Government Actuary's Department

Local Government Pension Scheme England and Wales

Review of the Actuarial Valuations of Funds as at 31 March 2016 pursuant to Section 13 of the Public Service Pensions Act 2013

Appendices

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Local Government Pension Scheme England and Wales
Appendices to the review of the actuarial valuations of funds as at 31 March 2016
pursuant to Section 13 of the Public Service Pensions Act 2013

Appendix A: Compliance

A.1 In this appendix we set out checks we conducted to determine whether the actuarial valuations of the 91 Local Government Pension Scheme (LGPS) funds have been completed in accordance with the scheme regulations.

Statement of Compliance

A.2 GAD selected one fund as a representative example from each of the firms of actuarial advisors. The following statements of compliance were contained within the chosen reports by each firm:

Compliance with valuation regulations

Actuarial Valuation Reports Regulation 62 (1 - 2)

A.3 Regulation 62 (1) requires the administering authority to obtain an actuarial valuation report on the assets and liabilities of each of its pension funds, including a rates and adjustments certificate, as at 31st March 2016 and on 31st March in every subsequent valuation year. Regulation 62 (2) requires that the above documents be obtained by the first anniversary of the date at which the valuation is made, namely, 31 March 2017 in the case of the 2016 valuation.

Publication

A.4 Each chosen fund was published in accordance with regulations. The following table sets out dates of publication of the actuarial report.

Table A1: Statement of Compliance

Fund	Statement of Compliance
Merseyside (Mercer)	This report is addressed to the Administering Authority of the Merseyside Pension Fund ("the Administering Authority") and is provided to meet the requirements of Regulation 62 of the Local Government Scheme Regulations 2013 (as amended) ("the Regulations").
Haringey (Hymans Robertson)	We have carried out an actuarial valuation of the London Borough of Haringey Pension Fund ("the Fund") as at 31 March 2016 under Regulation 62 of The Local Government Pension Scheme Regulations 2013 ("the Regulations").
Hampshire (Aon)	This report was … produced in compliance with Regulation 62 of the Local Government Pension Scheme Regulations 2013
Berkshire (Barnett Waddingham)	In accordance with Regulation 62 of the Local Government Pension Scheme (LGPS) Regulations 2013 (as amended), we have been asked by Royal Borough of Windsor and Maidenhead to prepare an actuarial valuation of the Royal County of Berkshire Pension Fund (the Fund) as at 31 March 2016 as part of their role as the Administering Authority to the Fund.

Table A2: Publication Date

Fund	Publication Date
Merseyside (Mercer)	31 March 2017
Haringey (Hymans Robertson)	29 March 2017
Hampshire (Aon)	31 March 2017
Berkshire (Barnett Waddingham)	31 March 2017

Demographic Assumptions

A.5 Regulation 62 (3) states that the actuarial valuation report must contain a statement of the demographic assumptions that have been used in making the valuation, and must show how these assumptions reflect the experience that has actually occurred during the period since the last valuation. Each valuation report contains a section on demographic assumptions including all the assumptions that we would expect in an actuarial valuation report.

Table A3: Demographic Assumptions

Demographic	Merseyside (Mercer)	Haringey (Hymans Robertson)	Hampshire (Aon)	Berkshire (Barnett Waddingham)
Pre-retirement mortality	✓	✓	✓	✓
Post-retirement mortality	✓	✓	✓	✓
Dependant mortality	✓	✓	✓	✓
Ill health retirement	✓	✓	✓	✓
Normal health retirements	✓	✓	✓	✓
Withdrawal	✓	✓	✓	✓
Promotional salary scale[1]		✓	✓	✓
Family details (partners and dependants)	✓	✓	✓	✓
50:50 option take-up	✓	✓	✓	✓
Commutation	✓	✓	✓	✓

[1] Mercer combine promotional salary scale into their general pay increase assumption.

Local Experience

A.6 The regulation requires that the reports "must *show how* the assumptions relate to the events which have actually occurred in relation to members of the Scheme since the last valuation." Most reports have *stated that* the assumptions have been updated to reflect experience. All funds have shown differences between expectations and experiences for the inter-valuation period, and the impact of these differences on the funding position. We note that this information may be contained in supporting (non-public) reports/advice.

Contribution Rates

A.7 Regulation 62 sets out that employer contributions are separated into two components: primary rates which meet the cost of ongoing accrual for current active members and secondary rates, which are mainly established to repay deficit or eliminate surplus over a given period (the deficit/surplus recovery period).

A.8 Regulation 62 (6) states that when setting the contribution rates the actuary must have regard to —

- the existing and prospective liabilities arising from circumstances common to all those bodies,
- the *desirability* of maintaining as nearly constant a common rate as possible,
- the current version of the administering authority's funding strategy mentioned in regulation 58 (funding strategy statements), and
- the *requirement* to secure the solvency of the pension fund and the long term cost efficiency of the Scheme, so far as relating to the pension fund.

A.9 Regulation 62 (4) states that the rates and adjustments certificate must specify both the primary rate of the employer's contribution and the secondary rate of the employer's contribution, for each year of the period of three years beginning with 1st April in the year following that in which the valuation date falls.

A.10 Each valuation report must set out primary and secondary employer contribution rates.

Primary Rates

A.11 Regulation 62 (5) defines the primary rate of an employer's contribution as "the amount in respect of the cost of future accruals which, in the actuary's opinion, should be paid to a fund by all bodies whose employees contribute to it so as to secure its solvency", and specifies that this must be expressed as a percentage of the pay of their employees who are active members.

A.12 The following table shows the primary rate of employer contribution for the administering authorities whole fund:

Table A4: Primary Contribution Rates

Fund	Primary rate of Employer Contribution
Merseyside (Mercer)	15.4%
Haringey (Hymans Robertson)	17.6%
Hampshire (Aon)	17.1%
Berkshire (Barnett Waddingham)	14.3%

A.13 Each primary rate of employer contribution has been calculated to cover the cost of future benefits accrued by their employees. Each valuation also provides a breakdown of the primary rate for each employer. Each valuation provides a secondary rate for each employer (expressed as a cash amount and/or percentage of pay for each employer).

Secondary Rates

A.14 Regulation 62 (7) states that the secondary contribution rate may be expressed as either a percentage or a monetary amount. Each valuation provides a secondary rate for each employer (expressed as a cash amount and/or percentage of pay for each employer). The secondary rates of employer contributions for each valuation have been defined to be adjustments to the primary rate as required. In all cases, the secondary rates have been provided for the next three years for each employer.

Table A5: Whole Fund Secondary Contribution Rates

	Whole fund secondary contribution rates		
Fund	**2017**	**2018**	**2019**
Merseyside (Mercer)	£136,300,000 less 0.9% of pensionable pay	£52,500,000 less 0.4% of pensionable pay	£53,600,000 plus 0.1% of pensionable pay
Haringey (Hymans Robertson)	£9,252,000	£8,612,000	£9,554,000
Hampshire (Aon)	£75,680,400 less 2.9% of pensionable pay	£81,548,300 less 1.9% of pensionable pay	£87,248,800 less 0.9% of pensionable pay
Berkshire (Barnett Waddingham)	£21,017,000 or 5.3% of pensionable pay	£27,468,000 or 6.7% of pensionable pay	£34,075,000 or 8.2% of pensionable pay

Rates and Adjustments Certificate Regulation 62 (8)

A.15 Regulation 62 (8) states that the rates and adjustments certificate must contain a statement of the assumptions on which the certificate is given as respects— (a) the number of members who will become entitled to payment of pensions under the provisions of the Scheme; and (b) the amount of the liabilities arising in respect of such members, during the period covered by the certificate.

A.16 In the following table we set out where the assumptions for each valuation can be found.

A.17 Each Rates and Adjustments Certificate contains a statement detailing the assumptions on which the certificate has been given and where to find them.

Regulation 62 (9)

A.18 Regulation 62 (9) States that the administering authority must provide the actuary preparing a valuation or a rates and adjustments certificate with the consolidated revenue account of the fund and such other information as the actuary requests.

A.19 Each valuation shows evidence of having received relevant data from the administering authority, including cash flows for the years 2014, 2015 and 2016.

Table A6: Location of assumptions

Fund	Statement in Rates and Adjustments Certificate	Location of assumptions in Valuation Report
Merseyside (Mercer)	✓	Appendix A
Haringey (Hymans Robertson)	✓	Appendix E
Hampshire (Aon)	✓	Appendix 5
Berkshire (Barnett Waddingham)	✓	Appendix 2 and Funding Strategy Statement

Appendix B: Consistency

B.1 In this appendix we set out analysis we undertook in relation to whether the actuarial valuations were carried out in a way which is not inconsistent with other valuations completed under the scheme regulations. This appendix contains comments and a number of charts referring to the following aspects:

- Key information
- Funding levels
- Discount rates
- Demographic assumptions

Key Information

B.2 Based on one report from each actuarial firm, table B1 sets out the outcomes for key information that we would expect to see in each valuation.

Table B1: Key Information

Demographic	Hampshire (Aon)	Berkshire (Barnett Waddingham)	Haringey (Hymans Robertson)	Merseyside (Mercer)
Funding level (assets/liabilities)	81%	73%	79%	85%
Market value of assets	£5.2b	£1.6b	£1.0b	£6.9b
Value of liabilities	£6.5b	£2.2b	£1.3b	£8.1b
Surplus (Deficit)	(£1.2b)	(£0.6b)	(£0.3b)	(£1.2b)
Deficit recovery end point*	2036	2040	2036	2035
Primary contribution rate (average for the fund)	17.1%	14.3%	17.6%	15.4%
Secondary contribution rate (average for the fund)		See below		
Employee contribution rate	6.5%	6.5%	6.5%	6.6%
Discount rate(s)	4.5%	5.7%**	4.0%	4.2%
Life expectancies	Given	Not given	Given	Given
Funding level on SAB basis***	Not given	Not given	94%	Not given

* derived from deficit recovery period; Berkshire stated as “illustrative”, Haringey in Funding Strategy Statement
** Discount rate – Unitaries = 5.7%, discount rate Non-Unitaries = 5.5%
*** we note that it was agreed with SAB this need not be presented. We recommend this be reconsidered.

B.3 Most information was included for most funds, with some exceptions. All firms of actuarial advisors provide a detailed breakdown of the secondary contribution rates by employer for each of the next three years in their Rates and Adjustments Certificates. However, the summary statistics provided for the funds as a whole varied significantly between actuarial advisors. A standardised dashboard could help the reader make comparisons. We note that this information may be contained in supporting (non-public) reports/advice.

Funding Levels

B.4 Chart B1 shows how the ranking of local funding levels varies when results are restated onto the SAB standardised basis. We might expect the rankings of funding levels when calculated on the local bases to correspond roughly to the rankings of funding levels when calculated on the SAB standard basis. We would therefore expect the lines in Chart B1 joining each fund in the column on the left with itself in the column on the right to be roughly horizontal. However, we see that there is no clear correlation between how funds rank on local bases and how they rank on the SAB standard basis. To choose a typical example, Warwickshire is ranked mid-table on the local basis but is towards the top quartile of the table on the SAB standard basis, indicating that their local fund basis is, relatively, more prudent than other funds.

Chart B1: Standardising Local Valuation Results

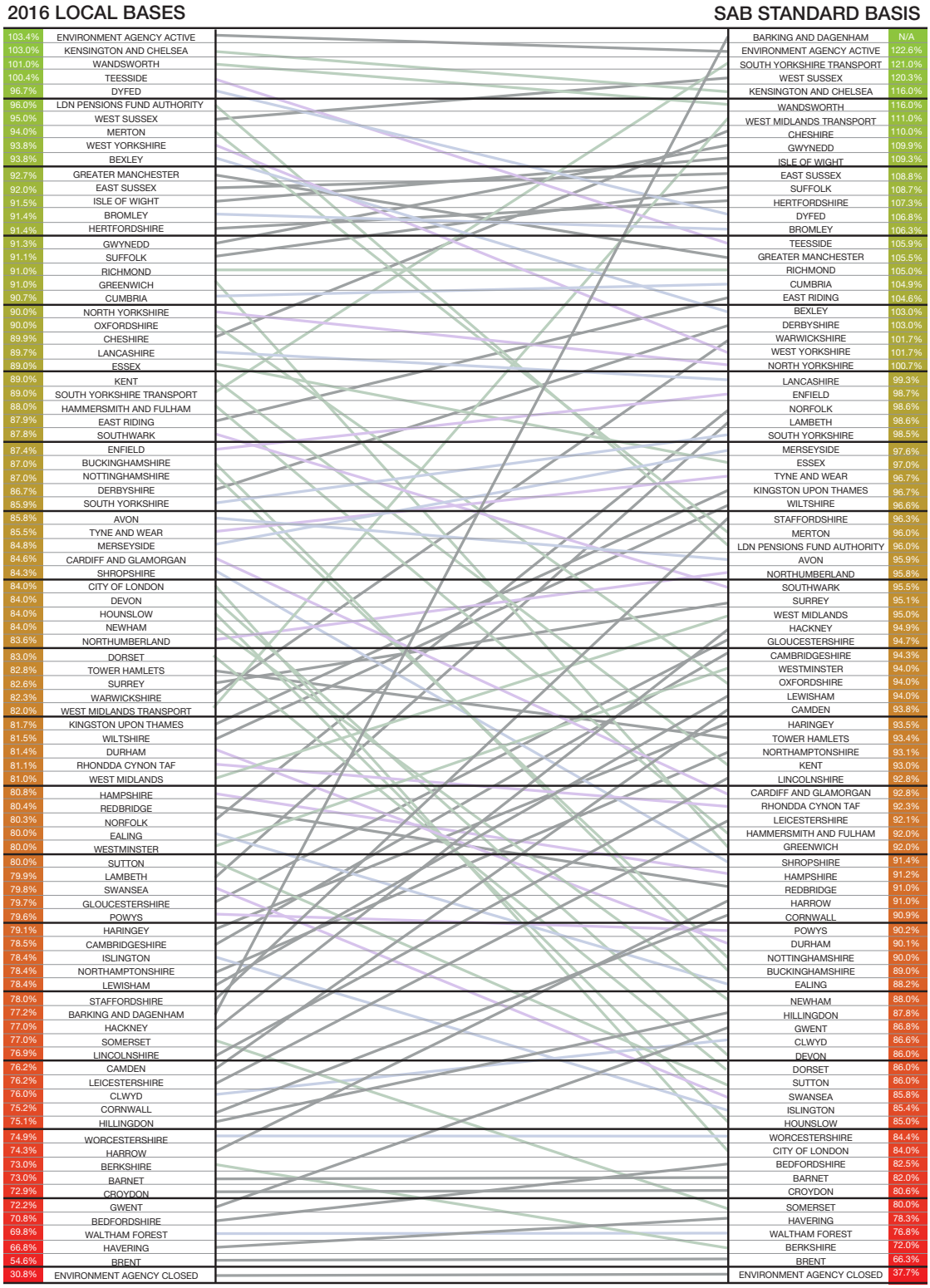
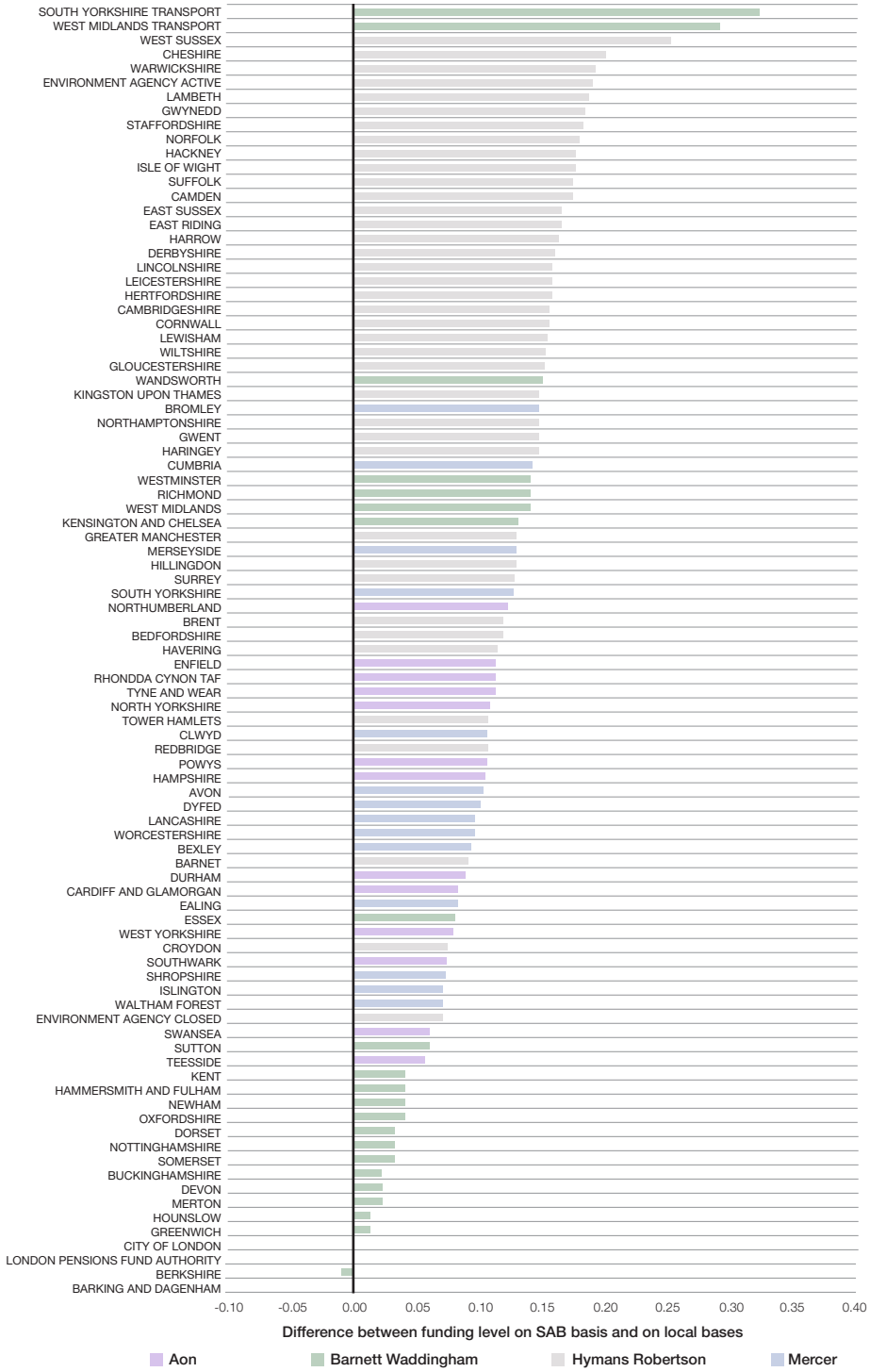


Chart B2: Difference Between Funding Level on SAB Standardised Basis and Funding Level on Local Bases



Discount Rates

B.5 Each firm of actuarial advisors applies a different method for calculating discount rates as shown in the table below[2]:

Table B2: Discount Rate Methodology

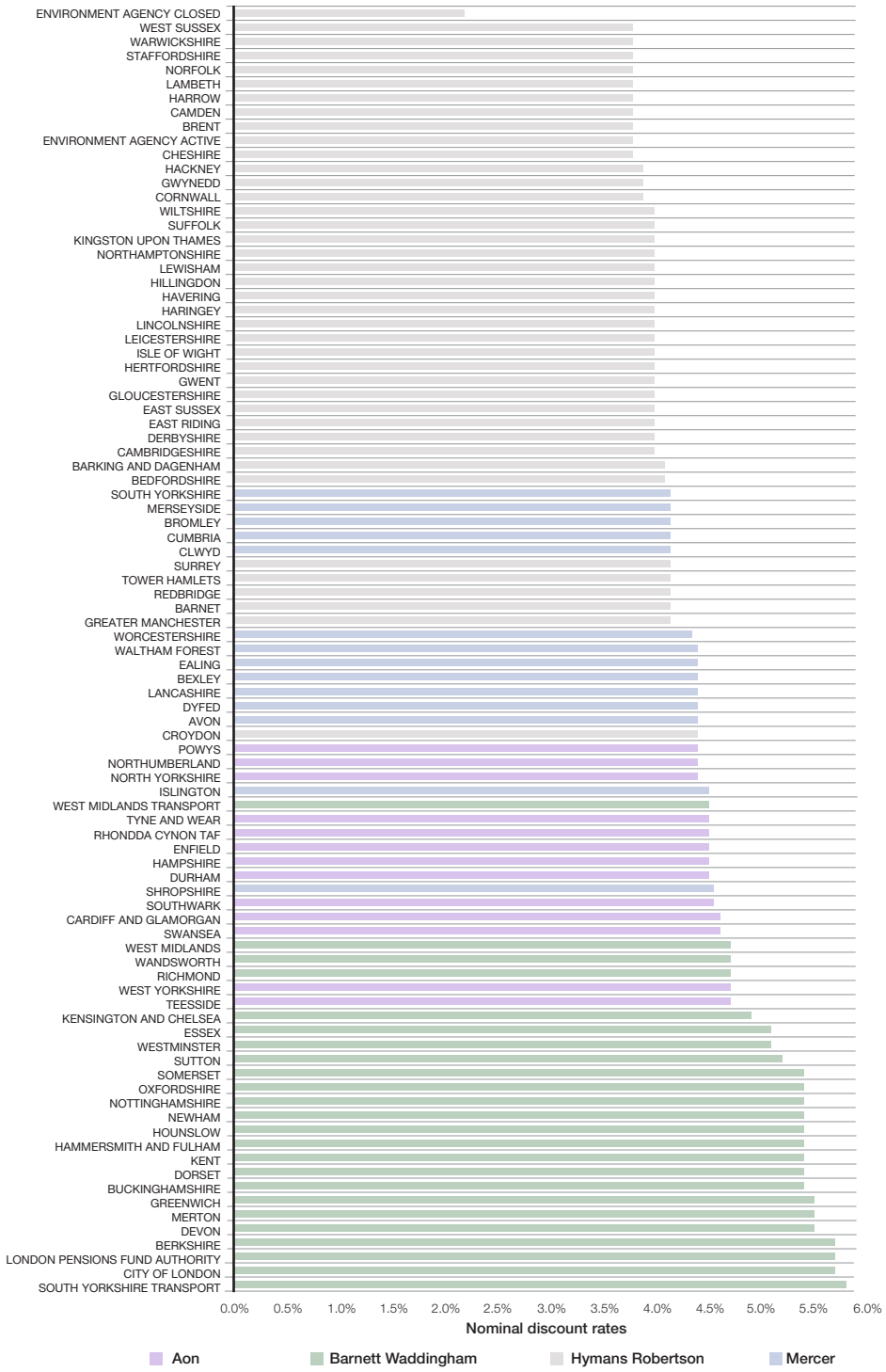
Firm of actuarial advisors	Discount rate methodology
Aon	Stochastic Method
Barnett Waddingham	Weighted average expected return on assets classes
Hymans Robertson	Gilts +
Mercer	CPI + real discount rate derived using stochastic modelling

B.6 Chart B3 shows the pre-retirement discount rate used to assess past service liability[3] applied in the actuarial valuations for each fund. The discount rates set by each fund are likely to be linked to the mix of assets held by the fund, and we would therefore expect to see differences in discount rate from fund to fund. Hymans Robertson and Mercer use different methods and/or discount rates for future contribution requirements.

[2] Note: the method of deriving discount rate is not shown in all reports, but was provided by each firm as part of GAD's data request.

[3] Note that some funds used different discount rates to assess past service liabilities and future service contribution rates, we consider only the former here.

Chart B3: Pre-retirement Discount Rates

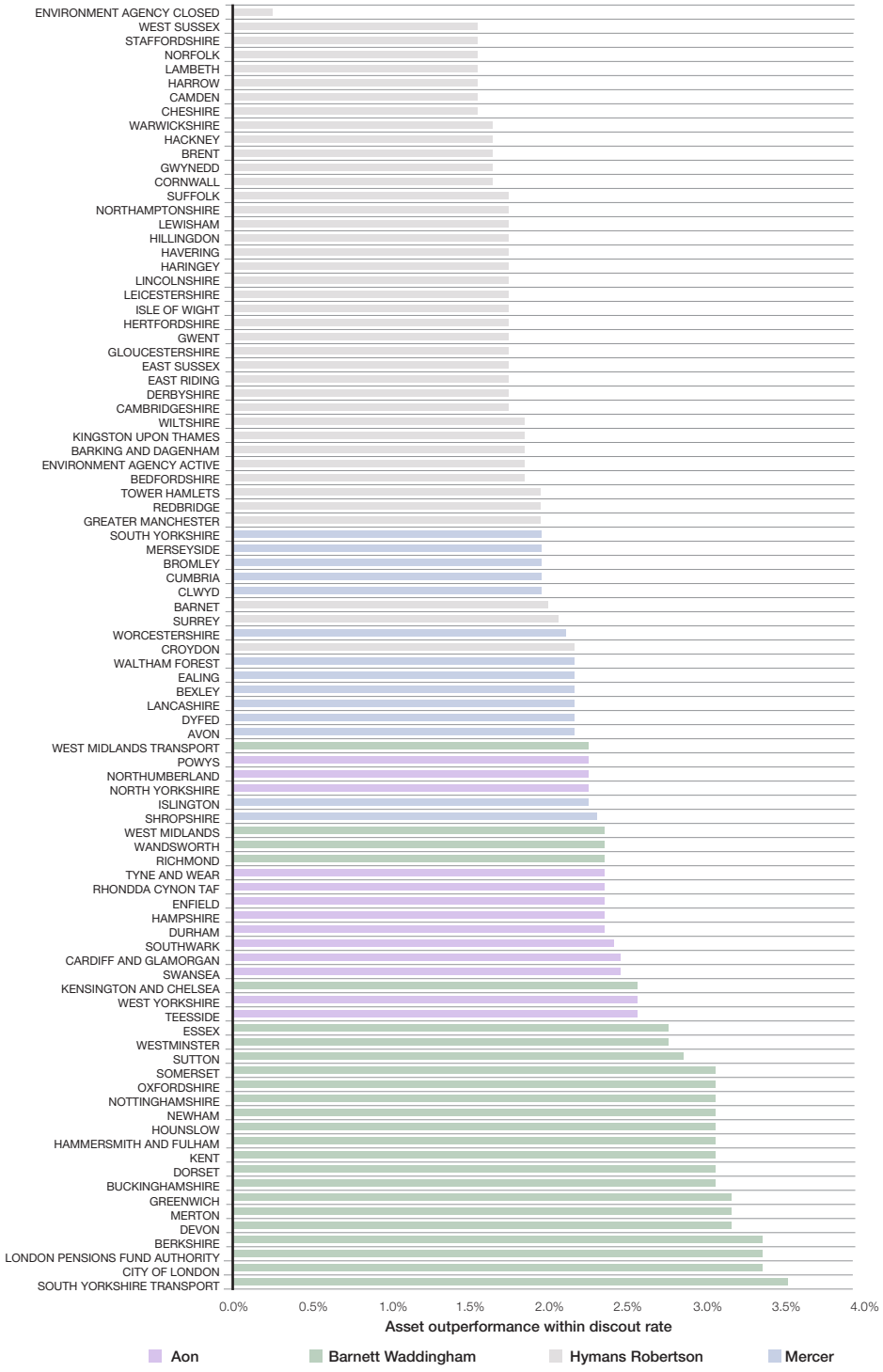


B.7 We assess implied asset outperformance as discount rate less risk free rate less RPI, where the risk free rate is taken to be the real 20 year Bank of England spot rate as at 31 March 2016 (-0.96%). Chart B4 shows the assumed asset out performance ("AOA") over and above the risk free rate, where AOA is calculated as the fund's nominal discount rate ("DR") net of:

- The RFR – the real 20 year Bank of England spot rate as at 31 March 2016
- Assumed CPI – as assumed by the fund in their 2016 actuarial valuation
- The excess of assumed RPI inflation over assumed CPI inflation ("$RPI–CPI$") – as assumed by the fund in their 2016 actuarial valuation

i.e. $AOA = DR–RFR–RPI$. (Chart B4 shows the implied rate of asset outperformance for each fund.)

Chart B4: Assumed Asset Outperformance within Discount Rate

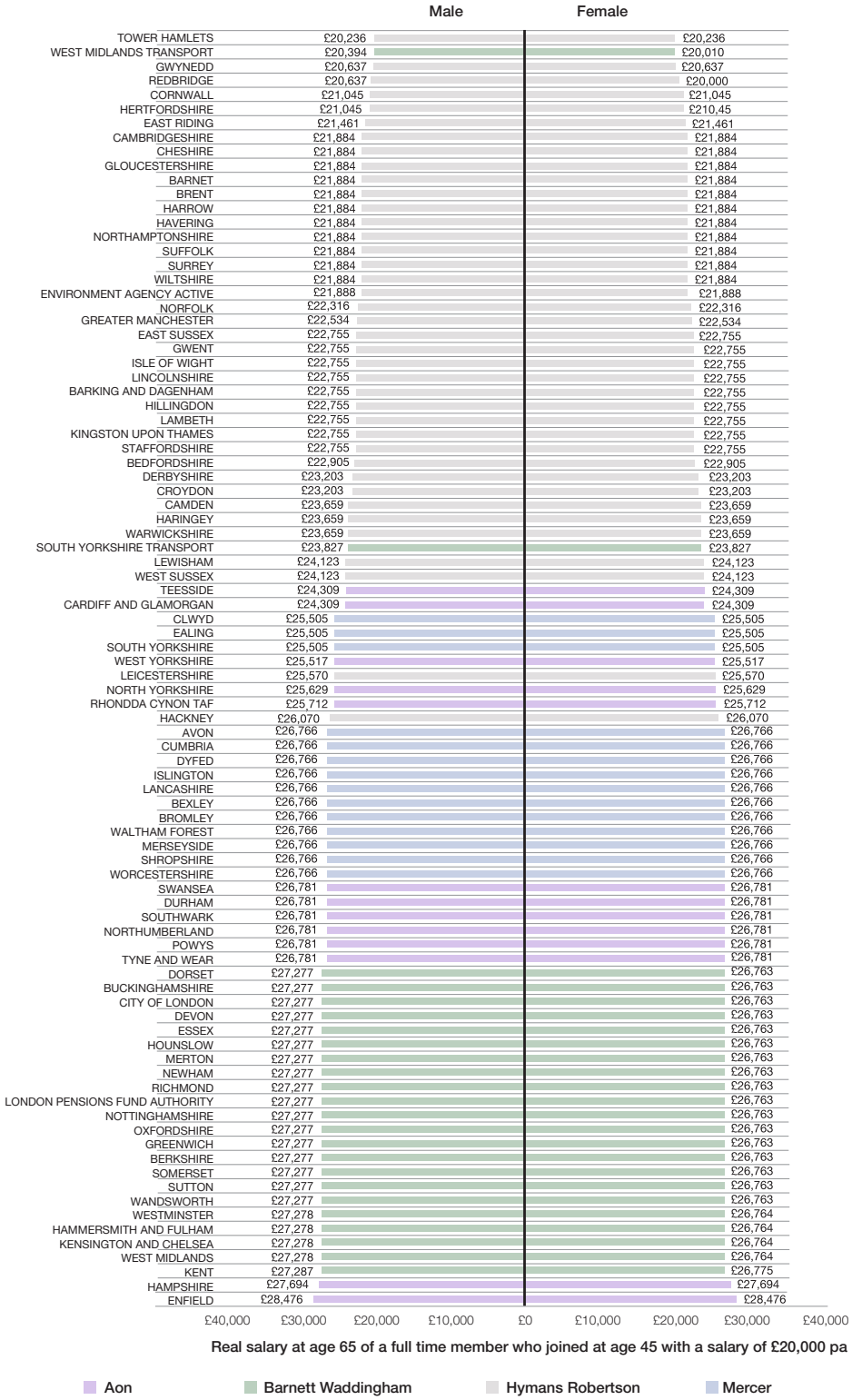


Demographic assumptions

B.8 Chart B5 shows the projected salary in present day terms at age 65 for a 45 year old currently earning £20,000 per year.

B.9 The chart indicates that assumed salary increases appear to follow a house view rather than explicitly reflecting local variations. We note that NJC pay bargaining affects all local councils.

Chart B5: Projected Real Salary at age 65 for a 45 year old currently earning £20k pa



B.10 Commutation assumptions (the extent to which members on average exchange pension in favour of a tax free cash benefit) are set as the percentage of the maximum commutable amount that a member is assumed to take on retirement. Chart B6 shows the assumed percentages for both pre 2008 and post 2008 pensions, which may be set separately.

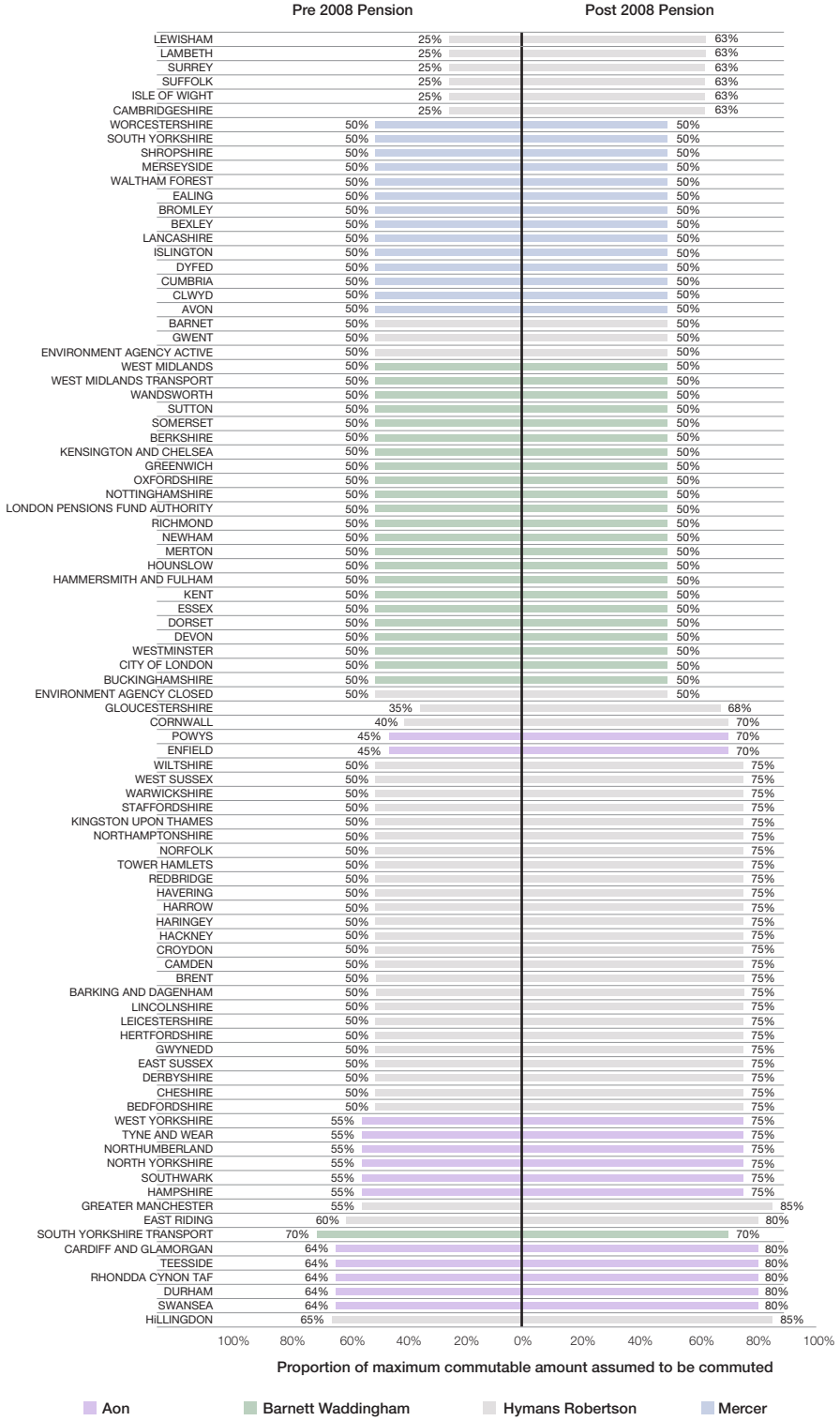
B.11 Other things being equal, it is more prudent to assume a lower rate of commutation, because the cost of providing a pension benefit is higher than the commutation factor. In addition, cash was provided as of right in the LGPS prior to 2008; whereas for benefits accrued after that date, cash was available only by commutation of pension.

B.12 The chart shows that all the funds advised by Mercer and most funds advised by Barnett Waddingham assume that members commute 50% of the maximum allowable amount. Funds advised by Aon assume that their members commute at least 70% of the maximum allowable amount for post 2008. There is more variation in the commutation assumptions made by funds advised by Hymans Robertson, but with a large cluster of funds assuming 50% for pre 2008 pensions and 75% for post 2008.

B.13 If it is the case that firms of actuarial advisors find that there is insufficient data to make assumptions on a fund by fund basis, then it would be reasonable for them to make the assumption based on scheme wide data. However, each advisor only has access to the data from the funds that it advises, and therefore can only base their assumptions on the data from those funds. Another firm of actuarial advisors has access to the data for a different collection of funds and therefore might draw a different conclusion as to what the scheme wide average commutation rate is.

B.14 The result is that each firm of actuarial advisors takes a “house view” on commutation assumptions rather than an approach clearly based on local conditions, which calls into question whether the consistency criterion of Section 13 has been met.

Chart B6: Commutation Assumptions for Pre and Post 2008 Pensions



Appendix C: Solvency

C.1 In this appendix we set out analysis we undertook in relation to whether the rate of employer contributions to the LGPS pension fund is set at an appropriate level to ensure the solvency of the pension fund. This appendix contains a description of:

- Solvency considerations
- Core Spending Power
- Mapping of solvency considerations to measures adopted
- Methodology used for solvency measures
- Table of outcomes for each fund

Potential for default

C.2 In the context of the LGPS:

- Our understanding based on confirmation from MHCLG is that, in contrast to employers in the private sector, there is no insolvency regime for local authorities
- Therefore, for the purposes of our analysis we assume that local authority sponsors cannot default on their pension liabilities through failure
- Members' benefits are therefore dependent on the assets of the scheme and future contributions from employers including local authorities

Solvency considerations

C.3 In assessing whether the conditions for solvency are met, we will have regard to:

Risks already present:

- funding level on the SAB standard basis
- whether or not the fund continues to be open to new members. If the fund is closed to new members or is highly mature, we will focus on the ability to meet additional cash contributions
- the ability of tax raising authorities to meet employer contributions

Emerging risks:

- the risks posed by changes to the value of scheme assets (to the extent that these are not matched by changes to the scheme liabilities)
- the proportion of scheme employers without tax raising powers or without statutory backing

C.4 We express the emerging risks in the context of Core Spending Power[4] (for English local authorities, described below) or financing data (for Welsh local authorities).

Core Spending Power

C.5 GAD's stress tests are designed to test the ability of the underlying tax raising employers to meet a shock in the fund; one that results in a sustained reduction of the funding position, requiring remedial action from those employers in the form of long term additional contributions.

[4] For some funds, employers do not include local authorities with Core Spending Power or financing data, in which case we have followed the same approach used in the dry run.

C.6 The purpose is to put this in the context of the financial resources available to those tax raising employers. In order to do that, MHCLG has pointed to an objective, well used and publicly available measure referred to as Core Spending Power. This applies for all local authorities across England and is published here[5].

C.7 Core Spending Power has the following components:

- Modified Settlement Funding Assessment
- Estimated Council Tax excluding Parish Precepts
- Potential additional Council Tax revenue from Adult Social Care flexibility
- Potential additional Council Tax revenue from £5 referendum principle for districts with lower quartile Band D Council Tax levels
- Proposed Improved Better Care Fund
- New Homes Bonus
- Rural Services Delivery Grant

C.8 GAD have referenced Core Spending Power for 2016-17 (to be consistent with the effective date of the data provided for Section 13) as the measure of financial resource of the underlying (tax raising) employers, and amalgamated these up to the fund level, in order to compare like with like.

C.9 Core Spending Power is not a measure of total local authority income. It does not include commercial income, sales fees and charges, or ring-fenced grants (except improved Better Care Fund). Core Spending Power includes an assumed modelled amount of locally retained business rates and as such does not include growth (or falls) in actual retained business rates. In some authorities, non-uniformed police employees participate in the LGPS, but their funding comes from Home Office. On the basis that the majority of this applies to uniformed police officers, no adjustment is made for it. Similarly DfE funding for academies is not included.

C.10 Because Core Spending Power is publicly available and objective, MHCLG have advised it is the best such measure available currently.

C.11 Core Spending Power does not apply to Welsh local authorities. For Welsh funds GAD have used "financing of gross revenue expenditure" ("financing data"), which is broadly comparable with Core Spending Power, following discussions with Welsh Government. This applies for all local authorities in Wales and is published here[6].

C.12 Financing data has the following components which GAD have included for the purpose of Section 13 analysis:

- Adjustments (including amending reports)
- Council tax reduction scheme (including RSG element)
- Discretionary non-domestic rate relief
- General government grants
- Share of re-distributed non-domestic rates
- Amount to be collected from council tax

[5] https://www.gov.uk/government/publications/core-spending-power-final-local-government-finance-settlement-2018-to-2019

[6] https://www.gov.uk/government/publications/core-spending-power-final-local-government-finance-settlement-2018-to-2019

C.13 Financing data also has the following components which we have not included for the purpose of Section 13 analysis:

- Specific grants
- Appropriations from(+) / to(-) reserves

C.14 We have referenced financing data for 2016-17 (to be consistent with the effective date of the data provided for Section 13) as the measure of financial resource of the underlying (tax raising) employers, and amalgamated these up to the fund level, in order to compare like with like.

C.15 Similarly to Core Spending Power, financing data excludes income from sales, fees and charges.

C.16 Similarly to Core Spending Power, We have excluded police funding from the analysis.

Solvency measures

C.17 For the 2016 exercise, we have tested the following five metrics under solvency. We developed other measures but have not used them. For example, we considered that liability shock did not add value under current circumstances beyond what was already measured under asset shock.

Table C1: 2016 Solvency measures

Consideration	Measure Used
Risks already present:	
The relative ability of the fund to meet its accrued liabilities	**SAB funding level:** A fund's funding level using the SAB standard basis, as set out in Appendix D
The extent to which the fund continues to be open to new members. If a fund is closed to new members or is highly mature, we will focus on the ability to meet additional cash contributions	**Open fund:** Whether the fund is open to new members
The proportion of scheme employers without tax raising powers or without statutory-backing	**Non-statutory members:** The proportion of members within the fund who are/were employed by an employer without tax raising powers or statutory backing
Emerging risks:	
The cost risks posed by changes to the value of scheme assets (to the extent that these are not matched by changes to the scheme liabilities)	**Asset shock:** The change in average employer contribution rates expressed as a percentage of Core Spending Power (or financing data) after a 15% fall in value of return-seeking assets
The impact that non-statutory employers defaulting on contributions would have on the income of sponsoring employers as a whole	**Employer default:** The change in average employer contribution rates as a percentage of Core Spending Power (or financing data) if all employers without tax raising powers or statutory backing default on their existing deficits

C.18 Emerging risk measures require assumptions. We used best estimate assumptions for this purpose, details of which can be found in Appendix G. Details of the methods used to calculate scores under each measure and the criteria used to assign a colour code can be found in this chapter.

Funds with no or low core spending

C.19 There were six funds with no or low core spending

- Environmental Agency Active Fund
- Environmental Agency Closed Fund
- West Midlands Integrated Transport Authority Pension Fund
- South Yorkshire Passenger Transport Authority Pension Fund
- London Pension Fund Authority Pension Fund
- City of London Corporation Pension Fund

C.20 For each of these funds, we have reverted to the dry run methodology for asset and liability shock, which expressed the resulting additional contributions to meet the emerging deficit as a percentage of pensionable pay.

Solvency measures – methodology

C.21 This Appendix details the methodology behind the measures used to assess a fund's solvency position. Some of the measures listed below were calculated using a market consistent set of assumptions. For more information on this best estimate basis please see Appendix G.

SAB funding level: *A fund's funding level using the SAB standard basis*

C.22 This measure highlights possible risks to a fund as a result of assets being significantly lower than liabilities, where liabilities are those estimated on the SAB standard basis detailed in Appendix G.

C.23 A fund in deficit will need to pay additional contributions in order to meet the liabilities that have already been accrued.

C.24 This measure assesses the relative funding levels of individual funds. All funds have been ordered by this measure (highest funding level first) and the ten funds ranked 81 to 90 out of 91 (i.e. not including Environment Agency Closed Fund) are assigned an amber colour code. All other funds are assigned a green colour code.

Open fund: *Whether the fund is open to new members*

C.25 A scheme that is closed to new members will be closer to maturity than a scheme which is still open. This creates a possible risk to sponsoring employees as there is less scope to make regular contributions and receive investment returns on those contributions. Additionally, if problems do occur with the scheme funding level, the reduced time to maturity of the scheme means that additional contributions must be spread over a shorter timeframe, and could be more volatile as a result.

C.26 This measure is a *'Yes'* when a fund is still open to new members and a *'No'* otherwise. A *'Yes'* results in a green colour code, while a *'No'* results in a red colour code.

Non-statutory members: *The proportion of members within the fund who are employed by an employer without tax raising powers or statutory backing*

C.27 We have considered tax payer-backed employers of stronger covenant value than other employers. It is important, in this context, that administering authorities and other employers understand the potential cost that may fall on taxpayers in the future if employers without statutory backing or tax raising powers are unable to meet their required contributions and those with such powers become responsible for the accrued costs.

C.28 Data for this measure has been taken from the publicly available *'Local government pension scheme funds local authority data: 2016 to 2017'* published by DCLG[7]. The data contains the number of employees within each fund by employer group, where:

- Group 1 refers to local authorities and connected bodies
- Group 2 refers to centrally funded public sector bodies
- Group 3 refers to other public sector bodies and
- Group 4 refers to private sector, voluntary sector and other bodies

C.29 For the purposes of this measure, and unless information has been provided to the contrary, it has been assumed that employers listed under groups 1 and 2 are those ***with*** tax raising powers or statutory backing and that employers listed under groups 3 and 4 are those ***without*** tax raising powers or statutory backing.

C.30 The measure therefore gives the proportion of members within the fund that are/were employed by group 1 and 2 employers as a proportion of all members within the fund.

C.31 Under this measure a fund has been allocated a red colour code if its proportion of members who are employed by an employer without tax raising powers or statutory backing is greater than 50%.

C.32 A fund has been allocated an amber colour code if its proportion of members who are employed by an employer without tax raising powers or statutory backing is between 25% and 50%, and a green colour code in all other cases.

Asset shock: *The change in average employer contribution rates as a percentage of Core Spending Power or financing data after a 15% fall in value of return-seeking assets*

C.33 This measure shows the effect on total employer contribution rates of a one-off decrease in the value of a fund's return seeking assets equal to 15% of the value of those assets expressed as a percentage of Core Spending Power or financing data. Defensive assets are assumed to be unaffected.

C.34 For the purposes of this measure liabilities have restated on the standardised best estimate basis and deficit recovery periods have been standardised using a period of 20 years to ensure that results are comparable. Where a fund is in surplus under the standardised best estimate basis, the surplus is assumed to be paid back to the employer over a period of 20 years. However, where the fund is in surplus after the shock, we have not applied a flag.

C.35 Return-seeking asset classes are assumed to be:

- Overseas Equities
- UK Equities
- Other Investments
- Property
- Other return seeking assets

[7] https://www.gov.uk/government/collections/local-government-pension-scheme

Defensive asset classes are assumed to be:

- Cash
- Gilts
- Corporate Bonds
- Other defensive assets

C.36 We calculated the emerging deficit from the shock following a 15% fall in return seeking assets applying to tax raising employers (local authorities and connected bodies & other public sector bodies):

$$New\ Defecit = (Pre\ stress\ asset\ value - post\ stress\ asset\ value) \times \%\ Tax\ raising\ employers$$

C.37 We spread this over 20 years of annual payments and express as a percentage of Core Spending Power (or financing data for Welsh funds)

$$\frac{New\ Defecit}{\bar{a}_{20} \times Core\ Spending\ Power}$$

C.38 Where:

- new deficit is calculated on the standardised best estimate basis as at 31 March 2016
- $\bar{a}_{20}$ is a continuous annuity over the 20 year deficit recovery period at the rate of interest equal to $\frac{1+i}{1+e} - 1$.
- i is the nominal discount rate assumption on the standardised best estimate basis.
- e is the general earnings inflation assumption on the standardised best estimate basis

C.39 A fund is allocated an amber colour code if its result is above 3% and a green colour code otherwise.

C.40 For those funds with no/low core spending, the change of contribution rate was expressed as a percentage of pensionable pay, with an amber flag raised if that was greater than 5%. No results are available for the Environment Agency Closed Fund as there are no remaining active members within the fund with which to calculate contribution rates.

Funds in surplus after shock

C.41 The asset shock resulted in a reduction to the funding level of the scheme on GAD's best estimate basis. However if the fund was in surplus post shock (the funding level was in excess of 100% after the shock) the fund would not receive a flag.

C.42 However, the risk remains that such an event could bring forward the need to increase contributions for the following funds:

- East Riding Pension Fund
- Greater Manchester Pension Fund
- Royal Borough of Kensington and Chelsea Pension Fund
- Teesside Pension Fund
- Wandsworth Council Pension Fund

Equity Protection Strategy

C.43 South Yorkshire Pension Fund has recently added a protection strategy to attempt to limit downside risk from its equity portfolio. The intention of this strategy is to protect £2.6bn of the equity portion of the fund against falls in total return of between 5% and 30%, by giving up total returns above 14.25% over a two year period.

C.44 The strategy has been implemented through buying and selling options and giving up sufficient upside to reduce the net cost to zero. On implementation there was actually a net gain to the scheme of £73k. The structure has been implemented in four parts based on four indices: S&P 500 (c£1bn), FTSE 100 (c£0.9bn), Euro Stoxx 50 (c£0.6bn), Nikkei 225 (c£0.2bn).

C.45 We have not adjusted our asset shock outcomes to reflect this strategy. Although we consider such a strategy may benefit funds wishing to protect their downside risk, and which may mean the premise for our asset shock could change, we would need to understand this in more detail, and that may be appropriate if the strategy is maintained or extended through to the next valuation.

Employer default: *The change in average employer contribution rates as a percentage of payroll if all employers without tax raising powers or statutory backing default on their existing deficits*

C.46 LGPS regulations require employers to pay contributions set in the valuation. DCLG has confirmed that:

- there is a guarantee of LGPS pension liabilities by a public body;
- that public body is incapable of becoming insolvent; and
- the governing legislation is designed to ensure the solvency and long term economic efficiency of the Scheme.

C.47 It is important, in this context, that administering authorities and other employers understand the potential cost that may fall on taxpayers in the future if employers without statutory backing or tax raising powers are unable to meet their required contributions and those with such powers become responsible for the accrued costs.

C.48 For the purposes of this measure liabilities have been restated on the standardised best estimate basis and deficit recovery periods have been standardised using a period of 20 years to ensure that results are comparable. Where a fund is in surplus under the standardised best estimate basis, the surplus is assumed to be paid back to the employer over a period of 20 years. However, where the fund is in surplus after the shock, we have not applied a flag.

C.49 A fund's deficit will not change as a result of the default, but as the deficit is spread over a smaller number of employers, the contribution rate for each remaining employer will increase.

C.50 If an employer defaults when the fund is in surplus, the risk is mitigated, so we have not considered funds in surplus on the standardised best estimate basis for this measure.

C.51 We calculated the amount of deficit from the default of other public sector bodies & private sector, voluntary sector and other bodies:

$$Share\ of\ Defecit = Defecit \times \%\ non\text{-}tax\ raising\ employers$$

C.52 We spread this over 20 years of annual payments and express as a percentage of Core Spending Power (or financing data for Welsh funds)

$$\frac{Share\ of\ Defecit}{\bar{a}_{20} \times Core\ Spending\ Power}$$

C.53 Where:

- Share of deficit is calculated on the standardised best estimate basis as at 31 March 2016
- $\bar{a}_{20}$ is a continuous annuity over the 20 year deficit recovery period at the rate of interest equal to $\frac{1+i}{1+e} - 1$.
- i is the nominal discount rate assumption on the standardised best estimate basis.

- e is the general earnings inflation assumption on the standardised best estimate basis

C.54 A fund is allocated an amber colour code if its result is greater than 3% and a green colour code otherwise.

Covenant review comments

C.55 We are aware that a significant amount of work goes on by fund managers in relation to covenant of employers.

C.56 Specific covenant reviews are conducted each year in respect of the employers in the WMITA fund.

C.57 We have discussed this covenant work with a range of fund managers, as well as the Pensions Regulator. It helps protect each fund against the risk of the employer defaulting on its obligations to the fund.

C.58 We include a measure for high proportion of non-tax backed employees as a proxy for the risk that their employers do default. We also do a stress test on this item to see if it has a material impact on the finances of the local authorities that may retain any residual deficit in relation to those employers. By doing these tests, it is not our intention to comment on the covenant work that goes on, rather to highlight that there remains some risk.

C.59 This risk exists because those employers have a different potential impact on the funds, and the tax raising employers retain the risk should an employer default.

Solvency measures – by fund

Table C2: Solvency measures by fund

	2016 solvency measures				
Pension fund	**Open fund**	**SAB funding level**	**Non-Statutory employees**	**Asset shock**	**Employer default**
Avon Pension Fund	Yes	95.9%	5.5%	2.0%	Surplus
Bedfordshire Pension Fund	Yes	82.5%	4.2%	1.8%	0.1%
Buckinghamshire County Council Pension Fund	Yes	89.0%	4.8%	1.9%	0.0%
Cambridgeshire Pension Fund	Yes	94.3%	3.8%	2.2%	Surplus
Cardiff and Vale of Glamorgan Pension Fund	Yes	92.8%	6.7%	1.5%	Surplus
Cheshire Pension Fund	Yes	110.0%	7.6%	Surplus	Surplus
City and County of Swansea Pension Fund	Yes	85.8%	10.2%	1.4%	0.1%
City of London Corporation Pension Fund *	Yes	84.0%	10.6%	3.6%*	1.1%
City of Westminster Pension Fund	Yes	94.0%	0.0%	2.9%	Surplus
Clwyd Pension Fund	Yes	86.6%	2.4%	0.9%	0.0%
Cornwall Pension Fund	Yes	90.9%	6.3%	1.1%	Surplus
Cumbria Local Government Pension Scheme	Yes	104.9%	7.2%	Surplus	Surplus
Derbyshire Pension Fund	Yes	103.0%	4.5%	Surplus	Surplus
Devon County Council Pension Fund	Yes	86.0%	24.9%	2.5%	0.3%
Dorset County Pension Fund	Yes	86.0%	4.9%	1.9%	0.1%
Durham County Council Pension Fund	Yes	90.1%	3.8%	2.1%	0.0%
Dyfed Pension Fund	Yes	106.8%	3.8%	Surplus	Surplus
East Riding Pension Fund	Yes	104.6%	3.0%	Surplus	Surplus
East Sussex Pension Fund	Yes	108.8%	1.7%	Surplus	Surplus
Essex Pension Fund	Yes	97.0%	9.6%	2.1%	Surplus
Gloucestershire County Council Pension Fund	Yes	94.7%	9.6%	2.0%	Surplus
Greater Gwent (Torfaen) Pension Fund	Yes	86.8%	7.3%	1.5%	0.0%
Greater Manchester Pension Fund	Yes	105.5%	22.8%	Surplus	Surplus
Gwynedd Pension Fund	Yes	109.9%	3.4%	Surplus	Surplus
Hampshire County Council Pension Fund	Yes	91.2%	3.5%	1.9%	Surplus
Hertfordshire County Council Pension Fund	Yes	107.3%	5.8%	Surplus	Surplus
Isle of Wight Council Pension Fund	Yes	109.3%	2.7%	Surplus	Surplus
Islington Council Pension Fund	Yes	85.4%	5.9%	2.6%	0.1%
Kent County Council Pension Fund	Yes	93.0%	8.7%	2.1%	Surplus
Lancashire County Pension Fund	Yes	99.3%	7.9%	2.7%	Surplus
Leicestershire County Council Pension Fund	Yes	92.1%	5.0%	2.1%	Surplus

Pension fund	2016 solvency measures				
	Open fund	SAB funding level	Non-Statutory employees	Asset shock	Employer default
Lincolnshire Pension Fund	Yes	92.8%	2.6%	2.1%	Surplus
London Borough of Barking and Dagenham Pension Fund	Yes	90.6%	2.9%	2.3%	0.0%
London Borough of Barnet Pension Fund	Yes	82.0%	11.8%	1.7%	0.2%
London Borough of Bexley Pension Fund	Yes	103.0%	5.7%	1.9%	Surplus
London Borough of Brent Pension Fund	Yes	66.3%	13.4%	1.2%	0.6%
London Borough of Bromley Pension Fund	Yes	106.3%	2.4%	Surplus	Surplus
London Borough of Camden Pension Fund	Yes	93.8%	8.7%	2.6%	Surplus
London Borough of Croydon Pension Fund	Yes	80.6%	3.6%	1.3%	0.1%
London Borough of Ealing Pension Fund	Yes	88.2%	11.0%	1.8%	0.1%
London Borough of Enfield Pension Fund	Yes	98.7%	1.5%	1.4%	Surplus
London Borough of Hackney Pension Fund	Yes	94.9%	0.0%	2.2%	Surplus
London Borough of Hammersmith and Fulham Pension Fund	Yes	92.0%	13.2%	2.4%	Surplus
London Borough of Haringey Pension Fund	Yes	93.5%	0.0%	2.5%	Surplus
London Borough of Harrow Pension Fund	Yes	91.0%	1.7%	1.9%	0.0%
London Borough of Havering Pension Fund	Yes	78.3%	1.1%	1.3%	0.0%
London Borough of Hillingdon Pension Fund	Yes	87.8%	1.2%	1.6%	0.0%
London Borough of Hounslow Pension Fund	Yes	85.0%	12.6%	1.8%	0.2%
London Borough of Lambeth Pension Fund	Yes	98.6%	0.0%	1.9%	Surplus
London Borough of Lewisham Pension Fund	Yes	94.0%	5.8%	2.1%	Surplus
London Borough of Merton Pension Fund	Yes	96.0%	2.4%	1.7%	Surplus
London Borough of Newham Pension Fund	Yes	88.0%	1.3%	2.4%	0.0%
London Borough of Redbridge Pension Fund	Yes	91.0%	10.5%	1.2%	0.0%
London Borough of Richmond Upon Thames Pension Fund	Yes	105.0%	3.8%	Surplus	Surplus
London Borough of Southwark Pension Fund	Yes	95.5%	3.2%	2.3%	Surplus
London Borough of Tower Hamlets Pension Fund	Yes	93.4%	0.0%	2.3%	Surplus
London Borough of Waltham Forest Pension Fund	Yes	76.8%	3.1%	1.3%	0.1%
Merseyside Pension Fund	Yes	97.6%	12.7%	3.0%[8]	Surplus
Norfolk Pension Fund	Yes	98.6%	8.7%	2.1%	Surplus
North Yorkshire Pension Fund	Yes	100.7%	2.0%	2.6%	Surplus
Northamptonshire Pension Fund	Yes	93.1%	1.6%	2.0%	Surplus
Northumberland County Council Pension Fund	Yes	95.8%	4.5%	2.4%	Surplus
Nottinghamshire County Council Pension Fund	Yes	90.0%	6.2%	2.8%	0.0%
Oxfordshire County Council Pension Fund	Yes	94.0%	4.4%	2.5%	Surplus

[8] Unrounded figure is less than 3%

	2016 solvency measures				
Pension fund	**Open fund**	**SAB funding level**	**Non-Statutory employees**	**Asset shock**	**Employer default**
Powys County Council Pension Fund	Yes	90.2%	5.1%	1.2%	0.0%
Rhondda Cynon Taf County Borough Council Pension Fund	Yes	92.3%	5.9%	2.0%	Surplus
Royal Borough of Greenwich Pension Fund	Yes	92.0%	6.8%	1.7%	Surplus
Royal Borough of Kensington and Chelsea Pension Fund	Yes	116.0%	7.1%	Surplus	Surplus
Royal Borough of Kingston Upon Thames Pension Fund	Yes	96.7%	13%	2.5%	Surplus
Royal County of Berkshire Pension Fund	Yes	72.0%	5.5%	1.5%	0.2%
Shropshire County Pension Fund	Yes	91.4%	9.8%	1.8%	Surplus
Somerset County Council Pension Fund	Yes	80.0%	21.9%	2.7%	0.7%
South Yorkshire Pension Fund	Yes	98.5%	9.6%	3.0%	Surplus
Staffordshire Pension Fund	Yes	96.3%	6.6%	2.9%	Surplus
Suffolk Pension Fund	Yes	108.7%	24.5%	Surplus	Surplus
Surrey Pension Fund	Yes	95.1%	5.1%	2.0%	Surplus
Sutton Pension Fund	Yes	86.0%	4.4%	1.3%	0.0%
Teesside Pension Fund	Yes	105.9%	9.7%	Surplus	Surplus
Tyne and Wear Pension Fund	Yes	96.7%	11.8%	3.5%	Surplus
Wandsworth Council Pension Fund	Yes	116.0%	8.9%	Surplus	Surplus
Warwickshire Pension Fund	Yes	101.7%	5.9%	2.2%	Surplus
West Midlands Pension Fund	Yes	95.0%	4.1%	2.7%	Surplus
West Sussex County Council Pension Fund	Yes	120.3%	5.7%	Surplus	Surplus
West Yorkshire Pension Fund	Yes	101.7%	13.4%	3.7%	Surplus
Wiltshire Pension Fund	Yes	96.6%	21.8%	2.6%	Surplus
Worcestershire County Council Pension Fund	Yes	84.4%	9.0%	2.2%	0.1%
Environment Agency Active Fund*	Yes	122.6%	N/A	Surplus*	N/A
Environment Agency Closed Fund	No	37.7%	N/A	N/A	N/A
South Yorkshire Passenger Transport Pension Fund*	No	121.0%	100.0%	Surplus*	N/A
West Midlands Integrated Transport Authority Pension Fund*	No	111.0%	100.0%	Surplus*	N/A
London Pensions Fund Authority Pension Fund*	Yes	96.0%	19.7%	7.4%*	N/A

Notes:

1. Funding levels are on the SAB standard basis.
2. The liability value and salary roll figures in the maturity indicator are as at 31 March 2016. The liability value was calculated on the standardised best estimate basis.
3. For funds marked * against asset shock we have assessed the shock as a percentage of pensionable pay (as we did in the dry run)

Appendix D: Long term cost efficiency

D.1 We developed a series of relative and absolute considerations to help assess whether the contributions met the aims of section 13 under long term cost efficiency. This appendix contains a description of:

- Mapping of long term cost efficiency considerations to measures adopted
- Methodology used for long term cost efficiency measures
- Table of outcomes for each fund

Table D1: Long Term Cost Efficiency Considerations and Measures

Consideration	Measure Used
Relative considerations:	
The implied deficit recovery period	**Deficit Period:** Implied deficit recovery period calculated on a standardised best estimate basis (SAB key indicator 3)
The investment return required to achieve full funding	**Required Return:** The required investment return rates to achieve full funding in 20 years' time on a standardised best estimate basis (SAB key indicator 4(i))
The pace at which the deficit is expected to be paid off	**Repayment Shortfall:** The difference between the actual deficit recovery contribution rate and the annual deficit recovery contributions required as a percentage of payroll to pay off the deficit in 20 years, where the deficit is calculated on a standardised best estimate basis
Absolute Considerations:	
The extent to which the required investment return above is less than the estimated future return being targeted by a fund's investment strategy	**Return Scope:** The required investment return rates as calculated in required return (i.e. SAB key indicator 4(i)), compared with the fund's expected best estimate future returns assuming current asset mix maintained (SAB key indicator 4(ii))
The extent to which any deficit recovery plan can be reconciled with, and can be demonstrated to be a continuation of, the previous deficit recovery plan, after allowing for actual fund experience	**Deficit Reconciliation:** Confirmation that the deficit period can be demonstrated to be a continuation of the previous deficit recovery plan, after allowing for actual fund experience.

D.2 For the 2016 report, we have removed some measures which represented the same information in a slightly different way to make the report more succinct.

D.3 Three of these measures were selected from the KPIs defined by the SAB[9]. The selected SAB measures have been augmented with two additional measures which we believe are appropriate in helping to assess whether the aims of section 13 are met.

D.4 The analyses and calculations carried out under these long term cost efficiency measures are approximate. They rely on the accuracy of the data provided by the respective local firms of actuarial advisors.

D.5 Although the calculations are approximate, we consider they are sufficient for the purposes of identifying which funds are a cause for concern. While the measures should not represent targets, these measures help us determine whether a more detailed review is required; for example, we would have concern where multiple measures are triggered amber for a given fund.

Long term cost efficiency measures – methodology

D.6 We detail the methodology behind the measures used to assess a fund's long term cost efficiency position below. Some of the measures listed were calculated using a best estimate set of assumptions. For more information on this best estimate basis please see Appendix G.

Deficit period: *The implied deficit recovery period calculated on a standardised best estimate basis*

D.7 This measure is based on SAB key indicator 3. However, as the SCAPE discount rate used in the SAB standard basis is not market-related, the calculations are done on a standardised best estimate basis.

D.8 The implied deficit recovery period on the standardised best estimate basis was found by solving the following equation for x:

$$\bar{a}_{x} = \frac{\textit{Defecit on standardised BE basis}}{\textit{Annual defecit recovery payment on standardised BE basis}}$$

D.9 Where:

- x is the implied deficit recovery period.
- $\bar{a}_{x}$ is a continuous annuity over x years at the rate of interest equal to $\frac{1+i}{1+e} - 1$.
- i is the nominal discount rate assumption on the standardised best estimate basis.
- e is the general earnings inflation assumption on the standardised best estimate basis.
- The deficit on the standardised best estimate basis is as at 31 March 2016.
- The annual deficit recovery payment on the standardised best estimate basis is calculated as the difference between the average employer contribution rate for the years 2017/18 – 2019/20, allowing for both contributions paid as a percentage of salary and fixed monetary contributions into the fund, where deficit contributions are fixed (i.e. the fixed monetary contributions, if any, have been converted so that they are quoted as a percentage of salary roll), and the employer standard contribution rate on the standardised best estimate basis for the years 2017/18 – 2019/20 (which is assumed to be equal to the future cost of accrual of that particular fund).

[9] http://committees.westminster.gov.uk/documents/s15058/11%20-%20Appendix%201%20-%20KPI%20Guidance.pdf

D.10 Funds that were in surplus or where the implied deficit recovery period was less than 10 years were flagged as green. Those with recovery periods greater than or equal to 10 years were flagged as amber. If there were any funds that were paying contributions at a level that would result in an increase in deficit, they would have been flagged as red.

Required return: *The required investment return rates to achieve full funding in 20 years' time on the standardised best estimate basis*

D.11 This measure is based on SAB key indicator 4(i). However, as the SCAPE discount rate used in the SAB standard basis is not market-related, the calculations are done on a standardised best estimate basis. No amber or red flags were raised under this measure.

D.12 The following assumptions were made for the purposes of this calculations:

- Time 0 is 31 March 2016.
- Time 20 is 31 March 2036.
- A_0 is the value of the fund's assets at time 0, and was obtained from the data provided by the local firms of actuarial advisors.
- A_{20} is the value of the fund's assets at time 20.
- L_0 is the value of the fund's liabilities at time 0, and was obtained from the data provided by the local firms of actuarial advisors.
- L_{20} is the value of the fund's liabilities at time 20.
- C_0 is one year's employer contributions paid from time 0.
- $C_{0\text{-}20}$ is the total employer contributions payable over the period time 0 – 20, assumed to occur mid-way between time 0 and time 20 (i.e. at time 10).
- B_0 is the value of one year's benefits paid (excluding transfers) from time 0.
- $B_{0\text{-}20}$ is the total value of benefits payable (excluding transfers) over the period time 0 – 20, assumed to occur mid-way between time 0 and time 20 (i.e. at time 10).
- SCR_0 is the standard contribution rate payable from time 0 to time 1 and was calculated by restating the standard contribution rates on the local fund bases using the best estimate basis.
- $SCR_{0\text{-}20}$ is the standard contribution rate payable from time 0 – 20, assumed to occur mid-way between time 0 and time 20 (i.e. at time 10).
- Sal_0 is the salary roll at time 0 and was obtained from the data provided by the local firms of actuarial advisors.
- i is the nominal discount rate assumption on the standardised best estimate basis.
- e is the general earnings assumption on the standardised best estimate basis.
- x is the required investment return that is to be calculated.

D.13 The membership profile is assumed to be constant.

D.14 The assets and liabilities at time 20 were then equated and the resulting quadratic equation solved to find the required rate of investment return to achieve full funding, i.e.:

$$A_{20} - L_{20} = 0$$

Where:

- $A_{20} = [A_0 \times (1+x)^{20}] + [(C_{0\text{-}20} - B_{0\text{-}20}) \times (1+x)^{10}]$
- $L_{20} = [L_0 \times (1+i)^{20}] + [(SCR_{0\text{-}20} - B_{0\text{-}20}) \times (1+x)^{10}]$
- $C_{0\text{-}20} = C_0 \times 20 \times (1+e)^{10}$
- $B_{0\text{-}20} = B_0 \times 20 \times (1+e)^{10}$
- $SCR_{0\text{-}20} = Sal_0 \times SCR_0 \times 20 \times (1+e)^{10}$

D.15 Where the required investment return was higher than the nominal discount rate on the standardised best estimate basis (i.e. i where i = 5.59%) funds would be classified as amber, whereas funds were classified as green if the required return was less than i.

Repayment shortfall: *The difference between the actual deficit recovery contribution rate and the annual deficit recovery contributions required as a percentage of payroll to pay off deficit in 20 years, where the deficit is calculated on a standardised best estimate basis*

D.16 This measure extends the deficit period measure. We calculate the required annual deficit recovery contribution rate on a standardised best estimate basis to pay off the deficit in 20 years' time, and then work out the difference between the actual deficit recovery contribution rate and this rate.

D.17 The 20 year deficit recovery period is based on the SAB key indicator 4(i).

D.18 The required annual deficit recovery contribution rate to be paid on a standardised best estimate basis is equal to:

$$\frac{Defecit\ on\ standardised\ best\ estimate\ basis}{\bar{a}_{20} \times Salary\ Roll}$$

Where:

- The deficit on the standardised best estimate basis is as at 31 March 2016.
- $\bar{a}_{20}$ is a continuous annuity over the 20 year deficit recovery period at the rate of interest equal to $\frac{1+i}{1+e} - 1$.
- i is the nominal discount rate assumption on the standardised best estimate basis.
- e is the general earnings inflation assumption on the standardised best estimate basis.
- The salary roll is as at 31 March 2016 and has not been adjusted.

D.19 The difference in deficit recovery contribution rates is then defined as:

$$(Avg\ ER\ cont\ rate\ paid - ER\ SCR\ on\ BE\ basis) - \frac{Defecit\ on\ BE\ basis}{\bar{a}_{20} \times Salary\ Roll}$$

Where:

- The average employer contribution rate is for the years 2017/18 – 2019/20, allowing for both contributions paid as a percentage of salary and fixed monetary contributions into the fund where deficit contributions are fixed ((i.e. the fixed monetary contributions, if any, have been converted so that they are quoted as a percentage of salary roll).
- The employer standard contribution rate on the standardised best estimate basis is for the years 2017/18 – 2019/20. It is assumed that the standard contribution rate is equal to the future cost of accrual of that particular fund.

D.20 The data required for each of the funds to carry out the above calculation was provided by their respective firms of actuarial advisors.

D.21 Where appropriate data has been restated on the standardised best estimate basis.

D.22 Funds where the difference in deficit recovery contribution rates is greater than 0% are flagged as green. Where the difference between contribution rates is between 0% and -3%, the funds would be flagged as amber. If the difference in deficit recovery contribution rates is less than -3%, then the fund would be flagged as red. No amber or red flags were raised under this measure.

Return scope: *The required investment return rates as calculated in required return, compared with the fund's expected best estimate future returns assuming current asset mix maintained*

D.23 This measure is based on SAB key indicator 4(ii).

D.24 The required investment return (x) calculated in the required return measure was compared against the best estimate investment return expected from the fund's assets held on 31 March 2016.

D.25 The asset data used in this calculation was provided by each fund's respective firm of actuarial advisors.

D.26 Funds where the best estimate future returns were higher than the required investment return by 0.5% or more were flagged as green. Those funds where this difference was between 0% and 0.5% would be flagged as amber, whilst those where the best estimate returns were lower than the required investment returns were flagged as red.

Deficit reconciliation: *Confirmation that the deficit period can be demonstrated to be a continuation of the previous deficit recovery plan, after allowing for actual fund experience*

D.27 This measure is used to monitor the change in the deficit recovery end point set locally by the fund at each valuation and what the underlying reasons are for any adverse changes in this period.

D.28 This measure considers the following:

- Whether contributions have decreased since the previous valuations (reducing the burden on current tax payers)
- Whether the deficit recovery end point has moved further into the future, compared with the previous valuation (increasing the burden on future tax payers)

Funds where both of the above have occurred are flagged amber; otherwise funds are flagged green.

Long term cost efficiency measures – by fund

Table D2: Long term cost efficiency measures by fund

	2016 long term cost efficiency measures					
		Relative considerations			Absolute considerations	
Pension fund	**Maturity (rank)**	**Deficit period**	**Required return**	**Repayment shortfall**	**Return scope**	**Deficit Reconciliation**
Avon Pension Fund	6 (54)	Surplus	3%	11%	2.2%	Green
Bedfordshire Pension Fund	5.5 (82)	4	3%	11%	2.3%	Green
Buckinghamshire County Council Pension Fund	5.3 (88)	0	3%	9%	2.1%	Green
Cambridgeshire Pension Fund	5.8 (71)	Surplus	3%	11%	2.8%	Green
Cardiff and Vale of Glamorgan Pension Fund	6.1 (48)	Surplus	3%	13%	3.1%	Green
Cheshire Pension Fund	6.6 (32)	Surplus	1%	14%	3.5%	Green
City and County of Swansea Pension Fund	5.6 (75)	3	3%	10%	2.4%	Green
City of London Corporation Pension Fund	7.1 (20)	6	4%	7%	1.8%	Green
City of Westminster Pension Fund	8.8 (5)	Surplus	1%	26%	4.9%	Green
Clwyd Pension Fund	6.5 (35)	2	2%	15%	2.6%	Green
Cornwall Pension Fund	5.9 (60)	Surplus	3%	14%	2.0%	Green
Cumbria Local Government Pension Scheme	7 (21)	Surplus	3%	10%	2.2%	Green
Derbyshire Pension Fund	5.6 (76)	Surplus	3%	8%	2.4%	Green
Devon County Council Pension Fund	6.3 (42)	4	4%	7%	1.7%	Green
Dorset County Pension Fund	5.7 (72)	4	4%	7%	1.4%	Green
Durham County Council Pension Fund	6.8 (23)	0	3%	13%	1.5%	Green
Dyfed Pension Fund	5.9 (56)	Surplus	3%	5%	2.3%	Green
East Riding Pension Fund	5.7 (73)	Surplus	2%	13%	3.7%	Green
East Sussex Pension Fund	6 (52)	Surplus	2%	10%	3.6%	Green
Environment Agency Active Fund	5.9 (62)	Surplus	3%	7%	3.0%	Green
Environment Agency Closed Fund	0 (N/A)	N/A	N/A	N/A	N/A	Green
Essex Pension Fund	5.6 (80)	Surplus	3%	10%	3.1%	Green
Gloucestershire County Council Pension Fund	5.9 (58)	Surplus	1%	19%	4.3%	Green
Greater Gwent (Torfaen) Pension Fund	6 (53)	3	4%	8%	1.9%	Green
Greater Manchester Pension Fund	6.9 (22)	Surplus	3%	9%	3.0%	Green
Gwynedd Pension Fund	5.4 (86)	Surplus	2%	10%	3.4%	Green
Hampshire County Council Pension Fund	5.5 (84)	Surplus	3%	12%	2.2%	Green
Hertfordshire County Council Pension Fund	5.8 (69)	Surplus	2%	12%	3.3%	Green
Isle of Wight Council Pension Fund	7.2 (17)	Surplus	2%	12%	3.7%	Green
Islington Council Pension Fund	7.3 (16)	5	4%	7%	1.1%	Green

	2016 long term cost efficiency measures					
		Relative considerations			Absolute considerations	
Pension fund	**Maturity (rank)**	**Deficit period**	**Required return**	**Repayment shortfall**	**Return scope**	**Deficit Reconciliation**
Kent County Council Pension Fund	5.8 (70)	Surplus	3%	10%	2.6%	Green
Lancashire County Pension Fund	6.4 (37)	Surplus	3%	9%	2.8%	Green
Leicestershire County Council Pension Fund	5.4 (85)	Surplus	2%	13%	3.0%	Green
Lincolnshire Pension Fund	5.8 (66)	Surplus	3%	12%	3.0%	Green
London Borough of Barking and Dagenham Pension Fund	5.6 (79)	0	2%	14%	3.3%	Green
London Borough of Barnet Pension Fund	5.9 (61)	4	3%	11%	2.4%	Green
London Borough of Bexley Pension Fund	7.2 (18)	Surplus	3%	8%	3.1%	Green
London Borough of Brent Pension Fund	7.3 (15)	10	4%	10%	1.8%	Green
London Borough of Bromley Pension Fund	6.6 (33)	Surplus	2%	11%	3.4%	Green
London Borough of Camden Pension Fund	8.1 (7)	Surplus	2%	21%	3.9%	Green
London Borough of Croydon Pension Fund	6.1 (51)	6	4%	8%	2.1%	Green
London Borough of Ealing Pension Fund	6.8 (24)	2	3%	12%	2.3%	Green
London Borough of Enfield Pension Fund	5.8 (67)	Surplus	2%	12%	3.0%	Green
London Borough of Hackney Pension Fund	6.1 (50)	Surplus	0%	23%	5.0%	Green
London Borough of Hammersmith and Fulham Pension Fund	9.1 (4)	Surplus	4%	13%	2.0%	Green
London Borough of Haringey Pension Fund	7.4 (12)	Surplus	3%	11%	2.0%	Green
London Borough of Harrow Pension Fund	6.5 (34)	0	3%	11%	2.4%	Green
London Borough of Havering Pension Fund	6.3 (43)	6	3%	9%	2.1%	Green
London Borough of Hillingdon Pension Fund	5.8 (65)	2	3%	10%	2.1%	Green
London Borough of Hounslow Pension Fund	6.2 (44)	4	4%	8%	1.5%	Green
London Borough of Lambeth Pension Fund	8.5 (6)	Surplus	2%	18%	3.5%	Amber
London Borough of Lewisham Pension Fund	7.5 (9)	Surplus	3%	13%	2.6%	Green
London Borough of Merton Pension Fund	6.1 (49)	Surplus	4%	7%	1.6%	Amber
London Borough of Newham Pension Fund	6.4 (39)	2	4%	8%	1.6%	Amber
London Borough of Redbridge Pension Fund	6.3 (41)	0	3%	12%	1.3%	Green
London Borough of Richmond Upon Thames Pension Fund	6.7 (25)	Surplus	3%	11%	2.2%	Green
London Borough of Southwark Pension Fund	6.7 (28)	Surplus	3%	11%	2.4%	Green
London Borough of Tower Hamlets Pension Fund	7.2 (19)	Surplus	2%	20%	3.8%	Green
London Borough of Waltham Forest	7.5 (11)	9	4%	8%	1.8%	Green
London Pensions Fund Authority Pension Fund	9.2 (3)	Surplus	3%	10%	2.4%	Green
Merseyside Pension Fund	7.7 (8)	Surplus	3%	13%	2.8%	Green

		2016 long term cost efficiency measures				
		Relative considerations			Absolute considerations	
Pension fund	**Maturity (rank)**	**Deficit period**	**Required return**	**Repayment shortfall**	**Return scope**	**Deficit Reconciliation**
Norfolk Pension Fund	6.7 (29)	Surplus	2%	14%	3.1%	Green
North Yorkshire Pension Fund	5.4 (87)	Surplus	3%	10%	2.5%	Green
Northamptonshire Pension Fund	6.2 (46)	Surplus	3%	13%	2.7%	Green
Northumberland County Council Pension Fund	7.5 (10)	Surplus	2%	15%	3.2%	Green
Nottinghamshire County Council Pension Fund	5.6 (74)	1	4%	7%	1.6%	Green
Oxfordshire County Council Pension Fund	5.5 (83)	Surplus	4%	8%	2.3%	Green
Powys County Council Pension Fund	6.1 (47)	0	3%	12%	2.5%	Green
Rhondda Cynon Taf County Borough Council Pension Fund	5.8 (63)	Surplus	3%	13%	2.9%	Green
Royal Borough of Greenwich Pension Fund	5.6 (78)	Surplus	4%	7%	0.8%	Green
Royal Borough of Kensington and Chelsea Pension Fund	7.4 (13)	Surplus	3%	6%	3.5%	Green
Royal Borough of Kingston Upon Thames Pension Fund	5.2 (90)	Surplus	2%	13%	3.5%	Amber
Royal County of Berkshire Pension Fund	5.3 (89)	13	5%	3%	1.2%	Green
Shropshire County Pension Fund	6.6 (31)	Surplus	3%	10%	1.9%	Green
Somerset County Council Pension Fund	5.6 (77)	6	4%	8%	2.0%	Green
South Yorkshire Passenger Transport Pension Fund	32.7 (1)	Surplus	N/A	77%	N/A	Green
South Yorkshire Pension Fund	6.6 (30)	Surplus	3%	11%	2.6%	Green
Staffordshire Pension Fund	6.4 (40)	Surplus	3%	13%	3.1%	Green
Suffolk Pension Fund	5.9 (59)	Surplus	1%	14%	4.2%	Green
Surrey Pension Fund	5.5 (81)	Surplus	3%	12%	3.0%	Green
Sutton Pension Fund	6.4 (36)	2	3%	12%	2.0%	Green
Teesside Pension Fund	6.7 (27)	Surplus	4%	4%	2.4%	Green
Tyne and Wear Pension Fund	6.4 (38)	Surplus	2%	14%	3.4%	Green
Wandsworth Council Pension Fund	7.4 (14)	Surplus	2%	6%	3.9%	Green
Warwickshire Pension Fund	5.8 (64)	Surplus	3%	10%	2.8%	Green
West Midlands Integrated Transport Authority Pension Fund	30.5 (2)	Surplus	N/A	64%	N/A	Green
West Midlands Pension Fund	6.7 (26)	Surplus	2%	16%	3.5%	Green
West Sussex County Council Pension Fund	5.9 (57)	Surplus	2%	12%	4.2%	Green
West Yorkshire Pension Fund	6 (55)	Surplus	4%	6%	2.1%	Green
Wiltshire Pension Fund	5.8 (68)	Surplus	2%	13%	3.3%	Green
Worcestershire County Council Pension Fund	6.2 (45)	3	3%	12%	3.0%	Green

Notes:

1. The liability value and salary roll figures in the maturity indicator are as at 31 March 2016. The liability value was calculated on the standardised best estimate basis.
2. The 'Required Return' and 'Return Scope' measures were not calculated for South Yorkshire PTA and West Midlands ITA as these are closed funds. They were also not calculated for the Environment Agency Active Fund as the DCLG SF3 statistics did not contain data for the fund.
3. The 'Deficit Reconciliation' measure was not calculated for South Yorkshire PTA and West Midlands ITA as information on deficit recovery periods was not applicable.

Appendix E: Asset Liability Modelling Exercise

Why perform an Asset Liability Modelling (ALM) exercise?

E.1 An ALM allows us to simultaneously project the assets and liabilities of the scheme under a range of scenarios, using stochastic techniques to investigate possible outcomes for key variables and metrics. Modelling the scheme in this way allows us to understand not only central, expected outcomes but also the wider range of possible outcomes and associated probabilities.

E.2 A common use of ALM studies is to help scheme managers and sponsors determine investment, contribution and funding policy by illustrating the impact of changing policy on key variables, such as the funding level (i.e. ratio of assets to liabilities), of the scheme under a range of scenarios.

E.3 For this piece of work, we modelled the whole Scheme rather than individual funds and our focus was on variations of the employer contribution rates as a broad measure of long term cost efficiency and sustainability. We are primarily interested in the extent to which contributions can vary from current levels. Consequently we have assumed that the investment policy remains constant over the projection period.

E.4 Stochastic modelling techniques allow us to simulate thousands of economic scenarios – with different outturns and paths of key parameters and variables. The simulations are calibrated to reflect views on expected returns and relative behaviours between key variables, but importantly include an element of randomness in order to capture volatility observed in financial markets. By running the scenario generator many times, the spread of different possible outcomes can be illustrated and the probability of certain outcomes can be estimated.

E.5 As with all models, the outcomes are a function of the assumptions adopted, and the outcomes are not intended to be predictors of the future but can illustrate the range of possible outcomes. Our study models changes in economic outcomes only – we have not looked at demographic changes, including mortality, nor management changes such as changes to the investment approach.

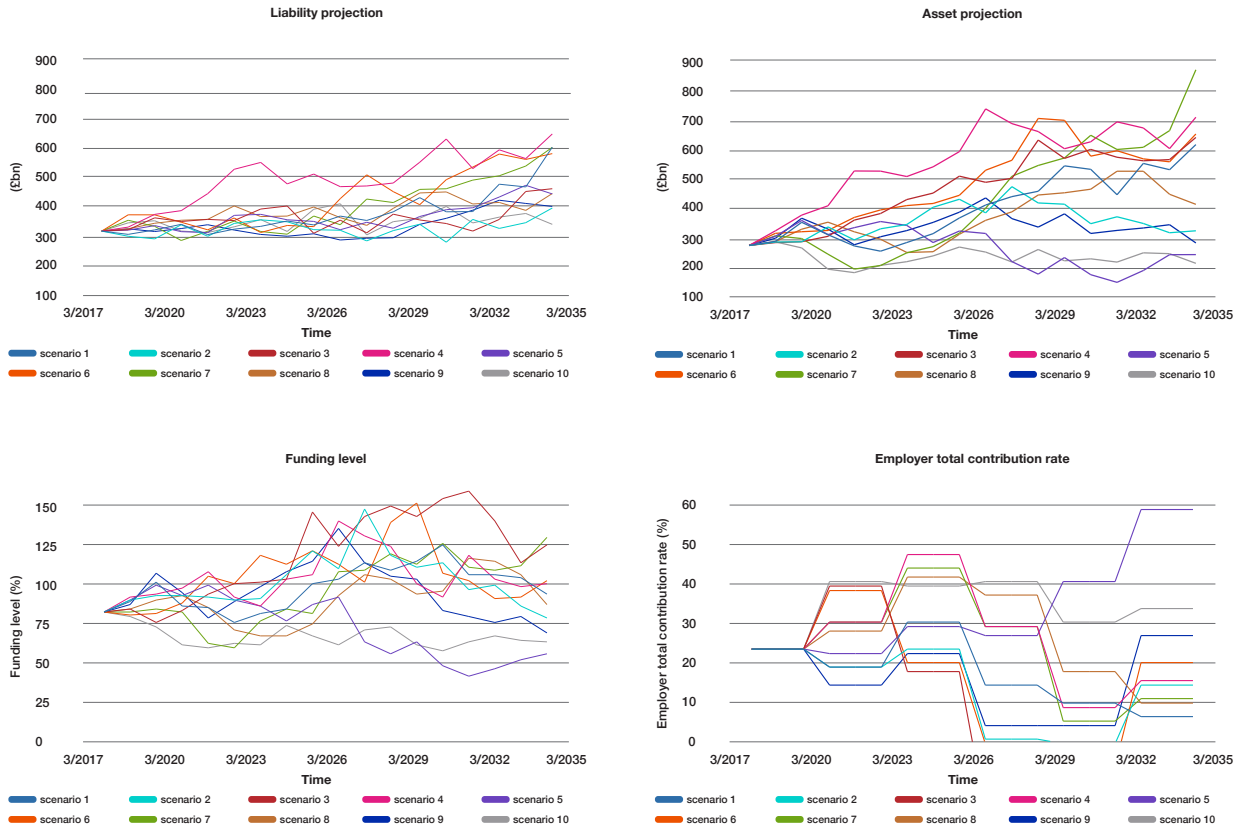
Outcomes of our modelling

E.6 The ALM exercise provides underlying projections, under thousands of scenarios, for a number of key variables and metrics of interest – including:

- The scheme's assets
- The scheme's liabilities
- The scheme's funding level and
- The contribution rate

E.7 For example, the charts below provide an illustration of these projected variables for the first 10 scenarios.

Chart E1: Simulated scenarios within the ALM

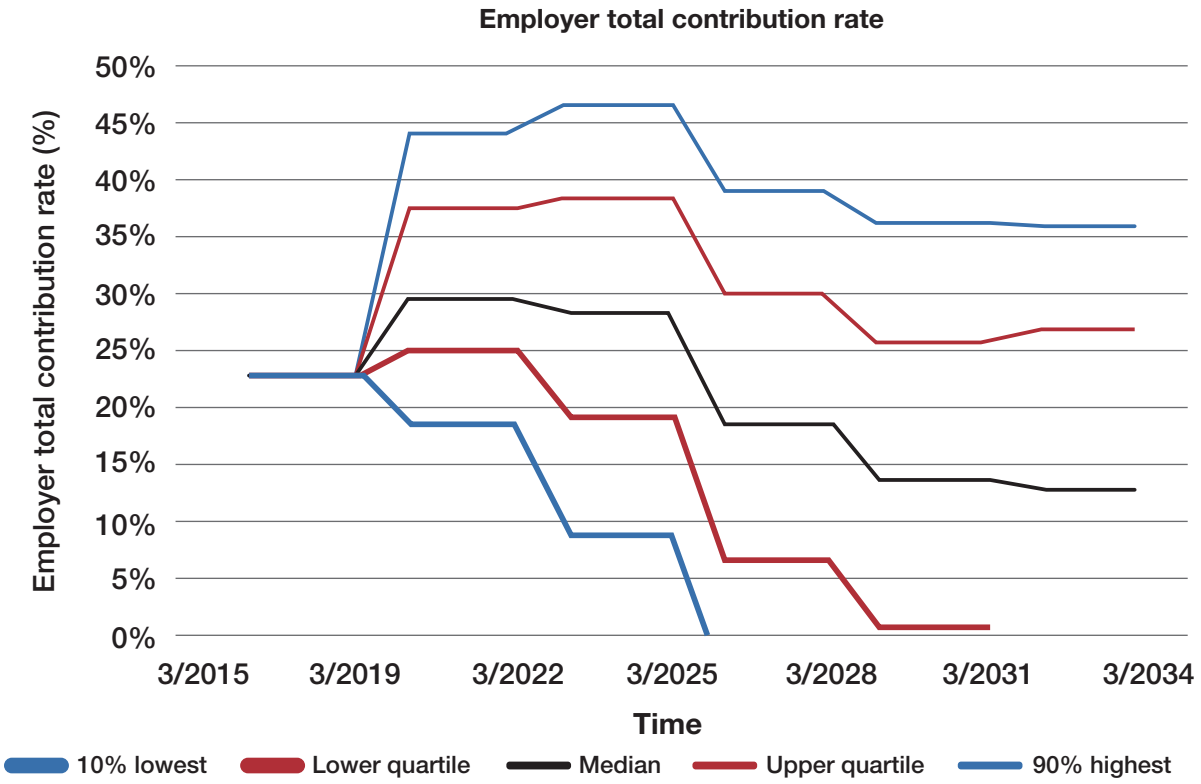


E.8 As demonstrated in these charts, there is a wide range of potential outcomes and there is a significant degree of volatility – demonstrating the risks taken by the Scheme.

E.9 In order to identify the projected trends of the scheme and assess the probability of extreme events, we instead consider different percentiles of the projected employer total contribution rates emerging at each future valuation.

E.10 Chart E2 shows the median value (black), upper and lower quartiles (red, 75th and 25th percentile respectively) and 90th highest, 10th lowest (blue, 90th and 10th percentile respectively) for the employer contribution rate, which allow for both the cost of benefit accrual and deficit contributions and are net of member contributions.

Chart E2: Employer total contribution rate

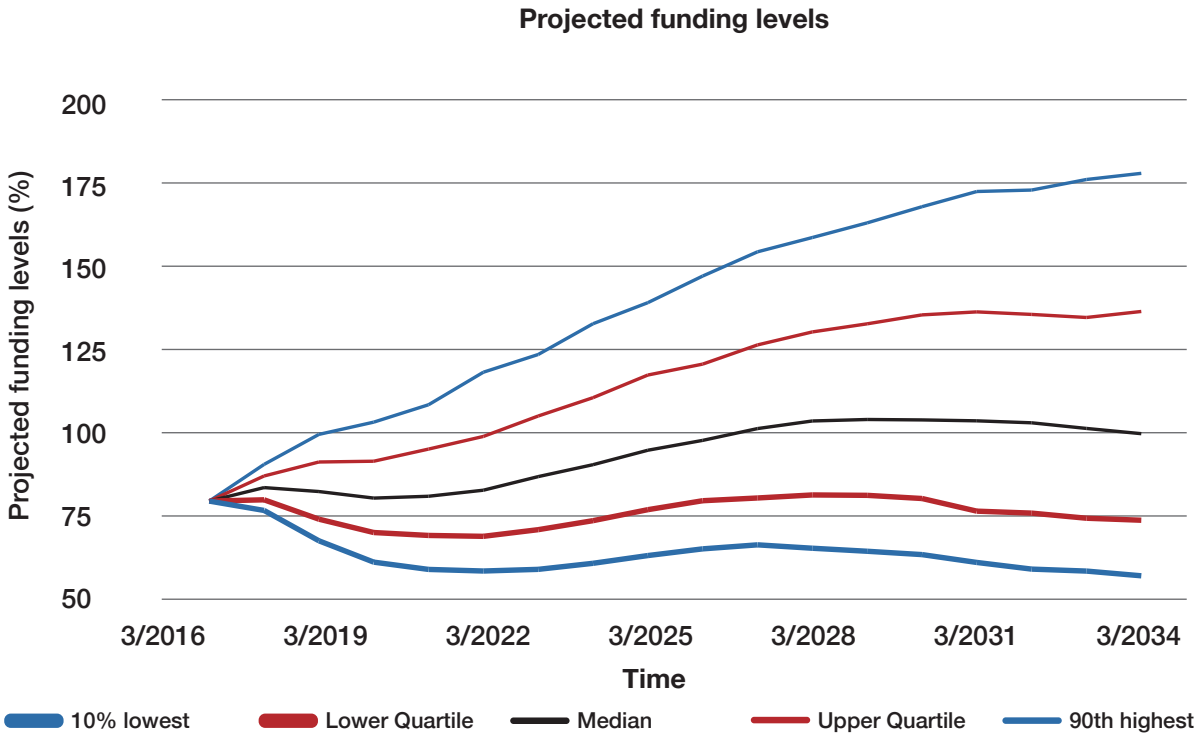


E.11 Note that none of the lines shown on this chart represent any simulated scenario – instead they are intended to represent the distribution of possible outcomes and how the range of simulated scenarios changes over the projection period.

E.12 The flipside to the projected contribution rate is the projected funding level of the scheme which is shown below.

E.13 Chart E3 shows that, under the parameters of the model, the funding level could range between 60% and 180% (10th and 90th percentile outcomes) but the median outcome tends towards a funding level of just above 100% over the projection period.

Chart E3: Projected funding levels



E.14 The key messages from the charts above show:

- In the short term, the model predicts upwards pressure on employer contributions at the next valuation cycle.
- In the medium to longer term, employer contributions are expected to fall, such that they are expected to be lower than current contribution levels.
- However there remains a significant risk that contributions are materially higher than current levels, throughout the projection period.
- Whilst the path of expected contribution rates is relatively smooth, the significant variation within each scenario demonstrates the sensitivity of the contribution rate and the extent to which it could swing from valuation to valuation.
- This should not be regarded as a prediction of the changes in future employer contribution rates, because it's highly unlikely that the assumptions made will be borne out in practice and adjustments might be made to manage such pressures as discussed below.

Short term cost pressure

E.15 Volatility of asset returns and economic conditions may place significant pressures on future rate of employer contributions. We performed an asset liability study to help quantify these risks.

E.16 For the purpose of assessing liabilities and determining contributions, assumptions are needed on how the set of assumptions used to carry out an actuarial valuation at each future point in time is updated. In our modelling we have assumed that:

- Changes to the financial assumptions will reflect market conditions at the valuation date (specifically, long term gilt yields)
- The length of the recovery period is fixed at 20 years
- Demographic experience is as assumed in the underlying valuations

E.17 The output of the model is the upward or downward pressure on contribution rates assuming that the impact of changes in economic conditions feed through directly to contribution setting.

E.18 In practice we might not expect these pressures to feed directly into changes in employer contribution rates, because for example if there was a downward (or upward) cost pressure the following adjustments might be considered:

- Asset strategy might be made more defensive which would be expected to reduce future volatility but would reduce the scope for reducing contributions (conversely, if there was an upward cost pressure, assets strategy might be made more return seeking)
- The length of the recovery period might be reduced (conversely, if there was an upward cost pressure, the length of recovery periods might be increased)
- The level of prudence might be increased, which could reduce the chance that future experience was worse than assumptions, but could also limit the scope for reducing contributions (conversely, if there was an upward cost pressure, the level of prudence might be increased)

E.19 The output of the model should not therefore be regarded as a prediction of changes in future employer contribution rates, but rather potential pressures on the employer contribution rates that might need to be managed in some way. It should be noted that any change to manage down employer contribution rates in the short term do not alter the long term cost of the scheme (which depends on the level of scheme benefits and scheme experience, including asset returns) and more generally might have some other less desirable outcomes, for example:

- increasing the length of recovery periods transfers costs onto future generations;
- choosing a more return seeking asset strategy would be expected to increase volatility and risk

E.20 The model is based on certain parameters and assumptions which drive projected assets, liabilities and contributions. The key assumptions and methodology are discussed in detail below, but the key drivers of the projected increase in contributions rates are:

- A fall in gilt yields, since the last valuation date (31 March 2016), which is assumed to feed through to lower discount rates in the valuation basis
- The fall in gilt yields affects both the cost of providing ongoing benefits and increases the deficit in the Scheme, leading to higher deficit recovery contributions being required
- This is partially offset by strong investment returns, in particular in equity markets in 2016 and 2017

Longer term reduction in costs

E.21 In the longer term, the median outcome is that employer contributions come back to below current levels. The key drivers of this are:

- An assumed increase in gilt yields from currently low levels. This is assumed to feed through to higher valuation discount rates, which affects both the cost of providing ongoing benefits and lower deficit recovery contributions
- Deficit repair contributions paid by the employers leading to an improvement in the funding position of the Scheme and a reduction in the overall level of contributions payable
- The assumed investment return – reflecting the investment strategy that is heavily weighted towards equities and other growth assets

Risks of materially higher contribution rates

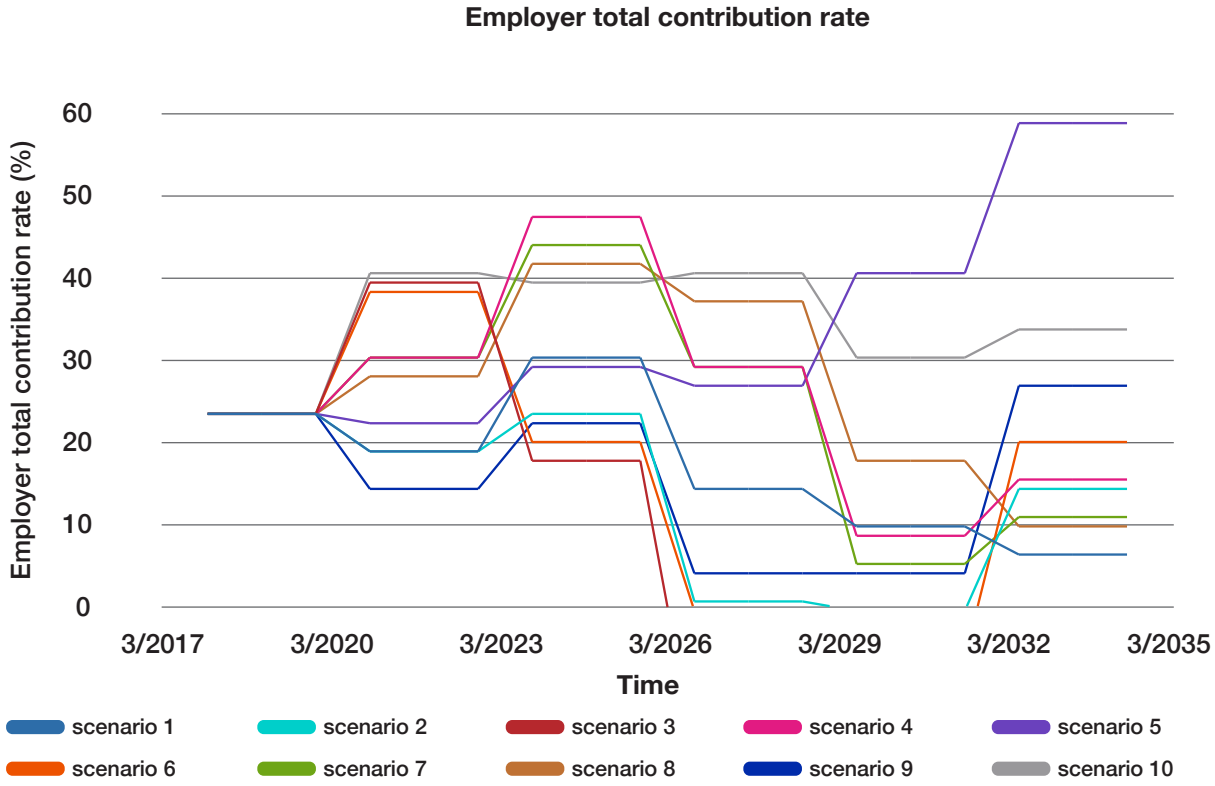
E.22 Despite the projected fall in contribution rates at the average level, the charts above demonstrate the potential for pressure on employer contributions relative to current rates. In particular, they demonstrate that there is roughly a 25% chance that contribution rates remain above 25% throughout the projection, and a 10% chance that they remain above 35%, before allowing for the management of those pressures discussed above.

E.23 The drivers of these scenarios is discussed in more detail below and reflects the key risk factors that the Scheme is running.

Contribution risk/volatility

E.24 Chart E2 represents the relevant percentile outcome at each point in time. As this is the percentile of all simulated scenarios, the lines shown do not represent particular scenarios or simulated outcomes. In the following chart we illustrate a series of contribution rate "paths" that the Scheme could experience according to our model. These show somewhat more apparent variation.

Chart E4: Individual employer contribution rate paths



E.25 This chart indicates that contribution rates can vary significantly from valuation to valuation under the model parameters.

E.26 Looking across all simulated scenarios and after removing the average trend in the projected future contribution rate, we estimate that there is around a 30% chance of potential pressure on the contribution rate of more than 8%, not allowing for management actions.

E.27 Again, the key drivers of this volatility are gilt yields and investment returns:

- Projected changes in gilt yields result in changes to the valuation basis which affect both the ongoing cost of accrual and the level of surplus or deficit in the Scheme.
- The significant investment exposure to risky assets (e.g. equities) which results in a volatile returns and funding levels.

Scheme risks

E.28 Whilst the charts and analysis outlined above give an indication of the range of plausible outcomes and the risk of material potential pressure on employer contributions, they do not explain the factors that might cause such increases.

E.29 As part of section 13, under solvency, we model (deterministically) some stress tests to evaluate whether fund employers are able to meet the additional contributions generated in relation to stress events. These stresses help quantify and illustrate each fund sensitivity to different risk factors.

E.30 In this section we further illustrate two of the key risk factors that can contribute to material increases in employer contribution rates – namely equity returns and future expected returns. We illustrate the risk factors by comparing experience of key variables in the scenarios with large contribution rates and how this compares to other scenarios.

Equity risks

E.31 With an investment strategy weighted towards growth assets, the return on equities is clearly a key risk factor in determining future contribution rates. As a result, one of the stress tests included in our solvency chapter captures an "asset shock", in which return seeking assets are stressed by 15% relative to the liabilities.

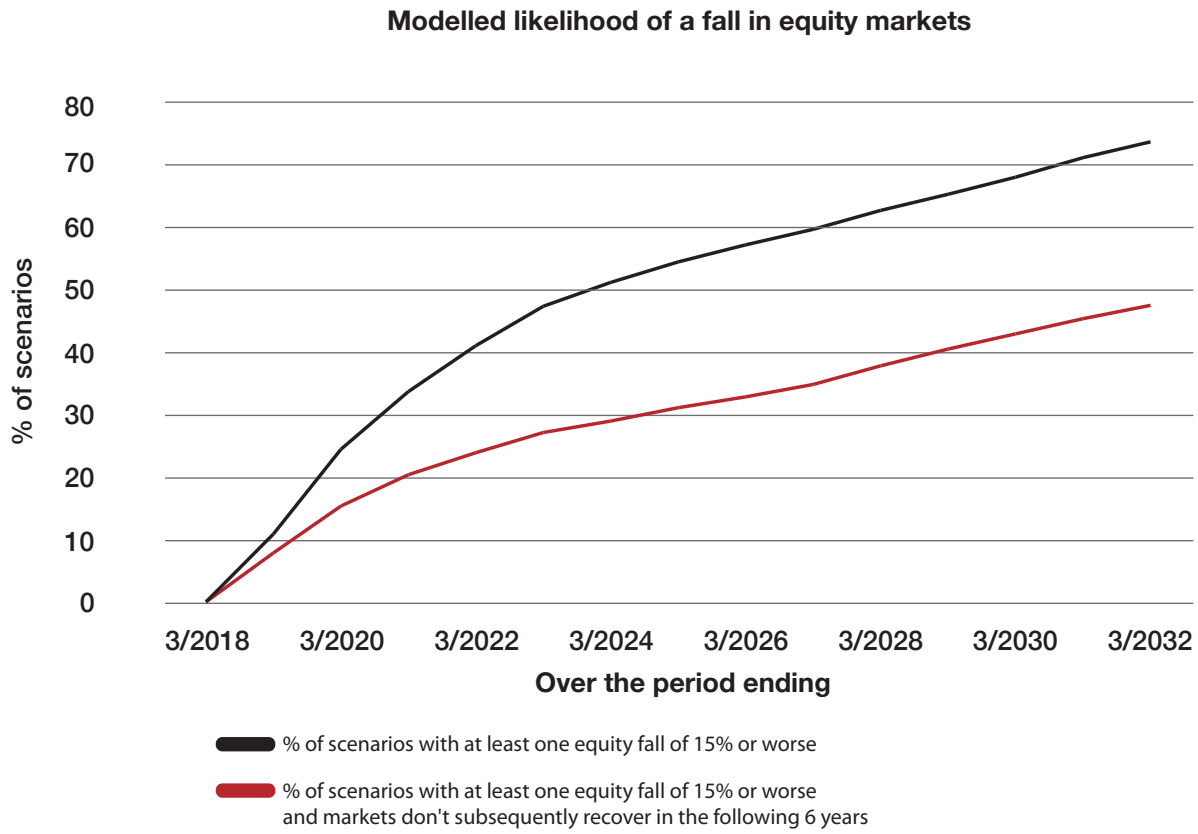
E.32 Investing in equities and other growth assets inevitably comes with volatile returns and the potential for significant downturns in asset values and returns. As a long term investor, the Scheme should be able to ride out short term volatility in returns. However, there remains significant risk of deeper and longer lasting shocks to equity markets.

E.33 The following chart helps to illustrate the possibility of this by showing:

- The proportion of simulated scenarios that experience at least one equity market fall by more than 15% over 12 months (black line) and
- The proportion of these scenarios that do not make a subsequent recovery[10] in the following 6 year period (red line)

[10] Defined as the equity total return index still being less than the pre-crash level 6 years after the fall.

Chart E5: Modelled likelihood of a fall in equity markets



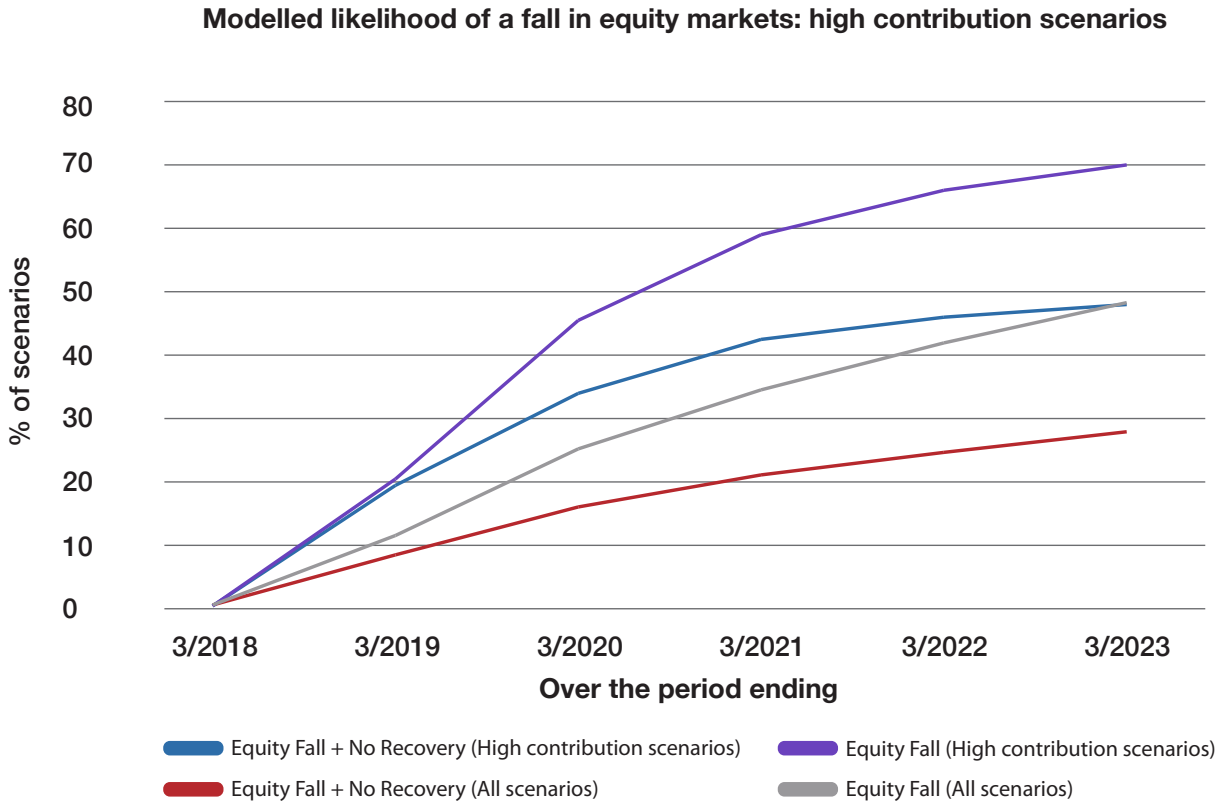
E.34 The chart shows that by 2023, roughly 50% of scenarios are simulated to experience a significant equity downturn, of which 30% of those scenarios do not make a subsequent recovery.

E.35 The chart above is populated for all scenarios. Generally speaking, scenarios which have material potential pressure on employer contributions are more likely to have experienced a significant equity downturn – reflecting the high level of equity risk being run in the scheme.

E.36 This is shown in the chart below, which filters on the scenarios with large simulated contribution rates in 2023[11] and shows the proportion of scenarios which are simulated to experience a downturn significantly increases.

[11] Defined as the scenarios which have a contribution rate at the 90th percentile or higher.

Chart E6: Modelled likelihood of a fall in equity markets: high contribution scenarios



E.37 In the scenarios with high contribution levels roughly 70% of scenarios are simulated to experience a significant equity downturn (vs 50% for all scenarios), of which 50% of those scenarios do not make a subsequent recovery (vs 30% for all scenarios).

E.38 This demonstrates that equity returns are a key driver of contribution rates.

Expected future returns

E.39 Equity returns are a key risk factor as they influence the returns achieved by the Scheme's assets and hence influence funding and valuation outcomes. Another key driver of contribution rates is the discount rate assumed in the valuation – which will be primarily driven by assumed future returns on investments.

E.40 In our ALM study, we have assumed that firms of actuarial advisors will update their views on expected future returns in line with projected changes in long term gilt yields (see below). Whilst we appreciate this is unlikely to be the approach adopted by the firms of actuarial advisors in practice, market expectation theory suggests that changes in gilt yields do provide an indication of the change in market expectations for future economic conditions.

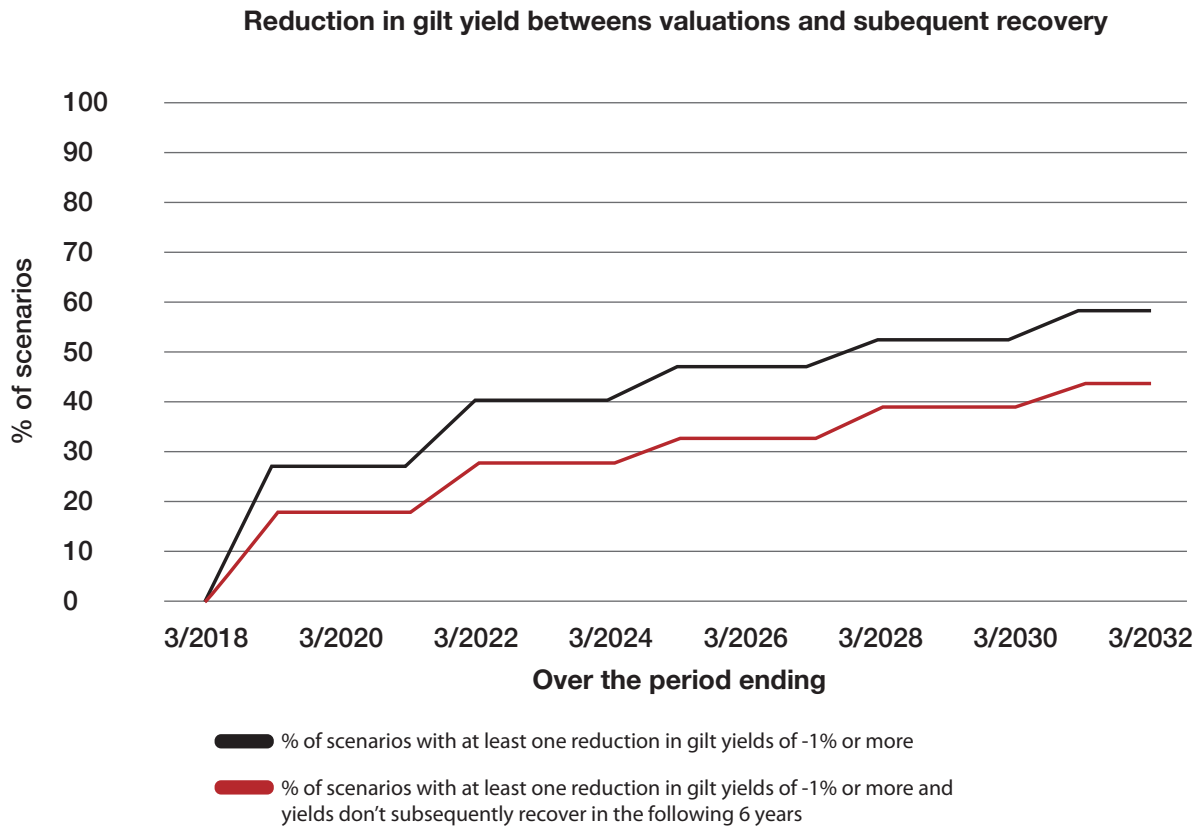
E.41 As a result, large reduction in gilt yields are likely to coincide with reduction in expected future returns which in turn would be expected to lead to higher contributions.

E.42 The following chart helps to illustrate the possibility of this by showing:

- The proportion of simulated scenarios that experience at least one significant reduction in expected future returns between valuations[12] (black line); and
- The proportion of these scenarios where expected returns do not revert[13] in the next two valuations (red line).

E.43 The chart shows that by 2023 around 50% of scenarios are simulated to experience a significant reduction in expected future returns, of which just over 30% of those scenarios do not experience a reversion in expectations in the next two valuations.

Chart E7: Modelled likelihood of a fall in gilt yields



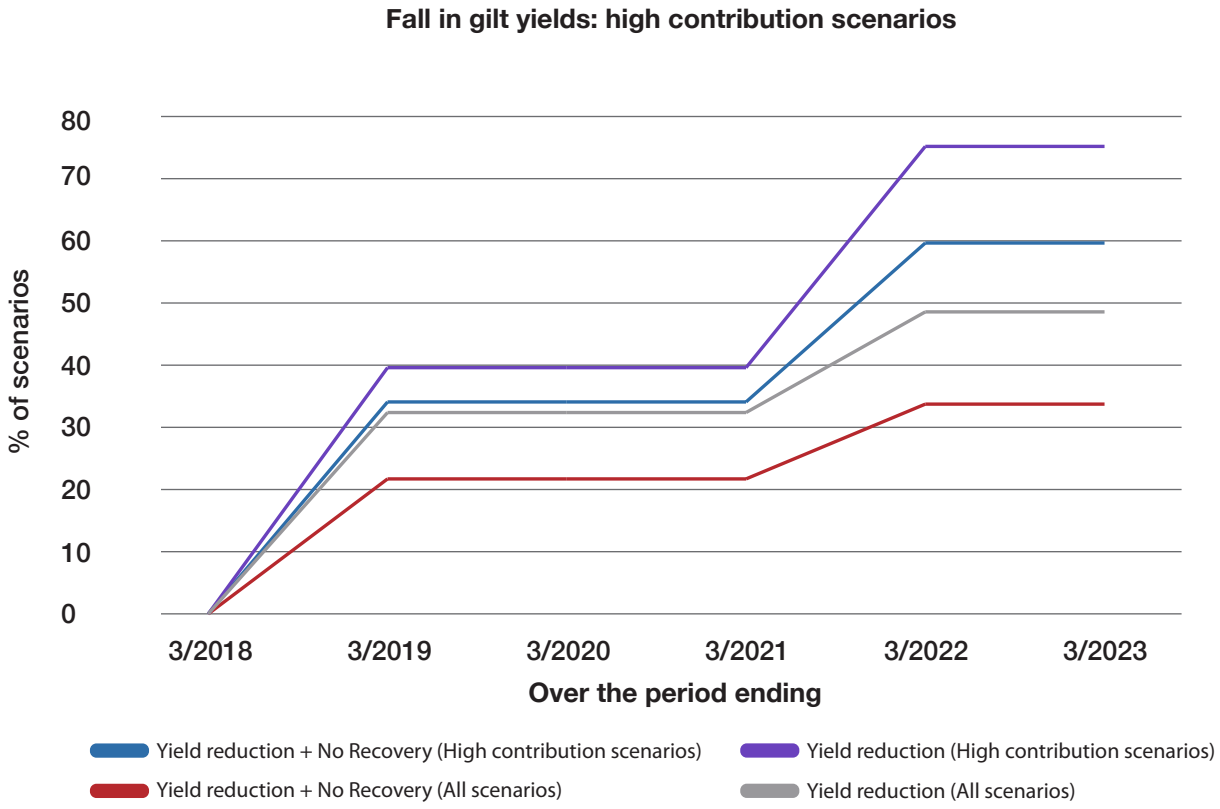
[12] Defined as a reduction in gilt yields of 1% or more between valuation cycles.

[13] Defined as the gilt yield still not returning to previous levels after two valuations.

E.44 The chart above is populated for all scenarios. Generally speaking, scenarios which have material potential pressure on employer contributions are more likely to have experienced a significant reduction in expected returns.

E.45 This is shown in the chart below, which filters on the scenarios with large simulated contribution rates in 2023[14] and shows the proportion of scenarios which are simulated to experience a reduction in expected returns significantly increases.

Chart E8: Modelled likelihood of a fall in gilt yields: high contribution scenarios



E.46 In the scenarios with high contribution levels roughly 75% of scenarios are simulated to experience a significant reduction in expected future returns (vs 50% for all scenarios), of which 60% of those scenarios do not experience a reversion in expectations in the next two valuations (vs 30% for all scenarios).

E.47 This demonstrates that future expected returns are a significant driver in determining contribution rates.

[14] Defined as the scenarios which have a contribution rate at the 90th percentile or higher.

Assumptions and methodology

Model

E.48 For this purpose we used our third party Asset Liability Model ('ALM') developed by Ortec Finance called GLASS (Global Liability and Asset Scenario Simulator). GLASS is based on a total balance sheet approach, meaning that assets, liabilities and contributions are consistently projected into the future.

E.49 GLASS takes scheme cash flow projections (that is benefit payments in respect of current active and non-active members of the Scheme) together with current asset values as its base input. To fully determine future cash flows over the future projection period, the scheme cash flows above are overlaid with:

- Additional cash flows in respect of new accrual in respect of both current and new active members.
- Projected revaluation and pension increases made to accrued pensions.

E.50 The initial assets within the scheme are projected forwards allowing for:

- Contributions paid by both members and employers.
- Pensions payable to retired members.
- Investment returns.

E.51 One of the key model inputs is the economic scenario generator (ESG) which is calibrated to current conditions and expectations for the future, and specifies how key economic variables such as inflation, wage growth and asset returns may vary (stochastically, according to probability distributions) in future.

E.52 Using these inputs and overlaying methodology, GLASS can be used to estimate future contribution rates, assets and liability values and hence funding levels in a dynamic projection process.

E.53 For this purpose we have used Ortec's "Lower for Longer" calibration that has been adjusted slightly in line with our house views. Ortec does provide alternative calibrations, but the Lower for Longer calibration, along with our adjustments aligns most closely with our own views.

Assumptions required

E.54 An ALM produces a broader amount of information than a traditional deterministic actuarial valuation. Consequently, we need to make more detailed assumptions to simplify the calculations involved in the projections and make it practical to analyse all the key outcomes we are interested in.

E.55 To project the development of the scheme we must make assumptions about:

- Key economic variable and financial assumptions – for example price inflation, salary growth and returns on assets held. These are determined from the ESG
- The way in which the Scheme invests its assets and whether and how this might change in the future
- The way in which liabilities will evolve – for example, the rate at which current active liabilities "migrate" to being non-active (i.e. deferred/pensioner liabilities) over time or the extent to which active liabilities are driven by CPI inflation and wage inflation at each point in time
- The way in which liabilities are assessed; and
- The way in which contributions are determined – both in respect of ongoing accrual and in respect of any surplus or deficit that arises

E.56 For the purpose of assessing liabilities and determining contributions we needed to assume what set of assumptions will be used by the firms of actuarial advisors to carry out an actuarial valuation at each future point in time being considered.

E.57 In practice, the firms of actuarial advisors are likely to set the discount rate with regards to the expected return on each fund's investments and are required to use prudence in setting these assumptions.

E.58 In our modelling we have assumed that changes to the valuation basis will be made in accordance with changes in long term gilt yields. The extent of the margin above gilt yields included in the valuation may, in practice, vary according to prevailing conditions, but we have not attempted to model this. That is we assume that the margin above gilt yields is constant relative to prevailing conditions at each valuation date.

E.59 Our model projects the entire Scheme in one go. The assumed asset strategy and future valuation assumptions are an average of those for the individual funds.

E.60 Full details of the calibration and projection and future valuation assumptions adopted for this exercise are available on request.

Appendix F: Data provided

F.1 At the request of the Ministry for Housing, Communities and Local Government ('MHCLG') the Government Actuary's Department ('GAD') has collected data from each fund's 2016 valuation report. These actuarial funding valuations were conducted by four firms of actuarial advisors:

- Aon
- Barnett Waddingham
- Hymans Robertson
- Mercer

F.2 Data was received from the relevant firm of actuarial advisors for all 91 pension funds. Information for both the Environment Agency Closed Fund and South Yorkshire Passenger Transport Authority Pension Fund have been taken directly from firms of actuarial advisors. Additional date was provided at an employer level in relation to Academies.

F.3 Limited checks, consisting of spot checks to make sure that data entries appear sensible, have been performed by GAD and the data received appears to be of sufficient quality for the purpose of analysing the 2016 valuation results. These checks do not represent a full, independent audit of the data supplied. The analysis contained in this report relies on the general completeness and accuracy of the information supplied by the administering authority or their firms of actuarial advisors.

F.4 In addition, data has been collated from the '*Local government pension scheme funds local authority data*', which is published annually by DCLG. This published data may be referred to elsewhere as SF3 statistics.

F.5 Unless otherwise stated the data detailed above has been used to inform the analysis contained in the LGPS England and Wales Section 13 2016 Report.

F.6 The information provided to GAD is, in many instances, more detailed than that provided in the actuarial valuation reports.

F.7 There was some inconsistency in the information provided to GAD. For example, membership details were not always split by gender as requested. However, this did not have a material impact on the analysis that GAD was able to complete (we assumed the average male female breakdown for these funds).

F.8 Table F1 shows instances where material information was not provided by the fund on time. These gaps in information forced us to implement a work around that could cast doubt on the outcomes of our work for those funds.

Table F1: Missing or late Information

Fund	Missing or late Information
London Borough of Barnet Pension Fund	No valuation data was provided to GAD as at 2016
Environmental Agency Closed/ Active Funds	Valuation data was provided to GAD as at 2016, but after the deadline specified
London Borough of Barking and Dagenham Pension Fund	No value of liabilities and funding level on the SAB standardised basis were provided.

F.9 We had no alternative but to assume an average profile for these funds, which limits the reliance that can be placed on the analysis.

F.10 Our engagement has highlighted that some funds have provided incorrect data for statutory data returns to MHCLG[15], particularly in relation to the proportion of non-statutory members. It would be helpful if funds ensured that correct information was provided in these returns.

[15] These returns are known as SF3 returns, https://www.gov.uk/government/statistics/local-government-pension-scheme-funds-for-england-and-wales-2016-to-2017

Contribution rate data

F.11 Primary and secondary rates have now replaced common contribution rate (CCRs) in legislation. We now have data that gives an overview of total employer contributions to the fund, which we have used. In contrast, CCRs from 2013 valuations did not always reflect employer contribution rates actually paid, so primary and secondary rates are more useful. However, we have also compared contribution rates between 2013 and 2016 valuations. There is a transitional issue, as 2013 valuations CCRs don't always reflect average employer contribution rates and alternative data were not available. In some cases therefore we have used dry run data for 2014/15 contributions (see table below). However, we expect that this will not be a material issue for future section 13 reports, as it should be possible to compare primary and secondary rates between the 2016 and 2019 valuations.

- For example, in the Wiltshire Pension Fund 2016 Valuation Report, Hymans Robertson stated "The table below shows the Fund "common contribution rate" as at 31 March 2013 for information purposes. The change in regulatory regime and guidance on contribution rates means that a direct comparison to the Whole Fund rate at 2016 is not appropriate.[16]"

F.12 In the following table we set out the 2013 common contribution rate, the 2014-15 actual contribution rate and the 2016 recommended contribution rates to illustrate the variation between actual rates and disclosed (common contribution rates) which could lead to incorrect interpretations being drawn.

Table F2: Contribution comparison

Pension fund	Firm of actuarial advisors	2013 common contribution rate*	Average employer contribution rate actually paid**	Difference	2016 standard contribution rate*
Avon Pension Fund	Mercer	23%	21%	-2%	23%
Bedfordshire Pension Fund	Hymans Robertson	28%	23%	-5%	26%
Buckinghamshire County Council Pension Fund	Barnett Waddingham	20%	19%	0%	21%
Cambridgeshire Pension Fund	Hymans Robertson	31%	20%	-11%	23%
Cardiff and Vale of Glamorgan Pension Fund	Aon	22%	23%	1%	23%
Cheshire Pension Fund	Hymans Robertson	27%	23%	-4%	27%
City and County of Swansea Pension Fund	Aon	22%	22%	0%	25%
City of London Corporation Pension Fund	Barnett Waddingham	17%	17%	0%	21%
City of Westminster Pension Fund	Barnett Waddingham	30%	20%	-10%	29%
Clwyd Pension Fund	Mercer	28%	26%	-2%	28%
Cornwall Pension Fund	Hymans Robertson	30%	21%	-9%	27%
Cumbria Local Government Pension Scheme	Mercer	24%	21%	-3%	21%
Derbyshire Pension Fund	Hymans Robertson	28%	20%	-8%	20%
Devon County Council Pension Fund	Barnett Waddingham	19%	19%	0%	21%
Dorset County Pension Fund	Barnett Waddingham	19%	18%	0%	21%
Durham County Council Pension Fund	Aon	21%	21%	0%	25%
Dyfed Pension Fund	Mercer	18%	16%	-2%	17%

[16] No alternative figure was provided to facilitate comparison

Pension fund	Firm of actuarial advisors	2013 common contribution rate*	Average employer contribution rate actually paid**	Difference	2016 standard contribution rate*
East Riding Pension Fund	Hymans Robertson	29%	24%	-6%	24%
East Sussex Pension Fund	Hymans Robertson	27%	20%	-7%	22%
Environment Agency Active Fund	Hymans Robertson	24%	14%	-10%	19%
Environment Agency Closed Fund	Hymans Robertson	0%	0%	0%	0%
Essex Pension Fund	Barnett Waddingham	22%	23%	1%	22%
Gloucestershire County Council Pension Fund	Hymans Robertson	33%	28%	-5%	33%
Greater Gwent (Torfaen) Pension Fund	Hymans Robertson	23%	23%	0%	22%
Greater Manchester Pension Fund	Hymans Robertson	22%	18%	-4%	21%
Gwynedd Pension Fund	Hymans Robertson	24%	23%	-1%	21%
Hampshire County Council Pension Fund	Aon	22%	20%	-1%	25%
Hertfordshire County Council Pension Fund	Hymans Robertson	26%	22%	-4%	24%
Isle of Wight Council Pension Fund	Hymans Robertson	31%	23%	-9%	24%
Islington Council Pension Fund	Mercer	28%	20%	-8%	21%
Kent County Council Pension Fund	Barnett Waddingham	20%	21%	1%	20%
Lancashire County Pension Fund	Mercer	23%	20%	-3%	20%
Leicestershire County Council Pension Fund	Hymans Robertson	28%	21%	-8%	25%
Lincolnshire Pension Fund	Hymans Robertson	32%	20%	-12%	24%
London Borough of Barking and Dagenham Pension Fund	Hymans Robertson	31%	23%	-8%	25%
London Borough of Barnet Pension Fund	Hymans Robertson	24%	24%	0%	27%
London Borough of Bexley Pension Fund	Mercer	24%	21%	-3%	21%
London Borough of Brent Pension Fund	Hymans Robertson	39%	28%	-11%	35%
London Borough of Bromley Pension Fund	Mercer	26%	25%	-1%	23%
London Borough of Camden Pension Fund	Hymans Robertson	35%	28%	-7%	33%
London Borough of Croydon Pension Fund	Hymans Robertson	31%	23%	-8%	25%
London Borough of Ealing Pension Fund	Mercer	28%	22%	-6%	24%
London Borough of Enfield Pension Fund	Aon	21%	21%	0%	23%
London Borough of Hackney Pension Fund	Hymans Robertson	35%	38%	3%	33%
London Borough of Hammersmith and Fulham Pension Fund	Barnett Waddingham	22%	22%	0%	23%
London Borough of Haringey Pension Fund	Hymans Robertson	36%	24%	-12%	24%
London Borough of Harrow Pension Fund	Hymans Robertson	34%	20%	-14%	25%
London Borough of Havering Pension Fund	Hymans Robertson	38%	23%	-15%	29%
London Borough of Hillingdon Pension Fund	Hymans Robertson	29%	22%	-7%	24%
London Borough of Hounslow Pension Fund	Barnett Waddingham	19%	20%	1%	21%
London Borough of Lambeth Pension Fund	Hymans Robertson	36%	35%	-1%	28%

Pension fund	Firm of actuarial advisors	2013 common contribution rate*	Average employer contribution rate actually paid**	Difference	2016 standard contribution rate*
London Borough of Lewisham Pension Fund	Hymans Robertson	36%	18%	-18%	22%
London Borough of Merton Pension Fund	Barnett Waddingham	21%	36%	15%	19%
London Borough of Newham Pension Fund	Barnett Waddingham	25%	24%	-1%	21%
London Borough of Redbridge Pension Fund	Hymans Robertson	28%	25%	-4%	25%
London Borough of Richmond Upon Thames Pension Fund	Barnett Waddingham	28%	26%	-2%	24%
London Borough of Southwark Pension Fund	Aon	21%	22%	1%	21%
London Borough of Tower Hamlets Pension Fund	Hymans Robertson	36%	31%	-5%	29%
London Borough of Waltham Forest	Mercer	27%	24%	-4%	27%
London Pensions Fund Authority Pension Fund	Barnett Waddingham	20%	23%	3%	20%
Merseyside Pension Fund	Mercer	25%	23%	-1%	24%
Norfolk Pension Fund	Hymans Robertson	30%	22%	-8%	27%
North Yorkshire Pension Fund	Aon	21%	21%	0%	21%
Northamptonshire Pension Fund	Hymans Robertson	32%	23%	-10%	24%
Northumberland County Council Pension Fund	Aon	25%	25%	0%	27%
Nottinghamshire County Council Pension Fund	Barnett Waddingham	19%	19%	0%	20%
Oxfordshire County Council Pension Fund	Barnett Waddingham	19%	20%	1%	19%
Powys County Council Pension Fund	Aon	23%	23%	0%	27%
Rhondda Cynon Taf County Borough Council Pension Fund	Aon	21%	21%	0%	24%
Royal Borough of Greenwich Pension Fund	Barnett Waddingham	19%	19%	1%	18%
Royal Borough of Kensington and Chelsea Pension Fund	Barnett Waddingham	18%	18%	0%	18%
Royal Borough of Kingston Upon Thames Pension Fund	Hymans Robertson	31%	25%	-6%	23%
Royal county of Berkshire Pension Fund	Barnett Waddingham	19%	19%	0%	22%
Shropshire County Pension Fund	Mercer	25%	19%	-6%	22%
Somerset County Council Pension Fund	Barnett Waddingham	20%	18%	-3%	23%
South Yorkshire Passenger Transport Pension Fund	Barnett Waddingham	23%	23%	0%	31%
South Yorkshire Pension Fund	Mercer	24%	21%	-3%	22%
Staffordshire Pension Fund	Hymans Robertson	31%	20%	-11%	26%
Suffolk Pension Fund	Hymans Robertson	28%	26%	-3%	26%
Surrey Pension Fund	Hymans Robertson	31%	22%	-9%	23%
Sutton Pension Fund	Barnett Waddingham	35%	23%	-12%	26%
Teesside Pension Fund	Aon	13%	15%	2%	16%
Tyne and Wear Pension Fund	Aon	24%	26%	2%	25%
Wandsworth Council Pension Fund	Barnett Waddingham	19%	19%	0%	18%

Pension fund	Firm of actuarial advisors	2013 common contribution rate*	Average employer contribution rate actually paid**	Difference	2016 standard contribution rate*
Warwickshire Pension Fund	Hymans Robertson	29%	17%	-12%	23%
West Midlands Integrated Transport Authority Pension Fund	Barnett Waddingham	22%	52%	30%	84%
West Midlands Pension Fund	Barnett Waddingham	26%	26%	0%	28%
West Sussex County Council Pension Fund	Hymans Robertson	26%	24%	-2%	25%
West Yorkshire Pension Fund	Aon	16%	16%	0%	19%
Wiltshire Pension Fund	Hymans Robertson	31%	21%	-11%	27%
Worcestershire County Council Pension Fund	Mercer	26%	25%	-1%	26%

*The sum of primary contribution rate and contribution rate in respect of surplus/ deficit

**For Mercer clients, this represents the average employer contribution rate paid over the intervaluation period submitted with the 2016 data. For other funds, this represents the average 2014/15 employer contribution rate submitted in the data for the 2013 dry run.

Data specification

1) MEMBERSHIP DATA

Data split by gender.

a) Active members: number of members, average age (weighted as appropriate), average period of membership, total rate of annual actual pensionable pay at 31 March 2016 and 31 March 2013, total rate of annual FTE pensionable pay at 31 March 2016 and 31 March 2013,

b) Pensionable pay definition, has the 2008 or 2014 definition been used to assess pensionable pay for both 31 March 2016 and 31 March 2013

c) Deferred members: number of members, average age (weighted as appropriate), total annual preserved pension revalued to 31 March 2016 for both 31 March 2016 and 31 March 2013. Note this should exclude undecided members.

d) Pensioners (former members): number of members, average age (weighted as appropriate), total annual pensions in payment at 31 March 2016 and 31 March 2013

e) Pensioners (dependants including partners and children): number of members, average age (weighted as appropriate), total annual pensions in payment at 31 March 2016 and 31 March 2013

2) FINANCIAL ASSUMPTIONS

f) Provide assumptions used for past service liabilities these have been given for both as at 31 March 2016 and 31 March 2013.

- i) Nominal discount rate (pre & post retirement separately if applicable)
- ii) RPI inflation
- iii) CPI inflation rate
- iv) Earnings inflation

g) Provide assumptions used for future contributions, these have been given for both as at 31 March 2016 and 31 March 2013.

- i) Nominal discount rate (pre & post retirement separately if applicable)
- ii) RPI inflation
- iii) CPI inflation rate
- iv) Earnings inflation

h) Provide a method by which the discount rates are derived

- i) CPI+
- ii) Gilts
- iii) Weighted Average expected return on assets classes
- iv) Other (please specify)

i) Asset Outperformance assumption for both 31 March 2016 and 31 March 2013.

j) Short term assumptions used in the valuation for year 2016-17,2017-18,2018-19,2019-20

- i) CPI
- ii) Salary Increases
- iii) Discount Rate

If different assumptions were adopted, there was a separate tab (called Alternative Assumptions) for these other assumptions.

ALTERNATIVE FINANCIAL ASSUMPTIONS

a) Provide assumptions used for past service liabilities these have been given for both as at 31 March 2016 and 31 March 2013.

- i) Nominal discount rate (pre & post retirement separately if applicable)
- ii) RPI inflation
- iii) CPI inflation rate
- iv) Earnings inflation

b) Provide assumptions used for future contributions, these have been given for both as at 31 March 2016 and 31 March 2013.

- i) Nominal discount rate (pre & post retirement separately if applicable)
- ii) RPI inflation
- iii) CPI inflation rate
- iv) Earnings inflation

c) Provide a method by which the discount rates are derived

- i) CPI+
- ii) Gilts
- iii) Weighted Average expected return on assets classes
- iv) Other (please specify)

d) Asset Outperformance assumption for both 31 March 2016 and 31 March 2013.

e) Short term assumptions used in the valuation for year 2016-17,2017-18,2018-19,2019-20

- i) CPI
- ii) Salary Increases
- iii) Discount Rate

3) DEMOGRAPHIC ASSUMPTIONS

Rates to be provided at sample ages split by gender

Each could be split further in Group 1, Group 2, Group 3, Group 4, and Group 5

a) Assumed life expectancy

i) Pensioner members aged 65 (for members retiring on normal health) (to 2dp)Rates of Ill-health Retirement from Active service

ii) Pensioner members aged 65 (for members retiring on ill health) (to 2dp)

iii) Pensioner members aged 65 (for dependants) (to 2dp)

iv) Active / deferred members at age 65 if they are currently aged 45 (for members retiring on normal health) (to 2dp)

v) Active / deferred members at age 65 if they are currently aged 45 (for members retiring on ill health) (to 2dp)

b) Post-retirement Mortality

i) Baseline (e.g. 100% S1NMA)

ii) Future improvements (e.g. CMI 2012)

iii) Long term rate of future improvement (%)

c) Commutation

i) Pre 2008 pension Commutation Assumptions (as % of maximum lump sum allowed under HMRC rules)*

ii) Post 2008 pension Commutation Assumptions (as % of maximum lump sum allowed under HMRC rules)*

*For example, maximum proportion of pension that may be commuted under the 2008 scheme is 35.71%. This will give a lump sum equal to the permitted maximum and thus if the member is assumed to commute this amount of pension, the entry in the table above is 100%.

* For pre2008 service, members already receive a lump sum = 3/80ths x pre 2008 pensionable service x final pensionable salary. Please specify the pre 2008 assumption as the proportion of the permitted maximum that is expected to be commuted over and above the 3/80ths lump sum.

d) Promotional Salary Scale (if not included in earnings inflation assumption), this is further split by ages increasing in multiples of 5 from age 20 to 65

If included in earnings assumption, indicate Y

4) ASSETS

These are split to provide information for 31 March 2016 and 31 March 2013

a) Value of Assets (market value)

b) Actual Asset Distribution split into the following:

i) Proportion of assets held in Bonds (fixed interest government bonds, fixed interest non-government bonds, inflation linked bonds)

ii) Proportion of assets held in Equities (UK equities, overseas equities, unquoted or private equities

iii) The rest in Property, Insurance Policies, Fully insured annuities, Deferred or immediate fully insured annuities, Hedge funds, Cash and net current assets, Commodities, ABC arrangements, Infrastructure – debt type, Infrastructure* – equity type “Other” investments – defensive*, “Other” investments – return seeking

* Please provide details of infrastructure projects undertaken since 1 April 2013, and further plans to increase this on a separate sheet.

** Please provide information on whether local housing stock is held within the property portfolio, and any future plans to add this asset class.

c) Value of assets used in valuation

d) Is a smoothed asset value used? If Yes, an explanation is included

5) LIABILITIES AND FUTURE CONTRIBUTION RATE

These are split to provide information for 31 March 2016 and 31 March 2013;

i) Local assumptions

a) Past service liability – split between Actives, Deferred, Pensioners and Total

b) Funding level

c) Surplus / deficit

d) Deficit recovery period

e) Past service liability (on a low risk / gilts basis) – split between Actives, Deferred, Pensioners and Total

Future contribution rates

f) Primary contribution rate

g) If primary contribution rate include deficit recovery contributions

h) Standard contribution rate

i) Contribution rate in respect of surplus or deficit

j) Assumed member contribution yield

k) Expenses, split by administration and investment (if not included implicitly in discount rate)

l) Pensionable Pay definition (2008 or 2014 scheme definition)

m) Is a smoothed liability value used? If Yes, an explanation is included

ii) SAB standardised basis (only relevant for England and Wales)

a) Past service liability – split between Actives, Deferred, Pensioners and Total

b) Funding level

c) Surplus / deficit

d) Deficit recovery period

Future contribution rates

h) Standard contribution rate

i) Contribution rate in respect of surplus or deficit

j) Assumed member contribution yield

6) REVENUE ACCOUNTS

a) Value of assets at last valuation (after any smoothing or other adjustments)

b) Value of assets at this valuation (after any smoothing or other adjustments)

c) Total Income: Employee contributions, normal employer contributions, special employer contributions, transfers in, investment income, other income

d) Total Expenditure: Pensions paid, retirement lump sums paid, other lump sums paid, transfers out, investment expenses, administration expenses, other outgoings

7) ANALYSIS OF SURPLUS (PAST SERVICE LIABILITY)

a) Surplus / deficit at last valuation

b) Interest on surplus/deficit

c) Difference between contribution paid and cost of benefits accrued

d) Total experience gains and losses (of which: investment return experience, salary increase experience, pension increase experience, pensioner mortality experience, other demographic experience)

e) Total change in assumptions (of which: financial assumptions, mortality assumptions, other demographic assumptions)

f) Other

g) Surplus / deficit at this valuation

8) ANALYSIS OF CHANGE IN FUTURE SERVICE CONTRIBUTION RATE

a) Future service rate at last valuation

b) Total effect of change in assumptions (Of which: financial assumptions, mortality assumptions, other demographic assumptions)

c) Change due to introduction new benefit design from April 2014

d) Other

e) Change in definition of pensionable pay

f) Future service rate at this valuation (common contribution rate)

9) DEFICIT RECONCILIATION

Complete the three yearly deficit repayments from the last valuation and from this valuation to demonstrate continuity of deficit recovery plan.

a) Nominal deficit contributions expected to be paid in the three year period for the current valuation (March 2016), previous valuation (March 2013) and the difference: for 2013-2016, 2016-2019, 2019-2022, 2022-2025, 2025-2028, 2028-2031, 2031-2034, 2034-2017, 2037+. The nominal difference should also be included.

b) Present value of deficit contributions expected to be paid in the three year period: the current valuation (March 2016), previous valuation (March 2013) and the difference: for 2013-2016, 2016-2019, 2019-2022, 2022-2025, 2025-2028, 2028-2031, 2031-2034, 2034-2017, 2037+, Sum of present values, Original deficit disclosed.

10) AVERAGE EMPLOYER CONTRIBUTION RATE

For years 2017/18, 2018/19 and 2019/20

a) Average employer contribution rate, current benefit accrual (%pay)

b) Total deficit contributions payable (where expressed as a fixed monetary amount (£)

c) Projected total deficit contributions (where expressed as a percentage of pay (% pay)

d) Total deficit contributions (£)

e) Total deficit contributions (expressed as a % of pay) (% pay)

f) Average employer contribution rate (% pay)

g) Total projected pay (£)

h) Pensionable Pay definition (2008 or 2014 scheme definition)

i) Long Stepping Periods – If a longer stepping period than three years, then it should be indicated and an explanation included.

11) POST 2014 SCHEME

a) Proportion of members assumed to be in 50/50 scheme split by gender

12) DOCUMENTATION REQUIRED

a) Valuation Report @ 31 March 2016

b) Relevant related reports

c) Compliance Extract

d) Statement of Investment Strategy

e) Funding Strategy Statement

f) Other

Explanatory notes

1 **Membership data:** Average ages should be unweighted, weighted by salary/pension and weighted liability as available. Accrued pensions should include the 2016 Pension Increase Order.

3 **Demographic Assumptions:** We expect this to be shown at sample ages only which will be specified in our template. For example promotional salary scale we intend to use five-year intervals from 20 to 65.

3c **Commutation:** Maximum proportion of pension that may be commuted under the 2008 scheme is 35.71%. This will give a lump sum equal to the permitted maximum and thus if the member is assumed to commute this amount of pension, the entry in the table above is 100%. For pre2008 service, members already receive a lump sum = 3/80ths x pre 2008 pensionable service x final pensionable salary. Please specify the pre 2008 assumption as the proportion of the permitted maximum that is expected to be commuted over and above the 3/80ths lump sum.

5j **Assumed member contribution yield:** This is the contribution yield that members are assumed to pay over the valuation period. It will vary by authority due to the tiered member contribution rates.

4b **Infrastructure - debt type:**

Infrastructure - equity type: Whether local housing stock is held within the property portfolio

10 The average employer contribution rate should be calculated as projected employer contributions in 2017/18 divided by projected pensionable pay in 2017/18. The rate for 2018/19 and 2019/20 should be calculated by the same method. We request the following:

10a **Average employer contribution rates –** current benefit accrual (% pay): weighted average of cost of current accruals (net of employee contributions)

10b **Total deficit contributions payable** (where fixed monetary amount) (£): Sum of deficit contribution where expressed as a fixed monetary amount. Ignore deficit contributions paid as a proportion of pay for this item

10c **Projected total deficit contributions payable** (where expressed as a percentage of pay) (£): Projected payment in £ terms – will require an assumption about projected pay. Ignore deficit contribution paid as a fixed monetary amount

10d **Total deficit contributions (£):** The sum of 10b) and 10c)

10e **Total deficit contributions expressed a percentage of pay (% pay):** Row 10d) re-expressed as a percentage of pay by dividing by projected pay across the whole fund (i.e. 10d) divided by 10g))

10f **Average employer contribution rate (% pay):** Sum of 10a) and 10e)

10g **Projected pay (£): Total projected pay (£):** For all employers in the fund

Since projected pensionable pay (10g)) acts only as the weightings in these weighted averages, it is acceptable to use a simple projection of pensionable pay (eg based on actual pensionable pay at 31 Mar 2016 with a simple factor for increases up to 2020).

Appendix G: Assumptions

G.1 Each section of analysis contained in the main report is based on one of three sets of assumptions:

- The local fund assumptions, as used in the fund's 2016 actuarial valuation
- The SAB standardised set of assumptions, or SAB standard basis
- A best estimate set of assumptions

G.2 Details of local fund assumptions can be found in each fund's actuarial valuation report as at 31 March 2016. Details of the SAB standard basis and the standardised best estimate basis can be found in the table below. Differences are highlighted.

Table G1: SAB standard basis[17] and best estimate basis

ASSUMPTION	SAB standard basis	Best estimate basis
Methodology	Projected Unit Methodology with 1 year control period	Projected Unit Methodology with 1 year control period
Rate of pension increases	2% per annum	1.9% per annum
Public sector earnings growth	3.5% per annum	3.9% per annum
Discount rate	5.06% per annum	5.59% per annum
Pensioner baseline mortality	Set locally based on Fund experience	
Mortality improvements	Long term reduction in mortality rates of up to 1.5% per annum	
Changes to state pension age	As legislated	
Age retirement	Set locally based on Fund experience	
Ill health retirement rates	Set locally based on Fund experience	
Withdrawal rates	Set locally based on Fund experience	
Death before retirement rates	Set locally based on Fund experience	
Promotional salary scales	None	Set locally based on Fund experience
Commutation	SAB future service cost assumption of 65% of the maximum allowable amount.	
Family statistics	Set locally based on Fund experience	

G.3 The financial assumptions for the best estimate basis are based on GAD's neutral assumptions for long term inflation measures and asset returns, and the split of LGPS assets held as at 31 March 2016. These neutral assumptions are not deliberately optimistic nor pessimistic and do not incorporate adjustments to reflect any desired outcome. We believe there is around a 50% chance of outcomes being better and a 50% chance of outcomes being worse than these assumptions imply.

G.4 Future asset returns are uncertain and there is a wide range of reasonable views on what future asset returns will be and therefore the best estimate discount rate should be. We have presented GAD's house view above, but there are other reasonable best estimate bases which may give materially different results.

[17] Details can be found in the Scheme Advisory Board's Cost Management Process at: http://www.lgpsboard.org/images/PDF/CMBDANov2016/AI5-SABCMP2.pdf. This document specifies assumptions, some of which have been approximated for the purposes of this exercise (as set out in Table G1).

Table G2: Implied[18] Life Expectency best estimate basis

	Implied weighted average life expectency best estimate basis (years)
Current pensioners	
Male aged 65	22.4
Female aged 65	24.9

[18] This is the weighted average life expectancy of locally derived figures, weighted by pensioner liability. Some actuaries combined ill health pensioners with normal health in their life expectancy calculations. We have not adjusted for this.

Appendix H: Section 13 of the Public Service Pensions Act 2013[19]

13 Employer contributions in funded schemes

(1) This section applies in relation to a scheme under section 1 which is a defined benefits scheme with a pension fund.

(2) Scheme regulations must provide for the rate of employer contributions to be set at an appropriate level to ensure—

(a) the solvency of the pension fund, and

(b) the long term cost efficiency of the scheme, so far as relating to the pension fund.

(3) For that purpose, scheme regulations must require actuarial valuations of the pension fund.

(4) Where an actuarial valuation under subsection (3) has taken place, a person appointed by the responsible authority is to report on whether the following aims are achieved—

(a) the valuation is in accordance with the scheme regulations;

(b) the valuation has been carried out in a way which is not inconsistent with other valuations under subsection (3);

(c) the rate of employer contributions is set as specified in subsection (2).

(5) A report under subsection (4) must be published; and a copy must be sent to the scheme manager and (if different) the responsible authority.

(6) If a report under subsection (4) states that, in the view of the person making the report, any of the aims in that subsection has not been achieved—

(a) the report may recommend remedial steps;

(b) the scheme manager must—

(i) take such remedial steps as the scheme manager considers appropriate, and

(ii) publish details of those steps and the reasons for taking them;

(c) the responsible authority may—

(i) require the scheme manager to report on progress in taking remedial steps;

(ii) direct the scheme manager to take such remedial steps as the responsible authority considers appropriate.

(7) The person appointed under subsection (4) must, in the view of the responsible authority, be appropriately qualified.

[19] http://www.legislation.gov.uk/ukpga/2013/25/section/13

Appendix I: Extracts from other relevant regulations

Regulations 58 and 62 of 'The Local Government Pension Scheme Regulations 2013[20]'

Funding strategy statement

58.–(1) An administering authority must, after consultation with such persons as it considers appropriate, prepare, maintain and publish a written statement setting out its funding strategy.

(2) The statement must be published no later than 31st March 2015.

(3) The authority must keep the statement under review and, after consultation with such persons as it considers appropriate, make such revisions as are appropriate following a material change in its policy set out in the statement, and if revisions are made, publish the statement as revised.

(4) In preparing, maintaining and reviewing the statement, the administering authority must have regard to—

(a) the guidance set out in the document published in March 2004 by CIPFA, the Chartered Institute of Public Finance and Accountancy and called "CIPFA Pensions Panel Guidance on Preparing and Maintaining a Funding Strategy Statement (Guidance note issue No. 6)[21]"; and

(b) the statement of investment principles published by the administering authority under regulation 12 of the Local Government Pension Scheme (Management and Investment of Funds) Regulations 2009.

Actuarial valuations of pension funds

62.–(1) An administering authority must obtain—

(a) an actuarial valuation of the assets and liabilities of each of its pension funds as at 31st March 2016 and on 31st March in every third year afterwards;

(b) a report by an actuary in respect of the valuation; and

(c) a rates and adjustments certificate prepared by an actuary.

(2) Each of those documents must be obtained before the first anniversary of the date ("the valuation date") as at which the valuation is made or such later date as the Secretary of State may agree.

(3) A report under paragraph (1)(b) must contain a statement of the demographic assumptions used in making the valuation; and the statement must show how the assumptions relate to the events which have actually occurred in relation to members of the Scheme since the last valuation.

(4) A rates and adjustments certificate is a certificate specifying—

(a) the primary rate of the employer's contribution; and

(b) the secondary rate of the employer's contribution,

for each year of the period of three years beginning with 1st April in the year following that in which the valuation date falls.

(5) The primary rate of an employer's contribution is the amount in respect of the cost of future accruals which, in the actuary's opinion, should be paid to a fund

[20] http://www.legislation.gov.uk/uksi/2013/2356/contents/made

[21] ISBN Number 085299 996 8; copies may be obtained from CIPFA at 3 Robert Street, London, WC2N 6RL

by all bodies whose employees contribute to it so as to secure its solvency, expressed as a percentage of the pay of their employees who are active members.

(6) The actuary must have regard to—

(a) the existing and prospective liabilities arising from circumstances common to all those bodies;

(b) the desirability of maintaining as nearly constant a common rate as possible;

(c) the current version of the administering authority's funding strategy mentioned in regulation 58 (funding strategy statements); and

(d) the requirement to secure the solvency of the pension fund and the long term cost efficiency of the Scheme, so far as relating to the pension fund.

(7) The secondary rate of an employer's contributions is any percentage or amount by which, in the actuary's opinion, contributions at the primary rate should, in the case of a Scheme employer, be increased or reduced by reason of any circumstances peculiar to that employer.

(8) A rates and adjustments certificate must contain a statement of the assumptions on which the certificate is given as respects—

(a) the number of members who will become entitled to payment of pensions under the provisions of the Scheme; and

(b) the amount of the liabilities arising in respect of such members,

during the period covered by the certificate.

(9) The administering authority must provide the actuary preparing a valuation or a rates and adjustments certificate with the consolidated revenue account of the fund and such other information as the actuary requests.