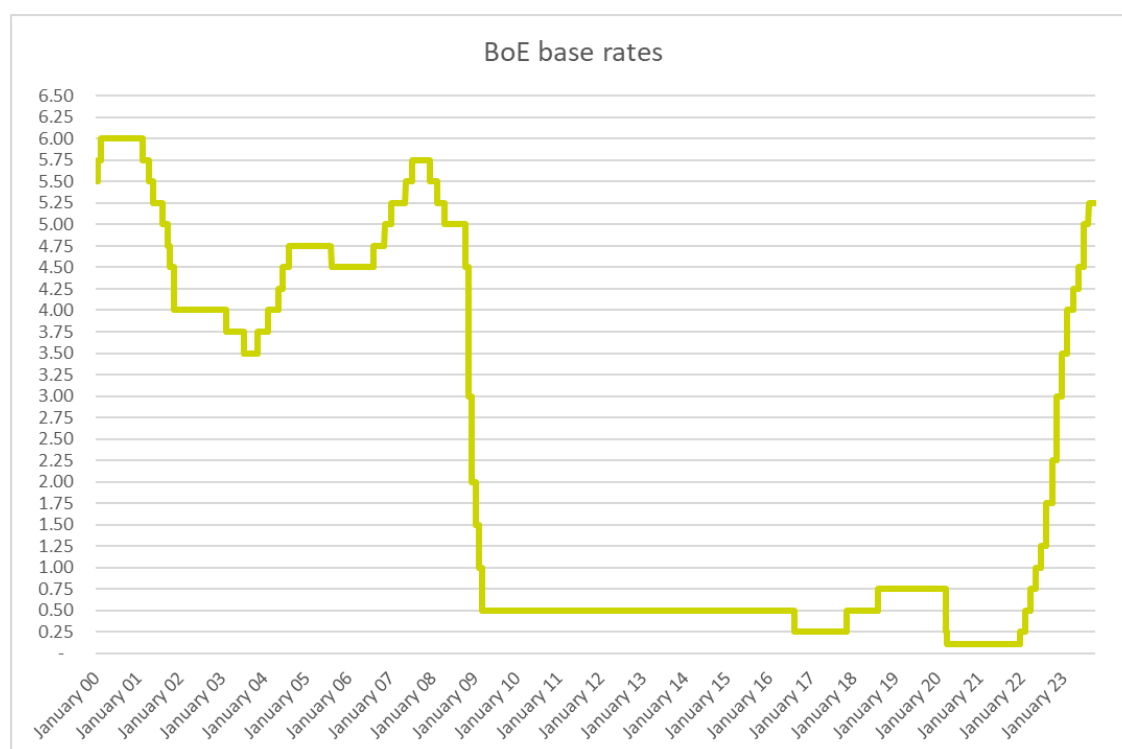
- 205. Where interest rates fall, the value of gilts increases and hence the value of the assets increases. Conversely, where interest rates rise, the value of gilts falls and hence the value of assets falls.
- 206. Where schemes have undertaken leverage to increase their exposure, when interest rates (gilt yields) rise, they need to post collateral to cover the loss in value of their additional exposure to gilts. Therefore, schemes need to ensure that they have both an appropriate level of liquid assets to meet any collateral calls plus the necessary governance arrangements in determining the waterfall in which assets will be sold.
- 207. In certain circumstances, the liquid assets sold to meet collateral calls will be direct holdings in gilts themselves. This will therefore lead to a loss in the overall levels of hedging in place (due to the lower levels of overall gilt holdings).
- 208. TPR guidance, issued in April 2023, [Using leveraged liability-driven investment | The Pensions Regulator](#), recommends that schemes have available liquidity to cover both a 250 basis points increase from a market stress, plus an allowance for an operational buffer, which for the example in the guidance was an additional 100 basis points increase.
- 209. Finally, any posting of collateral will be subject to the dealing costs associated with the selling of assets.

APPENDIX 3: GILT MARKETS OVER THE PERIOD 31 DECEMBER 2021 TO 31 DECEMBER 2022

Background

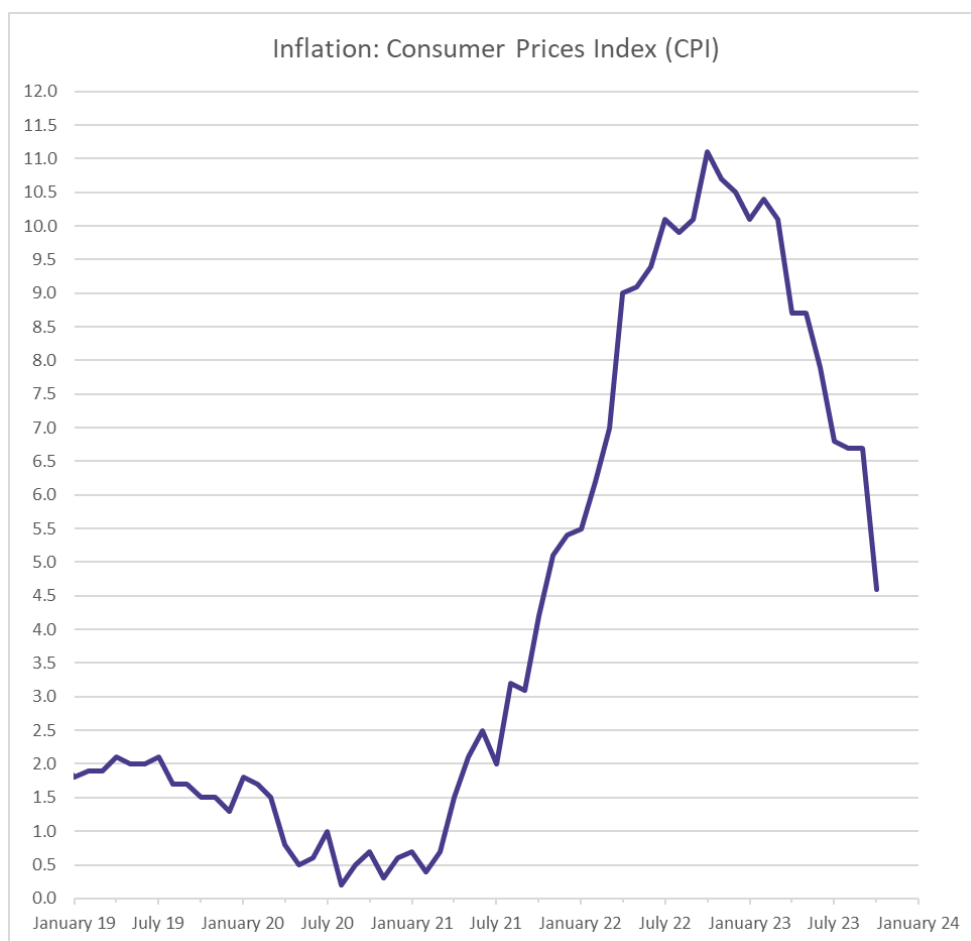
210. In response to the global financial crisis of 2007/8, the Bank of England (BoE) reduced base rates to historical lows, culminating with a 350-year historical low of 0.1% p.a. between March 2020 and December 2021.
211. From this low point and in response to increases in the rate of inflation over 2021, the BoE increased the base rate, so that over 2022 the base rate increased from a starting point of 0.25% p.a. to 3.5% p.a., with further frequent increases observed over 2023 such that by 30 September 2023, base rates had increased to 5.25% p.a.
212. The following charts track:
- the BoE base rate since the start of the century; and
 - the level of CPI inflation over the last five years.

Chart 20 – Bank of England Base Rates



Source: LSEG

Chart 21 – Inflation: Consumer Price Index (CPI)

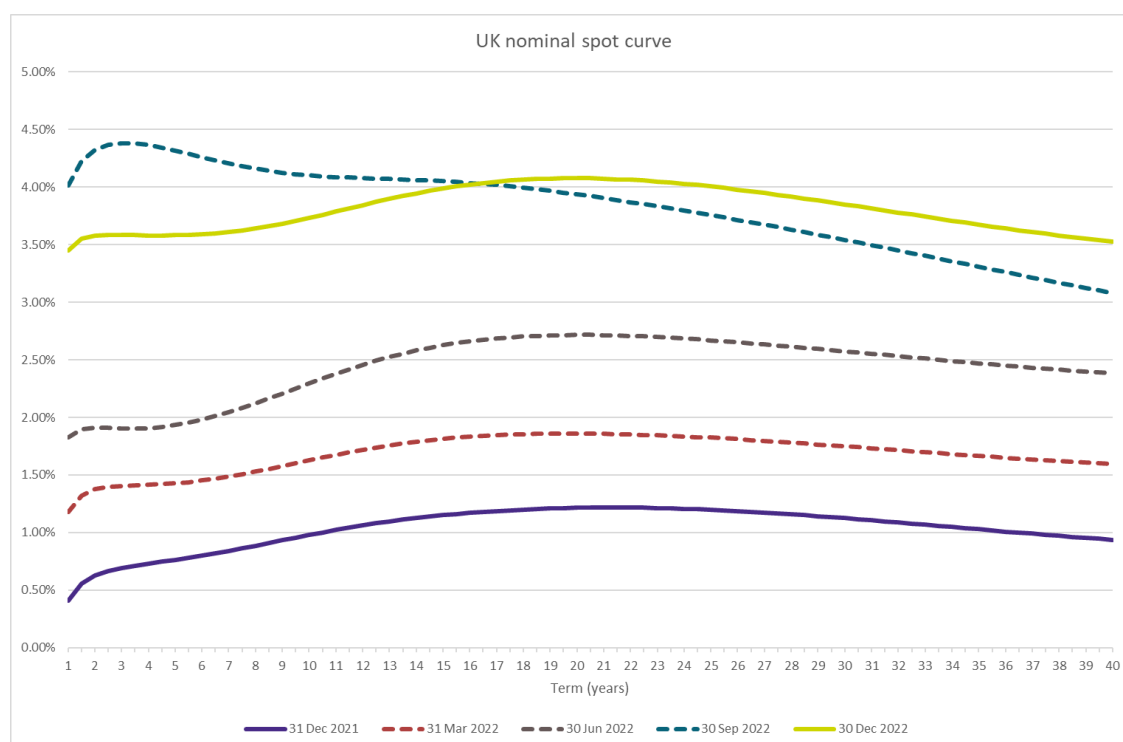


Source: LSEG

Gilt Markets

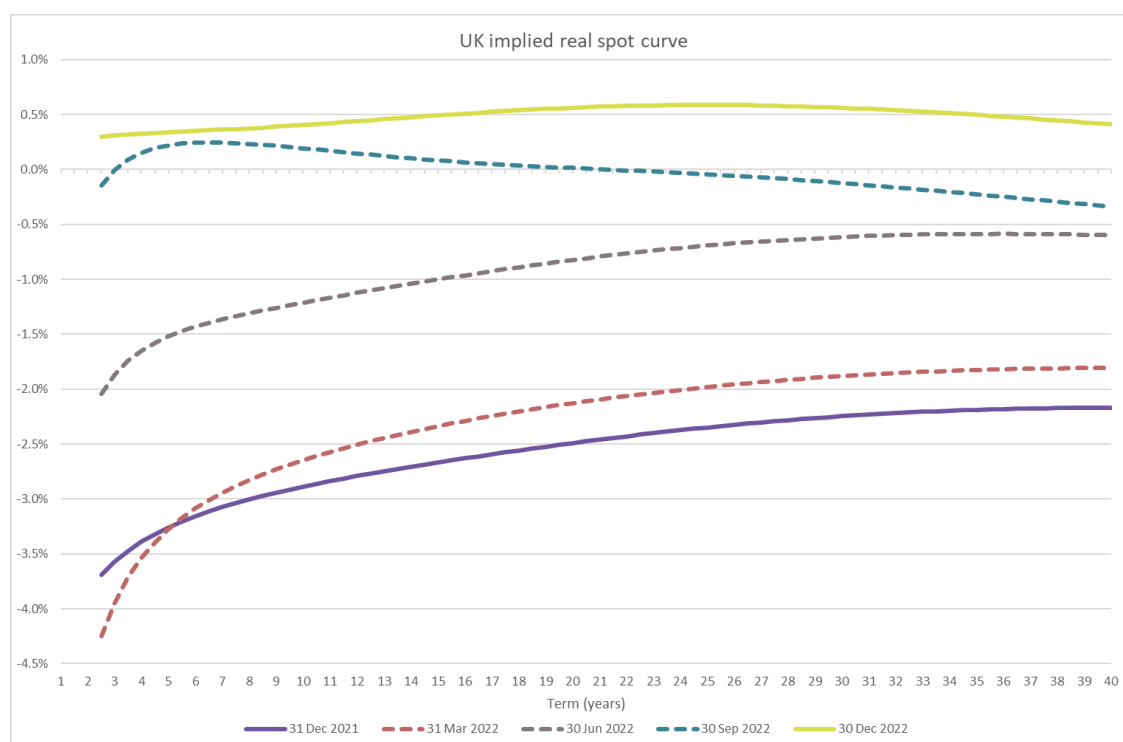
213. In response to the increase in both base rates and inflation the yield on both nominal and inflation linked gilts increased significantly over 2022. This can be seen with movement in the spot gilt curves, whereby the 20-year spot rate increased by c.300 basis points for both fixed interest and index linked gilts over 2022, with most of the increase observed over the period 31 December 2021 to 30 September 2022.

Chart 22 – Gilt Fixed Interest Spot Yields over the period 31/12/2021 to 31/12/2022



Source: BoE

Chart 23 – Index Linked Gilt Spot Yields over the period 31/12/2021 to 31/12/2022



Source: BoE

214. Associated with the increase in gilt yields, the value of gilts fell (because when yields rise, values fall) significantly over the year. The following table shows how the value of assets fell over the year, with overall reductions expected to be in the region of 25% to 40%, depending on the term of the gilts held.

215. It can also be seen that over 50% of those reductions were observed over the first 6 months of 2022 but because the value of the daily change in gilt values were smaller than the period late September 2022, this did not have any material impact on gilt markets because trustees were able to undertake collateral calls for leveraged LDI portfolios within the necessary time periods.

Table 13 – Gilt Return over the period 31/12/2021 to 31/12/2022

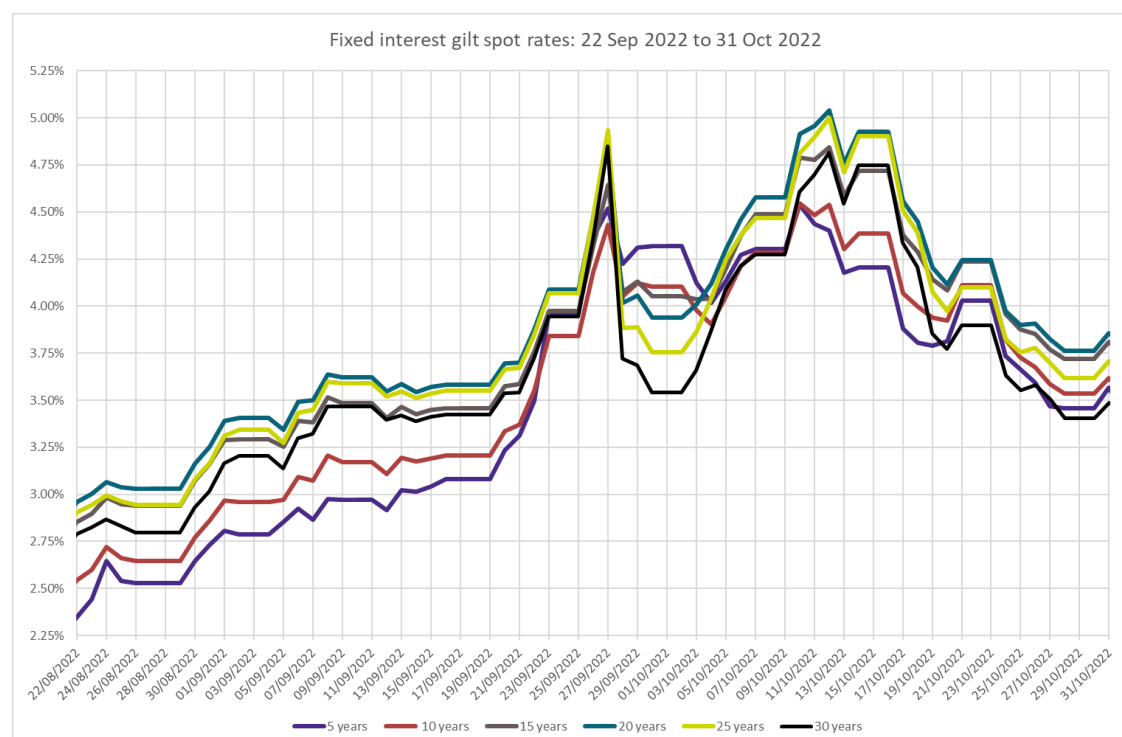
Total Return for the period:	Period	FTSE British Govt. Fixed All Stocks	FTSE British Govt. Fixed Over 15 Years	UK Govt. Index-linked Gilts, All Maturities	FTSE British Govt. Index-linked, Over 15 Years
31/12/2021 to 31/03/2022	3 months	-7%	-12%	-5%	-9%
31/12/2022 to 30/06/2022	6 months	-14%	-25%	-22%	-32%
31/12/2022 to 30/09/2022	9 months	-25%	-39%	-29%	-39%
31/12/2021 to 31/12/2022	12 months	-24%	-40%	-34%	-47%

Source: LSEG

Gilt Markets over the period 22 September 2022 to 31 October 2022

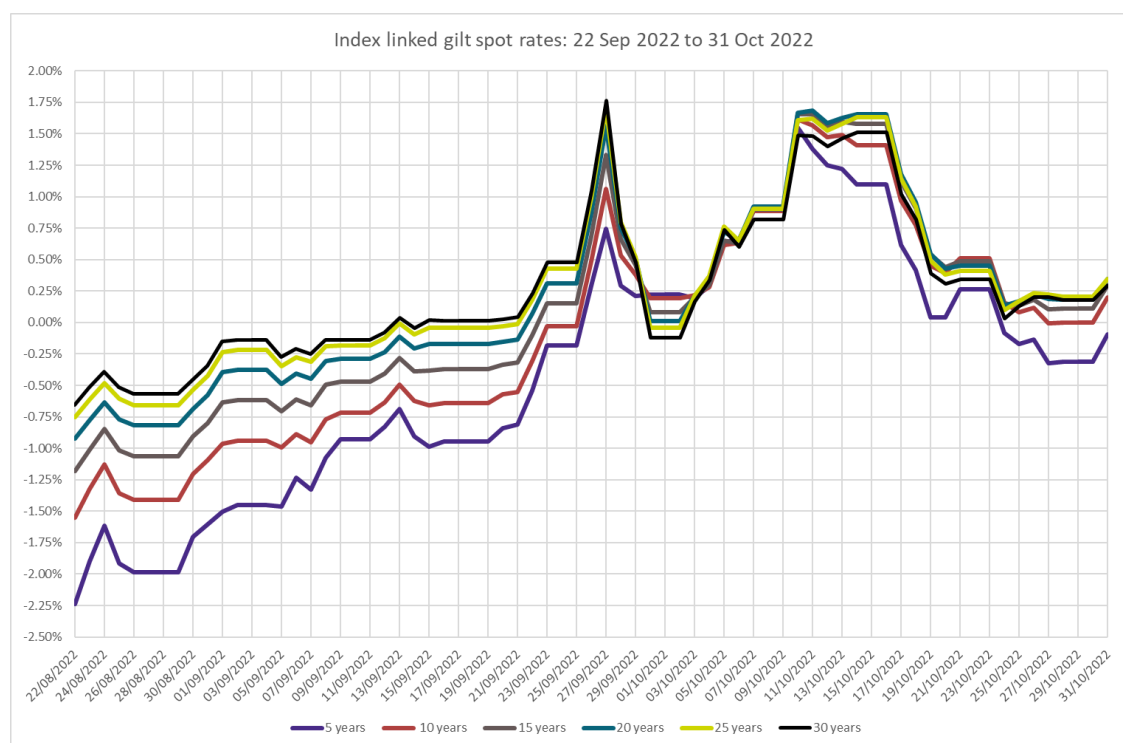
216. However, the figures in the above table hide the daily volatility that was observed, especially over the period 23 September 2022 to 31 October 2022, following the mini-budget of 2022 and the large daily increase in yields observed over that specific 40-day period.
217. This can be seen in the following charts that shows the 5-, 10-, 15-, 20-, 25- and 30-year spot yields observed daily. The actual intra-day volatility experienced was even higher.

Chart 24 - Fixed interest gilt spot yields over the period 22 September 2022 to 31 October 2022



Source: Bank of England

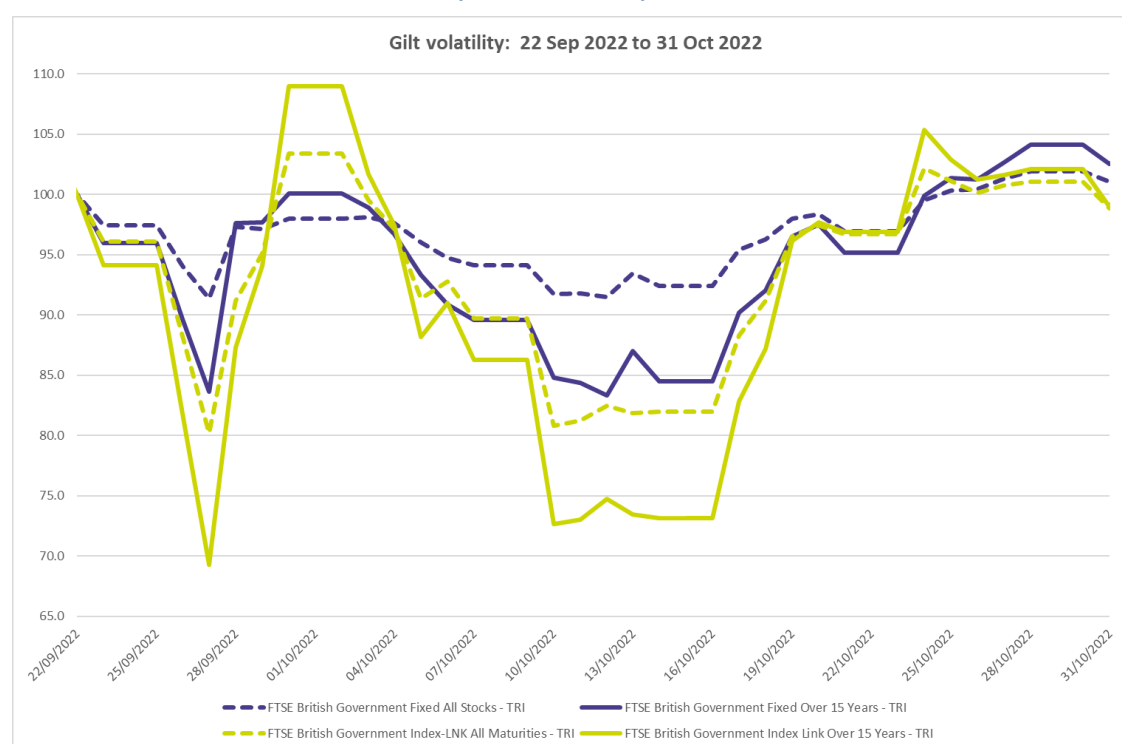
Chart 25 - Index Linked gilt forward yields over the period 22 September 2022 to 31 October 2022



Source: Bank of England

218. The charts above, highlight the largest daily movement, with the 25-year spot rate either falling by c.100 basis points or increasing by c.50 basis points from day to day in respect of the fixed interest gilt yield and falling by c.90 basis points and increasing by c.70 basis points in respect of the index linked gilt yield.
219. Associated with the volatility of gilt yields was the volatility of value of the underlying gilts. This can be seen in the following chart which tracks the movement in the British Government Fixed Interest All Stocks index, FTSE British Government Fixed Interest Over 15 Years index, British Government Index-linked Gilts All Maturities index and the British Government Index-linked Gilts Over 15 years index.

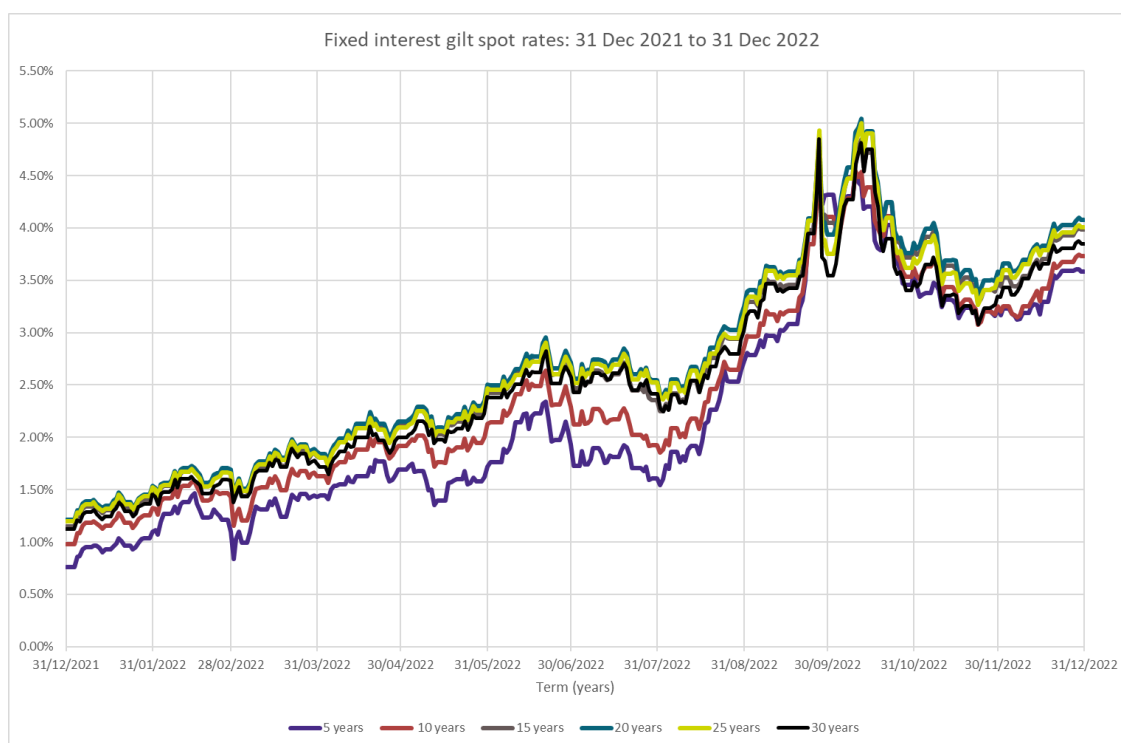
Chart 26 – Gilt returns over the period 22 September 2022 to 31 October 2022



Source: LSEG

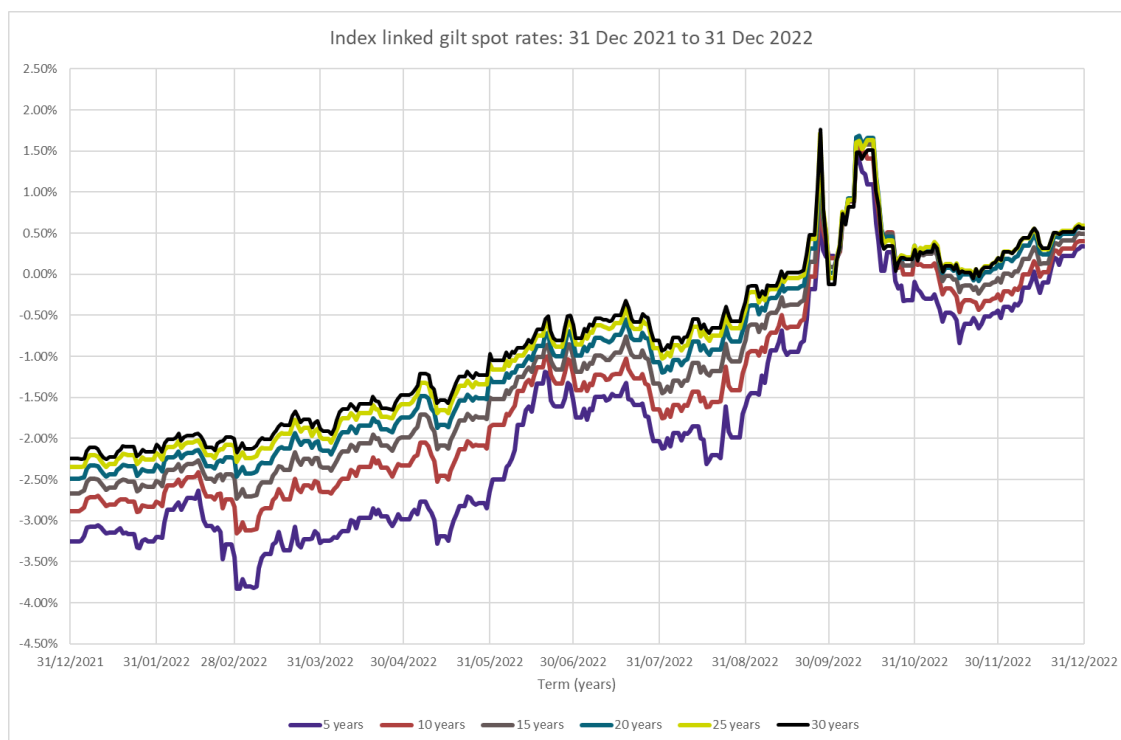
220. The issue, as can be seen from above, is the magnitude of movement over such a short time period that caused the issue for liquidity issues for leveraged LDI style investments and their ability to meet the daily high levels of collateral calls. This was particularly prevalent with a c.20% reduction in the value of gilts over the three-day period 25 September 2022 to 27 September 2022 and a similar movement in falls in gilt values over the first week of October 2022.
221. It can also be seen that the change in the value of gilts was very dependent on both the term of the gilts and the type. The All stocks indices i.e. shorter duration gilts, was c.50% less volatile than the Over 15-year indices i.e. longer dated gilts. Furthermore index-linked gilts were more volatile than that of fixed interest gilts over this period. Given pension funds generally invested in long-dated index-linked gilts, in order to match their long-dated index-linked liabilities, they were subject to the most volatility over this period and those with leveraged LDI the most pressing need for collateral calls.
222. For the remainder of 2022, the yield (and hence return) on gilts remained volatile with yields falling from their peak in mid-October to the beginning of November 2022, before continuing to rise again over the last two months of 2022, albeit the yield on gilts finished the year about 75 basis points below the high point of 2022. This can be seen in the following chart which tracks the 5-,10-,15-, 20-, 25- and 30-year spot yields for fixed interest and inflation-linked gilts over 2022.

Chart 27 –Gilt fixed interest spot yields over the period 31 December 2021 to 31 December 2022



Source: Bank of England

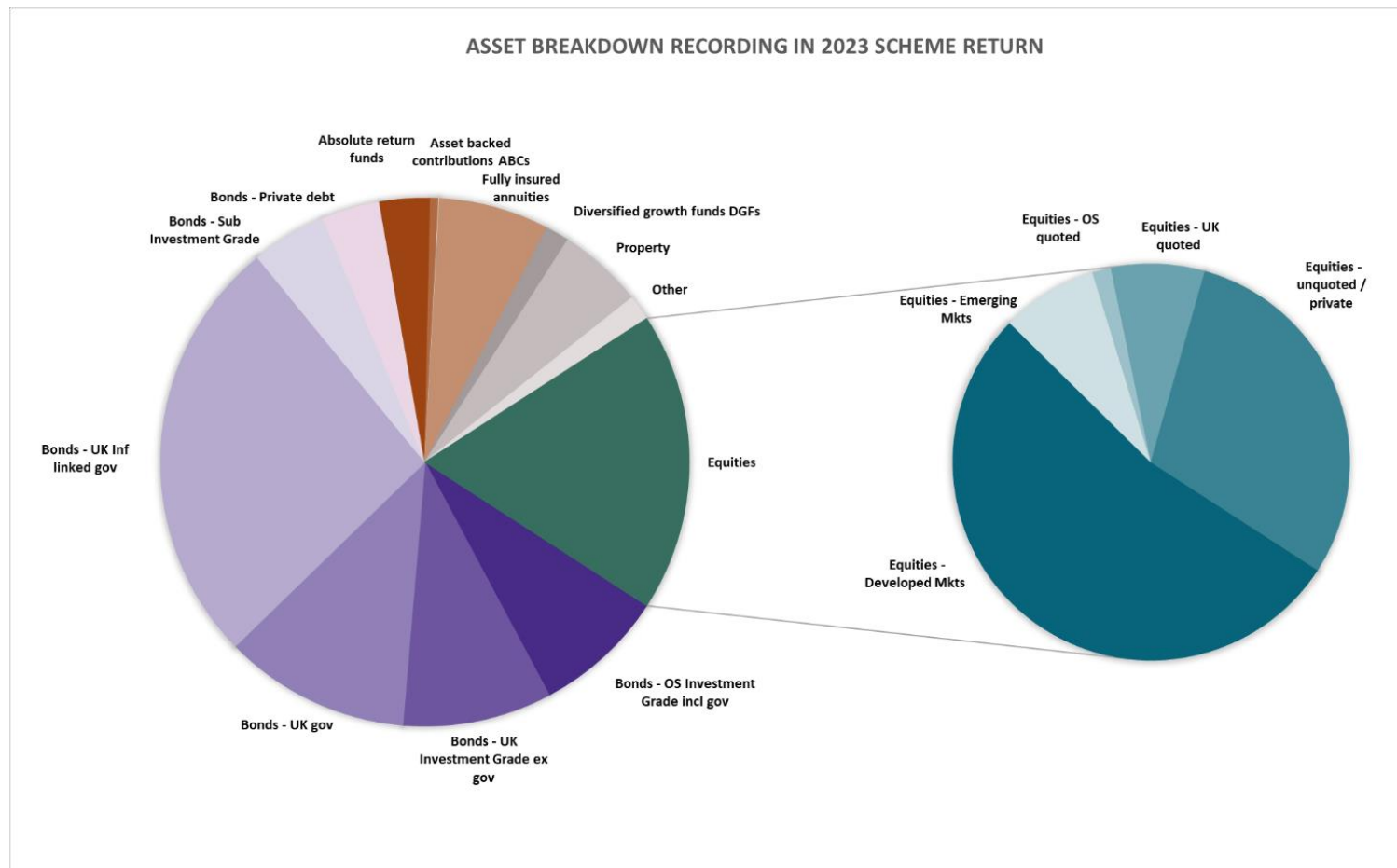
Chart 28 –Gilt index linked spot yields over the period 31 December 2021 to 31 December 2022



Source: Bank of England

Appendix 4 – ASSET ROLLFORWARD ASSUMPTIONS

223. The following chart shows the universe asset splits recorded in the 2023 scheme return:



Asset Roll-forward Assumptions

224. The table below lists the market indices used to estimate the returns on scheme assets over the period.

Asset Category	Market index used to estimate returns
Bonds – Tier 1 Investment Grade excluding UK Government	ICE Bank of America Global Corporate Index Return Index (RI)
<u>Bonds - Fixed interest - overseas investment grade</u>	
• Short & medium (<10 yrs)	ICE Bank of America Global Corporate Index RI
• Long (10+ yrs)	ICE Bank of America 10 or More Year Sterling Corporate Index RI
<u>Bonds - Fixed interest investment grade (excluding UK government)</u>	
• Short & medium (<10 yrs)	Iboxx United Kingdom Sterling Corporate All Maturities TRI
• Long (10+ yrs)	ICE Bank of America 10 or More Year Sterling Corporate Index RI

<u>Bonds - Fixed interest UK government bonds</u>	
• Tier 1	50% FTSE British Government Fixed All Stocks TRI + 50% FTSE British Government Fixed Over 15 Years TRI
• Short (<5 yrs)	50% FTSE British Government Fixed All Stocks TRI + 50% United Kingdom, Policy Rates, Bank Rate (Shorter History), End of Period TRI
• Medium (5-15 yrs)	FTSE British Government Fixed All Stocks TRI
• Long (>15 yrs)	FTSE British Government Fixed Over 15 Years TRI
<u>Bonds - UK Inflation linked – government</u>	
• Tier 1	50% FTSE British Government Index Linked All Maturities TRI + 50% FTSE British Government Index Linked Over 5 Years TRI
• Short (<5 yrs)	50% FTSE British Government Index Linked All Maturities TRI + 50% United Kingdom, Policy Rates, Bank Rate (Shorter History), End of Period TRI
• Medium (5-15 yrs)	FTSE British Government Index Linked All Maturities TRI
• Long (>15 yrs)	FTSE British Government Index Linked Over 15 Years TRI
Bonds - Fixed interest – sub-investment grade	ICE Bank of America Global High Yield Index RI
Bonds - Private Debt	ICE Bank Of America Global High Yield Index RI
<u>Equities</u>	
Overseas quoted	FTSE All World Excluding United Kingdom United Kingdom Sterling/Pounds TRI
Emerging market	FTSE Emerging TRI
Developed market	FTSE Developed TRI
UK quoted	FTSE All Share TRI
Unquoted equities/private equity	50% S&P 500 COMPOSITE TRI + 50% FTSE All Share TRI
Absolute Return	Cash rate (see below) + 3%
Asset-backed contributions (ABCs)	Present value estimated by adjusting recorded historic net present value to account for contributions made
Cash and net current assets	United Kingdom, Policy Rates, Bank Rate (Shorter History), End of Period TRI
Deferred or immediate fully insured annuities	Revalued in line with pensioner liabilities
Diversified growth funds	60% FTSE All World United Kingdom Sterling TRI + 20% FTSE British Gov Fixed All Stocks TRI + 20% Iboxx United Kingdom Sterling Corporate All Maturities TRI
Property	UK IPD: TRI (Time-weighted)
Other	Cash rate (see above) + 3%

Source: LSEG