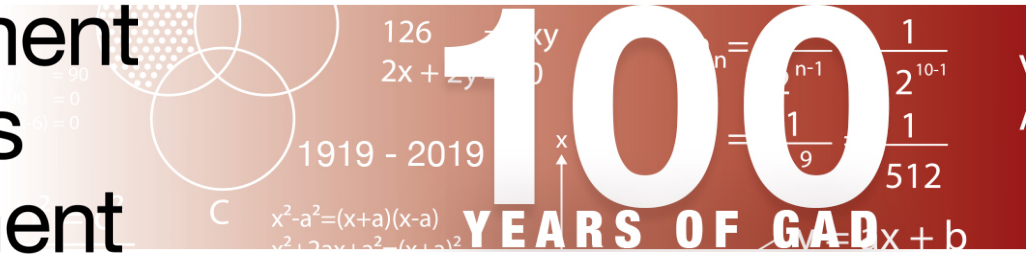
Government Actuary's Department



Civil Service Pension Schemes

Actuarial valuation as at 31 March 2016
Advice on assumptions

Date: 26 February 2019

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Contents

1 Executive summary

This report contains our recommendations for the best estimate assumptions to be set by the Minister for the Civil Service for the 2016 valuation of the Civil Service Pension Schemes.

1.1 An actuarial valuation of the Civil Service Pension Schemes[1], 'the Schemes', 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 the Minister for the Civil Service (the 'Minister'), having obtained advice from the scheme actuary. Direction 19(c) requires the assumptions to be the Minister's best estimates.

1.2 GAD is the appointed scheme actuary to the Schemes. This report sets out GAD's formal advice to the Minister on the actuarial assumptions to be adopted where these are not otherwise specified. The advice covers the assumptions to be set by the Minister. The main advised assumptions are summarised in Table 1 and further detail in Appendix A. This report was provided to the Minister in draft form in July 2017. The Minister consulted with the Civil Service Pension Scheme SAB ('SAB') in accordance with direction 19(b) and based on the draft report. No substantive changes have been made. It has been signed alongside the formal valuation report. The Minister has 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.

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 determining 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 The previous actuarial valuation of the Civil Service Pension Schemes 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:

- Reduced life expectancy for female pensioners (combined normal and ill-health)
- Reduced life expectancy for female dependants

[1] As provided under the rules of the Principal Civil Service Pension Scheme (established and governed by Section 2 (11) of the Superannuation Act 1972) and The Public Service (Civil Servants and Others) Pensions Regulations 2014 (SI 2014/1964, as amended)

[2] Certain assumptions are specified in the Directions

1.5 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 the valuation results. They also contain important background information about the context of this advice and its limitations.

1.6 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. There was insufficient data to undertake an analysis of male dependants' mortality. It was also not possible to separate out redundancies from the retirement and withdrawal data, and so a credible analysis of normal retirement rates and withdrawal rates could not be carried out. These omissions are not expected to be material to the valuation results.

1.7 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.

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

Assumption	Summary of recommended assumptions	Rationale for recommendation	Approximate impact of change from 2012 valuation assumptions	
			Past Service	SCR (2019-23)
Pensioner baseline mortality[3]	Aligned to standard SAPS table[4,5]			
Normal health	104% x S2NXA	In light of 2007-2016 experience*		
Ill-health (current)	104% x S2NXA	In light of 2007-2016 experience*	(£1bn)[6]	(0.1%)[6]
Ill-health (future)	104% x S2NXA	In light of 2007-2016 experience*		
Dependants	117% x S2NMA (M) 100% x S2DFA (F)	Member assumption plus margin In light of 2007-2016 experience*		

[3] HM Treasury has indicated that future improvements in mortality will be assumed to be in line with those underlying the most recent ONS population projections.
[4] SAPS tables are published by the UK Actuarial Profession and are 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), in ill-health (S2IXA) and for female dependants (S2DFA).
[5] 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.
[6] Aggregate change in baseline mortality only. Excludes any impact from the change in assumed future mortality improvements

Assumption	Summary of recommended assumptions	Rationale for recommendation	Approximate impact of change from 2012 valuation assumptions	
			Past Service	SCR (2019-23)
Age retirement				
Final Salary sections protected	Retirements spread between age 60 and 70 (inclusive). Early retirement included within the withdrawal assumption.	Unchanged from 2012 due to experience data potentially distorted by redundancies so not suitable as a guide to the future.	No change in assumptions	
Final Salary unprotected and tapered	Retirements spread between age 60 and SPA	Unchanged from 2012 due to lack of scheme experience on which to amend this assumption	No change in assumptions	
Nuvos protected	Retirements assumed to be at age 65	Unchanged from 2012 due to experience data potentially distorted by redundancies so not suitable as a guide to the future	No change in assumptions	
Nuvos unprotected and tapered	Retirements spread between age 65 and SPA	Unchanged from 2012 due to lack of scheme experience on which to amend this assumption	No change in assumptions	
New entrants from 2015	Retirements spread between age 60 and SPA	Unchanged from 2012 due to lack of scheme experience on which to amend this assumption	No change in assumptions	

Assumption	Summary of recommended assumptions	Rationale for recommendation	Approximate impact of change from 2012 valuation assumptions	
			Past Service	SCR (2019-23)
Ill-health retirement				
Incidence	Increasing by age, around 0.1% pa at age 45 increasing to around 0.6% pa at age 60	In light of 2007-2016 experience*	Immaterial	Immaterial
Upper/lower tier split	42% (M), 67% (F) on upper tier	Unchanged as 2007-2016 experience only slightly different from current assumption*	No change in assumptions	
Withdrawal	Withdrawals are net of re-entry and include allowance for early retirement. Varies significantly across salary bands	No change. 2012-16 experience distorted by redundancy exercises so not suitable as a guide to the future	No change in assumptions	
Death before retirement	Increasing by age, around 0.3% (M) and 0.2% (F) pa close to age 60	In light of 2007-2016 experience*	Immaterial	Immaterial
Promotional salary scale	Salary scales different for males and females and varies by salary bands.	No change. No clear evidence that the existing scales are no longer appropriate	No change in assumptions	

Assumption	Summary of recommended assumptions	Rationale for recommendation	Approximate impact of change from 2012 valuation assumptions	
			Past Service	SCR (2019-23)
Commutation				
Classic members	5.4% of pension commuted	In light of 2007-2016 experience*	(£0.1bn)	Immaterial
Family statistics				
Proportion married/partnered	68% (M), 50% (F) at retirement for Classic 73% (M), 50% (F) at retirement for non-Classic (consistent assumptions for existing pensioners)	In light of 2007-2016 experience*	Immaterial	Immaterial
Age difference	Male member 3 years older than partner Female 2 years younger than partner	No change In light of 2012-2016 experience[12]	No change in assumptions	
Remarriage	No allowance	Simplification on grounds of materiality	No change in assumptions	

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

2 Introduction

This report contains our advice to the Minister for the Civil Service but will be of interest to other parties who should note the limitations.

2.1 An actuarial valuation of the Civil Service Pension Schemes (CSPS or the 'Schemes') is being undertaken as at 31 March 2016. The Directions require that, unless specified otherwise[7], the actuarial assumptions to be adopted for this valuation are the responsibility of the Minister, having obtained advice from the scheme actuary. Direction 19(c) requires the assumptions to be the Minister's best estimates.

2.2 GAD is the appointed scheme actuary to the Schemes. This report is addressed to the Minister 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 Minister to determine the required best estimate assumptions.

2.3 The advice covers the main assumptions to be set by the Minister. 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 sets out assumptions made for data uncertainties and Appendix C sets out assumptions made for data uncertainties.

2.4 Other assumptions are required to complete the valuation calculations, e.g. projection of the membership over the implementation period. We will provide separate advice on additional assumptions as required.

2.5 This report was provided to the Minister in draft form in July 2017. The Minister consulted with the SAB in accordance with direction 19(b) and based on the draft report. No substantive changes have been made. It has been signed alongside the formal valuation report. The Minister has 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.

[7] Certain assumptions are specified in the Directions

2.6 MyCSP, the Scheme's administrator, 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, *CSPS Actuarial Valuation at 31 March 2016: Report on valuation 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 determining 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. The Minister should consider whether there is any reason why the conclusions reached would be inappropriate.

2.8 We are content for the Minister 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.

2.9 Third parties whose interests may differ from those of the Minister should be encouraged to seek their own actuarial advice where appropriate. Other than the Minister, 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 chapter.

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 Minister's '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 Regulation 158 of The Public Service (Civil Servants and Others) Pensions Regulations 2014 (SI 2014/1964) (as amended) requires this actuarial valuation to cover both the scheme established under the Public Services Pensions Act 2013[8] ('2015 Scheme') and the Principal Civil Service Pension Scheme[9] ('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***[10]. This requires assumptions about anticipated member behaviour and characteristics during 2019 to 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' behaviours are expected to be heavily influenced by the provisions of the 2015 Scheme.
- Members with service in both the 2015 Scheme and the pre-2015 Scheme (including members with tapered protection). Over time, as the proportion of 2015 Scheme service increases, the behaviours are expected to become increasingly influenced by the provisions of that scheme.

[8] The scheme established and governed by SI 2014/1964 (as amended)
[9] The schemes are established and governed by Section 2 (11) of the Superannuation Act 1972
[10] 1 April 2019 to 31 March 2023

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

Relative importance of assumptions

3.6 The Directions require the valuation results to be determined 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

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

Proposed assumptions for 2016 valuation

4.1 The assumptions we recommend for baseline pensioner mortality for the 2016 valuation may be summarised 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[11] and adjustments**	**Standard table and adjustments**
Males		
Retirements in normal health	104% S2NMA	93% S1NMA
Current ill-health pensioners	104% S2NMA	99% S1IMA
Future ill-health pensioners	104% S2NMA	100% S1IMA
Dependants	117% S2NMA	111% S1NMA
Females		
Retirements in normal health	104% S2NFA	96% S1NFA
Current ill-health pensioners	104% S2NFA	105% S1IFA
Future ill-health pensioners	104% S2NFA	100% S1IFA
Dependants	100% S2DFA	93% S1DFA

4.2 HM Treasury has indicated that future improvements in mortality will be assumed to be in line with those underlying the most recent ONS population projections, ONS-2016.

[11] 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 includes separate standard tables based on experience of members retiring in normal health (S2NXA) and in ill health (S2IXA) and for female dependants (S2DFA). The S3 series of tables were released by CMI on 5 December 2018, these updated mortality tables cover experience between 2009 and 2016. The final tables are unchanged from the working paper issued during 2018, from which GAD concluded that moving to the S3 tables would likely have no material impact on the valuation results as a whole. It therefore remains appropriate to use the S2 tables for the current valuation.

Comparison of expected pensioner longevity

4.3 The table below gives a comparison of the resulting life expectancies[12] (allowing for future improvements) assumed for the 2012 valuation, and recommended for the 2016 valuation. The Directions 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

	2012 valuation[13]	2016 valuation
Current pensioners		
Male aged 60	28.2	27.3
Male aged 65	23.3	22.4
Female aged 60	30.6	29.0
Female aged 65	25.6	24.1
Future pensioners – current age 45		
Male life expectancy from age 60	30.0	28.8
Male life expectancy from age 65	25.5	24.3
Female life expectancy from age 60	32.3	30.4
Female life expectancy from age 65	27.8	25.9

Impact of proposed change

4.4 The change in baseline mortality assumption (including moving from separate normal and ill health mortality assumptions to combined normal and ill health assumptions) will reduce the uncorrected employer contribution rate and employer contribution correction cost by around 0.6% of pensionable pay.

4.5 The change in the assumption for future mortality improvements is more significant. Moving to the allowance incorporated in the 2016-based ONS population projections may reduce the uncorrected employer contribution rate by around 5.3% of pay and the employer contribution correction cost by around 1.9% of pay.

[12] Cohort life expectancies based on the ages shown as at the valuation date, i.e. allowing for future mortality improvements.
[13] These reflect the life expectancies based on the combined normal and ill-health mortality assumption as at 2012 and therefore differ from the life expectancies quoted in the 2012 valuation report which were based on the mortality assumption for normal health pensioners only

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 an 'amounts' basis. An amounts basis weights the experience by the size of each member's pension. To derive an assumption we have compared the actual amounts of pension ceasing on deaths with those expected had the members' experience been in line with the mortality rates in the relevant current SAPS tables ("S2 tables"). The recommended assumption of baseline pensioner mortality is generally expressed by reference to suitable adjustments to the rates in the relevant S2 table ("the base table"). 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 Due to data issues[14], it has not been possible to undertake a separate analysis for pensioners in normal health and ill-health. Our analysis was therefore undertaken on the combined normal health and ill-health mortality experience over the four year period. In order to provide a comparison with the 2012 valuation the 2012 mortality assumptions were reconsidered to determine what the combined assumption would have been at that time.

4.8 The four year period ending on the valuation date showed significant volatility in mortality experience year on year. This is illustrated in Table 4.3 below. The figures shown are the ratios of actual to expected death rates with expected rates based on the 2012 valuation assumptions, adjusted as appropriate for each period analysed. This analysis suggests that differing conclusions may have been drawn had the valuation date and inter-valuation period fallen differently. 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 is that the short term effects should be smoothed out by considering the experience over a longer period from 2007 to 2012 (which is broadly similar to taking only 50% of the difference in experience since the 2012 valuation) for all except male dependant pensioners.

4.9 For male dependants the experience data is limited and not appropriate for setting a long term assumption. Our proposal is therefore to set an assumption which retains a margin over the existing male pensioner mortality assumption.

[14] See report titled: *Civil Service Pension Scheme: Actuarial valuation as at 31 March 2016: Report on membership data as at 31 March 2016* with today's date

Table 4.3 – variation in rates of death by scheme year

Year	Combined health males (A/E based on 2012 assumption*)	Combined health females (A/E based on 2012 assumption)*
2012-13	105.2%	110.0%
2013-14	96.7%	101.5%
2014-15	103.0%	111.1%
2015-16	101.1%	104.5%
Overall	101.5%	106.7%

*2012 combined mortality baseline with ONS-2014 improvements

Results of analysis

4.10 Table 4.4 sets out the number of pensioner deaths and amounts of pension ceasing due to deaths over the intervaluation period. Figures are shown separately for males and females retiring in normal/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 4.4: Pensioner mortality experience 2012-16

Category	Number of Pensions ceasing due to death	Pension amount ceasing due to deaths £'000s (pa)	A/E* relative to the 2012 valuation assumption†	A/E* relative to the S2 Base Tables†
Members:				
Males	37,807	345,571	102%	104%
Females	27,267	124,130	107%	107%
Dependants:				
Males	1,915	2,584	148%	174%
Females	27,749	113,605	114%	107%

*A/E is actual over expected
†With ONS-2014 improvements in each case (and based using revised combined mortality assumption for member pensioners)

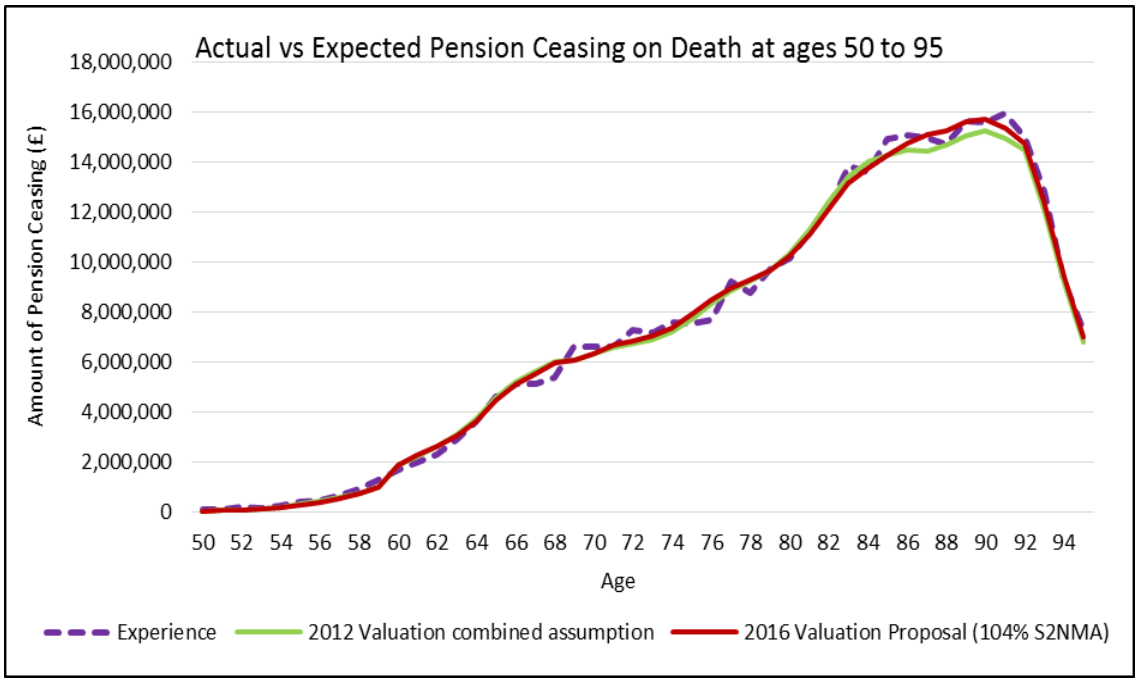
Results of Analysis: Combined Health Pensioner Mortality

4.11 Due to data issues, it has not been possible to undertake a separate analysis for pensioners in normal health and ill-health.

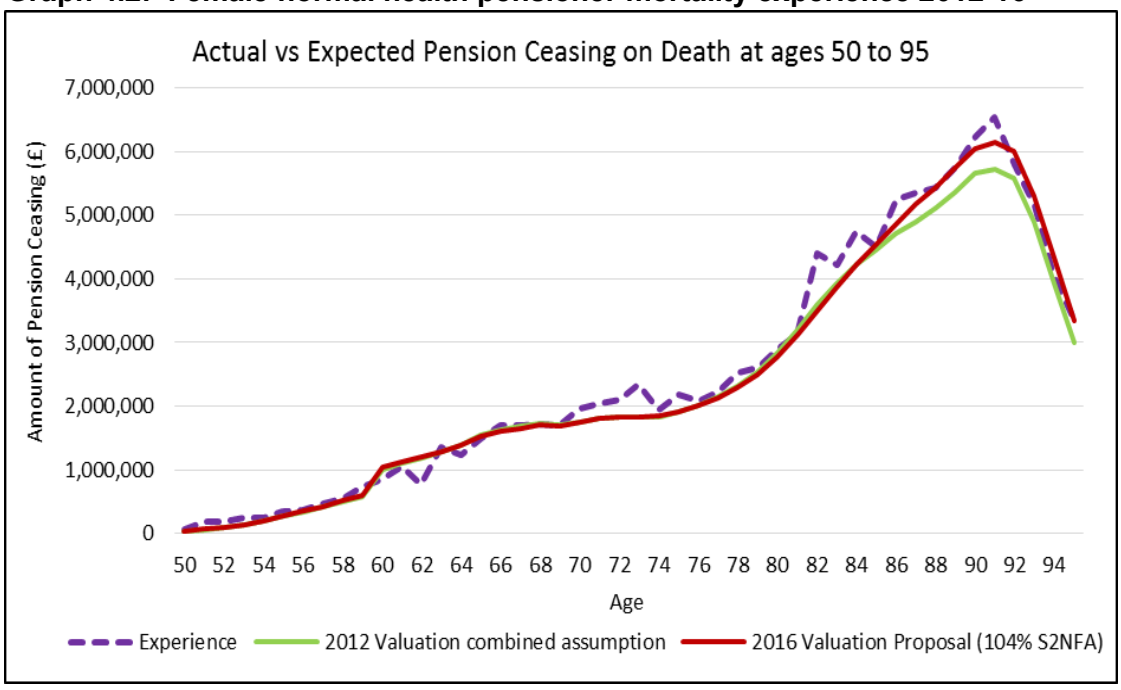
4.12 For male pensioners experience generally provided a good fit to the S2NMA standard table. For female pensioners experience provided a reasonable fit to the shape of the S2NFA standard table although experience was generally higher over most age ranges.

4.13 The graphs below show a comparison of the actual combined normal health and ill-health mortality experience (amount of pension ceasing) over the four year period with that expected based on the revised 2012 combined health valuation assumption and the proposed 2016 valuation assumption.

Graph 4.1: Male combined health pensioner mortality experience 2012-16



Graph 4.2: Female normal health pensioner mortality experience 2012-16



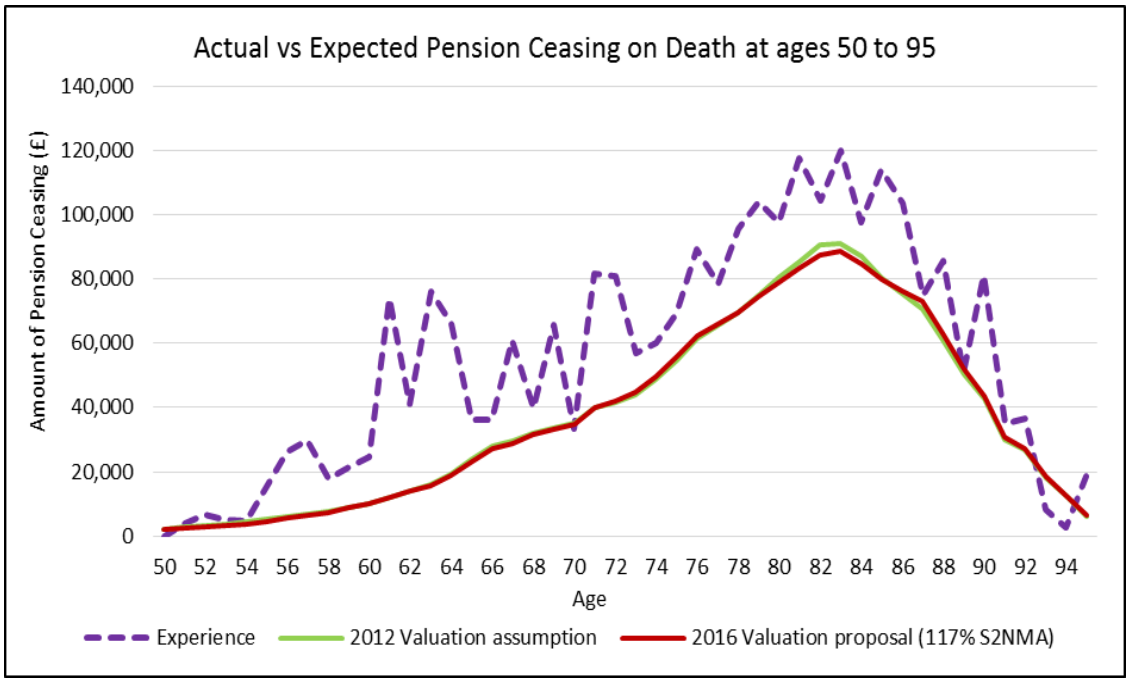
Additional comments on the combined normal and ill-health analysis

4.14 There has generally been more deaths than expected over the period compared with expectations based on the 2012 valuation assumption as set out in Table 4.4. As set out in 4.8 above, our proposed assumptions for the 2016 valuation takes account of broadly 50% of the difference in experience since the 2012 valuation.

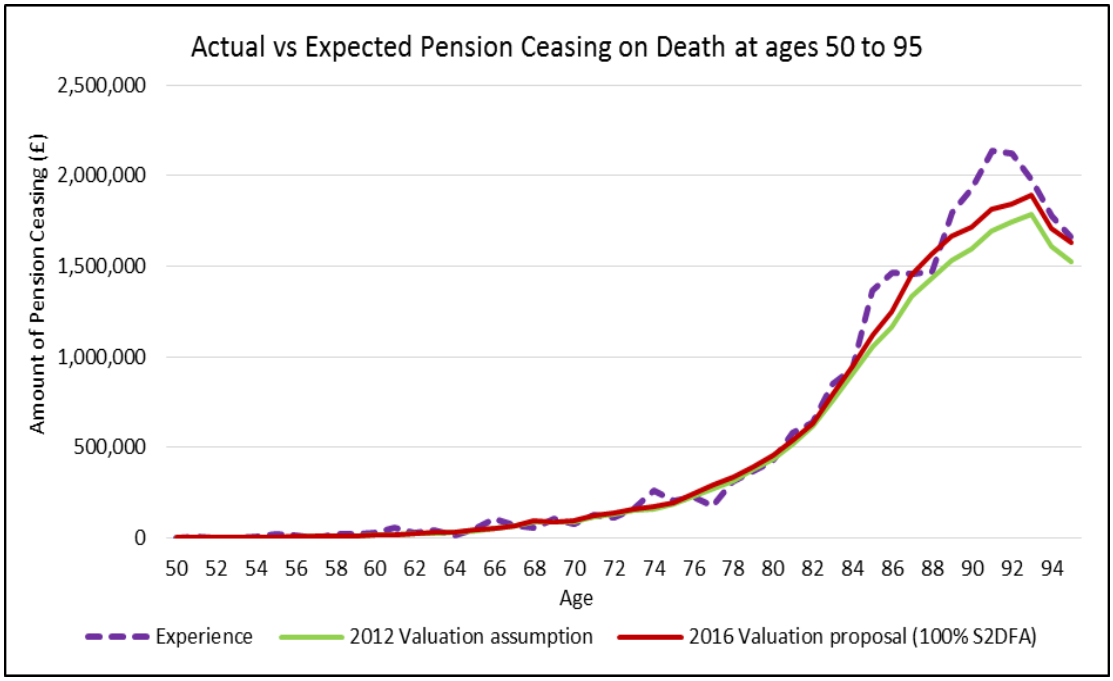
Results of Analysis: Dependant Pensioner Mortality

4.15 The charts below show a comparison of the actual mortality experience (amount of pension ceasing) over the four year period with that expected based on the 2012 assumption and the proposed 2016 valuation assumption.

Graph 4.3: Male Dependents mortality experience 2012-16



Graph 4.4: Female Dependants mortality experience 2012-16



Additional comments on Dependants analysis

4.16 There has generally been more deaths than expected over the period compared with expectations based on the 2012 valuation assumption. For female dependants the recommended assumption has been derived in the same way as for female pensioners by taking broadly 50% of the change in experience since the previous valuation. For male dependants the experience data is limited and not appropriate for setting a long term assumption. Our proposal is therefore to set an assumption which retains a margin over the existing male pensioner mortality assumption of 13% consistent with the margin between the 2012 male dependant assumption and the revised combined health existing male pensioner mortality assumption.

5 Age retirement from service

Age retirement rates specify the rate at which members are assumed to retire on grounds other than ill-health. Separate retirement rates are required for each of the 3 distinct groups of member Protected, New entrants and members with service in both the pre-2015 Scheme and the 2015 Scheme.

Proposed assumptions for 2016 valuation

5.1 We do not propose any changes to the 2012 valuation assumptions.

Analysis and setting the assumption

5.2 Over the inter-valuation period there has been a significant reduction in the membership of the CSPS as a consequence of Civil Service Reform. It has not been possible to separate out age retirements which have arisen due the redundancies over this period and therefore the analysis is unreliable for setting a long term assumption for age retirements for the 2016 valuation.

5.3 There remains limited evidence to undertake a full analysis of retirement patterns of Protected Nuvos members.

5.4 Pre-Fresh Start Prison Officers now represent a very small proportion of the overall scheme membership (broadly 0.4% of active members as at 31 March 2016). The retirement experience data for these members is limited and therefore not suitable for setting a long term actuarial assumption.

5.5 We have compared the actual rate of normal health retirements for the final salary members (by salary band, gender and age at retirement) to the expected based on the 2012 valuation assumptions.

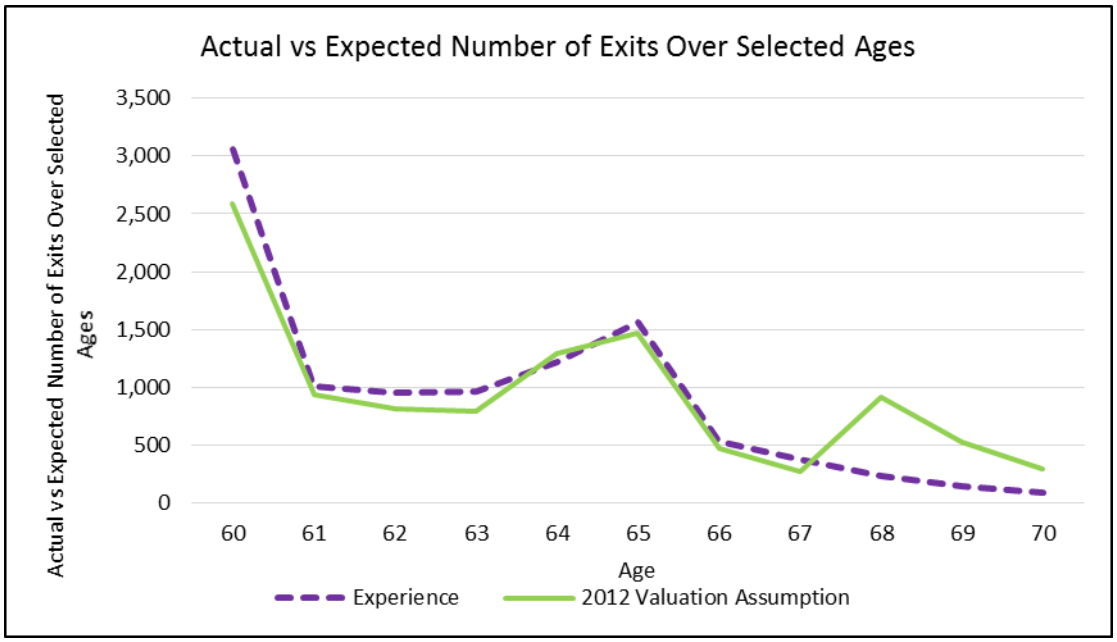
5.6 No explicit allowance is made for early retirement for Protected Members in line with previous valuations because early retirements are included within the rates of voluntary withdrawal from the scheme as discussed in Chapter 7 of this report. This is not an unreasonable approach as early retirements are broadly cost neutral on a deferred benefit basis.

Results of analysis

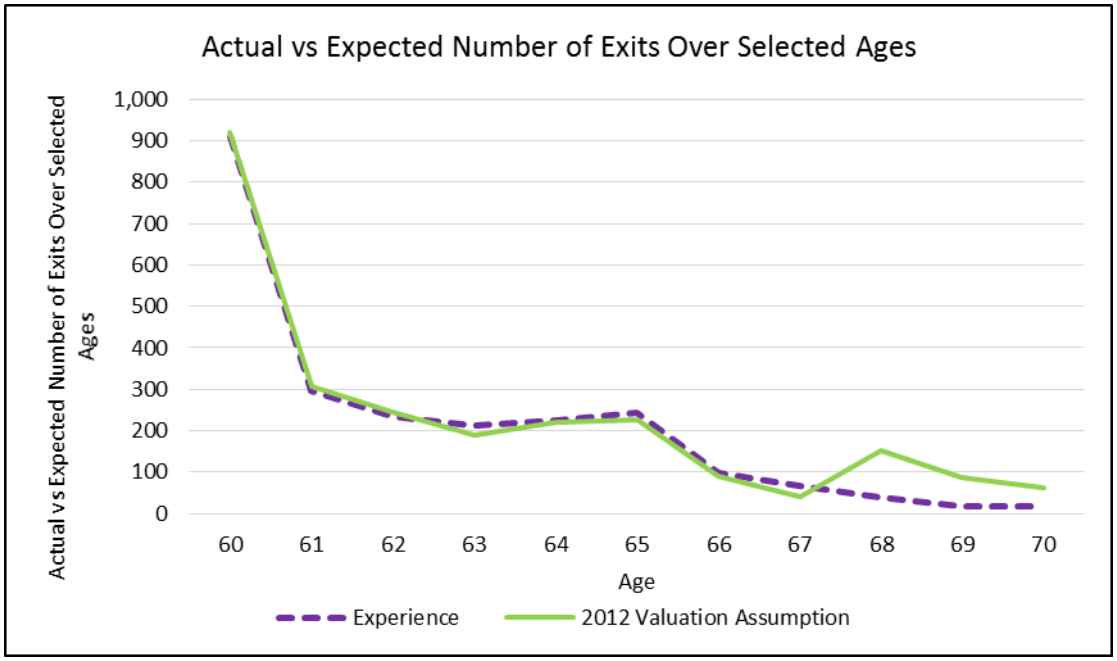
5.7 The graphs below show a comparison of the actual age retirement experience over the four year period with that expected based on the 2012 valuation assumptions.

Graph 5.1: Salary Band 1 Final Salary Males age retirement experience

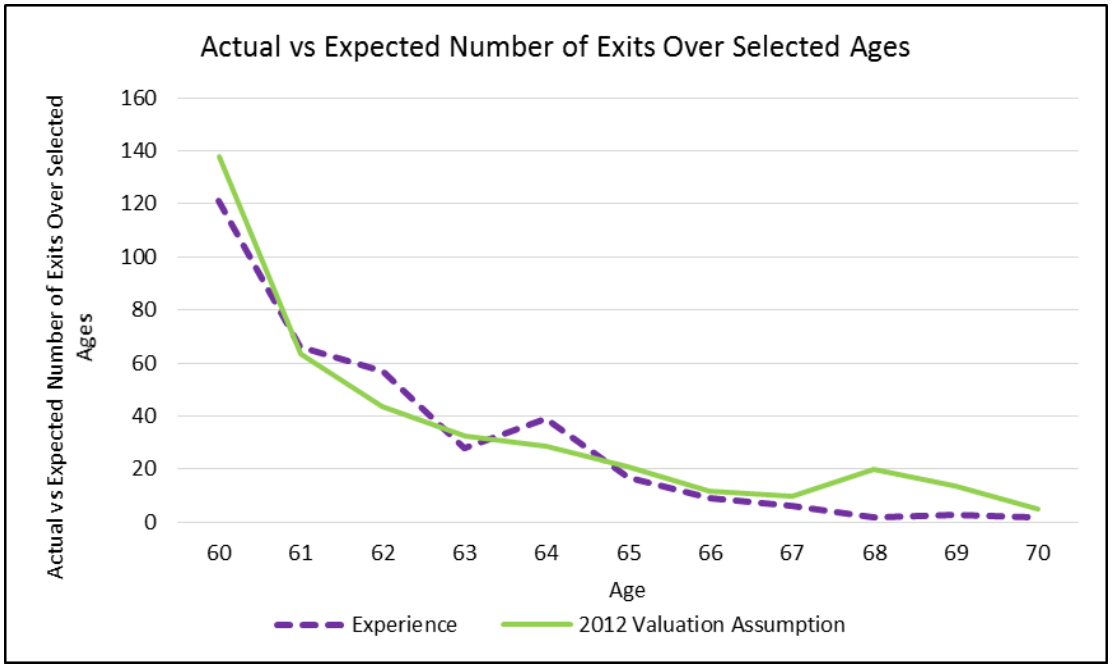
Graph 5.2 Salary Band 2 Final Salary Males age retirement experience



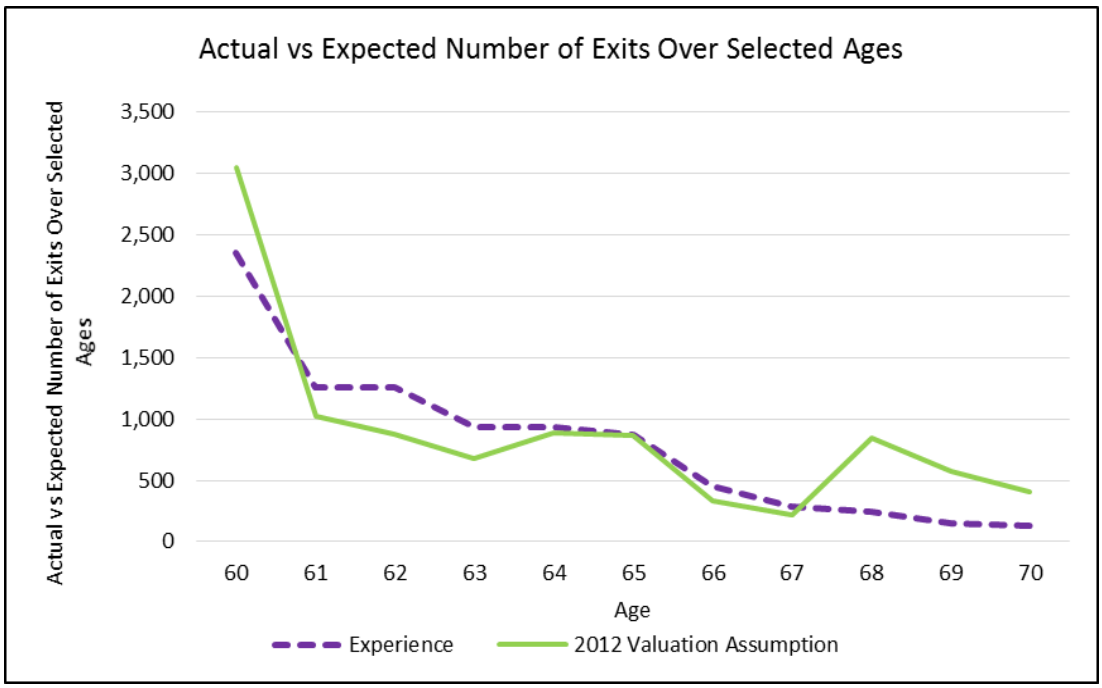
Graph 5.3 Salary Band 3 Final Salary Males age retirement experience



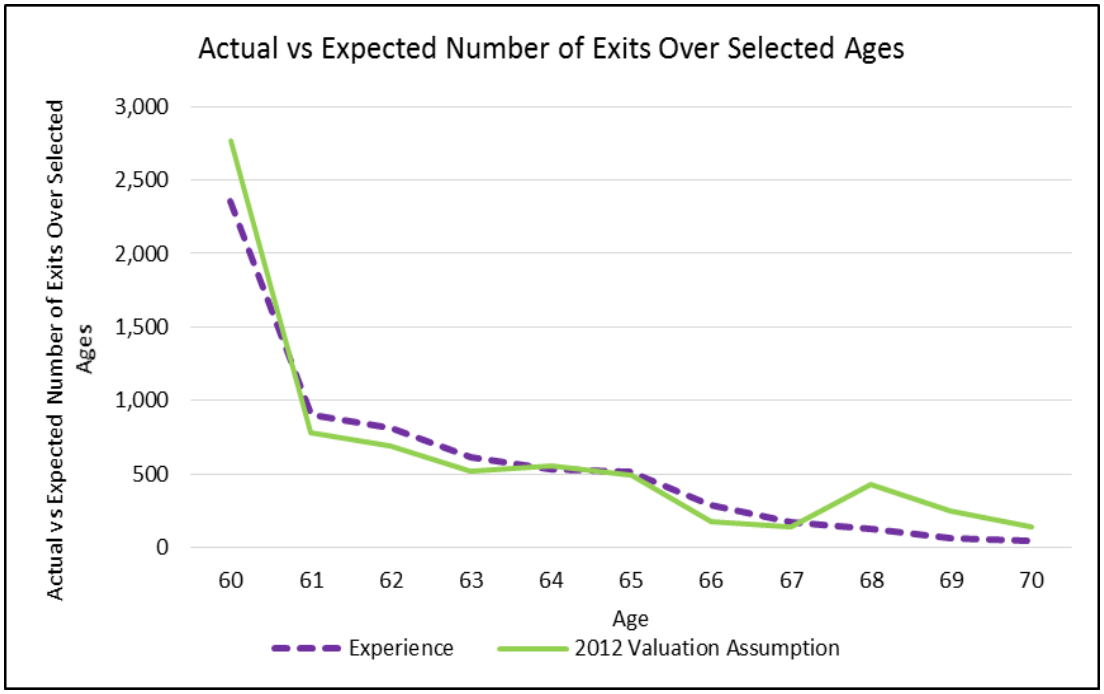
Graph 5.4 Salary Band 4 Final Salary Males age retirement experience



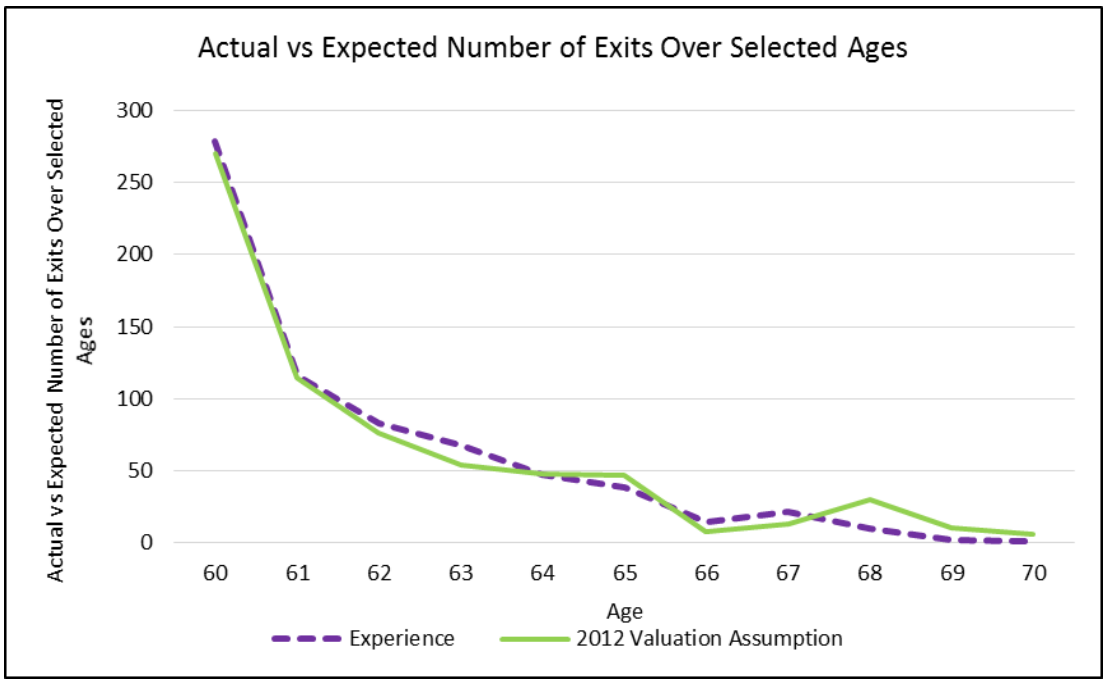
Graph 5.5 Salary Band 1 Final Salary Females age retirement experience



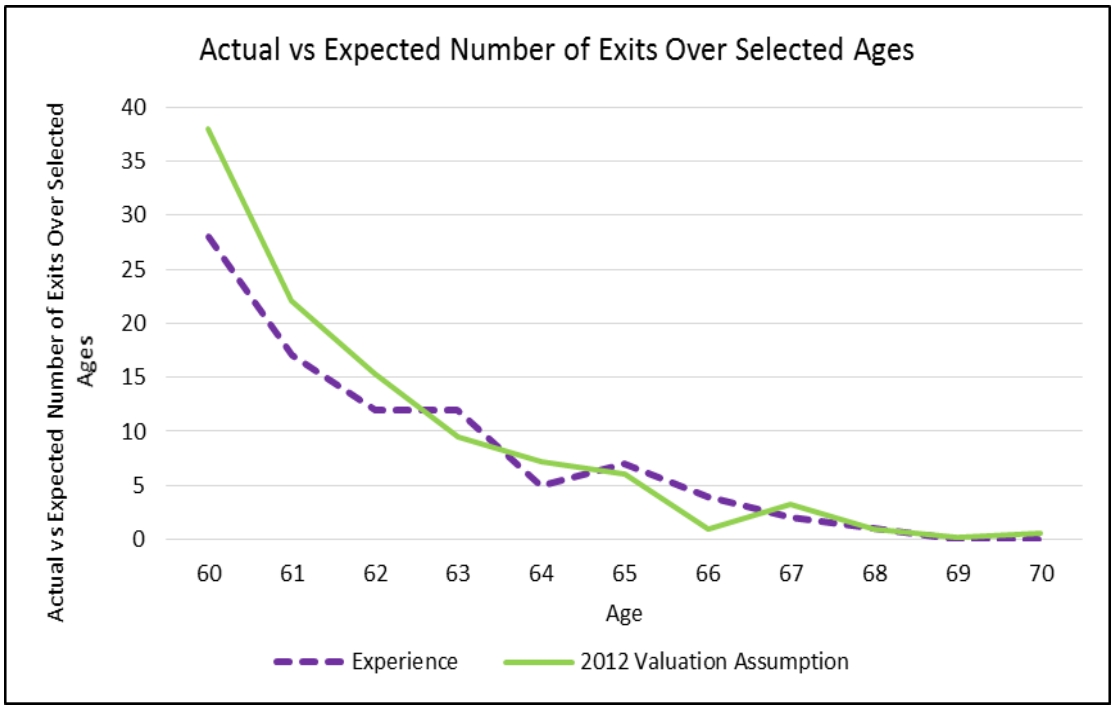
Graph 5.6 Salary Band 2 Final Salary Females age retirement experience



Graph 5.7 Salary Band 3 Final Salary Females age retirement experience



Graph 5.8 Salary Band 4 Final Salary Females age retirement experience



Additional comments on Analysis

5.8 As outlined in 5.2 above, it has not been possible to separate out age retirements which have arisen due to the redundancies over this period and therefore the analysis is unreliable for setting a long term assumption. However, as demonstrated from the graphs above the general pattern of age retirements have not been significantly out of line with expectations from the 2012 actuarial valuation for many of the categories.

Partial retirements

5.9 Under certain circumstances members can draw all or part of their pension while remaining in service. Partial retirements are a significant proportion of the total age retirements , representing around one-quarter of recent retirements. The experience data provided did not enable us to construct a separate assumption for the proportion of pension taken on partial retirement at each age. Within our analysis partial retirements are therefore assumed to take full retirement at the age from which members take the first part of their pension.

Other membership groups

5.10 As part of the 2012 actuarial valuation assumptions were set for other membership groups (e.g. new entrants) having regards to the experience of the Final Salary members. This was a pragmatic approach in the absence of other information. We consider that it would be inappropriate to amend these assumptions without strong evidence to suggest that the 2012 assumptions are inappropriate.

Additional data considered

5.11 The Civil Service Analysis and Insight Team also provided some statistics regarding retirements from the Civil Service over the period since 2006/07. The data was sourced from the Annual Civil Service Employment Surveys. This data did not provide evidence of a clear trend emerging in retirement experience within the Civil Service which would invalidate the current age retirement assumptions.

6 Ill-health retirement from service

Ill-health retirement rates specify the rates 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. A single set of assumptions is adopted for all categories of member (separate for males and females).

Proposed assumptions for 2016 valuation

6.1 We recommend amending the assumed incidence of ill-health at all ages in line with broadly 50% of the difference in experience since the 2012 valuation. This means an increase in ill-health rates of around 7% for males and a reduction in rates of around 7% for females. We recommend no change to the split between tiers: 42% of males and 67% of females should be assumed to receive upper-tier benefits.

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

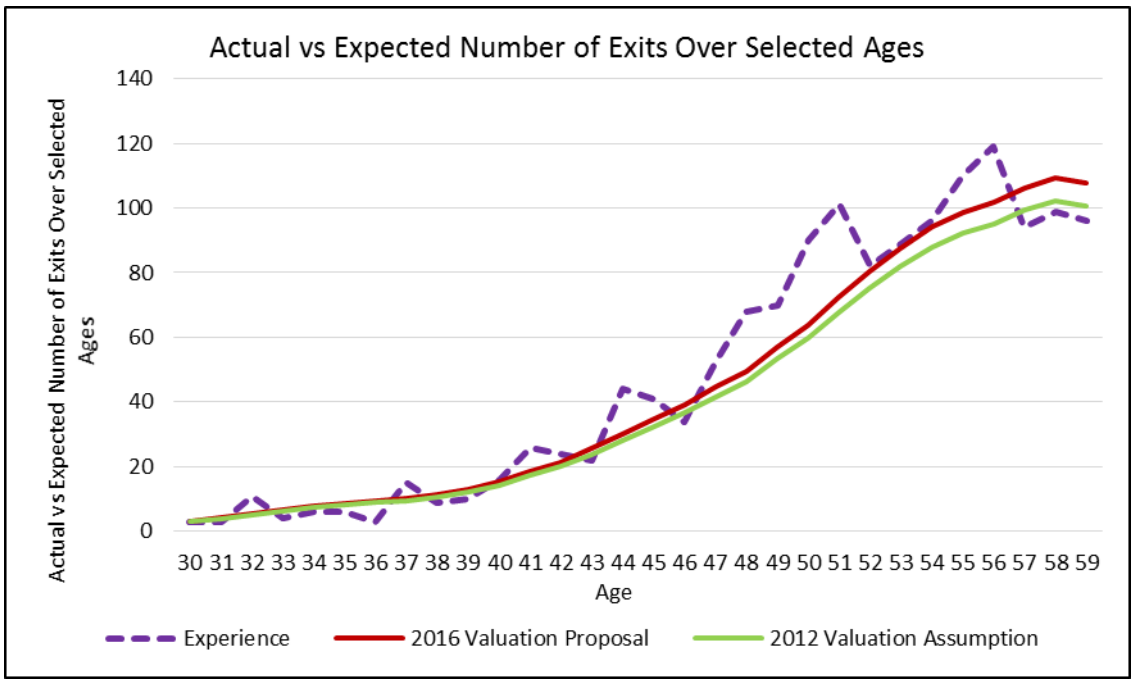
Analysis and setting the assumption

6.3 There were around 2,800 ill-health retirements in the scheme over the four-year period to 31 March 2016. We have compared the actual rate of ill-health retirements (by gender and age at retirement) to the expected rate from the 2012 actuarial valuation and the recommended assumption has been based on this comparison.

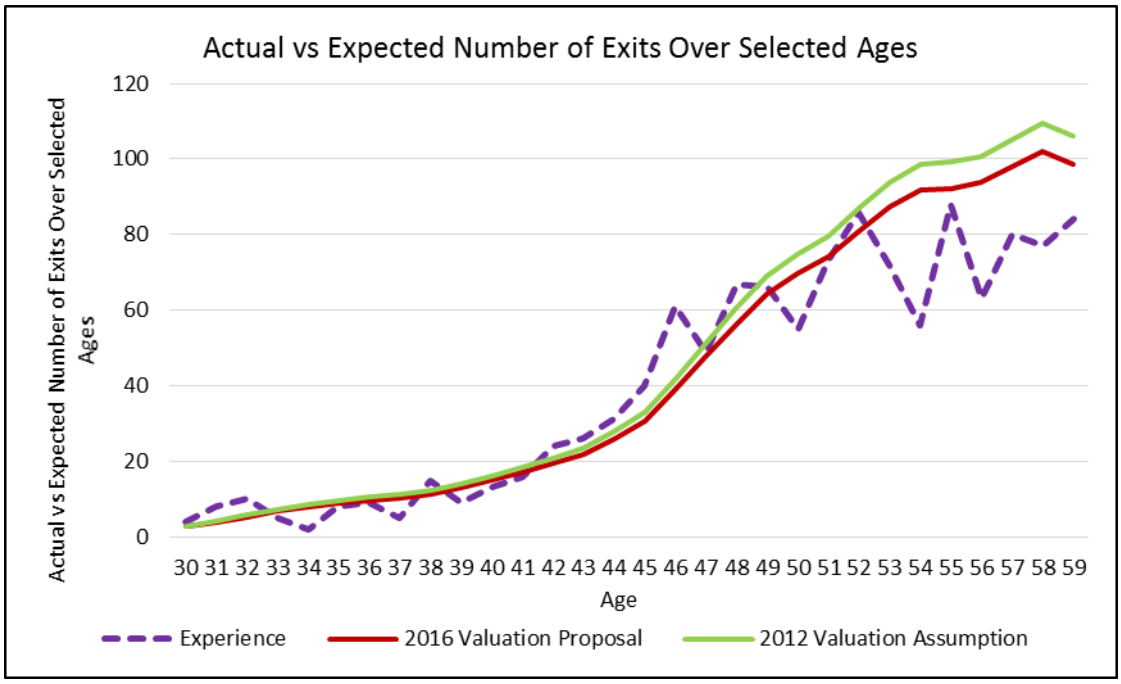
Results of analysis

6.4 The graphs below show a comparison of the actual ill-health retirement experience over the four year period with that expected based on the 2012 valuation assumption and the proposed 2016 valuation assumption.

Graph 6.1: Male ill-health retirement experience 2012-16



Graph 6.2: Female ill-health retirement experience 2012-16



Additional Comments on analysis

6.5 The majority of the scheme experience is in respect of the final salary sections. The 2016 proposal has therefore been determined by considering the experience between ages 30 and 60 only where the majority of the ill-health retirements occur. Over this age range there have been 15% more males and 14% fewer females retired on ill-health grounds over the 4 year period than expected, although there was significant variation year on year. For this reason we recommend that the assumed rates of ill-health retirement are decreased for males and increased for females. 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 males and females, i.e. rates are set at around 107% and 93% of those adopted for the 2012 valuation for males and females respectively.

6.6 Pre-Fresh Start Prison Officers now represent a very small proportion of the overall scheme membership (broadly 0.4% of the active membership as at 31 March 2016). The ill-health retirement experience data for these members is limited and therefore not suitable for setting a long term actuarial assumption.

Split between tiers

6.7 Upper and lower tier ill-health is relevant to all non-Classic sections of the scheme. We have analysed the pattern of ill-health retirements awarded with upper tier benefits over the four year period to 31 March 2016 for these members.

6.8 Overall 50% of male members and 62% of female members retired on upper tier ill health benefits over the 4 year period, compared to the 2012 valuation assumption of 42% and 67% for males and females respectively, although there was significant variation year on year. This variation applied across both the 2007-2012 experience and the 2012-16 experience, with no clear pattern emerging. If we were to consider the experience across both valuations then this would result in only a small change in assumption which would have very little impact on the valuation results. We therefore recommend no change to the assumptions.

7 Voluntary withdrawal from service

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. Separate assumptions are adopted for each salary band (and separate for males and females).

Proposed assumptions for 2016 valuation

7.1 We do not propose any changes to the 2012 valuation assumptions.

Analysis and setting the assumption

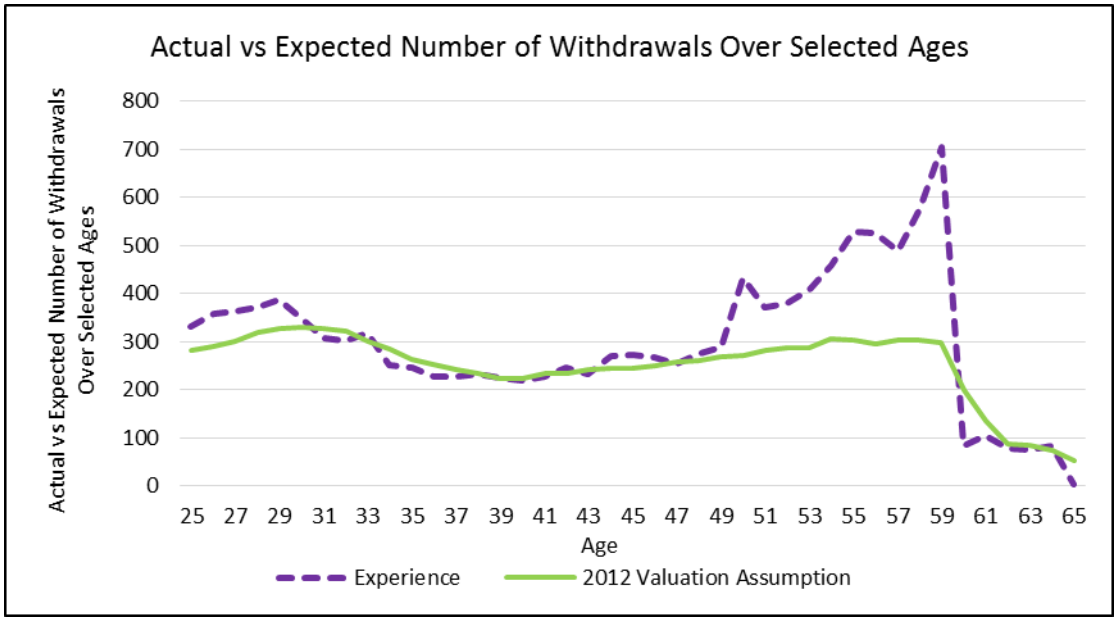
7.2 It has not been possible to carry out a robust withdrawal analysis using the valuation data. Over the inter-valuation period there has been a significant reduction in the membership of the CSPS as a consequence of Civil Service Reform. It has not been possible to separate out withdrawals which have arisen due the redundancies over this period and therefore the analysis is unreliable for setting a long term assumption for withdrawals for the 2016 valuation

7.3 Early retirements are included within the rates of voluntary withdrawal from the scheme as discussed in Chapter 5 of this report. This is not an unreasonable approach as early retirements are broadly cost neutral on a deferred benefit basis.

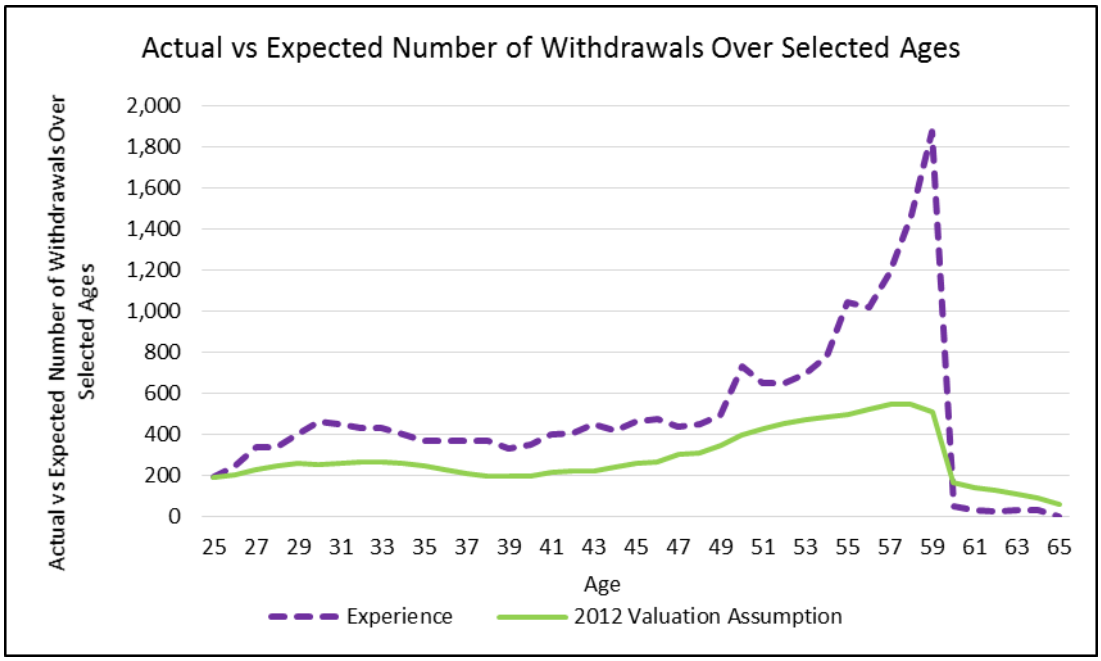
Results of analysis

7.4 The graphs below show the gross withdrawal rates derived from the experience data provided, together with the expected rates based on the 2012 assumption.

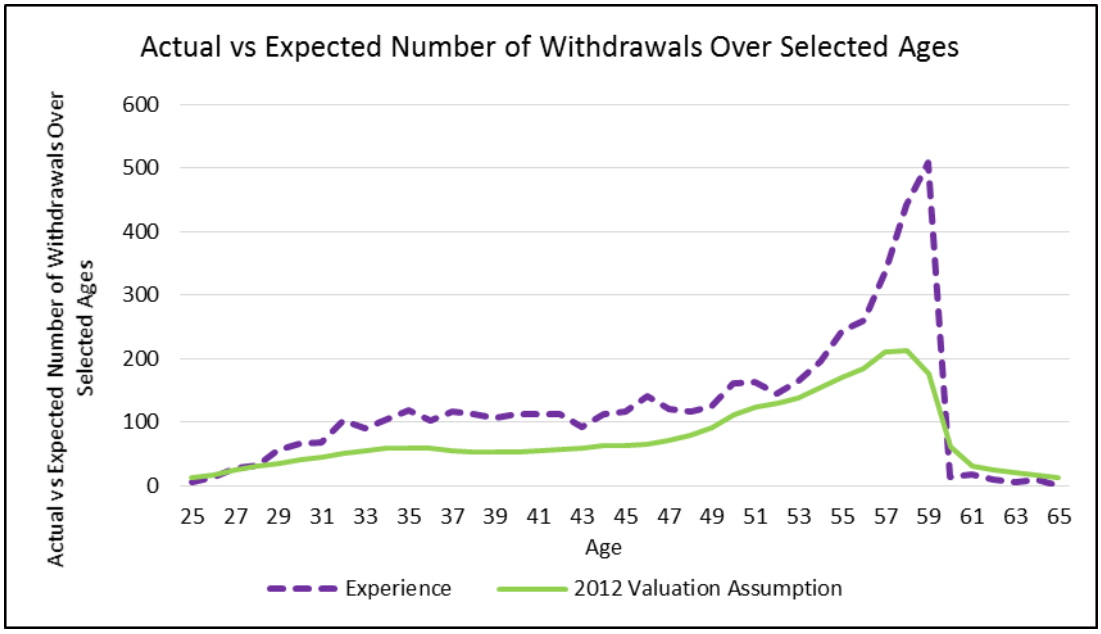
Graph 7.1: Salary Band 1 Males withdrawal experience 2012-16



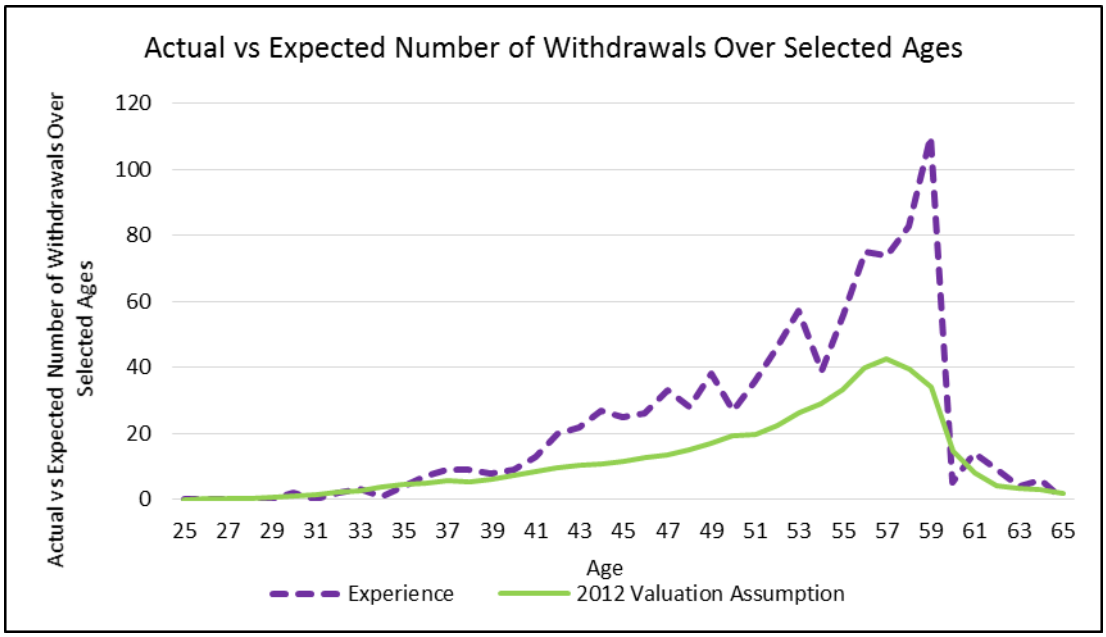
Graph 7.2: Salary Band 2 Males withdrawal experience 2012-16



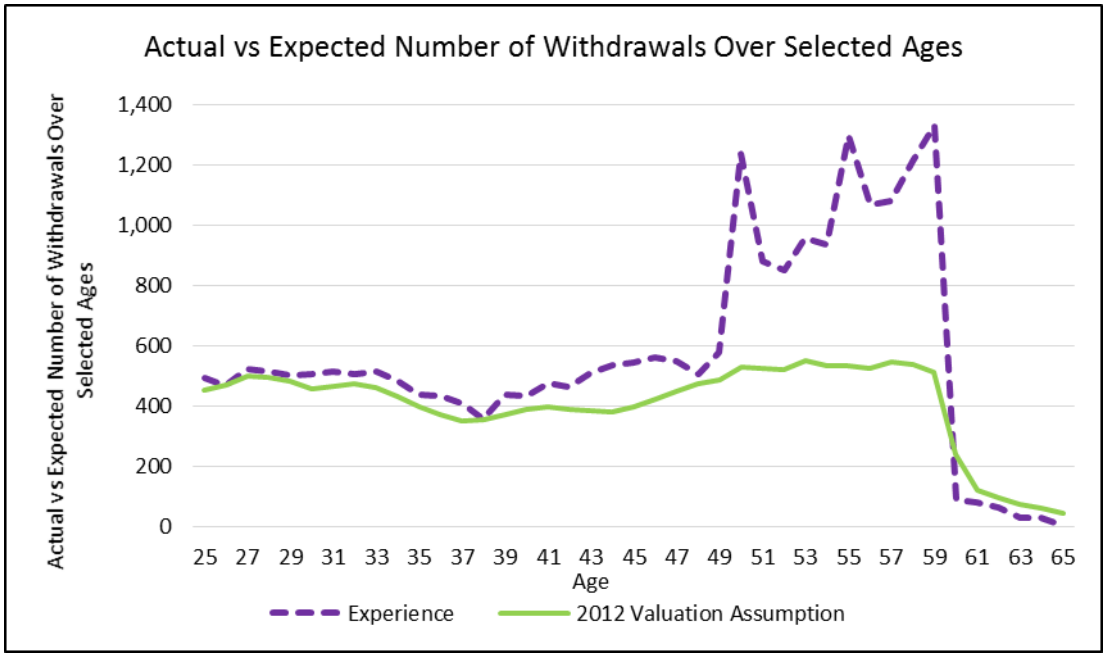
Graph 7.3: Salary Band 3 Males withdrawal experience 2012-16



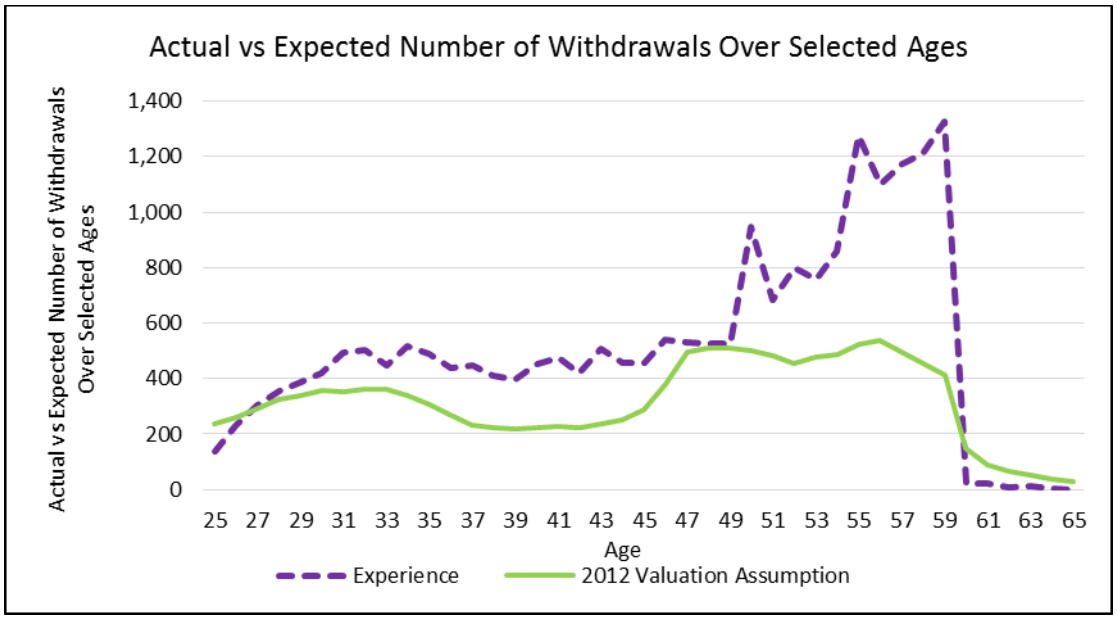
Graph 7.4: Salary Band 4 Males withdrawal experience 2012-16



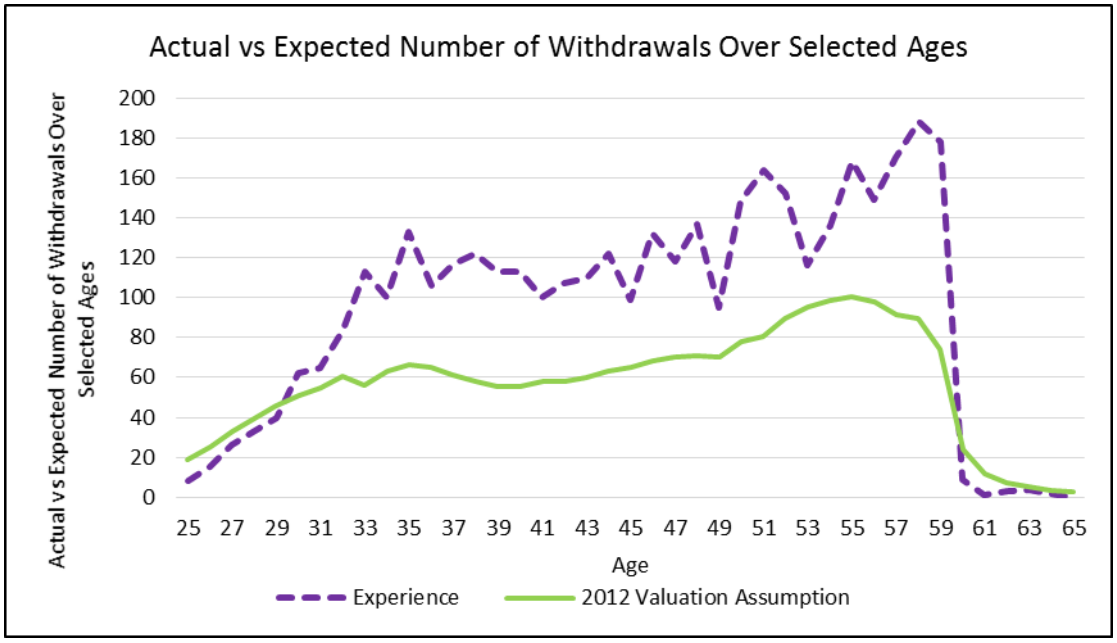
Graph 7.5: Salary Band 1 Females withdrawal experience 2012-16



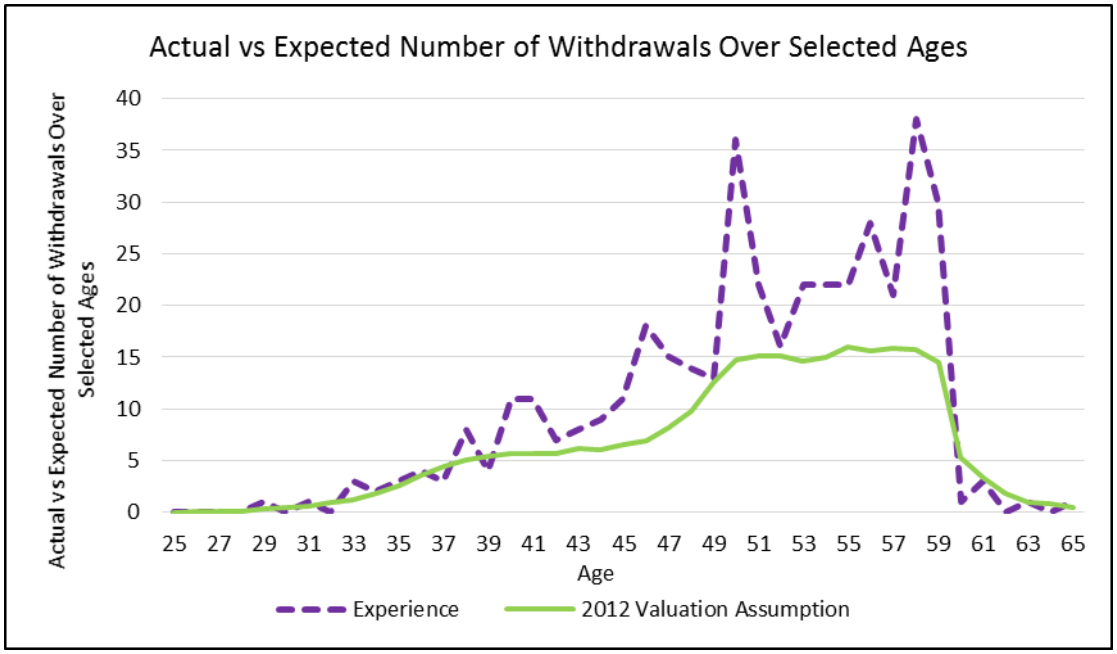
Graph 7.6: Salary Band 2 Females withdrawal experience 2012-16



Graph 7.7: Salary Band 3 Females withdrawal experience 2012-16



Graph 7.8: Salary Band 4 Females



Additional comments on analysis

7.5 Withdrawal rates are generally 'net' rates, i.e. they are intended to reflect the probability of leaving service and not re-joining, and therefore the members benefits not being linked to their final salary at retirement (or in service revaluation rate in the CARE scheme). Due to data issues it was not possible for us to identify members who had withdrawn and then subsequently re-joined the scheme and therefore our experience data considers 'gross' withdrawal rates, i.e. makes no allowance for re-joiners. Gross withdrawal rates will be higher than net rates. However, re-joiners represented only a very small proportion of the withdrawal experience as part of the 2012 actuarial valuation and had little impact on the withdrawal rates calculated at that time. We therefore do not expect our inability to allow for re-joiners to have a significant impact on our analysis.

7.6 Pre-Fresh Start Prison Officers now represent a very small proportion of the overall scheme membership (broadly 0.4% of the active membership as at 31 March 2016). The withdrawal experience data for these members is limited and therefore not suitable for setting a long term actuarial assumption.

Additional data considered

7.7 The Civil Service Analysis and Insight Team also provided some statistics regarding resignations from the Civil Service over the period since 2006/07. The data was sourced from the Annual Civil Service Employment Surveys. This data did not provide evidence of a clear trend emerging in resignation experience within the Civil Service which would invalidate the current voluntary withdrawal assumptions.

8 Death before retirement

Death before retirement rates are used to allow for the possibility of death whilst in active service or whilst entitled to a deferred pension. A single set of assumptions is adopted for all categories of member (separate for males and females).

Proposed assumptions for 2016 valuation

8.1 We recommend reducing the assumed rates of death in service by 11% for both males and females. The changes apply at all ages.

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

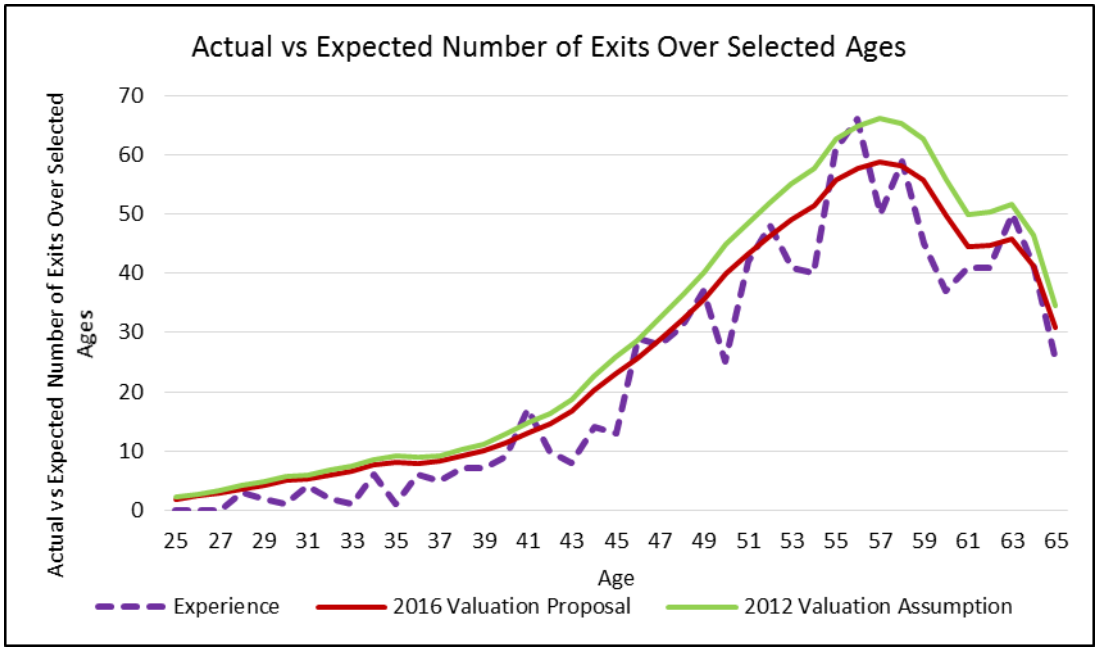
Analysis and setting the assumptions

8.3 To formulate a recommended assumption we compared the scheme experience to the expected rates from the 2012 actuarial valuation. In total there were 1,721 deaths of active members compared to an expected number of 2,319 based on the 2012 valuation assumptions over all ages.

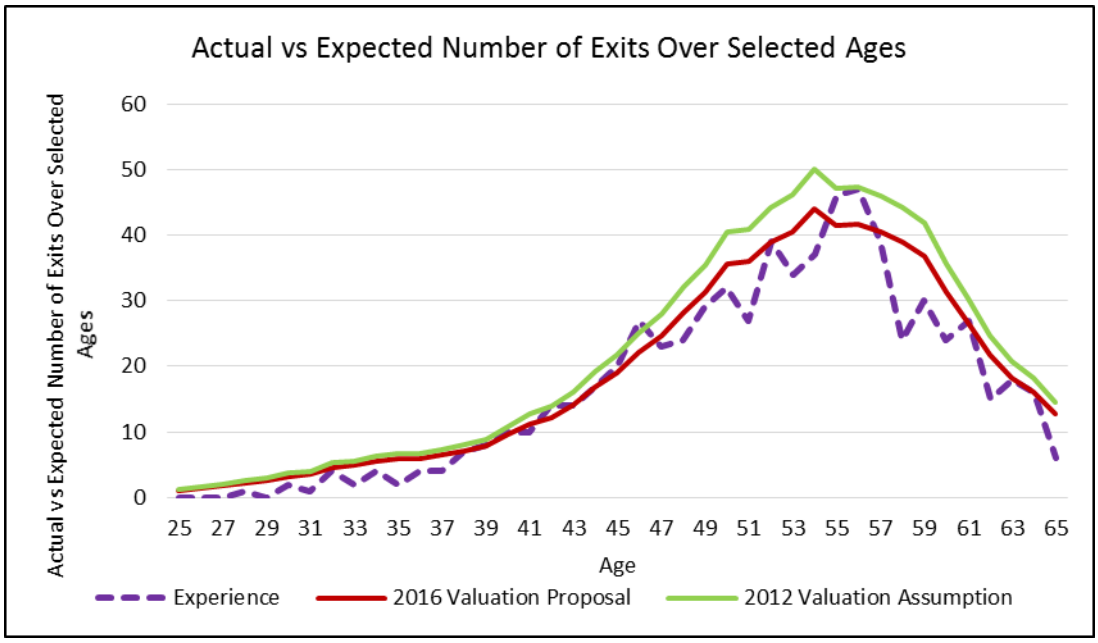
Results of analysis

8.4 The graphs below compare the rates of the actual and expected deaths under the 2012 assumptions by age for males and female respectively.

Graph 8.1: Male death before retirement experience 2012-16



Graph 8.2: Female death before retirement experience 2012-16



Additional Comments on analysis

8.6 Recent experience has been around 22% lighter for both males and females than the rates assumed for the 2012 valuation over ages to 65. Allowing for some fluctuation in experience over the periods we recommend 50% of the difference in experience is reflected in the assumptions to be adopted for the 2016 valuation, i.e. the rates are set equal to 89% of those adopted for the 2012 valuation for both males and females.

9 Promotional pay increases

Benefits within the final salary sections of the Schemes are linked to salary at, or near, retirement. Members' salaries increase through a combination of annual general pay awards and promotional pay increases. The assumption for general pay awards are directed by HMT. The Minister is required to set the assumption for promotional pay increases. Separate assumptions are adopted for each salary band (and separate for males and females).

Proposed assumptions for 2016 valuation

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

Analysis and setting the assumption

9.2 To formulate a recommended assumption we compared the scheme experience to the assumption adopted for the 2012 valuation. This analysis has been carried out in two separate ways:

> Looking at the profile of the active membership as at 31 March 2016 in terms of average pensionable pay at each age and how this compares with the next year of age (the 'profile analysis'); and

> Tracking the pensionable pay progression of individual members who were in active service at both 31 March 2012 and 31 March 2016 (the 'annual increase analysis'). Under this analysis, we have stripped out the effect of general pay increase over the period.

9.3 Both types of analysis should be treated with some caution

9.4 For the profile analysis:

> The analysis is affected by the mixture of members at each age. For example, the group of members at, say 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.

9.5 For the annual increase analysis:

> Not all members will benefit from the same headline pay award

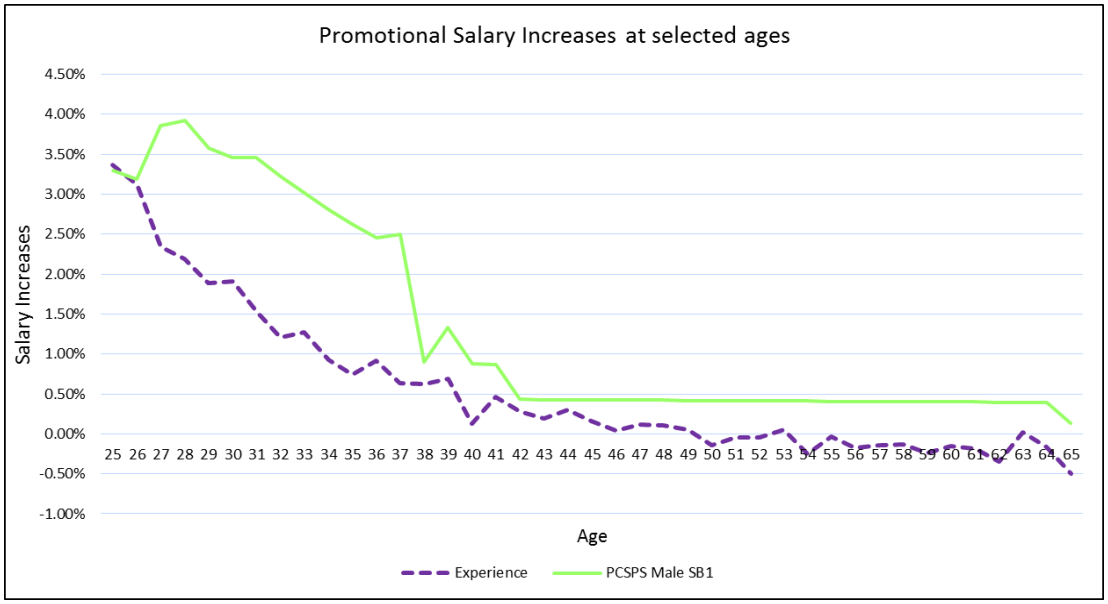
- It is often the case that average pay increases by more than the headline general pay award (usually referred to as 'pay drift'). We have only allowed for the headline general pay award and so any drift will be included in this analysis. HMT have included an allowance for drift in their directed general earnings increase assumption. If the promotional salary assumption also includes drift then this will be double counted.
- Much of the increase is driven by members with shorter service where pay scales are relatively steep. Applying the average increase to all members is likely to understate the liability for members with less service and overstate for those with more service. As the overall liability is dominated by those with more service this is likely to be overstated if the average increase is applied to all members.
- No allowance is made for members moving between salary bands over the period

Results of the Annual Increase analysis

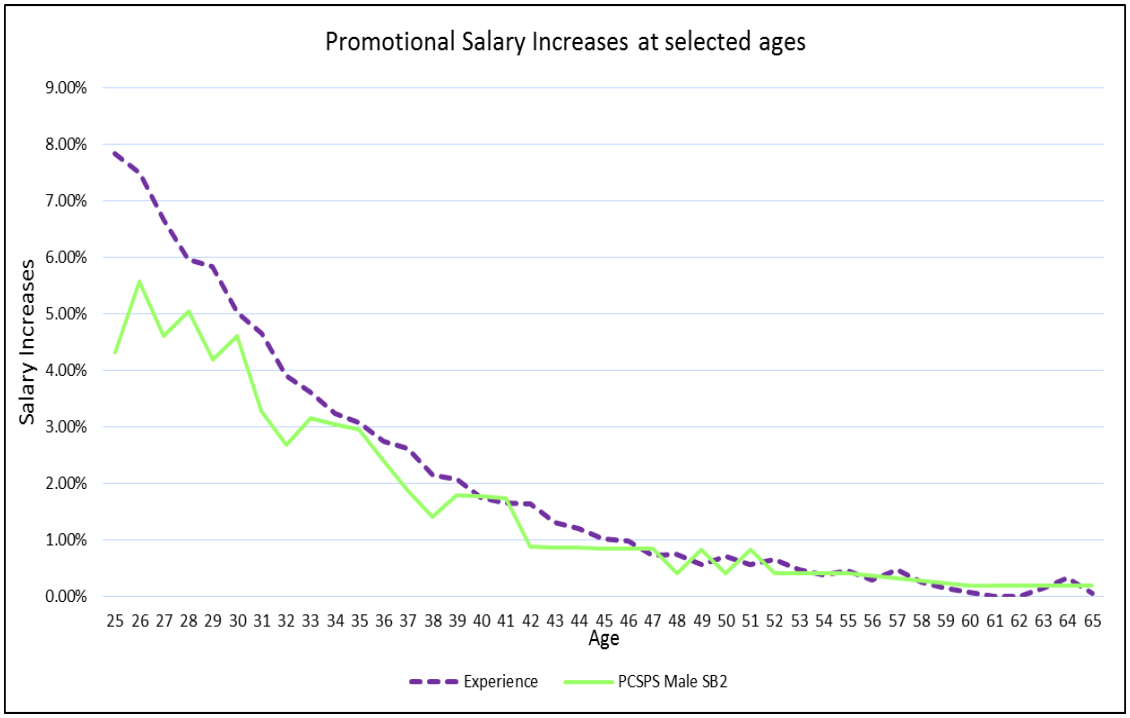
9.6 The graphs below show the implied age related promotional pay scales for males and females respectively (for each salary band) based on the annual increase analysis. These are compared with the expected promotional salary scales for males and females adopted for the 2012 valuation.

9.7 For salary band 1 members the annual increase analysis suggests that experience has been significantly lower than expected under the current assumptions. For other salary bands increase have been higher than expected at the youngest ages but broadly supportive of the current assumptions at older ages for males but higher than expected across the whole age range for females.

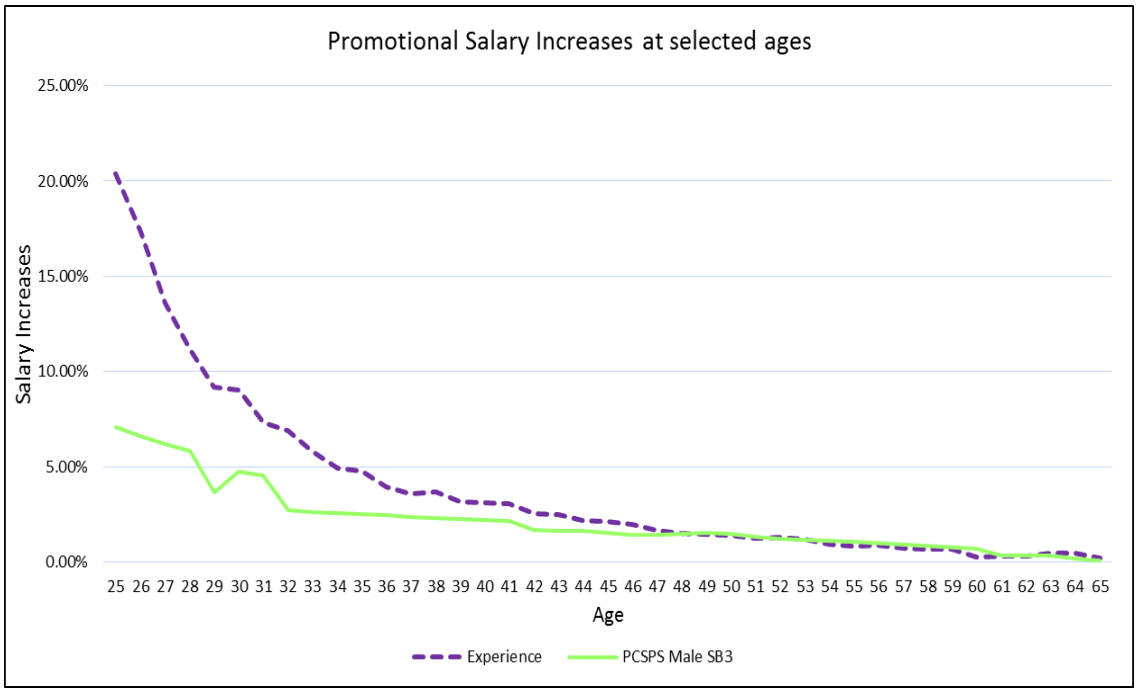
Graph 9.1: Salary Band 1: Males Annual Increase analysis



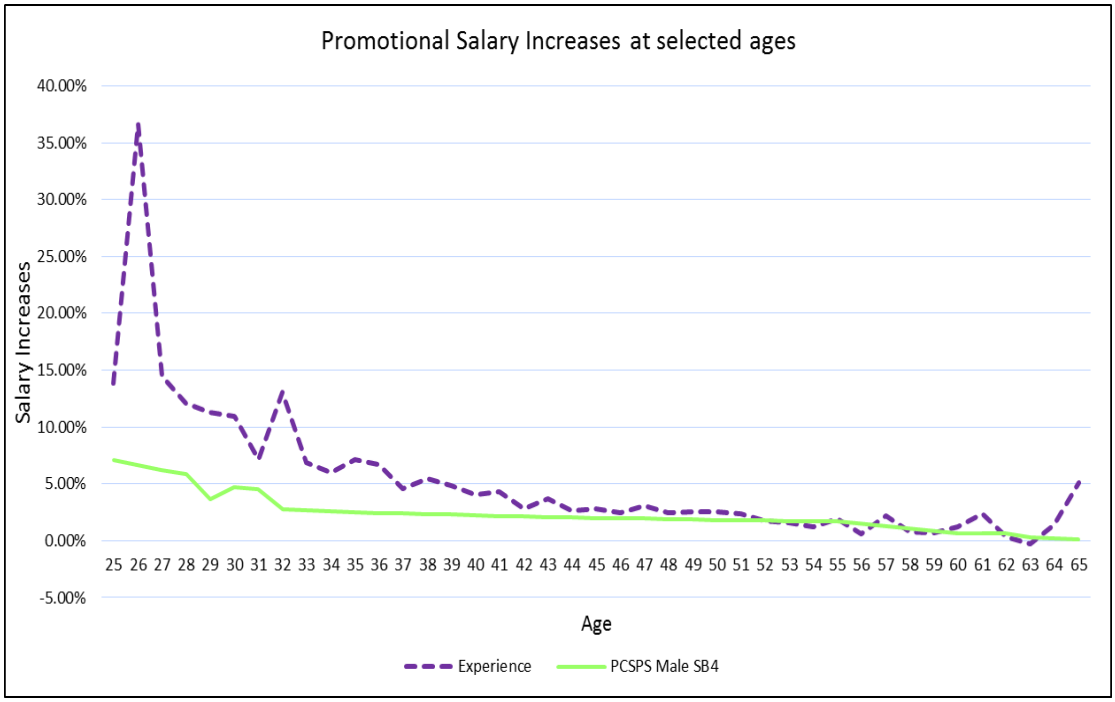
Graph 9.2: Salary Band 2: Males Annual Increase analysis



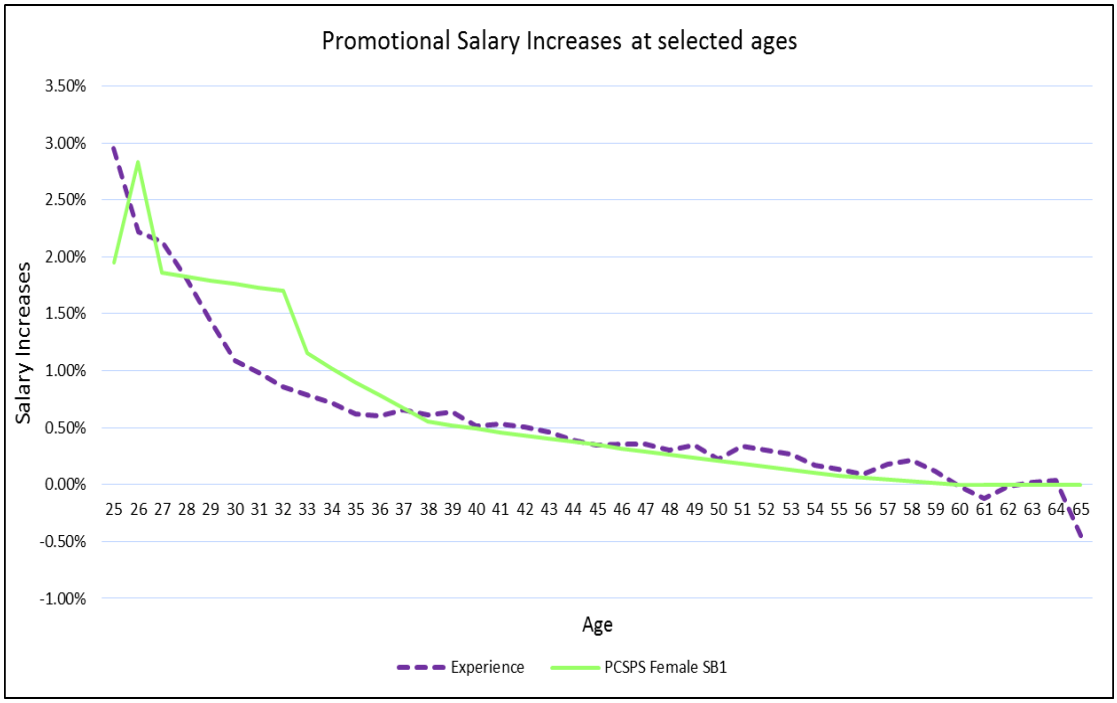
Graph 9.3: Salary Band 3: Males Annual Increase analysis



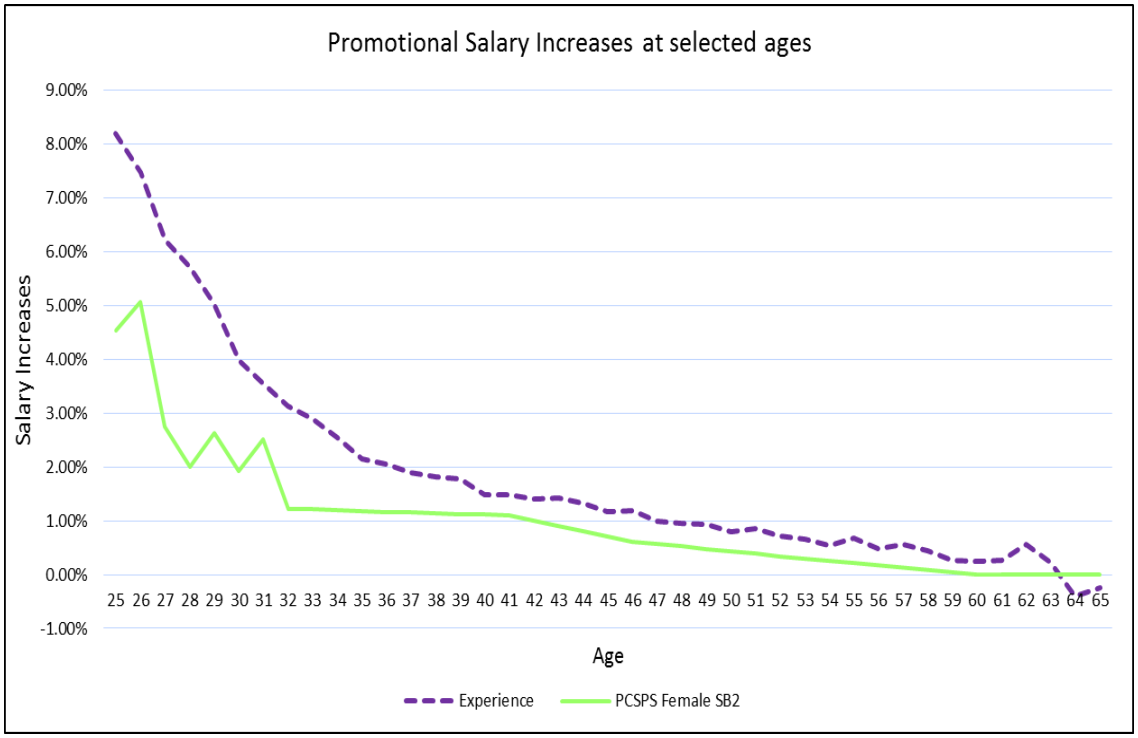
Graph 9.4: Salary Band 4: Males Annual Increase analysis



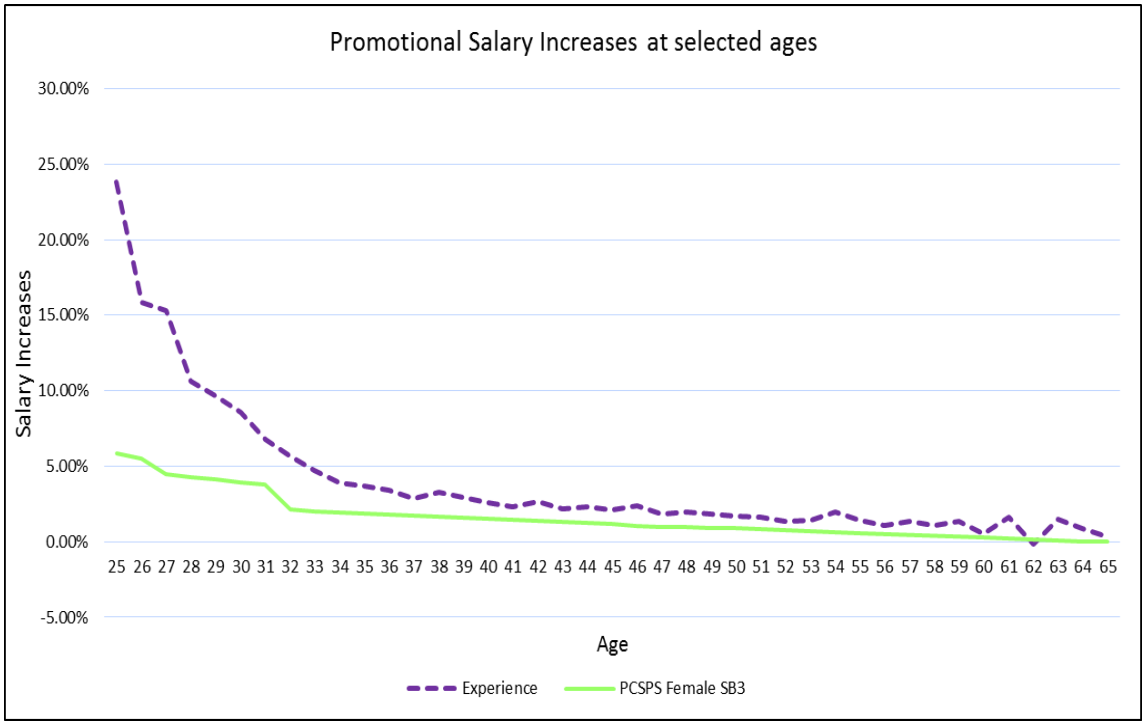
Graph 9.5: Salary Band 1: Females Annual Increase analysis



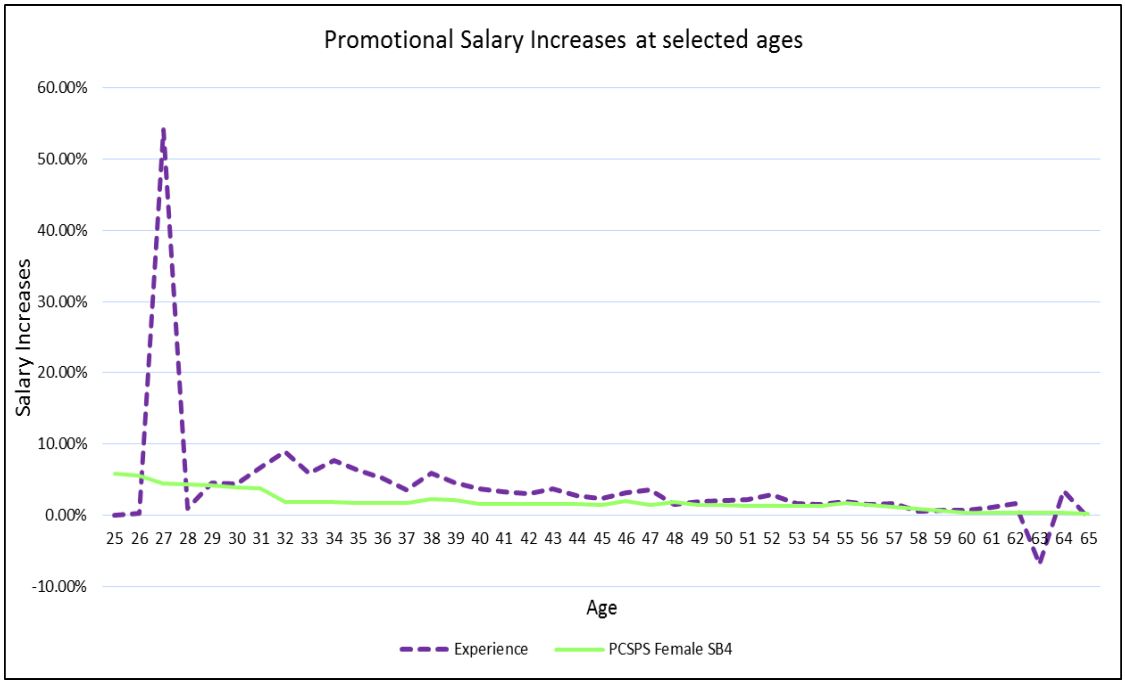
Graph 9.6: Salary Band 2: Females Annual Increase analysis



Graph 9.7: Salary Band 3: Females Annual Increase analysis



Graph 9.8: Salary Band 4: Females Annual Increase analysis



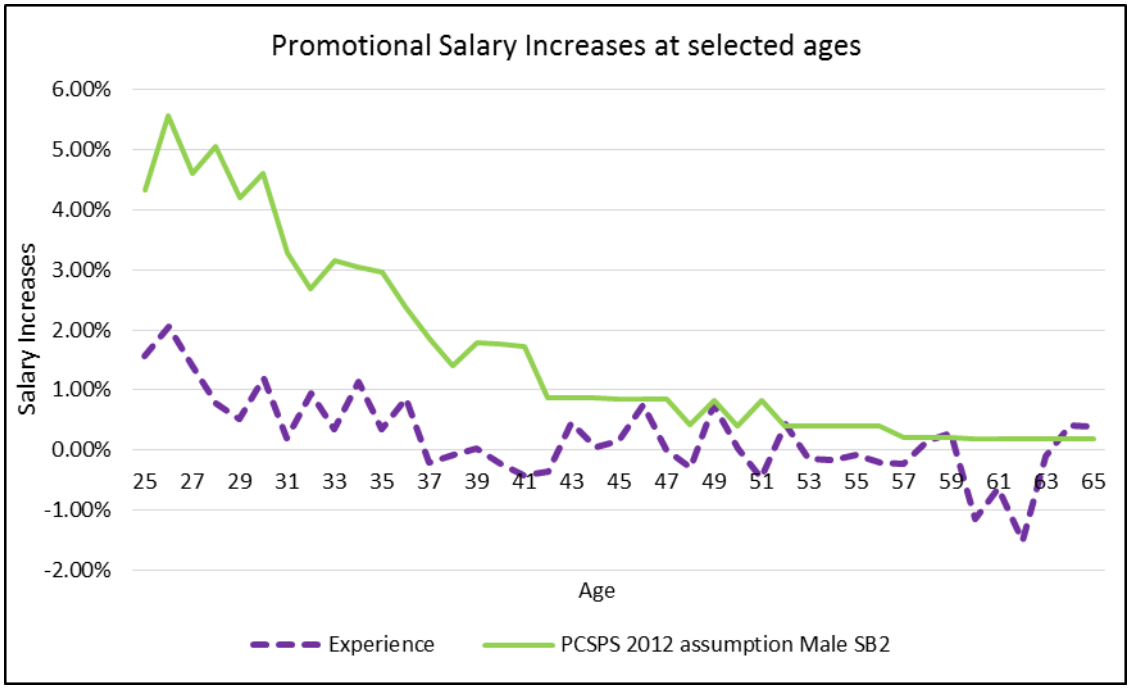
Results of Profile analysis

9.8 The profile analysis determined that experience has been considerably lower than expected for all categories.

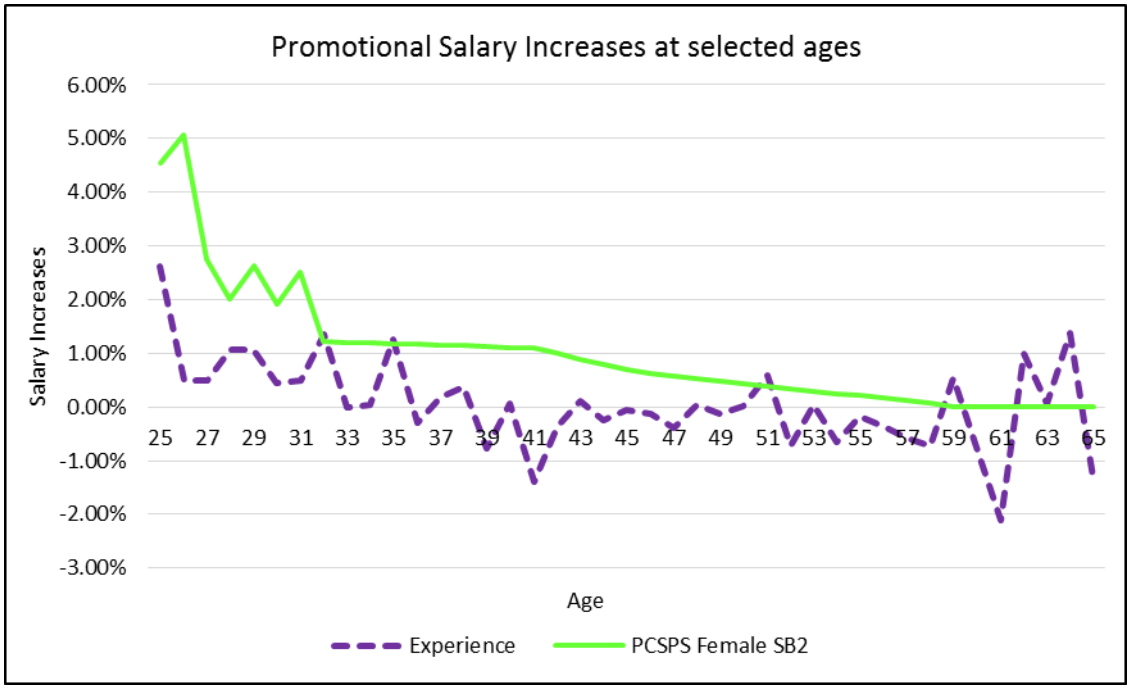
9.9 It is expected that this analysis has been significantly distorted by the change in membership profile over the period due to Civil Service Reform. This analysis has therefore not been considered further.

9.10 The following graphs show the implied age related promotional pay scales for Salary Band 2 males and females respectively based on the profile of all members at the valuation date. Graphs have only been shown for Salary Band 2 members as this is the most populated salary band.

Graph 9.9 Salary Band 2: Males Profile analysis



Graph 9.10 Salary Band 2: Females Profile analysis



Additional comments on the analyses

9.11 The annual increase analysis shows that except at the youngest ages the experience over the period generally follows a similar pattern to the 2012 assumptions although the experience may have been higher or lower than expected. At the youngest ages the experience has been significantly different from expected. However, the final salary benefits for younger members is not a significant proportion of the overall accrued benefits for active members given that new joiners to the Schemes over the inter-valuation period would have joined Nuvos or the 2015 Scheme.

9.12 There is no compelling evidence to suggest that the promotional pay increase assumptions used previously are no longer appropriate. Given the financial significance of this assumption on the valuation results (see Table 2), it would be inappropriate to make a change to the assumption without robust evidence.

10 Commutation of pension for cash at retirement

Members may commute part of their pension for a lump sum at a rate of £12 for each £1 of pension given up. The assumption is important because the value of the pension given up is typically more than £12 and so commutation can have a significant impact on the valuation results. A separate assumption is set for Classic and non-Classic sections and is the same for both males and females.

Proposed assumptions for 2016 valuation

10.1 We recommend amending the commutation assumption for Classic members in line with broadly 50% of the difference in experience since the 2012 valuation. This means an increase in Classic commutation of 0.4% to 5.4% of pension. The assumption for all other sections is specified in the Directions (currently 17.5% of pension).

Results of the Analysis

10.2 We analysed the amounts of pension exchanged for cash at retirement separately for Classic and non-Classic members.

Table 10.1: Commuted pensions on retirement (includes all types of retirements)

	Pension at retirement (before commutation) £ 000s	Pension commuted £000s	Commutation proportion
Classic members	592,176	39,521	6.7%
Non-Classic members	105,075	19,510	18.6%

Additional comments on analysis

10.3 Classic Plus members have benefits which are split between Classic and non-Classic scheme sections. From the data provided it was not possible to split Classic Plus benefits between the two sections to inform the separate analyses. Classic Plus benefits represented less than 5% of the pension coming into payment over the period and is therefore not expected to have a significant impact on the analyses undertaken.

10.4 Given the small proportion of ill-health retirements we have concluded that a combined assumption for all retirements is more appropriate for each of the Scheme sections.

10.5 Consistent with the other assumptions, we have considered scheme experience over a longer period, averaging experience over this and the previous actuarial valuation with the proposed 2016 assumption therefore effectively taking account of broadly half of the scheme's experience over the four year period to the 31 March 2016. This approach would result in Classic members being assumed to commute broadly 5.4% of pension. We therefore recommend updating the assumption to 5.4% consistent with the approach adopted for other scheme specific demographic assumptions.

11 Family statistics

Dependants' pensions are provided to qualifying dependants on the death of a member. Assumptions are required for the proportion of members who are married or partnered to determine how many dependants' pensions will be paid. Assumptions are required about age difference between members and partners as this affects how long dependants; pensions will be paid for.

Proposed assumptions for 2016 valuation

11.1 We recommend the following assumptions:

- Classic members are assumed to be married broadly in line with 97.5% of the 2012 actuarial assumption for males and 91.5% of the 2012 actuarial assumption for females. This is equivalent to around 68% of males and 50% of females being assumed to be married at retirement. Consistent assumptions are proposed for current and future pensioners.
- Non-Classic members are assumed to be married/partnered broadly in line with 97.5% of the 2012 actuarial assumption for males and 91.5% of the 2012 actuarial assumption for females. This is equivalent to around 73% of males and 50% of females being assumed to have a qualifying partner at retirement. Consistent assumptions are proposed for current and future pensioners.
- Male members are assumed to be 3 years older than their partners and female members are assumed to be 2 years younger than their partners. This is consistent with the 2012 assumptions.
- No allowance is made for remarriage on the grounds of materiality. This is consistent with the 2012 assumptions.

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

Analysis and approach to setting the assumptions

a) Proportions married/partnered

11.3 To formulate a recommended assumption we compared the scheme experience with the corresponding 2012 assumption.

11.4 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 of the Classic section 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).

11.5 As there is no robust scheme specific experience of proportions 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[15] with the same adjustment being applied to the standard table.

Results of analysis

11.6 The overall ratio of actual to expected numbers of members dying over the four-year period to 31 March 2016 and leaving a dependant eligible for a contingent pension are shown in the table below. In the below, expected numbers are based on the proportions married assumptions adopted for the 2012 valuation for the reasons outlined above.

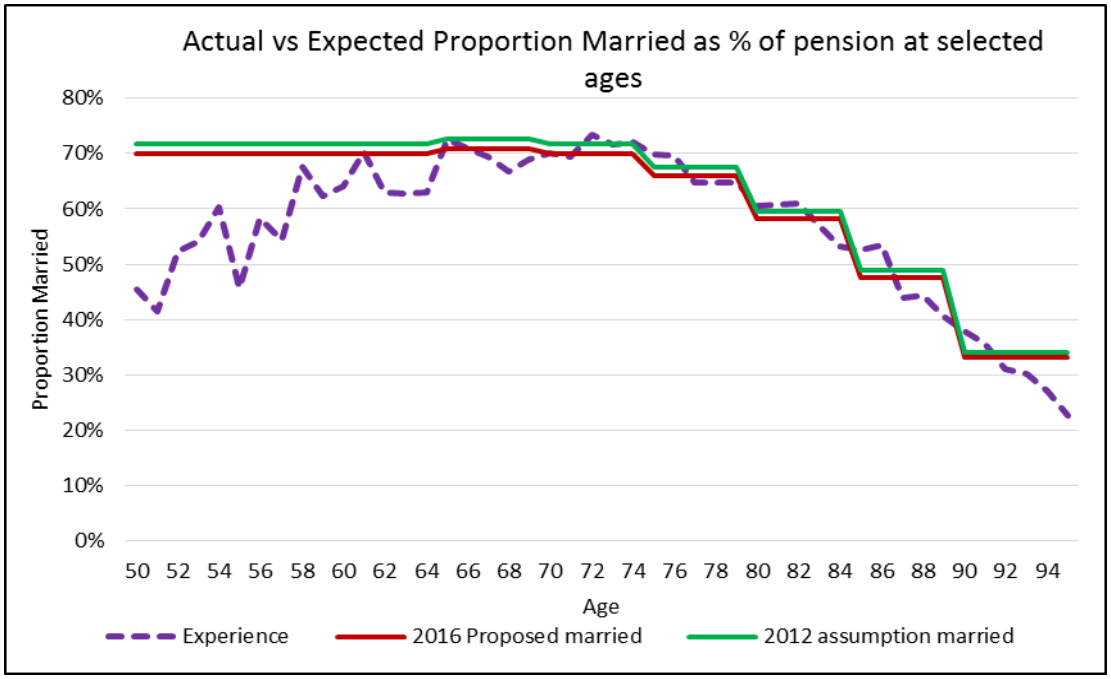
Table 11.1 Comparison of actual to expected proportions married at death

	A/E
Males	95%
Females[16]	83%

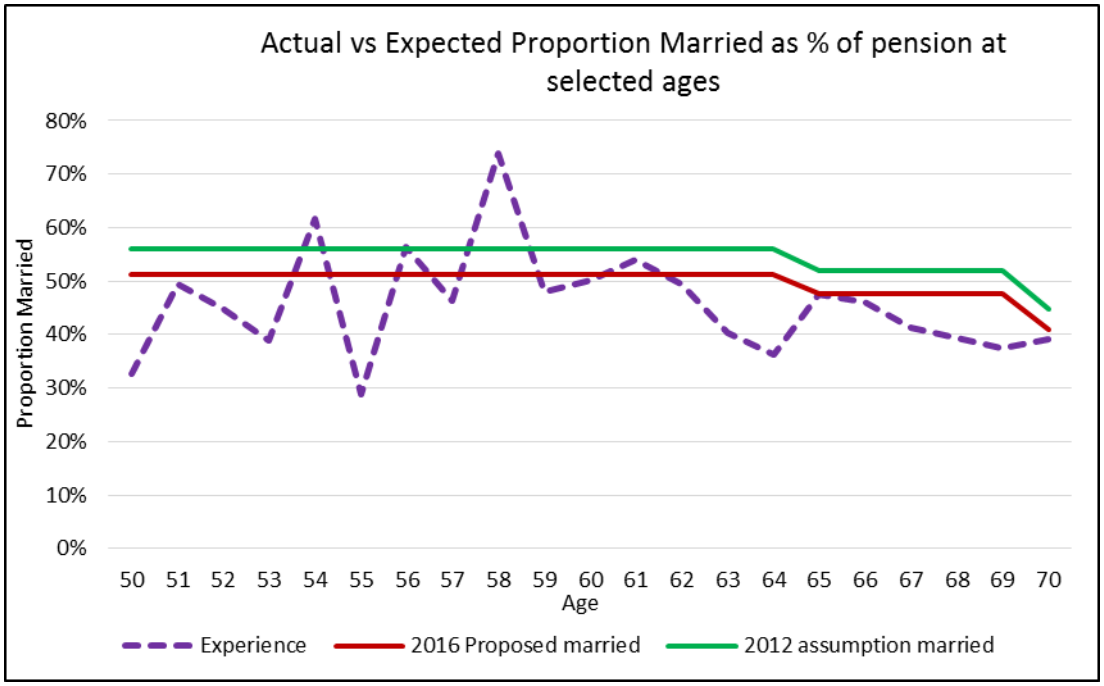
11.7 The graphs below show the proportion of members married who died in the 4 years ending 31 March 2016 compared with the 2012 assumption.

[15] Published by the Office for National Statistics (ONS)
[16] The analysis only covers deaths of members up to age 70. Above this age, there will be significant numbers of members with no service that counts for a spouse's pension. As a result, no dependant's pension will be payable for some members even if the member is married and so the experience does not provide a reliable measure of whether the member was married at death.

Graph 11.1: Comparison of actual proportions married for male pensioners who died in the 4 years ending 31 March 2016 against the 2012 assumptions



Graph 11.2: Comparison of actual proportions married for female pensioners who died in the 4 years ending 31 March 2016 against the 2012 assumptions



Additional comments on analysis

11.8 The scheme's experience by age over the four year period to 31 March 2016 is reasonably consistent to the assumption made for the 2012 valuation. The overall proportion dying with a dependant entitled to a pension is slightly lower than expected for male members (female dependants) but much lower than expected for female members. Allowing for some fluctuation in experience over periods of time we recommend broadly 50% of the difference in experience is reflected in the assumption to be adopted for the 2016 valuation.

b) Age difference between member and spouse/partner

11.9 We analysed the average age difference between members and their dependants (spouse, civil partner or other partner) at the date of the member's death over the four-year period from 1 April 2012 to 31 March 2016. The table below shows the results of this analysis.

Table 11.2: Age difference between member and spouse based on experience of the scheme over the 4-year period ending 31 March 2016

	Age difference between member and spouse
Males	+3.4 years
Females	-1.7 years

Additional comments on analysis

11.10 The use of a single age difference between a member and spouse, rather than an assumption that varies by the member's age at death, is a simplification, which is justified because the assumption is not particularly material. The analysis shows that the existing assumptions of +3 years for males and -2 years for females remain reasonable, especially when considering the ages of deaths that will result in dependants' pensions being paid for longer periods.

Appendix A: Details of assumptions

A.1 This appendix contains details of the recommended assumptions including sample rates and values.

Pensioner mortality

Table A1: Baseline mortality assumptions

Baseline mortality	Standard table[17]	Adjustment
Males		
Retirements in normal health	S2NMA	104%
Current ill-health pensioners	S2NMA	104%
Future ill-health pensioners	S2NMA	104%
Dependants	S2NMA	117%
Females		
Retirements in normal health	S2NFA	104%
Current ill-health pensioners	S2NFA	104%
Future ill-health pensioners	S2NFA	104%
Dependants	S2DFA	100%

A.2 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.

[17] From the 'S2' series of standard tables published by the CMI and based on the experience of self-administered pension schemes over the period 2004 to 2011. Separate tables are available based on experience of members retiring in normal and ill-health and for dependants.

Age retirement from service

Table A2: Age retirement rates for members with full protection in Classic, Premium and Classic Plus

Age	Salary band 1		Salary band 2		Salary band 3		Salary band 4	
	Males	Females	Males	Females	Males	Females	Males	Females
60	0.17	0.38	0.27	0.39	0.39	0.34	0.37	0.34
61	0.10	0.17	0.14	0.17	0.21	0.24	0.25	0.29
62	0.11	0.18	0.13	0.19	0.20	0.21	0.22	0.30
63	0.12	0.18	0.14	0.19	0.18	0.20	0.22	0.28
64	0.32	0.28	0.27	0.26	0.26	0.25	0.23	0.28
65	0.46	0.35	0.40	0.31	0.35	0.35	0.29	0.33
66	0.20	0.20	0.23	0.17	0.23	0.09	0.24	0.11
67	0.18	0.19	0.20	0.21	0.16	0.22	0.30	0.80
68	0.14	0.15	0.19	0.14	0.07	0.31	0.18	0.87
69	0.14	0.15	0.19	0.19	0.07	0.66	0.59	0.93
70	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

A.3 Nuvos members with full protection are assumed to retire at age 65.

Table A3: Age retirement rates for Salary Band 1 members with service in existing NPA 60 and 2015 Schemes

Age	SPA 65		SPA 66		SPA 67		SPA 68	
	Males	Females	Males	Females	Males	Females	Males	Females
60	0.17	0.38	0.17	0.38	0.17	0.38	0.10	0.21
61	0.10	0.17	0.10	0.17	0.10	0.17	0.07	0.11
62	0.11	0.18	0.11	0.18	0.08	0.14	0.06	0.10
63	0.12	0.18	0.12	0.18	0.09	0.14	0.06	0.10
64	0.32	0.28	0.06	0.07	0.05	0.07	0.04	0.05
65	1.00	1.00	0.16	0.24	0.06	0.07	0.05	0.07
66	1.00	1.00	1.00	1.00	0.16	0.24	0.06	0.07
67	1.00	1.00	1.00	1.00	1.00	1.00	0.16	0.24
68	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table A4: Age retirement rates for Salary Band 2 members with service in existing NPA 60 and 2015 Schemes

Age	SPA 65		SPA 66		SPA 67		SPA 68	
	Males	Females	Males	Females	Males	Females	Males	Females
60	0.27	0.39	0.27	0.39	0.27	0.39	0.15	0.22
61	0.14	0.17	0.14	0.17	0.14	0.17	0.09	0.11
62	0.13	0.19	0.13	0.19	0.10	0.15	0.07	0.10
63	0.14	0.19	0.14	0.19	0.11	0.15	0.07	0.10
64	0.27	0.26	0.06	0.07	0.05	0.07	0.04	0.05
65	1.00	1.00	0.16	0.24	0.06	0.07	0.05	0.07
66	1.00	1.00	1.00	1.00	0.16	0.24	0.06	0.07
67	1.00	1.00	1.00	1.00	1.00	1.00	0.16	0.24
68	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table A5: Age retirement rates for Salary Band 3 members with service in existing NPA 60 and 2015 Schemes

Age	SPA 65		SPA 66		SPA 67		SPA 68	
	Males	Females	Males	Females	Males	Females	Males	Females
60	0.39	0.34	0.39	0.34	0.39	0.34	0.21	0.20
61	0.21	0.24	0.21	0.24	0.21	0.24	0.12	0.15
62	0.20	0.21	0.20	0.21	0.15	0.16	0.09	0.10
63	0.18	0.20	0.18	0.20	0.13	0.15	0.08	0.10
64	0.26	0.25	0.06	0.07	0.05	0.07	0.04	0.06
65	1.00	1.00	0.16	0.24	0.06	0.07	0.05	0.07
66	1.00	1.00	1.00	1.00	0.16	0.24	0.06	0.07
67	1.00	1.00	1.00	1.00	1.00	1.00	0.16	0.24
68	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table A6: Age retirement rates for Salary Band 4 members with service in existing NPA 60 and 2015 Schemes

Age	SPA 65		SPA 66		SPA 67		SPA 68	
	Males	Females	Males	Females	Males	Females	Males	Females
60	0.37	0.34	0.37	0.34	0.37	0.34	0.20	0.20
61	0.25	0.29	0.25	0.29	0.25	0.29	0.14	0.17
62	0.22	0.30	0.22	0.30	0.16	0.22	0.10	0.14
63	0.22	0.28	0.22	0.28	0.16	0.21	0.10	0.14
64	0.23	0.28	0.06	0.07	0.05	0.07	0.04	0.05
65	1.00	1.00	0.16	0.24	0.06	0.07	0.05	0.07
66	1.00	1.00	1.00	1.00	0.16	0.24	0.06	0.07
67	1.00	1.00	1.00	1.00	1.00	1.00	0.16	0.24
68	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table A7: Age retirement rates for Nuvos members with service in existing and 2015 Schemes

Age	SPA 65		SPA 66		SPA 67		SPA 68	
	Males	Females	Males	Females	Males	Females	Males	Females
65	1.00	1.00	0.67	0.67	0.50	0.50	0.25	0.25
66	1.00	1.00	1.00	1.00	0.25	0.25	0.06	0.07
67	1.00	1.00	1.00	1.00	1.00	1.00	0.16	0.24
68	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table A8: Age retirement rates for new entrants to the 2015 Scheme

Age	SPA 65		SPA 66		SPA 67		SPA 68	
	Males	Females	Males	Females	Males	Females	Males	Females
60	0.03	0.05	0.03	0.05	0.03	0.05	0.03	0.05
61	0.04	0.05	0.03	0.05	0.03	0.05	0.03	0.05
62	0.05	0.07	0.04	0.05	0.03	0.05	0.03	0.05
63	0.06	0.07	0.05	0.07	0.04	0.05	0.03	0.05
64	0.16	0.24	0.06	0.07	0.05	0.07	0.04	0.05
65	1.00	1.00	0.16	0.24	0.06	0.07	0.05	0.07
66	1.00	1.00	1.00	1.00	0.16	0.24	0.06	0.07
67	1.00	1.00	1.00	1.00	1.00	1.00	0.16	0.24
68	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Ill-health retirement from service

Table A9: Ill-health retirement rates for all members

Age	Males	Females
20	0.0001	0.0001
25	0.0001	0.0001
30	0.0002	0.0002
35	0.0005	0.0004
40	0.0009	0.0007
45	0.0013	0.0010
50	0.0020	0.0019
55	0.0036	0.0032
60	0.0058	0.0058
65*	0.0079	0.0081

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

A.4 In all non-Classic scheme sections, 42% of male ill-health retirements and 67% of female ill-health retirements are assumed to qualify for upper tier awards. There is a single tier for ill-health retirements in the Classic section so no assumption is needed.

Voluntary withdrawal from service

Table A10: Withdrawal rates (net of re-entry) for all members

Age	Salary band 1		Salary band 2		Salary band 3		Salary band 4	
	Males	Females	Males	Females	Males	Females	Males	Females
20	0.130	0.121	0.060	0.059	0.044	0.059	0.035	0.039
25	0.099	0.100	0.038	0.050	0.032	0.050	0.035	0.032
30	0.080	0.060	0.027	0.035	0.026	0.030	0.034	0.020
35	0.063	0.050	0.022	0.024	0.020	0.020	0.030	0.023
40	0.053	0.045	0.017	0.017	0.018	0.020	0.025	0.025
45	0.047	0.035	0.015	0.016	0.015	0.020	0.025	0.025
50	0.045	0.038	0.020	0.025	0.022	0.023	0.030	0.040
55	0.050	0.043	0.030	0.035	0.040	0.045	0.050	0.060
60	0.041	0.032	0.020	0.025	0.030	0.035	0.040	0.050
65	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.025

*rates are zero if above NPA (Where NPA is assumed to be that which would apply in the 2015 scheme for those members who are unprotected or have tapered protection).

Death before retirement

Table A11: Death before retirement rates for all members

Age	Males	Females
20	0.0003	0.0001
25	0.0003	0.0001
30	0.0004	0.0002
35	0.0004	0.0003
40	0.0006	0.0004
45	0.0009	0.0006
50	0.0012	0.0010
55	0.0020	0.0014
60	0.0031	0.0022
65	0.0049	0.0035

Promotional pay increases

Table A12: Promotional salary scales for all members

Age	Salary band 1		Salary band 2		Salary band 3		Salary band 4	
	Males	Females	Males	Females	Males	Females	Males	Females
20	111.6	128.7	110.7	120.4	134.6	128.7	134.6	128.7
25	133.7	148.9	134.1	158.8	208.6	173.4	208.6	173.4
30	159.3	164.8	169.1	187.6	277.7	219.7	277.7	219.7
35	186.4	177.3	199.4	203.2	329.0	251.8	329.0	250.3
40	205.4	183.5	221.0	215.2	370.5	274.3	370.5	275.1
45	211.7	187.5	234.8	226.0	406.9	294.0	412.0	297.1
50	216.2	190.2	243.8	232.6	438.3	309.3	453.5	321.9
55	220.7	191.7	249.8	236.6	467.4	321.5	495.0	343.9
60	225.2	192.0	253.3	238.0	488.7	329.0	521.1	357.1
65	229.7	192.0	255.8	238.0	498.3	331.5	533.8	363.1

Commutation of pension for cash at retirement

Table A13: Recommended commutation assumptions for the 2016 valuation

	Classic	Non-Classic[18]	2015 scheme service[37]
Males	5.4%	17.5%	17.5%
Females	5.4%	17.5%	17.5%

A.5 Classic Plus members are assumed to commute 17.5% of their post 1 October 2012 pension.

Family statistics

Table A14: Recommended proportion married or partnered at retirement for future pensioners

	Classic members	Non-Classic members
	Proportion married	Proportion married or partnered
Males	68%	73%
Females	50%	50%

Table A15: Proposed proportion married or partnered for current pensioners (at the valuation date)

Age	Classic members		Non-classic members	
	Males	Females	Males	Females
50	70%	51%	74%	53%
60	70%	51%	74%	53%
70	69%	41%	72%	42%
80	59%	20%	59%	20%
90	33%	5%	33%	5%

A.6 Male members are assumed to be 3 years older than their partners and female members are assumed to be 2 years younger than their partners.

[18] Specified by Directions

Appendix B: Modelling approach and minor assumptions

Active membership projections

B.1 Direction 11 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 70%) 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 expected cost of accruing benefits over periods after the effective date have been determined by assuming an overall stable population (age and pay profile) to the end of implementation period. In particular:

- Allow for the protected population to reduce over the projection period (i.e. to 2023) with a corresponding increase in those accruing benefits in the 2015 scheme to maintain the stable population. SPA in the projected populations is determined by implied dates of birth and so the SPA mix changes over time despite the assumed stable population.
- Mortality is projected forward to the relevant year of use in all cases.
- The run off of the protected population is broadly linear from the relevant calculation date to the average age at which members of each identified group (e.g. NPA 60 and 65 members) are expected to retire.

B.4 The expected cost of accruing benefits over periods after the effective date for cost cap purposes has been determined by assuming:

- The aggregate membership has the same age/pay profile over all projection periods (i.e. to 2023) (and assuming all in the 2015 scheme).
- Allow for the actual membership (assumed) accruing benefits in the 2015 scheme to change over the projection period (i.e. to 2023). SPA in the projected populations is determined by implied dates of birth and so the SPA mix changes over time despite the assumed stable population.
- Mortality is projected forward to the relevant year of use in all cases.

Grouping of individual active member records

B.5 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. Classic, Classic Plus, Premium, Nuvos or Alpha) and protection status (i.e. protected, tapered or unprotected), and are also based on the following criteria.

Age	*Age nearest*
Service	Duration (years nearest)

Accrual cost methodology

B.6 See B.3 and B.4. The cost over each relevant period has been taken as the average of the cost at the start and end of each period.

B.7 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 for the pre-2015 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.8 Non-accruing benefits such as lump sums payable on death in service have been recognised only when a benefit payment is expected.

B.9 Members accruing or expecting to accrue benefits at double rate (Prison Officers after completion of 20 years' service) are treated as though the overall expected benefit accrues uniformly over all service.

Guaranteed Minimum Pensions (GMPs)

B.10 A global adjustment was applied to reduce the past service liability in respect of estimated GMP entitlements for which provision of post SPA pension increases is not the responsibility of the scheme. The reduction is equivalent to a contribution rate of 0.9% of pensionable pay over the 15 year period from the implementation date. This estimation has no impact on the calculation of the employer contribution correction cost.

Earnings cap

B.11 For members joining pensionable service on or after 1 June 1989 pensionable pay is restricted to an 'earnings cap' unless they are members of the Nuvos section of the scheme (unless they have linked service). Due to the way in which individual active member data is grouped for valuation purposes it is not possible to directly restrict pay in the valuation system. However, there are very few such members of the scheme whose earnings are either already above the earnings cap or estimated to exceed the earnings cap by retirement. The earnings cap has therefore not been allowed for.

Public Service Transfer Club (PSTC) and re-joiner aggregation costs

B.12 Allowance will be made for the potential additional liabilities arising from inward transfers on PSTC terms and additional benefits arising due to linkage of service for re-joiners.

B.13 We have made an addition to the value of future benefit accrual of 0.2% of pensionable pay, to cover the estimated costs arising from PSTC transfers-in. This adjustment applies to the calculation of the valuation results.

B.14 In the longer term, PSTC transfers will increasingly be transfers of career average benefits, and it is likely that PSTC costs to the Scheme will fall over time.

B.15 No allowance has been made for the cost of the additional benefits arising when a member re-joins the PCSPS and links their current and previous periods of pensionable service. This is a change from the previous assumption that cost of the additional benefits arising are equivalent to about 0.2% of pensionable pay. These costs do not apply to the calculation of the employer contribution correction cost.

B.16 Re-entry of current active members to pensionable service in future has been modelled by the use of a 'net' withdrawal assumption. This explicitly allows for a proportion of those leaving active service to return.

Expenses

B.17 The current employer contribution rates include an additional 0.15% of pensionable pay in respect of the central administration expenses of the scheme. Cabinet Office have confirmed that an addition of 0.32% of pensionable pay should be made for administration expenses from 1 April 2019.

Final pensionable pay

B.18 All liabilities have been based on pensionable pay at the effective date as provided by the administrator. 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.19 No allowance has been made for short term dependant pensions or children's pensions (other than those already in payment), on grounds of immateriality.

Early retirement factors

B.20 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).

Additional voluntary contributions

B.21 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.22 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.23 Cabinet Office have confirmed that we should assume that the member contribution yield over the implementation period will be 5.6%.

Partnership Pension Account Ill-Health and Death Benefits Arrangements

B.24 The Partnership Pension Account Ill-Health and Death Benefits Arrangements provided under Schedule 3 and Schedule 4 respectively of the 2015 scheme regulations (SI 2014/1964, as amended) are not included in the calculation of the valuation results, since exclusion of these benefits is not expected to have a material impact on the results. Employers currently pay 0.5% of pensionable pay (for members of "Partnership", a defined contribution stakeholder pension scheme) towards the cost of these benefits (sometimes referred to as the "mini-ASLC"). A separate review of the mini-ASLC will be carried out following the completion of the 2016 Valuation of the Scheme.

Other Direction interpretations

Directions 27 and 28 (contribution rates)

B.25 27(1)(a) and 27(1)(c) : Payroll at effective date projected forward (only) in line with valuation earnings assumptions for purposes of spreading the deficit.

B.26 27(1)(c)(ii) and 28 : Member contributions since the effective date based on actual (or expected) yield for past periods and periods up to 31 March 2019. Set equal to target contribution yield from April 2019. See B23.

B.27 27(1)(b) and 27(1)(d) : See B.3 and B.4.

Directions 28, 31, 32(1), 33(2)(a) (and related) – member contribution yields

B.28 See paragraph B.23.

Directions 32(1) – expected cost of benefits for past periods (for cost cap purposes)

B.29 Assume that contribution rate required to cover cost of benefits over 2015-16 is the same as the rate required to cover cost of benefits over 2015-19.

Directions 32(1) and 40(1) – expected cost of benefits for future periods (for cost cap purposes)

B.30 See B.4.

Direction 33 – cost cap income

B.31 For the CCNLL element this has been based on the liability discount rate used for the cost cap liabilities at 2016 rather than the investment roll up. The impact is immaterial to the results.

Appendix C: Assumptions made for data uncertainties

Summary

C.1 Data was received from MyCSP for the 2016 valuation. This was generally reasonable for the purposes of the valuation calculations, however, some aspects of the data were incomplete and/or unreliable for certain elements of our 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 Minister 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 MyCSP 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 MyCSP to address a number of these issues, however where critical data items were missing from member records or not considered to be reliable 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 1% of records were excluded from the 2016 valuation data and around 3% of the data provided for the purposes of setting the initial cost cap fund.

C.6 As noted, the approach taken to data omissions is to assume each record with missing data has the same average profile as the complete records and therefore there is a risk that this assumption is not appropriate. The table below indicates the extent to which the valuation results might be incorrect if the approach in fact under/overstates the liability for the omitted members by 10%, which we believe to be a reasonable level to consider.

Membership group	Uprating applied	Impact of error in assumption for missing data (% of pay)	
		Uncorrected employer contribution rate	Employer contribution correction cost
Actives	4%	0.3%	0.3%
Deferreds	1%	<0.05%	nil
Pensioners	0%	nil	nil

C.7 The table above illustrates 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.8 MyCSP 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.9 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. A number of the 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 assumption for baseline pensioner mortality.

C.10 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 valuation results. For example, if the number of pensioner deaths was overstated or understated in the data available for setting assumptions for the 2016 valuation but correctly stated at a subsequent valuation, this would have an impact on the mortality assumptions adopted and potentially lead to a large change in the assumption at future valuations and hence a corresponding change in liability and employer cost.

Net Leavers Liability (NLL)

C.11 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.12 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.13 For the purposes of determining the 2016 valuation results, we recommend 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.14 We expect that the uncertainty introduced by the approach above is not more than 0.1% of pay. Although it should be noted that the deficiencies in the membership data discussed above could compound this scale of uncertainty.

C.15 We would not expect significant unidentified experience gains or losses to arise over the one year period 2015 to 2016 in the normal course of events, although such experience can occur. In addition we have reconciled the surplus or deficit arising over the period 2012-16 with only a small unattributed item.

C.16 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 Minister set assumptions

D.1 The table below provides an indication of the sensitivity of the valuation results to the particular assumptions under consideration. The figures shown here are also provided in section 4 of the formal valuation report.

Sensitivity of valuation results to Minister set assumptions

	Addition to uncorrected employer contribution rate	Addition to employer contribution correction rate
B. Minister set assumptions		
Membership profile: 2 years older on average over implementation period	1.1%	1.1%
Mortality rates: 5%* heavier rates of pensioner mortality	(1.0)%	(0.5)%
Age retirement rates: members without full protection to retire (on average) one year later than currently assumed	(0.3)%	(0.2)%
Commutation (other than as directed) all eligible members of Classic commute 2% of pension more than assumed	(0.1)%	(0.1)%
Ill-health retirement: 5%* increase to assumed rates	0.0%	0.0%
Ill-health retirement: 5%* increase in proportion assumed to receive higher tier benefits	0.0%	0.0%
Proportions partnered: 5%* more members assumed to have qualifying partners at death	0.3%	0.3%
Resignations and opt outs: 5%* higher numbers assumed to leave voluntarily before retirement (net of rejoiners)	0.0%	0.0%
Promotional pay increases: 0.5% higher promotional pay increases than assumed	1.7%	1.3%

* All these represent multiplicative increases to rates, i.e. 5% means rates 1.05 times higher.

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

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