# DB Scheme Funding: Some Empirical Results And Considerations

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Authors

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## Introduction

We have been collecting the reported funding ratios of DB schemes since December 2022. Through this analysis we are finding some fairly large discrepancies between reported funding ratios and the widely broadcast narrative of highly significant improvements of those ratios across the sector. One basic figure from our analysis is that range of funding ratios spans 50% to 161%.

In this note, we touch upon some of the notable points of our collected sample of 350 schemes. Of course, at slightly less than 7% of the universe of private sector funded DB schemes, this sample is not large enough, nor sufficiently assured of being representative, to prove or disprove anything, but it is sufficiently large to raise questions and concerns.

First, there is no scheme in this sample which reported a positive return on assets in 2022. The best three reported results are losses of 3.8%, 4.6%, and 5.1%; the worst performances show losses in excess of 40%. This means that any improvements in funding ratios must have been derived solely from declines in the present value of scheme liabilities.

Second, 32% of our sample saw their funding ratios deteriorate over the year. The median deterioration was 4.1%. There is a pronounced difference in the symmetry of the distribution of improvements/deterioration. The median improvement was 11.6%. The median funding level of our overall sample was 95.4% in December 2021, and this improves to just 102.1% by the end of December 2022.

It is also evident from the sample that schemes which were in deficit in 2021 were far more prone to experience deteriorations in the 2022 funding ratios than schemes that were in surplus, which exhibited a tendency to improve further.

## Expectations

Before illustrating why schemes which were in deficit were far more prone to experience deteriorations (see Table 1 below), it is worth considering how much the returns of funds might be expected to have been.  With the gain due to the decline in the present value of liabilities for schemes overall estimated by the PPF to be 38.8%, hedging 50% of interest rate exposure would suggest a gain from this of 19.4%. With , say, 50% of the fund invested in other growth assets which lost, say, 10%, we would have expected our sample to return 14.4% (19.4% – 0.5*10%)[1]. Our results are consistent in terms of both the overall results (6.7% gain), and the gain (11.6%) and loss (4.1%) partitions, when the allocation of those schemes to growth assets was 44% and schemes were overall 72% hedged.

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[1] In these calculations, we are abstracting from the surplus/deficit issues discussed in Box 1. As the sample median was 95.4% funded, we do not believe this introduces a major bias into the calculations which follow.

This can also serve as a sense check for the claims of 15% or more overall improvement in scheme funding. This would have required LDI hedging of only 49%, far below its level by most accounts and in our sample.

We would also note that with the presence of the present value of liabilities in the denominator of the funding ratio, the ratio may improve even though the amount of surplus funds has fallen. A constant cash surplus of say £10 and a funding ratio of 110% in 2021 with liabilities at £100, would be reported as an improvement to 16.34% in 2022, if the liabilities have declined to £61.2% (this is assuming a 38.8% decline as reported by PPF for the market overall).

The best three improvements in the sample were from 58% to 90%, from 68% to 104% and from 88% to 137%. These improvements, to schemes that were in deficit, are all of schemes which were not employing LDI or doing so only to a very limited extent and without leverage. The worst deteriorations were from 97% to 74%, from 88% to 69% and from 83% to 65%. The largest gain in funding ratio was 55.2% and the greatest loss, 23.2%.

41.5% of our sample were in deficit on their section 179 value at December 2021, which agrees closely with the PPF's overall estimate of 41.3% at that date. However, the PPF's estimate that, at December 2022, just 13.4% of schemes were in deficit disagrees significantly from our sample estimate of 22%.

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**Box 1 Illustration of the LDI problem for schemes in deficit**

The table below shows a notional scheme in deficit which has assets of £80 and liabilities of £100; it was at end 2021, 80% funded. If we assume the scheme adopted an LDI strategy which perfectly (and without any costs) hedges the interest rate sensitivity of the liabilities. In 2022, this LDI strategy results in a loss on the hedge of £34, the amount by which liabilities have declined (from £100 to £66)

*Table 1. A Scheme In Deficit*

|  | 2021 | 2022 | Return |
|---|---|---|---|
| *Scheme with deficit* |  |  |  |
| Assets | 80 | 46 | -42.5% |
| Liabilities | 100 | 66 | -34.0% |
|  |  |  |  |
| Funding | 80.0% | 69.7% |  |
|  |  |  |  |
| *Fully funded scheme* |  |  |  |
| Assets | 100 | 66 | -34.0% |
| Liabilities | 100 | 66 | -34.0% |
|  |  |  |  |
| Funding | 100% | 100% |  |

**Box I Continued**

The result is that assets decline by £34 from £80 to £46. The liabilities have declined by 34% but the assets have declined by 42.5%. The funding ratio of this notional scheme declines from 80% to 69.7%. This provides a direct challenge to the wisdom of fully hedging the interest rate sensitivity of liabilities when schemes are in deficit.

To quote one of our correspondents:

*"For most of these (schemes with low or inadequate asset coverage of liabilities) TPR has encouraged an overtly defensive attitude, getting them to double up on their LDI positions "to protect the coverage you have as the first objective" – all part of TPR's real objective which is to minimise calls on the PPF."*

With TPR pushing schemes in this direction, this approach has been actively promoted by consultants and advisors.

The scheme in balance shows no gains in funding ratio. Of course, a scheme in surplus, say 150% funded, will show a gain from 150% to 176% even though its assets have fallen from £150 to £116. The decline in the present value of liabilities, the denominator of the funding ratio, drives this increase.

It is worth highlighting explicitly the implications of this. Full hedging will tend to decrease funding ratios for schemes in deficit and increase them for schemes in surplus, when rates rise, and the present values of liabilities fall. We should expect the net overall improvement or decline in the funding ratio to be determined in part by the ex-ante distribution of scheme funding. Just 30.6% of the schemes in our sample were in surplus at the end of 2021. The second major effect on the distribution of outcomes is of course the distribution of LDI hedging levels, and their costs.

While we have focussed on the 2021-2022 year, a period of interest rate rises and liability declines, this differential action is present also in other years when interest rates were declining and liabilities rising. In times of declining interest rates, the differential action will tend to compress the range of outcomes rather than expand them as is seen with interest rate increases.

Conversely, this differential action in times of rate increases will increase the dispersion of resultant funding ratios for the overall funded DB system making it intrinsically riskier than would otherwise to the case. Adding leverage to the LDI strategy compounds and increases this dispersion or riskiness further. In our sample, this increase in dispersion is substantial. When measured as the first moment of the distribution about its median, it is a threefold increase. It is evident visually in Figure 1, the comparison of the sample distributions for 2021 and 2022.

Figure 1 below shows, the funding ratio distributions of our sample at December 31st 2021 and December 31st 2022. The observation that there were both gains and losses is evident from this Figure. For example, the increase in 2022 of schemes funded between 60% and 70% can only be explained by more schemes experiencing declines in scheme funding than from improvements in funding, as the number of schemes in this range in 2022 is greater than the total number of schemes combined in the 50-60% and less than 50% range in 2021.
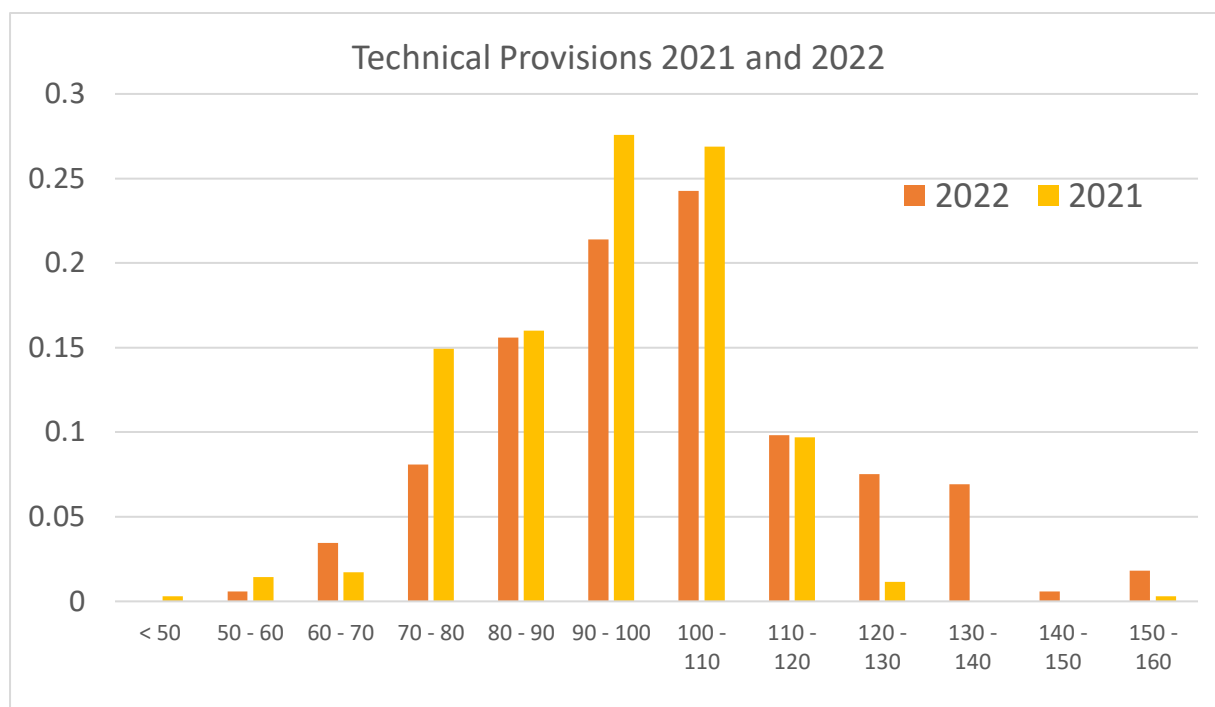
The most pronounced improvements are of schemes which are now 120% or more funded. However, this is a modest proportion of our sample, 16.8%, which is an increase of 15.2% from the 2021 distribution. However, if we take 120% funding as the level needed for buy-out, it suggests that the Pensions Regulator's recent statement that 25% of schemes are now sufficiently funded to buy-out may be an overstatement.

Before moving to comparisons of our sample distributions with those published by the PPF, we shall consider two specific schemes within our sample – Table 2

*Table 2: Scheme specific examples*

|  | 2021 | 2022 | Return |
|---|---|---|---|
| **Scheme One** |  |  |  |
| Assets | 83 | 43.55 | -47.5% |
| Liabilities | 100 | 65 | -35.0% |
|  |  |  |  |
| Funding | 83% | 67% |  |
|  |  |  |  |
| **Scheme Two** |  |  |  |
| Assets | 95 | 46.58 | -51.0% |
| Liabilities | 100 | 62.1 | -37.9% |
|  |  |  |  |
| Funding | 95% | 75% |  |

*Scheme One*

Scheme One was 83% funded at the beginning of 2022. It reported scheme assets of £43.55 at the end of 2022. As the scheme was targeting 100% hedging, the decline in assets is attributed as to £35 to its LDI hedge and £4.45 to declines in the prices of other assets held. The scheme reports a funding ratio of 67% overall, which would have been 73.8% in the absence of those other losses.

*Scheme Two*

The funding ratio of this scheme was 95% at the end of 2021, very close to the median of the sample. Its liabilities dropped by 37.9% due to the rise in the discount rate from increased interest rates, to £62.10. The scheme reported assets of £46.58 at the end of 2022, down 51% from the £95 value reported in 2021.

This scheme was pursuing a strategy of using LDI not just to immunise against funding ratio declines but also to repair deficits. This strategy was widely promoted by advisors and consultants, and apparently approved by TPR. It was targeting a 125% hedge of liability movements. The loss of £48.43 can be attributed to LDI as to £47.38 and £1.05 growth assets (-2.56% on the amount invested).

This strategy of leveraging the portfolio flies in the face of the old market adage: "*The road to hell is paved with the carry trade.*" The decline in scheme assets of 51% left the scheme just 75% funded at the end of 2022.

## Losses On LDI, Liability Declines, And The Distribution Of Outcomes

There are many schemes reporting losses on their LDI portfolios far in excess of the decline in the present value of scheme liabilities. For some, it was the result of deliberate over-hedging as in the case of scheme Two above. However, for many it was the product of financial incompetence as they were targeting 100% hedges which proved different in practice. This error most commonly arises from the use of the mathematical modified duration for Index Linked Gilts and corporate bonds when their empirical volatility is far higher than that. In the case of Linkers, this volatility stems in large part from the concentrated nature of the holdings by pension funds, and in the case of corporate bonds, from the failure to recognise that part of the yield spread is compensation for default and credit migration, and that the yield spread has a life of its own.[2]

Figure 2 below compares the PPF 7800 published distribution of funding levels and that of our sample (C&K) at December 2022.

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[2] In this analysis of these two schemes, the costs of realisation of liquidity during the Gilts crisis and the subsequent rebalancing of portfolios, which appears still to be ongoing, are attributed to the residual non-LDI assets, as these costs are not currently separable in published or other data.

*Figure 2: PPF 7800 funding levels and C&K funding levels*
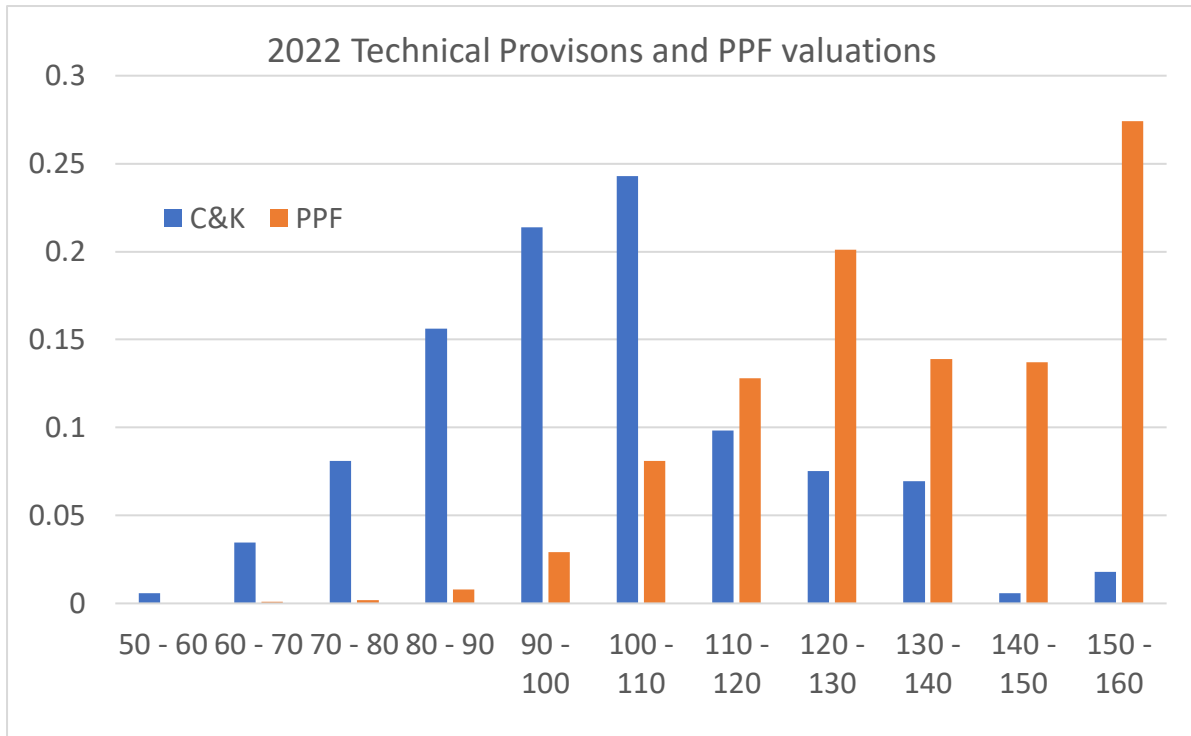


It is evident by inspection as well as formal statistical tests that these distributions are dissimilar. This is of course a comparison of two different valuation bases, the PPF section 179 value and scheme technical provisions. The principal source of idiosyncratic differences in these two valuation bases is the degree of maturity of schemes, that is the relative proportions of pensioner and deferred member claims. However, if we consider this difference to be broadly similar across schemes in our sample, say 20% in funding ratio, we may simply transpose our distribution as is illustrated in Figure 3 below.

**Figure 3: Transposed (+ 20%) sample and PPF distribution of funding ratios**
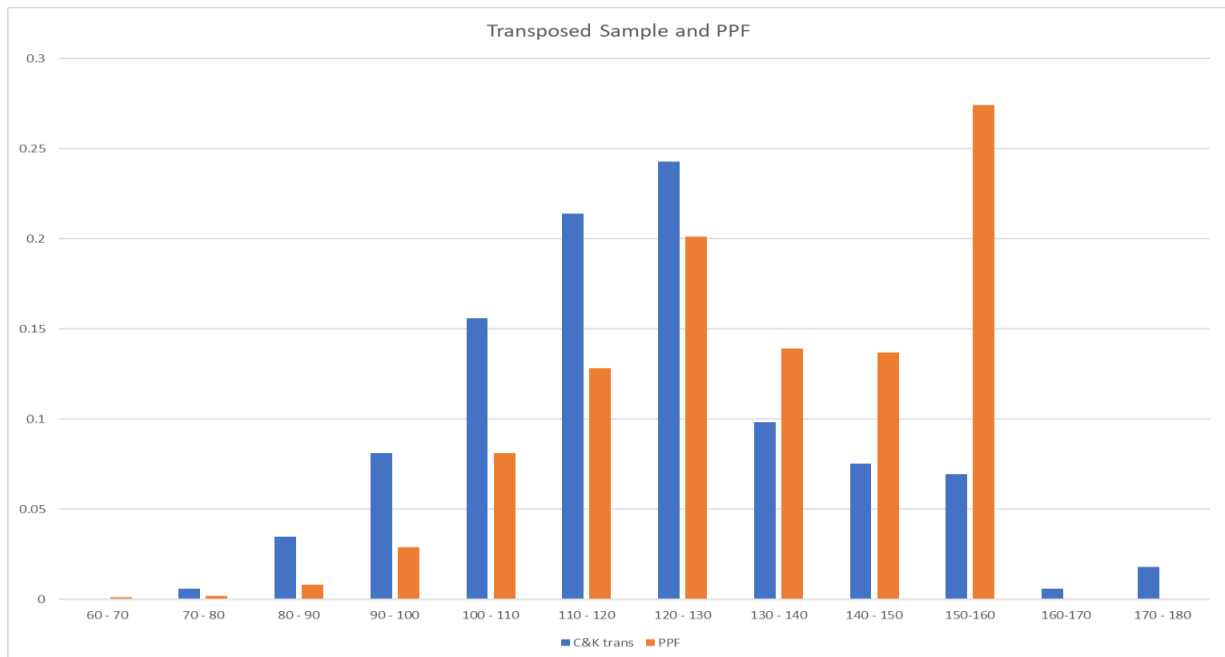


The transposition of the sample, of 20%, is we believe somewhat higher than the true difference between scheme technical provisions and will tend to inflate the number of schemes apparently able to buy-out. Given the maturity of schemes, that is the relative proportions of pensioners and deferreds and the structure of PPF compensation arrangements, we would estimate a more accurate transposition would 15%.

If we consider 130% funding on a PPF basis to be the level of funding needed for buy-out, 55% of schemes would, by PPF reckoning, be able to buy-out. If we were to consider 140% to be a better guide to the buy-out level this falls to 41%. These are respectively 28% and 24% above our sample estimates. Indeed, if we consider the correct transposition to be the more conservative 15% rather than the more generous 20% of Figure 3, then 21.7% of sample schemes are expected to exceed the 130% funding level and 13.1% to exceed the 140% level. The PPF estimates are two and threefold multiples of these values.

We can also consider the end 2021 results reported by PPF as a possible mechanism for calibration of the difference between their s179 value and the sample TP median funding ratio. The 2021 PPF 107.7% funding is equivalent to the 95.4% of the sample data, an adjustment of 12.3%. If this differential were applied to the sample 2022 results, 102.1% technical provision funding becomes 114.4% as a PPF equivalent and that differs materially from the 136.5% reported by the PPF.

Examination of the PPF distribution and our sample as at the end of 2021 is also informative. For completeness, we should point out that the PPF distribution is marginally larger in 2021 than in 2022, whereas ours has a constant membership. For ease of examination, we show as Figure 4, the PPF distribution and our sample transposed by one bucket, 10%.

The PPF distribution had, at a 130% threshold, 16% of its schemes eligible for buy-out and at 140%, this falls to 8%. These are large numbers of schemes, 820 and 410 respectively. This prompts an immediate question: if this many schemes were eligible for buy-out in 2021, why did we not see far more than we did?

By contrast, our sample had at 140% PPF equivalent just 1.4% of schemes eligible and at 130% equivalent, this rises to 11% of schemes being eligible. At a 15% transposition as previously discussed, these fall to less than 1% at 140% and to 6% at the 130% threshold, that is from 600 schemes as the PPF number to around 50 schemes based on our data.

*Figure 4: Distributions of funding ratios for PPF and the sample, transposed by 10%.*
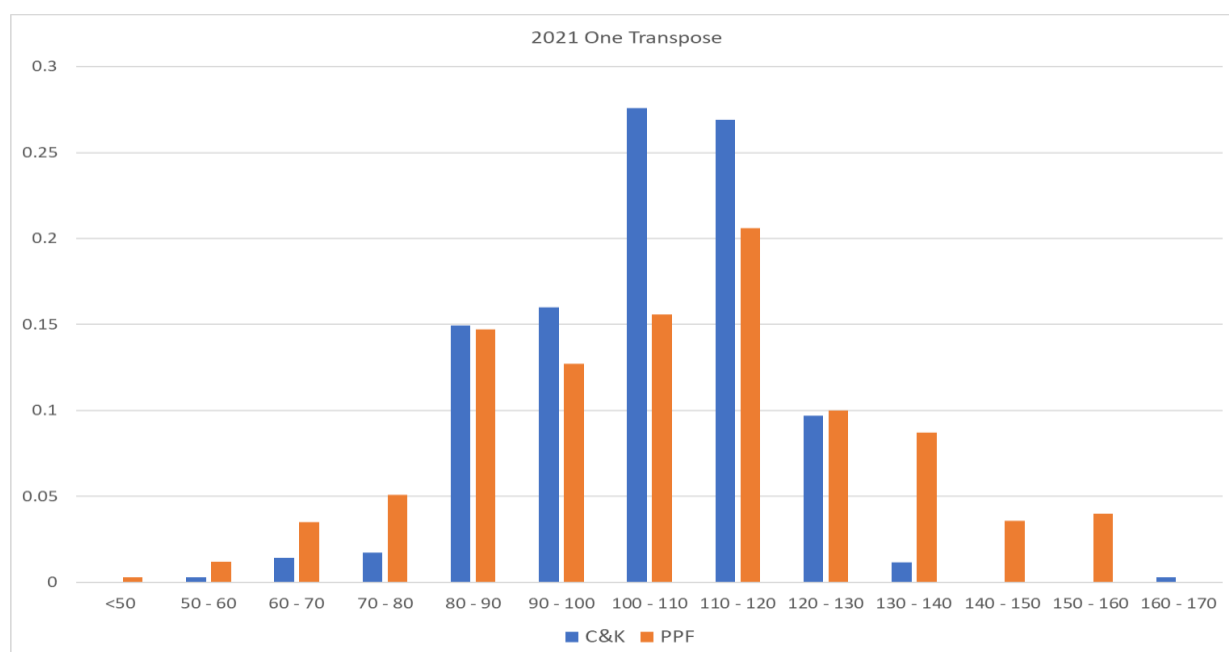


The empirical analysis we have conducted strongly suggests that, if our sample is representative of the overall universe of schemes, funding ratios have not improved by as much as is widely asserted. In particular, the improvement at higher funding levels is much lower than otherwise believed, for example, by the Pensions Regulator.

When combined with the upswell in discussions of schemes running on and off in self-sufficiency, it seems that the much publicised, and cautioned against, gold-rush bonanza of buy-out may be a rather muted affair.

## LDI 2.0 And Liquidity Buffers

It is evident from their statements and actions that TPR would like to see a continuation of the use if LDI by schemes. This is evident in, for example, the formulation of larger liquidity buffers. It is notable that these buffers will operate in a manner counter to the carry-trade spread if they are to be maintained in cash as the pensions minister, Laura Trott has indicated:

*"The framework expects that funds have sufficient resilience to respond to moves in the gilt market of 250 basis points at minimum, <u>without the need to sell assets</u>."*[3]

(Emphasis added)

The principal concern has been the avoidance of a repeat of the gilt market turmoil. We find this emphasis surprising for reasons which will become clear if we apply a simple stress test to schemes. The stress test we would apply is a repeat of the losses seen in 2022. By virtue of having occurred once it is plausible, if unlikely. We show first, as Table 3 below, the effect of such a shock on the illustrative scheme considered in Box 1.

***Table 3: 2022 As A Stress Test Of Our Hypothetical Scheme***

|  | **2022** | **2022 Stress test** | **Return** |
|---|---|---|---|
| Assets | 46 | 12 | -73.90% |
| Liabilities | 66 | 32 | -51.50% |
|  |  |  |  |
| Funding | 69.70% | 37.50% |  |

The effect is obvious, the same magnitude of shock as previously produces a far larger deterioration of the funding ratio than was seen in 2022, 32.2% versus 10.3%. If we examine the two schemes considered earlier, the effect is even more pronounced, Table 4

***Table 4: 2022 as a stress test of our actual schemes***

|  | **2022** | **2022 Stress test** | **Return** |
|---|---|---|---|
| **Scheme One** |  |  |  |
| Assets | 43.55 | 8.55 | -80.4% |
| Liabilities | 65 | 30 | -53.8% |
|  |  |  |  |
| Funding | 67.0% | 28.5% |  |
|  |  |  |  |
| **Scheme Two** |  |  |  |
| Assets | 46.58 | 8.68 | -81.4% |
| Liabilities | 62.1 | 24.2 | -61.0% |
|  |  |  |  |
| Funding | 75.0% | 35.8% |  |

With these levels of funding, there is simply no way in which a scheme could recover without massive additional contributions from the employer sponsor; fixed costs and pensions payments which might conservatively be of the order of £3 per annum would make additional support from the employer a necessity.

These schemes are on the verge of bankruptcy. The stress is catastrophic in effect. Schemes which have failed and entered the PPF have done so because of the insolvency of their

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[3] https://committees.parliament.uk/publications/39828/documents/193805/default/

sponsors rather than the scheme itself. The principal point here is that TPR ought not to favour LDI for these schemes in deficit and already reduced circumstances. In doing so, it is increasing the likelihood of major losses for the Pension Protection Fund (PPF), which can scarcely be considered protecting it, one of its statutory objectives. Of course, schemes which are well funded do not benefit the PPF. Indeed, because of these differential effects, TPR should never have supported and advocated the use of LDI and leveraged LDI.

In this note we have considered the funding ratio as a measure of scheme sufficiency. This is the most widely used metric in practice. We would actually prefer another more intuitive metric, schemes assets as a proportion of undiscounted projected liabilities. With this measure, declines in asset values or increases in projected liabilities will be reported as decreases in coverage.

## Final Thoughts

While most of this commentary has been concerned with the effects of LDI on asset values and the funding ratio, there are also to be material differences in the changes to the present value of liabilities. The PPF reports liabilities having declined by 38.8% over the year to December 2022. For comparison, a 15-year duration discount function would have declined by 34% and a 20-year by 42.7%. Our sample shows very considerable heterogeneity with liability declines from as little as 7% and 8% to as much as 41% and 42%. However, the vast majority of our sample are clustered between 30% and 35%. Of course, changes to inflation and mortality assumptions will affect liability estimates, but these observed differences still appear to be very large by comparison with plausible estimates of those potential effects taken account of.

Last, and most importantly, it is easy to overlook the significance of a ratio difference. A difference of 20% in the overall funding ratio of DB schemes is a difference of the order of magnitude £200 billion to £250 billion in monetary terms. This is no small beer and given the sensitivities of ratios, very small changes will lead to very large changes in the perceived overall position of funding.

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