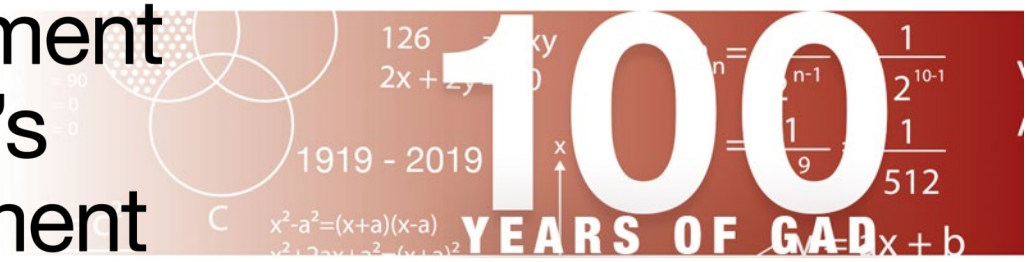
Government Actuary's Department



Scottish Teachers' Pension Schemes

Actuarial valuation as at 31 March 2016
Advice on assumptions

Date: 18 February 2019

Authors: George Russell & Garth Foster

Contents

1 Executive summary

This report contains our recommendations for the best estimate assumptions to be set by Scottish Ministers for the 2016 valuation of the Scottish Teachers' Pension Schemes.

1.1 An actuarial valuation of the Scottish Teachers' Pension Schemes[1] ('the Scheme' or 'STPS') is being carried out as at 31 March 2016. The Public Service Pensions (Valuations and Employer Cost Cap) Directions 2014 as amended ("the Directions") require that, unless specified otherwise[2], the assumptions to be adopted for this valuation will be set by Scottish Ministers, having obtained advice from the scheme actuary. Direction 19(c) requires the assumptions to be the Scottish Ministers' best estimates.

1.2 GAD is the appointed scheme actuary to the Scheme. This report sets out GAD's formal advice to the Scottish Ministers on the actuarial assumptions to be adopted where these are not otherwise specified. The advice covers the assumptions to be set by the Scottish Ministers. The main advised assumptions are summarised in Table 1 with further detail in Appendix A. The advice contained in this report has been shared and discussed with the STPS Scheme Advisory Board.

1.3 This report relates to demographic assumptions i.e. assumptions about member behaviours. When considering appropriate assumptions experience, both recent and longer term, generally provides the most reliable evidence when considering best estimates of future experience. Anticipated future events may also influence how assumptions are set. This advice sets out relevant analysis of recent experience and indicates which other factors have been considered in deriving recommendations of best estimate assumptions.

1.4 In some areas the data available to analyse the experience of the STPS is scarcer than other larger public service pension schemes, including the Teachers' Pension Scheme in England and Wales ('TPS E&W'). Where there is no reason to believe experience across the memberships of the two schemes is materially different we have also considered the conclusions reached based on the England and Wales scheme's experience[3] in formulating our recommendations for the STPS.

1.5 The previous completed actuarial valuation of the STPS was carried out as at 31 March 2012. Many of the assumptions put forward in this report are the same as adopted for that valuation. The most significant changes are:

[1] As provided by The Teachers' Superannuation (Scotland) Regulations 2005 (SSI 2005/393) and The Teachers' Pension Scheme (Scotland) (No. 2) Regulations 2014 (SSI 2014/292)

[2] Certain assumptions are specified in the Directions.

[3] A draft report *Teachers' Pension Scheme England and Wales: Actuarial valuation as at 31 March 2016: Advice on assumptions dated 15 June 2017* was shared with SPPA and this is due to be finalised shortly with no material amendments to the analysis.

- Rates of pensioner mortality have been updated to reflect recent experience and to reflect changes in population mortality as reflected in the updated ONS population projections[4].
- The assumption for the proportion of pension that members commute for a lump sum at retirement has been updated to reflect recent scheme experience.

1.6 The following chapters and appendices provide more detail on the advice, supporting analysis and an indication of the magnitude of financial impact of each assumptions on valuation results. They also contain important background information about the context of this advice and its limitations.

1.7 Where the scheme membership data is not sufficient for the scheme actuary to carry out a robust analysis of that aspect, the Directions require the report to include a statement to that effect. Some of the movements data provided was not considered sufficiently reliable to form a basis for setting assumptions (in particular that available for voluntary withdrawals, member retirements, and age differences between members and their spouses). As in previous valuations for these and other assumptions our advice has been informed by the analysis undertaken for the larger Teachers' Pension Scheme in England & Wales. Although the absence of reliable movements data to set assumptions is not considered critical for this valuation since other data sources have been able to be considered, it should be recognised that should movements data become available for future valuations it could result in recommendations regarding appropriate assumptions which lead to greater changes in valuation results than otherwise.

1.8 This report was provided to the Scottish Ministers in draft form, and was also circulated to the Scheme's member and employer representatives, in September 2017. It has been signed alongside the formal valuation report. Apart from reflecting suggestions resulting from discussions with the Scheme's member and employer representatives, no substantive changes have been made.

1.9 The Scottish Ministers have already confirmed to GAD, having consulted with relevant stakeholders, that the actuarial assumptions to be adopted for the valuation should be those set out in this report.

Compliance and quality standards

1.10 This work has been carried out in accordance with the applicable Technical Actuarial Standards: TAS 100 and TAS 300 issued by the Financial Reporting Council (FRC). The FRC sets technical standards for actuarial work in the UK.

[4] From the 2012 based projections to the 2016 based projections.

Table 1: Summary of recommended assumptions consistent with the 'best estimate' requirement

Assumption	Summary of recommended assumptions	Rationale for recommendation	Magnitude of financial impact of change from 2016 valuation assumptions	
			Past service	SCR (2019-23)
Pensioner baseline mortality[5]	Aligned to standard SAPS table[6,7]		(£50m)[8]	(0.1%)[8]
Normal health	Males: 119% of S2NMA_L Females: 84% of S1NFA_L up to age 79, 97% at ages 80-84, 113% at ages 85-89, 122% from age 90	Informed by wider analysis of mortality differentials experienced by members of public service scheme members in Scotland compared to England and Wales*.		
Ill-health (current)	Males: 79% of S2IMA up to age 75 with underpin of 134% of S2NMA, 134% of S2NMA above age 75 Females: 96% of S2IFA up to age 75 with underpin of 128% of S2NFA, 128% of S2NFA above age 75	Informed by wider analysis of mortality differentials experienced by members of public service scheme members in Scotland compared to England and Wales*.		
Ill-health (future)	100% x S2IXA	In line with experience of UK self-administered pension schemes due to lack of Scheme experience on which to base this assumption.		
Dependants	Males: 135% of S2NMA Females: 107% of S2DFA	Informed by wider analysis of mortality differentials experienced by members of public service scheme members in Scotland compared to England and Wales*.		

[5] As directed by HMT, future improvements in mortality assumed to be in line with those underlying the most recent ONS population projections. The financial impact shown relates only to the change in baseline mortality.

[6] SAPS tables are published by the Actuarial Profession and are based on the experience of self-administered pension schemes from 2004 to 2011. The S2 series has separate standard tables based on experience of members retiring in normal health (S2NXA), in ill health (S2IXA) and for widows (S2DFA). The assumption for women retiring in normal health relates to the low mortality variant of the previous S1 series (S1NFA_L) because no corresponding tables have been produced in the S2 series.

[7] Adjusted to take account of improvements in population mortality between the base year for the tables and the date the future improvements are applied from.

[8] Change in baseline mortality only. Excludes any impact from the change in assumed future mortality improvements.

Assumption	Summary of recommended assumptions	Rationale for recommendation	Magnitude of financial impact of change from 2016 valuation assumptions	
			Past service	SCR (2019-23)
Age retirement				
NPA 60 protected	Retirements spread between ages 55 and 70	Unchanged from 2012 assumption as no reliable evidence to suggest the existing assumption is inappropriate	No change in assumption	
NPA 60 unprotected and tapered	Retirements spread between ages 55 and 70 (average retirement age later than protected members and dependent on SPA)	Unchanged from 2012 due to lack of scheme experience on which to amend this assumption		
NPA 65 protected	Retirements spread between ages 60 and 65	Unchanged from 2012 due to lack of scheme experience on which to amend this assumption		
NPA 65 unprotected and tapered	Retirements spread between age 60 and SPA (average retirement age later than protected members and dependent on SPA)	Unchanged from 2012 due to lack of scheme experience on which to amend this assumption		
New entrants from 2015	Retirements spread between age 60 and SPA (average retirement age later than protected members and dependent on SPA)	Unchanged from 2012 due to lack of scheme experience on which to amend this assumption		
Ill-health retirement				
Incidence	Sex dependent. Increasing by age: <0.01% at age 25, <0.1% at age 45, about 0.75% at age 65	Unchanged from 2012 assumption and broadly in line with 2012-2016 scheme experience.	No change in assumption	
Upper/lower tier split	55% on upper tier	Unchanged from 2012 assumption, and in line with 2012-2016 scheme experience.	No change in assumption	

Assumption	Summary of recommended assumptions	Rationale for recommendation	Magnitude of financial impact of change from 2016 valuation assumptions	
			Past service	SCR (2019-23)
Withdrawal	Withdrawals, net of re-entry within 5 years, of about 1.5%(M)/1%(F) at most ages, but higher for youngers members e.g. about 5%(M)/4%(F) at age 25	Unchanged from 2012 assumption as no reliable evidence to suggest the existing assumption is inappropriate	No change in assumption	
Death before retirement	Increasing by age, around 0.2%(M)/0.1%(F) a year close to age 60	Same as 2016 TPS (E&W) assumption[9]	Immaterial	Immaterial
Promotional salary scale	Steeper at younger ages: about 4% a year at age 25, 1% at age 45 and 0.01% at age 65	As adopted for the 2009 and 2012 valuations as no clear evidence to suggest it is no longer appropriate. Same as 2016 TPS (E&W) assumption	No change in assumption	
Commutation	10% of NPA 60 pension commuted	Changed from 2012 assumption, on the basis of experience since the 2012 valuation date and other evidence	(£200m)	(0.1%)
Family statistics				
Proportion married/partnered	77%(M)/58%(F) at retirement (consistent assumptions for existing pensioners)	Same as 2016 TPS (E&W) assumption following consideration of STPS experience	Immaterial	
Age difference	Male member 3 years older than partner Female 2 years younger than partner	Same as 2016 TPS (E&W) assumption[9]	No change in assumption	
Remarriage	No allowance	Simplification on grounds of materiality	No change in assumption	

* In general 50% of the observed difference in experience since the 2012 assumptions were set has been taken into account when resetting assumptions.

[9] The relatively small size of the STPS makes it difficult to set robust assumptions for these assumptions directly. However, scheme experience does not appear inconsistent with TPS E&W assumption.

2 Introduction

This report contains our advice to the Scottish Ministers but will be of interest to other parties who should note the limitations.

2.1 An actuarial valuation of the Scottish Teachers' Pension Schemes ('the Scheme' or 'STPS') is being undertaken as at 31 March 2016. The Public Service Pensions (Valuations and Employer Cost Cap) Directions 2014 (as amended) ('the Directions') require that, unless specified otherwise[10], the actuarial assumptions to be adopted for this valuation are the responsibility of the Scottish Ministers, having taken advice from the scheme actuary. Direction 19(c) requires the assumptions to be the Scottish Ministers' best estimates.

2.2 GAD is the appointed scheme actuary to the Schemes. This report is addressed to the Scottish Ministers and contains our formal advice on the appropriate assumptions to be adopted for the 2016 valuation, as required by the Directions. The purpose of this advice is to enable the Scottish Ministers to determine the required best estimate assumptions.

2.3 The advice covers the main assumptions to be set by the Scottish Ministers. In particular, we consider the following sets of demographic assumptions in this report:

- Pensioner mortality
- Age retirement from service
- Ill-health retirement from service
- Voluntary withdrawal from service
- Death before retirement
- Promotional pay progression
- Commutation of pension for cash at retirement
- Family statistics

Appendix B includes other calculation assumptions as required to complete the valuation and Appendix C sets out assumptions made for data uncertainties.

2.4 This report was provided to the Scottish Ministers in draft form, and was also circulated to the STPS Scheme Advisory Board, in September 2017. It is being signed alongside the formal valuation report. Apart from reflecting suggestions resulting from discussions with the Scheme's member and employer representatives, no substantive changes have been made.

2.5 The Scottish Ministers have confirmed to GAD, having consulted with relevant stakeholders, that the actuarial assumptions to be adopted for the valuation should be those set out in this report.

[10] Certain assumptions are specified in the Directions.

2.6 The Scottish Public Pensions Agency ('SPPA') supplied data on the experience of the scheme membership over the four-year period to 31 March 2016. We have used this data to analyse the Scheme's experience in order to develop our advice on the assumptions. Our report, *Scottish Teachers' Pension Schemes: Actuarial Valuation at 31 March* 2016*: Report on membership data*, also finalised today, provides information about this data and should be read in conjunction with this advice. The report includes details of the checks carried out on the data, the amendments made to the data and our residual concerns about the quality of the data. In preparing our advice, we have relied upon the general completeness and accuracy of the data provided.

2.7 When considering appropriate assumptions experience, both recent and longer term, generally provides the most reliable evidence when considering best estimates of future experience. Anticipated future events may also influence how assumptions are set. However robust analysis of scheme experience will only be possible where there is both sufficient quality, and quantity, of data available. The level of reliance that can be placed on any assumptions derived from this analysis will also vary depending on these two factors.

2.8 It is generally accepted that larger datasets will be subject to less volatility and statistical variation, and may be less prone to the impact of errors in individual records. For the smallest public service pension schemes it may therefore not be possible to undertake, in isolation, a statistically reliable analysis of that scheme's own experience. For other schemes it may only be possible to complete a reliable analysis of certain aspects of the scheme's own experience. Where appropriate, it may therefore be preferable to consider whether the experience of similar larger schemes might be used when setting assumptions.

2.9 The STPS is a moderately large sized public service pension scheme of around 175,000 members. In this advice we propose to set certain assumptions based on an analysis of the scheme's own experience. Other proposed assumptions have been recommended on the basis of, or in conjunction with, the outcome of a similar analysis of scheme experience recently completed for the larger Teachers' Pension Scheme England & Wales[11]. This is consistent with the approach used in previous valuations where in many cases the same assumptions have been used for both schemes.

2.10 This report sets out relevant analysis of recent experience and indicates which other factors have been considered in deriving recommendations of best estimate assumptions. The Scottish Ministers should consider whether there is any reason why the approach taken to setting the assumptions would be inappropriate.

[11] A draft report *Teachers' Pension Scheme England and Wales: Actuarial valuation as at 31 March 2016: Advice on assumptions dated 15 June 2017* was shared with SPPA and this is due to be finalised shortly with no material amendments to the analysis.

2.11 We are content for the Scottish Ministers to release this report to third parties, provided that:

- it is released in full
- the advice is not quoted selectively or partially
- GAD is identified as the source of the report, and
- GAD is notified of such release.

2.12 Third parties whose interests may differ from those of the Scottish Ministers should be encouraged to seek their own actuarial advice where appropriate. Other than to the Scottish Ministers GAD has no liability to any person or third party for any act or omission taken, either in whole or in part, on the basis of this report.

3 General considerations

This chapter sets out a number of general considerations common to the setting of the different assumptions considered in this report.

3.1 The key considerations taken into account in formulating the advice in this report are explained in this section.

Directions

3.2 The advice in this report reflects the requirements of the Directions issued by HM Treasury that assumptions should be set as the Scottish Ministers' 'best estimates' of future experience and should contain no margin for prudence or optimism. They should be set having regard to:

- assumptions set for previous valuations
- analysis of demographic experience in the period up to the valuation date
- historic long term trends and emerging evidence which may illustrate long-term trends in the future
- relevant data from any other sources.

Different populations

3.3 The Public Service Pensions (Valuations and Employer Cost Cap) Directions 2014 require this actuarial valuation to cover both the scheme established under the Public Service Pensions Act 2013[12] ("2015 Scheme") and the previous pension scheme for Teachers ("pre-2015 scheme"). Assumptions appropriate to both the 2015 scheme and the pre-2015 scheme are required for the valuation. The Directions also require assessment of benefit accrual costs over the ***implementation period***[13]. This requires assumptions about anticipated member behaviour and characteristics during 2019 - 2023 as well as assumptions about member behaviour and characteristics in the longer term.

3.4 There are currently 3 distinct groups of members.

- Those with full protection and remaining in the pre-2015 scheme to retirement. The introduction of the 2015 scheme is not expected to have any impact on this group's behaviours
- New members to the 2015 scheme. These members' retirement behaviours are expected to be heavily influenced by the provisions of the 2015 scheme

[12] Public Service Pensions Act 2013.
[13] 1 April 2019 to 31 March 2023.

> Members with service in both the 2015 scheme and pre-2015 scheme (including members with tapered protection). Over time, as the proportion of 2015 scheme service increases, the retirement behaviours are expected to become increasingly influenced by the provisions of that scheme.

3.5 Where relevant we indicate in each of the following chapters the relative importance of each set of assumptions to the groups of members identified above.

Relative importance of assumptions

3.6 The Directions require the valuation results to be estimated to the nearest 0.1% of pensionable payroll. This is a required level of accuracy for a particular calculation and based on a particular set of assumptions. Appendix D provides an indication of the sensitivity of the valuation results to the particular assumptions under consideration.

4 Pensioner Mortality

This chapter sets out our recommendation for the baseline pensioner mortality assumptions and summarises the analysis undertaken in order to inform that recommendation.

4.1 The assumptions we recommend for baseline pensioner mortality for the 2016 valuation may be summarised by reference to standard mortality tables as follows. The corresponding assumptions for the 2012 valuation are also shown.

Table 4.1: Recommended mortality assumptions

	2016 valuation	2012 valuation
Baseline mortality	**Standard table[14] and adjustments**	
Males		
Retirements in normal health	119% of S2NMA_L	120% of S1NMA_L
Current ill-health pensioners	Age-dependent assumption: ≤75: 79% of S2IMA with an underpin of 134% of S2NMA >75: 134% of S2NMA	Age-dependent assumption: ≤71: 73% of S1IMA >71: 128% of S1NMA
Future ill-health pensioners	100% of S2IMA	100% of S1IMA
Dependants	135% of S2NMA	122% of S1NMA
Females		
Retirements in normal health	Age-dependant adjustments to S1NFA_L: ≤79: 84%, 80-84: 97% 85-89: 113%, ≥90: 122%	Age-dependant adjustments to S1NFA_L: ≤79: 83%, 80-84: 95% 85-89: 110%, ≥90: 119%
Current ill-health pensioners	Age-dependent assumption: ≤75: 96% of S2IFA with an underpin of 128% of S2NFA >75: 128% of S2NFA	Age-dependent assumption: ≤71: 100% of S1IFA >71: 123% of S1NFA
Future ill-health pensioners	100% of S2IFA	100% of S1IFA
Dependants	107% of S2DFA	99% of S1DFA

[14] SAPS (S2) tables are published by the Actuarial Profession and based on the experience of self-administered pension schemes over the period 2004 to 2011. The 'S2' series has separate standard tables based on experience of members retiring in normal health (S2NXA and a low mortality variant S2NXA_L) and in ill health (S2IXA) and for female dependants (S2DFA). There is no low mortality variant for female pensioners and so the previous S1 table is used for female normal health pensioners. The S3 series of tables were released by CMI in October 2018, these updated mortality tables cover experience between 2009 and 2016. GAD have concluded that moving to the S3 tables would have no material impact on either our analysis of mortality or the valuation results as a whole. It therefore remains appropriate to use the S2 tables for the current valuation although we would expect to transition to the S3 tables for future if this is appropriate.

4.2 As specified by HM Treasury, future improvements in mortality will be assumed to be in line with those underlying the most recent ONS population projections.

4.3 The above assumptions are similar to those recommended for the 2016 valuation of the TPS E&W but with an adjustment being applied which increases rates of mortality by 12.5%. This is the same differential in mortality rates assumed between the schemes for the 2012 valuation.

Comparison of expected pensioner longevity

4.4 The table below gives a comparison of the resulting life expectancies[15] (allowing for future improvements) assumed and recommended for the 2012 and 2016 valuations. The final column shows life expectancies on the proposed 2016 base tables but with future improvements based on the ONS 2012 projections. This column is provided to illustrate the impact of the change in allowance for future improvements on expected life expectancy. The Directions (as amended) specify that the future improvement basis for the 2016 valuation should be the ONS 2016 projections.

Table 4.2: Comparison of life expectancies (years) at the valuation date

Baseline:	**2012 valuation**	**2016 valuation**	**2016 baseline**
Future mortality improvements:	**ONS 2012**	**ONS 2016**	**ONS 2012**
Current pensioners			
Male aged 60	28.2	27.4	28.6
Male aged 65	23.3	22.5	23.7
Female aged 60	30.9	29.4	31.2
Female aged 65	25.9	24.4	26.1
Future pensioners – current age 45			
Male life expectancy from age 60	29.8	28.8	30.2
Male life expectancy from age 65	25.3	24.3	25.7
Female life expectancy from age 60	32.4	30.8	32.7
Female life expectancy from age 65	27.8	26.2	28.0

[15] Cohort life expectancies based on the ages shown as at the valuation date, i.e. allowing for future mortality improvement .

Use of the assumption

4.5 Pensioner mortality is a key valuation assumption and is a measure of how long members retiring in normal or ill-health, or their dependants, expect to live and receive benefits.

Analysis and setting the assumption

4.6 We have analysed the actual pensioner mortality experience over the four-year period to 31 March 2016 on a 'lives' basis. A lives basis doesn't make any allowance for the size of each member's pension. We compared the actual number of deaths with those expected had the members' experience been in line with the mortality rates in the relevant current SAPS tables ("S2 Tables"). The analysis is carried out using ONS 2014 projections, being the set of projections available at the time that the analysis was carried out. Previous analysis carried out by GAD suggested that the impact of using ONS 2014 or 2016 projections for mortality analysis would be minimal.

4.7 This analysis suggested that mortality rates in the STPS were similar to those in the TPS E&W. However, there is a difference for the general populations of about 1½ years. Although we might expect to see a smaller difference between teachers' pension schemes we would not expect mortality rates to be the same. As a result we did not consider the result of the analysis to be credible.

4.8 In light of this, our view is that it is more appropriate to set the mortality assumption for the STPS by adjusting the TPS E&W assumptions for expected differences in mortality between the STPS and TPS E&W. This is the same approach as used in the 2012 valuation of the STPS.

4.9 When setting the baseline pensioner mortality assumption we recommend the assumption is expressed both by reference to suitable adjustments to the rates in the relevant S2 table ("the base table") and by reference to suitable adjustments to the TPS E&W assumption.

Results of analysis

4.10 The results of the STPS analysis for the four year period ending on the valuation date showed significant volatility in mortality experience year on year. This is illustrated in Table 4.4 (for normal health pensioners) below. The figures shown are the ratios of actual (A) to expected (E) death rates with expected rates based on the 2012 valuation assumptions, adjusted as appropriate for each period analysed. The analysis suggests that differing conclusions may have been drawn had the valuation date and inter-valuation period fallen differently. The volatility is believed to be largely a reflection of environmental factors. An A vs E comparison for the four year period is also shown for the TPS E&W. Volatility year on year was also observed in that scheme. As assumptions are intended to reflect long term expectations it is reasonable to seek to smooth out the impact of these short term effects. Our recommendation for TPS E&W was that the short term effects should be smoothed out by taking only 50% of the difference in experience since the 2012 valuation.

Table 4.4: variation in rates of death by scheme year

Year	Normal health males (A vs E based on 2012 assumption*)	Normal health females (A vs E based on 2012 assumption*)
2012-13	86.1%	100.6%
2013-14	91.5%	92.9%
2014-15	81.7%	99.4%
2015-16	84.9%	89.0%
Overall STPS	86.0%	95.3%
Overall TPS E&W**	98.7%	104.1%

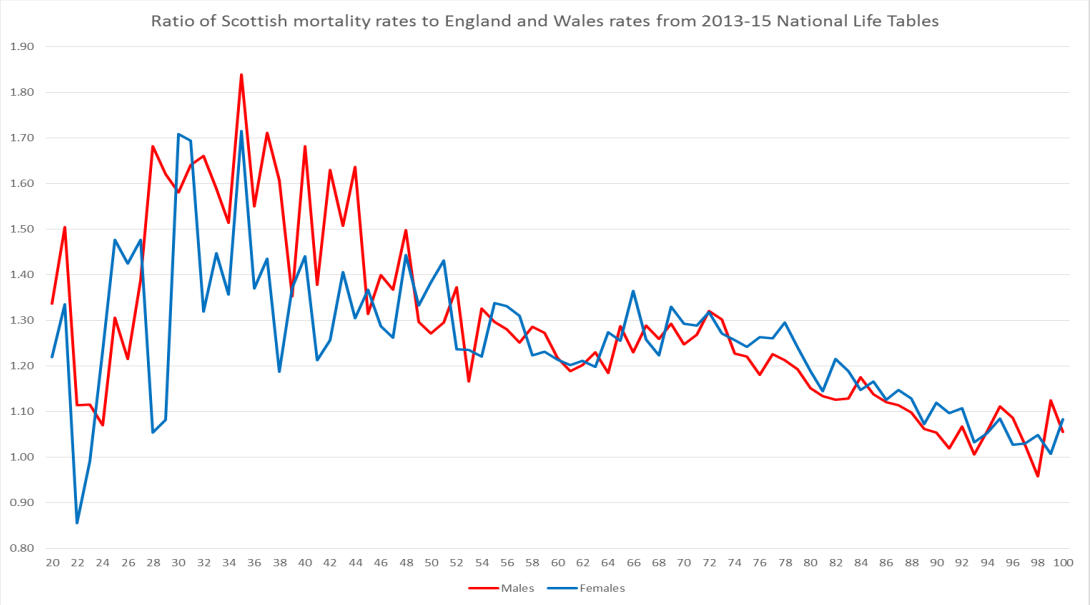
*2012 baseline with ONS-2014 improvements.
**TPS E&W experience compared with 2012 TPS E&W assumptions, which were 12.5% lighter than 2012 STPS assumptions.

4.11 The final two lines in the above table illustrate that STPS experience was significantly lower than the assumptions set in 2012 when compared to the TPS E&W (comparing both against their respective 2012 assumptions). This is a surprising result, and coupled with differences in the patterns of scheme experience by year, leads us to have concerns about the reliability of this analysis. We also note that the number of 'cessations' in the data provided for this analysis does not appear to be entirely consistent with the membership reconciliations shown in the annual scheme accounts.

4.12 We therefore recommend the retention of an assumption for baseline pensioner mortality equivalent to the TPS E&W assumption with a 12.5% loading (i.e. heavier rate of mortality).

4.13 We have also considered the up to date analysis of differences between aggregate population mortality rates for Scotland and England and Wales. Chart 4.1 shows the ratio of Scottish population mortality rates to those for England and Wales for ages 20 to 100. The comparison remains similar to that taken into account in setting the 2012 assumption. Looking at ages 60 and older (as relevant for pensioner mortality), mortality rates for Scotland are generally around 25% higher for ages 60 to 70; the ratio then declines in a relatively linear fashion until around age 90 after which mortality rates in Scotland are around 5% heavier in Scotland. Similar differentials were observed in similar data available for the 2012 valuation. In 2012 it was concluded an appropriate differential for STPS pensioners would be in the range of 10% to 15% heavier for Scotland (compared to England and Wales). The valuation assumption was set as 12.5% heavier. As a result of the lack of credible data suggesting this assumption is invalid, we recommend retention of a differential of 12.5%.

Chart 4.1: Ratio of Scottish mortality rates to England and Wales rates from 2013-15 Interim Life tables



4.14 Table 4.5 sets out the number of pensioner deaths and amount of pension ceasing due to deaths over the inter-valuation period. Figures are shown separately for males and females retiring in normal or ill-health and for dependants. In each case these are compared with the expected figures from the 2012 valuation assumption (with ONS-2014 improvements) and from the unadjusted 2016 base table.

Table 4.5: Pensioner mortality experience 2012-16

Category	Number of Pensions ceasing due to death	A/E* relative to the 2012 valuation assumption†
Normal Health:		
Males	1,701	86.0%
Females	2,797	95.3%
Ill Health:		
Males	229	113.4%
Females	433	113.9%
Dependants:		
Males	219	85.3%
Females	877	82.6%

*A/E is actual over expected.
† With ONS-2014 improvements in each case.

Results of Analysis: Normal Health Pensioners and Dependants Mortality

4.15 The charts below show by age, and for males and females separately, a comparison of the actual mortality experience over the four year period with that expected based on the 2012 valuation assumption and the recommended assumption.

Chart 4.2: Male normal health pensioner mortality experience 2012-16

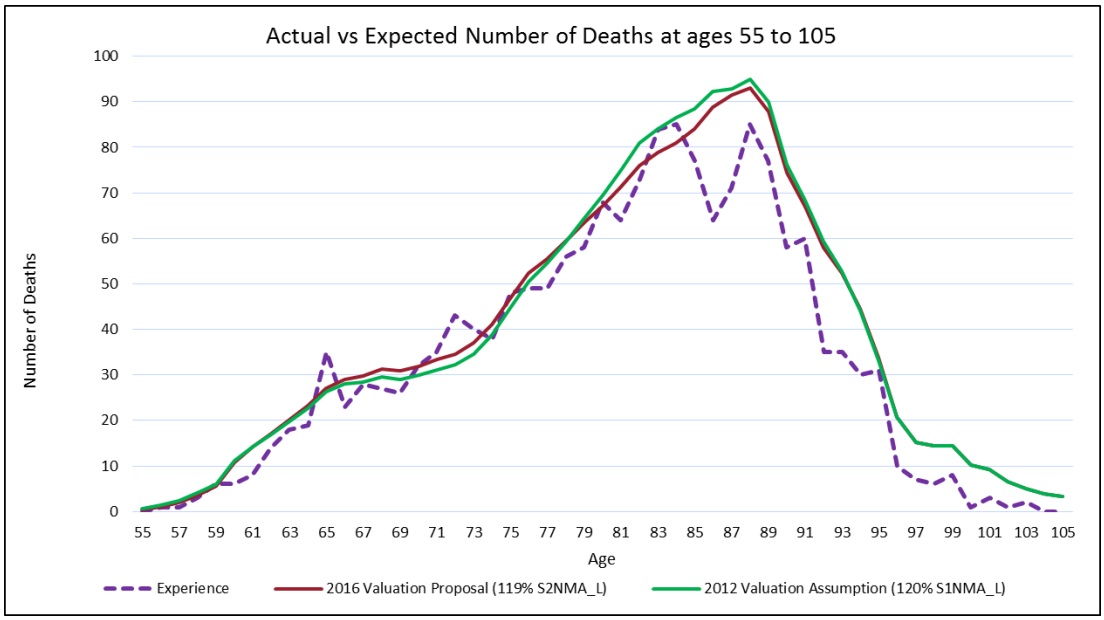
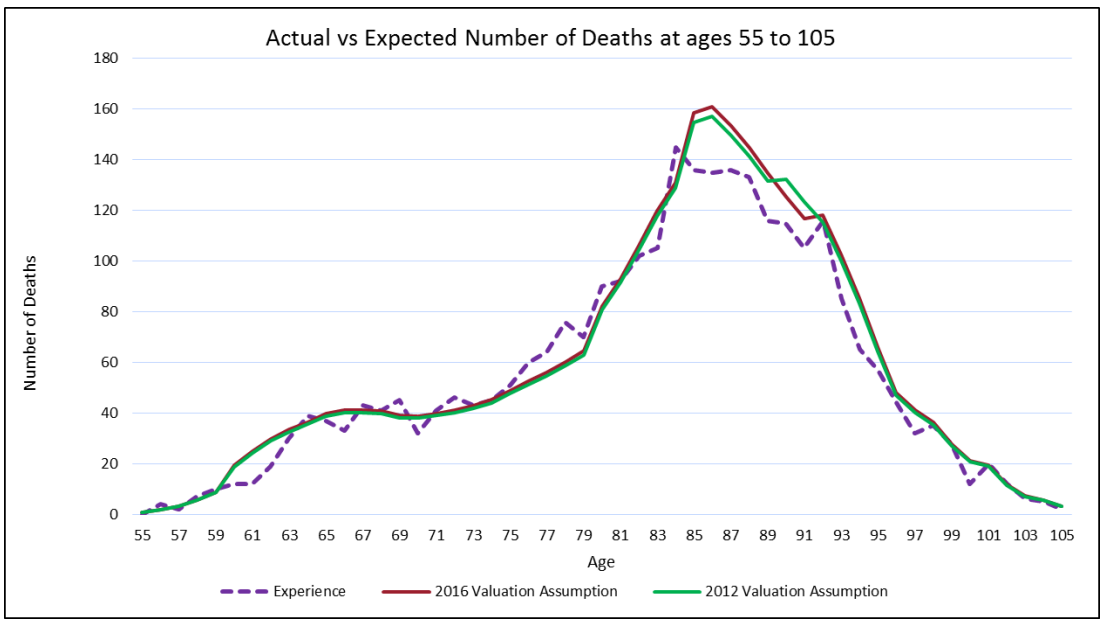


Chart 4.3: Female normal health pensioner mortality experience 2012-16



Ill-Health Pensioner and Dependant Mortality

4.16 Given the relatively small size of the ill-health pensioner and dependant death datasets we recommend the pensioner baseline assumption is set by direct reference to the TPS E&W assumption maintaining the same 12.5% differential as for normal health pensioners for current ill health pensioners and dependants.

4.17 For future ill-health pensioners the approach we recommend is to assume mortality is in line with the S2IA tables (which are based on the ill-health experience of certain private sector pension schemes). This may be justified on the grounds that the ill-health criteria in public and private sector pension schemes are now likely to be broadly similar, with ill-health mortality being driven primarily by the illness rather than the type of work undertaken. The relatively low level of ill-health retirement means that the choice of assumption is not particularly material.

5 Age retirement from service

This chapter sets out our recommendation for the assumed patterns of retirement on grounds other than ill-health, and summarises the analysis undertaken in order to inform that recommendation.

Proposed assumptions for 2016 valuation

5.1 We recommend that rates of age retirement are set separately for members who:

- continued in the pre-2015 scheme after April 2015;
- transferred to the new scheme on 1 April 2015 and have service in both the existing and 2015 schemes; or
- joined as new entrants after 1 April 2015.

5.2 Sample age retirement rates are provided in Appendix A and are unchanged from assumptions adopted for the 2012 valuation of the STPS.

Members remaining in the existing scheme

5.3 We recommend retention of the assumption used for the 2012 valuation. About 40% of men and 35% of women retire before age 60, with about 25% and 30% respectively retiring at age 60 and the rest spread to age 70. The average assumed retirement age in the NPA 60 section is around 60 for both men and women. NPA 65 members are assumed to have the same early retirement pattern (but relative to age 65 rather than 60) but no allowance is made for late retirement. This is appropriate because, unlike the NPA 60 section, adjustments apply to late retirement pensions in the NPA 65 section to make them actuarially neutral to a retirement at NPA. The average assumed retirement age in the NPA 65 section is about 64 for both men and women.

New entrants after April 2015

5.4 We recommend retention of the assumption used for the 2012 valuation. Members who reach age 65 are assumed to retire evenly spread between age 65 and State Pension Age (SPA). This makes allowance for the impact of the enhanced early retirement terms available and is consistent with the assumptions adopted for the 2012 valuation of the TPS in England and Wales. The same early retirement pattern will apply before age 65 as for members remaining in the existing scheme (but relative to age 65 rather than 60). No allowance is made for late retirement, as actuarial adjustments apply to late retirement pensions in the 2015 scheme. The average assumed retirement ages depend on SPA: about 64 for SPA 65 increasing to about 65 for SPA 68.

Members with service in the existing and 2015 schemes

5.5 We recommend retention of the assumption used for the 2012 valuation. We propose a gradual change between the patterns of retirement for members remaining in the existing scheme and those applying to new entrants to the 2015 scheme. To allow for reasonable implementation, we propose to make this change in steps so that a single retirement pattern (separate for men and women) applies to members with a particular SPA. Members will be assumed to have a single retirement date applying to all their service, reflecting the requirement to leave teaching service before accessing their benefits (subject to the approach taken on phased retirement).

Phased retirements

5.6 Phased retirements are not currently a significant feature of the Scheme. In the absence of any evidence of increased uptake of phased retirement we are not recommending an allowance for any change in behaviour. SPPA and other stakeholders may have a view on the likelihood of such an increase and Scottish Ministers may wish to make an allowance on the basis of their evidence. GAD would be happy to analyse any evidence provided.

Use of the assumption

5.7 Age retirement rates specify the rate at which members are assumed to retire on grounds other than ill-health and therefore potentially include allowance for retirements before and after normal pension age.

5.8 In both sections of the pre-2015 scheme and in the 2015 scheme an actuarial reduction is applied to a pension payable on retirement before NPA. The actuarial reduction is set to give the early retirement pension the same value as the deferred benefits payable following withdrawal at the same age (with special terms applying for the period between 65 and SPA in the 2015 scheme). As the deferred benefits are expected to be less valuable than the benefits payable had the member stayed in service and retired at NPA, early retirement represents a saving to the Scheme. Early retirement is common in the STPS and so the early retirement assumptions have a significant impact on overall costs.

5.9 An actuarial uplift is applied for retirement after NPA in the NPA 65 section and in the 2015 scheme. However, in the NPA 60 section the pension payable on retirement after NPA is not subject to actuarial adjustment. This means pensions paid from the 1995 section on retirement after NPA are less costly to the scheme (i.e. the value of the benefit payable to a member is lower) than a pension paid at or before NPA. The rates of retirement of members of the 1995 section at or after NPA are therefore financially significant components of the assumption.

Analysis and setting the assumption

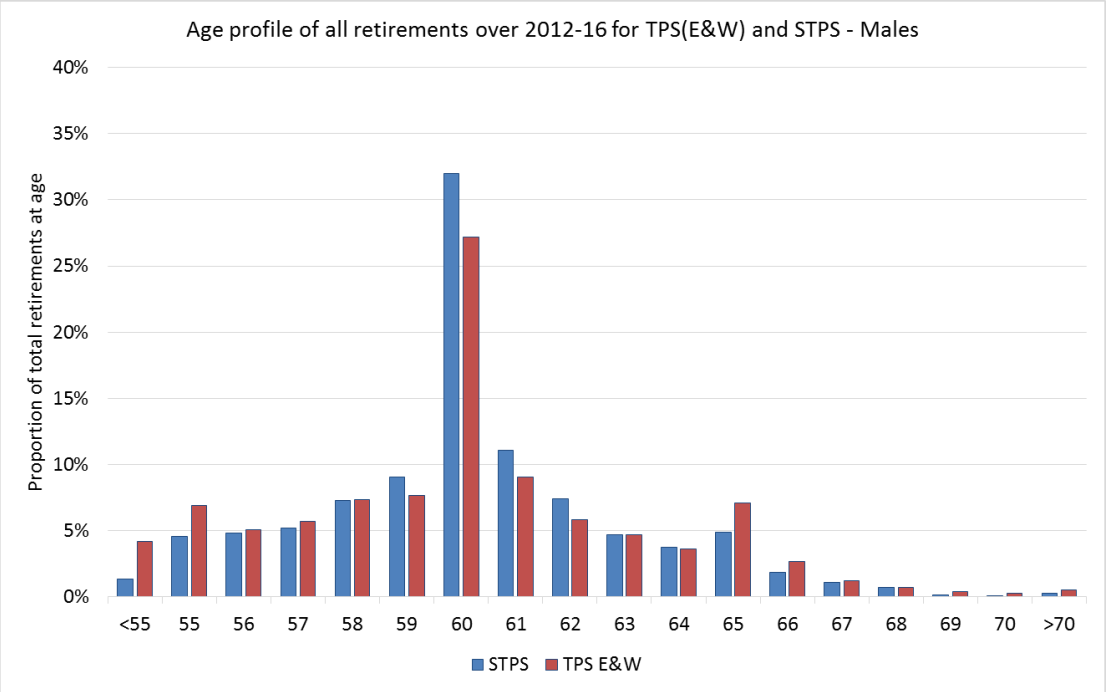
5.10 A limited analysis of retirements over the four-year period ending 31 March 2016 was carried out. A full analysis was not possible due to data limitations.

5.11 We have considered the proportion of retirements in the STPS data provided, occurring between 2012 and 2016, at each age. We have then compared this to the retirement experience of the TPS E&W[16] over the same period.

5.12 Due to difficulties in differentiating between members retiring from active status and those retiring from deferred status, these charts include all retirements. We would expect this to mean that the proportion of retirements occurring at age 60 will overstate the numbers expected from active service (for both STPS and E&W). The charts also include retirements from all sections of the schemes. However the overwhelming majority of retirements over the period are expected to have been from the NPA 60 sections. These factors, and inconsistencies in the number of retirements provided relative to other sources, suggest this analysis may not be sufficiently robust to allow specific assumptions to be derived. However the comparison with E&W is intended to provide some reassurance that the differences in the NPA 60 retirement assumption used for the 2012 valuation remain reasonable.

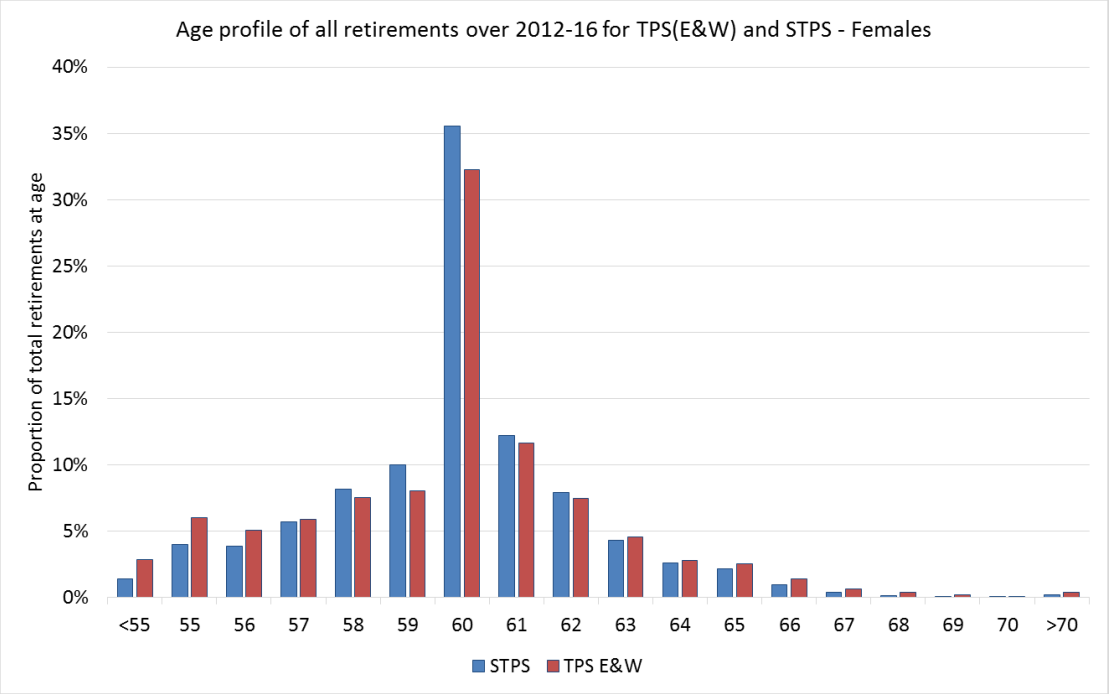
5.13 The assumptions adopted in 2012 for members of the NPA 60 section of the STPS suggested that there would be fewer retirements at age 55, and more retirements at and shortly after age 60, than in the TPS E&W. These expected differences in retirement behaviours between the two schemes still appear to be present in the four-year period to 31 March 2016, as shown in the charts below.

Chart 5.1: comparison of age retirement patterns against TPS E&W - Males



[16] See *Teachers' Pension Scheme England and Wales: Actuarial Valuation as at 31 March 2016: Advice on assumptions*

Chart 5.2: comparison of age retirement patterns against TPS E&W - Females



Comments on results of age at retirement analysis

Protected NPA 60 members

5.14 The vast majority of age retirements over four-year period to 31 March 2016 are expected to have been from the NPA 60 section. The charts above show that the differences in retirement behaviour when compared to the TPS E&W were broadly in line with expectations. Analysis of scheme data for TPS E&W suggested that experience since 2012 had not been significantly different to expectations at the 2012 valuation of that scheme. As a result, we recommend retaining the existing 2012 STPS assumption for age retirements of protected members in the NPA 60 section.

Protected NPA 65 members and other membership groups

5.15 The recent experience of NPA 60 members is not directly relevant to other groups of members. The assumptions for these other groups of members at the 2012 valuation were set by reference to NPA 60 experience but this was a pragmatic approach in the absence of other information. We consider that it would be inappropriate to amend these assumptions based on the lack of experience over the four-year period to 31 March 2016. To do so would add volatility to the valuation results without strong evidence to suggest that the revised assumptions are better.

6 Ill-health retirement from service

This chapter sets out our recommendation for the assumed rates of retirement on grounds of ill-health, and summarises the analysis undertaken in order to inform that recommendation.

Proposed assumptions for 2016 valuation

6.1 We recommend that a single set of assumptions (separate for men and women) is used to allow for the incidence of ill-health retirement i.e. applying both to those members who remain in the pre-2015 scheme and members of the new scheme. The recommended rates are the same as proposed for the 2012 valuation of the STPS. Assumed rates of ill-health increase with age, but fewer than 1% of members are assumed to retire on ill-health grounds each year, even at the highest ages. Sample rates are provided in Appendix A.

6.2 We also recommend assuming that 55% of members retiring on ill-health grounds will receive the upper-tier benefit and the remainder will receive the lower-tier benefit. This is also unchanged from assumption proposed for the 2012 valuation of the STPS.

Use of the assumptions

6.3 Ill-health retirement rates specify the rate at which members are assumed to retire on grounds of ill-health. The assumed eligibility for upper or lower tier awards specifies the benefits which will be provided. The rates of mortality experienced after ill-health retirement are also relevant to the valuation calculations. Post retirement mortality is addressed in Chapter 4.

Analysis and setting the assumption

Ill health incidence

6.4 There were just over 300 ill-health retirements over the four-year period to 31 March 2016. The split between male and female members is set out in the table below.

Table 6.1: Number of ill health retirements, 2012 to 2016

Gender	Number of ill health retirements 2012-2016	Number of active members as at 31 March 2012 (000s)	Number of active members as at 31 March 2016 (000s)
Men	62	19	19
Women	243	55	58

6.5 The ill-health retirement assumptions adopted for the 2012 valuation of the STPS were derived from the TPS E&W 2012 valuation assumptions. Given the relatively low number of retirements in STPS, particularly for men, we have looked to make use of the experience and analysis undertaken for the TPS E&W 2016 valuation. This analysis confirmed that the assumed age profile of ill-health retirements appeared to remain reasonable, but suggested that the assumed incidence of ill health in the TPS E&W could be reduced at all ages, by 17% for men, and 8% for women.

6.6 As part of our analysis for the STPS we have compared the average actual rate of ill-health retirements (by gender) in the STPS to the average actual rate of ill-health retirements in the TPS E&W, as shown in the table below.

Table 6.2: Average rates of ill health retirement, 2012 to 2016

Scheme	Men	Women
STPS	0.082%	0.108%
TPS E&W	0.073%	0.070%
Ratio of STPS to TPS E&W	111%	154%

6.7 Average rates of ill health retirement in the STPS are approximately 10% higher for men and 55% higher for women than in the TPS E&W. This is higher than the assumed difference in the 2012 valuation, when the proposed STPS assumption was aligned to the 2012 TPS E&W assumption for men, and was 25% higher than the 2012 TPS E&W assumption for women.

6.8 However, when considering these numbers it should be noted that with only 300 ill-health retirements occurring, the results of this analysis are likely to be subject to a reasonable amount of statistical fluctuation.

6.9 Allowing for some expected fluctuation in experience over periods of time we recommend 50% of the difference in experience is reflected in the revised assumptions for both men and women. This approach broadly supports retaining the existing assumptions for women and slightly reducing the existing assumption for men. However, given the low number of male ill-health retirements and notable differences in the year-on-year number of retirements, we propose retaining the 2012 STPS assumptions for both men and women.

Split between tiers

6.10 The table below shows the percentage of members retiring on ill-health grounds over the four-year period which qualified for upper tier benefits as provided in the data. Over the period 2012-2016 the percentage of upper tier awards averaged at 53% for men and 56% for women.

Table 6.3: Ill-health retirements on upper tier

	2012/13	2013/14	2014/15	2015/16	Total
Males	45%	63%	55%	33%	53%
Females	54%	52%	61%	69%	56%
All	52%	54%	60%	63%	56%

6.11 The 2012 valuation assumption was 55% for both men and women. We recommend no change to this assumption.

7 Voluntary withdrawal from service

This chapter sets out our recommendation for the assumed rates of withdrawal from active service, and summarises the analysis undertaken in order to inform that recommendation.

Proposed assumptions for 2016 valuation

7.1 We recommend that a common set of net rates of withdrawal (separate for men and women) are used for the purposes of the valuation i.e. applying equally to those members who remain in the pre-2015 scheme and members of the 2015 scheme.

7.2 The recommended rates are the same as proposed for the 2012 valuation of the STPS. The recommended rates are net of re-entry within five years and are related to age. The same rates apply regardless of the length of the member's service.

Use of the assumption

7.3 Withdrawal rates specify the rate at which members are assumed to leave voluntarily before retirement becoming entitled to either deferred benefits or, for those with less than two years' service, a refund of contributions. In all cases the withdrawal rates are 'net' rates, i.e. they are intended to reflect the probability of leaving service and not re-joining within five years, and therefore the member's benefits not being linked to their final salary at retirement (or the in-service revaluation rate in the CARE scheme).

Analysis and setting the assumption

7.4 We were unable to analyse age and duration rates of withdrawal over the four-year period ending 31 March 2016 due to data limitations.

7.5 An analysis of the TPS E&W withdrawal experience over this period appeared to indicate that withdrawal rates had increased since the previous valuation. As a consequence of that analysis we recommended that the withdrawal assumption used for the 2016 valuation be increased by 12.5% from the 2012 assumption. However it is not clear that withdrawal rates in Scotland will necessarily follow the experience of England & Wales, and this is reflected in the differing rates of withdrawal assumed for the 2012 valuation.

7.6 Without firm evidence that the pattern of withdrawals has materially diverged from that expected under the assumptions proposed for the 2012 STPS valuation, we therefore propose to retain the 2012 assumption.

8 Death before retirement

This chapter sets out our recommendation for the assumed rates of death before retirement, and summarises the analysis undertaken in order to inform that recommendation.

Proposed assumptions for 2016 valuation

8.1 We recommend increasing the assumed rates of death in service by 2% for men and reducing them by 4% for women. The changes apply at all ages and are applied to remain aligned with the assumptions proposed for the 2016 valuation of TPS E&W. We do not expect a material impact on the valuation results from the changes made.

8.2 Assumed rates of death in service increase with age, but fewer than 0.5% of members are assumed to die each year, even at the highest ages. Sample rates are provided in Appendix A.

Use of the assumption

8.3 Death before retirement rates are used to allow for the possibility of deaths whilst in active service or whilst entitled to a deferred pension. The numbers of deaths observed annually, and the recommended rates to be assumed are low, and thus this assumption has relatively little financial significance.

Analysis and setting the assumption

8.4 There have been around 115 deaths of active members of the scheme over the four-year period to 31 March 2016. There is therefore not enough data to allow a full analysis by age and gender of deaths of active members or to set a robust assumption by analysing the Scheme's own data. We have therefore looked to make use of the experience and more complete analysis which was made of the data for the TPS in England and Wales.

8.5 An analysis of the experience of the TPS E&W experience over the four-year period has been carried out. As a result of that analysis we proposed that the death in service rates for males be increased by 2%, and the rates for females be reduced by 4%.

Results of analysis

8.6 Data is available to indicate that differences in rates of pensioner mortality exist between Scotland and England & Wales. However, primarily due to sparse data, it is unclear whether a similar differential would apply to currently employed teachers, and if so, the size of such differential. In the absence of any specific evidence which would suggest that the rates of mortality amongst active members in STPS would be significantly different to that of the corresponding members in TPS E&W, our recommended assumptions are aligned to the updated TPS E&W assumptions proposed for the 2016 valuation. This is the same approach as was taken for the 2012 valuation.

9 Promotional pay increases

This chapter sets out our recommendation for the assumed promotional pay increases of active members, and summarises the analysis undertaken in order to inform that recommendation.

Proposed assumption

9.1 We recommend no changes to the promotional pay increase assumptions.

Use of the assumption

9.2 For most members of the pre-2015 scheme benefits earned in that scheme are linked to pay at or near retirement. Members' pay can increase through a combination of general annual pay awards and promotional, or other increases, to pensionable pay. To calculate an estimate of the level of benefit payable in the future requires assumptions for both these components. The assumption for general pay awards is directed by HMT. The assumption for promotional pay increases is set by the Scottish Ministers.

9.3 It should be noted that the data available only allows analysis of non-general pay growth. The non-general pay growth relates to promotional pay growth and changes in non-basic pay i.e. pensionable allowances. It is possible that in a period of general pay restraint, such as the inter-valuation period, that increases in other elements of pay may not be representative of the level of increases in periods of more normal pay growth. For this reason care should be applied when considering if the evidence from recent periods would be equally applicable to periods with more 'normal' general pay policy.

9.4 Future pay progression will be more significant (in terms of expected pension) for those members with either full or tapered protection because they continue to have benefits linked to final pensionable pay for service beyond 31 March 2015.

Analysis and setting the assumption

9.5 To formulate a recommended assumption we compared the scheme experience to the assumption adopted for the 2012 valuation. This analysis has been carried by looking at the profile of the active membership as at 31 March 2016 in terms of average pensionable pay at each year of age and how this compares with the next year of age (a 'profile analysis').

9.6 This analysis considers the overall active membership as at 31 March 2016 and compares average (FTE[17]) pensionable pay at each year of age with that at other ages. This analysis illustrates how (average FTE) pay varies by age and may form a

[17] Full Time Equivalent

suitable means of setting an age related pay scale. For this analysis only pensionable pay at the valuation date is considered.

9.7 The analysis should be treated with some caution:

- The analysis is affected by the mixture of members at each age. For example, the group of members at, say, age 30 might better correspond to the members at age 31 with at least a year's service (i.e. those who were in service at age 30) than the full group at age 31
- There will be effects from members leaving and re-joining. For example, early retirement may lead the average salary of active members aged 55 and above to be lower than the average salary of younger members, as members with higher salaries are thought more likely to take early retirement.
- A restructuring of teaching posts in Scotland has been taking place during the period since the 2012 valuation could mean that the current salary profile of the scheme may not be representative of future valuation periods. For example, we are aware that over the inter-valuation period some scheme members retained entitlements to former higher rates of pay.

9.8 A starter/ender analysis may also be helpful when considering the assumption for non-general pay growth. This analysis considers only those members who were in active membership at both the 2012 and 2016 valuation dates and compares the increase in their pensionable pay (FTE) over the period (net of assumed general pay increases[18]) with that assumed. The rates of assumed increase being based on the members' ages over the intervaluation period and the 2012 valuation assumptions. This analysis can illustrate how actual promotional pay increases (or rather actual non-general increases) have impacted the rates of earnings of members remaining in service over the intervaluation period. Data limitations meant we were unable to undertake this type analysis.

Results of profile analysis

9.9 The charts below show the implied age related promotional pay scales for men and women respectively based on the pay profile of all members at the valuation date. These are compared with the assumed age related promotional scales adopted for the 2012 valuation.

[18] General pay increases have been assumed to be in line with stated government pay policy i.e. 0% for 2012-13 and 1% pa from 2013-16.

Chart 9.1: Males

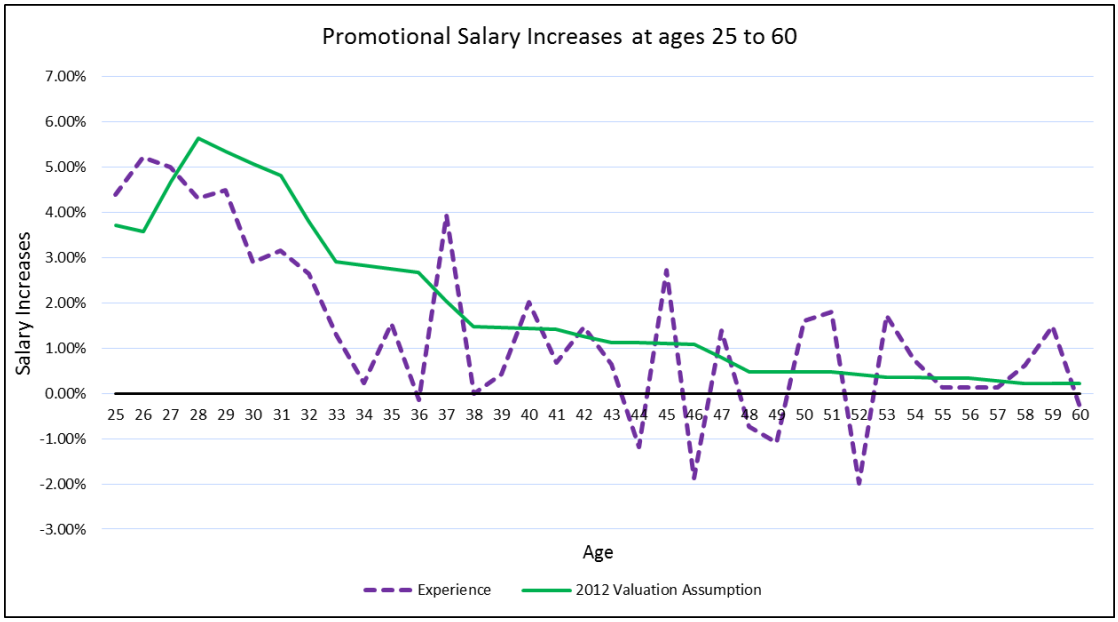
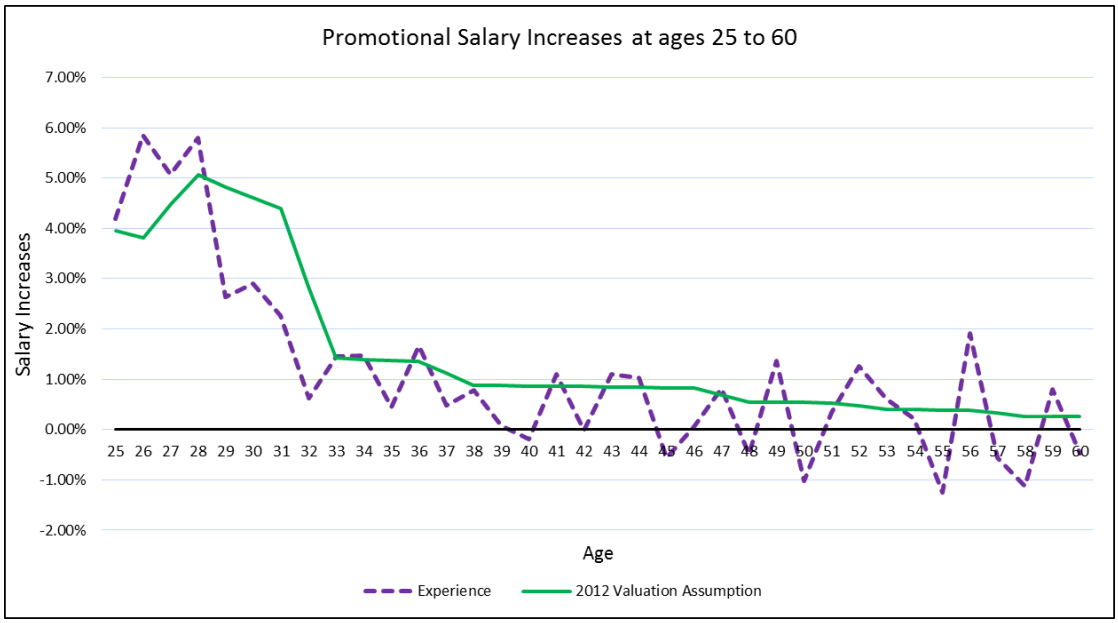


Chart 9.2: Females



Comments on the analysis

9.10 For both males and females we note the relatively close alignment between scheme experience, and the 2012 valuation promotional pay assumptions, in the charts above. We therefore suggest that the analysis broadly supports retaining the existing salary scales unchanged.

9.11 We do however recognise the charts above could present some evidence which might suggest that whilst the age distribution of promotional increases was broadly in line with expectations, the general level of the increases could have been lower than expected since the 2012 valuation. At this time, there is a reasonable level of uncertainty attached to the analysis that was possible. We therefore do not feel that there is sufficient evidence to allow us to make a recommendation of an alternative promotional scale which we believe would produce a material improvement to our calculations. However in light of this analysis, and following discussions with the STPS Scheme Advisory Board, we recommend that this assumption is revisited in detail ahead of the next actuarial valuation of the scheme.

9.12 The same promotional pay scales were adopted for the 2012 valuations of the STPS and the TPS E&W. Our recent analysis of the TPS E&W's experience also broadly supported the retention of the existing promotional scale, for use its 2016 valuation.

9.13 We note that whilst there are similarities between the profile of the teaching workforces in England & Wales and Scotland, there are also differences. For example, differences driven by different withdrawal and retirement patterns, and different underlying payscales. It would therefore not be unreasonable to adopt different promotional salary scales for each of the two schemes, if that is what was suggested by scheme experience. However at present, as outlined above, whilst there are indications of some differences between the two schemes, our analysis suggests that retaining the 2012 valuation assumption for both would not be unreasonable, on the basis of the analysis we have carried out on both schemes' recent experience.

9.14 We therefore recommend that the promotional pay increase assumption used in the 2012 valuation is retained for the STPS 2016 valuation.

10 Commutation of pension for cash at retirement

This chapter sets out our recommendation for the assumed level of pension commutation at retirement (where this is not specified in the HM Treasury valuation directions), and summarises the analysis undertaken in order to inform that recommendation.

Proposed assumptions for 2016 valuation

10.1 An assumption is required about the amount of pension commuted by members with NPA 60 service to increase their automatic entitlement to retirement lump sum. The assumption for NPA 65 service and 2015 scheme service is specified in the HM Treasury directions. Table 10.1 shows the recommended proportion of pension that members are assumed to commute (the assumptions for NPA 65 service and 2015 scheme service are included for completeness). The proposed assumptions are different to the 2012 assumptions. The NPA 60 assumptions are also different to those adopted by the TPS E&W for the 2016 valuation.

Table 10.1: Recommended commutation assumption for the 2016 valuation

	NPA 60 service	NPA 65 service*	2015 scheme service*
Males	10%	17.5%	17.5%
Females	10%	17.5%	17.5%

Use of the assumption

10.2 Members may commute part of their pension for a lump sum at a rate of £12 for each £1 of annual pension given up. The assumption is important because the value of the pension given up, as assessed using the actuarial assumptions underlying the valuation is, on average, more than £12 and so commutation has a significant impact on total liabilities and contribution rates. Differences between assumed and actual experience in the 2015 scheme will feed through into the cost cap fund but experience in the NPA 60 and NPA 65 sections of the existing scheme will not.

Analysis

10.3 Owing to data limitations it has not been possible to do a robust and fulldetailed analysis of recent commutation experience for NPA 60 retirements in the scheme, on individual member by member retirements data alone. Similar difficulties were encountered at the 2012 valuation of the scheme.

10.4 For the 2012 valuation of the STPS there was insufficient evidence to set an STPS-specific commutation assumption for NPA 60 members. As a result, the STPS assumptions for these members were aligned with the assumptions adopted for the Teachers' Pension Scheme in England and Wales. It was therefore assumed that 4% of female, and 5% of male, NPA 60 members' pensions would be commuted for lump sums at retirement.

10.5 However, with the data received, we were able to carry out a partial analysis which suggested that NPA 60 section members of the STPS may be commuting a larger proportion of their benefits than members of the TPS E&W.

10.6 The results of this partial analysis (which will includes are set out in the following table:

	Proportion of pension commuted in STPS (primarily NPA 60 section, but will include limited number of NPA 65 member retirements)				
	12/13	**13/14**	**14/15**	**15/16**	**Total**
Males	7.3%	9.2%	9.2%	9.9%	8.9%
Females	8.4%	10.1%	10.6%	10.7%	10.0%
Total	**8.0%**	**9.8%**	**10.2%**	**10.5%**	**9.6%**

10.7 The corresponding totals for the TPS E&W are 5.4% for males and 4.7% for females over the same period.

10.8 Although this analysis suggests that members of the STPS tend to commute a larger proportion of pension than under the existing assumption, we do not believe it is sufficiently robust to derive an STPS specific assumption in isolation.

10.9 Our concerns over the robustness of the data predominantly relate to:

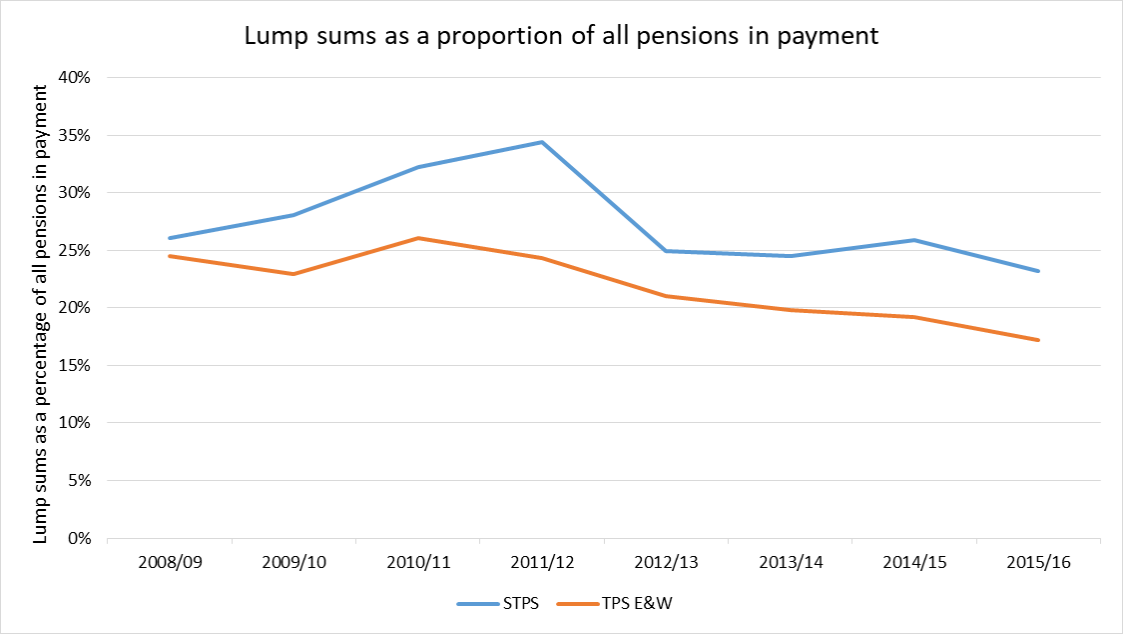
- Possible inconsistencies between years resulting from differences in the data submitted for each year;
- The inability to differentiate between members retiring in the NPA 60 and NPA 65 sections; and
- Some implausibly high and implausibly low implied commutation proportions.

Accounting information over the period 2008 to 2016

10.10 We have also carried out an analysis on some of the data included within the publically available STPS Annual Report and Accounts[19].

10.11 Our analysis considers lump sums paid from the scheme as a proportion of total pensions in payment. A higher number implies that commutation could be higher, as more lump sums are paid relative to pensions. However, a higher number could also be caused by other factors, such as a higher number of retirements relative to the number of pensioners. The results of our analysis are shown in the chart below.

[19] http://www.sppa.gov.uk/index.php?option=com_content&view=article&id=323&Itemid=840



10.12 Lump sums as a proportion of pensions in payment are consistently higher in the STPS than in the TPS E&W. A similar analysis of the NHS pension schemes in England & Wales, and in Scotland, did not show a similar significant difference between the two schemes. This is further evidence that current rates of commutation in STPS may be higher than under the existing assumption. However, as there could be other reasons for the discrepancy shown in the chart, we do not believe this analysis is suitable to set a robust assumption for the STPS, in isolation.

Additional information from SPPA

10.13 Following discussions between GAD, the STPS SAB and SPPA, SPPA were able to provide us with some additional information on the proportions of retiring members that commuted their STPS pension for a lump sum. This information was based on a random sample of members retiring on normal health grounds, comprising around a third of those retiring in each year. This additional information is shown in the table below:

Proportion of normal retirements from active status that commuted / did not commute

Sample year	Did Commute (%)	Did Not Commute (%)
2012-13	51.94%	48.06%
2013-14	54.42%	45.58%
2014-15	56.90%	43.10%
2015-16	53.07%	46.93%

Total (of sampled members)	54.13%	45.87%

10.14 This information is not ideal for setting an assumption as it does not provide information on the proportion of pension commuted by those who did commute, or commutation levels amongst members who retired on ill-health. It is also based on a sample group from the entire membership population of the scheme, so will include retirements from the NPA 65 and career average sections of the Scheme.

10.15 Despite these drawbacks, we would still expect the information provided to give a good indication of commutation proportions in the STPS.

10.16 Anecdotally, we have been told by the STPS SAB that members tend to either commute the maximum they are able to under HMRC rules, or not commute at all. This is consistent with our recent experience of analysing commutation data across a range of public service pension schemes. Under current HMRC pension tax rules, the maximum proportion of pension a NPA 60 member can commute for an additional lump sum is around 19.6% of their pension (after allowing for their automatic lump sum). If all members who commuted their pension in the data provided (54.13%) actually commuted the maximum allowable, then resulting commutation rate for NPA 60 members of the STPS would be around 10.6% (54.13% x 19.6% = 10.6%).

10.17 This is close to the results of the partial analysis on retirement data outlined above, and is a further indication that current rates of commutation may be higher in STPS, than under the existing assumption from the 2012 valuation. However, once again, given the uncertainties detailed above, we do not believe this data in isolation is robust enough to set an assumption.

Comments on the analysis

10.18 On the basis of the three different sources of evidence outlined above, GAD's recommendation is that the assumption for commutation rates in the NPA 60 section of the STPS should be derived directly from the evidence. This differs from our standard approach, which is to allow for around 50% of the difference in experience when setting new assumptions in order to avoid excess volatility resulting from short term effects. We believe this approach is appropriate in this case as the existing assumption was not based on an experience analysis of the STPS, but was aligned with the TPS in England and Wales.

10.19 Under this revised approach, our proposed assumption is that all NPA 60 section members commute 10% of their pension for an additional lump sum. This is broadly equivalent to assuming half of members commute the maximum amount allowable under HMRC rules, and half of members do not commute any pension. The proposed assumption is double the assumption adopted for the 2012 valuation for male members, and a little more than double for female members.

11 Family statistics

This chapter sets out our recommendation for the assumptions around dependants' pensions for current pensioners, and summarises the analysis undertaken in order to inform that recommendation.

Proposed assumptions for 2016 valuation

11.1 We recommend the following assumptions.

- 77% of men and 58% of women are assumed to be married or have a qualifying partner at retirement with consistent assumptions for current pensioners
- Men are assumed to be three years older than their partners and women are assumed to be two younger than their partners
- On the grounds of materiality, no allowance is made for remarriage.
- All dependants are assumed to be the opposite sex to the member.

11.2 This section refers to assumptions made for current pensioners. No robust analysis is possible for non-pensioner members and corresponding assumptions for proportions married are based on population statistics.

Previous valuation assumptions

11.3 The proportion married/partnered assumption is a change from the 2012 assumption (75% for men and 60% for women). The age difference assumption and the approach for remarriage are unchanged.

11.4 We do not expect a material impact on the valuation results from the changes made.

Use of the assumptions

11.5 Dependants' pensions[20] are provided on the death of a member. The scheme's benefit provisions for dependants differ according to when service is accrued. For pension in relation to service accrued on or after 1 April 2007 a pension is payable to qualifying partners as well as to legal spouses and civil partners. For pension in relation to pre-1 April 2007[21] service, only legal spouses and civil partners are eligible for a survivor's pension.

11.6 Where the member has no service on or after 1 April 2007, the spouse's pension will cease if the spouse remarries.

[20] Pensions are also payable to dependent children on a member's death but the costs are not material overall. No allowance is included for children pensions following pensioner deaths and an allowance is incorporated in the population proportions assumed for non-pensioner deaths.
[21] Only service after certain dates counts for dependants' pensions.

Analysis and approach to setting the assumptions

Proportions married/partnered

11.7 The same proportion married assumptions were adopted for the 2012 STPS valuation and the 2012 valuation of TPS E&W.

11.8 To formulate a recommended assumption we compared the overall scheme experience with the corresponding scheme experience in TPS E&W over the period April 2012 to March 2016. We also performed a full age and gender based analysis of the TPS E&W experience to compare that against expectations under the assumptions which was adopted at the 2012 valuation.

11.9 We analysed the proportion of deaths giving rise to the payment of a surviving spouse's or partner's pension. The majority of deaths observed relate to members with service before 1 April 2007 only and so would qualify for a pension to a legal spouse (or civil partner) and the analysis compared the aggregate experience with the assumption for proportions married (rather than partnered).

11.10 As there is no robust scheme specific experience of proportion partnered we recommend the same approach as adopted for the 2012 valuation is retained for this assumption. That approach relies on the differential between proportions married and proportions partnered in population statistics for England and Wales[22].

Results of analysis

11.11 Our analysis of the STPS experience is based on the three year period from 1 April 2012 to 31 March 2015. There was insufficient reliable data to analyse for the year 1 April 2015 to 31 March 2016. Our analysis indicated that approximately 35% of the member pensions that ceased resulted in the payment of a dependant's pension. A similar analysis of the TPS E&W experience over the four year period to 31 March 2016 indicated that approximately 37% of member pensions ceasing in that scheme resulted in the payment of a dependant's pension.

11.12 A full analysis of the TPS E&W experience by age and gender relative to expectations under the 2012 assumptions, indicated that there had been slightly more male members with dependants at death than expected (106% of expectation), and slightly fewer female members with dependants at death than expected (95% of expectation).

Comments on analysis

11.13 The STPS experience was too sparse to allow a full age and gender based analysis of the proportion of deaths giving rise to a surviving spouse or partner's pension or the age of dependants relative to members.

[22] published by the Office for National Statistics (ONS).

11.14 As the pensioner populations of both the STPS and TPS E&W are similar, in terms of age and gender distributions, it is reasonable to compare the overall proportion of members dying with dependants in each of the two schemes. We are not aware of any reason why the future proportion of deaths giving rise to a survivor's pensions in STPS would be significantly different to that of the corresponding members in TPS.

11.15 We recommend that on the basis of this analysis the assumption adopted for the STPS 2016 valuation remain aligned with that proposed for the 2016 TPS E&W valuation.

11.16 The proportion married assumptions proposed for the TPS E&W 2016 valuation have been updated to reflect the experience of that scheme. The proposed male assumption is 2% higher than that adopted for the 2012 valuation, and the female assumption is 2% lower.

Age difference between member and spouse

11.17 STPS data on the age differences between members and their partners was too sparse for a full analysis. However there was no evidence from the data that was available that these age differences were materially different from the gaps assumed at the 2012 valuation.

11.18 A full analysis of experience was carried out for TPS E&W. On the basis of that analysis we recommended that no change be made since from that adopted for the 2012 valuation. We have no reason to expect that family circumstances in the STPS should be substantially different to those in the TPS. We recommend that the STPS assumption remains aligned with the proposed TPS E&W assumption and unchanged from 2012.

Appendix A: Details of assumptions

This appendix contains details of the recommended assumptions including sample rates and values.

Pensioner mortality

Table A1: Baseline mortality assumptions

	2016 valuation	2012 valuation
Baseline mortality	**Standard table[23] and adjustments**	
Males		
Retirements in normal health	119% of S2NMA_L	120% of S1NMA_L
Current ill-health pensioners	Age-dependent assumption: ≤75: 79% of S2IMA with underpin of 134% of S2NMA >75: 134% of S2NMA	Age-dependent assumption: ≤71: 73% of S1IMA >71: 128% of S1NMA
Future ill-health pensioners	100% of S2IMA	100% of S1IMA
Dependants	135% of S2NMA	122% of S1NMA
Females		
Retirements in normal health	Age-dependant adjustments to S1NFA_L: ≤79: 84%, 80-84: 97% 85-89: 113%, ≥90: 122%	Age-dependant adjustments to S1NFA_L: ≤79: 83%, 80-84: 95% 85-89: 110%, ≥90: 119%
Current ill-health pensioners	Age-dependent assumption: ≤75: 96% of S2IFA with underpin of 128% of S2NFA >75: 128% of S2NFA	Age-dependent assumption: ≤71: 100% of S1IFA >71: 123% of S1NFA
Future ill-health pensioners	100% of S2IFA	100% of S1IFA
Dependants	107% of S2DFA	99% of S1DFA

As specified by HM Treasury, future improvements in mortality will be assumed to be in line with those underlying the ONS 2016-based population projections.

[23] SAPS (S2) tables are published by the Actuarial Profession and based on the experience of self-administered pension schemes over the period 2004 to 2011. The 'S2' series has separate standard tables based on experience of members retiring in normal health (S2NXA and a low mortality variant S2NXA_L) and in ill health (S2IXA) and for female dependants (S2DFA). There is no low mortality variant for female pensioners and so the previous S1 table is used for female normal health pensioners. The S3 series of tables were released by CMI in October 2018, these updated mortality tables cover experience between 2009 and 2016. GAD have concluded that moving to the S3 tables would have no material impact on either our analysis of mortality or the valuation results as a whole. It therefore remains appropriate to use the S2 tables for the current valuation although we would expect to transition to the S3 tables for future if this is appropriate.

Age retirement from service

Table A2: Age retirement rates (members with full protection)

Age	NPA 60		NPA 65	
	Males	Females	Males	Females
55	0.08	0.05	-	-
56	0.08	0.06	-	-
57	0.11	0.09	-	-
58	0.14	0.12	-	-
59	0.16	0.14	-	-
60	0.42	0.48	0.08	0.05
61	0.40	0.49	0.08	0.06
62	0.34	0.39	0.11	0.09
63	0.32	0.31	0.14	0.12
64	0.39	0.35	0.16	0.14
65	0.70	0.56	1.00	1.00
66	0.60	0.57	1.00	1.00
67	0.67	0.62	1.00	1.00
68	0.67	0.62	1.00	1.00
69	0.67	0.62	1.00	1.00
70	1.00	1.00	1.00	1.00

Table A3: Age retirement rates (new entrants to the 2015 scheme)

Age	SPA 65		SPA 66		SPA 67		SPA 68	
	Males	Females	Males	Females	Males	Females	Males	Females
55	-	-	-	-	-	-	-	-
56	-	-	-	-	-	-	-	-
57	-	-	-	-	-	-	-	-
58	-	-	-	-	-	-	-	-
59	-	-	-	-	-	-	-	-
60	0.08	0.05	0.08	0.05	0.08	0.05	0.08	0.05
61	0.08	0.06	0.08	0.06	0.08	0.06	0.08	0.06
62	0.11	0.09	0.11	0.09	0.11	0.09	0.11	0.09
63	0.14	0.12	0.14	0.12	0.14	0.12	0.14	0.12
64	0.16	0.14	0.16	0.14	0.16	0.14	0.16	0.14
65	1.00	1.00	0.50	0.50	0.33	0.33	0.25	0.25
66	1.00	1.00	1.00	1.00	0.50	0.50	0.33	0.33
67	1.00	1.00	1.00	1.00	1.00	1.00	0.50	0.50
68	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table A4: Age retirement rates (members with service in NPA 60 and 2015 schemes)

Age	SPA 67		SPA 68	
	Males	Females	Males	Females
55	0.06	0.04	0.02	0.01
56	0.06	0.05	0.02	0.02
57	0.08	0.07	0.03	0.02
58	0.11	0.10	0.03	0.03
59	0.12	0.11	0.04	0.04
60	0.34	0.39	0.16	0.16
61	0.33	0.40	0.16	0.17
62	0.29	0.32	0.16	0.16
63	0.28	0.27	0.18	0.17
64	0.34	0.30	0.22	0.19
65	0.60	0.49	0.36	0.33
66	0.54	0.52	0.40	0.39
67	0.63	0.59	0.54	0.53
68	0.74	0.70	0.92	0.90
69	0.74	0.70	0.92	0.90
70	1.00	1.00	1.00	1.00

Table A5: Age retirement rates (members with service in NPA 65 and 2015 schemes)

Age	SPA 65		SPA 66		SPA 67		SPA 68	
	Males	Females	Males	Females	Males	Females	Males	Females
55	-	-	-	-	-	-	-	-
56	-	-	-	-	-	-	-	-
57	-	-	-	-	-	-	-	-
58	-	-	-	-	-	-	-	-
59	-	-	-	-	-	-	-	-
60	0.08	0.05	0.08	0.05	0.08	0.05	0.08	0.05
61	0.08	0.06	0.08	0.06	0.08	0.06	0.08	0.06
62	0.11	0.09	0.11	0.09	0.11	0.09	0.11	0.09
63	0.14	0.12	0.14	0.12	0.14	0.12	0.14	0.12
64	0.16	0.14	0.16	0.14	0.16	0.14	0.16	0.14
65	1.00	1.00	1.00	1.00	0.76	0.76	0.41	0.41
66	1.00	1.00	1.00	1.00	0.78	0.78	0.48	0.48
67	1.00	1.00	1.00	1.00	1.00	1.00	0.61	0.61
68	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Although there has been no change to the assumptions, rates in Tables A2 to A5 differ from the equivalent tables in the 2012 report because they have been presented using a different age definition.

Ill-health retirement from service

Table A6: Ill-health retirement rates for all members

Age	Males	Females
20	-	-
25	0.0000	0.0000
30	0.0000	0.0001
35	0.0001	0.0002
40	0.0003	0.0003
45	0.0008	0.0008
50	0.0022	0.0020
55	0.0039	0.0039
60	0.0056	0.0059
65*	0.0069	0.0079

*Rates are zero if above the NPA of the relevant section

In all scheme sections, 55% of ill-health retirements are assumed to qualify for upper tier awards.

Voluntary withdrawal from service

Table A7: Withdrawal rates (net of re-entry within 5 years) for all members

Age	Males	Females
20	0.064	0.041
25	0.052	0.037
30	0.018	0.015
35	0.016	0.010
40	0.013	0.009
45	0.013	0.009
50	0.014	0.011
55	0.014	0.012
60	0.014	0.012
65*	0.014	0.013

*Rates are zero if above the NPA of the relevant section

Death before retirement

Table A8: Death before retirement rates for all members

Age	Males	Females
20	0.0001	0.0000
25	0.0001	0.0001
30	0.0002	0.0001
35	0.0003	0.0002
40	0.0004	0.0003
45	0.0006	0.0004
50	0.0008	0.0006
55	0.0014	0.0009
60	0.0023	0.0012
65	0.0036	0.0017

Promotional pay increases

Table A9: Promotional salary scales for all members

Age	Males	Females
20	89	89
25	100	100
30	125	124
35	151	143
40	168	152
45	179	158
50	186	164
55	190	168
60	192	170
65	194	172

Commutation of pension for cash at retirement

Table A10: Recommended commutation assumptions for the 2016 valuation

	NPA 60 service	NPA 65 service*	2015 scheme service*
Males	10%	17.5%	17.5%
Females	10%	17.5%	17.5%

*Specified by HMT Directions

Family statistics

Table A11: Proportion married or partnered at retirement for future pensioners

	Accrual before 1/1/2007	Accrual on or after 1/1/2007
	Proportion married	Proportion married or partnered
Males	77%	77%
Females	58%	58%

Table A12: Proportion married or partnered for current pensioners (at the valuation date)

Age	Accrual before 1/1/2007		Accrual on or after 1/1/2007	
	Males	Females	Males	Females
50	74%	58%	78%	60%
60	74%	58%	78%	60%
70	74%	46%	76%	47%
80	61%	23%	62%	23%
90	35%	7%	35%	7%

Dependants are assumed to be of the opposite gender as the member.

Men are assumed to be three years older than their partners and women are assumed to be two years younger than their partners.

No allowance is made for pensions to cease on remarriage.

Appendix B: Modelling approach and minor assumptions

Active membership projections

B.1 Direction 11[24] requires the actuary to use the 'projected unit methodology' to calculate the valuation results. The valuation results require the calculation of the cost of benefit accrual over periods after the effective date (31 March 2016). The expected cost of benefits provided to members remaining in the pre-2015 scheme under the provisions of transitional protection differs from the expected cost of providing members with benefits in the 2015 scheme. Further the expected cost of providing benefits varies for members with differing benefit provisions within the pre-2015 scheme (notably for members with differing normal pension ages). This implicitly requires the actuary to estimate the membership to future dates in order to determine the valuation results.

B.2 Since the majority of members (around 80%) were accruing benefits in the 2015 scheme at the effective date, and further given that the remaining members continuing to accrue benefits in the pre-2015 scheme are expected to rapidly decline to close to nil over the future periods being considered in this valuation, a pragmatic approach to estimating the future membership of each section/scheme over the relevant future periods is suitable.

B.3 The approach taken has 3 component assumptions:

- Members of the pre-2015 sections at the valuation date are assumed to retire in line with recent experience. This provides for some protected members to remain in the scheme beyond 2022 due to late retirement
- The overall profile of the membership in terms of average age and pay distribution is assumed to remain constant over the period

These assumptions enable the average cost of accrual based on the proportions of members in each section/scheme in any period to be determined.

- The overall active membership will be in receipt of pensionable pay for each relevant year equal to that assumed for forecasting purposes.

This assumption is required only to determine any contributions required for past service adjustments.

[24] The Public Service Pensions (Valuations and Employer Cost Cap) Directions 2014 (as amended).

Grouping of individual active member records

B.4 Individual active members have been grouped together for the purposes of calculating liabilities. This grouping is necessary to accommodate the volume of data within our valuation system. The approach taken to grouping the data has been tested to ensure it does not result in any distortion of the valuation results. The groupings are made for each section/scheme (i.e. NPA 60, NPA 65 or 2015), protection status (i.e. protected, tapered or unprotected) and based on the following criteria.

Age	*Age nearest*
Service	*Duration (years nearest)*

Accrual cost methodology

B.5 When determining the costs of accrual as required by Directions 27(1)(d) and 40(1) the cost for members in each group at each relevant date (as identified from the membership projections) has been determined for each age and that rate has been applied to the total pensionable pay at each age to determine the average for the membership as a whole at each date. The cost over each relevant period has been taken as the average of the cost at the start and end of each period. The calculation allows for mortality improvements assuming the calculation date is the midpoint of each period.

B.6 Direction 11 requires use of the projected unit methodology to determine the valuation results. Directions 14, 16 and 17 specify some modifications to the financial assumptions in the short term. An implication of the short term modifications is that the projected unit methodology is expected to result in an increasing standard contribution rate over successive periods. For example the cost of accrual under the existing scheme over the period 2016 - 2019 is lower than that over the period 2019 - 2023 (ignoring any redistribution of members between sections and into the 2015 scheme). This effect is not immaterial for final salary benefits but has no effect on the cost cap future service cost calculation since short term assumptions are explicitly disregarded for this purpose in Direction 40.

B.7 Non-accruing benefits such as lump sums payable on death in service have been recognised only when a benefit payment is expected.

Guaranteed Minimum Pensions (GMPs)

B.8 A global adjustment will be applied to reduce the past service liability in respect of estimated GMP entitlements for which provision of post SPA pension increases is not currently the responsibility of the scheme. The reduction is equivalent to a contribution rate of 0.8% of pay over the 15 year period from the implementation date. This estimation has no impact on the calculation of the employer contribution correction cost.

Public Service Transfer Club (PSTC)

B.9 Allowance has been made for the potential additional liabilities arising from inward transfers on PSTC terms. The financial impact is expected to be 0.6% of Pensionable Pay.

Final pensionable pay

B.10 All liabilities have been based on pensionable pay at the effective date as provided by SPPA. No explicit allowance has been made for the impact of prior years' earnings resulting in higher final pensionable pay for particular members since this effect is not expected to impact a material number of members.

Dependants' pensions

B.11 No allowance has been taken for short term dependant pensions or children's pensions (other than those already in payment), on ground of immateriality.

Expenses

B.12 No allowance has been made for expenses. Expenses are outside the valuation framework.

Early retirement factors

B.13 When modelling retirement before Normal Pension Age where an actuarial reduction would be applied early retirement factors have been set equal to current factors (applied for the appropriate period before the normal pension age).

Deferred members over NPA

B.14 Many of the records for deferred members aged over NPA are expected to relate to benefits which are unlikely to be claimed (e.g. partial refund cases or where preserved records have been incorrectly maintained after benefits have been put into payment). For this reason, and in agreement with SPPA, we have assumed that only half of these members will ultimately claim their benefits. This approach is equivalent to a reduction in the contribution rate of 0.4% of pay over the 15 year period from the implementation date.

Re-entry of members

B.15 Re-entry of members to pensionable service has been modelled by the use of a 'net' withdrawal assumption for active members. This explicitly allows for a proportion of those leaving active service to return. No explicit allowance has been made in the valuation for a proportion of those deferred at the effective date to subsequently rejoin. However the analysis undertaken for active members, and the resultant 'net' withdrawal rates include those rejoining from deferred status and hence the valuation of active members implicitly includes some provision for deferred members to return.

Additional voluntary contributions

B.16 Additional voluntary contributions paid to on a money purchase basis are paid in accordance with Regulations which are separate to the pension scheme regulations and have not been considered for the valuation. Additional voluntary contributions paid in accordance with the pension scheme regulations to secure added service or pension are taken into account as liabilities of the scheme.

Scheme pays

B.17 Members can opt to use the scheme pays facility to pay HMRC for an annual allowance or lifetime allowance tax charge (i.e. the scheme pays the tax charge on behalf of the member for a corresponding reduction to the member's pension). Where members have opted to use this facility a lower liability has been valued for these members, to reflect a scheme pays pension debit. The notional fund allows for actual cash flows and reflects any tax charges paid by the scheme, therefore a corresponding lower notional fund has been valued. The impact of these will broadly net off for valuation purposes.

Member contribution yield over implementation period

B.18 The latest STPS Annual Report and Accounts shows that the member contributions received by the scheme have averaged around 9.5% of pensionable pay across all members of the scheme. This is 0.1% of pensionable pay less than the target yield of 9.6% of pay. The member contribution rate tier thresholds are increased annually in line with the Consumer Price Index, however without additional changes to the member contribution rate structure, the underyield of 0.1% of pay is expected to persist throughout the valuation implementation period. Following discussions at the STPS Scheme Advisory Board, SPPA have instructed us to adopt an assumption that member contributions yield an average of 9.5% of pensionable pay throughout the implementation period.

Appendix C: Assumptions made for data uncertainties

Summary

C.1 Whilst comprehensive data was received from SPPA for the 2016 valuation, some aspects of the data were incomplete and/or unreliable for certain elements of our valuation calculations.

C.2 It has not been possible to fully resolve these data issues in the timescale required for the valuation. Therefore to calculate results for the 2016 valuation of the Scheme requires assumptions in respect of incomplete and/or unreliable individual member records and movements data, the latter is used for setting assumptions and in the calculation of the Net Leavers Liability.

C.3 Scheme specific assumptions are determined by the "responsible authority", which is the Scottish Ministers in the case of the Scheme, and must be set as best estimate assumptions and not include margins for prudence or optimism.

Individual member records

C.4 Membership data is provided by SPPA for the purpose of the 2016 valuation and we apply checks to these membership records to ensure all key data items are provided and reliable for valuation purposes. Following these checks, it was identified that individual member records at the relevant dates as required for valuation purposes were not fully complete and reliable. We worked with SPPA to address a number of these issues, however where critical data items were missing from member records the general approach taken was to exclude that record for calculation purposes with calculations based on the remaining dataset being rated up incorporate an allowance for the excluded records.

C.5 Uprating factors were determined for each membership category equal to the ratio of known valid records and the number of records with adequate data. Implicitly this uprating approach assumes that the records with omissions or errors have the same average profile (age, sex, pay, service) as fully complete records. Some 3% of records were excluded from the 2016 valuation data and around 1% of the data provided for the purposes of setting the initial cost cap fund. As relatively few records were ultimately excluded and rated up as a result of our data checks, risks related to the use of this estimation approach are not expected to be a material source of uncertainty on the overall results of the STPS valuation.

C.6 A critical uncertainty in the context of the STPS valuation is the reliability of the data used for the assessment, and the validity of the adjustments that have been made to the data. Full details of the checks and adjustments applied to the membership data are described in Appendix E of our Data report. Of particular note are the adjustments that have been required to members Reckonable Service, which have a direct impact on the assessed liabilities of the scheme in the valuation, and identified inconsistencies between datasets at different dates. Whilst it has been possible to reconcile the liabilities of the scheme between the 2012 and 2016 valuations, this relies upon an estimate of scheme experience over the period, which is itself made challenging by limitations of the movements data provided for the valuation.

C.7 Whilst it is difficult to precisely quantify the level of uncertainty which relates to issues and uncertainty with the membership data, and our ability to reconcile liabilities between valuations, we believe this may be of the order of 1% of pensionable pay on the uncorrected employer contribution rate, and ½% of pensionable pay on the employer contribution correction cost.

C.8 The figures above illustrate the potential impact if known data omissions are subsequently found to have been handled incorrectly. Since it is not possible to undertake independent checks for all categories of members and a full reconciliation has not been achieved against all prior datasets there is the potential for currently unidentified problems with the data to emerge in future. For example a group of deferred members could be identified where no liability has previously been determined. The impact of such unknowns emerging at subsequent valuations could be considerably more than the sensitivity indicated above.

Movements data

Setting assumptions

C.9 SPPA supplied data on the experience of the scheme membership over the four-year period to 31 March 2016. Fully complete and comprehensive data about members moving status between certain dates (e.g. leaving active status due to death or retirement) was not able to be provided. Analysis of member movements is needed to inform scheme specific demographic assumptions as scheme-specific experience, both recent and longer term, generally provides the most reliable evidence when considering best estimates of future experience.

C.10 Assumption setting relies on analysis of movements data in consideration with such other relevant information which is available. The setting of demographic assumptions is to some extent subjective and a matter of interpretation. Changes in assumptions may be expected at successive valuations as circumstances change even with full data. Thus the absence of fully complete movements data does not necessarily introduce uncertainty into the valuation results provided there is other relevant information available to inform those assumptions. It is to be expected that there is some volatility in the experience arising from an analysis of movements data. As assumptions are intended to reflect long term expectations it is reasonable to seek to smooth out the impact of these short term effects. Typically, recommendations we make for scheme-specific valuation assumptions smooth out the short term effects by taking only 50% of the difference in experience since the 2012 valuation, for example in recommending the underlying assumption for baseline pensioner mortality (based on the experience of the TPS E&W scheme, uplifted to reflect population differences).

C.11 It should however be recognised that should movements data become available for future valuations it could result in recommendations regarding appropriate assumptions which lead to greater changes in valuation results than otherwise. It is difficult to quantify the potential scale of this discontinuity but it could be over +/-1% of pensionable pay on the employer contribution rates. For example, if the number of pensioner deaths assumed when setting assumptions for the 2016 valuation was subsequently found to be materially under or overstated relative to data available at a subsequent valuation, this could have an impact on the mortality assumptions adopted and potentially lead to a large change in the assumption at future valuations and hence result in a large corresponding change in liability and employer cost.

Net Leavers Liability (NLL)

C.12 The initial cost cap fund is set equal to the liability for actives members at 31 March 2015. The cost cap mechanism is intended to manage the costs of the reformed scheme and recognise any unexpected experience relating to pre-reformed entitlements of members in service at 1 April 2015, but only to the point at which they leave active service. NLL is a quantification of the amount of pre-reformed liabilities which fall out of the cost cap fund at a valuation owing to members which have left service since the previous valuation (or since the initial cost cap fund was set in the case of the 2016 valuation), net of the additional liabilities in respect of members with pre-reformed service who rejoined active membership during 2015-16.

C.13 To accurately calculate NLL in accordance with the directions requires full movement data for all members who were active in 2015 and are no longer active at the 2016 valuation. The data available was not suitable for calculating NLL and it was not possible to make assumptions to adjust the data available to provide for a reasonable estimate of NLL to be calculated.

C.14 For the purposes of determining the 2016 valuation results, we have adopted an approach which implicitly makes an assumption that there is no unidentified experience gain or loss arising over the period 2015 to 2016. A risk of this approach is that any upward or downward cost pressure that has occurred over the period but has not been explicitly identified will not be reflected in the 2016 valuation results.

C.15 Under this approach the NLL is set in order that the change in the Cost Cap liabilities can be fully reconciled against the known impact of changes in assumptions, and changes noted from identified experience of the scheme. For STPS the calculated NLL appeared significantly out of line with the proportionate size of the NLL for other similar schemes. We believe this may be a reflection of inconsistencies between the 2015 and 2016 active datasets.

C.16 An alternative approach would be to estimate the NLL directly. That approach may be viewed as preferable if it is believed that uncertainties in estimating the impact of experience, and assumption, changes on the cost cap assessment are larger than the uncertainty associated with the underlying membership data and direct estimation of the NLL. For STPS we do not believe that that is the case.

C.17 Our Data report sets out the various adjustments that have been required to be made to the underlying data, and the associated uncertainty linked to estimating the NLL. This suggests a combined level of uncertainty which may be of the order of 0.5% of pensionable pay of the employer contribution correction cost.

C.18 We would not expect significant unidentified experience gains or losses to arise over the one year period 2015 to 2016, although uncertainty remains, particularly in respect of potential inconsistencies in data over 2015-16. In addition we have reconciled the surplus or deficit arising over the period 2012-16 with an unexplained item of £0.1 billion. However we note that that reconciliation is reliant on the estimation of promotional salary experience over the period, which is itself subject to some uncertainty given the limitations of the movements data provided to us.

C.19 For the 2016 valuation, the NLL calculation period is only one year, rather than a full four-year valuation. Given the short period over which any gain or loss may have arisen it might reasonably be concluded that the lack of data for the NLL calculation is not critical for this valuation although it would become so in future valuations when a longer period is considered.

Appendix D: Sensitivity of valuation results to Scottish Ministers set assumptions

D.1 The table below provides an indication of the sensitivity of the valuation results to the particular assumptions under consideration. This table is taken from our report on the results of the valuation of the STPS as at 31 March 2016 and the figures quoted are with reference to the 2016 valuation results. Initial discussions with the STPS SAB were conducted using figures quoted in the equivalent 2012 report, and were with reference to the 2012 valuation results.

Sensitivity of valuation results to Scottish Ministers set assumptions	**Combined addition to uncorrected employer contribution rate[25]**	**Addition to employer contribution correction cost**
(i) **Membership profile***: 2 years older on average over implementation period	0.6%	0.6%
(ii) **Mortality rates***:		
(a) pensioners subject to mortality rates 5% heavier than assumed[26]	(0.9)%	(0.4)%
(iii) **Age retirement rates*** members without full protection to retire (on average) one year later than currently assumed	0.1%	0.1%
(iv) **Commutation*** (other than as directed)**:** all eligible members of the NPA 60 section commute 2% of pension more than assumed	(0.3)%	(0.3)%
(v) **Ill health retirements***		
(a) Rate of ill-health retirements: 5% higher numbers of members assumed to retire on ill health grounds than currently assumed	Nil	Nil
(b) Severity of ill health retirements: 5% more members assumed to receive upper tier benefits than currently assumed	Nil	Nil
(vi) **Members' dependants***		
(a) proportions partnered: 5% more members assumed to have qualifying partners at death	0.2%	0.2%

[25] Combined effect of additions for past service, underpayment of contributions over 2012-15 (not shown separately) and future accrual.
[26] Broadly speaking this is equivalent to assuming members spend 0.5 years less in retirement.

	Combined addition to uncorrected employer contribution rate[25]	Addition to employer contribution correction cost
(vii) **Withdrawal***: 5% higher numbers assumed to leave voluntarily before retirement (net of rejoiners)	(0.1)%	(0.1)%
(viii) **Promotional pay increases***: promotional pay increases 0.5% per annum higher on average than assumed	1.2%	1.1%

* Opposite changes in the assumptions will produce approximately equal and opposite changes in the valuation results.

D.2 In each variant of the above table the sensitivity shown is in relation only to the change in assumption described. The impact of a combination of assumption changes will not necessarily equate to the sum of the relevant rows above.