Modelling the Long-Term Funding Objective

Likely outcomes of different approaches

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Contents

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Executive Summary

The Department for Work and Pensions (DWP) white paper, Protecting Defined Benefit Pension Schemes[1] noted that, whilst most defined benefit pension scheme members are likely to receive their benefits in full, there are risks to members' benefits from insufficient sponsor contributions and risks to sponsor strength from excessive contributions. To improve decision-making and governance across the defined benefit pension scheme sector, a revised Funding Code of Practice from the Pensions Regulator (TPR) was proposed. The revised Code would focus on:

* how prudence is demonstrated when assessing scheme liabilities
* what factors are appropriate when considering recovery plans
* ensuring a long-term view is considered when setting the statutory funding objective

TPR have asked the Government Actuary's Department (GAD) to assist them consider the impact of setting the long-term funding objective (LTO) under the revised Code in different ways and the approach that schemes might take to achieve their LTO over a suitable time period. This paper presents our analysis on the costs, in terms of sponsor contributions, and the change in security of member benefits from a range of approaches to the LTO and briefly considers the integration of current funding approaches with the LTO. For those outside TPR, this paper should be read alongside TPR's consultation paper on the new DB funding code which sets out more detail about the LTO and purpose, including the concepts of Fast Track and Bespoke approaches to assessing a scheme's performance against the LTO. The purpose of the modelling in this report is to assess the appropriate level of funding position that the scheme should be projected to meet, such that a Fast Track framework to assessing their performance against the LTO can be used.

We understand that TPR consider a scheme's LTO should mean by the time it has reached a position of significant maturity the scheme should have a low future dependency on the scheme's sponsor, to enable full benefits to be provided, and is invested with a high resilience to risk. However, this should be considered appropriately with the cost to the employer of reaching such a low dependency (LD) funding position. Whilst LD funding is set below buy-out pricing, there will remain a risk to member outcomes and the extent of this risk is reduced the closer LD is to buy-out pricing.

Based on the analysis undertaken, it would seem feasible to set the parameters of the LTO (the level of LD and what constitutes significant maturity) at what would appear an affordable level for most schemes, with a high probability of proceeding to full buy-out of member benefits without resorting to sponsor support. However, the analysis has not considered sponsor covenant in detail and the hence the extent to which different LD funding levels (and timing of significant maturity) would impact affordability. It is also worth noting that the range of possible outcomes remains relatively wide and in some scenarios of market conditions considered, support would be required from the sponsor or the Pension Protection Fund (PPF).

LTO Analysis

We have produced analysis to assess the implications on expected member outcomes of setting LD at different levels, assuming significant maturity is reached at different scheme durations and based on a variety of long-term investment strategies. For this element of analysis we assess the funding position over the initial 25 years after the assumed significant maturity point, by which time

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[1] https://www.gov.uk/government/publications/protecting-defined-benefit-pension-schemes

the scheme is only around 25% of the initial size and is therefore considered a reasonable point by which the long-term security of the scheme should have been secured.

Scheme's may still choose to run on at this point, but for the purposes of the analysis we have assessed the likelihood of reaching buy-out funding.

The higher the required LD funding, the greater the likelihood of members receiving benefits in full and hence the less likely the scheme sponsor or the Pension Protection Fund (PPF) will need to provide financial support. Table 1 illustrates the outcomes of some of the scenarios we have considered, further details are in described in Sections 2 and 3:

Table 1: The impact of different LTO approaches on member security

Assumed Scheme Duration[2] representing significant maturity (Years)	Indicative LD discount rate basis (pa)	Long-term investment strategy[3]	Likelihood of achieving buy-out funding within 25 years	Unpaid cashflows as a proportion of total cashflows[4]	
				Across scenarios not reaching buy-out	Across all scenarios
14	Gilts + 0.25%	Core hedged	89%	7%	1%
14	Gilts + 0.25%	Corporate bond	93%	5%	0%
14	Gilts + 0.5%	Core hedged	72%	7%	2%
14	Gilts + 0.5%	Corporate bond	82%	6%	1%
14	Gilts + 0.75%	Core hedged	54%	9%	4%
14	Gilts + 0.75%	Corporate bond	64%	7%	2%
14	Gilts + 1.0%	Core hedged variant	66%	14%	5%
14	Gilts + 1.0%	Corporate bond variant	72%	14%	4%

The point at which a scheme reaches significant maturity has been considered based on scheme duration. The duration relates to the average length of time before the liabilities fall due. TPR prescribed the central scenario of reaching LD based on a significant maturity at around 14 years duration.

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[2] This is modified duration determined by the sensitivity to small changes in the discount rate from the gilts + 0.5% pa basis

[3] The different investment strategies are described in more detail in Section 2

[4] The calculation of this shortfall is described in paragraph 3.6 and excludes any uplift in benefits provided as a result of the Pension Protection Fund

Table 1 illustrates the impact of setting the LD discount rate at different levels. The lower the indicative LD discount rate, the greater the likelihood of reaching a buy-out funding level within 25 years and the lower the potential loss to member benefits.

Lower LD discount rates increase the value placed on the liabilities, and hence the scheme's fund value needs to be higher to reach a LD funding level. At scheme duration of 14 years, the LD liabilities on a gilts + 0.25% pa basis are around 4% greater than on a gilts + 0.5% pa basis, 7% greater than on a gilts + 0.75% pa basis and 11% greater than on a gilts + 1% basis. All other things being equal, a gilts + 0.25% pa approach would therefore require greater sponsor contributions to achieve.

Table 1 also illustrates that in the scenarios where schemes do not reach buy-out funding within 25 years, the level of shortfall is relatively small except in the gilts + 1% pa scenario. This is shown by relatively small levels of benefits expected to go unpaid in these scenarios. This suggests that if schemes can reach the proposed LD funding level, the risk to member benefits will be relatively small. The risk is higher in the gilts + 1% pa scenario where a higher risk investment strategy is required to generate the returns necessary to exceed the LD discount rate. Also, in a few extreme scenarios for all LD approaches, schemes are projected to run out of funds within the first 25 years if they do not receive further financial support.

We have also considered using a definition of significant maturity both more and less than a duration of 14 years. Table 2 illustrates the impact of duration on scheme outcomes over the subsequent 25 years. The figures indicate that the duration of reaching the LTO has little impact on outcomes over the subsequent 25 years.

Table 2: The impact of different duration upon reaching the LTO

Assumed Scheme Duration representing significant maturity (Years)	Indicative LD discount rate basis (pa)	Long-term investment strategy	Likelihood of achieving buy-out funding within 25 years	Unpaid cashflows as a proportion of total cashflows	
				Across scenarios not reaching buy-out	Across all scenarios
14	Gilts + 0.5%	Core hedged	72%	7%	2%
14	Gilts + 0.5%	Corporate bond	82%	6%	1%
12	Gilts + 0.5%	Core hedged	75%	7%	2%
12	Gilts + 0.5%	Corporate bond	80%	6%	1%
17	Gilts + 0.5%	Core hedged	72%	7%	2%
17	Gilts + 0.5%	Corporate bond	82%	6%	1%

The investment strategy adopted by a scheme once it is significantly mature and has reached LD funding will also have an impact on member outcomes. The scenarios shown in Tables 1 and 2 are based on investment strategies that might be considered relatively low risk and reasonable for significantly mature pension schemes. The core hedged strategy provides full interest and inflation

hedging and includes a 20% allocation to growth assets, whereas the corporate bond strategy has a similar expected return but only has 55% explicit interest rate and inflation hedging together with a 55% allocation to corporate bonds.

The impact of alternative investment strategies with higher return expectations has also been considered in the gilts + 1% pa LD figures in Table 1. However, several other investment strategies, with higher or lower return expectations than the core hedged strategy, have also been tested on the gilts + 0.5% pa LD basis in Section 3. The analysis indicates that increasing the proportion of growth assets, whilst retaining full hedging of interest rate and inflation risks, tends to increase the likelihood of reaching buy-out funding.

Whilst increasing the proportion of growth assets increases expected returns and hence increases the chance of reaching buy-out funding it also brings increased volatility to the asset value and therefore a greater chance of requiring future funding from the sponsor. It is therefore also worth considering the impact of holding different levels of growth assets on the funding level over shorter periods than 25 years. This can illustrate the potential shortfalls that could arise in the short-term when a scheme sponsor insolvency event could trigger loss of member benefits.

Chart 1 below shows the proportion of scenarios in which the scheme falls below 95% funding of a gilts + 0.5% pa LD level, for different investment strategies. We can see that over the short term the proportion of scenarios that fall below 95% funding is higher the greater the level of growth assets in the strategy. However, over time, the lower return expected from the more cautious portfolio results in an increasing proportion of scenarios falling below 95% funding.

Chart 1: Proportion of modelled scenarios in which the LD funding level drops below 95%
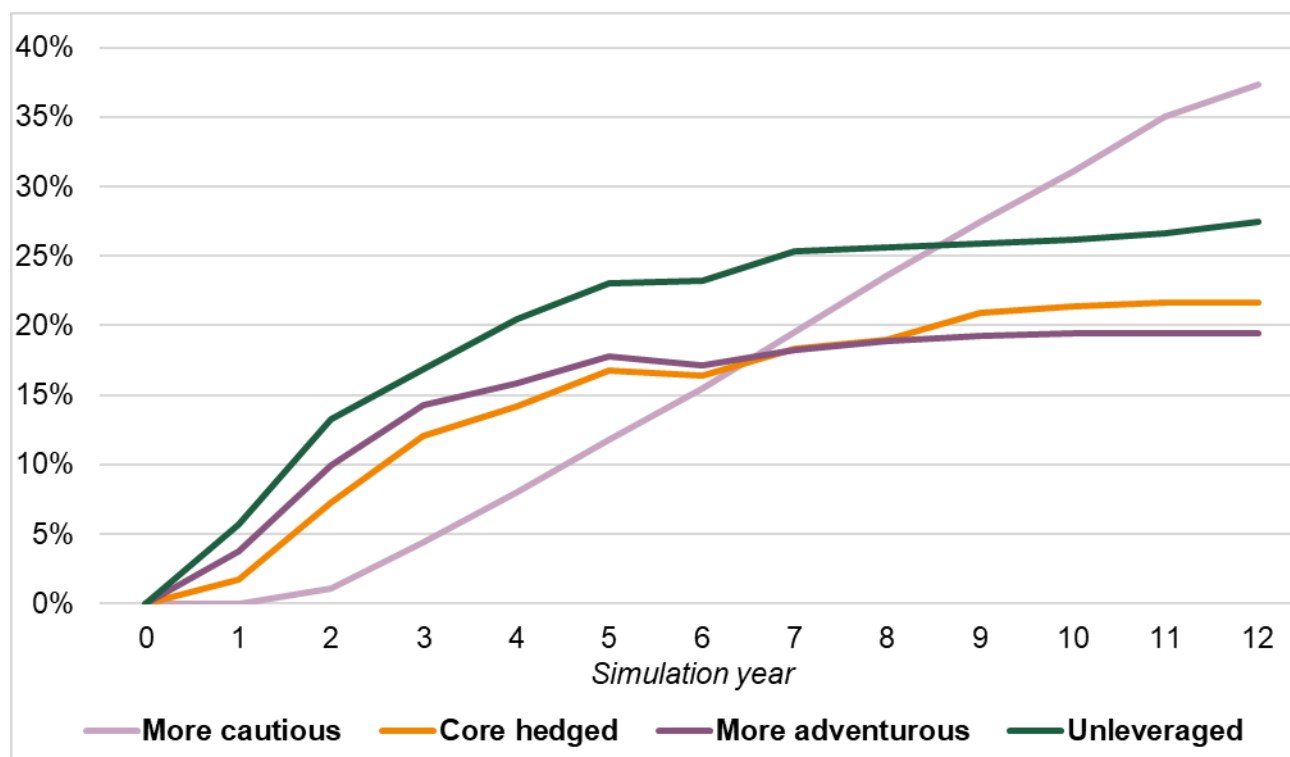
An investment strategy including a corporate bond allocation will similarly experience volatility resulting from changing credit spreads and defaults out of line with expectations, which result in the asset value changing in a different way to the LD liabilities. Changing market conditions can therefore impact on the relative strength of the LD basis, and this should be considered further.

In practice the investment strategies adopted by schemes might be more or less complex than those modelled, involve less hedging or be adjusted regularly to reflect experience, all of which could result in different outcomes for a scheme. Further details of the outcomes produced by alternative investment approaches is summarised in Section 3.

Period before significant maturity

The analysis above assumes that a scheme is fully funded on the LD basis at a particular definition of significant maturity and considers the risks to member benefits from setting the LD basis at different levels. The following analysis considers the likelihood and costs involved for less mature schemes to reach this funding position, given lower current funding positions. Table 3 summarises some initial analysis on the likelihood of reaching full-funding on the proposed LD basis by the time a scheme with current duration around 20 years reaches a remaining duration of around 14 years (i.e. reached significant maturity). We have considered three "archetype" schemes with specific investment strategies, recovery plans and discount rates:

A.   A scheme with a strong sponsor covenant, reasonably well funded and seeking to pay off deficits quickly: adopting five year recovery plans, mid-range basis for setting Technical Provisions (TPs) and a 55% growth investment approach

B.   A scheme with a strong sponsor covenant adopting a high risk investment and funding strategy and reluctant to pay off the deficit quickly: adopting fifteen year recovery plans, a relatively weak basis for setting Technical Provisions (TPs) and an 80% growth investment approach

C.   A scheme with a weak sponsor covenant and poorly funded: adopting fifteen year recovery plans capped for affordability, a relatively weak basis for setting Technical Provisions (TPs) and a 70% growth investment approach

These three "archetype" schemes are designed to show some of the more diverse characteristics rather than be a reflection of 'typical' schemes. We understand that Archetype A represents a strategy which is around the mid-range and Archetype B represents a strategy which is at the risky end of those adopted by range of strategies used by the schemes that TPR regulate. We also understand that there are relatively few schemes which are likely to be constrained in terms of future contributions to the extent modelled in Archetype C. Further details are provided in Section 4.

Table 3: The impact of different LTO approaches on required sponsor contributions

Archetype	Assumptions					Result
	LD discount rate basis (pa)	Initial investment strategy de-risking over time	Recovery plan type	Technical provisions discount rates (gilts + pre/post retirement pa)	Initial funding level (TP basis)	Likelihood of reaching LD funding by 14 year duration point
A	Gilts + 0.5%	55% growth, 17.5% corporate bond, 27.5% matching	5 year, uncapped contributions	2.2%/0.4%	91%	74%
B	Gilts + 0.5%	80% growth, 5% corporate bond, 15% matching	15 year, uncapped contributions	3.5%/1.0%	91%	34%
C	Gilts + 0.5%	70% growth, 10% corporate bond, 20% matching	15 year, capped contributions	2.85%/0.7%	81%	29%

Table 3 shows that, in these scenarios, the likelihood of reaching LD funding or better by the 14 year duration point is relatively low except in the better funded scheme scenario A in which the scheme adopts a short recovery plan and a less risky investment strategy and funding basis. This is a result of both the technical provisions basis and recovery plan being significantly weaker than the LD basis and higher levels of risk in the investment strategies which result in volatile funding outcomes for archetypes B and C. Further, in some circumstances, these funding approaches may result in very large sponsor contributions and the analysis assumes these will always be affordable for the sponsor.

Archetype C in Table 3 uses a riskier investment strategy and a weaker funding basis to set contributions. This archetype also assumes that deficit contributions will be no larger in nominal terms than those set at the outset to meet the initial 19% funding shortfall over 15 years. Therefore, in scenarios where the funding position deteriorates the deficit contributions will be capped and the recovery plan will be assumed to be longer than 15 years in length.

In practice the affordability of deficit contributions will depend upon the scheme sponsor and recovery plans will need to be tailored to reflect this. This analysis implies that some schemes will need to reconsider their funding plans to have a reasonable chance of reaching LD at a reasonable cost to the sponsor.

Further analysis

Different approaches could be taken to scheme funding in order to reach LD funding by the point the scheme reaches significant maturity. Further analysis is required to assess the implications of different approaches, but this analysis is beyond the scope of this report. Such analysis might also consider the impact at an aggregate defined benefit pension scheme universe level as well as at an individual scheme level.

The analysis carried out for this report is based on a representation of a typical defined benefit pension scheme and assumptions about funding and investment approaches as well as economic conditions and competitiveness of the buy-out market. Further details of the approach and assumptions are set out in Section 2 with details of the limitations covered in Section 5.

1 Background and introduction

1.1 The Department for Work and Pensions (DWP) white paper, Protecting Defined Benefit Pension Schemes[5] noted that, whilst most defined benefit pension scheme members are likely to receive their benefits in full, there are risks to members' benefits from insufficient sponsor contributions and risks to sponsor strength from excessive contributions. The paper outlines a number of approaches to improving scheme security including increased regulatory powers and the intention to update the Pensions Regulator (TPR)'s Code of Practice on funding defined benefit pension schemes.

1.2 To help improve scheme security, the revised Code would focus on:

- how prudence is demonstrated when assessing scheme liabilities;
- what factors are appropriate when considering recovery plans; and
- ensuring a long-term view is considered when setting the statutory funding objective.

1.3 TPR wants the long-term funding objective (LTO) to be defined such that by the time a scheme has reached a position of significant maturity the scheme should have reached a funding level at which there is a low future dependency on the scheme's sponsor and it is invested with a high resilience to risk. Hence achieving the LTO should result in good security for members' pensions. However, there is a balance to be struck between protection of member benefits and the cost to sponsors of reaching such a low dependency (LD) funding position. The more stringent the LD funding requirement, the greater the financial pressure on sponsors to fund the scheme which in turn increases the risk of sponsor insolvency.

1.4 TPR is looking to implement Fast Track and Bespoke frameworks for assessing a scheme's performance against the LTO and are interested in testing the impact on scheme funding and member benefits of different approaches to LTO guidance and the transition for schemes from the current regulatory approach to any new requirements. To assist their consideration of the different possible approaches, TPR has asked the Government Actuary's Department (GAD) to model a number of combinations of LTO objectives, including a range of LD funding levels, points of significant maturity (measured by duration), investment strategies, projection periods (post the significant maturity point) and market conditions. The analysis produced enables comparisons to be made of the extent of future scheme self-sufficiency and gives indicative probabilities of reaching sufficient funding to buy-out with an insurance company or, in poor scenarios, the shortfall in benefits members may be exposed to. This analysis will be used to assist TPR in assessing the appropriate LD funding level to be used in implementing the Fast Track framework.

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[5] https://www.gov.uk/government/publications/protecting-defined-benefit-pension-schemes

1.5   The analysis has been produced using stochastic modelling (running a model under many different scenarios to generate a distribution of potential outcomes). The modelling uses 1,000 different economic scenarios to project simulated scheme outcomes into the future. For this purpose we assess the funding position after 25 years, by which time the scheme is only around 25% of its initial size and is therefore considered a reasonable point by which the long-term security of the scheme should have been secured (see Section 2). Scheme's may still choose to run on at this point, but for the purposes of the analysis we have principally assessed the likelihood of reaching a buy-out level of funding within 25 years.

1.6   The range of outcomes considered in the analysis are:

- reaching a funding level sufficient to buy-out with an insurer, within 25 years
- not reaching buy-out funding but having a funding level greater than full PPF level funding at the end of 25 years
- funding falling below the PPF funding level after 25 years

1.7   Different LTO approaches give different likelihoods of reaching a buy-out level of funding and result in different shortfall amounts for scenarios that do not reach buy-out funding. In practice sponsor support might be available after the start of the projection period, but no allowance is made for additional contributions within the modelling. Furthermore, no allowance is made for sponsor insolvency during the projection period, instead we consider the extent of any PPF funding shortfall at the end of the projection. We have also looked at the impact of different investment approaches on the potential LD funding shortfall that might arise.

1.8   Our analysis indicates that an LTO can be defined such that there is a high likelihood (over 70%) that a typical significantly mature, closed scheme with a conservative investment strategy could achieve buy-out, with an insurance company, within 25 years and without requiring further sponsor support. Details of the methodology and assumptions used for the analysis is contained in Section 2 and the detailed output from the analysis is contained in Section 3.

1.9   TPR has also asked GAD to carry out some analysis of the period prior to the time at which schemes should reach their LD funding position, ie before they reach significant maturity (duration of around 14 years in the central case). This modelling has concentrated on the funding progression schemes might experience and the likelihood of reaching the LD funding level, by the time they reach significant maturity, based on some example funding approaches that might currently be adopted by schemes. As might be expected schemes with more prudent funding approaches and shorter recovery plans are more likely to reach at least the LD funding position during the projection, but this is balanced by higher required sponsor contributions before reaching the point of significant maturity. The output from this analysis is covered in Section 4.

1.10   Further analysis of different ways in which schemes could move towards the LD funding level could be undertaken to consider for example adopting higher risk investment strategies for longer or shorter periods, or adopting different recovery plan periods. However, analysis of this type is beyond the scope of this report.

1.11   We have also carried out a considerable amount of variant analysis in order to assist TPR consider the LTO approach they might adopt. A full overview of the analysis undertaken is displayed in Appendix C.

2 Methodology and assumptions

LD analysis approach

2.1 This section gives an overview of the methodology and assumptions used to derive the analysis of scheme outcomes in the period after they are assumed to have reached the LD funding level. These results are discussed in Section 3. The analysis for the period before a scheme reaches significant maturity, in Section 4, has been modelled in a similar manner with the exception that a less mature scheme is modelled and deficit reduction contributions are payable in the period before reaching LD funding.

2.2 For the central analysis we have simulated a representative large mature closed scheme where significant maturity is equivalent to a duration of approximately 14 years. Duration is a measure of the average length of time before liabilities are due to be paid. As a scheme matures and scheme members age, the scheme duration reduces. TPR requested a duration of around 14 years to be used for the central analysis, intended to represent a significantly mature scheme. We have also considered the implications of using a definition of significant maturity as a duration longer or shorter than 14 years.

Liabilities

2.3 The central analysis has then been based on determining liabilities for the simulated representative scheme using discount rates determined from the gilt yield curve, as at 31 March 2018, plus 0.5% per annum. This resulted in a starting LD liability value of £634m, which we have estimated to be equivalent to around 93% of the scheme liabilities determined on an insurance company buy-out basis. Our assumed buy-out pricing basis and PPF basis is based on our understanding of current market practice and PPF's current methodology.

2.4 The scheme experience has been modelled by projecting expected member benefit cashflows from a representative scheme over a 40 year period, allowing for assumed mortality rates, dependents benefits and future economic conditions. These cashflows are then used to determine liability values at each time point based on discount rate assumptions allowing for assumed market conditions at the relevant time point. Liability values have been calculated on the LD basis and an estimated insurance company buy-out pricing approach.

2.5 No allowance has been made within the liability figures for an expense reserve, except for a 2% addition when considering buy-out pricing. Additionally, whilst stochastic analysis has been adopted allowing for different economic scenarios, mortality has not been analysed on a stochastic basis. Both of these issues are outside of the scope of this analysis and being considered separately by TPR. Further details of the liability assumptions are included in Appendix A.

Assets

2.6 To project the scheme asset values, we have assumed a simple core investment strategy with a fixed 20% exposure to diversified return-seeking (growth) assets and the rest of the assets invested in government bonds and low risk liability driven investments (LDI). Chart 2 shows the asset allocations for this core hedged investment strategy.

Chart 2: Asset allocation for core hedged investment strategy
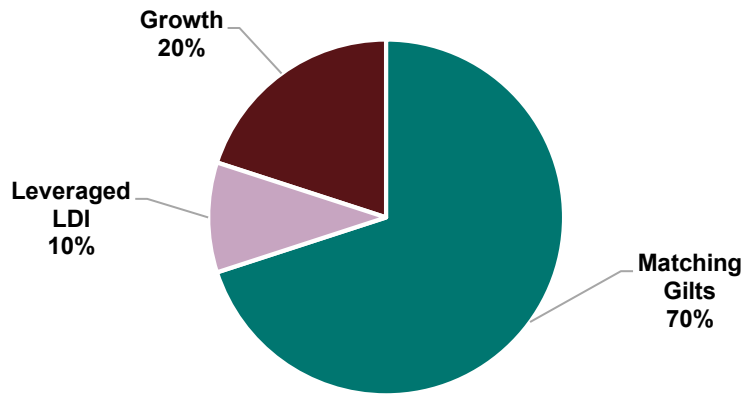
2.7   The LDI allocation is three times leveraged, which, combined with the matching gilt portfolio, provides full hedging of inflation and interest rate risks (provided the scheme is fully funded). The construction of the growth asset portfolio is shown in Table 4 below.

Table 4: Asset allocation for the growth asset portfolio

Portfolio	Allocation (%)			
	Global Equity	US High Yield Bonds	Hedge Funds	UK Property
Growth assets	50	17	17	16

2.8   Several alternative investment strategies have also been considered with varying allocations to growth and hedging assets. In particular we have considered an alternative portfolio with similar return expectations as the core hedged strategy but including a corporate bond investment allocation and hedging, using matching gilts and the leveraged LDI holdings, of less than 100% of the liabilities. This portfolio reflects feedback TPR received from schemes and advisors that they would typically expect to see mature schemes holding a corporate bond element within their portfolio.

2.9   Two investment strategies have been considered with higher investment return expectations, in order that a higher LD discount rate basis can be considered. The strategies are based on the core hedged strategy and the corporate bond strategy, but with an increased allocation to growth assets to increase the expected return in excess of gilts.

2.10   Asset values are determined at each future time point allowing for the assumed investment return of each asset class and the expected benefit cashflows to be paid from the scheme assets. For the purposes of the modelling, the investment strategies are assumed to be static over time with rebalancing carried out on an annual basis. The range of investment portfolios modelled are shown in Table 5. Appendix B also provides further details on portfolio returns and annual management charges (AMCs). Other expenses such as administration costs and PPF levies are assumed to be met by the sponsor.

Table 5: Modelled investment strategies

Strategy description	Asset allocation percentages				Level of interest rate and inflation hedging
	Growth assets	Matching gilts	3x leveraged LDI	Corporate bonds	
Core hedged	**20**	**70**	**10**	**0**	**100%**
Corporate bond	**10**	**25**	**10**	**55**	**55%**
More cautious	10	85	5	0	100%
More adventurous	25	62.5	12.5	0	100%
Unleveraged	30	70	0	0	70%
Core hedged variant	33.3	50	16.7	0	100%
Corporate bond variant	37.5	15	7.5	40	37.5%

Economic Scenario Generator (ESG)

2.11   Outcomes are simulated stochastically, by running through 1,000 future economic scenarios from an economic scenario generator (ESG) provided by a market leading scenario supplier. The ESG produces distributions of possible annual asset returns and economic factors such as price inflation and interest rates. These scenarios are used to project scheme asset and liability values on an annual basis, which enables calculation of the scheme funding level each year.

2.12   Current market conditions imply UK interest rates will stay low for decades. We have used an ESG that has been calibrated to be consistent with market conditions as at 31 March 2018 as shown in Chart 3. The dashed lines show the market implied fixed and index-linked gilt yields at various time points, and the solid lines show the ESG assumed yields. This shows the ESG calibration provides a projected yield path very close to that implied by the market.

**Chart 3: Summary ESG information**

Median projected gilt yields
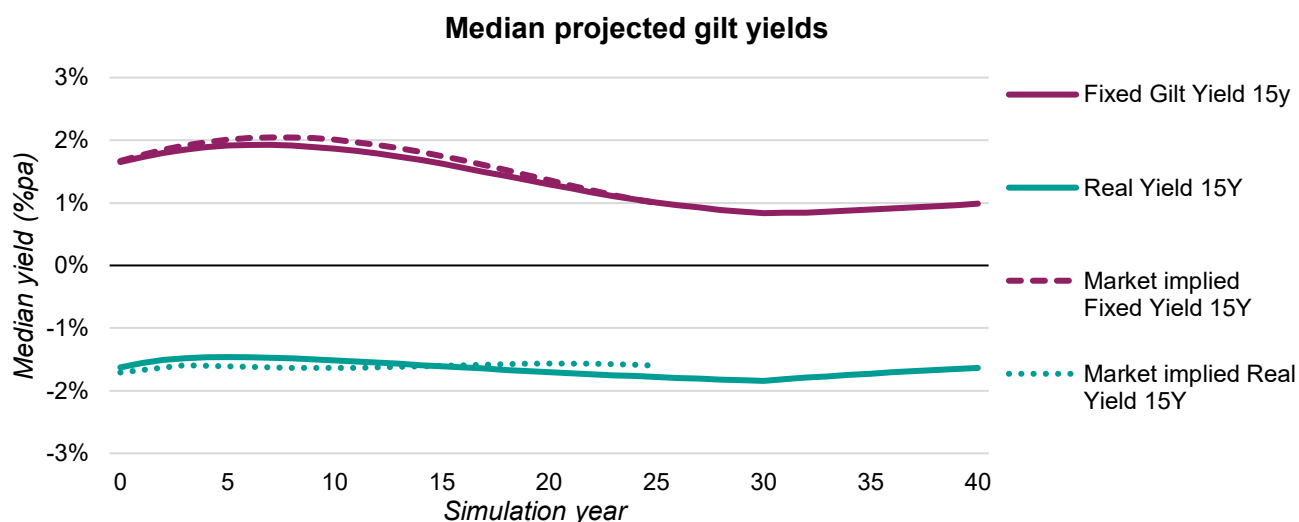
2.13   Some commentators suggest that market implied yields are reflecting distortions in the supply and demand for gilts, which will not be sustained. We have therefore also tested an alternative approach which assumes real gilt yields converge towards higher levels, than the market implies, in the future. Appendix C provides further details of the analysis on an alternative set of economic scenarios, which suggests based on the LD basis and investment strategies modelled scheme outcomes are not materially altered as a result. This is largely due to the high levels of interest rate and inflation hedging included in the investment strategies modelled.

Scheme details

2.14   As noted above, in 2.2 and 2.3, the analysis is based on a scheme of approximately 14 years duration, with starting LD liabilities of £634m. Chart 4 illustrates the median projected liabilities for this scheme over the first 40 years of projection. This illustrates that, although scheme cashflows continue for over 50 years, after 25 years the median LD liability has fallen to around a quarter of the initial value.

Chart 4: progression of median LD liabilities over time for the central analysis

Median LD Liabilities
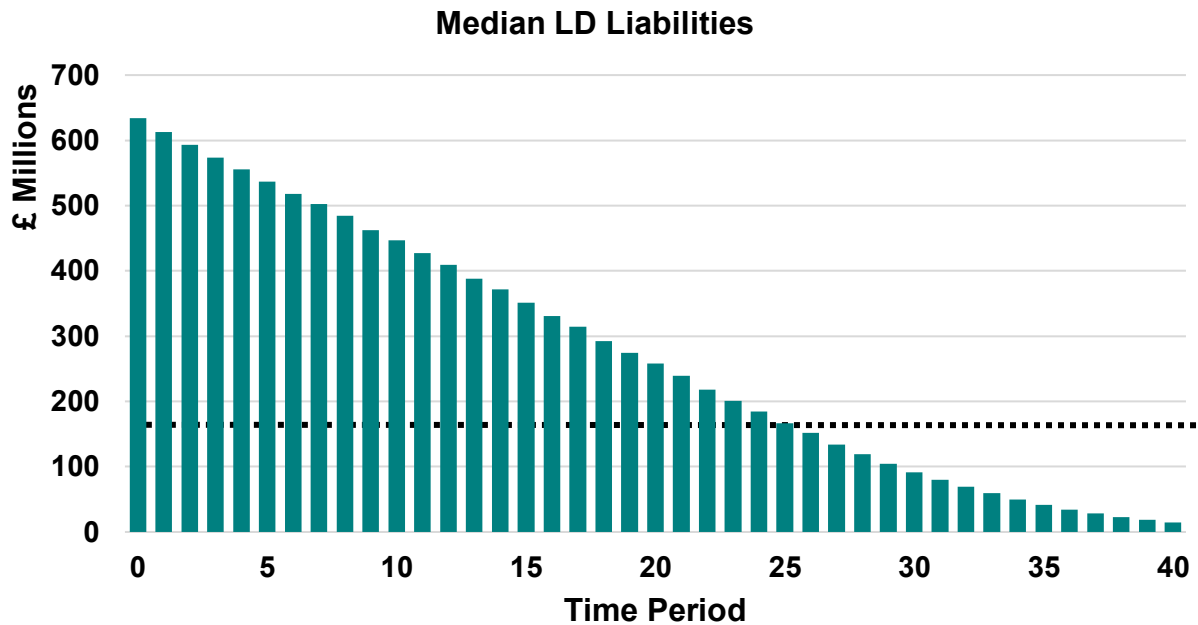
2.15   Chart 5 overleaf shows the progression of the scheme's duration on the LD basis over the same 40 year projection period. This indicates that duration has approximately halved by the 25 year point of the projection. Given the significant reduction in liability value and duration after 25 years it was considered appropriate to test progress of scheme funding at this point.

Chart 5: duration change over time for central case scheme

Scheme duration over time calculated on LD basis
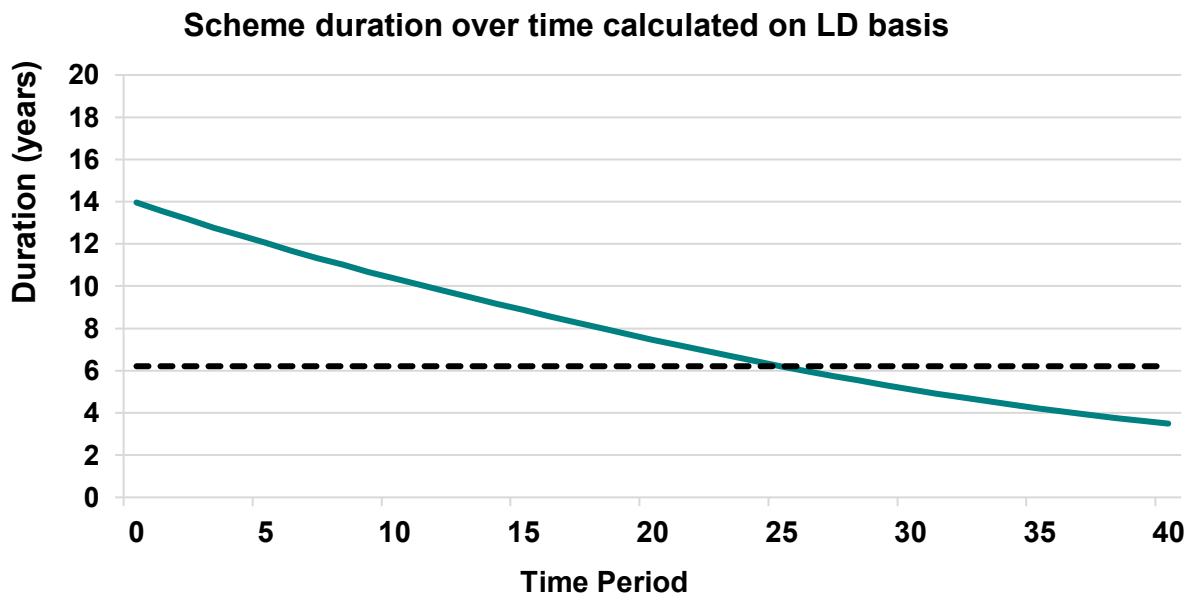
3 LTO outcomes

3.1   TPR consider a scheme's LTO should mean by the time it is significantly mature the scheme has low future dependency on a scheme's sponsor and is invested with a high resilience to risk. In this section we summarise our analysis after the point of significant maturity to test the impact of different LD funding levels and investment approaches on the security of members' benefits.

3.2   Scenarios are modelled over periods up to 40 years after the point of significant maturity is reached. However, as noted in Sections 1 and 2, outcomes are assessed over the initial 25 years by which point the scheme has significantly reduced in size. This is considered a reasonable time frame for significantly mature schemes to target a full buy-out of member benefits. Separately we have also assessed the impact of the scheme running on for 40 years. The results of this are shown in Appendix C, but have shown minimal impact on the likelihood of the scheme reaching buy-out funding without further sponsor support.

3.3   The LD funding target and investment strategy can be set so as to offer a high probability of achieving buy-out without relying on sponsor support. However, the higher the LD funding target the greater the contributions required to reach that level. Hence, there is a balance between affordability of the LD funding target and the certainty in reaching buy-out funding.

3.4   We have considered a central LD basis using a discount rate of gilt yields + 0.5% pa. This produces initial liabilities of £634m and we therefore set the initial assets to £634m such that the scheme is 100% funded. At this point the starting funding level is equivalent to around 93% of the estimated buy-out cost, before allowance for winding up expenses.

3.5   Table 6 illustrates outcomes on the central LD basis for the range of investment strategies set out in Section 2. To put the shortfalls below in context the median estimated buy-out cost, including expenses, at time 0 is around £694m and by time 25 is around £178m.

Table 6: Indicative LTO outcomes (gilts + 0.5% pa)

| Investment Strategy	Explicit Hedging	Mean 25 year return in excess of gilts (pa)	Probability of reaching buy-out funding	Average shortfall at 25 years for scenarios not reaching buy-out		% unpaid cashflows as a proportion of total cashflows	
				Buy-out basis	PPF basis	for schemes not reaching buy-out	for all scenarios
Core hedged	100%	1.0%	72%	£47m	£38m	7%	2%
Corporate bond	55%	1.0%	82%	£65m	£51m	6%	1%
More cautious	100%	0.5%	29%	£39m	£29m	6%	4%
More adventurous	100%	1.3%	80%	£53m	£44m	9%	2%
Unleveraged	70%	0.9%	73%	£82m	£67m	10%	3%

3.6   The percentage of unpaid cashflows shown in the final two columns of the table provides an indication of the extent to which member benefits might be at risk. For each of the scenarios that does not reach buy-out funding, we calculate the nominal amount of benefit cashflow expected to be paid after year 25 to the end of the 40 year projection period. We then calculate the amount of these cashflows that are assumed to be paid by multiplying by the buy-out funding level at time 25, ie if the scheme has an 80% buy-out funding level at time 25 we assume 80% of the remaining benefit cashflows will be paid. The final column in the table then shows the unpaid amount as a percentage of the first 40 years cashflows under all 1,000 scenarios, and the penultimate column shows the unpaid amount as a percentage of the first 40 years cashflows just for the scenarios that do not reach buy-out funding.

3.7   The scenarios in which the scheme does not reach a buy-out funding level within 25 years vary depending upon the investment strategy followed. In particular the scenarios for the corporate bond strategy, which don't reach buy-out funding have higher average LD deficits at the 25 year point than the scenarios that don't reach buy-out funding for the 100% interest rate and inflation hedging investment strategies. This is likely to reflect that the corporate bond strategy, without 100% interest rate and inflation hedging, is expected to be less effective in scenarios where inflation is high or interest rates are low both of which lead to higher LD liability figures.

3.8   In practice, whilst a scheme sponsor exists, it would be expected that further financial support might be available. Where the sponsor is no longer able to support the scheme it would be expected that the scheme would likely enter a PPF assessment period. Therefore, members are unlikely to be fully exposed to the most extreme negative scenarios illustrated.

Impact of investment strategy

3.9   The analysis indicates that increasing the proportion of growth assets, whilst retaining full hedging of interest rate and inflation risks (more adventurous), tends to increase success rates. Although not shown in the above table, we have tested this up to a 40% allocation to growth assets and the pattern continues to hold. However, in scenarios with higher levels of growth assets the negative returns and hence funding shortfalls are more severe in the most extreme downside scenarios.

3.10   Comparing the Core hedged strategy with the Corporate bond strategy illustrates an expected improvement in the probability of reaching buy-out, but can also lead to larger shortfalls in downside scenarios. Comparing the two strategies:

- mean returns over 25 years are the same
- the Corporate bond strategy provides a 10% increase in the chance of reaching buy-out within 25 years
- the Corporate bond strategy increases the nominal average shortfall in scenarios not reaching buy-out by around 35%
- the economic scenarios that result in the scheme not reaching buy-out funding vary between the strategies

3.11   Our use of stochastic modelling allows a distribution of outcomes to be generated reflecting the range of 1,000 economic scenarios considered. Charts 6 and 7 show the distribution of funding level (on a buy-out basis) at the 25 year point for scenarios that have not reached buy-out. Chart 6 is based on the Core hedged portfolio and Chart 7 on the Corporate bond portfolio.

3.12 These two charts show the higher number of scenarios that do not reach buy-out within 25 years using the Core hedged portfolio (because there are more scenarios shown on the top chart than the bottom chart). However, this still represents relatively few of the 1,000 scenarios modelled. The charts also illustrate that the spread of funding outcomes for those not reaching buy-out is similar under both strategies, with the majority of scenarios in the 60% to 100% funding level range.

Chart 6: Distribution of scenarios not reaching buy-out funding by time 25 for the Core hedged portfolio
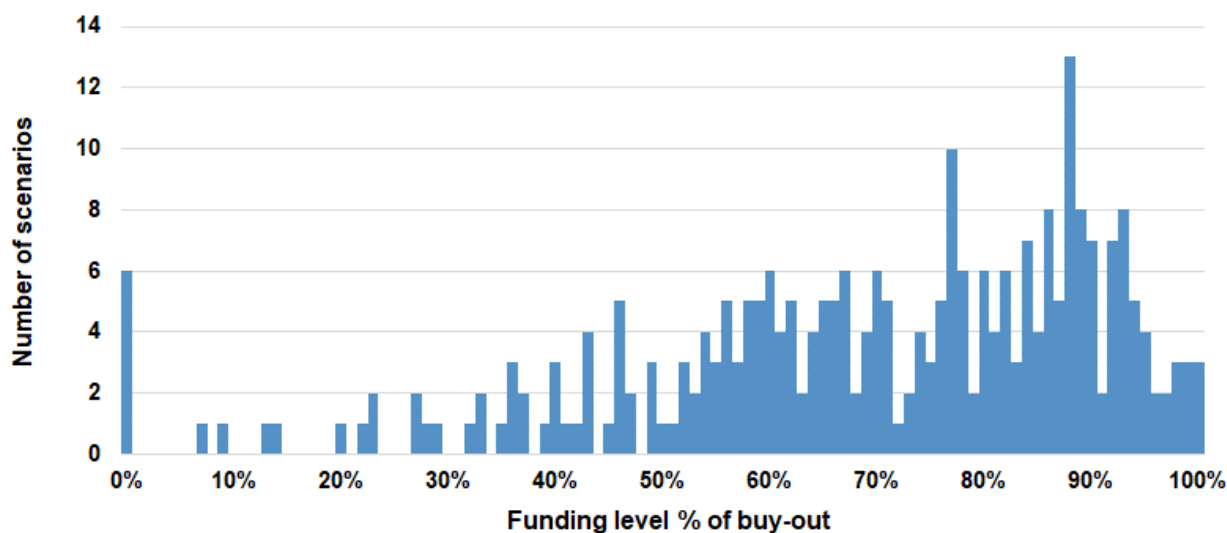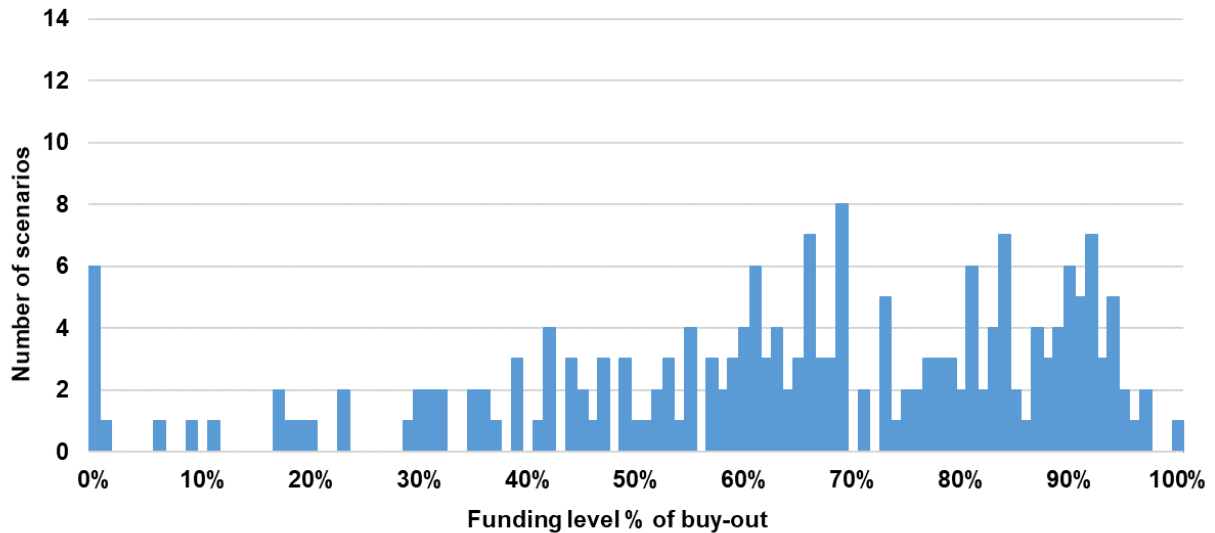

**Chart 7: Distribution of scenarios not reaching buy-out funding by time 25 for the Corporate bond portfolio**
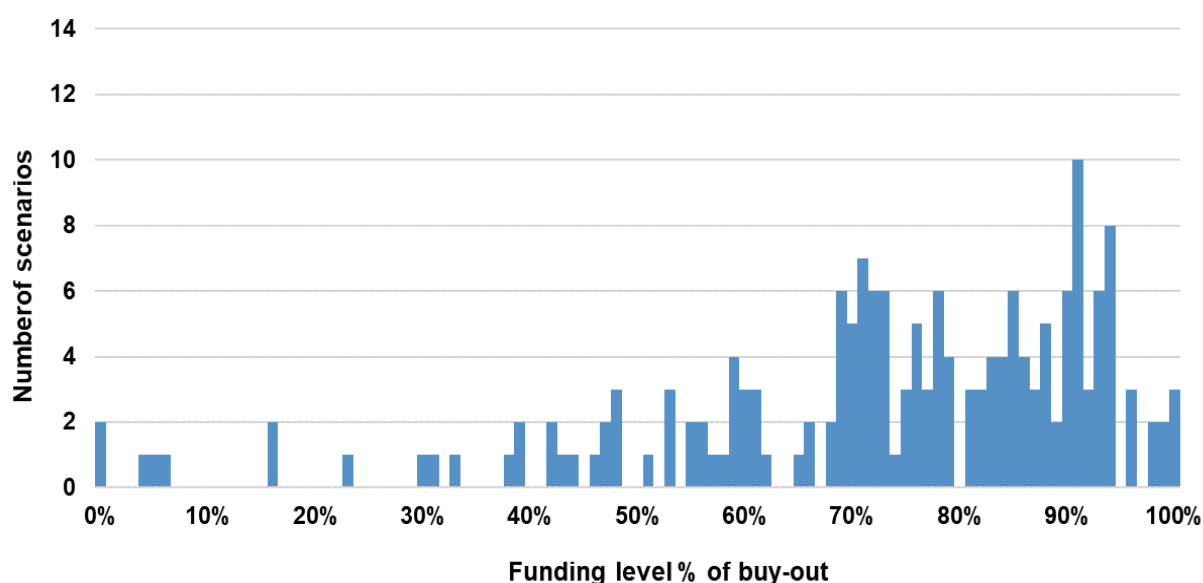
3.13 The equivalent spread of outcomes for the More adventurous portfolio is ilustrated in Chart 8. This demonstrates a similar spread of outcomes to the Core hedged strategy, with a greater number running out of assets compared to the Corporate bond strategy.

Chart 8: Distribution of scenarios not reaching buy-out funding by time 25 for the More adventurous hedged portfolio

3.14 Changing the point of analysis from 25 years after inception to 40 years does not result in significant uplifts in the proportion of scenarios reaching buy-out funding (less than a 5% change). However, the scenarios not reaching buy-out have largely run out of assets by the 40 year point, although the scale of the scheme later in the 40 year period is much smaller as shown in Chart 4 in Section 2. Appendix C provides further details of this analysis.

3.15 The charts above indicate that there are risks of the scheme running out of money in some market conditions. However, as noted earlier, in practice it would be expected that sponsor support, or PPF support would be received before reaching this point.

3.16 Although the analysis presented above is shown at the 25 year point of the projection, the underlying modelling provides information for each year of the projection. We have therefore also considered, illustrated in Chart 9 overleaf, the impact of different investment strategies on the risk of the scheme being underfunded over shorter time periods.

3.17 Chart 9 highlights that, over the short term, investment strategies with higher allocations to growth assets have a higher chance of funding falling below 95% of the LD funding level. However, over time the lower expected return of strategies with very low allocations to growth assets cause the likelihood of falling below 95% LD funding to steadily rise to higher levels than for the other strategies.

3.18 In the short term, before the scheme has had opportunity to generate additional return and reach a level of funding equivalent to buy-out pricing, the scheme is exposed to the risk of sponsor insolvency. If sponsor insolvency does occur, the weaker the funding position of the scheme at that time the more likely the members are to suffer a benefit reduction.

Chart 9: Proportion of modelled scenarios in which the LD funding level drops below 95%
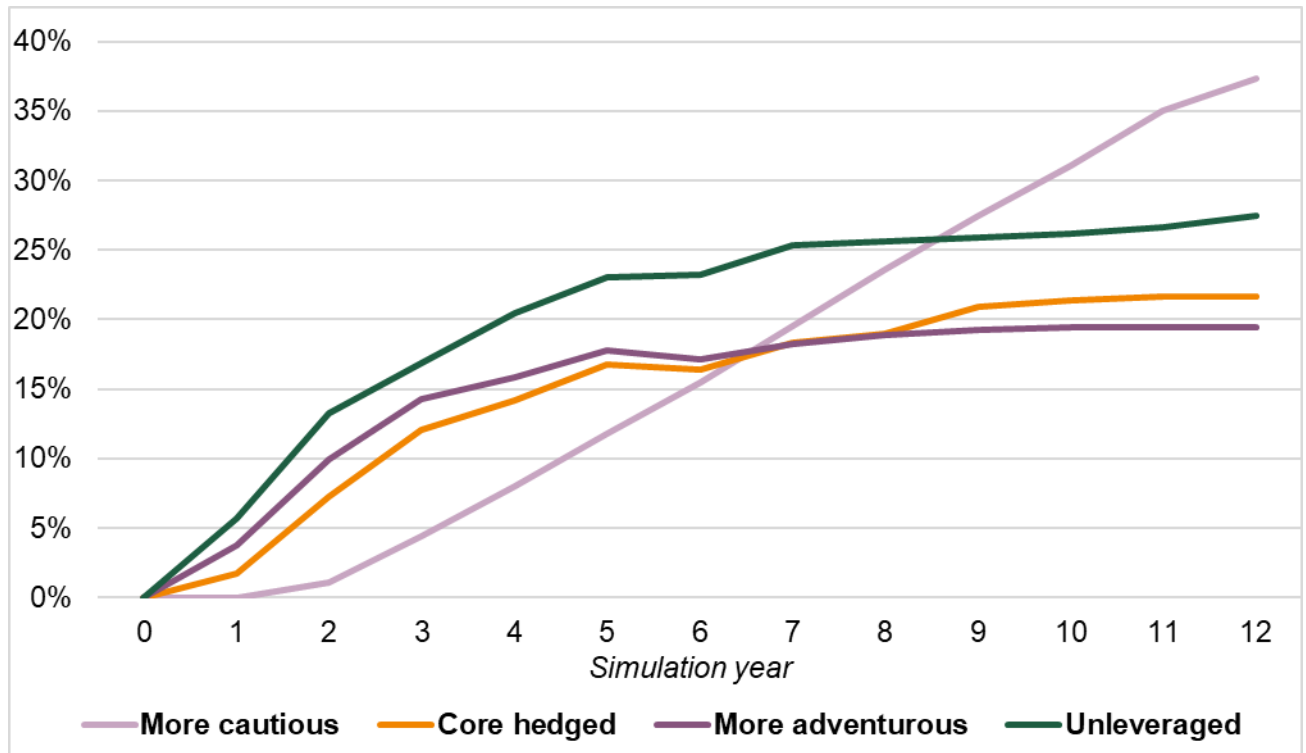
Impact of LD level

3.19 As well as different investment strategies, we have also analysed the impact of setting the LD funding target at different levels. Adopting a LD discount rate of gilts plus 0.25% pa, rather than 0.5% pa, increases the required LD funding level to about 96% of the estimated buy-out cost before wind-up expenses. This requires initial scheme assets of £656m rather than £634m for the gilts + 0.5% pa approach. As might be expected this increases the likelihood of reaching a buy-out within the 25 year assessment period, but requires higher funding to be provided before the LD funding level is reached.

3.20 Table 7 overleaf summarises the analysis of a gilts + 0.25% pa LD funding target using the same investment strategies as shown in Table 6. Comparing the results in Tables 6 and 7, for the Core hedged strategy, a gilts + 0.25% pa LD approach increases the likelihood of reaching buy-out in the first 25 years from 72% to 89%. This increase in likelihood of reaching buy-out necessitates an additional £22m (or around 3.5% of the gilts + 0.5% pa liability) in scheme assets.

3.21 We have also carried out analysis using a LD discount rate of gilts + 0.75% pa, with the same investment strategies as the central analysis, and using a LD discount rate of gilts + 1% pa, with the core hedged variant and corporate bond variant investment strategies. The variant investment strategies are necessary for the gilts + 1% pa approach to ensure the expected investment return exceeds the discount rate.

3.22 Table 8 overleaf illustrates the results for both the gilts + 0.75% pa and gilts + 1% pa approaches. Whilst the higher return expectations of the investment portfolios for the gilts + 1% pa approach results in a reasonable level of scenarios reaching a buy-out level of funding, the downside for the scenarios not reaching buy-out is materially greater than for other LD discount approaches. This reflects the higher risk required to be taken in the investment strategy in an attempt to achieve higher returns.

Table 7: Indicative LTO outcomes (gilts + 0.25% pa)

Investment Strategy	Hedging	Mean 25 year return in excess of gilts (pa)	Probability of reaching buy-out	Average shortfall at 25 years for scenarios not reaching buy-out		% unpaid cashflows as a proportion of total cashflows	
				Buy-out basis	PPF basis	for schemes not reaching buy-out	for all scenarios
Core hedged	**100%**	**1.0%**	**89%**	**£40m**	**£30m**	**7%**	**1%**
Corporate bond	**55%**	**1.0%**	**93%**	**£61m**	**£56m**	**5%**	**0%**
More cautious	100%	0.5%	70%	£25m	£18m	4%	1%
More adventurous	100%	1.3%	91%	£49m	£37m	8%	1%
Unleveraged	70%	1.0%	85%	£69m	£53m	8%	1%

Table 8: Indicative LTO outcomes (gilts + 0.75% pa and gilts + 1% pa)

Investment Strategy	LD basis (pa)	Probability of reaching buy-out	Average shortfall at 25 years for scenarios not reaching buy-out		% unpaid cashflows as a proportion of total cashflows	
			Buy-out basis	PPF basis	for schemes not reaching buy-out	for all scenarios
Core hedged	Gilts + 0.75%	54%	£57m	£47m	9%	4%
Corporate bond	Gilts + 0.75%	64%	£72m	£56m	7%	2%
More cautious	Gilts + 0.75%	6%	£61m	£47m	9%	8%
More adventurous	Gilts + 0.75%	66%	£62m	£52m	10%	3%
Unleveraged	Gilts + 0.75%	59%	£89m	£75m	11%	5%
Core hedged variant	Gilts + 1%	66%	£85m	£70m	14%	5%
Corporate bond variant	Gilts + 1%	72%	£119m	£97m	14%	4%

Timing of reaching significant maturity

3.23 Under the central LTO analysis schemes are assumed to be significantly mature when their duration is around 14 years. We tested the impact of defining significant maturity at different durations. For this purpose we have considered a scheme reaching significant maturity at a duration around 12 years or alternatively at around 17 years. Table 9 summarises the analysis for the core hedged and corporate bond investment strategies.

3.24 The analysis in Table 9 shows that at a shorter duration, ie a more mature scheme, there is a marginal improvement (c. 2-3%) in the likelihood of reaching buy-out within 25 years and minimal difference in the average shortfall in those scenarios not reaching buy-out. Considering the longer duration alternative, the analysis indicates the likelihood of reaching buy-out within 25 years and the average shortfall in those scenarios not reaching buy-out are equivalent to those in the central case.

3.25 The above outcome is primarily because buy-out terms are more favourable for schemes with shorter durations and therefore the LD funding target gets closer to buy-out funding over time. There is a balance to strike between the size of sponsor contributions required, the period over which the scheme is most exposed to sponsor insolvency risk and the likelihood of achieving buy-out funding after reaching the LD funding target.

Table 9: The impact of different duration upon reaching the LTO

Assumed Scheme Duration[6] representing significant maturity (Years)	Indicative LD discount rate basis (pa)	Long-term investment strategy	Likelihood of achieving buy-out funding within 25 years	Unpaid cashflows as a proportion of total cashflows	
				Across scenarios not reaching buy-out	Across all scenarios
14	Gilts + 0.5%	Core hedged	72%	7%	2%
14	Gilts + 0.5%	Corporate bond	82%	6%	1%
12	Gilts + 0.5%	Core hedged	75%	7%	2%
12	Gilts + 0.5%	Corporate bond	80%	6%	1%
17	Gilts + 0.5%	Core hedged	72%	7%	2%
17	Gilts + 0.5%	Corporate bond	82%	6%	1%

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[6] This is modified duration determined by the sensitivity to small changes in the discount rate from the gilts + 0.5% pa basis

3.26   We have also completed analysis to consider the impact of testing whether the longer duration scheme has reached a buy-out level of funding after 30 years, by which time its duration would be roughly equivalent to the central scheme after 25 years. This analysis indicated that the likelihood of reaching a buy-out funding level is slightly improved (1%-2%) relative to assessing the outcomes after 25 years. Further details of the various scenarios considered are included in Appendix C.

3.27   The impacts of when a scheme is required to reach the LD funding target are therefore expected to be fairly minor in terms of the likelihood of achieving buy-out funding. However, they do have the following implications:

- the quicker schemes are required to reach the LD funding target, the higher the necessary sponsor contributions will be
- the slower schemes are required to reach the LD funding target, the longer member benefit security is exposed to weakening of the sponsor covenant

3.28   Targeting LD funding when a scheme has a longer duration, ie earlier in the scheme's lifetime, would generally be beneficial for member security as it would bring forward the time when schemes are fully funded on a low risk basis. Conversely, it would require higher sponsor contributions and the likelihood of reaching buy-out within 25 years is slightly reduced, because of buy-out pricing, so reliance on sponsor support is potentially greater than in the central case.

Buy-out pricing

3.29   Our analysis relies on our assumed buy-out pricing basis, which is based on our understanding of current market practice. Buy-out pricing may prove to be different for a particular scheme and could change materially in future for various reasons such as changing regulatory requirements, different levels of supply and demand and changes to life expectancies. We have therefore tested the sensitivity of our analysis to a step change in buy-out pricing.

3.30   Table 10 shows the impact on the analysis of higher buy-out pricing than the central assumption, without any change to a scheme's assets. This has only been considered for the central analysis and Core hedged investment strategy to illustrate sensitivity.

Table 10: Sensitivity of outcomes to buy-out pricing (gilts + 0.5% pa LD basis, Core hedged investment strategy)

Buy-out pricing	Probability of reaching buy-out within 25 years	Average shortfall at 25 years for scenarios not reaching buy-out		% unpaid cashflows as a proportion of total cashflows	
		Buy-out basis	PPF basis	for schemes not reaching buy-out	for all scenarios
Core	72%	£47m	£38m	7%	2%
+5%	67%	£49m	£37m	7%	2%
+10%	63%	£51m	£37m	7%	3%

3.31   These figures indicate that, even with a 10% increase in buy-out pricing, there remains a better than 50% chance of reaching buy-out within 25 years with no further financial support. Furthermore, in scenarios where buy-out funding is not attained, the average shortfall is not materially different as a result of the higher buy-out pricing. Further details of the analysis we have carried out is included in Appendix C.

4 Pre significant maturity

4.1 Section 3 analyses the impact of setting the LD funding target at different levels. However, many defined benefit pension schemes are currently some way from reaching significant maturity, and their funding levels are lower than the LD target. We have therefore modelled a selection of "archetype" schemes, which are intended to represent some of the range of schemes regulated by TPR, in the period before they reach significant maturity and would be expected to reach the LD funding level.

4.2 This modelling considers current funding levels and funding approaches, and indicates the likelihood of such an approach resulting in the scheme reaching the LD funding level. For this analysis we have used a scheme with an initial duration of around 20 years, which would be expected to reach a duration of around 14 years in 15 years' time. Therefore, we have modelled the development of the funding level and recovery plans over the next 15 years at which point the scheme would have reached a position of significant maturity and we assess whether the archetype is likely to have reached the LD target.

Method of analysis

4.3 In order to check the affordability of a chosen LD target it is necessary to model scheme behaviour and outcomes prior to the scheme reaching significant maturity. For the purposes of this report we have confined our analysis to the consideration of several "archetype" schemes and assessed the extent to which their current funding approach would be expected to be sufficient to reach the LD target by the time they reach a duration of 14 years. We have considered this on the gilts + 0.5% pa and gilts + 0.25% pa LD bases.

4.4 This analysis is intended to provide some context for setting the LD target, but does not reflect the full range of possible scheme positions or the ways in which funding could be changed to improve the chance of the LD funding target being achieved.

4.5 During the period before reaching significant maturity we have adopted the same method and assumptions as used for the LD analysis and summarised in Section 2. However, we have also allowed for deficit recovery contributions to be paid to target 100% funding on the assumed Technical Provisions (TP) funding basis. Each archetype has a different TP basis, which affects the likelihood of it reaching a LD funding level. When setting deficit recovery contributions we have also included a limit on the size of contributions where there is assumed to be a weak sponsor covenant.

4.6 We have considered three separate archetype schemes for this analysis, with LD liabilities, on a gilts + 0.5% pa basis, of £958m at the starting point (full details are included in Appendix A):

A. A scheme with a strong sponsor covenant, reasonably well funded and seeking to pay off deficits quickly: adopting five year recovery plans, mid-range basis for setting Technical Provisions (TPs) and a 55% growth investment approach, which we understand is a more mid-range strategy used by schemes that TPR regulate

B.   A scheme with a strong sponsor covenant adopting a high risk investment and funding strategy and reluctant to pay off the deficit quickly: adopting fifteen year recovery plans, a relatively weak basis for setting Technical Provisions (TPs) and an 80% growth investment approach, which we understand is at the risky end of the range of strategies used by schemes that TPR regulate

C.   A scheme with a weak sponsor covenant and poorly funded: adopting fifteen year recovery plans capped for affordability[7], a relatively weak basis for setting Technical Provisions (TPs) and a 70% growth investment approach, in practice we understand that there are relatively few schemes which are likely to be constrained in terms of future contributions in this way

4.7   In each of these cases, the investment strategy is assumed to de-risk over time as the scheme matures. The TP basis for each scheme adjusts consistently with this de-risking through the use of a higher pre-retirement discount rate than post-retirement discount rate. Consequently, as the scheme matures the effective discount rate reduces, as does the expected return on the scheme assets.

4.8   Deficit recovery contributions (DRCs) are set each three years based upon the funding level on the relevant TP basis. The TP bases reflect approaches currently being used by pension schemes of the type described. Therefore, at the duration at which we test to see if the scheme has reached the LD funding target, the TP basis will not match the LD basis which therefore reduces the likelihood the scheme will have reached the LD funding target.

4.9   No allowance is made in the analysis for sponsor failure and hence all contributions under a recovery plan are assumed to be paid. For the archetype with a weak sponsor covenant, deficit recovery contributions (DRCs) are limited (in nominal terms) to the amount that was payable at the start of the projection. Therefore, in some scenarios this can result in a recovery plan longer than 15 years in length. Those schemes with a strong sponsor covenant have no limit applied to the level of DRCs that can be paid.

Archetype A: Strong covenant, short recovery plan, typical funding strategy

4.10   Archetype A is assumed to be funded at 91% of TPs at the start of the projection period. This is equivalent to around 71% of the estimated cost of buying-out before wind-up expenses, 83% of the LD liabilities on gilts + 0.5% pa and 79% of the LD liabilities on gilts + 0.25% pa. Table 11 summarises the projected funding outcomes after 15 years and the level of DRCs that arise during this period for the scenarios which result in the related outcome. For example 57% of scenarios result in the scheme reaching buy-out funding. These are typically scenarios in which investment markets have been beneficial and as a result the median DRCs payable are only 8% of the initial TPs (or less than the initial TP deficit). The analysis shows that over the next 15 years relatively high levels of DRCs are likely to be payable to meet the defined recovery plan, but this results in a fairly high likelihood of the archetype reaching at least the LD funding level.

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[7] The annual contribution cap is set at the initial rate of DRCs, which is equivalent to 1.7% of the starting TP liability

Table 11: Archetype A funding position at time 15 (main figures gilts + 0.5% pa, figures in brackets gilts + 0.25% pa)

Outcome by 15 year point	Likelihood	Average shortfall at 15 years relative to LD	Median DRCs as % of initial TPs
Buy-out	57% (57%)	- (-)	8% (8%)
Reach 100% of LD	17% (9%)	- (-)	18% (17%)
Between 95% and 100% LD	12% (14%)	£19m (£24m)	18% (18%)
Less than 95% of LD	13% (20%)	£80m (£92m)	19% (19%)

4.11   The table also indicates that in the majority of scenarios, this approach to funding results in the archetype scheme reaching a higher funding level than the LD target and is potentially in a position to buy-out with an insurance company.

Archetype B: Strong covenant, long recovery plan, riskier funding strategy

4.12   Archetype B is also assumed to be funded at 91% of TPs at the start of the projection period. However, the TP basis is weaker than for archetype A and therefore this is only equivalent to around 62% of the estimated cost of buying-out before wind-up expenses, 72% of the LD liabilities on gilts + 0.5% pa and 69% of the LD liabilities on gilts + 0.25% pa. Table 12 summarises the expected funding outcomes after 15 years and the level of DRCs that are expected to be paid during this period. The analysis shows that over the next 15 years there is a low likelihood of the archetype reaching at least the LTO funding level and that much lower levels of DRCs are paid than for archetype A.

Table 12: Archetype B funding position at time 15 (main figures gilts + 0.5% pa, figures in brackets gilts + 0.25% pa)

Outcome by 15 year point	Likelihood	Average shortfall at 15 years relative to LD	Median DRCs as % of initial TPs
Buy-out	28% (28%)	- (-)	3% (3%)
Reach 100% of LTO	6% (3%)	- (-)	9% (9%)
Between 95% and 100% LTO	7% (5%)	£20m (£24m)	7% (6%)
Less than 95% of LTO	59% (63%)	£165m (£181m)	18% (17%)

4.13   Archetype B indicates that for a scheme following a weaker funding approach than archetype A, with a high level of growth assets in their strategy, there is a large amount of variation in outcome. This reflects the greater volatility between the asset values and liability values produced by such a strategy. Furthermore, funding in this manner in the majority of scenarios is not expected to be sufficient to reach a LD funding level by the time the scheme reaches a duration of 14 years.

Archetype C: Weak covenant, long recovery plan, poorly funded

4.14   Archetype C is assumed to be funded at 81% of TPs at the start of the projection period. The TP basis falls between that for archetype A and archetype B and the result is that the funding position is equivalent to around 59% of the estimated cost of buying-out before wind-up expenses, 69% of the LD liabilities on gilts + 0.5% pa and 66% of LD liabilities on gilts + 0.25% pa, which is similar to archetype B. Table 13 summarises the expected funding outcomes after 15 years and the level of DRCs that are expected to be paid during this period. The analysis shows that over the next 15 years outcomes are similar to archetype B with a low likelihood of reaching LTO funding, but with a wider range of DRCs paid.

Table 13: Archetype C funding position at time 15 (main results gilts + 0.5% pa, figures in brackets gilts + 0.25% pa)

Outcome by 15 year point	Likelihood	Average shortfall at 15 years relative to LD	Median DRCs as % of initial TPs
Buy-out	20% (20%)	- (-)	7% (7%)
Reach 100% of LTO	9% (4%)	- (-)	12% (12%)
Between 95% and 100% LTO	11% (8%)	£21m (£19m)	15% (15%)
Less than 95% of LTO	61% (68%)	£182m (£192m)	24% (23%)

4.15   Archetype C is more complex than A and B because the level of DRCs payable can be limited due to the assumed weak covenant. This, together with an investment strategy that initially includes a 70% allocation to growth assets, leads to a wide spread of potential outcomes. However, overall continued funding on this approach is not expected to be sufficient for the scheme to achieve a LD funding level by the time it reaches a duration of 14 years.

Conclusion

4.16   The analysis suggests that the likelihood of schemes reaching a LD funding level by a duration of 14 years depends heavily on the strength of the TPs, the level of DRCs paid and, to the extent DRCs are limited by the strength of the sponsor, the initial funding level. The analysis also identifies that, for scheme's currently funding in the manner of archetypes B or C, they would need to increase future funding to improve the chances of reaching a LD funding level. Therefore, trustees are likely to reconsider their funding approach in order to improve their chances of reaching a LD funding level.

4.17   Further analysis of the period before schemes reach significant maturity should be carried out to consider the different paths that could be taken for a scheme to reach LD funding. Such analysis can consider the balance between the affordability for sponsors against the risk to members benefit from lower levels of funding and higher risk investment strategies. However, such analysis is beyond the scope of this report.

5 Limitations and risks

5.1 The GAD analysis has been carried out for TPR to help illustrate the relative levels of risk to member benefits and the PPF as a result of setting a long-term funding target at a variety of different levels. There is no modelling of sponsors so there is no allowance for insolvency or unpaid contributions in the period before scheme's reach significant maturity.

5.2 Further analysis would be required to understand the impact of different approaches to funding, eg different recovery periods, alternative investment strategies etc, on the likelihood of reaching a chosen LD funding target. Such analysis is necessary to consider the implications of different LD funding targets on sponsor affordability.

5.3 The analysis illustrates the level of risk in several alternative investment strategies. It is not intended to represent the only strategies available to schemes or to propose a strategy that should be adopted. It is instead focused on the different levels of investment risk that might be adopted. The investment strategies are generally fixed apart from annual rebalancing to maintain hedging and asset allocation proportions. In practice it would be expected that strategies might adapt to changing conditions, with the intention of reducing the impact of the most negative scenarios.

5.4 The analysis is a simplified representation of the defined benefit pension scheme system and, for example, assumes that the relative value of buy-out pricing remains stable, perfect hedging can be achieved, the modelled scheme is representative and no regulatory action or financial support is provided to the scheme during the projection period. Other longer term external factors, such as climate change or longevity improvements being different from current assumptions are also not considered.

5.5 The assumptions adopted for the analysis, both in terms of benefit cashflows and economic changes, are intended to provide a reasonable projection of possible outcomes without material bias for prudence or optimism. However, it should be recognised that different outcomes remain possible. The economic simulations underpinning the analysis are provided by a market leading scenario provider and calibrated closely to conditions and market implied interest rate paths as at 31 March 2018. Many asset-liability models do not calibrate as tightly to market prices, though as we assume that the scheme is fully hedged in the period after reaching significant maturity, the sensitivity of the analysis to the scenario calibration is limited.

5.6 The analysis is based on the RPI calculation method applying at the date of the report. The Chancellor of the Exchequer on 4 September 2019 stated that a consultation on the future calculation of RPI would begin in January 2020 and consider a revised approach being introduced between 2025 and 2030. The outcomes of the analysis might be affected if changes to RPI created difficulties for schemes hedging their inflation exposure and/or caused material distortions between the expected returns on assets and expectations of future inflation. The impact of such possible changes have not been considered in this report.

5.7 The modelling covers 1,000 possible scenarios and the outputs presented illustrate the probability of certain outcomes based on these scenarios. In practice all schemes will face the same economic conditions at the same time and there is therefore risks from accumulations of risk if all scheme adopt similar strategies.

5.8 The DWP white paper refers to consolidation and new vehicles that would be able to take on schemes at less than buy-out funding levels. In future it may be possible for funds to transfer into consolidation vehicles, either before or after reaching significant maturity. We have made no allowance for this possibility in the modelling. However, the funding level required to enter a consolidation vehicle might influence pension fund behaviour and TPR's decision regarding an appropriate LD funding level.

5.9 The analysis should not be used for any other purpose than noted above. Other than TPR, no person or third party is entitled to place any reliance on the contents of the analysis. GAD has no liability to any person or third party for any action taken or for any failure to act, either in whole or in part, on the basis of the analysis.

5.10 For those outside TPR, this paper should be read alongside TPR's consultation paper on the new DB funding code which sets out more detail about the LTO and purpose.

5.11 This work has been carried out in accordance with the applicable Technical Actuarial Standard: TAS 100 issued by the Financial Reporting Council (FRC). The FRC sets technical standards for actuarial work in the UK.

Appendix A – Scheme Details

This section provides further details of the scheme and assumptions used in the analysis in this report. Detailed pension scheme assumptions

| Scheme information	
Data set	Member pension amounts from anonymised scheme for which GAD is the Scheme Actuary. Membership of c10,000+. Membership aged or adjusted to generate schemes of required duration
Future benefit accrual	Assumed all members are pensioners or deferred pensioners

Pension increases:
 	
    Pre-97 service
 	
    Post-97 service
	
	RPI
	
	RPI capped at 5%

PPF increases:
 	
    Pre-97 service
 	
    97-09 service
 	
    Post-09 service
	
	0%
	
	CPI capped at 5% pa
	
	CPI capped at 2.5% pa

Cash commutation	90% of maximum allowance commuted for cash on retirement
Investment strategy	Various fixed allocations considered, centred on 80% matching assets, 20% return seeking, with full hedging of interest and inflation risks
Economic Scenario Generator	Moody's "Best Views" calibration adjusted such that the path of interest rates more closely matches market yields
Run number	1,000

Actuarial basis	
Inflation	Expected RPI inflation derived from gilt curves
CPI assumption	RPI - 1.1% (for liability calculations)
Economic Scenario Generator (ESG)	Moody's "Best Views" calibration adjusted such that the path of interest rates more closely matches market yields
Economic Scenarios	1,000 scenarios taken from the ESG
Liability calculation discount rates	Based on adjustments to the gilt yield curves in the ESG. The table below provides the gilt yield adjustments for the various liability calculations
Expense allowance	2% addition to liabilities for buy-out Investment expenses detailed in Appendix B

Liability discount rates		
Basis	**Pre-retirement gilt curve adjustment**	**Post-retirement gilt curve adjustment**
LD (gilts + 0.25% pa)	+0.25% pa	+0.25% pa
LD (gilts + 0.5% pa)	+0.5% pa	+0.5% pa
LD (gilts + 0.75% pa)	+0.75% pa	+0.75% pa
LD (gilts + 1% pa)	+1% pa	+1% pa
Archetype A TPs	+2.2% pa	+0.4% pa
Archetype B TPs	+3.5% pa	+1.0% pa
Archetype C TPs	+2.85% pa	+0.7% pa
Buy-out basis	+0.7% pa for immediate benefit cashflows -1.25% pa for benefit cashflows in 60 year's time Linear interpolation of adjustment for cashflows in the interim	

Insurance company buy-out

As described in the table above, the buy-out basis evolves over time to allow for the fact that more mature liabilities are normally more attractive to insurers. It is therefore assumed these can be bought out at lower prices, implying higher discount rates. This means over time as the maturity of our modelled scheme increases, the buy-out basis becomes more favourable with a higher average adjustment relative to gilt yields. Chart A1 below illustrates this change in the average discount rate of the buy-out basis over time for the scheme with initial duration of 14 years.

Chart A1: indicative buy-out basis single equivalent discount rate

Evolution of Buy Out Basis Discount Rate (LTO scheme)
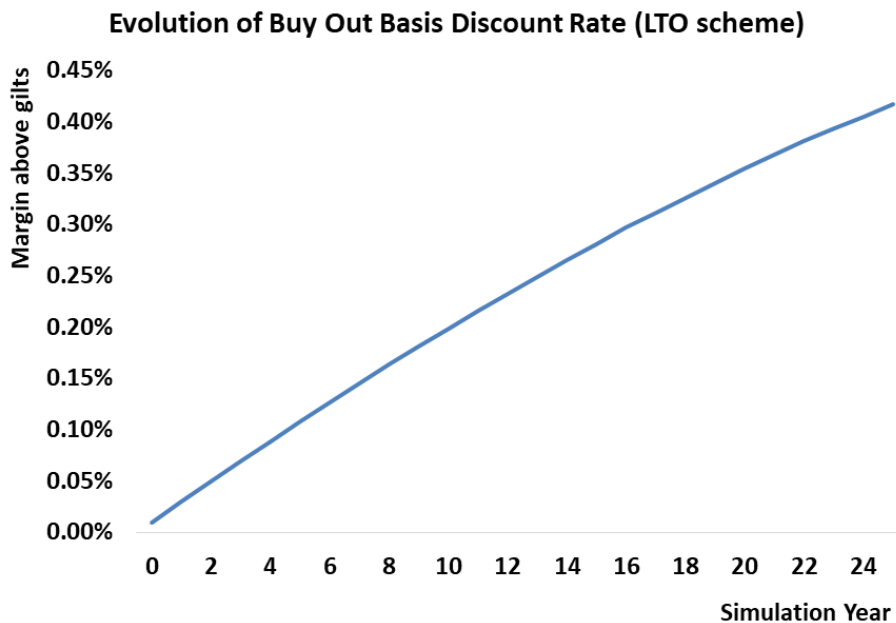
We have assumed that schemes reaching 100% of buy-out funding, after allowing for expenses, would buy out as is common practice for mature schemes. In practice there will be a number of other approaches that might be adopted:

- some schemes may run-on rather than buying-out at the first available opportunity
- some schemes may not identify an opportunity to buy-out in time to capture favourable market conditions
- some schemes may buy-out before reaching a buy-out funding level with some additional financial support from the sponsor

Appendix B – Investment Portfolios

The investment portfolios modelled in the paper are summarised in Section 2. We have set out further details below of the portfolio allocations, assumed annual management charges and indicative return expectations.

Table B1: Growth Portfolio Allocation:

Allocation (%)			
Global Equity	**US High Yield Bonds**	**Hedge Funds**	**UK Property**
50	17	17	16

Chart B1: Portfolio Asset Allocations

	More cautious	Corporate bond	Core hedged	More adventurous	Unleveraged	Core hedged variant	Corporate bond variant
■ Growth Assets	10.0%	10.0%	20.0%	25.0%	30.0%	33.3%	37.5%
■ Leveraged LDI	5.0%	10.0%	10.0%	12.5%	0.0%	16.7%	7.5%
■ Matching Gilts	85.0%	25.0%	70.0%	62.5%	70.0%	50.0%	15.0%
■ UK Corporate Bonds	0.0%	55.0%	0.0%	0.0%	0.0%	0.0%	40.0%
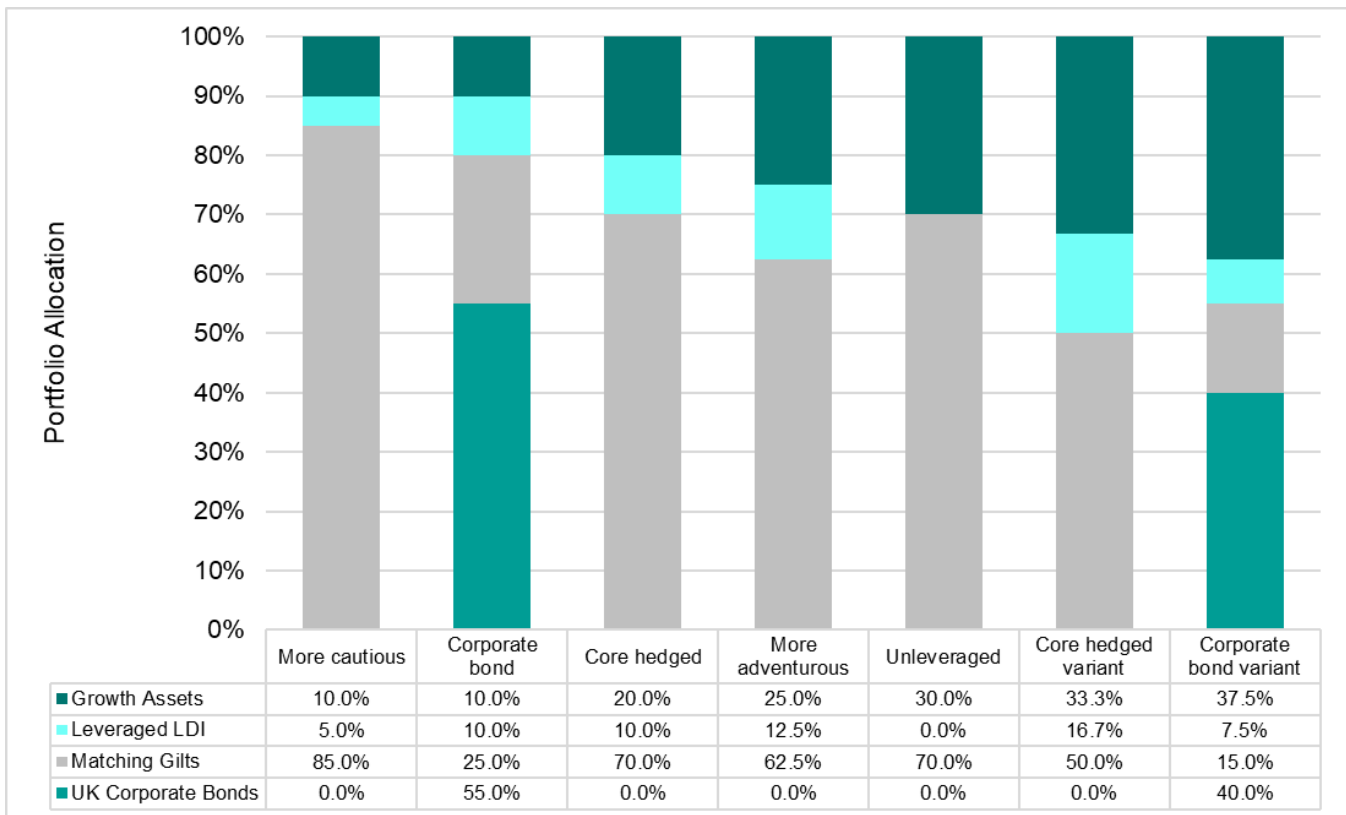
Table B2: Assumed Annual Management Charge (AMC) for each asset class:

Asset class	AMC
Gilts	0.10%
Equities	0.40%
Hedge funds	1.50%
Property	1.50%
High yield bonds	0.50%
LDI	0.20%

Table B3: Summary of assumed returns and AMC for each investment strategy:

Investment strategy	Mean returns over (pa)			25 year return (pa)			AMC
	5	10	25	Median	25th percentile	75th percentile	
Core hedged	1.8%	2.2%	2.8%	2.5%	1.7%	3.3%	0.25%
Corporate bond	1.8%	2.2%	2.8%	2.6%	2.0%	3.3%	0.26%
More cautious	1.4%	1.8%	2.3%	2.1%	1.3%	2.9%	0.17%
More adventurous	2.0%	2.4%	3.1%	2.8%	1.8%	3.7%	0.28%
Unleveraged	1.9%	2.3%	2.7%	2.5%	1.7%	3.3%	0.30%
Core hedged variant	2.3%	2.8%	3.4%	3.1%	2.0%	4.1%	0.39%
Corporate bond variant	2.5%	2.9%	3.4%	3.2%	2.4%	4.0%	0.45%

The return figures shown in the table above are net of the assumed AMC. The table illustrates the similarity in return of the core hedged and corporate bond strategies, with mean returns equal over 5, 10 and 25 years.

Appendix C – LTO Analysis

This appendix provides further details of the various sets of analysis carried out, and illustrates how these alter the outcomes.

Variant analysis

Table C1 illustrates the analysis over a 40 year period rather than 25 years. For these figures we consider whether the scheme has reached a buy-out level of funding by year 40 and, if not, the shortfall in funding at that point. The figures are based on the LD funding target using a gilts + 0.5% pa basis, and show similar proportions of scenarios reaching buy-out within the 40 years as were seen in the central analysis over 25 years.

Table C1: Summary of central analysis over 40 year period (LD basis = gilts + 0.5% pa)

Investment Strategy	Mean 40 year return in excess of gilts (pa)	Probability of reaching buy-out within 40 years	Average shortfall at 40 years for scenarios not reaching buy-out		% unpaid cashflows as a proportion of total cashflows	
			Buy-out basis	PPF basis	for scenarios not reaching buy-out	for all scenarios
Core hedged	1.0%	74%	£13m	£12m	8%	2%
Corporate bond	0.8%	83%	£20m	£18m	6%	1%
More cautious	0.5%	31%	£14m	£13m	6%	4%
More adventurous	1.3%	81%	£13m	£12m	9%	2%
Unleveraged	0.9%	74%	£16m	£15m	11%	3%

Table C2 overleaf expands on the analysis of outcomes when significant maturity is assumed to be 12 years rather than 14. This expands on the analysis shown in Table 9 of Section 3 of the report. This indicates that outcomes over the 25 year period after reaching significant maturity are generally slightly better where significant maturity is assumed to be 12 rather than 14 years. However, the differences are relatively small and therefore the actual outcomes are not expected to be materially different.

Table C2: Summary of analysis where significant maturity is duration 12 (LD basis = gilts + 0.5% pa)

Investment Strategy	Mean 25 year return in excess of gilts (pa)	Probability of reaching buy-out	Average shortfall at 25 years for scenarios not reaching buy-out		% unpaid cashflows as a proportion of total cashflows	
			Buy-out basis	PPF basis	for scenarios not reaching buy-out	for all scenarios
Core hedged	1.0%	75%	£30m	£25m	7%	2%
Corporate bond	0.9%	80%	£40m	£34m	6%	1%
More cautious	0.5%	36%	£24m	£18m	5%	3%
More adventurous	1.3%	82%	£33m	£28m	8%	2%
Unleveraged	0.9%	73%	£51m	£44m	10%	3%

Table C3 shows equivalent analysis as Table C2 but based on the LD basis of gilts +0.25% pa. This can be compared to the analysis shown in Table 7 of Section 3 of the report. As in Table C2, this indicates that outcomes over the 25 year period after reaching significant maturity are generally slightly better where significant maturity is assumed to be 12 rather than 14 years. However, the differences are relatively small and therefore the actual outcomes are not expected to be materially different.

Table C3: Summary of analysis where significant maturity is duration 12 (LD basis = gilts + 0.25% pa)

Investment Strategy	Mean 25 year return in excess of gilts (pa)	Probability of reaching buy-out	Average shortfall at 25 years for scenarios not reaching buy-out		% unpaid cashflows as a proportion of total cashflows	
			Buy-out basis	PPF basis	for scenarios not reaching buy-out	for all scenarios
Core hedged	1.0%	90%	£27m	£20m	7%	1%
Corporate bond	0.9%	92%	£39m	£35m	6%	0%
More cautious	0.5%	74%	£16m	£12m	4%	1%
More adventurous	1.3%	92%	£31m	£25m	8%	1%
Unleveraged	0.9%	85%	£47m	£38m	9%	1%

Table C4 provides similar analysis as Table C2, but based on significant maturity being a duration of 17. This indicates that outcomes over the 25 year period after reaching significant maturity are similar to those where significant maturity is assumed to be 14 years. We have also carried out this analysis after 30 years, by which time the duration 17 scheme has a remaining duration similar to the duration 14 scheme after a 25 year projection period. Table C5 summarises this analysis and again indicates there is not a material difference between the outcomes for these different definitions of significant maturity.

Table C4: Summary of analysis where significant maturity is duration 17 (LD basis = gilts + 0.5% pa)

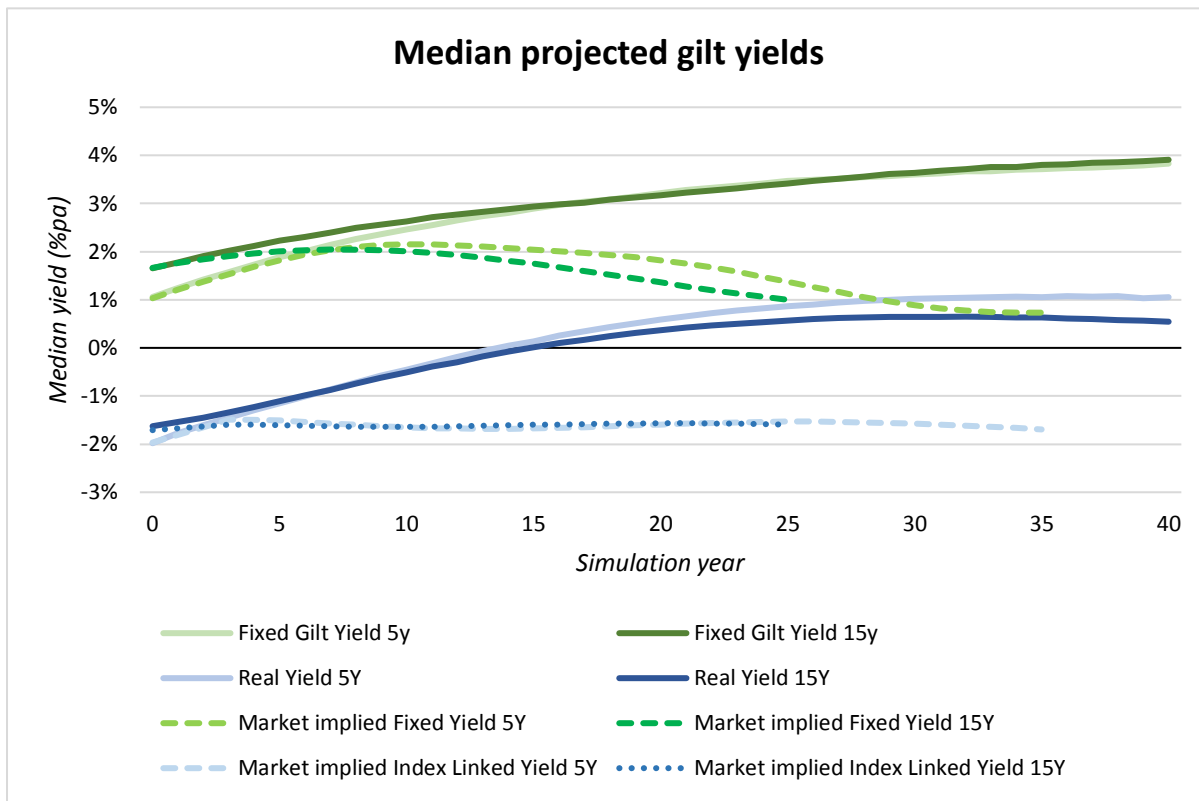| Investment Strategy	Mean 25 year return in excess of gilts (pa)	Probability of reaching buy-out	Average shortfall at 25 years for scenarios not reaching buy-out		% unpaid cashflows as a proportion of total cashflows	
			Buy-out basis	PPF basis	for scenarios not reaching buy-out	for all scenarios
Core hedged	1.0%	72%	£59m	£43m	7%	2%
Corporate bond	0.9%	82%	£92m	£63m	6%	1%
More cautious	0.5%	28%	£51m	£31m	6%	4%
More adventurous	1.2%	79%	£66m	£49m	8%	2%
Unleveraged	0.9%	73%	£110m	£74m	10%	3%

Table C5: 30 year analysis where significant maturity is duration 17 (LD basis = gilts + 0.5% pa)

Investment Strategy	Mean 30 year return in excess of gilts (pa)	Probability of reaching buy-out	Average shortfall at 30 years for scenarios not reaching buy-out		% unpaid cashflows as a proportion of total cashflows	
			Buy-out basis	PPF basis	for scenarios not reaching buy-out	for all scenarios
Core hedged	1.0%	75%	£62m	£50m	7%	2%
Corporate bond	0.9%	84%	£99m	£75m	5%	1%
More cautious	0.5%	31%	£53m	£39m	6%	4%
More adventurous	1.3%	82%	£69m	£56m	8%	2%
Unleveraged	1.0%	74%	£111m	£88m	9%	2%

Alternative economic scenarios

As noted in Section 2, the economic scenarios used for the analysis summarised in the main body of the report are calibrated to market expectations of future interest rates. Additional analysis was completed using economic scenarios calibrated to future interest rates at higher levels than the market implies. Chart C1 overleaf shows the median projected gilt yields over time underlying the alternative economic scenarios, and the dotted lines show the equivalent market implied gilt yields. This clearly illustrates the deviation between market implied rates and the economic scenarios after the first five years.

Chart C1: Median projected gilt yields compared to market implied yields

In Table C6 we summarise the outcomes of the analysis using the alternative economic scenarios with the same investment strategies as used for the core analysis. The table considers the outcomes for an LD funding target based on a gilts + 0.5% pa discount rate. This indicates that the investment strategy using a significant portfolio of corporate bonds continues to provide a high probability of funding reaching buy-out funding levels, but suffers particularly poor outcomes in downside scenarios.

Table C6: Summary of analysis using alternative economic assumptions

Investment Strategy	Mean 25 year return in excess of gilts (pa)	Probability of reaching buy-out within 25 years	Average shortfall at 25 years for scenarios not reaching buy-out		% unpaid cashflows as a proportion of total cashflows	
			Buy-out basis	PPF basis	for scenarios not reaching buy-out	for all scenarios
Core hedged	1.1%	71%	£45m	£39m	9%	3%
Corporate bond	0.7%	65%	£77m	£62m	9%	3%
More cautious	0.5%	26%	£39m	£31m	7%	5%
More adventurous	1.3%	78%	£50m	£43m	10%	2%
Unleveraged	1.0%	78%	£73m	£59m	11%	2%