



Financial Reporting Council

AS TM1 - accumulation rates assumptions

**Technical analysis as at 30
September 2022**

January 2023

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1. Executive Summary

- 1.1. The FRC published AS TM1 v5.0 in October 2022 which is to be effective from 1 October 2023. The assumptions in relation to the accumulation of the defined contribution pension pots to retirement in AS TM1 v5.0 were based on analysis of market conditions and fund returns up to 31 August 2021. To ensure the accumulation rates and volatility group boundaries remain appropriate for application from October 2023, we have now carried out an updated review of these assumptions based on data up to 30 September 2022.
- 1.2. The approach to determine the assumptions in this review follows the overall methodology and principles in the previous analysis.
- 1.3. Since the previous analysis, which considered data up to August 2021, the global economic outlook has changed significantly. Although there has been a general increase in volatility since the 2021 analysis, this is relatively small for most asset groupings of the funds other than fixed income funds. Detailed analysis of the distribution of the volatilities by asset groups of funds shows that the volatility group boundaries in AS TM1 v5.0 continue to be appropriate and provide some distinction between asset groupings of the funds.
- 1.4. In deriving the accumulation rate assumptions based on historical data, our methodology has a smoothing effect as it takes into account the returns over a long period. This results in limited change in the expected long-term return compared to the previous analysis. Looking forward, whilst the market conditions and outlook have changed since the previous review was carried out, considerable uncertainty remains. We therefore consider it appropriate, at this time, to retain the accumulation rates assumptions specified in AS TM1 v5.0 in the interest of maintaining stability of these assumptions over time.
- 1.5. Our conclusion from this review is that the assumptions used in AS TM1 v5.0 remain appropriate. Therefore, AS TM1 v5.0 will come into effect without change for SMPs issued on or after 1 October 2023. These assumptions will remain in force until at least 5 April 2024.

2. Context and scope

- 2.1. Actuarial Standard Technical Memorandum 1: Statutory Money Purchase Illustrations (“[AS TM1](#)”) specifies the assumptions and methods to be used for the calculation of statutory illustrations of money purchase pensions (also known as defined contribution (“DC”) pensions) for annual Statutory Money Purchase Illustration (SMPI) statements, and Estimated Retirement Income (ERI) illustrated on pensions dashboards.
- 2.2. A revised AS TM1 v5.0 was published in October 2022, to be effective for SMPI statements issued on or after 1 October 2023. The FRC reviews AS TM1 regularly and intends to review the boundaries between volatility groups, and the accumulation rate assumptions to be used for each volatility group annually.
- 2.3. This technical paper provides details of the analysis supporting our decision to make no change to the assumptions in AS TM1 v5.0. This should be read in conjunction with the previous [technical paper](#) issued in October 2022 which supported our development of AS TM1 v5.0, and considered data up to 31 August 2021. The analysis set out in this paper follows the same methodology as used in the paper issued in October 2022.
- 2.4. This paper covers:
- Data used within our updated analysis up to 30 September 2022;
 - Our analysis of the volatility group boundaries; and
 - Our analysis of the accumulation rates by volatility groups.
- 2.5. The analysis in relation to the rationale for adopting a volatility-based approach for setting accumulation rate assumptions for the purpose of AS TM1 as covered in our previous technical paper is out of scope of this paper. As such this paper does not include sections on:
- Volatility as a predictor of future returns; or
 - Stability of volatility groups.

3. Data used

3.1. The primary data set used in the analysis was based on Morningstar data. The data were checked, cleaned, and organised by Dr Paul Cox of the University of Bath. This included 1,190 time series of monthly returns for UK wholesale pooled pension funds covering the period from 1 January 1985 to 30 September 2022. This was equivalent to the data underlying our technical analysis published in October 2022 updated to include more recent return information, as well as 5 additional years of data from 1985 – 1989, which was not previously available to us. We conducted further checks and excluded some of the data from our analysis. For example:

- Some time series had missing returns for some months. For funds that remain extant, we understand that this results from the fund manager not reporting the fund's return in that month. The return reported in the following month does not include the return for the missing month. Therefore, any calculation of a volatility or a return which included a month with missing data was treated as null and excluded from the analysis. Funds with missing data were still included, but only for periods for which they had enough valid data to calculate the volatilities and returns required for the analysis.
- There were a number of funds which reported 0 returns in a given month. This differs from missing returns in that it indicates that a return of 0 was actually reported. We understand in some cases these could be genuine 0 returns, whereas in others these were a result of reporting stale prices. Within our analysis for any individual time series we excluded periods where more than 5% of returns were reported as zero. For money market funds, we extend this to allow up to 25% of reported returns being zero, as genuine zero returns were expected to be more common for these funds.

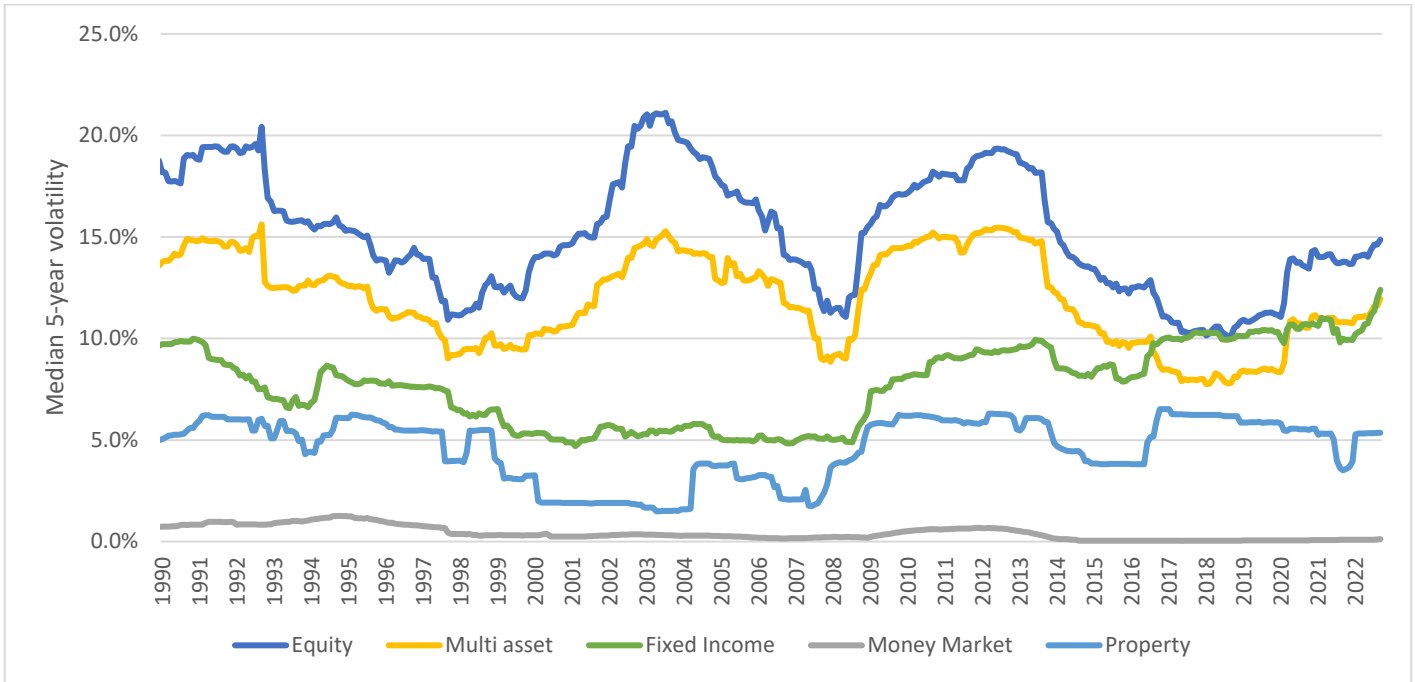
3.2. The analysis carried out for this update identified two issues in the data used for the October 2022 technical paper. For completeness we set these out below. These have been allowed for in our updated analysis, and our previous analysis (based on data to August 2021) remains reasonable once allowance is made for these changes.

- The data underlying our previous analysis reported returns calculated in USD for months from November 2019. This served to increase the volatility calculated at that time for certain funds, most noticeably for GBP money market funds, where the main source of volatility shown resulted from currency market fluctuations.
- We have identified a number of funds which appeared to be duplicated within the data set, based on time series being associated with identical fund IDs and/or fund sizes. We confirmed that these funds also had similar names and patterns of returns. Within the data set the 1,190 time series covered corresponded to 575 separate funds upon removing all potential duplicates we identified. Through testing we have confirmed the results would not be materially different if we excluded these duplicates. The analysis presented in this paper does not remove these potential duplicates.

3.3. The analysis described in this paper (and the analysis published in October 2022) was based on wholesale pooled pension funds, which we consider adequately covers the types of funds typically used by UK DC schemes. For research purposes, we also considered the impact of using an additional data set. The conclusions of this analysis are set out in Appendix 1.

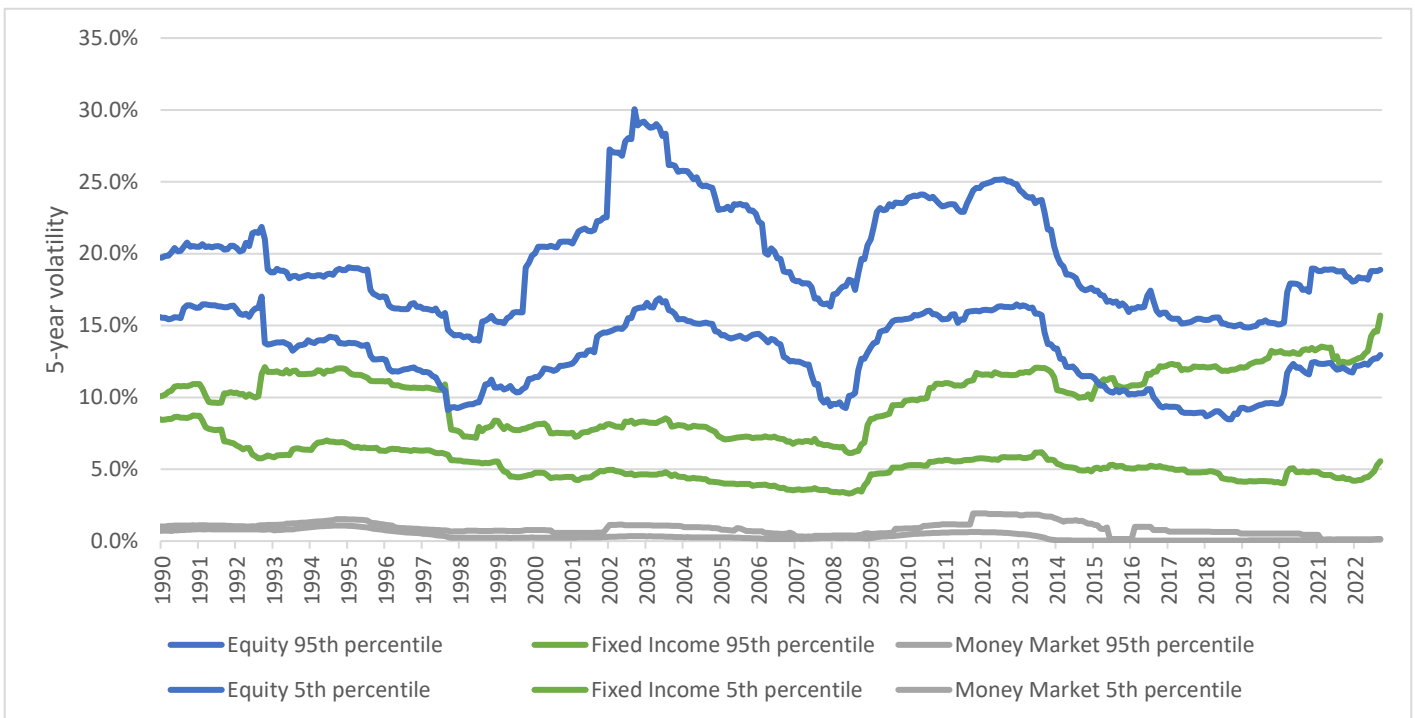
4. Volatility boundaries

- 4.1. The purpose of this analysis was to establish a set of volatility groups with which a set of accumulation rate assumptions can be associated. In line with the technical analysis published in October 2022, we aimed to establish a set of volatility groups which met the following principles:
- a) Funds in the same group should be sufficiently homogenous that it is reasonable to project them with the same accumulation rate
 - b) Funds in different groups should generally be discernibly heterogeneous such that it is reasonable to project them with different accumulation rates
 - c) The group ranges should strike a balance between being sufficiently broad that funds will change between them infrequently, but retain a reasonably small step change in accumulation rate assumption between different groups
 - d) The groups should be appropriate under the prevailing market conditions at the point at which providers are required to calculate their 5-year volatilities
 - e) We should avoid spurious accuracy in drawing the boundaries between groups.
- 4.2. We intend to keep the volatility groups the same where reasonable from year to year and only make adjustments where these are deemed necessary as a result of changes in market conditions. As such, our starting point is to build on the analysis published in October 2022, and then consider any changes that may be required.
- 4.3. In the October 2022 analysis we sub-divided the data into broad asset groupings (on an approximate basis from fund names and classifications provided by Paul Cox) and considered the historical rolling volatility of each asset grouping, to determine whether there is a clear separation in the volatilities between broad asset groupings.
- 4.4. This same analysis has been updated to include data up to 30 September 2022 and the results are shown in the graph below:

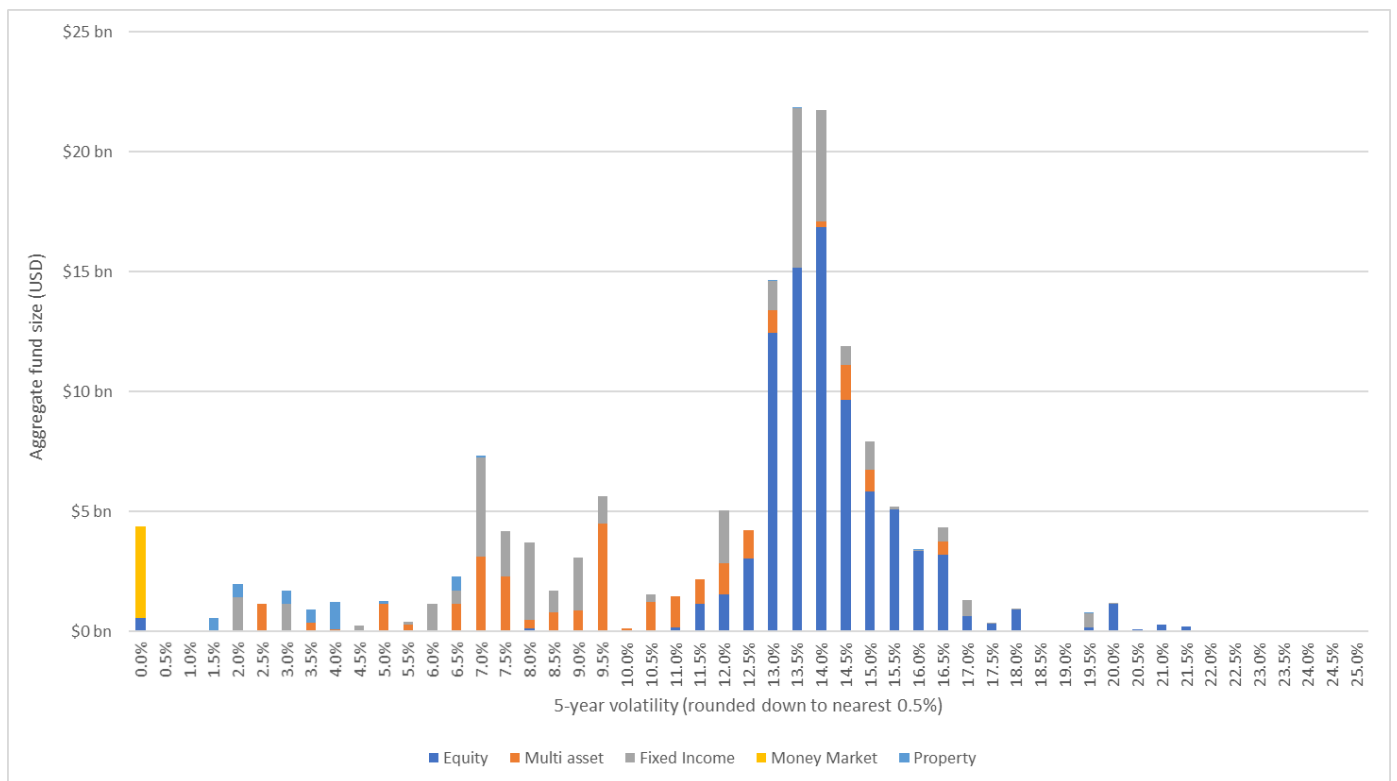


4.5. We observe a general increase in volatility since the 2021 analysis, but this is relatively small for most asset groupings other than fixed income funds.

4.6. As well as the rolling volatilities we have plotted the distribution of 5-year volatilities by asset grouping at 30 September 2022 below by plotting the 95th to 5th percentile of each key asset grouping. We observe that since the previous analysis, there is now a clear overlap between distribution of volatilities of the equity funds and fixed income funds.

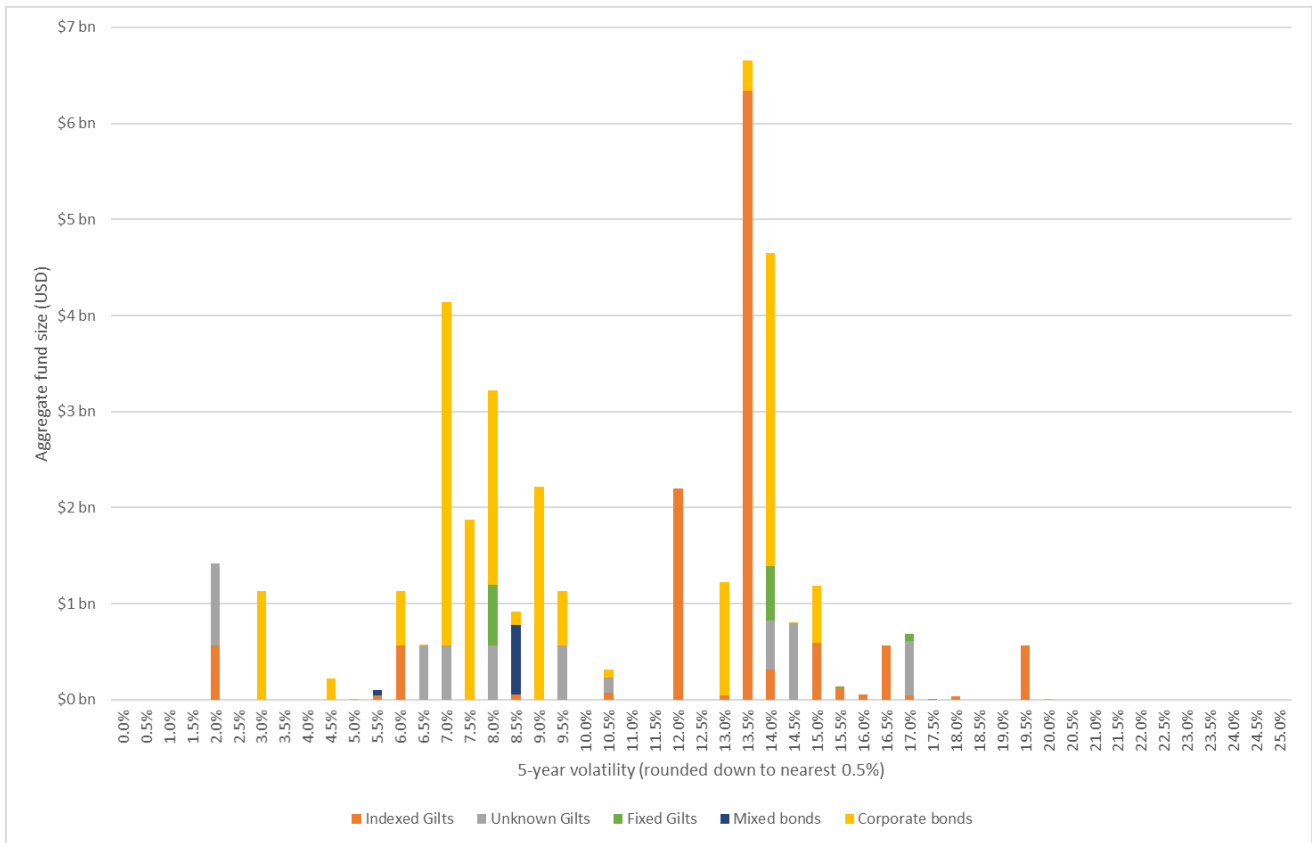


4.7. We also considered how the distribution of volatilities of each type of funds varies by fund size and this is shown in the graph below.



4.8. We observe:

- Volatility of equity funds is generally in the range 11-18% and maintaining a boundary of 15% would continue to divide equity funds into two reasonably sized groups.
- The majority of multi-asset funds would be captured within a 5-10% boundary group (although some do lie in the 10-15% range).
- Money market funds consistently sit at a very low volatility (0 to 0.5%).
- Fixed income funds are more complex, with volatilities ranging from 5% to beyond 15%. To investigate this further, we considered the breakdown between different types of fixed income funds in a similar manner.



4.9. The broad grouping of fixed income funds consists of funds which are invested in conventional gilts (fixed), index-linked gilts, corporate bonds, and other types of bonds.

4.10. The majority of the funds with a 5-year volatility that is above 10% are index-linked gilts (ILG). For ILG we already expected less correlation between volatility and forward-looking returns. This results from long-dated index-linked gilts potentially having a volatile market price (as their long duration makes them sensitive to long term real interest rate movements) but, as for conventional gilts, not being expected to earn a significant risk premium. This anomaly was considered and commented on in our consultation on AS TM1 v5.0 changes, and we considered it was acceptable due to the relatively low prevalence of ILG investment in DC funds. This disconnection between volatility and expected returns for ILG has arguably increased due to market movements in September 2022.

4.11. Corporate bonds span a wide range of volatilities. This is to be expected as this is a relatively broad asset class and could include a range of types of corporate bonds, including different levels of credit risk. Corporate bond funds can differ significantly in both volatility and expected returns and therefore can reasonably be expected to span multiple volatility groups.

4.12. Overall, we consider that 10% continues to be an appropriate boundary to provide a distinction between asset groupings of the funds.

4.13. Given this analysis, we consider the existing volatility group boundaries continue to give a reasonable split between distinct asset groupings for data up to 30 September 2022.

5. Accumulation rates

- 5.1. The determination of the appropriate accumulation rate assumption for each volatility group is a subjective process and requires an element of judgement to be applied to the results of any statistical analysis. We have based our updated analysis on the approach in the technical paper published in October 2022 (referred to below as the 'previous methodology'), which set out how we used a combination of backward-looking data-driven analysis and judgement-based forward-looking analysis.
- 5.2. Similar to the previous methodology, we have taken into account how resulting accumulation rates compare to other available market indicators and market benchmarks on future returns.
- 5.3. We have also considered the context in which the accumulation rate assumptions will be used. AS TM1's methods and assumptions are used for the purpose of general pension illustration, rather than an accurate individualised pension projection. We consider it important that the resulting accumulation rate assumptions can be determined consistently for different funds, and the resulting statutory illustration should be easy to describe to savers and to be understood by them. As such, our intention is to smooth the impacts of changes in market conditions to avoid significant changes in accumulation rate assumptions from one period to the next unless such changes are strongly justified and the new accumulation rates are expected to be sustained.
- 5.4. The derivation of the assumptions in the [technical paper](#) of October 2022, based on data up to 31 August 2021, is quoted in the below table. The derivation is set out in more detail within the October 2022 technical paper.

Group	Historical data analysis	Adjustment for bond effect ¹	Adjustment for prudence ²	Implied rate	Accumulation rate assumptions (rounded)
1	1.9%		-1.0%	0.9%	1%
2	6.8%	-2%	-1.5%	3.3%	3%
3	7.1%	-0.5%	-1.5%	5.1%	5%
4	8.9%		-1.5%	7.4%	7%

- 5.5. Following the same methodology but updating to include returns up to 30 September 2022 results in the following:

¹ See [AS TM1 v5.0 technical analysis](#) paragraphs 7.13 - 7.20.

² See [AS TM1 v5.0 technical analysis](#) paragraphs 7.26 - 7.32.

Group	Historical data analysis	Adjustment for bond effect	Adjustment for prudence	Implied rate	Accumulation rate assumptions (rounded)
1	1.9%		-1.0%	0.9%	1%
2	6.7%	-2%	-1.5%	3.2%	3%
3	6.8%	-0.5%	-1.5%	4.8%	5%
4	8.6%		-1.5%	7.1%	7%

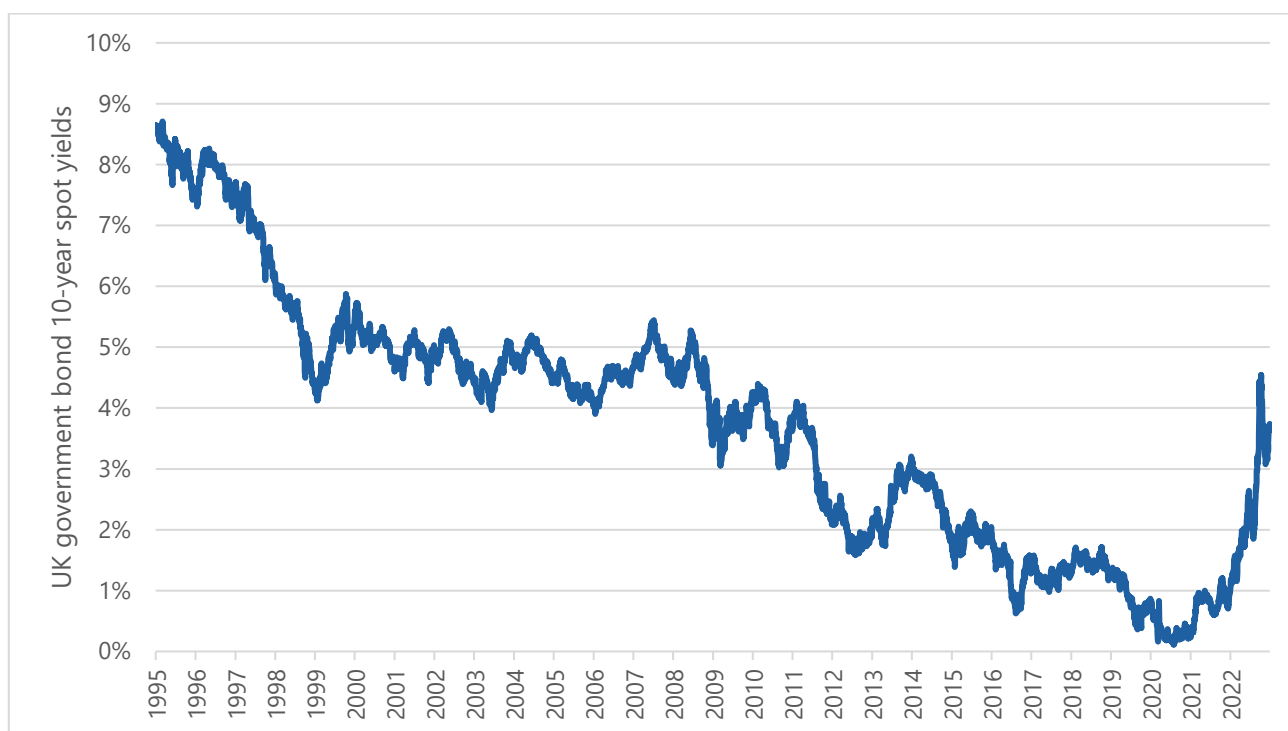
5.6. As expected, there is limited change in the returns based on the historical data analysis. This results from the inherent smoothing in the chosen methodology. We consider a long-term expected return, which takes into account monthly returns over rolling 15-year periods from 1990 until 2022. This means in total there are 214 overlapping 15-year periods of returns considered (the first ending on 31 December 2004 and the last ending on 30 September 2022), of which only 13 are 'new' periods resulting in our updating analysis for the period from 31 August 2021 to 30 September 2022.³

Movement in bond adjustment

5.7. Since the previous analysis, there has been a significant rise in gilt yields. The graph below shows the month-end 10-year gilt yield⁴ from 1995 to November 2022. As this illustrates, the calculation date of September 2022 for this review occurs during a particularly volatile period for the gilts market. Note that this chart illustrates the bond yields over time, whereas the charts in Section 4 show volatilities of fund prices.

³ The first 60 periods of 15-year returns (1 January 1990 – 31 December 2004, up to 1 December 1994 – 30 November 1999) were also not included in the previous analysis, although there are relatively few funds with return histories that allow for the calculation of prior 5-year volatilities for these periods.

⁴ <https://www.bankofengland.co.uk/statistics/yield-curves>



- 5.8. As set out in our previous technical analysis based on data up to August 2021, it could be considered that there is a natural floor to yields, and that therefore the past experience of significant reductions in bond yields up to 2020 would not continue in future. This is consistent with the increase in yields seen over 2022.
- 5.9. Given the retrospective analysis captures only the historical return, and bond yields had fallen significantly in the period up to August 2021, we considered it reasonable make an adjustment to the accumulation rate assumptions to allow for this effect. As such a 2% reduction was made for the accumulation rate for volatility group 2 and 0.5% reduction was made for the accumulation rate for volatility group 3 (adjusted for the composition of funds in group 3) within the technical paper of October 2022.
- 5.10. The approach in our analysis which considers rolling periods of 5-year volatilities and subsequent 15-year returns results in a lower weighting being placed on more recent monthly returns. For a fund with data throughout the analysis period, the return in the month of September 2022, for example, would only be included in one 15-year return period (the return from October 2007 to September 2022). By contrast, the return in the month of October 2007 would be included in 60 different 15-year return periods (November 1992 – October 2007, up to October 2007 – September 2022).
- 5.11. Whilst the yields have risen from historic lows in the past 2 years, the large increase in bond yields over 2022 affects a relatively small proportion of 15-year returns considered in the analysis. It therefore gives only small reduction to the 'bond adjustment' as our analysis continues to be weighted towards time periods prior to this when bond yields were falling.
- 5.12. In our previous technical analysis, we derived a bond adjustment of c.2.3%, which we rounded to 2% due to the inherent uncertainty of this analysis. This adjustment was based on a

sustained reduction in gilt yield across the whole period in which returns were analysed (from 1995 to 2021).

5.13. We have updated this analysis to allow for the addition of a further 13 months of data (from 31 August 2021 to 30 Sept 2022). The 15-year gilt returns ending between these dates will still have seen some upward pressure due to falls in gilt yields since 2006 (when this 15-year period started), but this will have been less than in prior periods.

5.14. When weighted by the number of new return periods that have been added to our data (as discussed in paragraph 5.6) the reduction in our derived bond adjustment is relatively small, falling from c.2.3% to 2.1%. After rounding we have therefore maintained the 2% adjustment. We will continue to review the appropriateness of this adjustment in future reviews.

Considerations on forward looking interest rates

5.15. As a possible market indicator of the expected return on money market investments, we also considered how the market implied future rates of return have changed by examining the yields on UK government bonds. There are, however, reasons not to consider this as a direct comparison – for example, some money market funds invest internationally and corporate commercial papers in the US, for example, can be a material constituent of these funds.

5.16. We considered 15 and 20 year real spot rates⁵ derived from yield curves published by the Bank of England⁶ based on the yields on UK government bonds. We considered the rates as at 31 August 2021 (consistent with previous analysis), 30 September 2022 and 30 November 2022.

Date	15 year real spot rate	20 year real spot rate	15 year implied inflation	20 year implied inflation
31/8/2021	-2.70%	-2.54%	3.7%	3.6%
30/9/2022	0.08%	0.01%	4.0%	3.9%
30/11/2022	-0.05%	0.12%	3.5%	3.5%

5.17. We considered whether it would be appropriate to increase the accumulation rate assumptions, to reflect this increase in market implied future returns. In particular, we considered whether an accumulation rate of 1% (real rate of -1.5% after allowing for inflation at 2.5%) remains appropriate for volatility group 1 (which are mainly money market funds) under current conditions.

5.18. However, in considering the wider market conditions, there remains considerable uncertainty in future returns and on the course of future price inflation. It is our intention, where

⁵ We considered a 15 and 20 year period broadly consistent with pre-retirement time horizons for DC funds. Expected inflation was based on the 15 and 20 year spot inflation rates (derived from the difference between inflation linked and nominal gilts). Cash returns were based on the 15 or 20 year spot nominal rate, being equal to the cumulative forward rates across the yield curve. The net of these is equal to the 15 or 20 year real spot rates.

⁶ <https://www.bankofengland.co.uk/statistics/yield-curves>

reasonable, to maintain stability in the accumulation rates over time. We do not believe it is appropriate to alter our assumptions to respond to short term market fluctuations, as such an approach may lead to frequent revisions to accumulation rates in future reviews as forward-looking market rates continue to move.

Proposed rates

5.19. For the reasons outlined above, we are not proposing any change to the methodology used in our analysis of data to 31 August 2021, and so we are maintaining the existing set of accumulation rate assumptions.

Appendix 1: Research into other data sources

- 6.1. The analysis in the main body of the paper (and the analysis published in October 2022) was based on wholesale pooled pension funds, which we consider adequately cover the types of funds typically used by UK DC pension schemes. For research purposes, we also considered an additional set of data - the 'IPP' data set. The IPP data set covered a broader range of funds available directly to individual UK investors (as opposed to the data for wholesale pooled funds) through small employer arrangements, SIPPs or other drawdown products. The 'IPP' data set covered 12,922 time series, which corresponded to 3,445 distinct funds once analysis of potential duplicates was carried out. We do not have sufficient data to allow us to understand what proportion of DC investments are held in funds that are contained in the IPP data set as opposed to the 'institutional' data set discussed in 3.1 above.
- 6.2. We observed a much lower correlation between backward looking volatility and forward-looking returns in the IPP data set (30%) than that observed in the institutional data (59%). The difference in correlation was observed for each fund type (equity/bonds etc) and over each time-period considered. Input from Paul Cox of University of Bath suggested that one potential cause of the difference in observed correlation could be that institutional funds are expected to be more diversified - and so be subject mainly to systematic risks (which would correlate with each other) rather than idiosyncratic risk (which would be specific to the individual funds).
- 6.3. This difference is understandable, given the different intended target markets, with institutional funds being used by large pension schemes (e.g. occupational schemes/ master trusts) while many funds in the IPP data set will be aiming to provide more specific fund types/exposures to appeal to individual (often SIPP) investors. This means that the IPP data set will be expected to include a wider range of funds with greater differences in their returns.
- 6.4. Most of the analysis set out in the rest of this paper was performed on both data sets separately, as well as the combination of the two. The results showed that:
- The distributions of 5-year volatilities to 30 September 2022 is similar across both data sets.
 - Average historical returns are slightly lower on the IPP data set than the institutional data set. Within each volatility group the difference in average returns between the IPP and institutional data set is small (within 0.5% before rounding), and within the margins for prudence applied to the returns.
- 6.5. For simplicity, the results of the analysis contained within this paper focuses on the 'institutional' data, because:
- It is our understanding that the institutional data more closely reflects the funds available for the majority of DC savers (as we expect most savers are in larger workplace pension

schemes, either trust based, contract based or master trust arrangements) and so is most relevant for the purposes of AS TM1; and

- This is consistent with the methodology and data set used in our previous analysis published in October 2022.

6.6. Despite our observing a lower correlation between fund volatilities and subsequent returns in the IPP data set, the results relevant to setting volatility groups and accumulation rates (which are the questions relevant to this paper) did not differ significantly between the two data sets. As a result, we were comfortable that the institutional data set continued to be appropriate for this analysis.

6.7. In future research, the FRC may continue to explore other data sets where this can provide further understanding and knowledge of the market and may enhance our analysis.



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