

The cost and value of UK defined benefit pension provision

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Abstract

The purposes of this paper are to consider the effect on remuneration of defined benefit pension accrual and the factors that have resulted in changes to the cost and value of this accrual. In this paper, I look at the effect of the change in the cost to an employer of providing a defined benefit pension on the overall cost of remunerating an employee and compare that with the cost of remunerating an employee with no such pension benefits. I allow for the additional cost to the employer of national insurance contributions ('NICs'). I also look at the change in value of an employee's remuneration, taking into account the value of defined benefit pension accrual and compare this with the change in remuneration for an employee with no such benefits. Here, I allow for employee national insurance contributions and income tax. These assessments look at the cost and value of pension accrual rather than any surplus or deficit relating to previously accrued pension entitlements. I find that costs of employment have risen significantly more for members of defined benefit pension schemes compared with other employees, and that this has largely been as a result of falling long-term interest rates and their effect on the cost of defined benefit pension accrual. The increase in the value of remuneration to employees has shown a similar pattern.

1 Introduction

Pension scheme deficits in the UK have been a cause of concern since the turn of the twenty-first century. Even with stock markets rising more or less continuously since early 2003, total deficits for the FTSE 100 are still around £36bn according to Lane, Clark and Peacock (2006). The negative effect of such deficits on corporate earnings is well understood. Less well understood, however, is the effect of the ongoing accrual of defined benefit pension benefits on company profits. This is important because firms offering defined benefit pensions could well be subject to different levels of wage inflation when compared to those firms offering defined contribution pensions or no pensions at all. It is also interesting to consider the situation from an employee's point of view, looking at the total level of remuneration received is impacted by pension scheme membership.

It might not be clear why the distinction should be between those receiving defined benefit pensions and all other employees. Consider two companies, one with a defined

contribution scheme with employer contributions of 10% of salary, and one with no pension benefits. If the average wage for each company rises from £10,000 to £10,500, this is clearly an increase of 5%. The firm with a defined contribution pension scheme will also see its average pension bill per member rise from £1,000 (10% of the average salary) to £1,050, so the average total remuneration for this company will have risen from £11,000 to £11,550 – still an increase of 5%. In other words, a firm with a defined contribution pension scheme can be treated as being the same as a firm with no pension scheme for the purpose of this analysis.

At first sight, it is difficult to see why a firm might want to pay different amounts to employees based on their pension scheme membership, or even to offer a pension scheme. Bolton (1997) suggests that non-wage benefits can be used to portray an employer as caring; given the paternalistic nature of a defined benefit pension scheme, such a reason could be particularly fitting for this type of benefit. Furthermore, Collard *et al.* (2005) suggest that one of the advantages of non-wage benefit provision is that it increases the transaction costs of moving jobs, committing workers to a specific firm. This would be particularly true for defined benefit pension schemes, where leaving service actually results in a fall in the expected value of accrued benefits. This is because, as an active member of a pension scheme, accrued pensions generally increase in line with salary, whereas a deferred pension would usually increase only in line with price inflation, and even then with a 5% per annum limit. Given that salary inflation exceeds price inflation, accrued benefits are more valuable to current employees. The transaction cost argument perhaps explains why a firm would be prepared to continue providing such benefits despite the large increase in costs. This is supported by Forth and Millward (2000), who find a positive relationship between the level of earnings and the likelihood of an occupational pension being offered. Such a relationship suggests that it is the more highly valued employees (with higher salaries) who are likely to be offered defined benefit pension provision.

The results of Forth and Millward (2000) suggest that better-paid jobs are more likely to come with occupational pensions, not that a higher salary is being offered as compensation for a lack of an occupational pension. In perfect markets with employees acting rationally, the total level of remuneration demanded should take into account the level and type of pension benefits offered; however, this does not appear to be the case.

The transaction costs mentioned above offer one explanation – suggesting that markets are not perfect – but another explanation is that employees are not acting rationally. Such irrationality would reflect the lack of knowledge that many people have about the retirement benefits to which they are entitled. Mitchell (1988) finds that in the US many people do not know even the type of pension scheme to which their membership relates, and many who think that they do know are wrong. Starr-McCluer and Sundén (1999) find some improvement in pension knowledge, but Gustman and Steinmeier (2001, 2004), when looking at workers nearing retirement age, find that only around half know their projected retirement benefits. Even more recently, Sundén (2006) still finds that a large share of participants do not know key details about their pension schemes.

There is less research in the UK on the knowledge of pensioners but Fidelity Investments International (2006) do find that most individuals seriously overestimate the level of income their savings will produce at retirement. Having said this, there is some evidence that the cost of pension accrual is now being reflected in the take-home pay of members in the UK. For example, as reported by BBC News (2006, 2007), BAE Systems has increased contribution rates to reflect the increase in costs, and British Airways is trying to take similar steps.

There is a considerable volume of research on changes in earnings over time, but this analysis generally looks at gross earnings excluding pensions. Much of this research is produced by Government agencies and departments. For example, Fitzner (2006) from the Department of Trade and Industry in the UK provides detailed analysis of wage growth analysed across a number of factors. He finds that in the ten years to 2006, real wages growth averaged around 2.75% per annum in the private sector and over 2.25% per annum in the public sector. He finds that these gains occurred across all major industries with women receiving higher pay rises than men. He also finds that those workers with poor qualifications or no qualifications at all received wage increases at least as high as their better-qualified counterparts, a situation helped by the introduction of the national minimum wage in 1998.

There is also research into the way in which various earnings indices are constructed. Ada *et al.* (2006) look at the impact of changing methodologies in the collection of earnings data from the Labour Force Survey (LFS) to the New Earnings Survey (NES), in particular analysing the effect across UK regions, and finding that the exclusion of lower-paid employees from the latter survey systematically understates earnings. The Annual Survey of Hours and Earnings (ASHE) addresses this issue, and data from this survey are analysed by Dobbs (2006).

Finally, there is research on the impact that tax has on earnings. Clark and Leicester (2004) find that tax changes account for around half of the increase in income inequality in the 20 years from 1979, Brunello *et al.* (2006) show that, in the UK, the proportion of earnings made up of from profit-related pay falls as taxes rise, and in analysing the effect of changes in taxation on the gross wage, Lockwood and Manning (1993) find that the effect is more complex than can be explained by assuming that the net wage is what employees care about.

What is missing from the literature, however, is an analysis of the impact on earnings not only of income tax, but also of national insurance contributions and, importantly, the value of defined benefit pension accrual where offered. Looking at these items as costs to the employer (where appropriate) rather than benefits to the employee is also useful. In order to assess the cost and value of benefits being paid and received, I look at the increase in the various costs of employing an individual taking into account wages, income taxes, and pension accrual. Implicitly, therefore, I ignore the effect on company profits of the cost of removing pension scheme deficits (the excess of pension scheme liabilities over pension scheme assets) since these have been created largely as a result of the investment policies and funding valuation bases adopted by pension schemes rather than by the liabilities themselves.

2 Methodology for the calculation of the cost of pension accrual

In order to calculate the effect of defined benefit pensions on the level of net earnings, I need to calculate the value of an extra year's pension being earned, also known as the cost of accrual. The basic approach that I use to calculate the cost of accrual is the projected unit credit method. This gives the cost now of providing for an additional year's accrual of pension payable from retirement. This is equivalent to calculating the present value of a deferred annuity payable from the date of retirement. In order to calculate the value of this deferred annuity, which I assume to be paid continuously with increases being awarded continuously until death, I use actuarial commutation functions. If the value of a continuous deferred annuity payable in n years to an individual currently aged x is ${}_n\bar{a}_x$, then

$${}_n\bar{a}_x = \frac{\bar{N}_{x+n}}{D_x}, \quad (1)$$

where $\bar{N}_x \approx N_x - (\frac{1}{2} \times D_x)$, $N_x = \sum_{t=0}^{\infty} D_{x+t}$, $D_x = \frac{l_x}{(1+i)^x}$, l_x is the number of lives aged x , and i is the valuation rate of interest used to discount the liabilities. I also allow for the cost of widows' and widowers' pensions payable if the pension scheme member dies after retirement. Such a benefit is known as a deferred reversionary annuity. If the value of such an annuity is ${}_n\bar{a}_{x|y}$, then

$${}_n\bar{a}_{x|y} = {}_n\bar{a}_y - {}_n\bar{a}_{xy}, \quad (2)$$

where ${}_n\bar{a}_{xy} = \frac{\bar{N}_{x+ny+n}}{D_{xy}}$, $\bar{N}_{xy} \approx N_{xy} - (\frac{1}{2} \times D_{xy})$, $N_{xy} = \sum_{t=0}^{\infty} D_{x+t;y+t}$, $D_{xy} = \frac{l_{xy}}{(1+i)^{(x+y)/2}}$ and l_{xy} is the number of lives aged x multiplied by the number of lives aged y .

One adjustment that needs to be made to the cost of accrual is the deduction of members' own contributions. According to Occupational Pension Schemes 2004, the level of member contributions to private sector defined benefit pension schemes follows a bimodal distribution with 20% of members making no contribution, 44% contributing between 5% and 7%, and the remainder contributing between 0% and 5% or more than 7%. I therefore consider the non-contributory scenario and also a scenario where 6% of member contributions are paid.

3 Methodology for the calculation of the change in earnings

In this section, I outline the procedure I use to convert gross levels of earnings excluding pensions to earnings net of tax and national insurance contributions and allowing for pensions. I use two very similar approaches, one for calculating the increase in cost from the employer's point of view and the other for calculating the increase in benefit from the employee's point of view.

From the employer's point of view, I compare:

- gross earnings excluding pension;
- earnings *plus* employer national insurance contributions, excluding pension accrual; and
- earnings *plus* employer national insurance contributions and pension accrual.

From the employee's point of view, I compare:

- gross earnings excluding pension;
- earnings *less* employee national insurance contributions and income tax, excluding pension accrual; and
- earnings *less* employee national insurance contributions and income tax *plus* pension accrual.

For this high-level part of the analysis, the approach I use to consider the impact of the different factors is to layer the effects one on top of the other. As mentioned above, the base scenario is the increase in gross earnings ignoring national insurance contributions and, if appropriate, income tax. The earnings that I consider are national average earnings ('NAE'). I then consider the effect of allowing for national insurance contributions and income tax and calculate the difference between the increase in this figure and the increase in gross earnings. This is the increase (or decrease) in benefits attributable to changes in national insurance contributions and income tax. Because the effects of national insurance contributions and income tax vary depending on the level of earnings, I consider the effects in respect of individuals not only earning national average earnings, but also half, twice, and four times national average earnings.

Next, I look at the effect of allowing for defined benefit pension accrual, assuming that the benefits paid are in line with the statutory minima. For contracted-in pension schemes, this meant that no increases were required for pension accrued before 6 April 1997; increases in line with Retail Price Index inflation subject to a maximum of 5% per annum (5% Limited Price Indexation) for pension accrued on or after 6 April 1997 and before 6 April 2005; and 2.5% Limited Price Indexation for pension accrued on or after 6 April 2005. I take the increase in earnings allowing for national insurance contributions, income tax (if appropriate) and pension accrual, and deduct the increase in earnings allowing only for national insurance contributions and income tax. This gives the increase in earnings attributable to changes in the cost of pension accrual.

In this part of the analysis, I also allow for all changes in nominal and real interest rates, and in mortality assumptions. For periods starting on 6 April for years up to and including 1999, I assume that the mortality is in line with the tables AM80 and AF80 for men and women before retirement, and PMA80(c=2010) and PFA80(c=2010) for men and women after retirement. All of these tables were published in 1990 and are based on mortality investigations using data from the years 1979 to 1982 with mortality projected to the calendar year 2010 in the second two tables. For the years commencing on or after 6 April 2000, I assume that the mortality is in line with the tables AM92 and AF92 for men and women before retirement, and PMA92(c=2020) and PFA92(c=2020) for men and women after retirement. All of these tables were published in 1999 and are based on mortality investigations using data from 1991 to 1994, with mortality projected to 2020 in the second two tables. For years commencing 6 April 2003 and later, three amendments to PFA92 and PMA92 are available, reflecting the greater than expected improvement in longevity, particularly in the 1980s and particularly for those

individuals born in and around 1926. These new bases are the short cohort ('sc'), medium cohort ('mc') and long cohort ('lc') projections. The sc projection assumes that the improvement continues to 2010; the mc projection assumes that it continues to 2020; and the lc projection assumes that it continues to 2040. In this high-level analysis, I ignore these projections. In these tables, 'AM' refers to male assured lives, and 'AF' to female assured lives, being the mortality of male and female holders of whole life assurance policies. 'PMA' and 'PFA' refer to pensioner male amounts and pensioner female amounts respectively, being the mortality of males and females holding pension annuities, the mortality being weighted by the size of the pension. The numbers '80' and '92' refer to the midpoint of the four-year period used for each of the data samples.

The change in gross earnings from year x to year $x + 1$ is ΔG_x , defined as

$$\Delta G_x = \frac{G_x}{G_{x-1}} - 1, \quad (3)$$

where G_x represents the gross earnings in year x . The change in net earnings *excluding* pension accrual from the employer's point of view is ΔN_x^{er} , defined as

$$\Delta N_x^{er} = \frac{G_x + NIC_x^{er}}{G_{x-1} + NIC_{x-1}^{er}} - 1, \quad (4)$$

where NIC_x^{er} represents the employer national insurance contributions payable for year x . The change in the cost of employment due to changes in national insurance contributions is therefore $\Delta N_x^{er} - \Delta G_x$. The change in net earnings *including* pension accrual from the employer's point of view is ΔT_x^{er} , defined as

$$\Delta T_x^{er} = \frac{G_x + NIC_x^{er} + (G_x \times PF_x)}{G_{x-1} + NIC_{x-1}^{er} + (G_{x-1} \times PF_{x-1})} - 1, \quad (5)$$

where PF_x is the cost of accruing an extra year's pension per £1 of gross earnings in year x . Therefore, the change in the cost of employment due to changes in the cost of pension accrual is $\Delta T_x^{er} - \Delta N_x^{er}$.

The calculations are similar from the employee's point of view. Here, the change in net earnings *excluding* pension accrual is ΔN_x^{ee} , defined as

$$\Delta N_x^{ee} = \frac{G_x - NIC_x^{ee} - IT_x^{ee}}{G_{x-1} - NIC_{x-1}^{ee} - IT_{x-1}^{ee}} - 1, \quad (6)$$

where NIC_x^{ee} represents the employee national insurance contributions and IT_x^{ee} the income tax both payable in year x . The change in the benefit to the employee due to changes in national insurance contributions and income tax is therefore $\Delta N_x^{ee} - \Delta G_x$. The change in net earnings *including* pensions accrual from the employee's point of view is ΔT_x^{ee} , defined as

$$\Delta T_x^{ee} = \frac{G_x - NIC_x^{ee} - IT_x^{ee} + (G_x \times PF_x)}{G_{x-1} - NIC_{x-1}^{ee} - IT_{x-1}^{ee} + (G_{x-1} \times PF_{x-1})} - 1, \quad (7)$$

so the change in the benefit of employment to the employee due to changes in the value of pension accrual is $\Delta T_x^{ee} - \Delta N_x^{ee}$.

Additionally, I analyse the components of the change in the value of pension accrual separately. The approach I use for this is slightly different to the approach above, in that I analyse the effect of each of the assumptions individually rather than cumulatively, resulting in an additional balancing item to allow for the cross-products.

I define ${}_yPF_x$ as the cost of accruing an extra year's pension per £1 of gross earnings in year x using all of the assumptions for year x , except the assumption for y , where y is equal to m (mortality), d (discount rate), or p (change to pension accrued). The assumption for y is that which would have been used if year $x-1$ data still applied. This is not necessarily the same as the assumption actually used in year $x-1$. For example, if the increase to pensions in payment for benefits accrued in year $x-1$ is nil, but for benefits accrued in year x is in line with RPI, then the discount rate used in the calculation of ${}_pPF_x$ is the real interest rate from year $x-1$ rather than the nominal interest rate actually used in year $x-1$.

The change in total cost to the employer using the data applicable to year $x-1$ for assumption y can be defined as $\Delta_yT_x^{er}$, where

$$\Delta_yT_x^{er} = \frac{G_x + NIC_x^{er} + (G_x \times {}_yPF_x)}{G_{x-1} + NIC_{x-1}^{er} + (G_{x-1} \times PF_{x-1})} - 1. \tag{8}$$

The cost to the employer attributable to a change in assumption y is therefore calculated as $\Delta T_x^{er} - \Delta_yT_x^{er}$ for each y . The difference between the sum of these three costs and the total cost attributable to pension accrual gives the residual.

Similarly, $\Delta_yT_x^{ee}$ is calculated as

$$\Delta_yT_x^{ee} = \frac{G_x - NIC_x^{ee} - IT_x^{ee} + (G_x \times {}_yPF_x)}{G_{x-1} - NIC_{x-1}^{ee} - IT_{x-1}^{ee} + (G_{x-1} \times PF_{x-1})} - 1 \tag{9}$$

and $\Delta T_x^{ee} - \Delta_yT_x^{ee}$ gives the benefit to the employee attributable to a change in assumption y , with the residual being calculated as above.

I also use this approach to calculate the additional effect of changing to the sc, mc, and lc projection bases in 2003.

As well as carrying out the analysis on a year-to-year basis, I also calculate the average change for each component over the whole period.

The interest rates I use in this analysis are the nominal gross redemption yield on the 30-year UK Government Bond and the real gross redemption yield on the 30-year UK Index Linked Government Bond assuming 3% per annum inflation.

I carry out these calculations over a range of ages (20, 40, and 60 years of age) and for both men and women.

4 Additional assumptions

A number of additional assumptions are required when calculating the cost of pension accrual. I assume that the contribution rate for the following 12-month period is set on 6 April each year using the yield information applicable on that date. I assume that the benefit provided is a pension of one-sixtieth of final salary for each year of pensionable service. According to Occupational Pension Schemes 2004, 60% of

private sector defined benefit pension schemes used this accrual rate in 2004, making this accrual rate more than five times as popular as the nearest alternative.

I assume a normal pension age of 65, the normal pension age used by 53% of private sector schemes, according to the same survey.

I assume that each pension scheme member also accrues a spouse's pension of 50% of the member's pension payable should the member die after retirement. The above survey shows that 96% of private sector defined benefit schemes provide a spouse's pension and of these 74% provide a pension of up to 50%.

I assume that pension scheme members remain in active service until retirement, and so their benefits increase in line with salary inflation in the period up to retirement. I assume future salary inflation to be 1.5% above the increase in the Retail Price Index. This is in line with the difference between average earnings and retail prices for the period 1990 to 2006.

Prior to retirement, pension schemes might be expected to offset the cost of pension accrual by investing in assets with a higher expected return than bonds, typically equities. One way of allowing for this higher expected return is to allow for an equity risk premium over bonds in the discount rate used to value the liabilities. Dimson *et al.* (2006) imply that a forward looking world equity risk premium of 4% over bonds would be appropriate. I therefore use this figure as the maximum risk premium, and also consider risk premia of 2% and 0% to allow for 50% and zero allocations to equities in respect of members' benefits before retirement.

The discount rate I use for pre-retirement benefits is therefore the real yield on the 30-year UK Index Linked Government Bond less 1.5% plus either 0%, 2%, or 4% depending on the degree to which equity investment is assumed.

The increases to pensions in payments accrued in different periods are outlined earlier; however, some assumptions are needed in the choice of interest rate used. I assume that equities will not be held in respect of pensioners' benefits, so no adjustment is needed here. The appropriate discount rate for benefits with no pension increase is therefore straightforward, being the nominal yield on the conventional gilt. For benefits where either 5% Limited Price Indexation or 2.5% Limited Price Indexation increases are due, I use the greater of the real yield on the index linked bond and the difference between the nominal yield on the conventional bond and the fixed upper limit to pension increases (either 5% or 2.5% per annum). This is, however, only an approximation if any volatility in price inflation is expected. To illustrate this, consider what happens if Retail Price Index inflation is expected to be 4.5% on average and the benefits receive 5% LPI pension increases. If price inflation actually oscillates between 5.5% and 3.5%, then the average pension increase will be 4.25% (the average of 3.5% and 5%) rather than 4.5% since the 5% cap on pension increases will apply for half of the time. I am therefore making an assumption that future inflation is expected to be in line with the implied inflation from the index linked and conventional bonds with no volatility from year to year.

I ignore indirect taxes and benefits related to factors such as age, marital status, disability, and dependent children. I also ignore any other benefits in kind. Finally, I assume that all earnings are pensionable, that is included in the calculation of the accrued pension benefits.

5 Results of the calculations

5.1 *The effect of pension accrual on the cost to the employer*

In this section, I look at the cost of employing an individual, considering the proportion of changes in income attributable to changes in gross pay, employer national insurance contributions, and pension accrual.

I initially consider a sample case, giving summary information for other assumptions later on. In this sample case, I assume:

- the member is a 40-year old male;
- the member's earnings are in line with national average earnings;
- the pre-retirement assets are invested 50% in equities, so the pre-retirement equity risk premium is 2% per annum; and
- the employee contribution rate is 6% of earnings.

The analysis I carry out looks at changes from the period 1995–6 to 2004–5. Looking first at high-level numbers, the average year-to-year increase in gross earnings over the period is 4.50% per annum. However, after allowing for national insurance contributions, the cost to employers has actually risen by an additional 0.42% per annum, bringing the total before-pension average cost increase to 4.92% per annum. This is also the average cost increase to an employer once pensions have been allowed for assuming that those pensions are defined contribution in nature and that the contribution rate has not changed, and is broadly consistent with the results of Fitzner (2006).

However, if defined benefit pension accrual is allowed for, there is an additional cost increase of 1.07% per annum, bringing the total average cost increase to 5.99% per annum.

The year-by-year development of this cost increase is shown in Figure 1. As is clear, the largest increase in cost each year is simply down to the increasing level of national average earnings. However, between 6 April 1998 and 6 April 1999 a change in the rate of national insurance contributions payable results in a larger-than-average cost increase over this period. There are also a number of years where the cost of pension accrual adds significantly to the rate of increase, most notably in the late 1990s.

5.2 *Components of pension accrual cost to the employer*

Next, I look specifically at a single item in the above analysis: the cost of pension accrual. In particular, I consider the components of the change in cost attributable to pension accrual: the benefit payable (in particular the rate of increase in payment applicable to the pension being accrued), the mortality assumptions used in the calculation, and the discount rate used to calculate the cost of accrual. Carrying out calculations as described earlier, I find that on average the 1.07% per annum increase in cost attributable to pension accrual is made up as follows:

- 0.75% per annum in respect of changes in the discount rate;
- 0.22% per annum in respect of changes in the mortality assumptions;
- 0.12% per annum in respect of changes in the benefits offered; and
- –0.02% as a balancing item.

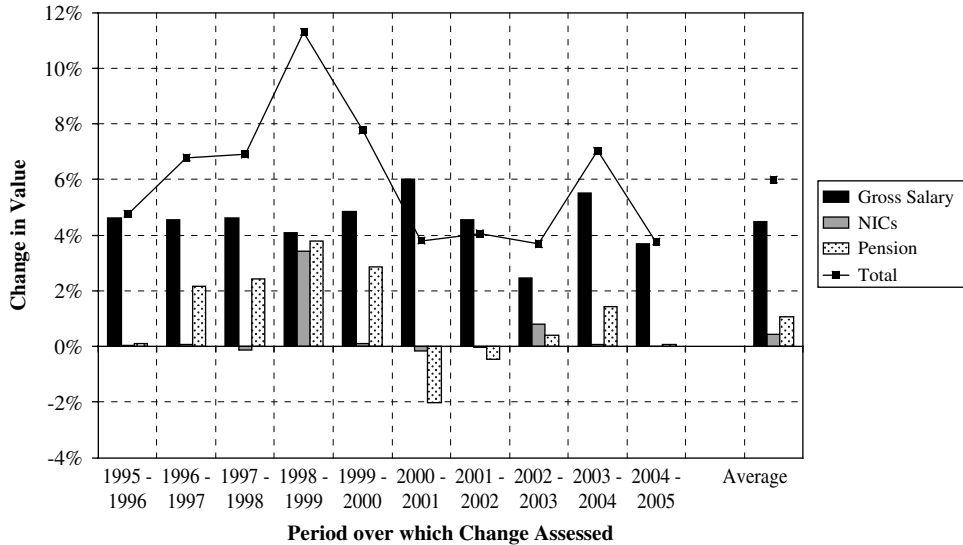


Figure 1. Annual change in the cost of employment allowing for gross salary, income tax and pension accrual

As described earlier, the balancing item arises because each of the effects is calculated independently rather than cumulatively. If the recent mortality projection bases are also allowed for, I find that the average increase in cost rises by an additional 0.06% (sc), 0.09% (mc), or 0.15% (lc). In other words, the biggest effect on the change in cost attributable to pension accrual is the fall in the discount rate. Even after allowing for the greatest projected improvement in longevity, the change in mortality tables only accounts for one-third of the increase in cost. Perhaps most surprising is that the change in benefits – from no guaranteed increases at all to (ultimately) 2.5% LPI – has made very little difference to the overall increase in cost.

Figure 2 shows how these three components contribute to the overall increase in cost attributable to defined benefit pension accrual on a year-by-year basis, with the changes attributable to mortality stacked to show the cumulative effect.

As might be expected, the change in respect of benefit changes results in a large increase in the cost on 6 April 1997 (when 5% LPI increases to pensions in payment were introduced) and a smaller reduction in cost on 5 April 2005 (when the 5% LPI was reduced to 2.5% LPI).

The change due to mortality assumption revisions also occurs at two distinct times – when the tables were changed in 2000 and (optionally) in 2003. Both have a significant effect in the years of introduction, but the average effect over the period of observation is significantly smaller.

However, long-term interest rates have fallen in seven out of the ten periods considered, and these falls have significantly increased the cost of pension accrual – by nearly 4% in one year.

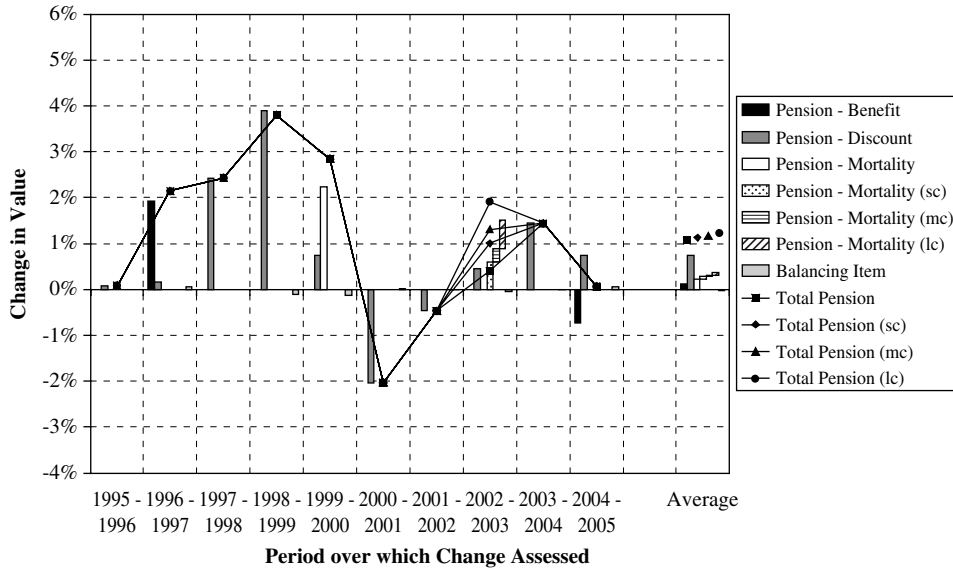


Figure 2. Components of the annual change in the cost to the employer of pension accrual

5.3 Variations in components of cost to the employer

As well as considering the average change in cost over the period covered, I also look at how the cost of employing an individual changed from year to year. In Appendix 1, I give details of the average cost increase, split by type, for a large range of combinations of earnings, age, sex, contribution rate, and ERP assumption. Several trends emerge from this analysis.

First, the increase in cost attributable to national insurance contributions is lowest for employees on national average earnings, being higher for individuals earning more or less than this. For employees on national average earnings, the average increase in cost is 0.42 %; it is 0.53 % for individuals earning 50 % of national average earnings, 0.68 % for individuals on 200 % of national average earnings, and 1.00 % for those on 400 % of national average earnings. The main reasons for this increase occurred in April 1999. At this time, employer national insurance contributions became payable on earnings above the Upper Earnings Limit (‘UEL’) as well as below. This was coincident with an increase in the rate of employer national insurance contributions. The increase in rate also adversely affected the costs in respect of those on only 50 % of national average earnings. Although employer national insurance contributions were no longer payable in respect of those on very low earnings, the increase in rate still meant that more was payable in respect of anyone earning over a few thousand pounds a year.

The increase in cost attributable to the cost of pension accrual ranges from 1.15 % to 2.13 %. This is a wide range, and clearly a number of factors influence the figure relating to costs in respect of a particular individual.

Looking first at contributory versus non-contributory pension schemes, it is clear that the proportional increase in pension cost is greater for contributory schemes.

This is what one would expect, given that in the increase-in-cost calculation the change, which is the numerator, is the same in both cases, but the denominator is smaller for contributory schemes than it is for non-contributory ones. The difference between the contributory and non-contributory calculations is small, ranging from a 0.08% to a 0.33% difference. The difference is larger if the employee is younger, earns more, is female, and if a higher equity risk premium is assumed in the calculations.

There is a difference between the pensions accrual cost increase for men and that for women. For 60-year olds, the increase is only 0.06% to 0.08% greater for women than for men; however, this difference is between 0.15% and 0.20% for 20-year olds.

Age is in fact the cause of the greatest difference in the increases in the costs of pension accrual. The difference between the cost for a 20-year old and a 60-year old ranges from 0.59% to 1.00%, the cost increase being higher for younger than for older employees. The figures are higher for women than for men, and higher the greater the ERP assumed. Unsurprisingly, the key here is the effect of the change on the discount rate. In fact, the difference in cost for a 20-year old and a 60-year old attributable to only the discount rate is between 0.83% and 1.27% – this figure is offset by the fact that the effect of the change in benefits is lower for younger employees.

The effect of mortality is similar in all cases. This is because most of the improvements to longevity occur at higher ages (post-retirement).

5.4 Value of benefits to the employee

Looking at the same sample individual as before, I next look at the increase in the value of benefits to that individual rather than the cost to the employer. The figures are similar, but there is the additional impact of income tax. Furthermore, whilst national insurance contributions are an addition to the cost for the employer, they are a deduction from the earnings received by an employee.

Again, considering the high level numbers first, the average year-to-year increase in gross earnings over the period is 4.50% per annum. The individual's earnings net of income tax and national insurance contributions have on average increased by an additional 0.22% per annum, bringing the total before-pension average benefit increase to 4.72%. However, this increase is small compared to the average additional 1.57% per annum increase in respect of defined benefit pension accrual, giving a total average increase of 6.29%. This increase is significantly larger than the increase in cost to the employer. However, this is to be expected – the increase for the employer is in addition to gross earnings *plus* national insurance contributions, whereas for the employee it is in addition to gross earnings *less* national insurance contributions and income tax.

The year-by-year development of this benefit increase is shown in Figure 3. Again, it is clear that the largest increase in cost each year is simply down to the increasing level of national average earnings. However, in this case, changes to national insurance contributions and income tax generally benefit individuals in the first half of

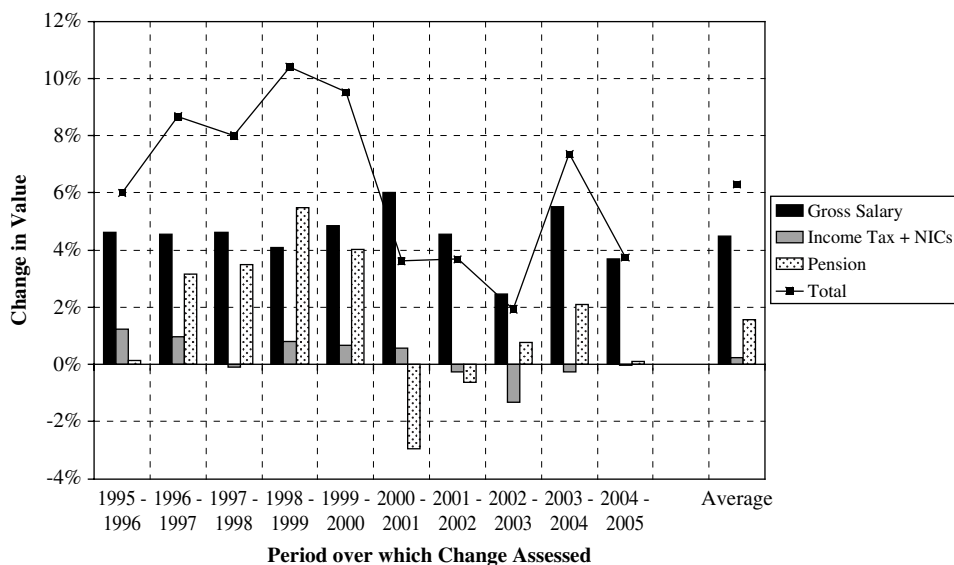


Figure 3. Annual change in net employee remuneration allowing for gross salary, income tax and pension accrual

the period under investigation, although changes to national insurance contributions in April 2003, resulting in an additional 1% of earnings being payable by nearly all employees, did reduce the average increase in net income. As expected, there are also a number of years where the cost of pension accrual adds significantly to the rate of increase, most notably in the late 1990s.

5.5 Components of the value of pension accrual to the employee

I next look at the impact of different aspects of the pensions accrual on the change in the value of the employee's benefit.

To recap, the components of the change in benefit attributable to pension accrual are of interest: the benefit payable, the mortality assumptions used in the calculation, and the discount rate used to calculate the value of pension accrual. Carrying out calculations as described earlier, I find that on average the 1.57% per annum increase in benefit attributable to pension accrual is made up as follows:

- 1.07% per annum in respect of changes in the discount rate;
- 0.32% per annum in respect of changes in the mortality assumptions;
- 0.17% per annum in respect of changes in the benefits offered; and
- 0.00% as a balancing item.

If the recent projection bases are also allowed for, I find that the average increase in benefit rises by an additional 0.08% (sc), 0.04% (mc), or 0.09% (lc). In other words, the biggest effect on the change in benefit attributable to pension accrual is still the fall in the discount rate. This reflects the fact that the pension accrual calculation is the same for the value to the member as it is for the cost to the employer.

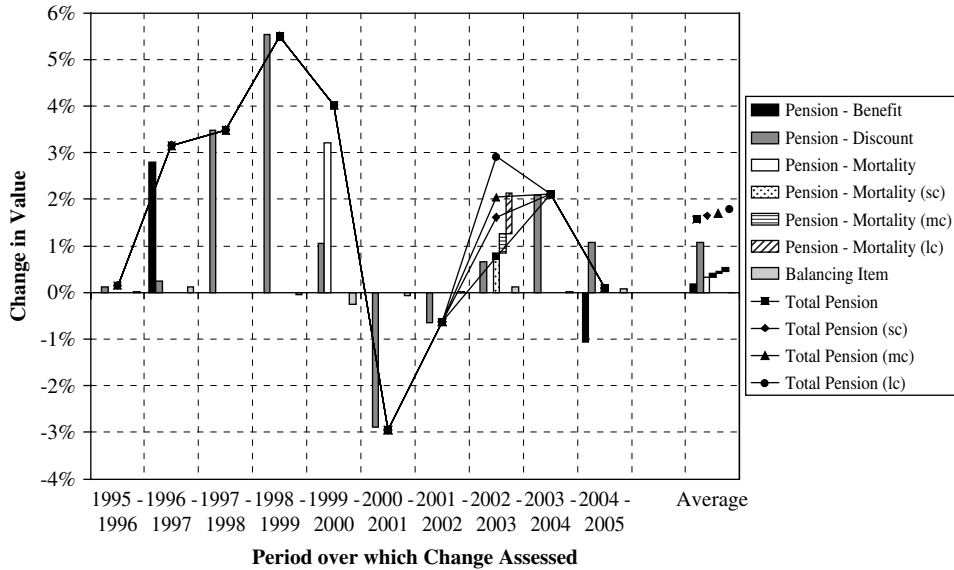


Figure 4. Components of the annual change in the value to the employee of pension accrual

Figure 4 shows how these three components contribute to the overall increase in cost attributable to defined benefit pension accrual on a year-by-year basis, with the changes attributable to mortality stacked to show the cumulative effect. The pattern is, unsurprisingly, similar to that shown in Figure 2.

5.6 Variations in the value of benefits to the employee

Finally, I take a year-by-year look at the change in the value of benefits to employees.

In Appendix 2, I give details of the average benefit increase, split by type, for a large range of combinations of earnings, age, sex, contribution rate, and ERP assumption. Unsurprisingly, the trends emerging from this analysis are similar to those arising from the analysis relating to employer costs.

However, the impact of income tax and national insurance contributions is less severe for employees than it is for employers. In fact, these items contribute on average 0.14% and 0.22% per annum to the increase in earnings for individuals on 50% and 100% national average earnings respectively. For those on 200% and 400% national average earnings, however, contributions of -0.04% and -0.10% respectively are seen. Reductions in income tax are primarily responsible for positive contributions to the increase in earnings for those on lower wages, whilst the increase in employee national insurance contributions – in particular the additional 1% payable from April 2003 – is the main cause of the negative contribution to the increase in earnings for those on higher wages.

The increase in earnings attributable to defined benefit pension accrual ranges from 1.61% to 4.16%. These figures are higher than those given for the cost to the employer, for reasons explained earlier. Again, the range is wide and influenced by a number of factors.

Table 1.

		ERP	0%			2%			4%		
		Age	20	40	60	20	40	60	20	40	60
Cost/Value of Accrual	Males	1995	4.6%	7.4%	12.9%	1.9%	4.6%	11.7%	0.8%	2.8%	10.7%
		2005	25.4%	26.2%	28.3%	10.4%	15.9%	25.7%	4.4%	9.8%	23.3%
	Females	1995	5.2%	8.3%	14.0%	2.2%	5.1%	12.8%	0.9%	3.2%	11.6%
		2005	27.9%	28.6%	30.4%	11.5%	17.4%	27.5%	4.8%	10.7%	25.0%

As before, the proportional increase in pension benefit is greater for contributory schemes, and the range of the difference is similar to that for the pension cost calculations, being 0.11–0.33%.

There is also a difference between the pension accrual benefit increase for men and that for women. For 60-year olds, the increase is only 0.08–0.11% greater for women than for men; however, this difference is between 0.19% and 0.30% for 20-year olds. This is slightly higher than the increase in the cost to the employer, but this is down to the same reason that the increase in pension cost overall is greater than the increase in pension benefit, as described earlier.

Once again, age is the cause of the greatest difference in the increases in the benefits attributable to pension accrual. The difference between the increase for a 20-year old and a 60-year old ranges from 0.76% to 1.57%, the cost increase being higher for younger than for older employees. The figures are again higher for women than for men, and higher the greater the ERP assumed. Unsurprisingly, the effect of the change in discount rate is the most important factor, and the difference in cost for a 20-year old and a 60-year old attributable to only the discount rate is between 1.09% and 2.07%. This figure is again offset by the fact that the effect of the change in benefits is lower for younger employees.

As before, and for the same reasons, the effect of mortality is similar in all cases.

5.7 The continuing difference

The above analysis looks at the increase in the cost and value of defined benefit pension provision since 1995. However, it is arguably more important to consider the situation looking forward.

The key item of information here is the cost or value of benefit accrual as a percentage of gross earnings, since this is directly comparable to the contribution rate for defined contribution pension schemes. Table 1 shows how the cost and value of accrual has changed for a pension scheme with an accrual rate of one-sixtieth of gross salary paying a benefit with statutory pension increases from age 65.

It is clear that the costs have increased sharply, the increase being greatest for younger members. This table shows that to provide benefits in a typical defined benefit pension scheme costs at least an additional 25% of gross salary per year if the equity risk premium is excluded from the calculation, and possibly over 30%. The

situation is only marginally better if a contributory pension scheme is considered. In 1995, an employee contribution rate of 6% would on average have been enough to cover the cost of accruing benefits, providing at least some of the pension scheme contributions were to be invested in assets other than bonds. However, in 2005 such a contribution rate would barely have reduced the cost to the employer (or the value of the benefit to the employee) to below 20% of gross salary.

The generosity of such a benefit is best appreciated if it is compared with the employer contributions to defined contribution arrangements. According to Occupational Pension Schemes 2004, the most popular level of contributions to defined contribution schemes was between 4% and 8% of salary, with 39% of employers contributing at this level, although 24% were paying less than this. Conversely, only 1% of employers was paying between 15% and 20%, and none was paying more than 20%.

6 Conclusion

If similar firms have given similar headline pay increases but one group has provided defined benefit pensions and the other defined contribution pensions, then the return on capital will have been lower for the firm offering defined benefit. Unless action is taken, there will continue to be a drag on the return to capital at the expense of the return to labour. Given that many firms within an industry are likely to offer similar benefits packages, the issue is perhaps more that certain industries will find themselves uncompetitive relative to the same industries in countries where generous corporate defined benefit provision is not the norm.

The biggest impact on the increase in the cost of defined benefit is the fall in real and nominal long-term interest rates. This has meant that the greatest increase in cost has been in respect of individuals furthest away from retirement due to the effect of compounding. Whilst the impact of increasing longevity has been significant, the effect has been much less than that of interest rates.

If the macroeconomic factors that caused this increase in cost persist, then one approach to relieve the burden on firms is to require employees to pay higher contributions. However, this inevitably leads to a reduction in the standard of living before retirement. Another approach is to reduce the defined benefit pension provided or to move to defined contribution with lower contribution rates. However, this leads to a reduction in the standard of living after retirement. Furthermore, both of these approaches effectively transfer the burden to the government which will then transfer it back to the tax-paying population, reducing standards of living by a different route. The only remaining solution is to delay retirement either by increasing retirement ages or by increasing the opportunities for part-time work and a more gradual move towards full retirement. This approach is also consistent with alleviating the symptoms of the increase in longevity. However, assuming that working carries some disutility, a combination of the above solutions – working for longer and lowering the post-retirement standard of living – seems the pragmatic approach.

On the benefits side, it is important to recognise that although employees with defined benefit pensions have effectively had higher pay rises than their defined

contribution counterparts, the increases attributable to defined benefit pension accrual do not actually result in a higher pension; they merely reflect the fact that the pensions to which individuals are entitled have got more expensive. Another way of looking at this is that deferred pay that pensions constitute has been cut for individuals with defined contribution pensions if the contribution rates to defined contribution schemes have remained static.

References

- Ada, H. Y., Roberts, E., Elliott, R. F., Bell, D. and Scott, A. (2006) Comparing the New Earnings Survey (NES) and the Labour Force Survey (LFS): an analysis of the differences between the data sets and their implications for the pattern of geographical pay in the UK. *Regional Studies*, **40**(6): 645–665.
- BBC News (2006) BAE seeks to fill pension deficit. <http://news.bbc.co.uk/1/hi/business/5075540.stm>
- BBC News (2007) New BA pension details revealed. <http://news.bbc.co.uk/1/hi/business/6241971.stm>
- Bolton, T. (1997) *Human Resource Management*. Oxford: Blackwell.
- Brunello, G., Comi, S., and Sonedda, D. (2006) Income taxes and the composition of pay. Discussion Paper No. 2203, Forschungsinstitut zur Zukunft der Arbeit, Bonn.
- Clark, T. and Leicester, A. (2004) Inequality and two decades of British tax and benefit reforms. *Fiscal Studies*, **25**(2): 129–158.
- Collard, D., Godwin, M., and Hudson, J. (2005) The provision of company benefits in the UK. *Journal of Business Finance and Accounting*, **32**(7 & 8): 1397–1421.
- Continuous Mortality Investigation Mortality Sub-Committee (1990) CMIR12. Continuous Mortality Investigation Bureau, London.
- Continuous Mortality Investigation Mortality Sub-Committee (1999) CMIR17. Continuous Mortality Investigation Bureau, London.
- Continuous Mortality Investigation Mortality Sub-Committee (2002) Working Paper 1: An interim basis for adjusting the '92' series mortality projections for cohort effects. Continuous Mortality Investigation Bureau, London.
- Dimson, E., Marsh, P., and Staunton, M. (2006) *Global Investment Returns Yearbook 2006*. ABN Amro, February.
- Dobbs, C. (2006) Patterns of pay: results of the annual survey of hours and earnings 1997 to 2005. *Labour Market Trends*, Office for National Statistics.
- Fitzner, G. (2006) How have employees fared? Recent UK trends. Employment Relations Research Series No. 56, Department of Trade and Industry.
- Forth, J. and Millward, N. (2000) The determinants of pay levels and fringe benefit provision in Britain. Discussion paper 171, National Institute of Economic and Social Research.
- Fidelity Investments International (2006) Improving Britain's retirement prospects. Viewpoint Discussion Paper, Fidelity International.
- Government Actuary's Department (2006) Occupational Pension Schemes 2004: the twelfth survey by the Government Actuary. The Government Actuary's Department, London, June.
- Gustman, A. L. and Steinmeier, T. L. (2001) Imperfect knowledge, retirement, and saving. NBER Working Paper 8406, National Bureau of Economic Research.
- Gustman, A. L. and Steinmeier, T. L. (2004) What people don't know about their pensions and social security: an analysis using linked data from the Health and Retirement Study. In W. Gale, J. Shoven, and M. Warshawsky (eds), *Public Policies and Private Pensions*. Washington, DC: World Bank.
- Lane, Clark and Peacock (2006) *Accounting for Pensions UK and Europe: Annual Survey 2006*. Lane, Clark and Peacock.

- Lockwood, B. and Manning, A. (1993) Wage setting and the tax system: theory and evidence for the United Kingdom. *Journal of Public Economics*, **52**: 1–29.
- Mitchell, O. S. (1988) Worker knowledge of pension provisions. *Journal of Labor Economics*, **6**(1): 21–39.
- Neill, A. (1977) *Life Contingencies*. Oxford: Heinemann.
- Starr-McCluer, M. and Sundén, A. (1999) Workers' knowledge of their pension coverage: a re-evaluation. Federal Reserve Board Discussion paper 1999–5, Federal Reserve Board of Governors.
- Sundén, A. (2006) How much do people need to know about their pensions and what do they know? In R. Holzmann and E. Palmer (eds), *Pension Reform: Issues and Prospects for Non-financial Defined Contribution (NDC) Schemes*. Washington, DC: World Bank.

Appendix 1: Employer costs

50% NAE, Non-Contributory – Males

ERP	0%			2%			4%		
Age	20	40	60	20	40	60	20	40	60
Increase – NAE	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%
Increase – NICs	0.53%	0.53%	0.53%	0.53%	0.53%	0.53%	0.53%	0.53%	0.53%
Increase – Pension	1.84%	1.60%	1.23%	2.10%	1.87%	1.34%	2.22%	2.05%	1.44%
Pension components									
<i>Discount rate</i>	1.50%	1.15%	0.64%	1.76%	1.43%	0.75%	1.88%	1.60%	0.85%
<i>Mortality</i>	0.33%	0.33%	0.29%	0.33%	0.33%	0.29%	0.33%	0.33%	0.29%
<i>Benefits</i>	0.09%	0.19%	0.37%	0.09%	0.19%	0.37%	0.09%	0.19%	0.37%
<i>Balancing item</i>	-0.07%	-0.07%	-0.08%	-0.07%	-0.07%	-0.08%	-0.07%	-0.07%	-0.08%
Total	6.86%	6.62%	6.25%	7.13%	6.90%	6.36%	7.24%	7.07%	6.46%

50% NAE, Non-Contributory – Females

ERP	0%			2%			4%		
Age	20	40	60	20	40	60	20	40	60
Increase – NAE	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%
Increase – NICs	0.53%	0.53%	0.53%	0.53%	0.53%	0.53%	0.53%	0.53%	0.53%
Increase – Pension	1.99%	1.71%	1.29%	2.29%	2.02%	1.41%	2.42%	2.21%	1.52%
Pension components									
<i>Discount rate</i>	1.72%	1.32%	0.73%	2.02%	1.63%	0.84%	2.15%	1.83%	0.95%
<i>Mortality</i>	0.23%	0.23%	0.22%	0.23%	0.23%	0.22%	0.23%	0.23%	0.22%
<i>Benefits</i>	0.11%	0.23%	0.43%	0.11%	0.23%	0.43%	0.11%	0.23%	0.43%
<i>Balancing item</i>	-0.07%	-0.07%	-0.08%	-0.07%	-0.07%	-0.08%	-0.07%	-0.07%	-0.08%
Total	7.02%	6.73%	6.32%	7.32%	7.04%	6.43%	7.44%	7.24%	6.54%

Appendix 1: (cont.)

50% NAE, 6% Employee Contributions – Males

ERP	0%			2%			4%		
Age	20	40	60	20	40	60	20	40	60
Increase – NAE	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%
Increase – NICs	0.53%	0.53%	0.53%	0.53%	0.53%	0.53%	0.53%	0.53%	0.53%
Increase – Pension	1.97%	1.71%	1.32%	2.25%	2.01%	1.43%	2.37%	2.19%	1.54%
Pension components									
<i>Discount rate</i>	1.58%	1.21%	0.68%	1.86%	1.51%	0.79%	1.98%	1.69%	0.90%
<i>Mortality</i>	0.34%	0.35%	0.30%	0.34%	0.35%	0.30%	0.34%	0.35%	0.30%
<i>Benefits</i>	0.09%	0.20%	0.39%	0.09%	0.20%	0.39%	0.09%	0.20%	0.39%
<i>Balancing item</i>	−0.05%	−0.05%	−0.05%	−0.05%	−0.05%	−0.05%	−0.05%	−0.05%	−0.05%
Total	6.99%	6.74%	6.34%	7.28%	7.03%	6.46%	7.40%	7.22%	6.56%

50% NAE, 6% Employee Contributions – Females

ERP	0%			2%			4%		
Age	20	40	60	20	40	60	20	40	60
Increase – NAE	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%
Increase – NICs	0.53%	0.53%	0.53%	0.53%	0.53%	0.53%	0.53%	0.53%	0.53%
Increase – Pension	2.13%	1.83%	1.38%	2.45%	2.15%	1.51%	2.58%	2.36%	1.62%
Pension components									
<i>Discount rate</i>	1.82%	1.39%	0.76%	2.14%	1.72%	0.89%	2.27%	1.93%	1.00%
<i>Mortality</i>	0.24%	0.24%	0.23%	0.24%	0.24%	0.23%	0.24%	0.24%	0.23%
<i>Benefits</i>	0.12%	0.24%	0.45%	0.12%	0.24%	0.45%	0.12%	0.24%	0.45%
<i>Balancing item</i>	−0.05%	−0.05%	−0.06%	−0.05%	−0.05%	−0.06%	−0.05%	−0.05%	−0.06%
Total	7.15%	6.85%	6.41%	7.47%	7.18%	6.53%	7.61%	7.39%	6.64%

100% NAE, Non-Contributory – Males

Equity Risk Premium		0%			2%			4%	
Age	20	40	60	20	40	60	20	40	60
Increase – NAE	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%
Increase – NICs	0.42%	0.42%	0.42%	0.42%	0.42%	0.42%	0.42%	0.42%	0.42%
Increase – Pension	1.80%	1.57%	1.22%	2.06%	1.84%	1.32%	2.17%	2.01%	1.42%
Pension components									
<i>Discount rate</i>	1.46%	1.12%	0.63%	1.71%	1.39%	0.73%	1.82%	1.56%	0.83%
<i>Mortality</i>	0.32%	0.33%	0.29%	0.32%	0.33%	0.29%	0.32%	0.33%	0.29%
<i>Benefits</i>	0.08%	0.18%	0.36%	0.08%	0.18%	0.36%	0.08%	0.18%	0.36%
<i>Balancing item</i>	-0.06%	-0.06%	-0.05%	-0.06%	-0.06%	-0.05%	-0.06%	-0.06%	-0.05%
Total	6.72%	6.49%	6.13%	6.97%	6.75%	6.24%	7.08%	6.92%	6.33%

100% NAE, Non-Contributory – Females

Equity Risk Premium		0%			2%			4%	
Age	20	40	60	20	40	60	20	40	60
Increase – NAE	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%
Increase – NICs	0.42%	0.42%	0.42%	0.42%	0.42%	0.42%	0.42%	0.42%	0.42%
Increase – Pension	1.95%	1.68%	1.28%	2.24%	1.98%	1.39%	2.37%	2.17%	1.50%
Pension components									
<i>Discount rate</i>	1.68%	1.29%	0.71%	1.97%	1.59%	0.82%	2.09%	1.78%	0.93%
<i>Mortality</i>	0.22%	0.23%	0.21%	0.22%	0.23%	0.21%	0.22%	0.23%	0.21%
<i>Benefits</i>	0.10%	0.22%	0.41%	0.10%	0.22%	0.41%	0.10%	0.22%	0.41%
<i>Balancing item</i>	-0.05%	-0.06%	-0.06%	-0.05%	-0.06%	-0.06%	-0.05%	-0.06%	-0.06%
Total	6.87%	6.59%	6.19%	7.16%	6.89%	6.31%	7.28%	7.09%	6.41%

Appendix 1: (cont.)

100% NAE, 6% Employee Contributions – Males

	0%			2%			4%		
Age	20	40	60	20	40	60	20	40	60
Equity Risk Premium									
Increase – NAE	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%
Increase – NICs	0.42%	0.42%	0.42%	0.42%	0.42%	0.42%	0.42%	0.42%	0.42%
Increase – Pension	1.92%	1.68%	1.30%	2.19%	1.96%	1.41%	2.31%	2.14%	1.51%
Pension components									
Discount rate	1.54%	1.18%	0.66%	1.81%	1.46%	0.77%	1.93%	1.64%	0.87%
Mortality	0.34%	0.34%	0.30%	0.34%	0.34%	0.30%	0.34%	0.34%	0.30%
Benefits	0.09%	0.19%	0.38%	0.09%	0.19%	0.38%	0.09%	0.19%	0.38%
Balancing item	-0.04%	-0.04%	-0.04%	-0.04%	-0.04%	-0.04%	-0.04%	-0.04%	-0.04%
Total	6.84%	6.59%	6.21%	7.11%	6.87%	6.33%	7.23%	7.05%	6.43%

100% NAE, 6% Employee Contributions – Females

	0%			2%			4%		
Age	20	40	60	20	40	60	20	40	60
Equity risk premium									
Increase – NAE	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%
Increase – NICs	0.42%	0.42%	0.42%	0.42%	0.42%	0.42%	0.42%	0.42%	0.42%
Increase – Pension	2.08%	1.79%	1.36%	2.39%	2.10%	1.48%	2.52%	2.31%	1.59%
Pension components									
Discount rate	1.77%	1.35%	0.74%	2.07%	1.67%	0.86%	2.21%	1.87%	0.97%
Mortality	0.24%	0.24%	0.22%	0.24%	0.24%	0.22%	0.24%	0.24%	0.22%
Benefits	0.11%	0.24%	0.44%	0.11%	0.24%	0.44%	0.11%	0.24%	0.44%
Balancing item	-0.04%	-0.04%	-0.04%	-0.03%	-0.04%	-0.04%	-0.03%	-0.04%	-0.04%
Total	6.99%	6.70%	6.28%	7.30%	7.02%	6.40%	7.43%	7.22%	6.51%

200 % NAE, Non-Contributory – Males

Equity risk premium		0 %			2 %			4 %	
Age	20	40	60	20	40	60	20	40	60
Increase – NAE	4.50 %	4.50 %	4.50 %	4.50 %	4.50 %	4.50 %	4.50 %	4.50 %	4.50 %
Increase – NICs	0.68 %	0.68 %	0.68 %	0.68 %	0.68 %	0.68 %	0.68 %	0.68 %	0.68 %
Increase – Pension	1.79 %	1.55 %	1.18 %	2.05 %	1.82 %	1.29 %	2.16 %	1.99 %	1.39 %
Pension components									
<i>Discount rate</i>	1.47 %	1.13 %	0.64 %	1.74 %	1.41 %	0.74 %	1.85 %	1.58 %	0.84 %
<i>Mortality</i>	0.32 %	0.32 %	0.28 %	0.32 %	0.32 %	0.28 %	0.32 %	0.32 %	0.28 %
<i>Benefits</i>	0.09 %	0.19 %	0.37 %	0.09 %	0.19 %	0.37 %	0.09 %	0.19 %	0.37 %
<i>Balancing item</i>	–0.08 %	–0.09 %	–0.10 %	–0.08 %	–0.09 %	–0.10 %	–0.08 %	–0.09 %	–0.10 %
Total	6.97 %	6.73 %	6.36 %	7.23 %	7.00 %	6.47 %	7.35 %	7.18 %	6.57 %

200 % NAE, Non-Contributory – Females

Equity risk premium		0 %			2 %			4 %	
Age	20	40	60	20	40	60	20	40	60
Increase – NAE	4.50 %	4.50 %	4.50 %	4.50 %	4.50 %	4.50 %	4.50 %	4.50 %	4.50 %
Increase – NICs	0.68 %	0.68 %	0.68 %	0.68 %	0.68 %	0.68 %	0.68 %	0.68 %	0.68 %
Increase – Pension	1.94 %	1.66 %	1.24 %	2.24 %	1.96 %	1.36 %	2.36 %	2.15 %	1.46 %
Pension components									
<i>Discount rate</i>	1.70 %	1.30 %	0.72 %	1.99 %	1.61 %	0.83 %	2.12 %	1.80 %	0.94 %
<i>Mortality</i>	0.22 %	0.22 %	0.21 %	0.22 %	0.22 %	0.21 %	0.22 %	0.22 %	0.21 %
<i>Benefits</i>	0.11 %	0.23 %	0.42 %	0.11 %	0.23 %	0.42 %	0.11 %	0.23 %	0.42 %
<i>Balancing item</i>	–0.09 %	–0.10 %	–0.11 %	–0.09 %	–0.10 %	–0.11 %	–0.09 %	–0.10 %	–0.11 %
Total	7.12 %	6.84 %	6.42 %	7.42 %	7.14 %	6.54 %	7.54 %	7.34 %	6.64 %

Appendix 1: (cont.)

200% NAE, 6% Employee Contributions – Males									
Equity risk premium	0%			2%			4%		
Age	20	40	60	20	40	60	20	40	60
Increase – NAE	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%
Increase – NICs	0.68%	0.68%	0.68%	0.68%	0.68%	0.68%	0.68%	0.68%	0.68%
Increase – Pension	1.93%	1.67%	1.28%	2.20%	1.96%	1.39%	2.32%	2.14%	1.49%
Pension components									
Discount rate	1.56%	1.19%	0.67%	1.83%	1.48%	0.78%	1.95%	1.66%	0.88%
Mortality	0.33%	0.34%	0.30%	0.33%	0.34%	0.30%	0.33%	0.34%	0.30%
Benefits	0.09%	0.20%	0.39%	0.09%	0.20%	0.39%	0.09%	0.20%	0.39%
Balancing item	-0.05%	-0.06%	-0.07%	-0.05%	-0.06%	-0.07%	-0.05%	-0.06%	-0.07%
Total	7.11%	6.85%	6.46%	7.38%	7.14%	6.57%	7.50%	7.32%	6.67%
200% NAE, 6% Employee Contributions – Females									
Equity risk premium	0%			2%			4%		
Age	20	40	60	20	40	60	20	40	60
Increase – NAE	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%
Increase – NICs	0.68%	0.68%	0.68%	0.68%	0.68%	0.68%	0.68%	0.68%	0.68%
Increase – Pension	2.08%	1.78%	1.34%	2.40%	2.10%	1.46%	2.53%	2.31%	1.57%
Pension components									
Discount rate	1.79%	1.37%	0.75%	2.10%	1.69%	0.87%	2.23%	1.90%	0.98%
Mortality	0.23%	0.24%	0.22%	0.23%	0.24%	0.22%	0.23%	0.24%	0.22%
Benefits	0.12%	0.24%	0.44%	0.12%	0.24%	0.44%	0.12%	0.24%	0.44%
Balancing item	-0.05%	-0.07%	-0.08%	-0.05%	-0.07%	-0.08%	-0.05%	-0.07%	-0.08%
Total	7.26%	6.96%	6.52%	7.58%	7.28%	6.64%	7.71%	7.49%	6.75%

400% NAE, Non-Contributory – Males

	0%			2%			4%		
Equity risk premium	0%			2%			4%		
Age	20	40	60	20	40	60	20	40	60
Increase – NAE	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%
Increase – NICs	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
Increase – Pension	1.79%	1.53%	1.15%	2.06%	1.81%	1.25%	2.17%	1.99%	1.35%
Pension components									
<i>Discount rate</i>	1.50%	1.15%	0.65%	1.77%	1.43%	0.75%	1.88%	1.61%	0.85%
<i>Mortality</i>	0.32%	0.32%	0.28%	0.32%	0.32%	0.28%	0.32%	0.32%	0.28%
<i>Benefits</i>	0.09%	0.19%	0.38%	0.09%	0.19%	0.38%	0.09%	0.19%	0.38%
<i>Balancing item</i>	-0.12%	-0.13%	-0.16%	-0.12%	-0.13%	-0.16%	-0.12%	-0.13%	-0.16%
Total	7.28%	7.03%	6.64%	7.55%	7.31%	6.75%	7.66%	7.48%	6.85%

400% NAE, Non-Contributory – Females

	0%			2%			4%		
Equity risk premium	0%			2%			4%		
Age	20	40	60	20	40	60	20	40	60
Increase – NAE	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%
Increase – NICs	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
Increase – Pension	1.94%	1.64%	1.20%	2.24%	1.95%	1.32%	2.37%	2.15%	1.43%
Pension components									
<i>Discount rate</i>	1.72%	1.32%	0.73%	2.03%	1.63%	0.85%	2.16%	1.83%	0.95%
<i>Mortality</i>	0.22%	0.22%	0.21%	0.22%	0.22%	0.21%	0.22%	0.22%	0.21%
<i>Benefits</i>	0.11%	0.24%	0.43%	0.11%	0.24%	0.43%	0.11%	0.24%	0.43%
<i>Balancing item</i>	-0.12%	-0.14%	-0.17%	-0.12%	-0.14%	-0.17%	-0.12%	-0.14%	-0.17%
Total	7.43%	7.13%	6.70%	7.73%	7.44%	6.81%	7.86%	7.64%	6.92%

Appendix 1: (cont.)

400% NAE, 6% Employee Contributions – Males										
Equity risk premium		0%			2%			4%		
Age	20	40	60	20	40	60	20	40	60	
Increase – NAE	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	
Increase – NICs	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	
Increase – Pension	1.94%	1.67%	1.26%	2.23%	1.97%	1.37%	2.35%	2.15%	1.48%	
Pension components										
<i>Discount rate</i>	1.58%	1.22%	0.68%	1.87%	1.51%	0.79%	1.99%	1.70%	0.90%	
<i>Mortality</i>	0.33%	0.34%	0.29%	0.33%	0.34%	0.29%	0.33%	0.34%	0.29%	
<i>Benefits</i>	0.10%	0.20%	0.40%	0.10%	0.20%	0.40%	0.10%	0.20%	0.40%	
<i>Balancing item</i>	−0.07%	−0.09%	−0.11%	−0.07%	−0.09%	−0.11%	−0.07%	−0.09%	−0.11%	
Total	7.44%	7.17%	6.75%	7.72%	7.46%	6.87%	7.84%	7.65%	6.97%	
400% NAE, 6% Employee Contributions – Females										
Equity risk premium		0%			2%			4%		
Age	20	40	60	20	40	60	20	40	60	
Increase – NAE	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	
Increase – NICs	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	
Increase – Pension	2.10%	1.78%	1.31%	2.42%	2.11%	1.44%	2.56%	2.32%	1.55%	
Pension components										
<i>Discount rate</i>	1.82%	1.39%	0.76%	2.14%	1.72%	0.89%	2.28%	1.93%	1.00%	
<i>Mortality</i>	0.23%	0.23%	0.22%	0.23%	0.23%	0.22%	0.23%	0.23%	0.22%	
<i>Benefits</i>	0.12%	0.25%	0.46%	0.12%	0.25%	0.46%	0.12%	0.25%	0.46%	
<i>Balancing item</i>	−0.07%	−0.10%	−0.13%	−0.07%	−0.10%	−0.13%	−0.07%	−0.10%	−0.13%	
Total	7.59%	7.27%	6.81%	7.91%	7.60%	6.93%	8.05%	7.81%	7.05%	

Appendix 2: Employee benefits

50% NAE, Non-Contributory – Males

	0%			2%			4%		
Age	20	40	60	20	40	60	20	40	60
Equity risk premium									
Increase – NAE	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%
Increase – NICs, IT	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%
Increase – Pension	2.37%	2.07%	1.61%	2.71%	2.42%	1.75%	2.86%	2.65%	1.87%
Pension components									
Discount rate	1.88%	1.43%	0.79%	2.22%	1.78%	0.93%	2.37%	2.01%	1.05%
Mortality	0.41%	0.41%	0.36%	0.41%	0.41%	0.36%	0.41%	0.41%	0.36%
Benefits	0.11%	0.24%	0.46%	0.11%	0.24%	0.46%	0.11%	0.24%	0.46%
Balancing item	-0.02%	-0.01%	0.00%	-0.02%	-0.01%	0.01%	-0.02%	-0.01%	0.01%
Total	7.01%	6.71%	6.25%	7.36%	7.07%	6.39%	7.51%	7.29%	6.52%

50% NAE, Non-Contributory – Females

	0%			2%			4%		
Age	20	40	60	20	40	60	20	40	60
Equity risk premium									
Increase – NAE	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%
Increase – NICs, IT	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%
Increase – Pension	2.56%	2.20%	1.69%	2.95%	2.60%	1.84%	3.12%	2.86%	1.97%
Pension components									
Discount rate	2.15%	1.63%	0.89%	2.53%	2.03%	1.03%	2.70%	2.28%	1.17%
Mortality	0.28%	0.29%	0.27%	0.28%	0.29%	0.27%	0.28%	0.29%	0.27%
Benefits	0.14%	0.29%	0.53%	0.14%	0.29%	0.53%	0.14%	0.29%	0.53%
Balancing item	-0.01%	0.00%	0.01%	-0.01%	0.00%	0.01%	-0.01%	0.00%	0.01%
Total	7.20%	6.85%	6.33%	7.59%	7.24%	6.48%	7.76%	7.50%	6.61%

Appendix 2: (cont.)

50% NAE, 6% Employee Contributions – Males

	0%			2%			4%		
Age	20	40	60	20	40	60	20	40	60
Equity risk premium		0%			2%			4%	
Increase – NAE	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%
Increase – NICs, IT	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%
Increase – Pension	2.55%	2.22%	1.73%	2.92%	2.60%	1.87%	3.08%	2.85%	2.01%
Pension components									
Discount rate	2.01%	1.53%	0.84%	2.38%	1.91%	0.99%	2.54%	2.15%	1.12%
Mortality	0.43%	0.44%	0.38%	0.43%	0.44%	0.38%	0.43%	0.44%	0.38%
Benefits	0.12%	0.25%	0.49%	0.12%	0.25%	0.49%	0.12%	0.25%	0.49%
Balancing item	–0.01%	0.00%	0.02%	–0.01%	0.00%	0.02%	–0.01%	0.00%	0.02%
Total	7.19%	6.86%	6.37%	7.56%	7.25%	6.52%	7.72%	7.49%	6.65%

50% NAE, 6% Employee Contributions – Females

	0%			2%			4%		
Age	20	40	60	20	40	60	20	40	60
Equity risk premium		0%			2%			4%	
Increase – NAE	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%
Increase – NICs, IT	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%
Increase – Pension	2.75%	2.36%	1.81%	3.17%	2.79%	1.96%	3.35%	3.07%	2.11%
Pension components									
Discount rate	2.30%	1.74%	0.94%	2.71%	2.17%	1.10%	2.90%	2.44%	1.24%
Mortality	0.30%	0.30%	0.28%	0.30%	0.30%	0.28%	0.30%	0.30%	0.28%
Benefits	0.15%	0.31%	0.56%	0.15%	0.31%	0.56%	0.15%	0.31%	0.56%
Balancing item	0.00%	0.01%	0.02%	0.00%	0.01%	0.02%	0.00%	0.01%	0.02%
Total	7.39%	7.00%	6.45%	7.81%	7.43%	6.61%	7.99%	7.71%	6.75%

100% NAE, Non-Contributory – Males

Equity risk premium		0%			2%			4%		
Age	20	40	60	20	40	60	20	40	60	
Increase – NAE	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	
Increase – NICs, IT	0.22%	0.22%	0.22%	0.22%	0.22%	0.22%	0.22%	0.22%	0.22%	
Increase – Pension	2.56%	2.23%	1.72%	2.94%	2.62%	1.87%	3.11%	2.87%	2.01%	
Pension components										
Discount rate	2.03%	1.55%	0.85%	2.41%	1.93%	1.00%	2.57%	2.18%	1.13%	
Mortality	0.44%	0.45%	0.39%	0.44%	0.45%	0.39%	0.44%	0.45%	0.39%	
Benefits	0.12%	0.26%	0.50%	0.12%	0.26%	0.50%	0.12%	0.26%	0.50%	
Balancing item	−0.03%	−0.02%	−0.01%	−0.03%	−0.02%	−0.01%	−0.02%	−0.01%	0.00%	
Total	7.29%	6.95%	6.45%	7.67%	7.34%	6.60%	7.83%	7.59%	6.74%	

100% NAE, Non-Contributory – Females

Equity risk premium		0%			2%			4%		
Age	20	40	60	20	40	60	20	40	60	
Increase – NAE	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	
Increase – NICs, IT	0.22%	0.22%	0.22%	0.22%	0.22%	0.22%	0.22%	0.22%	0.22%	
Increase – Pension	2.77%	2.37%	1.80%	3.19%	2.81%	1.97%	3.38%	3.09%	2.11%	
Pension components										
Discount rate	2.33%	1.76%	0.95%	2.75%	2.19%	1.11%	2.93%	2.47%	1.26%	
Mortality	0.30%	0.31%	0.28%	0.30%	0.31%	0.28%	0.30%	0.31%	0.28%	
Benefits	0.16%	0.32%	0.57%	0.16%	0.32%	0.57%	0.16%	0.32%	0.57%	
Balancing item	−0.02%	−0.02%	0.00%	−0.02%	−0.01%	0.00%	−0.01%	−0.01%	0.00%	
Total	7.49%	7.09%	6.53%	7.92%	7.53%	6.69%	8.10%	7.81%	6.84%	

Appendix 2: (cont.)

100% NAE, 6% Employee Contributions – Males									
Equity risk premium	0%			2%			4%		
Age	20	40	60	20	40	60	20	40	60
Increase – NAE	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%
Increase – NICs, IT	0.22%	0.22%	0.22%	0.22%	0.22%	0.22%	0.22%	0.22%	0.22%
Increase – Pension	2.78%	2.41%	1.86%	3.19%	2.84%	2.02%	3.37%	3.11%	2.17%
Pension components									
Discount rate	2.19%	1.66%	0.91%	2.60%	2.08%	1.07%	2.78%	2.35%	1.21%
Mortality	0.47%	0.48%	0.41%	0.47%	0.48%	0.41%	0.47%	0.48%	0.41%
Benefits	0.13%	0.28%	0.54%	0.13%	0.28%	0.54%	0.13%	0.28%	0.54%
Balancing item	-0.01%	0.00%	0.01%	-0.01%	0.00%	0.01%	-0.01%	0.00%	0.01%
Total	7.50%	7.14%	6.59%	7.92%	7.56%	6.75%	8.09%	7.83%	6.90%
100% NAE, 6% Employee Contributions – Females									
Equity risk premium	0%			2%			4%		
Age	20	40	60	20	40	60	20	40	60
Increase – NAE	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%
Increase – NICs, IT	0.22%	0.22%	0.22%	0.22%	0.22%	0.22%	0.22%	0.22%	0.22%
Increase – Pension	2.99%	2.56%	1.95%	3.46%	3.03%	2.12%	3.66%	3.34%	2.28%
Pension components									
Discount rate	2.50%	1.89%	1.02%	2.96%	2.36%	1.19%	3.16%	2.66%	1.34%
Mortality	0.32%	0.33%	0.30%	0.32%	0.33%	0.30%	0.32%	0.33%	0.30%
Benefits	0.17%	0.34%	0.62%	0.17%	0.34%	0.62%	0.17%	0.34%	0.62%
Balancing item	0.00%	0.00%	0.01%	0.00%	0.01%	0.01%	0.00%	0.01%	0.02%
Total	7.72%	7.28%	6.67%	8.18%	7.76%	6.84%	8.39%	8.07%	7.00%

200% NAE, Non-Contributory – Males

	0%			2%			4%		
Age	20	40	60	20	40	60	20	40	60
Equity risk premium									
Increase – NAE	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%
Increase – NICs, IT	–0.04%	–0.04%	–0.04%	–0.04%	–0.04%	–0.04%	–0.04%	–0.04%	–0.04%
Increase – Pension	2.74%	2.39%	1.86%	3.13%	2.79%	2.02%	3.30%	3.06%	2.16%
Pension components									
<i>Discount rate</i>	2.13%	1.61%	0.88%	2.52%	2.01%	1.04%	2.69%	2.27%	1.18%
<i>Mortality</i>	0.46%	0.46%	0.40%	0.46%	0.46%	0.40%	0.46%	0.46%	0.40%
<i>Benefits</i>	0.13%	0.27%	0.52%	0.13%	0.27%	0.52%	0.13%	0.27%	0.52%
<i>Balancing item</i>	0.03%	0.04%	0.06%	0.03%	0.05%	0.07%	0.03%	0.05%	0.07%
Total	7.20%	6.85%	6.32%	7.59%	7.25%	6.48%	7.76%	7.52%	6.62%

200% NAE, Non-Contributory – Females

	0%			2%			4%		
Age	20	40	60	20	40	60	20	40	60
Equity risk premium									
Increase – NAE	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%
Increase – NICs, IT	–0.04%	–0.04%	–0.04%	–0.04%	–0.04%	–0.04%	–0.04%	–0.04%	–0.04%
Increase – Pension	2.95%	2.54%	1.95%	3.40%	2.99%	2.12%	3.59%	3.29%	2.27%
Pension components									
<i>Discount rate</i>	2.43%	1.84%	0.99%	2.87%	2.29%	1.15%	3.07%	2.58%	1.31%
<i>Mortality</i>	0.32%	0.32%	0.30%	0.32%	0.32%	0.30%	0.32%	0.32%	0.30%
<i>Benefits</i>	0.16%	0.33%	0.59%	0.16%	0.33%	0.59%	0.16%	0.33%	0.59%
<i>Balancing item</i>	0.04%	0.05%	0.07%	0.05%	0.06%	0.07%	0.05%	0.06%	0.08%
Total	7.41%	7.00%	6.41%	7.86%	7.45%	6.58%	8.05%	7.75%	6.73%

Appendix 2: (cont.)

200% NAE, 6% Employee Contributions – Males

	0%			2%			4%		
Age	20	40	60	20	40	60	20	40	60
Equity risk premium		0%			2%			4%	
Increase – NAE	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%
Increase – NICs, IT	–0.04%	–0.04%	–0.04%	–0.04%	–0.04%	–0.04%	–0.04%	–0.04%	–0.04%
Increase – Pension	2.96%	2.57%	2.00%	3.39%	3.01%	2.17%	3.58%	3.30%	2.32%
Pension components									
Discount rate	2.30%	1.74%	0.94%	2.73%	2.17%	1.11%	2.91%	2.46%	1.26%
Mortality	0.49%	0.50%	0.43%	0.49%	0.50%	0.43%	0.49%	0.50%	0.43%
Benefits	0.14%	0.29%	0.56%	0.14%	0.29%	0.56%	0.14%	0.29%	0.56%
Balancing item	0.03%	0.04%	0.07%	0.04%	0.05%	0.07%	0.04%	0.05%	0.07%
Total	7.42%	7.03%	6.46%	7.85%	7.47%	6.63%	8.04%	7.76%	6.78%

200% NAE, 6% Employee Contributions – Females

	0%			2%			4%		
Age	20	40	60	20	40	60	20	40	60
Equity risk premium		0%			2%			4%	
Increase – NAE	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%
Increase – NICs, IT	–0.04%	–0.04%	–0.04%	–0.04%	–0.04%	–0.04%	–0.04%	–0.04%	–0.04%
Increase – Pension	3.18%	2.73%	2.09%	3.67%	3.23%	2.27%	3.89%	3.55%	2.44%
Pension components									
Discount rate	2.62%	1.97%	1.06%	3.10%	2.46%	1.24%	3.32%	2.78%	1.40%
Mortality	0.34%	0.34%	0.31%	0.34%	0.34%	0.31%	0.34%	0.34%	0.31%
Benefits	0.18%	0.36%	0.64%	0.18%	0.36%	0.64%	0.18%	0.36%	0.64%
Balancing item	0.05%	0.06%	0.08%	0.05%	0.06%	0.08%	0.06%	0.07%	0.08%
Total	7.64%	7.19%	6.55%	8.13%	7.69%	6.73%	8.35%	8.01%	6.90%

400% NAE, Non-Contributory – Males

	0%			2%			4%		
Age	20	40	60	20	40	60	20	40	60
Equity risk premium									
Increase – NAE	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%
Increase – NICs, IT	–0.10%	–0.10%	–0.10%	–0.10%	–0.10%	–0.10%	–0.10%	–0.10%	–0.10%
Increase – Pension	2.92%	2.54%	1.98%	3.34%	2.97%	2.15%	3.52%	3.25%	2.30%
Pension components									
<i>Discount rate</i>	2.27%	1.72%	0.94%	2.69%	2.15%	1.10%	2.87%	2.43%	1.25%
<i>Mortality</i>	0.49%	0.49%	0.42%	0.49%	0.49%	0.42%	0.49%	0.49%	0.42%
<i>Benefits</i>	0.14%	0.29%	0.55%	0.14%	0.29%	0.55%	0.14%	0.29%	0.55%
<i>Balancing item</i>	0.02%	0.04%	0.07%	0.03%	0.05%	0.07%	0.03%	0.05%	0.07%
Total	7.32%	6.94%	6.38%	7.74%	7.37%	6.55%	7.92%	7.65%	6.70%

400% NAE, Non-Contributory – Females

	0%			2%			4%		
Age	20	40	60	20	40	60	20	40	60
Equity risk premium									
Increase – NAE	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%
Increase – NICs, IT	–0.10%	–0.10%	–0.10%	–0.10%	–0.10%	–0.10%	–0.10%	–0.10%	–0.10%
Increase – Pension	3.15%	2.70%	2.07%	3.62%	3.18%	2.25%	3.83%	3.50%	2.41%
Pension components									
<i>Discount rate</i>	2.59%	1.95%	1.05%	3.07%	2.43%	1.22%	3.27%	2.75%	1.38%
<i>Mortality</i>	0.34%	0.34%	0.31%	0.34%	0.34%	0.31%	0.34%	0.34%	0.31%
<i>Benefits</i>	0.17%	0.35%	0.63%	0.17%	0.35%	0.63%	0.17%	0.35%	0.63%
<i>Balancing item</i>	0.04%	0.06%	0.08%	0.04%	0.06%	0.08%	0.05%	0.06%	0.08%
Total	7.54%	7.10%	6.47%	8.02%	7.58%	6.65%	8.23%	7.90%	6.81%

Appendix 2: (cont.)

400% NAE, 6% Employee Contributions – Males

	0%			2%			4%		
Age	20	40	60	20	40	60	20	40	60
Equity risk premium									
Increase – NAE	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%
Increase – NICs, IT	–0.10%	–0.10%	–0.10%	–0.10%	–0.10%	–0.10%	–0.10%	–0.10%	–0.10%
Increase – Pension	3.17%	2.75%	2.13%	3.63%	3.22%	2.31%	3.83%	3.53%	2.48%
Pension components									
<i>Discount rate</i>	2.47%	1.86%	1.01%	2.93%	2.33%	1.18%	3.13%	2.64%	1.35%
<i>Mortality</i>	0.52%	0.53%	0.45%	0.52%	0.53%	0.45%	0.52%	0.53%	0.45%
<i>Benefits</i>	0.15%	0.32%	0.60%	0.15%	0.32%	0.60%	0.15%	0.32%	0.60%
<i>Balancing item</i>	0.02%	0.04%	0.07%	0.02%	0.04%	0.07%	0.03%	0.05%	0.07%
Total	7.56%	7.15%	6.53%	8.03%	7.62%	6.71%	8.23%	7.93%	6.87%

400% NAE, 6% Employee Contributions – Females

	0%			2%			4%		
Age	20	40	60	20	40	60	20	40	60
Equity risk premium									
Increase – NAE	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%	4.50%
Increase – NICs, IT	–0.10%	–0.10%	–0.10%	–0.10%	–0.10%	–0.10%	–0.10%	–0.10%	–0.10%
Increase – Pension	3.41%	2.91%	2.23%	3.93%	3.44%	2.42%	4.16%	3.79%	2.60%
Pension components									
<i>Discount rate</i>	2.81%	2.11%	1.12%	3.33%	2.64%	1.31%	3.56%	2.98%	1.49%
<i>Mortality</i>	0.36%	0.36%	0.33%	0.36%	0.36%	0.33%	0.36%	0.36%	0.33%
<i>Benefits</i>	0.20%	0.39%	0.69%	0.20%	0.39%	0.69%	0.20%	0.39%	0.69%
<i>Balancing item</i>	0.04%	0.06%	0.08%	0.04%	0.06%	0.08%	0.04%	0.06%	0.08%
Total	7.81%	7.31%	6.63%	8.33%	7.84%	6.82%	8.56%	8.19%	6.99%