Modelling the Universe of Defined Benefit Pension Schemes

Assessing the proposed Fast Track regulatory approach

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Content

1 Executive Summary

This report documents the modelling undertaken by the Government Actuary's Department ('GAD') in relation to The Pensions Regulator's ('TPR') proposed funding code for Defined Benefit ('DB') pension schemes. The universe of DB schemes has been projected over a 40-year horizon and this report details the data, assumptions, methodology and key messages from the analysis.

Introduction

1.1   The Pensions Regulator ('TPR') regulates trustees' funding processes in line with Part 3 of the Pensions Act 2004. As part of the Pension Schemes Act 2021 ('PSA21'), there are new requirements for schemes to set Funding and Investment strategies, and trustees are required to submit a Statement of Strategy towards funding and risk management to TPR.

1.2   The DB funding code was proposed by TPR in the first consultation[1] in March 2020 and a twin-track approach ('Fast Track' and 'Bespoke') to valuations of schemes was introduced. The second consultation[2] on the draft DB funding code was published in December 2022.

1.3   The Government Actuary's Department ('GAD') has been asked by TPR to model the outlook of the DB pension scheme universe under a proposed revised framework, and under a set of parameters defined to be broadly in line with a Fast Track approach. The Fast Track approach is a tolerated risk level that will help provide more clarity to the regulated universe of schemes. The schemes taking less risk than the Fast Track line are unlikely to be subject to a regulatory intervention regarding their valuation approach.

1.4   One of the Fast Track parameters is the discount rate for the scheme's long term funding target and for the purposes of this report, the term Fast Track Low Dependency ('FTLD') is used to describe the funding level on a low dependency basis. This basis uses a discount rate of gilts+0.5% in line with the Fast Track consultation document[3] and this has been used to calculate the low dependency liabilities for the Fast Track approach.

1.5   This report presents the modelling and subsequent analysis carried out, details of the underlying data, assumptions and methodology adopted, and discusses the key conclusions from the analysis. This analysis should be considered in conjunction with TPR's consultation documents on the DB funding framework.

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[1] https://webarchive.nationalarchives.gov.uk/ukgwa/20230313055542/https://www.thepensionsregulator.gov.uk/en/document-library/consultations/defined-benefit-funding-code-of-practice-consultation

[2] https://www.thepensionsregulator.gov.uk/en/document-library/consultations/draft-defined-benefit-funding-code-of-practice-and-regulatory-approach-consultation

[3] https://www.thepensionsregulator.gov.uk/en/document-library/consultations/draft-defined-benefit-funding-code-of-practice-and-regulatory-approach-consultation/fast-track-and-our-regulatory-approach-consultation-document

Methodology and assumptions

1.6   GAD has produced a stochastic model of the universe of DB pension schemes to understand how a set of parameters expected to meet the Fast Track approach could affect schemes' funding positions in the future.

1.7   The modelling assumes that all schemes are closed to future accrual and new members. The analysis compares the outcomes of a Fast Track approach to a counterfactual approach on this closed scheme basis. The assumptions underlying the Fast Track modelling is a set of parameters defined to be broadly in line with a Fast Track approach. The assumptions underlying the counterfactual modelling are designed to represent the general existing approach to scheme funding, with an allowance for reducing risk over time as schemes mature. TPR has told us that in practice, it does not expect all the individual schemes to reduce risk in line with those assumptions, particularly those which are still open and those who expect to retain their existing investment strategy indefinitely.

1.8   Moving through the projection period, schemes will increase in maturity, gradually reducing in size in terms of membership numbers. Under both approaches, schemes are assumed to reduce risk over time and eventually, would be expected to reach a point where they can be secured by buying-out the liabilities with an insurer.

1.9   The modelling assesses the impact of these parameters over a 40-year horizon from a calculation date of 31 March 2021. TPR has provided the data for the universe of schemes, grouped by various characteristics into segments.

1.10   The universe model has been developed by GAD with a collaborative input from TPR informing the assumptions to be modelled. Details of the data used are set out in Section 3, the methodology is described in detail in Section 4 and the assumptions for the different modelling runs are outlined in the Section 5 of this report.

Outcomes and key messages

1.11   Table 1 summarises the assets, Technical Provisions, and surplus or deficit for the counterfactual and Fast Track approaches at time 0 (31 March 2021). Across the full universe of DB schemes, the Fast Track Technical Provisions are approximately 4% lower than the counterfactual Technical Provisions. This means that at the starting point of the projections, the "average" discount rate assumptions for the Fast Track basis are slightly higher than the "average" for the counterfactual.

	Assets (£bn)	Technical Provisions (£bn)	Surplus or (deficit) (£bn)
Counterfactual	1,710	1,737	(27)
Fast Track	1,710	1,665	45

Table 1: Time 0 assets and Technical Provisions for the counterfactual and Fast Track models

1.12   Chart 1 and Chart 2 show the 40 year projection of the proportion of universe liabilities that fall within four different FTLD funding level groups.

- Red bars show the proportion of overall liabilities for data points that are less than 75% funded on the FTLD basis
- Orange bars are for liabilities between 75% and 100% funded on the FTLD basis
- Turquoise bars are for liabilities funded 100% or above and less than the cost of buyout
- Purple bars are those liabilities funded at the buyout level

The charts show the results at the median level of outcomes, with Chart 1 on the counterfactual approach and Chart 2 on the Fast Track approach. A description of how the funding level progression charts were put together is given in Section 6.
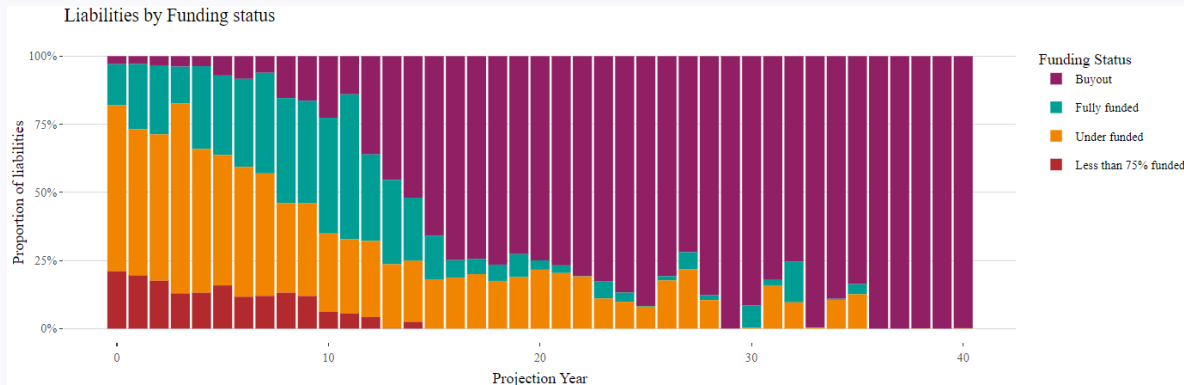

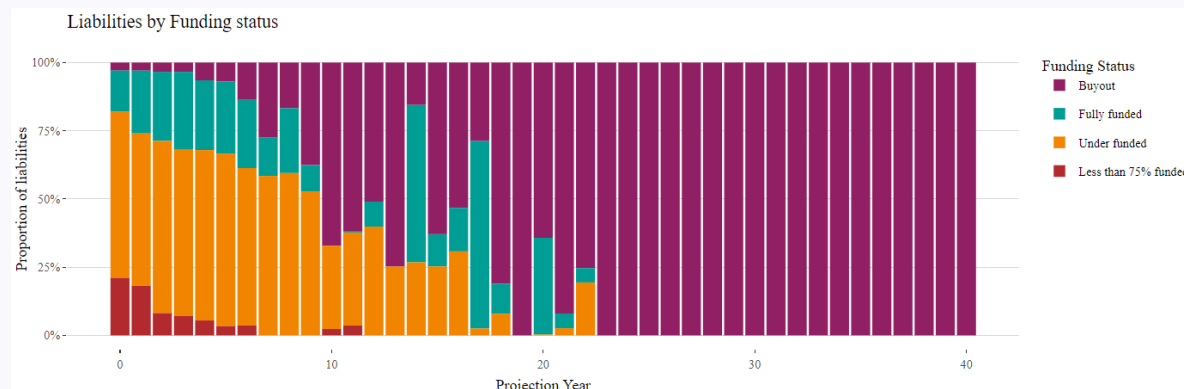*Chart 1: Counterfactual funding level progression, median level*

Chart 2: Fast Track funding level progression, median level

1.13   On the Fast Track approach at the median level of scenarios and on a low dependency basis, there is a greater probability of model points reaching a position of being fully funded or being able to buyout liabilities within 20 years, with a quicker progression of underfunded model points moving towards a fully funded status. The point at which model points are fully funded on a low dependency funding basis is reached significantly earlier under the Fast Track approach in aggregate, compared to the counterfactual approach.

Median scenario	< 75% funded			Fully funded and Buyout		
	Time 0	Time 10	Time 20	Time 0	Time 10	Time 20
Counterfactual	21.1%	6.1%	0.0%	18.0%	65.1%	78.3%
Fast Track	21.1%	2.3%	0.0%	18.0%	67.1%	99.6%

Table 2: Proportion of model point liabilities by funding status over time, median level

1.14   At the downside 5th percentile of scenarios, the model points with weaker initial funding levels, benefit from adopting a strategy in line with the Fast Track approach and reach a stronger funding position more quickly. For the model points that have a stronger initial funding position, the Fast Track approach doesn't materially improve funding until 25 years or more have passed. This shows that whilst adopting a strategy in line with the Fast Track approach could help improve funding outcomes for some schemes, there are many schemes which will reach a suitable funding position under current funding approaches.

5th percentile	< 75% funded			Fully funded and Buyout		
	Time 0	Time 10	Time 20	Time 0	Time 10	Time 20
Counterfactual	21.1%	22.8%	10.7%	18.0%	17.6%	63.8%
Fast Track	21.1%	23.7%	0.0%	18.0%	0.0%	24.9%

Table 3: Proportion of model point liabilities by funding status over time, 5th percentile

1.15   The Fast Track approach inherently assumes a higher risk investment strategy than the counterfactual approach. This is partly the result of reduced leverage in the LDI assumption and a higher allocation to growth assets in aggregate. The increased level of investment risk results in a wider range of outcomes for the Fast Track, including more frequent lower outcomes at the 5th percentile of scenarios.

1.16   The Fast Track outcomes see an improvement in the funding position for model points which are initially mature and have an investment strategy with a high allocation to return seeking assets. The higher maturity and high investment risk for this segment of schemes, means that member benefits are most at risk under existing funding and investment approaches. Although there is a higher risk investment strategy under a Fast Track approach, the outcomes and therefore the security of member benefits stabilise earlier in the projection period compared to the counterfactual.

1.17   The higher risk investment strategies on aggregate in the Fast Track lead to a broader range of potential contribution requirements. Up to and including the 80th percentile of scenarios, the projected cumulative DRCs are lower in the Fast Track approach compared to the counterfactual in the long term. The starting level of DRCs is approximately 20% lower than the counterfactual when all model points are modelled on a Fast Track approach. Over the 40-year projection period, the total DRCs at the median level are around 50% lower in the Fast Track approach.

1.18   The PPF potential losses have been assessed by looking at the PPF cumulative shortfall over time and applying an annual insolvency rate across all segments of the universe. Up to the 79th percentile of outcomes over the projection period, the PPF security is improved under the Fast Track approach. This is driven by the greater allocation to growth assets in the Fast Track approach, which is expected to improve funding for those with the weakest starting funding position, once the median assumptions or better are borne out.
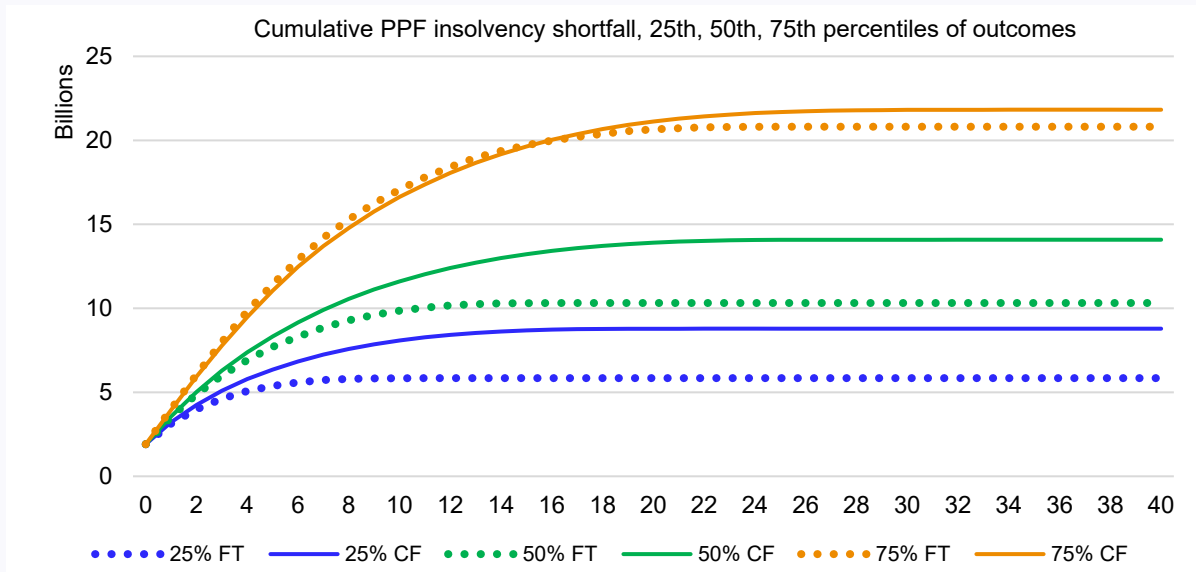
Chart 3: Cumulative PPF insolvent shortfall for Fast Track and counterfactual approaches (£bn)

1.19   Member security has been assessed by calculating the cumulative liabilities at risk over time, where the liabilities at risk are those between buyout liabilities and PPF liabilities, subject to the level of assets in the scheme. Up to the 60th percentile of outcomes, the Fast Track approach shows lower cumulative liabilities at risk, and consequently indicates better member security. Above the 60th percentile of outcomes, the Fast Track approach shows higher cumulative liabilities at risk and therefore lower member security across the model points, The additional risk taken in the Fast Track investment strategy results in a broader range of liabilities at risk across the percentiles of outcomes, where the downside of outcomes could be more significant.
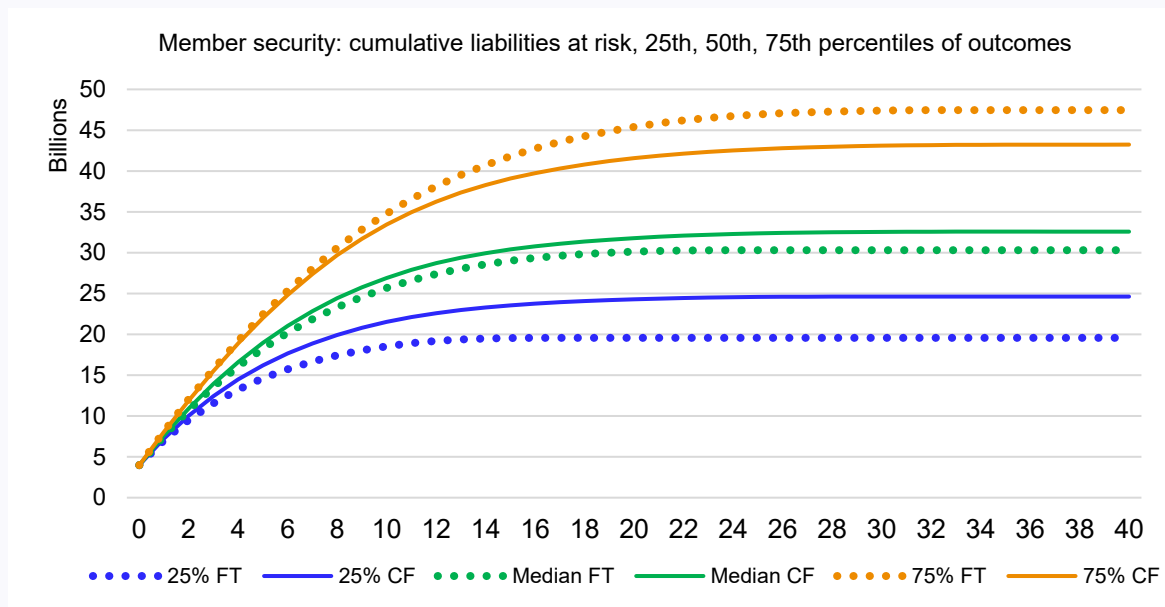
Chart 4: Cumulative liabilities at risk for Fast Track and counterfactual approaches (£bn)

1.20   There is more risk assumed on average in the Fast Track approach investment strategy, which results in a wider range of funding and contribution outcomes in the future. The modelling demonstrates that continuing with a counterfactual approach provides reasonable outcomes for a high proportion of model points, and this implies that schemes are broadly managing their investment and funding risks.

1.21   A Fast Track approach improves funding outcomes for some model points, including the groupings of schemes that have a high initial SEDR and a high allocation to return seeking assets. The modelled Fast Track approach helps those schemes reach a suitable level of low dependency at the point of significant maturity. It is expected that some immature schemes will see improvements in their funding levels over the projection period by adopting a Fast Track approach.

1.22   The 2X leveraged LDI assumption in the Fast Track leads to a lower level of interest rate and inflation hedging, and with the higher allocation to growth assets in aggregate, leads to more risk being taken, whereas the counterfactual is in a more hedged position with 3X leverage assumed. The additional risk taken on in the Fast Track leads to higher median funding outcomes and lower median costs, but also leads to a wider range of outcomes, where the downside could be more significant with slightly worse outcomes.

Market conditions

1.23   The calculation date for this modelling is 31 March 2021. There have been material movements in economic and market conditions since then, which have resulted in schemes being in a different position in terms of their funding levels and investment strategies. However, it has not been possible to update the data, assumptions and modelling to a recent date in the time available for this report.

1.24   The gilt market has moved rapidly and saw unprecedented volatility during September and October 2022 and the likely impact of this on DB pension schemes, is that aggregate funding is expected to be higher, however not all schemes will be better off. As such, different outcomes from the modelling would be expected if a later calculation date and a later set of economic scenarios was used. Further discussion on market conditions since 31 March 2021 is in Section 7.

1.25   Whilst there might be differences to modelling outcomes in the shorter term due to economic volatility, we might expect the key conclusions and messages to be more consistent with the modelling as at 31 March 2021 in the longer term, with similar relativities between the Fast Track and counterfactual approaches.

Reliance and limitations

1.26   This report is intended for use by TPR for the purpose of understanding the results provided by GAD as part of this analysis. This will assist TPR with understanding how a set of parameters expected to meet a Fast Track approach could impact funding and investment outcomes for the universe of DB schemes in the future.

1.27   No other user or third party is entitled to place any reliance on the contents of this report and GAD has no liability to any person or third party for any act of omission, taken either in whole or part on the basis of this report.

1.28   Reliance on this report and limitations to the modelling are included in Section 8.

1.29   At GAD, we seek to achieve a high standard in all our work. We are accredited under the Institute and Faculty of Actuaries' Quality Assurance Scheme. The analysis outlined in this report has been put together on the basis of complying with Technical Actuarial Standard: TAS 100 issued by the Financial Reporting Council ('FRC'). Please see our website for details of these standards and other standards that apply to our work.

2 Background

This section gives a wider context to the modelling undertaken and details the purpose of this this report. Further details of the proposed DB code of funding are given below.

Introduction

2.1   This report has been prepared by the Government Actuary's Department ('GAD') at the request of The Pensions Regulator ('TPR'). The purpose of this report is to detail the modelling of the universe of Defined Benefit Pension schemes under TPR's remit as at 31 March 2021 and to assist TPR with understanding how a set of parameters expected to meet a Fast Track approach could impact funding and investment outcomes for schemes in the future.

2.2   A review of the current funding regime for DB pension schemes is being carried out and the DB funding code was proposed by TPR in the first consultation in March 2020. A second consultation on the draft DB funding code of practice was published in December 2022.

2.3   The modelling of the universe of DB schemes assesses scheme performance in the future and analyses the effect of the proposed Fast Track approach on the security of members' benefits. The comparison of projections under different modelling parameters gives a better understanding of what could happen if schemes transition from the current regulatory approach to a new regulatory approach.

2.4   TPR have asked GAD to model the universe of DB schemes to understand the impact of implementing a new funding regime using several modelling parameters, including points of significant maturity (measured by duration), investment strategies and different de-risking journey shapes. The modelling assumptions are detailed in Section 5.

2.5   The analysis compares the outcomes of a Fast Track approach to a counterfactual approach and assumes that all schemes are closed to future accrual and new members. The assumptions underlying the Fast Track modelling is a set of assumptions that would be expected to meet the Fast Track approach. The assumptions underlying the counterfactual modelling are designed to represent the general existing approach to scheme funding, with an allowance for reducing risk over time as schemes mature.

2.6   The analysis produced shows the effects of implementing a Fast Track approach across the universe, and it shows how different segments of the DB pension schemes universe could be impacted by such a regulatory regime. There are likely to be many different approaches adopted by schemes and the assumptions used in this analysis is one example of this.

2.7   The data provided by TPR was grouped by maturity bands, recovery plan lengths, technical provision discount rate, investment allocation to growth assets and technical provision funding levels, and was taken from March 2022 scheme returns, rolled back to 31 March 2021 where appropriate.

2.8   Moving through the projection period, schemes will increase in maturity, gradually reducing in size in terms of membership numbers and with funding expected to improve.

Eventually, schemes would be expected to reach a point where they can be secured by buying-out the liabilities with an insurer.

2.9   The analysis has been produced using stochastic asset-liability modelling ('ALM'), where a model is run 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 a 40-year future projection period and then the output is then combined with rules and assumptions to assess the Fast Track approach for various segmentations of the DB pension schemes landscape. Further details about the economic scenarios can be found in Section 3. The modelling methodology has been detailed in Section 4.

2.10   The universe model is designed to capture the key characteristics of the DB landscape of around 5,000 UK pension schemes and to project future outcomes under a range of economic scenarios and funding journey plans. The underlying data is scheme data collected by TPR which has been grouped by several characteristics. Due to the underlying data being scheme specific and sensitive in nature, and the computational challenge of stochastically modelling over 5,000 model points, grouped data items have been provided. The data groupings have been created so that there are similar scheme characteristics within each group.

2.11   The outcomes considered as part of this analysis are:

- progression of funding levels over a 40-year projection period segmented by key scheme characteristics
- progression of deficit repair contributions and an assessment of sponsor cost
- potential losses to the PPF
- member security assessed against cumulative liabilities at risk

2.12   The proposed Fast Track approach has been simplistically modelled as a set of parameters and these are detailed in this report in Section 5. For the purposes of this modelling, the set of Fast Track parameters includes discount rates which are premia in excess of gilt spot yields, a set of investment strategy allocations determined by scheme duration and recovery plan rules for setting the level of Deficit Repair Contributions ('DRCs'). This is one example of a set of parameters that schemes might adopt and it is not expected that schemes will adopt the same set of parameters.

2.13   The model projects liabilities, cashflows and asset returns for three "archetype" schemes and interpolates these results to reflect the universe data points. Details of the data used are set out in Section 3, the methodology is described in detail in Section 4 and the assumptions for the different modelling runs are outlined in the Section 5 of this report.

2.14   The economic market conditions and modelling calculations are based as at 31 March 2021. Further analysis of the universe of schemes could be conducted at a more recent date however that analysis is out of scope of this report. A discussion about market conditions after 31 March 2021 and consideration of the impact on the future of the universe are included in Section 7.

3 Data

This section details the underlying data used in the modelling of the universe of DB schemes and in particular, the data which was used to create projections for the universe asset-liability model, which includes a description of the Economic Scenario Generator ('ESG'). Grouped scheme data was provided by TPR to represent and summarise the DB universe.

Economic Scenario Generator

3.1   A bespoke ESG has been used in the analysis. The underlying ESG was supplied by a market-leading provider and it has been calibrated to be consistent with market conditions, such that the path of interest rates more closely matches market yields.

3.2   The calculation date of the analysis is 31 March 2021, and the economic scenarios correspond to this date. Further discussions around market conditions since 31 March 2021 are discussed in Section 7.

3.3   The ESG contains 1,000 scenarios with projected returns for various indices of asset classes, including projected nominal and real gilt spot rates over a full range of terms at each future projection year. Outcomes are simulated stochastically by running through the 1,000 future economic scenarios and then distributions of possible annual asset returns and economic factors such as price inflation are produced. The ESG calibrations are used by pension schemes, insurance companies and other financial companies around the world and the supplier provides a coherent, robust, and well-documented multi-asset stochastic model.

3.4   In this analysis, the economic scenarios project simulated schemes over a 40-year projection period. Assets and liability values are projected on an annual basis and the funding level for each future year is calculated based on these projected assets and liabilities.

3.5   There are assumptions incorporated into the scenarios in the ESG over the range of asset classes to take account of the distributions of returns and the divergence of scenarios.

3.6   Chart 5 plots the ESG fixed gilt and real yields over future simulation years as at 31 March 2021.The dashed lines show the market implied fixed and index-linked gilt yields at various time points. The ESG was calibrated to be consistent with market condition and provides a projected yield path very close to that implied by the market.
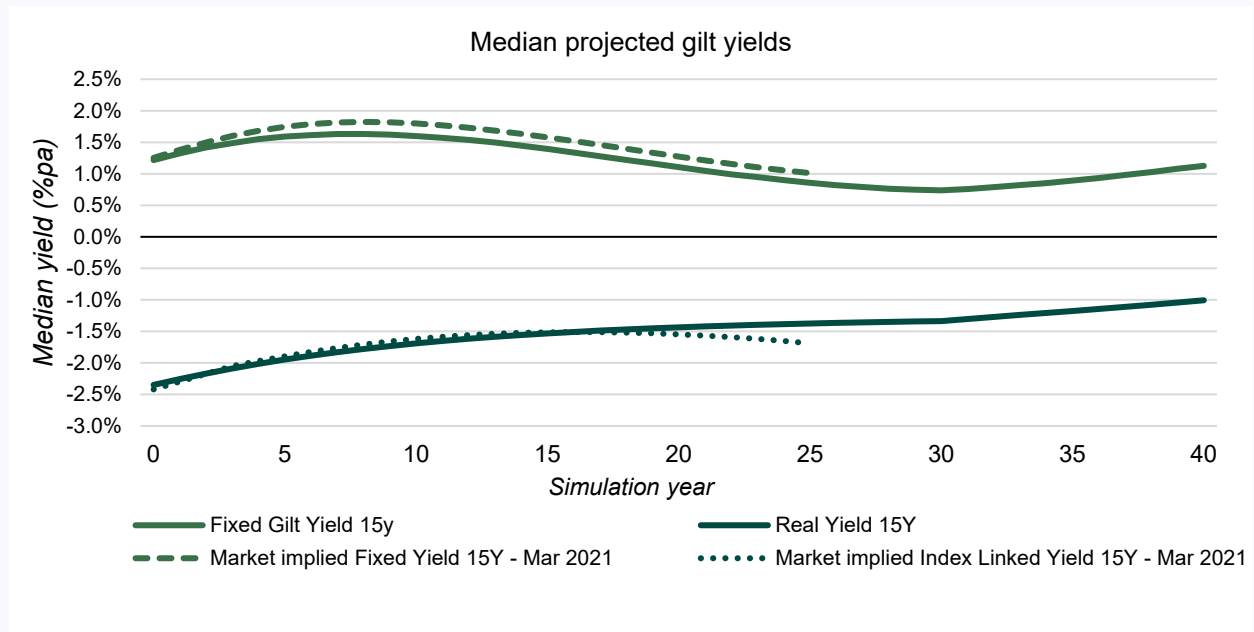
Chart 5: ESG median projected gilt yields

3.7   The gilt markets and wider economic landscape have seen material movements since 31 March 2021, along with unprecedented increases in gilt yields during September 2022. In the time available it has not been possible to obtain and use updated data and scenarios, and as such, the analysis is limited to understanding the impact of a Fast Track approach as at the calculation date. This is discussed further in Section 7.

3.8   The ESG includes assumptions about the likely pattern of key economic variables including interest rates and inflation as well as a wide range of asset class returns. The calibration is based upon expert views of the likely long-term behaviour of interest rates, inflation and asset class returns in different interest and inflation scenarios. Chart 6 shows the median asset returns, yields and RPI inflation over the 40 year projection period.
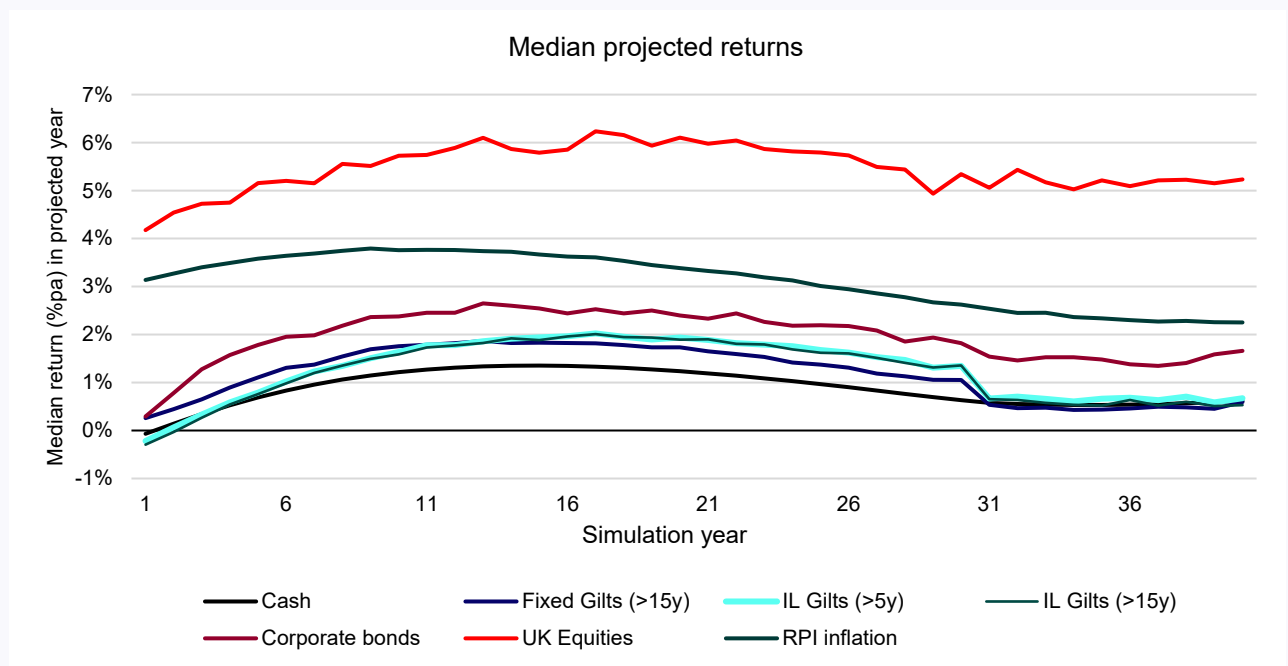

Chart 6: ESG median projected returns

Liability data

3.9   The ALM uses three base archetype schemes with varying durations to project assets and liabilities into the future. These archetype schemes have been created using proxy datasets to represent a typical run-off of liabilities for a scheme closed to future accrual and new member of the particular duration. The durations have been informed by analysis by TPR of pension scheme durations across the universe of schemes.

3.10   The three scheme archetypes reflect a range of scheme maturities, measured by duration in this circumstance, across the universe. These schemes are referred to as "Mature", "Standard" and "Immature".

Archetype scheme	Duration
Mature	17.0
Standard	19.9
Immature	23.2

Table 4: Archetype scheme durations

3.11   Maturity is a measure of how far a scheme has progressed through its lifetime, and this can be represented by its liability duration. The Draft Regulations require maturity to be measured using the duration of liabilities calculated on a low dependency basis. Duration is a measure of the average length of time before the liabilities are due to be paid and is calculated as the mean time until pension or other benefits are due to be paid weighted by the discounted value of each payment.

3.12   As a scheme matures, the duration of its liabilities reduces as can be seen by the archetype schemes in Table 4. Our modelling involves interpolation of the archetype schemes to represent the universe data points. The durations given in Table 4 allows this interpolation to represent an appropriate range of durations within the analysis, whilst controlling the risks from using grouped rather than individual scheme data. All durations would be expected to be lower if this analysis was redone in a higher yield environment.

3.13   The data underlying the three base archetype schemes used in the modelling was derived from real pension scheme data, which was selected to be representative in terms of distribution of age and distribution of a membership profile for a typical DB scheme.

3.14   For this analysis, the active membership has been assumed to leave service immediately and the benefit structure has been summarised in Appendix A.

3.15   The sample data has then been adjusted to create three datasets to reflect three stages of maturity; immature, standard and mature respectively. The dataset for the Immature scheme reflects the underlying data for the sample scheme. The Standard and Mature datasets were adapted from the Immature dataset by ageing the non-pensioners by 7 and 12 years respectively. Liabilities were set to zero for non-pensioners who were over 68 years old after this ageing was applied. Pensioners in the Mature and Standard schemes were aged by 3 years. A summary of the datasets is provided in Appendix A.

3.16   A breakdown of the membership by age and status is shown in Appendix A. These charts also include the membership who are deferred in the original dataset but are over Normal Pension Age after ageing is applied and therefore treated as pensioners. The ages and durations have been calculated with reference to a calculation date of 31 March 2021.

3.17   The cashflow profile, liability progression and duration run-off over time have been considered and are consistent with the shape of a typical DB pension scheme and these are shown in Appendix A. This enables projections to be generated which are representative of the model points.

Model points

3.18   Data groupings have been provided by TPR to represent and approximate the universe of around 5,000 DB schemes as at 31 March 2021. The data is taken from March 2022 scheme returns, rolled back to 31 March 2021 where appropriate. The data groupings are based on the pension scheme data collected by TPR for valuation and regulation purposes, which has been grouped by various characteristics into segments. The segmentation has been designed so that there are similar characteristics within each segment, along with an approximate even spread of assets and liabilities across each of the data points.

3.19   In total there are 281 model points which represent the universe of schemes in aggregate. The overall scheme data has been segmented into the following four parameter bands:

(i)   Maturity: defined in terms of scheme duration
(ii)   Recovery Plan length: defined in years
(iii)   Proportion allocated to growth: proportion invested in growth assets
(iv)   Single Equivalent Discount Rate ('SEDR')

3.20   Due to the complexity of the modelling and the practicalities of projecting over a longer-term horizon, it is necessary to use data groupings rather than individual scheme data. The time 0 Technical Provision calculations on the grouped data have been tested against deterministic scheme-by-scheme modelling carried out by TPR to ensure the grouping has not materially distorted the analysis.

3.21   The data provided by TPR includes information on the number of schemes, the total liability on a FTLD basis and total assets as at 31 March 2021 within each segment. The low dependency basis is based on schemes' technical provisions with financial assumptions adjusted to be market consistent with a discount rate of gilts+0.5% pa. The data groupings are summarised in Appendix B.

4 Methodology

This section gives an overview of the methodology used to assess the universe of DB schemes over the future projection period. Further details on the assumptions used in the model are in Section 5 and the results and outcomes of the analysis are discussed in Section 6.

Methodology

4.1   The universe model is a stochastic asset-liability projection model designed to capture the key characteristics of the DB landscape of c. 5,000 UK pension schemes and to project future outcomes under a range of economic scenarios and funding journey plans. The model produces results for a set of modelling points which have been designed to be representative of the universe of pension schemes which fall under the remit of TPR.

4.2   The analysis calculation date is 31 March 2021, and the underlying economic simulations and pension scheme data groupings are as at this date.

4.3   The model projects the assets and liabilities over 40 years, for a set of model points using funding rules that represent a Fast Track approach and a counterfactual approach. The modelling allows for mortality rates, dependent benefits, and future economic conditions.

4.4   Under the counterfactual run, outcomes for schemes in the DB Universe reflect TPR's understanding of current funding plans with an allowance for reducing risk over time as schemes mature, and it assumes that a Fast Track approach is not adopted. In the Fast Track model, all schemes are assumed to move onto a Fast Track basis and set of parameters which are expected to meet a Fast Track approach.

4.5   The starting total assets were informed by TPR data and are approximately £1.7 trillion.

4.6   The Universe Model comprises three main components:

 (1) **Base ALM:** a stochastic asset-liability model which projects the liabilities, cashflows and asset returns for three archetype schemes with varying durations, using a static funding and investment strategy.

   Liabilities and cashflows are projected over 40 years. Assets are projected using a third-party ALM software and stochastic mortality simulation model. The economic simulations are provided by a market leading ESG provider.

 (2) **Universe ALM:** the second section is an interpolation model, and it uses the results of the Base ALM to approximate the corresponding results for the model points provided by TPR.

   The model interpolates between the model points based on duration and discount rates from the ALM base scheme runs. De-risking strategies and journey paths are incorporated into the model at this stage. This will represent the universe of approximately 5,000 DB pension schemes. The model calculates recovery plan lengths and the associated deficit repair contributions for each model point across the simulations. The projections result in a set of assets, liabilities, funding levels and recovery plans over 40 years for the model points.

(3) **User interface**: The user interface aggregates the output of the ALM and shows the impact on member outcomes using data visualisation. The user can select different scenarios and subsets of the results for exploratory analysis.
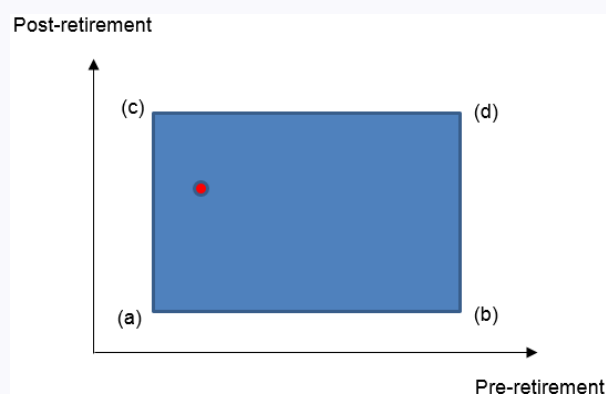
4.7 The output of the Base ALM includes projected liabilities each year on the Technical Provisions (TP), low dependency (FTLD), buyout (BO) and section 179 Pension Protection Fund (PPF) bases. Projected cashflows payments and investment returns for each asset class are also produced on a year-by-year basis.

4.8 The TP liabilities in the Base ALM are calculated on a set of discount rates in excess of the gilt yield curve within the economic scenarios. Interpolation of these liability figures can be used to approximate a de-risking flight path in the universe ALM. Four bases have been run in the valuation software to cover a combination of high and low pre- and post-retirement discount rates.

Interpolation methodology

4.9 The interpolation section of the model works in the following way:

(1) Interpolate between base schemes to derive the liability run-off for the appropriate duration. This assumes that the model point scheme liabilities follow the duration run-off shapes of the two nearest schemes in the same proportions over the whole projection period.

(2) Interpolate between discount rates to allow for SEDR de-risking. The discount rates detailed in Table 24 are interpolated between to determine the technical provision projections. Combinations of (a), (b), (c) and (d) are used to determine an estimate for the technical provisions.

(3) Combine factors into a "3D" projection. The interpolation factors are then combined to calculate a weighting factor for the overall interpolation.

4.10 The universe ALM loops through each model point using the base ALM output to generate an approximate ALM for each modelling point. The results are tailored to each model point to allow for initial duration and initial FTLD liability, SEDRs, initial return seeking asset ('RSA') allocation, investment de-risking and discount rate de-risking assumptions.

4.11 There are two versions of the model: the first is on a set of counterfactual parameters and assumptions, and the second is on a set of parameters expected to meet the Fast Track approach. Details on these assumptions are found in Section 5.

4.12 The modelling process is illustrated pictorially overleaf in Figure 1.
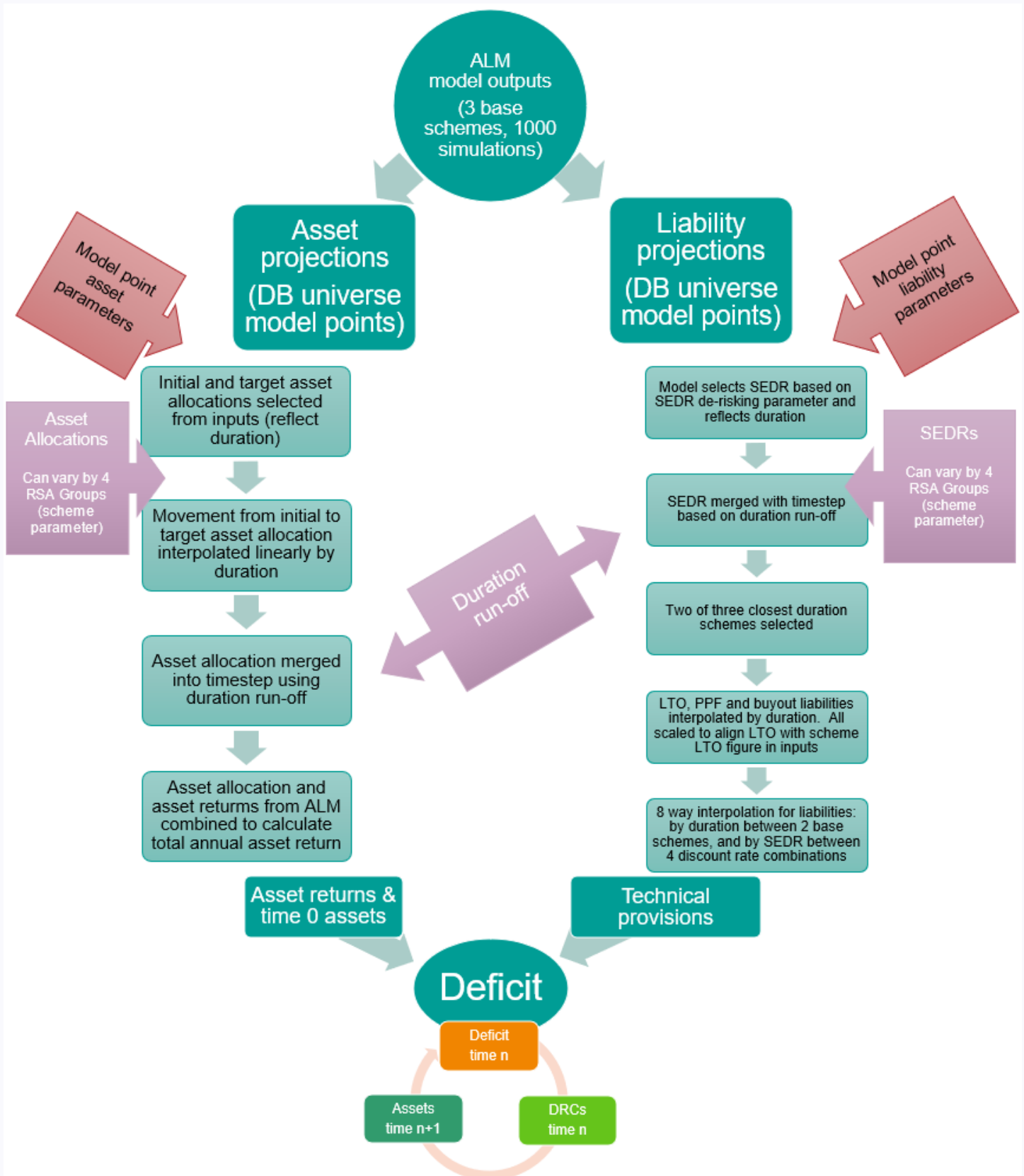
Figure 1: Universe modelling process

5 Assumptions

This section details the assumptions used in the modelling of the universe of DB schemes and outlines the differences between the Fast Track and counterfactual assumptions in the model.

Assumptions

Scheme, demographics, bases

5.1   As has been described above, member benefits are projected over a 40-year period, with allowance for mortality rates, inflation, dependent benefits, and future economic conditions. The cashflows are used to determine liability values at each time point based on discount rate assumptions, allowing for the assumed market conditions at each future time point. Further details on the assumptions are discussed below and can be found in Appendix A.

5.2   The buyout pricing basis is based on our understanding of market practice as at 31 March 2021, and it reflects our best views of bulk annuity pricing and the Pension Protection Fund's ('PPF') methodology. The buyout basis assumes that the discount rate is approximately gilts+0.7% for benefits payable next year and approximately gilts-1.25% for benefits payable in around 60 years. For periods in between, the spread relative to gilts is linearly interpolated.

5.3   The single equivalent buyout discount rate starts at around gilts-0.3% for an immature scheme and it increases as schemes mature to around gilts+0.5% in the longer term.

5.4   The PPF basis results are valued using the assumptions set out in the PPF guidance on Section 179 valuations applicable to the modelling dates. The basis reflects the cost of buying-out each scheme's PPF benefits with an insurer.

5.5   The low dependency basis assumes discounting using a rate of gilts+0.5% p.a. for all cashflows regardless of timing. Demographic assumptions for all liability calculations are set out in the Appendix A.

5.6   The counterfactual and Fast Track approaches adopt a different set of assumptions, which includes having different discount rate structures and rules on affordability, and these are detailed in the sub-sections below. The de-risking rules, recovery plans length rules and calculation methods for Deficit Repair Contributions also differ between the counterfactual and Fast Track runs and these are detailed in Appendix E.

5.7   Retail Price Inflation ('RPI') is calculated from the underlying economic scenarios, whereby yields on index-linked gilts are used to derive an implied rate of inflation.

5.8   RPI inflation is applied to RPI-linked benefits within the liability projection model. Consumer Prices Index ('CPI') is then determined by adjusting RPI, and the approach taken reflects the reform to RPI expected to take place in 2030.

5.9   The projection component of the ALM assumes a stochastic rate of CPI inflation generated by taking a normally distributed random variable deduction from the RPI

assumption. The random variable has a mean and standard deviation based on historic data on the gap between RPI and CPI.

5.10   The Annual Management Charges ('AMCs') for each asset class are given in Appendix C. Other expenses such as administration costs and PPF levies are assumed to be met by the sponsor. The annual returns for assets are calculated by taking linear combinations of yearly returns of each asset class and subtracting the AMC.

5.11   The scheme experience allows for assumed mortality rates which are detailed in Appendix A. The projections reflect the stochastic mortality scenarios in line with the third-party valuation software used for this analysis, with mean outcomes in line with the assumed mortality rates.

5.12   The calculations "lock in" the funding position when the level of funding exceeds 102% of the buyout liabilities. At this point it is assumed that DRCs will cease, and then the assets and liabilities are set equal to 100% of the buyout liabilities for the remainder of the projection period.

Counterfactual assumptions

5.13   The assumptions underlying the counterfactual modelling are designed to represent the general existing approach to scheme funding, with an allowance for reducing risk over time as schemes mature. As such, the counterfactual scenario can be thought of as representing how scheme funding might be expected to develop over time if there were no changes to the regulations.

Assets

5.14   Under the counterfactual approach, 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. The investment strategies de-risk over time in line with the de-risking rules outlined below.

5.15   Scheme were initially grouped into three nominal discount rate bands: less than 1.8%, between 1.8% and 2.6%, and greater than 2.6% respectively. For each SEDR band, a weighted nominal discount rate and an equivalent margin over the 20-year gilt yield was provided.

Band	Initial weighted nominal value	Average margin over 20yr gilts (approx.)
<1.80%	1.58%	0.20%
1.80% - 2.60%	2.14%	0.70%
>=2.60%	3.13%	1.70%

Table 5: SEDR bands weighted nominal values

5.16   Using the original weighted SEDR values from Table 5 resulted in liabilities that were initially different to the liabilities calculated by TPR on a scheme-by-scheme basis. The difference was the result of using grouped data and average SEDRs to represent the full universe of schemes.

5.17   For the purposes of this analysis and to ensure the liability position of the grouped data as at 31 March 2021 was representative of the universe of schemes on a scheme-by-scheme basis, the SEDR applicable to each discount rate band was adjusted. The adjustment was calculated to provide time 0 liabilities for each band that were closer to TPR's scheme-by-scheme calculations. The updated SEDRs used in the projections are detailed in Table 6 below.

Band	Adjustment	Weighted nominal value	Average margin over 20yr gilts (approx.)
<1.80%	0.20%	1.78%	0.40%
1.80% - 2.60%	0.25%	2.39%	0.95%
>=2.60%	0.30%	3.43%	2.00%

Table 6: SEDR bands with adjusted weighted nominal values

5.18   The following discount rate de-risking rules apply:

- For schemes in the "<1.8%" band: the discount rate reduces by 0.05% per year of duration until it reaches gilts+0.35%
- For schemes in the "1.8% to 2.6%" and ">=2.6%" bands: the discount rates reduce by 0.1% per year of duration until they reach gilts+0.35%.

5.19   The investment strategy under the counterfactual approach is based on the underlying Return Seeking Asset ('RSA') data groupings of <25% RSA, 25%-40% RSA, 40%-60% RSA and >60% RSA. For each RSA grouping there is a different asset allocation as detailed in Table 27 in Appendix C. The asset values are determined for each future point and allow for the underlying investment returns of each asset class.

5.20   The initial exposure to return-seeking assets ranges from 15% in the "<25% RSA" group up to 73% in the ">60% RSA" group and the remaining assets are invested in corporate bonds, government bonds and low-risk liability driven investments ('LDI').

5.21   LDI is an investment tool that focuses the asset allocation and investment strategy decisions on matching the current and future liabilities of the pension scheme. By matching the assets more closely with the liabilities, pension schemes mitigate the risk of interest rate and inflation movements, and its main purpose is to hedge the value of liabilities against these risks. It therefore helps to minimise the overall impact on scheme funding levels when interest rates fall. Leveraged LDI allows a scheme to increase the amount of liability matching assets it holds and simultaneously maintain its investment in other asset classes.

5.22   The counterfactual approach assumes that schemes are adopting a LDI portfolio with an average leverage assumption of 3X. This approach is an estimate that aims to reflect typical LDI market operations in force over the period around 31 March 2021 and therefore is an attempt to mirror the perceived levels of leverage in force in aggregate across the DB universe at the date of modelling.

5.23   Investment de-risking is assumed to take the following form:

- For schemes with less than 25% of return seeking assets there is no de-risking as they are already assumed to have de-risked to an appropriate level

- For schemes with more than 25% of return seeking assets, de-risking is assumed to be 5% per year of duration until the growth asset allocation is 20%, then 1% per year of duration until the growth asset allocation is 15%.

5.24   The counterfactual Recovery Plans are outlined in Appendix C.

Fast Track assumptions

5.25   For the purposes of this modelling, all schemes are modelled under a set of parameters expected to meet a Fast Track approach. The universe model assumes that all schemes follow a Fast Track de-risking journey towards the FTLD by the time they reach significant maturity, equivalent to a duration of 12 years.

5.26   This means the Technical Provisions ('TPs') should be measured on a gilts+0.5% basis and a low-risk asset allocation at a point of significant maturity.

Assets

5.27   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. The investment strategies de-risk over time in line with the de-risking shapes shown in Chart 7.

5.28   The SEDRs used in this modelling have been estimated based on the Technical Provisions being a percentage of the FTLD basis and the SEDR is expressed as a premium in excess of the yields on UK Government Bonds ('gilts'). The SEDRs are given in Appendix C. It should be noted that the Fast Track parameters are set as a percentage of the low dependency liabilities and for the purposes of this modelling, the table of SEDRs in Appendix C has been adopted. These are assumed to be the same across all model point groupings.
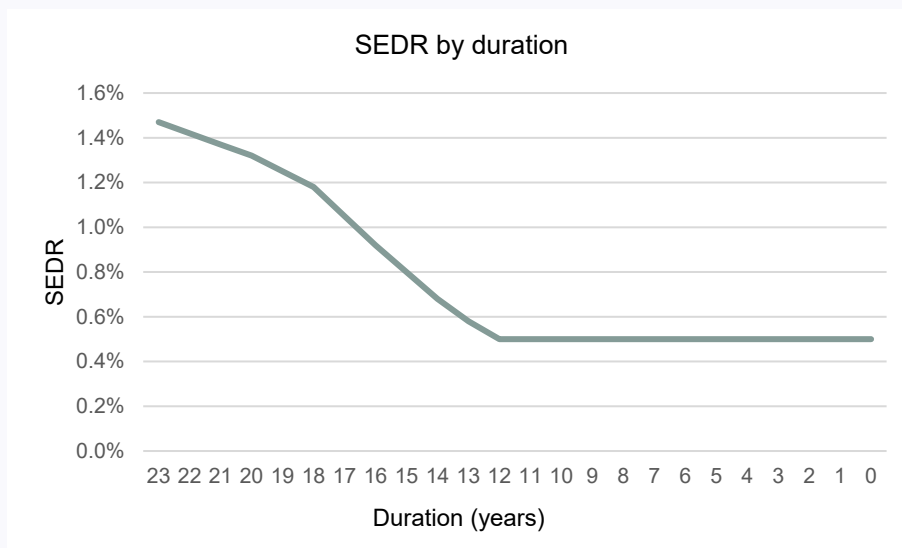

Chart 7: SEDR progression with duration

5.29   For all model points, the investment strategy is assumed to de-risk over time as the scheme matures and the duration decreases. The higher durations have a higher SEDR and consequently, as the scheme matures over time, the discount rate reduces. The

journey plans are represented by specified asset allocations with reducing risk over time and a progression of SEDRs expressed as a margin over gilts.

5.30   The Fast Track approach adopts a LDI portfolio with leverage of 2X. This reflects observed responses to the effects of the volatility of the gilts and LDI market through late September 2022 and the potential for future levels of leverage offered by LDI managers to be at lower levels than historically and the potential for higher costs of purchasing LDI due to higher levels of collateral.

5.31   Effective de-risking strategies will reduce the risk to the scheme over time. De-risking under the Fast Track approach is assumed to take place between duration 17 and duration 12. By duration 12 the scheme is assumed to have reached significant maturity and there will be a low level of risk remaining in the funding strategy.

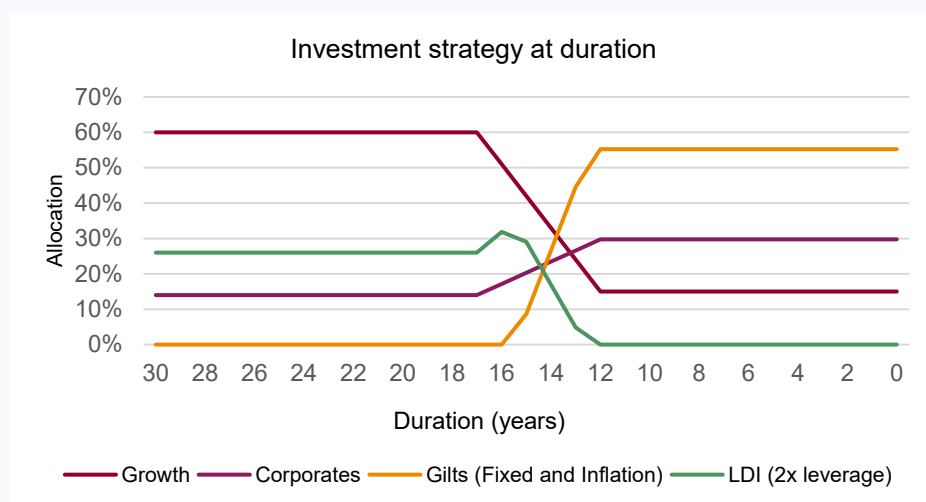5.32   The investment strategy modelled under the Fast Track approach is plotted by duration in Chart 8 below.

Chart 8: Investment Strategy by duration

5.33   TPR have stated that the point of significant maturity should be assumed to be at duration 12. At that point, the Fast Track appropriate level of investment risk is given by the following investment strategy:

Asset	Allocation at duration 12
Growth (equity proxy)	15.00%
Corporates	29.75%
Gilts (fixed and inflation)	55.25%
LDI	0.00%

Table 7: Fast Track investment strategy at the point of significant maturity

5.34   The percentage allocation of the growth element of this portfolio is shown Table 30 in Appendix C.

6 DB Funding Code outcomes

This section gives a summary of the outcomes from the universe modelling and details key messages when comparing the counterfactual outcomes to the Fast Track outcomes.

Key messages and conclusions from the analysis are highlighted in boxes throughout this section.

Results and conclusions

6.1   The analysis is based on modelling c. 5,000 pension schemes across the DB landscape. The starting total asset values across the universe is approximately £1.7 trillion.

6.2   Table 8 summarises the assets, Technical Provisions, and surplus or deficit for the counterfactual and Fast Track approaches at time 0 (31 March 2021).

	Assets (£bn)	Technical Provisions (£bn)	Surplus or (deficit) (£bn)
Counterfactual	1,710	1,737	(27)
Fast Track	1,710	1,665	45

Table 8: Time 0 assets and Technical Provisions for the counterfactual and Fast Track runs

6.3   At time 0, the counterfactual aggregate funding level is 98% and the Fast Track aggregate funding level is 103%.

6.4   In the Fast Track model, we have assumed that all schemes move to a Fast Track approach. We have considered the Technical Provisions in aggregate and as at 31 March 2021 (time 0), the Fast Track Technical Provisions are approximately 4% lower in aggregate across the universe of DB schemes.

> **Key Message 1:**
>
> Across the universe of schemes, the Fast Track Technical Provisions are approximately 4% lower than the Technical Provisions on the counterfactual approach. This means on average, the starting SEDR for the Fast Track approach is slightly higher than that for the counterfactual approach.

6.5   The FTLD basis calculates liabilities on a gilts+0.5% basis and gives a total liability of £1.94 trillion at time 0. The FTLD basis gives an indication of where the model points are against the objective of reaching a low dependency target.

6.6   The output from the model can by sub-divided by the key assumptions, such as maturity group, SEDR, allocation to return seeking assets, initial funding level and recovery plan length. The key messages have been extracted from the analysis by sub-dividing the output across these different scheme characteristics.

Funding level progression

6.7   Under each modelling run, the model projects assets and liabilities over a 40-year projection horizon. The following set of graphs plot the proportion of low dependency liabilities across model points by funding level status over time. The funding level in this circumstance is calculated as total assets divided by liabilities on a low dependency basis. The low dependency basis shows where the model points are against the long-term target and by assessing the Fast Track and counterfactual on a similar basis, allows for comparison of outcomes in the future.

6.8   The funding level progression graphs segment the liabilities across the model points by a funding status, where the following funding statuses have been applied:

- The "Buyout" status is assumed once a scheme reaches a funding level of 102% of buyout liabilities and at which point a solvency level of funding is "locked in" to the calculations. If the assets are greater than or equal to 102% of the buyout liabilities at the start of any particular year, the assets will be set to equal 100% of the buyout liabilities at the end of the year and for the remainder of the projection period.

- The "Fully funded" status is when a scheme has a reached funding level of 100% of the FTLD and is considered to be in surplus (assets >= liabilities) but has not yet reached buyout position.

- The "Under funded" status is when a scheme is between 75% and 100% funded on the FTLD basis.

- The "Less than 75% funded" status is when a scheme's total assets are less than 75% of the value of the scheme's liabilities on the FTLD basis.

6.9   As we have used stochastic modelling of 1,000 economic scenarios, the funding level progression charts can be shown at different percentile levels at a particular timestep. The model takes the distribution of funding levels for the individual model points at each timestep and illustrates the chosen percentile point of the distribution.

6.10   The graphs within the dashboard are generated by taking the relevant percentile of either aggregate or average funding level across the scenarios for a given timestep. The process diagram in Figure 2 below explains how the funding level progression graphs have been created.
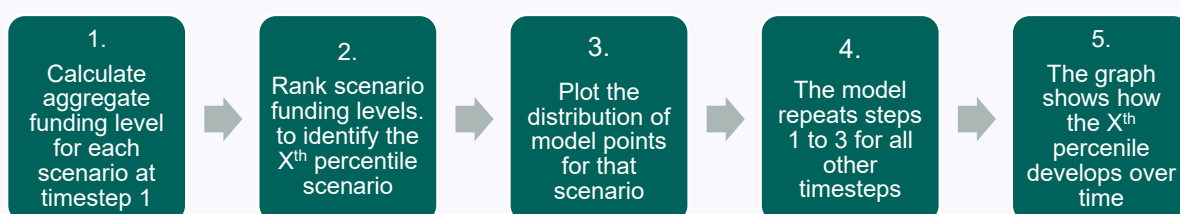

Figure 2: Process diagram for funding level progression graphs

6.11 If we want to assess how the median level of outcomes develops over time, then the 50th percentile of scenarios would be selected for all timesteps. For interpretation purposes, it should be noted that the percentiles are unlikely to be the same economic scenario at each timestep, which can cause the proportion of model points within each funding status to vary from year to year.

6.12 The lower percentile of scenarios relates to those scenarios which have a lower funding level across the outcomes and so particular attention should be drawn to these scenarios as they can be considered to correspond to the downside scenarios. The scenarios that fall into the lower percentiles are particularly relevant for the Fast Track to control the risk of poor member outcomes.

Funding level progression: median level

6.13 Chart 9 shows the low dependency funding level progression over 40 years at the median level of scenarios for the counterfactual assumptions and Chart 10 shows the low dependency funding level progression over 40 years at the median level of scenarios for the Fast Track assumptions. Table 9 provides some of the underlying figures at time 0, 10 and 20.
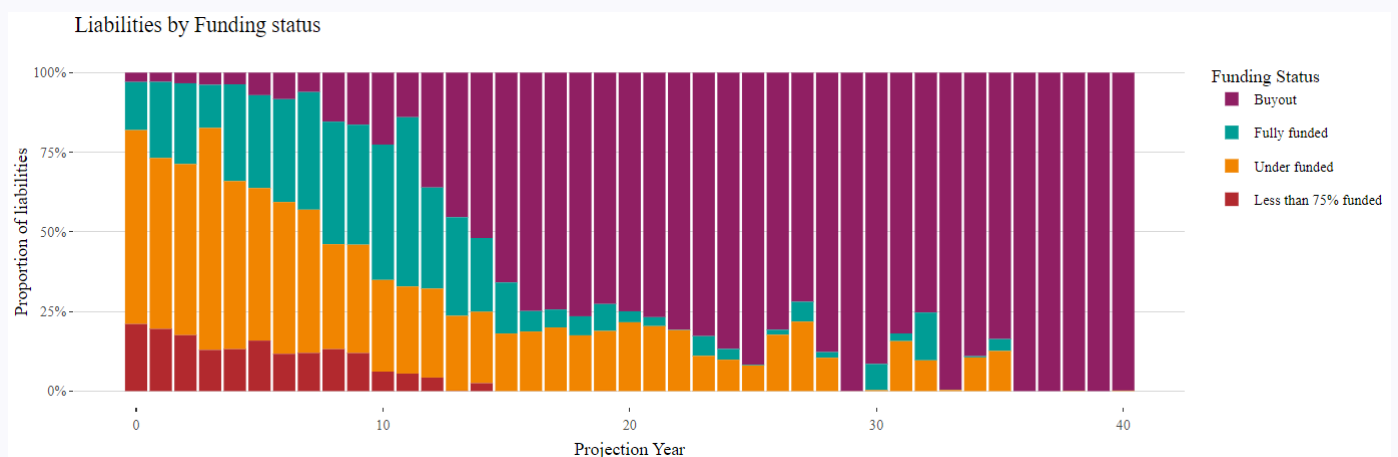

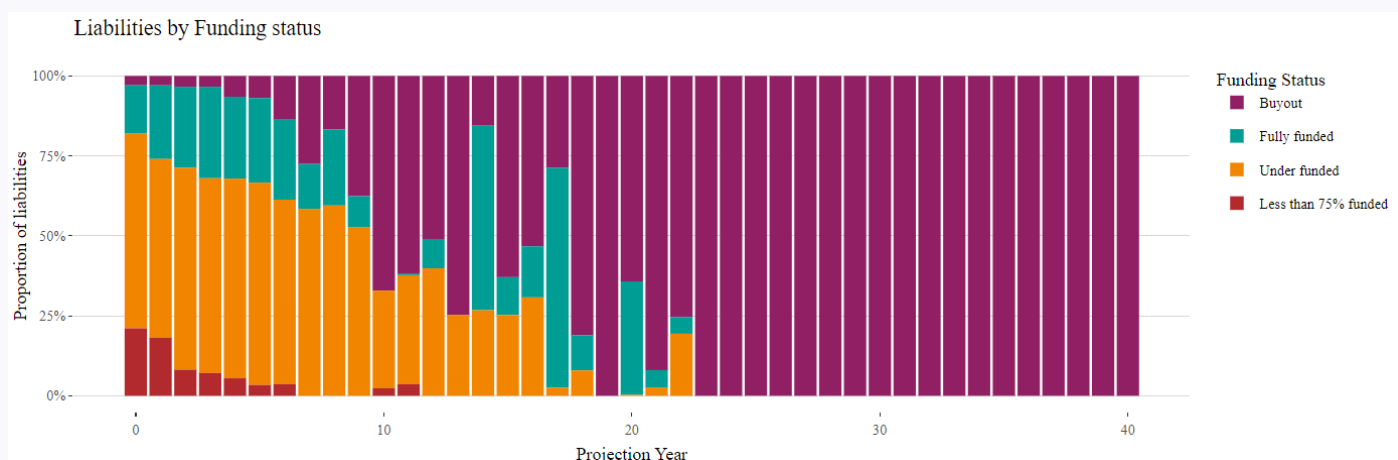*Chart 9: Counterfactual funding level progression, median level*

Chart 10: Fast Track funding level progression, median level

Median scenario	< 75% funded			Fully funded and Buyout		
	Time 0	Time 10	Time 20	Time 0	Time 10	Time 20
Counterfactual	21.1%	6.1%	0.0%	18.0%	65.1%	78.3%
Fast Track	21.1%	2.3%	0.0%	18.0%	67.1%	99.6%

Table 9: Proportion of model point liabilities at different funding statutes over time, median level

6.14   At time 0 under the low dependency basis, the Fast Track and the counterfactual have the same proportions of liabilities across the scenarios that fall into each funding status. Around 82% of model points are underfunded on an FTLD basis at time 0.

6.15   Looking at the progression of model points with less than 75% funding levels at the median level, the proportion in this category decreases at a faster rate in the Fast Track approach than under the counterfactual. For example, over the first ten years, the proportion of overall FTLD liabilities which have funding levels less than 75% in the counterfactual decreases from 21.1% to 6.1%, whereas under the Fast Track it decreases from 21.1% to 2.3%.

6.16   The median level of outcomes also shows that by time 20, the Fast Track approach is expected to have delivered full low dependency funding for almost all of the liabilities. Whereas in the counterfactual there remains over 20% of liabilities still under funded. This indicates that over the medium to longer term the Fast Track approach is delivering better funding level outcomes for schemes than the counterfactual.

6.17   A point of significant maturity on average across all schemes is achieved at around duration 12 and this can be seen at around projection year 23 in the Fast Track results. There is quicker progression to the buyout status for all model points under the Fast Track and by time 23, all model points at the 50th percentile have progressed to reach the buyout status. In the counterfactual approach, all model points reach this level at around time 29, but only secure this level by time 36.

Key message 2:

On the Fast Track approach at the median level of scenarios and on a low dependency basis, there is a greater probability of model points reaching a position of being fully funded or being able to buyout liabilities within 20 years, with a quicker progression of underfunded model points moving towards a fully funded status.

The point at which model points are fully funded on a low dependency funding basis is reached significantly earlier under the Fast Track approach in aggregate, compared to the counterfactual approach.

Funding level progression: 5th percentile

6.18   Chart 11 shows the funding level progression over 40 years at the 5th percentile level of scenarios under the counterfactual and Chart 12 shows the funding level progression over 40 years at the 5th percentile level of scenarios under the Fast Track.
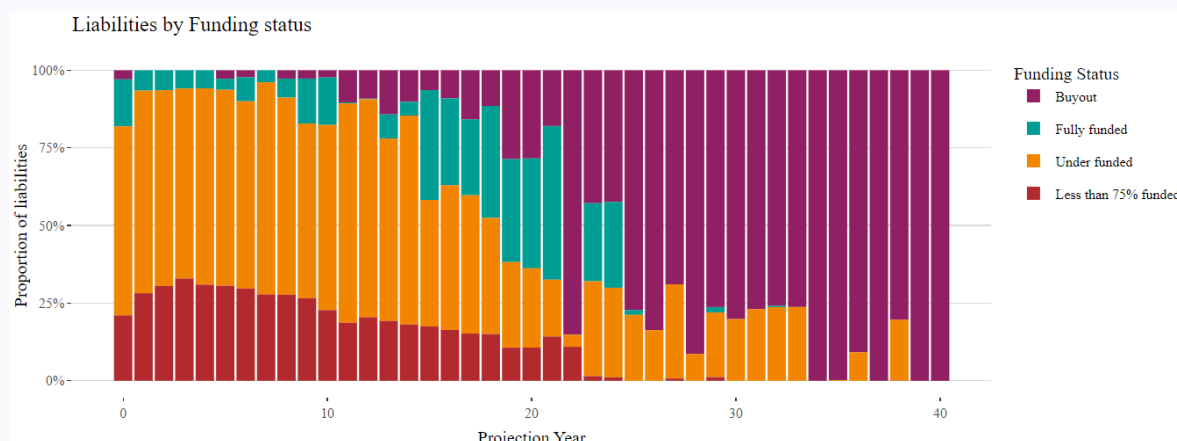

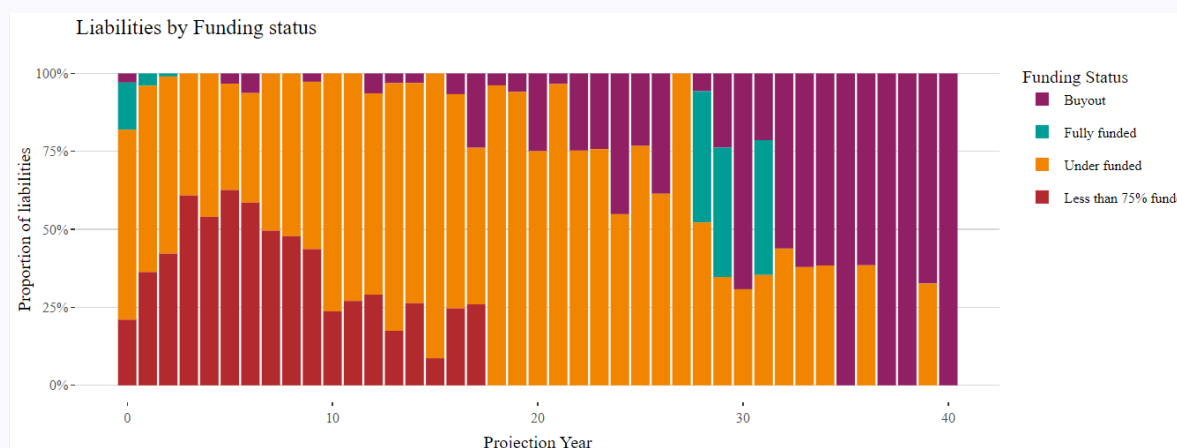*Chart 11: Counterfactual funding level progression, 5th percentile*

Chart 12: Fast Track funding level progression, 5th percentile

5th percentile	< 75% funded			Fully funded and Buyout		
	Time 0	Time 10	Time 20	Time 0	Time 10	Time 20
Counterfactual	21.1%	22.8%	10.7%	18.0%	17.6%	63.8%
Fast Track	21.1%	23.7%	0.0%	18.0%	0.0%	24.9%

Table 10: Proportion of model point liabilities by funding status over time, 5th percentile

6.19   At the 5th percentile level of scenarios, there is a higher proportion of model points in aggregate which are underfunded on the Fast Track approach, and this can be seen in projection years 4 to 10 in Chart 12.

6.20   In the counterfactual approach, over the short to medium term, more of the liabilities reach fully funded status than for the Fast Track and this can be seen in Table 10, where 63.8% of the model points have reach this position at time 20. Over the longer term, the Fast Track approach moves the majority of model points to a buyout position, but generally

counterfactual outcomes are better in these downside scenarios with a higher proportion of model points reaching a buyout position.

6.21   The Fast Track approach does however move liabilities from the weakest funding status (<75% funded) more quickly than the counterfactual. By time 20, all liabilities are at least 75% funded under the Fast Track whilst just over 10% remain under 75% funded on the counterfactual.

6.22   From a funding code perspective, the Fast Track approach is aiming to ensure those schemes with the weakest funding levels can reach a position of low reliance on the sponsor by the time they reach significant maturity. These charts of downside scenarios suggest that the Fast Track approach is providing those schemes with the weakest funding levels with improved outcomes over the medium to longer term.

6.23   To understand this further, the model points have been segmented further by key characteristics of schemes, such as maturity, SEDR, RP length and allocation to return-seeking assets.

Key message 3:

At the downside 5th percentile of scenarios, the model points with weaker starting funding levels benefit from adopting a strategy in line with the Fast Track approach and reach a position of stronger funding more quickly.

For the model points that have a stronger initial funding position, the Fast Track approach doesn't materially improve funding until 25 years or more have passed. This demonstrates that whilst a Fast Track approach could help improve funding outcomes for some schemes, the Fast Track approach does not necessarily benefit members in all economic circumstances.

Funding level progression segmented by maturity: median

6.24   The following analysis takes the funding progression over time and splits the analysis out by initial maturity groups. The maturity segments are given in Table 11.

Duration (years)
Less than 18
Between 18 and 22
Greater than 22

Table 11: Duration of maturity segments

6.25   The funding progression in Charts 13 and 14 below show a clear progression to a low dependency position under both the counterfactual and Fast Track approaches. For the schemes in the most mature category, initial duration less than 18 years, this progression to a buyout position is faster than for those in the least mature category, initial duration greater than 22 years.
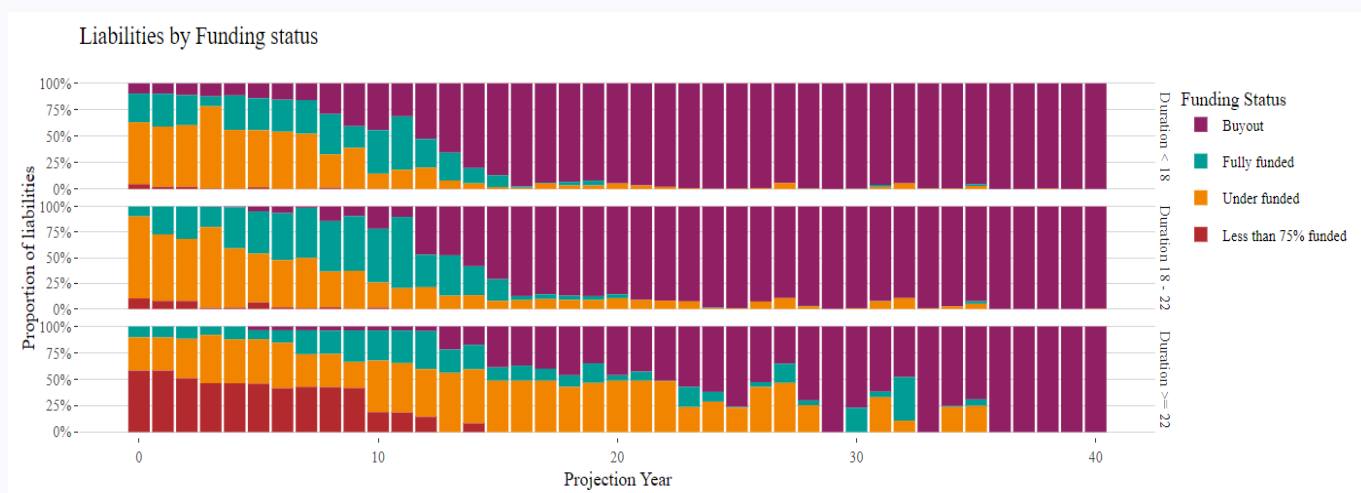
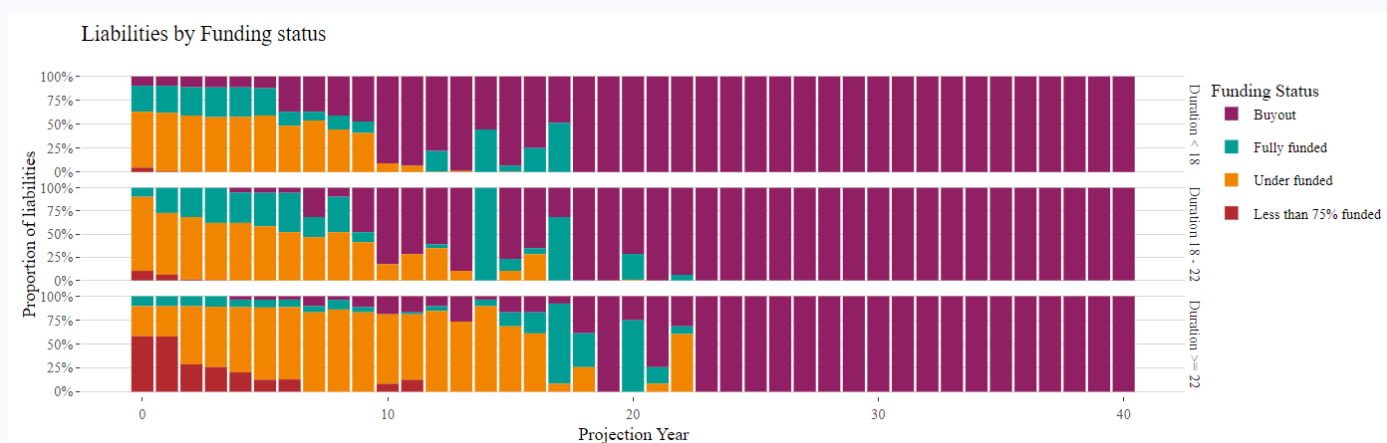*Chart 13: Counterfactual funding progression by maturity groupings, median level*

Chart 14: Fast Track funding progression by maturity groupings, median level

6.26   Charts 13 and 14 are shown at the median level and illustrate broadly the same pattern as the aggregate position in Charts 9 and 10. That is, the Fast Track approach generally improves the speed at which model points are expected to reach full funding and buyout relative to the counterfactual approach. This suggests that the initial starting duration of a scheme does not materially alter the effectiveness of the Fast Track approach.

6.27   As the initially immature model points reach a point of significant maturity under the Fast Track approach, all model points are expected to be at least fully funded. Under the counterfactual approach, approximately 25% of the initially immature model points have funding less than 100% and are therefore underfunded.

6.28   The Fast Track set of parameters helps improve the funding position of schemes which are initially immature, with a duration greater than 22. The proportion of model points that have funding levels less than 75% is lower in almost all future years of the projections when the Fast Track parameters are adopted. At the median level, the Fast Track approach appears to work as effectively for schemes regardless of initial duration.

Funding level progression segmented by asset allocation: 5th percentile

6.29   The following charts show the funding progression splits by asset allocation to return-seeking assets. The asset allocation groups are defined in terms of allocation to return seeking assets; Band 1: < 25%, Band 2: 25% - 40%, Band 3: 40% - 60%, Band 4: >= 60%

Chart 15: Counterfactual funding progression by asset allocation, 5th percentile

Chart 16: Fast Track funding progression by asset allocation, 5th percentile

6.30   At the 5th percentile of scenarios, the funding outcomes for model points with a high initial allocation to return seeking assets (Band 4: >=60%), are improved when moved onto a Fast Track approach. The charts show that model points move out of a weak funding position (less than 75% funded) in a shorter timeframe, compared to the counterfactual.

6.31   Funding outcomes across the other asset allocation groupings have better outcomes under the counterfactual, whereby a higher proportion of the model points reach a buyout position from projection year 23. This is driven by the downside risk at the 5th percentile being protected by the higher leverage assumption, and therefore a lower risk investment strategy, in the counterfactual.

> **Key Message 4:**
>
> The Fast Track approach inherently assumes a higher risk investment strategy than the counterfactual approach. This is partly the result of reduced leverage in the LDI assumption and a higher allocation to growth assets in aggregate.
>
> The increased level of investment risk results in a wider range of outcomes for the Fast Track, including more frequent lower outcomes at most durations. The downside 5th percentile outcomes illustrate the lower proportion of liabilities reaching a buyout funding position.

Funding level progression segmented by maturity and asset allocation: 5th percentile

6.32   The following charts show the funding progression over time at the 5th percentile of scenarios and splits the analysis out by initial maturity groups and asset allocation. The maturity segments are less than 18 years, between 18 and 22 years, and greater than 22 years. The asset allocation groups are defined in terms of allocation to return seeking assets; Band 1: < 25%, Band 2: 25% - 40%, Band 3: 40% - 60% and Band 4: >= 60%
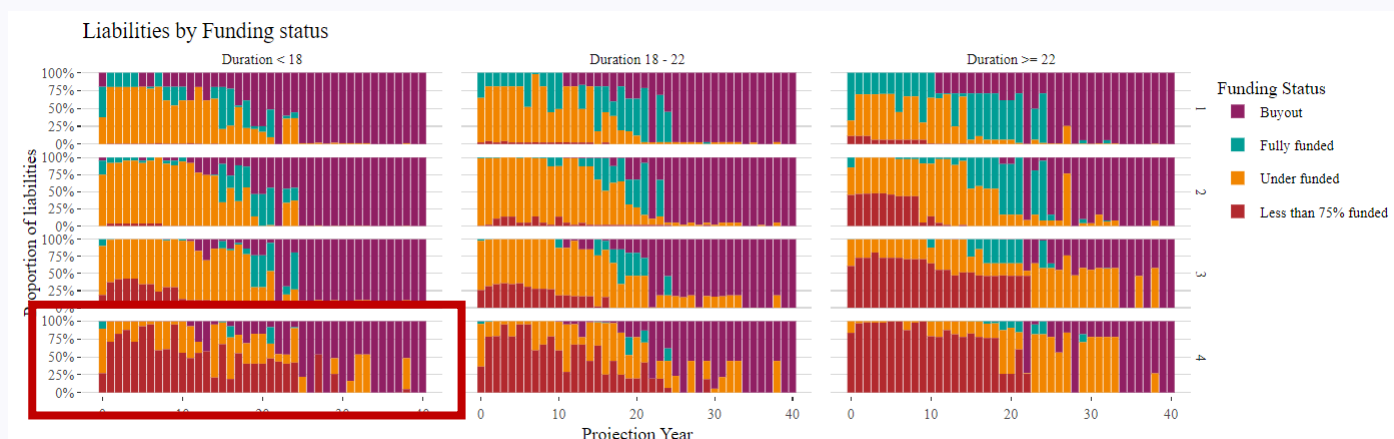

Chart 17: Counterfactual funding progression by maturity and asset allocation, 5th percentile
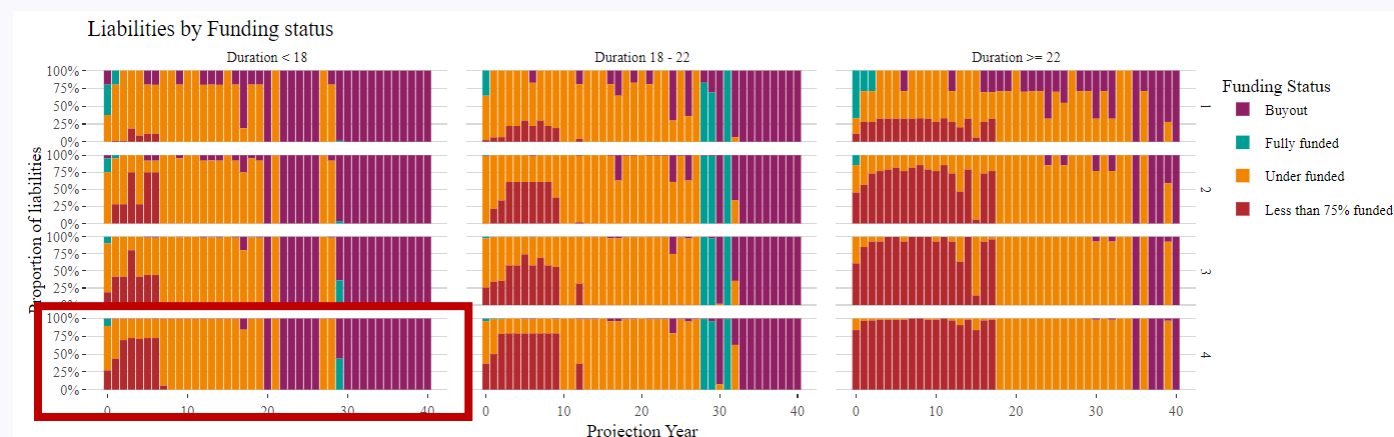

Chart 18: Fast Track funding progression by maturity and asset allocation, 5th percentile

6.33   Charts 17 and 18 show that the Fast Track parameters improve the funding positions for the model points which have a high allocation to return seeking assets (Band 4). In particular, schemes with an initial duration of less than 18 and that have a higher allocation to return seeking assets, see a proportionate improvement in funding outcomes and a more stable funding level outlook over the projection period. This reflects the initial high allocation to growth assets in the counterfactual approach for these model points. The outcomes for this segment are highlighted in Chart 17 and Chart 18 by red boxes.

6.34   In the grouping of mature schemes invested with a high allocation to return seeking assets, the model points with weaker funding levels (less than 75% funded status) see improved outcomes as the majority of these model points move into a higher funding level status by time 7. The investment strategies should be resilient to short term adverse changes in market conditions as this will impact on the level of employer contributions which are required in the future.

> **Key Message 5:**
>
> The Fast Track outcomes see an improvement in the funding position for model points in general which are initially mature and have an investment strategy that has a high allocation to return seeking assets. The higher maturity and high investment risk for this segment of schemes, means that member benefits are most at risk under existing funding and investment approaches. Under a Fast Track approach, the outcomes and therefore the security of member benefits improve and stabilise earlier in the projection period compared to the counterfactual.

Funding level progression segmented by SEDR: 5th percentile

6.35   The following charts show the funding progression over time at the 5th percentile of scenarios and splits the analysis out by SEDR band: high (>=2.6%), medium (1.8% to 2.6%) and low (<1.8%) respectively.

Chart 19: Counterfactual funding progression by SEDR band, 5th percentile
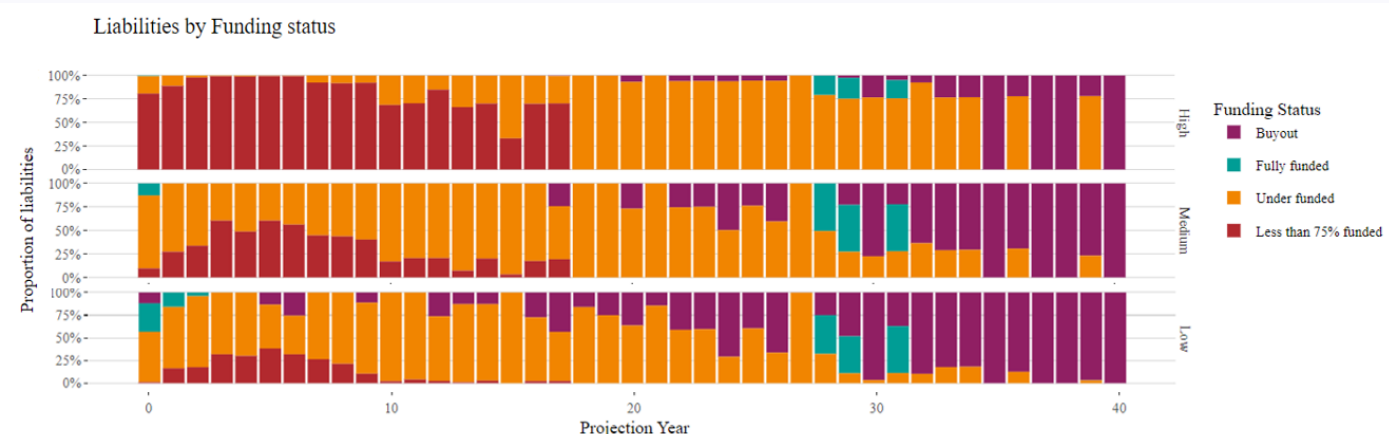
Chart 20: Fast Track funding progression by SEDR band, 5th percentile

6.36   Charts 19 and 20 illustrate that for model points in the 'high' SEDR band, the outcomes and progression of funding levels under the Fast Track improve at the 5th percentile level, with a lower proportion of model points projected to have a funding level lower than 75% by time 18. Even at this downside level and the increased investment risk in the Fast Track approach, the outcomes over the long term are similar between Fast Track and the counterfactual.

6.37   For the model points in the medium and low SEDR bands, the funding level outcomes are more stable in the counterfactual, which suggest that the Fast Track approach is likely to be most beneficial to schemes with higher initial SEDRs. At the 50th percentile of scenarios, the effect on the high SEDR band model points is accentuated and this is evident in Chart 21 below, where almost all of the model points at the median level reach a position of buyout at projection year 23.
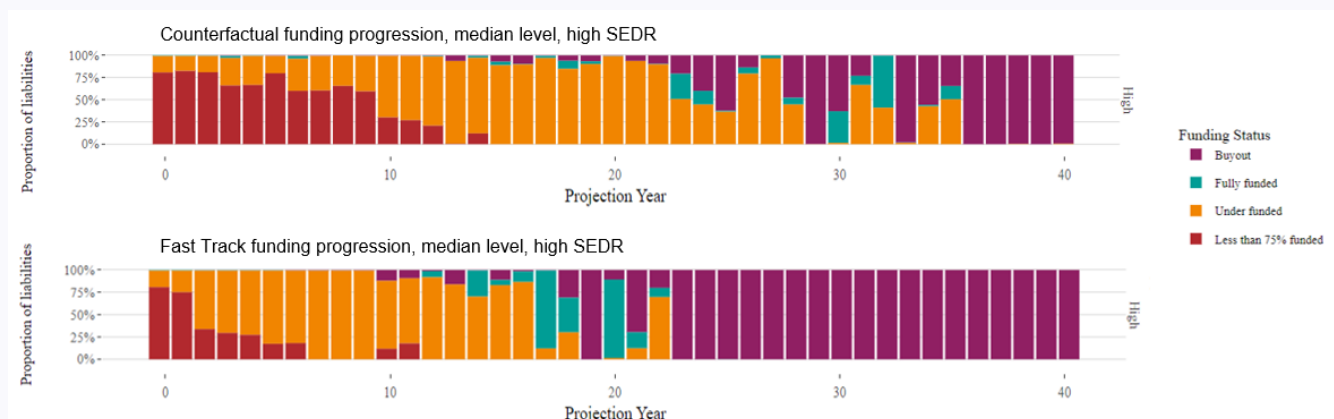

Chart 21: Counterfactual and Fast Track funding progression, median, high SEDR band

Funding level progression segmented by SEDR and asset allocation: 5th percentile

6.38   The following charts show the funding progression over time at the 5th percentile of scenarios and splits the analysis out by SEDR 'high' band and asset allocation.
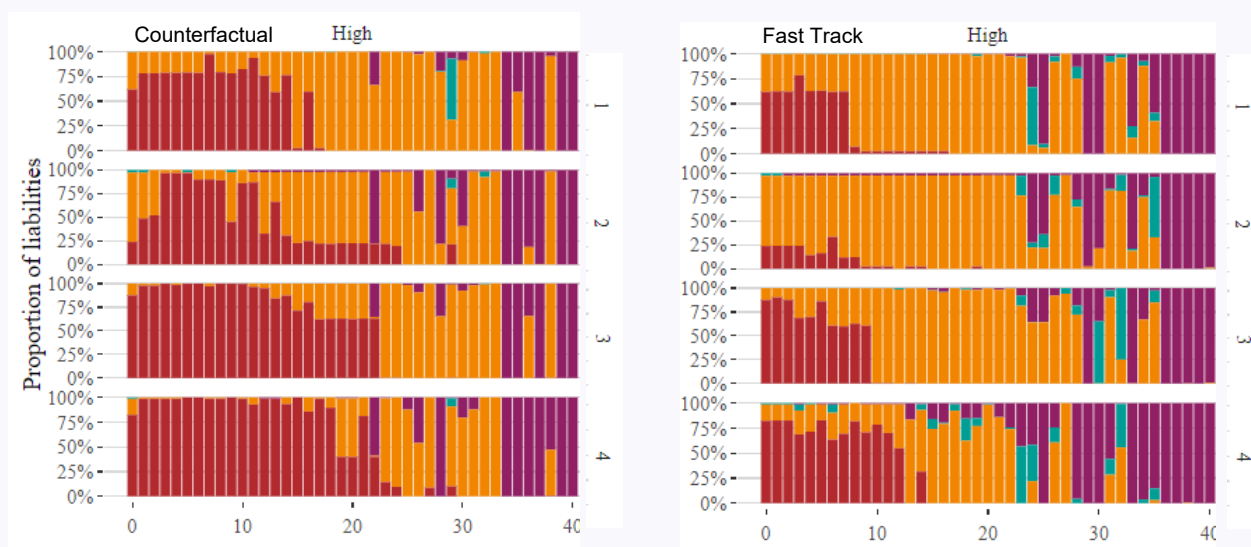
Chart 22: Counterfactual (left) and Fast Track (right) funding progression, 5th percentile, high SEDR band

6.39   Chart 22 shows how the funding level progresses for the model points in the high SEDR band, and the charts illustrate how the initial level of return seeking assets affects funding outcomes in the future. Across all four asset allocation bands, the proportion of model points that are under 75% funded is lower in the Fast Track than the counterfactual. This is a consequence of the different Fast Track investment strategies and DRC rules, which result in stronger asset growth than under the counterfactual.

6.40   The discount rate should be consistent with expected returns in an investment portfolio where the scheme assets and liabilities are reasonably well matched. For those schemes that have been adopting a high discount rate and level of investment risk moving to a Fast Track approach is likely to result in better funding outcomes.

Sponsor cost: Annual Deficit Repair Contributions

6.41   We have considered the level of sponsor cost in terms of Deficit Repair Contributions and how the aggregate level of contributions develops over the 40-year projection period. The following charts show the progression of aggregate DRCs over the period at the 5th, 50th (median), 75th and 95th percentile of scenarios.
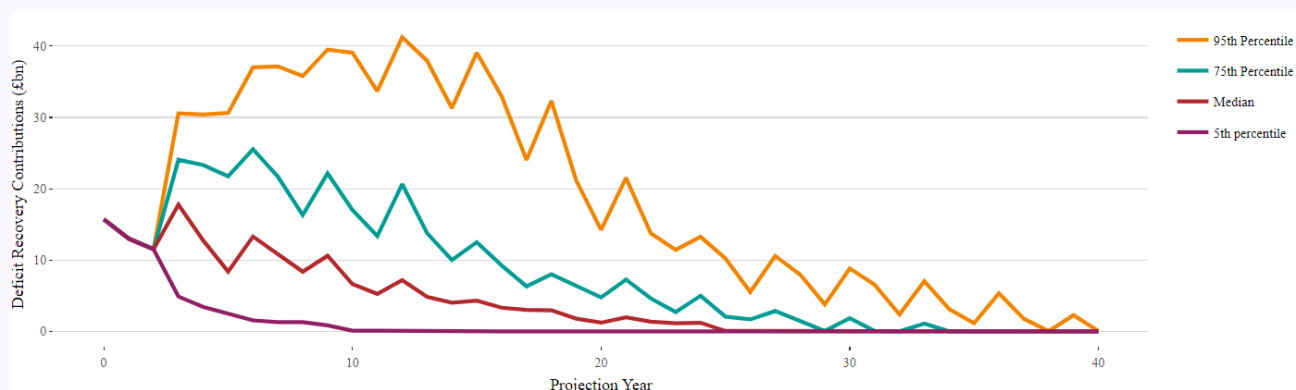
Chart 23: Counterfactual annual total DRCs
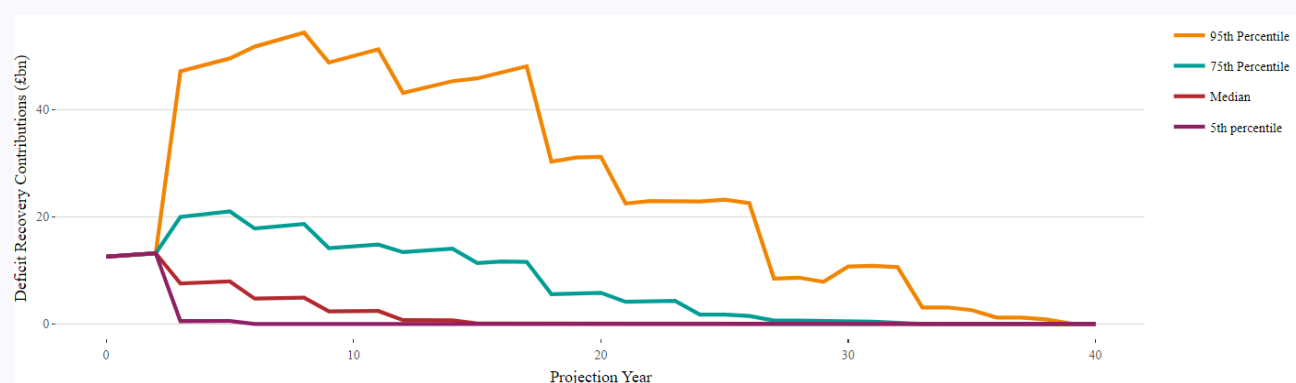
Chart 24: Fast Track annual total DRCs

6.42   The total level of DRCs at time 0 for the counterfactual is £15.7bn and the total level of DRCs at time 0 for the Fast Track is £12.6bn.

6.43   The sponsor cost graphs show that the Fast Track profile of median DRCs start at a lower level initially and maintain a lower more stable level over the course of the projection period, resulting in a lower total sponsor cost over time.

6.44   In projection year 10, at the median level, the annual level of DRCs under the Fast Track is approximately 36% of the total contributions projected under the counterfactual. The combination of taking on more risk on average in the investment strategy and different recovery plans rules, means that the Fast Track has lower DRCs across the model points.

6.45   There is a broader range of contribution outcomes across the percentiles in the Fast Track and this can be seen by the 95% percentile lines in the charts above. The broader range is due to the additional investment risk taken on in the Fast Track approach, which may not always provide positive outcomes. Therefore, in the downside scenarios, the Fast Track approach tends to cause poorer outcomes and require higher DRCs to resolve.

6.46　　The wider range of outcomes on the Fast Track basis is driven by contributions not being capped, whereas the counterfactual contributions sit within a corridor of 100% and 102% in the modelling assumptions. The median Fast Track line has lower contributions since the funding is made up more from investment returns relative to the counterfactual basis.

6.47　　Schemes will aim to achieve a low dependency on the sponsor, which is where schemes are not expected to require further contributions from the employer. The DRCs under Fast Track progress to a lower level in a quicker timeframe. Whilst the counterfactual outcomes result in higher DRCs at the median and 75th percentile levels for the sponsor, this should be balanced by the security of member benefits.

Sponsor cost: Cumulative Deficit Repair Contributions

6.48　　Charts 25 and 26 show the cumulative DRCs for the counterfactual and Fast Track approaches respectively, shown across a range of percentile levels.

6.49　　At the median level, the cumulative DRCs in the Fast Track are approximately half of the total DRCs in the counterfactual over the longer term. Whilst the Fast Track is expected to have lower DRCs at the median level, it has been noted there is also increased risk and a much wider range of cumulative DRCs across the percentiles of scenarios.

6.50　　The increased risk assumed in the Fast Track investment strategy, results in a wider range of funding and contribution outcomes in the future. The 2X leveraged LDI assumption in Fast Track leads to a higher allocation to growth assets, which leads to more risk being taken. At the median level, there are better outcomes for buyout under the Fast Track as the average asset return is higher and the additional return drives funding positions more quickly. At the downside of outcomes, the counterfactual results in better outcomes because it has less exposure to growth assets initially and has a more leveraged position within its matching assets.
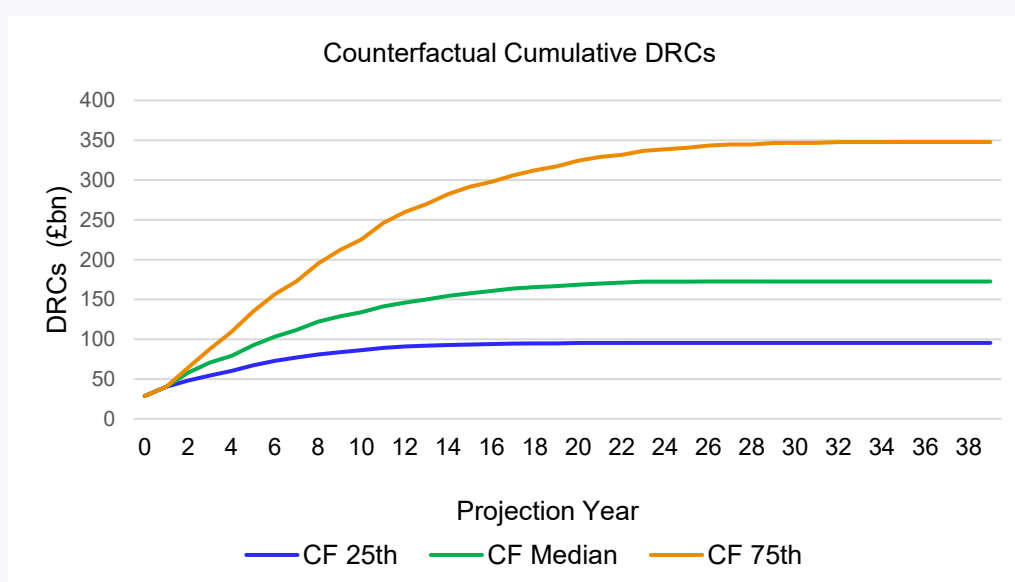
Chart 25: Counterfactual cumulative DRCs
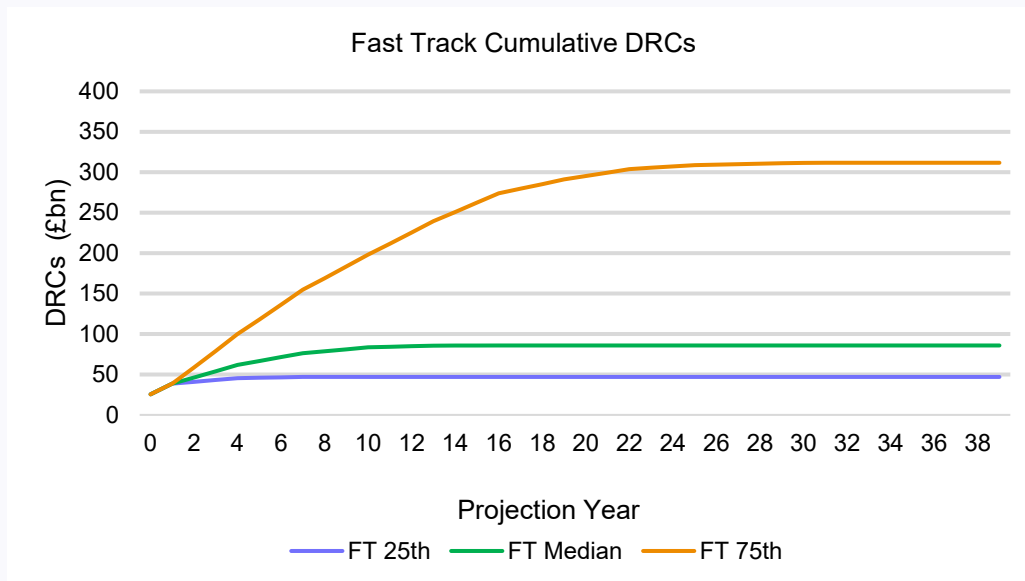
Chart 26: Fast Track cumulative DRCs

6.51   At the 25th percentile of outcomes, the Fast Track DRCs are approximately 49% lower than the cumulative DRCs in the counterfactual in the longer term. At the 75th percentile of outcomes, the Fast Track DRCs are approximately 10% lower than the cumulative DRCs in the counterfactual in the longer term. The total DRCs at the 95th percentile level of outcomes is around 40% higher in the Fast Track approach over the long term.

Counterfactual	Cumulative DRCs (£bn)				
Percentile	**Time 0**	**Time 10**	**Time 20**	**Time 30**	**Time 40**
25th	15.7	83.8	94.7	95.4	95.4
50th	15.7	128.8	166.7	172.5	172.5
75th	15.7	212.0	317.1	346.6	347.8

Table 12: Counterfactual cumulative DRCs (£bn)

Fast Track	Cumulative DRCs (£bn)				
Percentile	**Time 0**	**Time 10**	**Time 20**	**Time 30**	**Time 40**
25th	12.6	46.9	46.7	46.7	46.7
50th	12.6	81.1	85.8	85.8	85.8
75th	12.6	183.5	291.1	311.1	311.7

Table 13: Fast Track cumulative DRCs (£bn)

Key Message 6:

The higher risk investment strategies on aggregate in the Fast Track lead to a broader range of potential contribution requirements. Up to and including the 80th percentile of scenarios, the projected cumulative DRCs are lower in the Fast Track approach compared to the counterfactual in the long term.

The starting level of DRCs is approximately 20% lower than the counterfactual when all model points are modelled on a Fast Track approach. Over the 40-year projection period, the total DRCs at the median level are around 50% lower in the Fast Track approach. The higher contributions required under the counterfactual do feed through to different funding level outcomes as seen earlier in this Section. There is a balance to be struck between sponsor affordability and security of member benefits.

PPF potential losses

6.52   The PPF shortfall (assets minus PPF liabilities) has been assessed to understand the potential losses to the PPF over the projection period. The shortfall has been calculated by looking at the liabilities calculated on a PPF basis over time, and assessing the percentile of outcomes for each projection year.

6.53   An insolvency rate of 1.0% of liabilities per annum is allowed for across the segments of the universe, to give an indication of the approximate liabilities at risk and an indication of the liabilities that might be expected to fall to the PPF if the scheme sponsor becomes insolvent. It is assumed that schemes are eligible to enter the PPF, and that any model points that have over 100% funding of PPF liabilities are excluded from the figures.

6.54   Since short term insolvency rates have become increasingly difficult to project due to the uncertain impacts of events such as Covid-19, Brexit and the Russia/Ukraine conflict, the modelling assumes a simplified insolvency rate of 1% of liabilities per annum for all future years. This assumes that 1% of sponsors go insolvent each year, which is broadly consistent with the percentage of sponsor insolvencies experienced between 6 April 2005 and 6 April 2021 in the scheme universe data held by TPR.

6.55   There is a significant risk that sponsors could face increased financial pressures to fund the scheme in the future, which could result in future sponsor insolvencies. Annual insolvency rates have been allowed for to show the size of the cumulative PPF shortfalls expected to fall to the PPF over time.

6.56   Chart 27 plots the cumulative PPF insolvent shortfall for the Fast Track and counterfactual approaches. The shortfall has been assessed by looking at the liabilities calculated on a PPF basis over time, and aggregating the percentiles over time for the Fast Track approach and the counterfactual. The higher percentiles of outcomes are showing those scenarios with higher shortfalls and therefore less member security compared to the lower percentiles of outcomes.
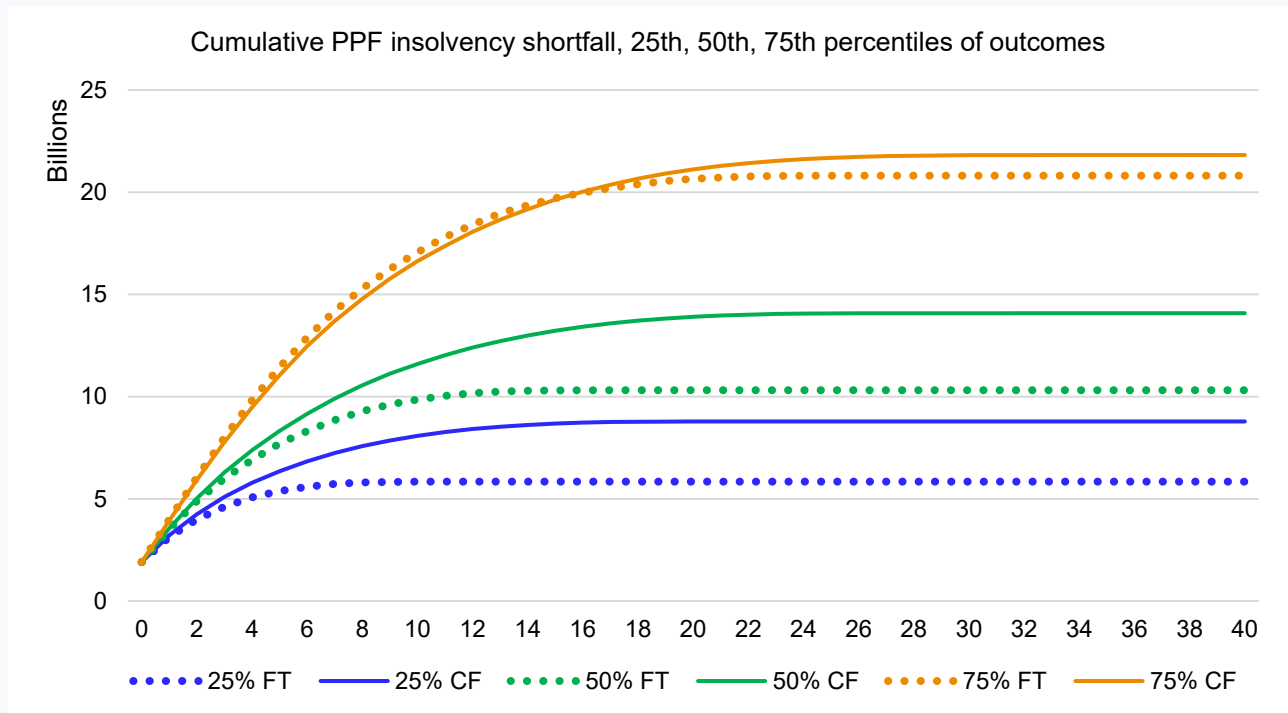
Chart 27: PPF insolvent shortfall (£bn)

6.57   The chart shows that at the 25th and 50th percentiles of outcomes, the insolvent shortfalls are significantly lower for the Fast Track over the projection period. Up to and including the 79th percentile of outcomes, there is a lower insolvent shortfall expected under the Fast Track in the longer term and so a lower risk to the PPF and a lower risk to member benefits. This reflects the additional risk taken in the Fast Track investment strategy which at these percentile levels are expected to more quickly improve the funding positions of model points with the weakest starting funding.

6.58   Table 14 shows the median total discounted PPF insolvent liabilities (£bn) projected over the 40-year period.

	Sum of PPF insolvent liabilities (£bn)
Counterfactual	14.1
Fast Track	10.3

Table 14: Total PPF discounted liabilities (£bn), median level

6.59   Over the projection period at the median level, the cumulative total liabilities at risk of falling to the PPF is higher for the counterfactual approach. This indicates that there is a higher risk that members would receive reduced benefits if all schemes were to continue their current funding approaches and each segment of schemes experiences 1% of remaining liabilities becoming insolvent each year.

Key Message 7:

The PPF potential losses have been assessed by looking at the PPF cumulative shortfall over time and applying an annual insolvency rate across all segments of the universe. Up to the 79th percentile of outcomes, the PPF security is improved under the Fast Track approach, with a lower cumulative total of liabilities projected to fall to the PPF. This is driven by the greater allocation to growth assets in the Fast Track, which is expected to improve funding for those with the weakest starting funding position, leading to smaller shortfalls for model points over the projection period.

Member security

6.60   Member security has been considered by looking at the differences between liabilities calculated on a buyout basis and on a PPF basis. Scheme members would expect to receive full benefits when a scheme buys out with an insurer and on the other hand, if buyout liabilites can't be met by a scheme, scheme members would be entitled to the greater of PPF liabilities and the scheme assets. The difference between the buyout liabilities and PPF liabilities, subject to the level of assets for each scenario, can be considered to be the liabilities at risk for members. The difference therefore gives an indication of member security.

6.61   An annual insolvency rate of 1.0% has been applied to liabilities across the segments of the universe to allow for the approximate liabilities at risk from sponsor insolvency. To represent member securiy, the maximum of PPF liabilities and assets is deducted from the buyout liabilities for each scenario across the model points at each future projection year.

6.62   Chart 28 plots the cumulative liabilities at risk for the Fast Track and counterfactual approaches and indicates the level of member security over time. At each timestep, a range of percentiles are calculated for the liabilities at risk, and these liabilities are cumulated over time.
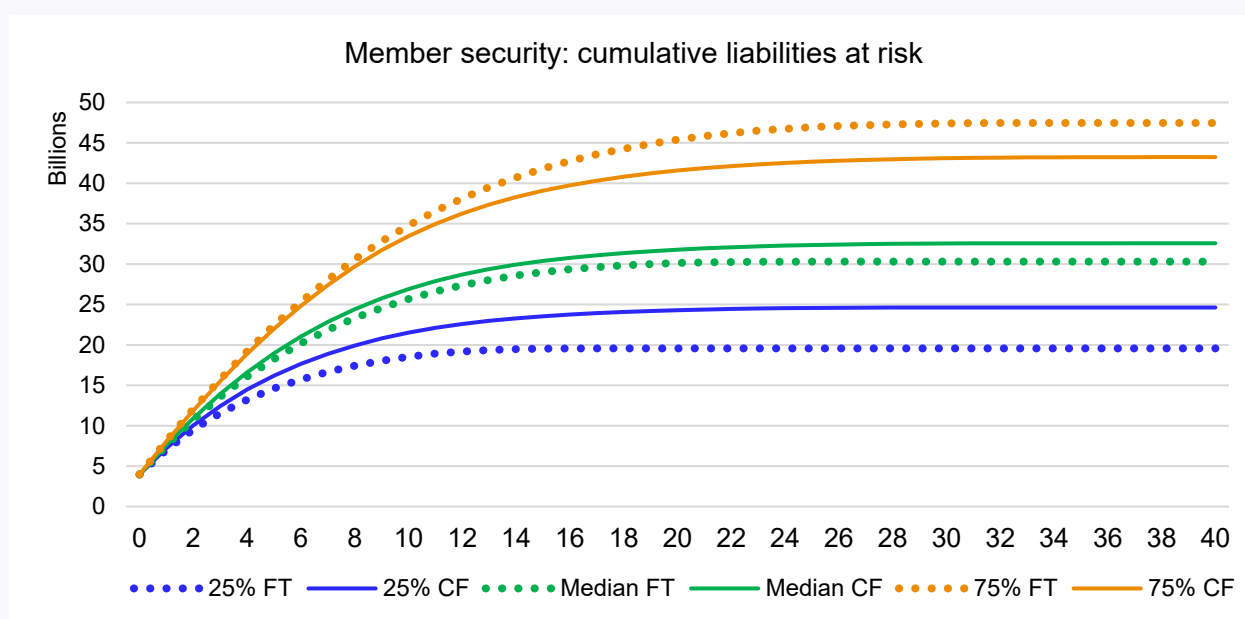

Chart 28: Member security: cumulative liabilities at risk (£bn)

6.63   The chart illustrates that at the median level of outcomes, there is a lower cumulative liability at risk over time for the Fast Track compared to the median level of outcomes under the counterfactual. In the longer term, the Fast Track cumulative liability at risk is approximately 7% lower than the counterfactual, and there is therefore higher security for members under the Fast Track approach. At the 25th percentile of outcomes, the Fast Track cumulative liability at risk is around 25% lower than the counterfactual outcomes. Up to and including the 60th percentile of outcomes, there is a higher member security in the Fast Track approach.

6.64   Above the 60th percentile of outcomes, the Fast Track approach has a higher cumulative liability at risk and so there is less member security. There is a broader range of outcomes under the Fast Track approach across the percentiles and this is from the additional risk taken in the Fast Track investment strategy, where the downside of outcomes could be more significant.

6.65   When considering the liabilities at risk on an annual basis, the liabilities at risk reduce to zero quicker under a Fast Track approach compared to the counterfactual. At the median level of outcomes, the liabilities at risk in the Fast Track approach reach zero around projection year 26, whereas the liabilities at risk in the counterfactual reach zero around projection year 40. This indicates that member benefits are at risk of not being paid in full for a shorter period of time under a Fast Track approach

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Key Message 8:

Member security has been assessed by calculating the cumulative liabilities at risk over time, where the liabilities at risk are those between buyout liabilities and PPF liabilities, subject to the level of assets in the scheme. Up to the 60th percentile of outcomes, the Fast Track approach shows lower cumulative liabilities at risk, and consequently shows better member security. Above the 60th percentile of outcomes, the Fast Track approach shows higher cumulative liabilities at risk and therefore lower member security across all the model points, The additional risk taken in the Fast Track investment strategy results in a broader range of liabilities at risk across the percentiles of outcomes, where the downside or outcomes could be more significant.

Overall

6.66   The analysis is based on underlying economic scenarios and data as at 31 March 2021. Between the calculation date and the time of writing of this report, there have been significant movements in economic and market conditions, and the impact of these are discussed in Section 7 ('Market Conditions').

6.67   The set of economic scenarios after 31 March 2021 will represent different market conditions. However, in the scope of work and time available, it has not been possible to obtain updated data and scenarios, and carry out refreshed modelling to inform this report.

6.68   Looking ahead, the changes in the economic scenarios might reveal different times at which the model points reach a fully funded or buyout position and the funding statuses are likely to be in different proportions across the model points over the projection period. Whilst there might be differences to modelling outcomes in the shorter term due to the recent economic volatility, we might expect the key conclusions and messages across the

counterfactual and Fast Track approaches to be more consistent with the modelling as at 31 March 2021 in the longer term, with similar relativities between the two approaches.

6.69   The analysis has been carried out as at 31 March 2021, and as such, the market conditions movements since then have not been reflected in the analysis. The significant uncertainty around economic and market conditions, means that funding level positions and outcomes should be considered further and on a scheme-by-scheme basis.

Key Message 9:

The modelling demonstrates that continuing with a counterfactual approach provides reasonable outcomes for a high proportion of model points, and this implies that schemes are broadly managing their investment and funding risks.

A Fast Track approach improves funding outcomes for some model points, including the groupings of schemes that have a high initial SEDR and a high allocation to return seeking assets. The modelled Fast Track approach helps those schemes reach a suitable level of low dependency at the point of significant maturity. It is expected that some immature scheme will see improvements in their funding levels over the projection period by adopting a Fast Track approach.

Key Message 10:

There is more investment risk assumed on average in the Fast Track approach investment strategy, which results in a wider range of funding and contribution outcomes in the future.

The 2X leveraged LDI assumption in the Fast Track leads to a lower level of interest rate and inflation hedging, and with the higher allocation to growth assets in aggregate, leads to more risk being taken. Whereas the counterfactual is in a more hedged position with an assumption of 3X leverage. The additional risk taken on in the Fast Track leads to higher median funding outcomes and lower median costs, but also leads to a wider range of outcomes, where the downside could be more significant with slightly worse outcomes.

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7 Market Conditions

The following section discusses market conditions at the 31 March 2021 calculation date, changes in conditions since then and what the impact may be if the modelling was updated.

Market conditions as at 31 March 2021

7.1   At 31 March 2021 the market was starting to look beyond the pandemic towards the economy reopening, commencing with areas that had stalled during the pandemic.

7.2   Annual inflation was increasing, partly driven by the increase in demand relative to the end of quarter one in 2020 when much of the world was shutting down in the initial stages of the pandemic. Longer term inflation expectations were also increasing as markets were optimistic about an economic recovery and return of demand. This was being reflected with increases to gilt yields.

7.3   Up to 31 March 2021, equity returns had been strong as although some areas of the economy had struggled, such as tourism and hospitality, other areas such as online spending and streaming services had surged, coupled with developed government's support during the pandemic. Government support during the pandemic had given markets confidence, although at 31 March 2021 the outlook was still uncertain, with various pandemic restrictions still in force.

Market conditions since 31 March 2021

7.4   By November 2021, developed economies had rolled out vaccine and booster programmes and had low levels of COVID-19 infections. There was confidence that further outbreaks could be managed, giving markets confidence to look ahead to a time where COVID-19 would play an increasingly small part.

7.5   The most significant economic development since 31 March 2021 has been high levels of inflation across all major economies. This has been due to several compounding factors, with varying relation to COVID-19. Inflationary factors and causes have included the Russia / Ukraine conflict, supply chain issues, increased demand for key components and materials, and labour shortages.

7.6   Chart 29 shows the progression of the RPI All Items Index for the United Kingdom between February 2021 and September 2022. In March 2021, RPI was at 1.5% and it rose to a level of 4.9% in September 2022. There have been rapid increases in inflation in the 12 months from September 2021.

7.7   The Bank of England expects inflation to peak at around 11% in quarter four 2022 and come back down to the 2% target by early 2024. They then expect inflation to run on below target into 2025. The Bank of England's narrative has been clear on the primacy of its objective to bring inflation back down to target.
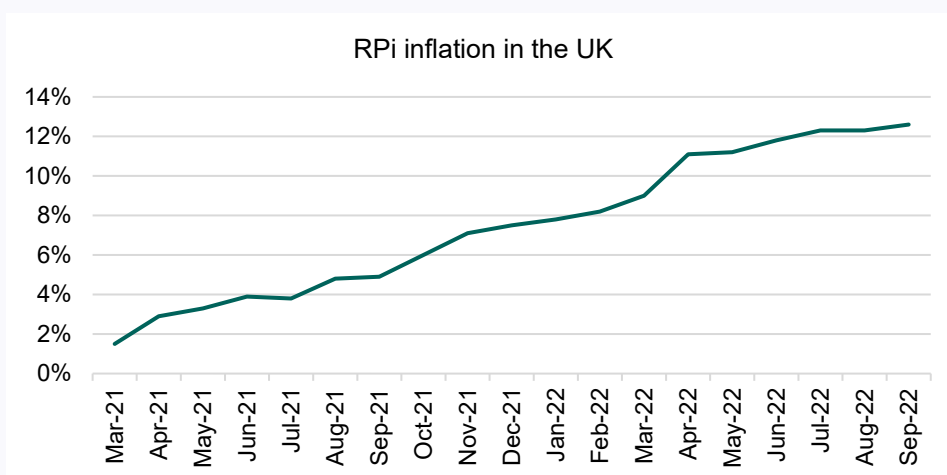
Chart 29: UK RPI inflation between March 2021 and September 2022[4].

7.8   Markets appear less optimistic for the speed at which inflation will dissipate, currently expecting it to subdue after around 5 years. However, the market is also challenged in its forecasting as many factors feed into market pricing and 30 September 2022, outlined below, was an exceptional time for gilt markets.
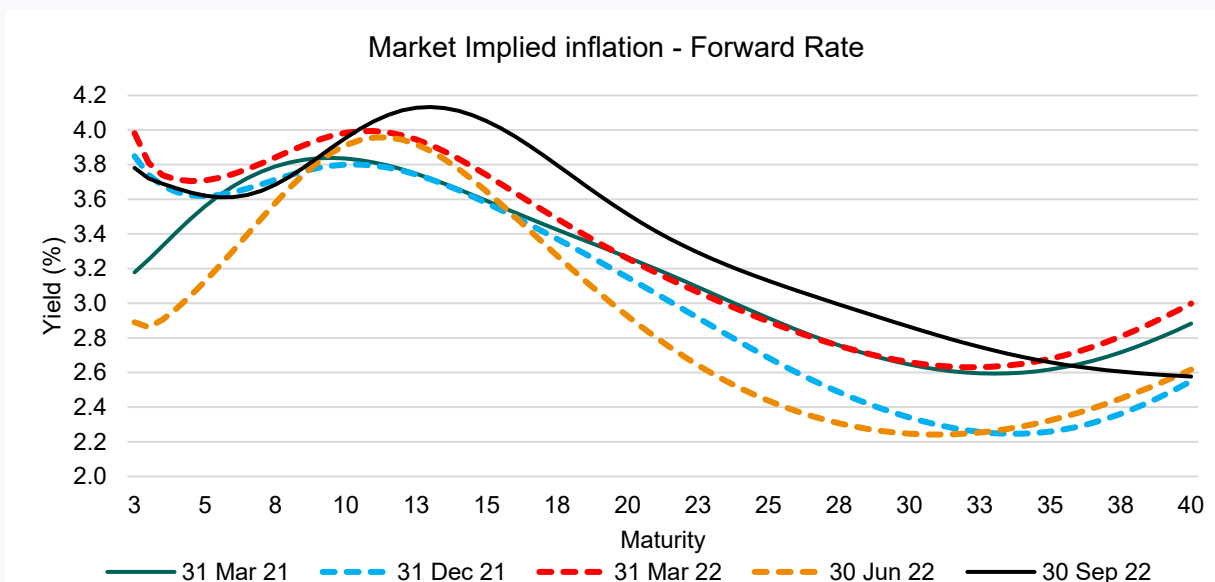
Chart 30 Forward market implied inflation [5]

7.9   Chart 30 shows the forward market implied inflation rates at a range of dates between 31 March 2021 and 30 September 2022. The rates can be interpreted as inflation expected over a given period which begins at a future date. The expectation of inflation up to around 2030 has increased since 31 March 2021 up to a high of 4.1%. The medium-term inflation expectations beyond 2030 imply RPI in the region of 2.5% to 3.5%.

7.10   The year to 31 March 2022 saw considerable increases in short-term inflation, particularly in the second half of 2021 and at the start of 2022, with a smaller increase in the medium-term expectations. The forward market implied inflation rates shows that the longer-term expectations are broadly similar across projections, at around the 2.5% level.

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[4] https://www.ons.gov.uk/economy/inflationandpriceindices/timeseries/chaw/mm23

[5] https://www.bankofengland.co.uk/statistics/yield-curves

7.11 Over the course of 2022, gilt yields have been increasing, as inflation has also been increasing. UK gilt yields significantly increased in late September 2022, coupled with extreme volatility, starting with the announcement of the government's mini-budget. Whilst market reaction to the Autumn Budget was subdued, markets are expected to remain volatile whilst central banks and governments attempt to bring inflation levels down, possibly inducing recession and then a period of recovery.

7.12 With the onset of high inflation, equity markets have struggled with most major indices down year to date and close to where they were in March 2021. A higher long-term inflation and risk-free rate environment is expected to lead to higher investment returns on growth assets, but there is uncertainty and so conditions are expected to be volatile.

Impact of conditions since 31 March 2021 on scheme funding

7.13 Although high inflation and poor equity returns will weigh on DB scheme funding levels, the effect of increasing gilt yields is expected to more than offset that with most DB schemes seeing an improvement in their funding levels.

7.14 Gilt yields peaked in late September 2022 and at the time of writing have decreased but are still at highs not seen for around 10 years. Higher gilt yields will result in DB schemes requiring lower contributions to meet longer term funding objectives.

7.15 Significant inflation and investment risks remain in the short-term, although we would expect many schemes would be taking action to try and reduce risk and lock in much of the recent improvement to funding levels.

7.16 Overall, we would anticipate the outcomes over the longer term to follow similar paths as the modelling carried out as at 31 March 2021. However, individual scheme circumstances are expected to be significant with some schemes trending above or below previous estimates. For example, items such as interest rate and inflation hedging levels, use of LDI and leverage levels, use of illiquid assets and equity exposures all being significant for the extent to which a scheme has benefited from market conditions.

7.17 Given yields are now starting at higher levels, coupled with a volatile outlook, we would expect a greater variation in funding paths, and so greater potential for downside outcomes.

7.18 If the modelling was updated to a more recent date, we expect the current volatility could lead to that analysis quickly being superseded. It may also be that recent experience has led schemes to make material changes to their funding and investment strategies so reducing the confidence in our starting positions and modelling projections.

7.19 Due to time constraints we have not completed any updates to modelling to reflect updated conditions and views, but if we were to do so, it could be useful to consider such modelling by performing a central scenario and the resultant stochastic variation, along with considering a number of other scenarios to reflect possible economic paths such as inflation staying higher for longer, possible effects of shallow and deep recessions, and the impact of schemes having complete further de-risking following recent yield increases.

8 Reliance and Limitations

8.1   This report is provided as part of our engagement with TPR and is dated 18 January 2023. The report is covered by the letters of engagement between GAD and TPR dated 20 November 2019 and 31 August 2022 respectively.

8.2   This report is intended for use by TPR for the purpose of understanding the results provided by GAD as part of this analysis. This will assist TPR with understanding how proposed parameters for the Fast Track approach could impact funding and investment outcomes for the universe of DB schemes in the future.

8.3   This report has been prepared for the use of TPR and must not be reproduced, distributed or communicated in whole or in part to any other person without GAD's prior written permission. The analysis should not be used for any other purpose than noted above.

8.4   Other than TPR, no person or third party is entitled to place any reliance on the contents of this report, except to any extent explicitly stated herein. 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 this report.

8.5   This report must be considered in its entirety, as individual sections, if considered in isolation, may be misleading, and conclusions reached by review of some sections on their own may be incorrect.

8.6   In preparing this report, GAD has relied on data and other information supplied by the TPR as described in the report. Any checks that GAD has made on this information are limited to those described in the report, including any checks on the overall reasonableness and consistency of the data. These checks do not represent a full independent audit of the data supplied. In particular, GAD has relied on the general completeness and accuracy of the information supplied without independent verification

8.7   This work has been carried out in accordance with the applicable Technical Actuarial Standards: TAS 100 issued by the Financial Reporting Council ('FRC'). The FRC sets technical standards for actuarial work in the UK. Please see our website for details of these standards and other standards that apply to our work.

Modelling limitations

8.8   The assumptions and methodology set out in this report are appropriate as at the date of calculation (31 March 2021). The outcomes should be considered within the context of the economic position as at 31 March 2021. Any changes or movements in economic conditions since this date have not been factored into the modelling or analysis.

8.9   The data provided by TPR was used as it was received, which means that in general GAD has relied on the completeness and accuracy of the information supplied without independent verification, apart from checks on the overall reasonableness and consistency of the data. These checks do not represent a full independent audit of the data supplied.

8.10   For the purposes of this modelling, the underlying scheme data was provided in a grouped data format. The data groupings approximate the full data and as such, the projection and modelled behaviours are not fully archetypal of an individual scheme's behaviour. The grouping of schemes into model points may mask some outlier schemes in terms of funding or sensitivity to financial changes.

8.11   Due to the complexity of modelling the entire universe of schemes over a 40-year projection period, as well as with the expected disproportionate increase in modelling time, a more granular and scheme-specific discount rate structure was not practical and was therefore not adopted.

8.12   Our assumed buyout pricing basis and PPF basis is based on our understanding of current market practice and PPF's current methodology.

8.13   Each model point can be considered to contain a range of schemes, and there may therefore be diversity within each model point. Average assumptions for model points have been adopted to allow for the spread of schemes.

8.14   The analysis is limited to the underlying assumptions and rules modelled, including the de-risking rules, Recovery Plan rules and investment strategies proposed by TPR.

8.15   The modelling assumes that all schemes move onto a Fast Track approach to regulation, whereas in practice only a portion of schemes are expected to do so. All model points used in the analysis adopt the same set of Fast Track parameters and are projected over the future period. For the purposes of the modelling, all schemes are modelled under a set of parameters expected to meet a Fast Track approach. This is one example of a set of parameters that schemes might adopt, and it is not expected that schemes will adopt the same set of parameters.

8.16   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 are therefore risks from accumulations of risk if all schemes adopt similar strategies.

8.17   The modelling is a simplification of reality and does not allow for any consideration of liquidity for instance. The modelling assumes that assets can be realised when needed at returns in line with the economic scenarios.

8.18   The outcome of the model is dependent on the profile of the underlying proxy schemes, both in terms of the shape of the cashflows and liability run-off, but also the sensitivity to

changes in economics under the ESG. We have selected proxy data which we believe is likely to be a representative shape and sensitivity profile of an average scheme, however it may not be representative for each individual model point.

8.19   The demographic assumptions are assumed to apply across all model points. In practice, different mortality and dependent assumptions are likely to apply to different model points. The mortality assumptions used make no specific allowance for the impact of Covid-19 on mortality rates. While the assumptions used are expected to be appropriate on average, it is possible that there is some correlation between mortality assumptions and SEDR group, for example, which would not be revealed by this analysis.

8.20   The modelling assumes that schemes are closed to future accrual and new members beyond the calculation date.

8.21   The methodology interpolates across a number of factors, including SEDRs, duration run-off, starting durations and discount rates. While interpolation approximations in a single interpolation are likely to be minor, they may be larger in aggregate. For this model this is not expected to be material as it is the overall distribution of results which is of interest, but a scheme-by-scheme analysis could produce different aggregate results.

8.22   The modelling uses economic scenarios supplied from a third-party ALM and all modelling is a simplification of real life. There are some risks not allowed for in the modelling including, but not limited to, idiosyncratic risks / non-investment risks, which includes trustee or employer behaviours.

8.23   The modelling uses an equal rate of insolvency across all segments of the universe when assessing the PPF potential losses and member security. The outcomes are likely to be different if varying insolvency rates were adopted across the segments of the universe.

8.24   In preparing this advice, we have considered the extent to which our analysis may be affected by material macro-level risks or uncertainties, such as climate-related risk or the impact of the UK's withdrawal from the European Union. Any explicit adjustments made to reflect such risks are discussed elsewhere in this report. The effect of climate risk on scheme investment strategies is not considered or modelling within the context of this analysis, although the underlying economic scenarios implicitly include some allowance for potential climate effects on future investment returns.

Appendix A – Scheme details

This section provides further details on the underlying archetype schemes and the assumptions used in the analysis in this report.

Scheme details

	Scheme benefit
Indexation	RPI in payment and CPI in deferment capped at 5% p.a.
Normal Pension Age	65 for males and females
Contingent benefits	50% of member's pension
GMP benefits	Not included
Lump sum cash benefits	Statutory tax-free cash lump sum on retirement

Table 15: Archetype scheme benefit structure

Dataset	Description	No. of members	Proportion of liability remaining at 12-year duration	Pensioner proportion of membership	Non-pensioner proportion of membership
Immature	Base dataset Actives under 17 have liabilities set to 0	10,005	77% (Year 21)	29%	71%
Standard	Base dataset with: Non-pensioners + 7y Pensioners +3y Non-pensioners over 68 have liabilities set to 0 Multipliers were applied to pension amounts as follows: 115% to non-pensioners, 90% pensioners	9,877	79% (Year 14)	40%	60%
Mature	Base dataset with: Non-pensioners +12y Pensioners +3y Non-pensioners over 68 have liabilities set to 0	9,498	84% (Year 7)	48%	52%

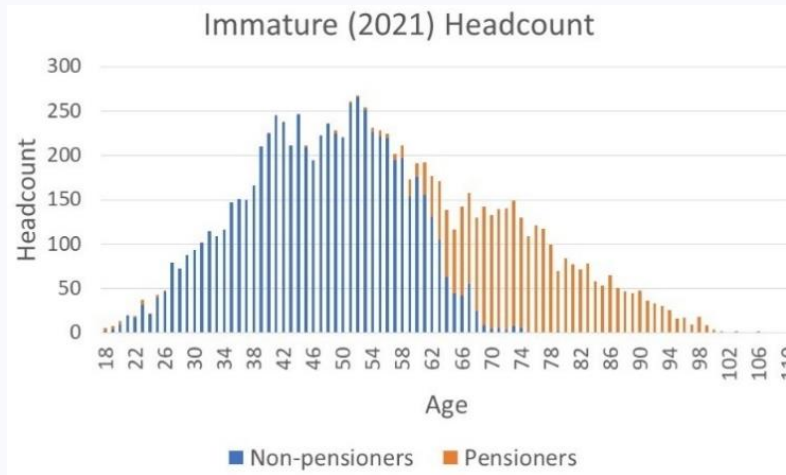*Table 16: Summary of datasets*

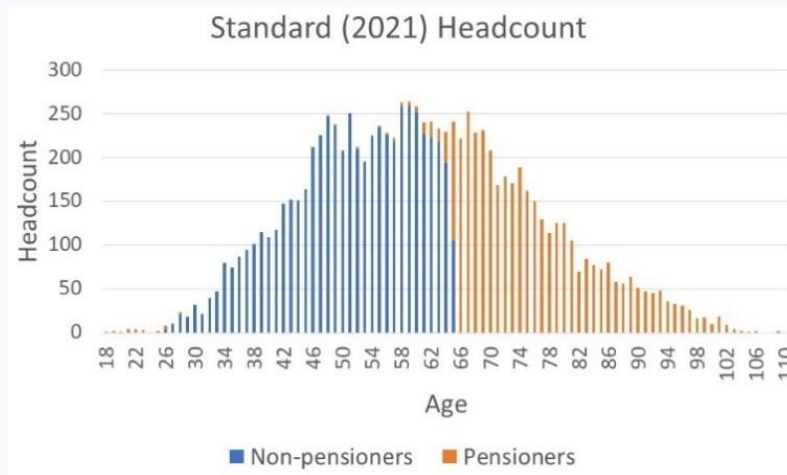*Chart 31: Immature scheme membership profile*

Chart 32: Standard scheme membership profile
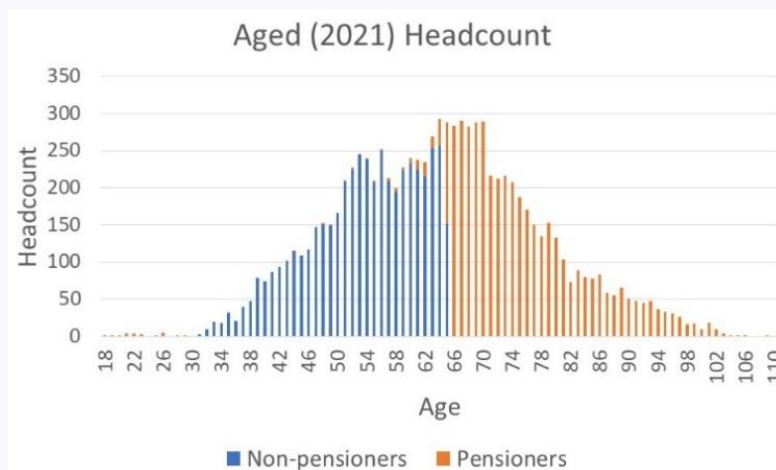
Chart 33: Aged (mature) scheme membership profile
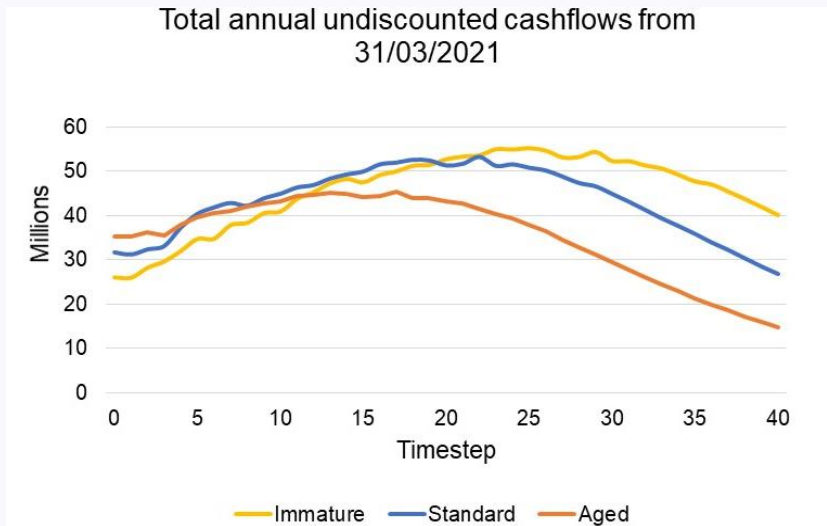
Chart 34: Archetype undiscounted cashflows from 31 March 2021
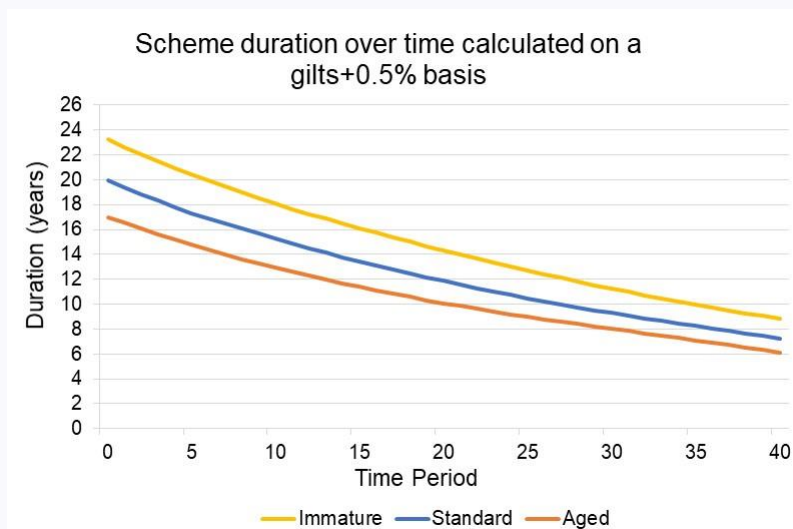
Chart 35: Archetype scheme duration progression

Chart 36: Archetype scheme liability progression from 31 March 2021

Mortality assumptions

	Males	Females	Dependant Males	Dependant Females
Base table by age	S3PMA C=2013	S3PFA C=2013	S3PMA C=2013	S3PFA C=2013
Mortality improvements used (and long-term rate ("LT"))	CMI_2019 Male (Core 1.5% LT)	CMI_2019 Female (Core 1.5% LT)	CMI_2019 Male (Core 1.5% LT)	CMI_2019 Female (Core 1.5% LT)

Table 17: Mortality assumptions

Scheme demographic assumptions

Other demographic assumptions	
Proportion of members leaving a dependant spouse on death	Age dependant rates set out in Appendix A. For simplicity assumed to be opposite sex to member.
Spouse age difference	Male pensioners are 3 years older than female spouses; female pensioners are 2 years younger than male spouses
Commutation at retirement	90% of maximum

Table 18: Scheme demographic assumptions

The commutation assumption used in the modelling is 90% of the maximum commuted at retirement using a factor of 25. This factor was used to be broadly cost neutral against the value of the pension surrendered at retirement. In practice, schemes will have varying levels of commutation factors that will provide a profit or loss against a particular liability basis.

Appendix B – Data groupings

The tables below show the data groupings provided by TPR which represent the universe of DB schemes as at 31 March 2021. The overall scheme data has been split by maturity, recovery plan length, Technical Provision basis (SEDR), allocation to growth assets and funding level. For each of these data groupings, the weighted value of each characteristic is given, along with an indication of the proportion of schemes within each grouping:

Maturity (measured by duration)					
Band	Number of schemes	LD liability (bn)	% total (Liabilities)	Duration (years)	% total (schemes)
<18	2,040	584.6	30%	15.9	40%
18-22	1,822	850.4	44%	19.9	36%
22+	1,189	505.8	26%	24.6	24%

Table 19: Grouped data summary by maturity bands

Recovery Plan Length					
Band	Number of schemes	LD liability (bn)	% total (Liabilities)	Recovery plan length	% total (schemes)
= 0	1,644	713.8 bn	37%	0.0	33%
< 7	2,085	643.6 bn	33%	4.1	41%
>=7	1,322	583.4 bn	30%	12.1	26%

Table 20: Grouped data summary by recovery plans lengths

Technical Provision basis (SEDR)						
Band	Number of schemes	LD liability (bn)	% total (Liabilities)	SEDR	Total assets	% total (schemes)
1: <1.8%	1,537	478.8 bn	25%	1.58%	472.1 bn	472.1 bn
1.8%-2.6%	2,565	1,091.8 bn	56%	2.14%	981.3 bn	981.3 bn
>=2.6%	949	370.1 bn	19%	3.13%	256.4 bn	256.4 bn

Table 21: Grouped data summary by SEDR band

Investment allocation to growth					
Band	Number of schemes	LD liability (bn)	% total (Liabilities)	Growth asset allocation	% total (schemes)
<25%	1,221	495.9 bn	26%	15%	24%
25%-40%	967	654.9 bn	34%	32%	19%
40%-60%	1,558	574.2 bn	30%	50%	31%
>=60%	1,305	215.8 bn	11%	73%	26%

Table 22: Grouped data summary by investment allocation

Technical Provisions Funding Level					
Band	Number of schemes	LD liability (bn)	% total (Liabilities)	Funding level	% total (schemes)
< 95%	2,008	541.1 bn	28%	87%	39.8%
95%-105%	1,670	780.0 bn	40%	100%	33.1%
>=105%	1,373	619.7 bn	32%	111%	27.2%

Table 23: Grouped data summary by funding level bands

Appendix C – Methodology & Assumptions

This section provides further details on the underlying methodology and assumptions in the model.

Discount rate	Pre-ret		Post-ret	
(a)	+1.50%	Low	-0.50%	Low
(b)	+4.50%	High	-0.50%	Low
(c)	+1.50%	Low	+1.50%	High
(d)	+4.50%	High	+1.50%	High

Table 24: discount rates used for interpolation of model points

Inflation measure	Rate
RPI	Market implied inflation
CPI	Up to 31 March 2030: RPI – 1.0% After 31 March 2030: RPI – 0.1%

Table 25: summary of inflation rates

Asset class	AMC (% p.a.)
Gilts	0.1
US High Yield Bond	0.5
Hedge Funds	0.75
LDI	0.2
Global Equity	0.4
Property	0.75
Corporate Bonds	0.25

Table 26: Assumed Annual Management Charges ('AMCs')

The AMCs were provided by TPR and were based on TPR views and experience, along with the charges that had been observed across different asset classes held by Defined Benefit pension schemes which were engaged with TPR at the time of setting the assumptions. The annual charges were designed to reflect broad market charging rates and the portfolios under consideration.

There was also recognition that smaller pension schemes typically have higher AMCs and given that most TPR-regulated schemes are small to medium in size, then the AMCs needed to be appropriate for small to medium sized schemes. Whilst any individual scheme may experience different charges, TPR felt that the AMCs adopted were appropriate for the purposes of modelling the universe as a whole.

Counterfactual assumptions

	Return Seeking Assets ('RSA') investment grouping			
	< 25%	25% to 40%	40% to 60%	> 60%
Growth	15%	32%	50%	73%
Corporate bonds	30%	24%	17.5%	9.5%
LDI	15%	20.5%	16.25%	8.75%
Gilts	40%	23.5%	16.25%	8.75%

Table 27: Counterfactual modelled investment strategies
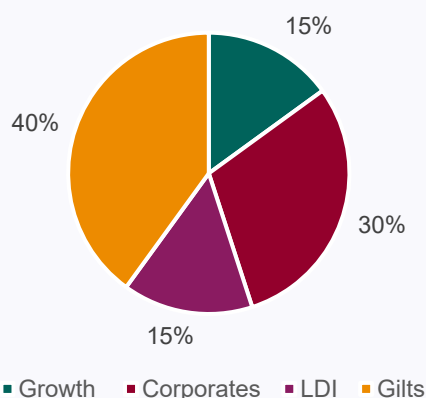
Chart 37: initial investment allocation for "<25% RSA" data grouping

The counterfactual recovery plans subject to the following rules:

- The initial Recovery Plan length is given by the underlying data groupings outlined in the table below. At each valuation point, the recovery plan reduces by three years subject to the reset and affordability rules:

Data grouping	Initial RP length
"0" RP	6
0-7 RP	4
>7 RP	12

Table 28: Counterfactual initial recovery plan lengths

- The initial DRC is calculated actuarially and is subject to the reset rules, detailed below. The contributions are assumed to be level over the Recovery Plan period.

- The initial RP length is set to 6 for the "0"RP grouping in line with recovery plan rule set out in (6) below

- The maximum size of the DRCs is limited by an affordability cap of 5% of the current FTLD liabilities.

- It is assumed that 10% of the deficit is met by asset outperformance above the discount rate, and this is allowed for by reducing the actuarial contributions by 10%.

  The counterfactual Recovery Plan length reset rules are the following:

(1) The DRC is calculated using the RP length at previous valuation minus 3 years.

(2) The RP maximum length is capped at 16 years. If the implied RP length is greater than 16 years, then the DRC is recalculated based on the 16-year maximum length.

(3) The minimum RP length is 1 year.

(4) The DRCs are adjusted at each 'valuation point' so that they do not reduce below the current DRC amount, and then they also do not increase by more than 20% of the current DRC. The recovery plans are then recalculated at each valuation point subject to the rules.

(5) Compare the DRC to the affordability cap which is defined as 5% of FTLD liabilities. The affordability cap is approximately the 95th percentile of current FTLD liability DRCs at the calculation date.

(6) If a new RP begins after the end of the previous RP, for example, after a scheme goes into surplus, then the RP length is reset to 6 years

Fast Track assumptions

Duration (years)	SEDR
12 and below	0.50%
13	0.58%
14	0.68%
15	0.80%
16	0.92%
17	1.05%
18	1.18%
19	1.25%
20	1.32%
21	1.37%
22	1.42%
23	1.47%

Table 29: Fast Track SEDR by duration, the SEDRs are expressed as a premium in excess of gilts

Growth asset class	Percentage
Global equity	50%
US high yield bonds	17%
Global hedge funds	17%
UK property	16%

Table 30: Fast Track percentage allocation of growth assets

The Fast Track Recovery Plans ('RP') have been modelled using the following rules:

- The initial RP is based on the following:

    (a) If the scheme has reached significant maturity, defined to be duration 12 year or less, then the recovery plan length is 3 years

    (b) If the scheme has not reached significant maturity, for example a scheme with duration of more than 12 years, then the recovery plan length is 6 years.

- Deficit repair contributions are assumed to increase each year by 2.5%, which has been used as a proxy to CPI. Initial contributions are calculated actuarially and make no allowance for asset outperformance. No affordability cap is applied to limit DRCs.

- Recovery plan lengths reset to the maximum every three years in line with a three-year valuation cycle. The maximum RP lengths at each 'valuation point' is given by the following rules:

    (a) If the scheme has reached significant maturity at valuation date (duration 12 or less), then the recovery plan length is 3 years

    (b) If the scheme has not reached significant maturity at the valuation point (duration of more than 12 years), then the recovery plan length is 6 years.

Appendix D – List of tables, figures and charts

Table number	Description of table
1	Time 0 assets and liabilities for the Counterfactual and Fast Track runs
2	Proportion of model point liabilities by funding status over time, median level
3	Proportion of model point liabilities by funding status over time, 5th percentile
4	Archetype scheme durations
5	SEDR bands weighted nominal values
6	SEDR bands with adjusted weighted nominal values
7	Fast Track investment strategy at the point of significant maturity
8	Time 0 assets and Technical Provisions for the counterfactual and Fast Track runs
9	Proportion of model point liabilities by funding status over time, median level
10	Proportion of model point liabilities by funding status over time, 5th percentile
11	Duration of maturity segments
12	Counterfactual cumulative DRCs (£bn)
13	Fast Track cumulative DRCs (£bn)
14	Total PPF discounted liabilities (£bn)
15	Archetype scheme benefit structure
16	Summary of datasets
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18	scheme demographic assumptions
19	Grouped data summary by maturity bands
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22	Grouped data summary by investment allocation
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24	discount rates used for interpolation of model points
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27	Counterfactual modelled investment strategies
28	Counterfactual initial recovery plan lengths
29	Fast Track SEDR by duration
30	Percentage allocation of growth assets

Figure 1	Description of figure
1	Universe modelling process
2	Process diagram for funding level progression graphs

Chart number	Description of chart
1	*Counterfactual funding level progression, median level*
2	*Fast Track funding level progression, median level*
3	*Cumulative PPF insolvent shortfall for Fast Track and counterfactual approaches*
4	*Cumulative liabilities at risk for Fast Track and counterfactual approaches (£bn)*
5	*ESG median projected gilt yields*
6	*ESG median projected returns*
7	*SEDR progression with duration*
8	*Investment Strategy by duration*
9	*Counterfactual funding level progression, median level*
10	*Fast Track funding level progression, median level*
11	*Counterfactual funding level progression, 5th percentile*
12	*Fast Track funding level progression, 5th percentile*
13	*Counterfactual funding progression by maturity groupings, median level*
14	*Fast Track funding progression by maturity grouping, median level*
15	*Counterfactual funding progression by asset allocation, 5th percentile*
16	*Fast Track funding progression by asset allocation, 5th percentile*
17	*Counterfactual funding progression by maturity and asset allocation, 5th percentile*
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19	*Counterfactual funding progression by SEDR band, 5th percentile*
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22	*Counterfactual (left) and Fast Track(right) funding progression, 5th percentile, high SEDR band*
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25	*Counterfactual cumulative DRCs*
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29	*UK RPI inflation between March 2021 and September 2022*
30	*Forward market implied inflation*
31	*Immature scheme membership profile*
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34	*Archetype scheme undiscounted cashflows from 31 March 2021*
35	*Archetype scheme duration progression*
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37	*initial investment allocation for "<25% RSA" data grouping*

Appendix E – Comparison of assumptions

The table below compares the assumptions used in the counterfactual and Fast Track modelling runs.

| **Counterfactual** | **Fast Track** |

Discount Rates

Band	Weighted nominal value	Average margin over 20yr gilts (approx.)
1: <1.80%	1.78%	0.40%
2: 1.80%-2.60%	2.39%	0.95%
3: >=2.60%	3.43%	2.00%

Note: margins derived for 3 archetype schemes

De-risking rules:

For schemes in Band 1: Discount rates reduce by 0.05% per year of duration until they hit gilts + 0.35%

For schemes in Band 2 and 3: Discount rates reduce by 0.1% per year of duration until they hit gilts + 0.35%

Cash-flow duration	Equivalent SEDR Premium Discount Rate above Spot Gilt curve
23	1.47%
22	1.42%
21	1.37%
20	1.32%
19	1.25%
18	1.18%
17	1.05%
16	0.92%
15	0.80%
14	0.68%
13	0.58%
12 or below	0.50%

Counterfactual

Fast Track

Investment strategies

RSA Investment Grouping				
	<25%	25%-40%	40%-60%	>60%
Growth	15.00%	32.00%	50.00%	73.00%
Corporates	30.00%	24.00%	17.50%	9.50%
LDI	15.00%	20.50%	16.25%	8.75%
Gilts	40.00%	23.50%	16.25%	8.75%

Duration (years)						
	30 to 17	16	15	14	13	12 and below
Growth	60.0%	51.0%	42.0%	33.0%	24.0%	15.0%
Corporates	14.0%	17.2%	20.3%	23.5%	26.6%	29.8%
LDI	26.0%	31.9%	29.1%	16.9%	4.8%	0.0%
Gilts	0.0%	0.0%	8.6%	26.6%	44.6%	55.3%

1. Taken the Growth allocation to work out the overall bond allocation

2. Allocated 35% of the non-growth allocation to corporates vs total bonds based on the 2021 PPF purple book (simple average)

3. Allocated the remainder equally between Gilts and LDI

4. Ensured hedging doesn't go over 85% assuming 3X leverage

The Fast Track adopts a LDI portfolio with leverage of 2X to reflect observed responses to the effects of the volatility of the gilts and LDI market through late September 2022 and the potential for future levels of leverage offered by LDI managers to be at lower levels than historically and the potential for higher costs of purchasing LDI due to higher levels of collateral.

Investment de-risking

Schemes in investment band 1 (<25% RSA) do not de-risk any further.

All other bands derisk by:

5% per year of duration until hits growth assets of 20% then
1% per year until hits growth assets of 15%

Follow the discount rate and asset tables above which set out de-risking by duration

	Counterfactual	Fast Track

Recovery Plan

Initial length

Data grouping	2021 data averages	Initial RP length
"0" RP	(0 overall average)	6
0-7 RP	4.1	4
>7 RP	12.1	12

RP lengths reduce by 3 years every valuation subject to the re-set and affordability rules

If duration at valuation date > 12 years (sig mat) then RP length = 6 years

If duration at valuation date < 12 years (sig mat) then RP length = 3 years

Initial contributions

Calculated actuarially, subject to corridors and caps described below, with regard to DRCs "in payment" given in data. Assumed DRCs increase year on year with CPI inflation (2.5%).

Calculated actuarially. Assume that DRCs increase year on year in line with CPI inflation (2.5%)

	Counterfactual	**Fast Track**
Re- set rules	16 year maximum RP length applied when relevant 1. Calculate DRC actuarially using RP length at previous valuation minus 3 2. Apply corridor of [0% to +20%] of previous non-zero DRC (refer to data if at time 0 or no previous deficit) and recalculate RP length accordingly 3. Check if implied RP length is < maximum length (16 years) 4. If > maximum length (16 years) then recalculate DRC amount based on maximum length 5. Check recalculated DRCs against affordability cap (overrides any corridor limits) 6. If cap applies then solve for new RP length (to use when calculating RP length at next valuation) <u>Note:</u> If new RP begins after the end of a previous RP, RP length is set to 6 years If RP length at a valuation date is 3 years and scheme is still in deficit at next valuation, reset RP length to 3 years. Recovery plan lengths are rounded up to the nearest whole year. A minimum RP length of 1 year is applied and this overrides any DRC floors in place.	Recovery plan length reset to the maximum every 3 years. Maximum RP lengths are as follows: If duration at valuation date > 12 years (sig mat) then RP length = 6 years If duration at valuation date < 12 years (sig mat) then RP length = 3 years
Affordability	The maximum size of DRC's is limited by an affordability cap of 5% of the current FTLD liabilities In these cases the RP length is the balancing item.	No affordability limit

	Counterfactual	**Fast Track**
Asset outperformance	10% of the deficit is met by asset outperformance above the discount rate. This is allowed for by reducing the "actuarial" contributions (calculated in step 1) by 10%. When applying the corridor, calculating implied RP length etc, the reduced DRC rate should be used.	No asset outperformance
Solvency lock-in	In any year, if assets exceed 102% of solvency liabilities, DRCs will be assumed to cease and assets and liabilities will be set to equal 100% of the solvency liabilities.	