Sir Humphrey's Legacy:

the true cost of public sector pensions[1]

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This publication is the first report of a continuing IEA project on public sector pensions. The final report will be published as an IEA monograph in mid 2006. This will include further research into policy solutions and also research into problems of governance of public sector schemes, including the particular problem of ill-health retirement.

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[1] As with IEA monograph publications, this work has gone through a process of peer review.

Sir Humphrey's Legacy: the true cost of public sector pensions

Neil Record[2]

Summary

The combined unfunded Public Sector Pension schemes in the UK now have a very substantial call on the nation's future taxes and taxpayers. This paper attempts to analyse this liability from two perspectives: firstly, the total value of the pension obligations under the current rules, and secondly, the 'real' current cost expressed as a percentage of salary in each of the large public sector employers. By 'real' cost, I mean the amount of money that would have to be put aside each year to fully fund the future pension cost without any investment risk being taken by the Government.

My estimate of the 'headline' unfunded Public Sector Occupational Pensions liability at March 2005 is **£817bn**, or 69.4% of GDP. This is £357bn higher than the last official estimate (£460bn) for March 2004 and £127bn higher than the Watson Wyatt estimate (£690bn) for March 2005.

My estimates of the annual costs as a percentage of salary are shown in detail in Chapter 3, but as an example, whereas in the case of the Teachers' scheme the Government charges employees 6% of salary, and employers (i.e. LEAs) 13.5% of salary (i.e. total cost **19.5%**), I calculate that the total 'real cost' of teachers' pensions[3] is **31.8%** of salary for men and **35.6%** for women.

This paper calculates pension liabilities on current scheme rules. The Government and the main Public Sector unions have been in negotiation over reform of the schemes (prompted by the Government), to make them more affordable. The current proposed compromise (as at Nov 05) is to raise the normal retirement age to 65 for new employees, but not for existing employees. This will not alter the current headline liability figure, nor (obviously) the 'real cost' calculations for existing employees. It will reduce the real cost of pensions for new employees, and this is quantified in Chapter 3.

I set out the basic facts of the main Public Sector schemes in Chapter 1. I attempt to analyse the 'pensions promise' from first principles in Chapter 2. In Chapter 3, I translate the theory into estimates of the liability and the 'real' pensions running costs from the most

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[3] I make a number of important assumptions for this – the main one being that employees spend their whole careers (40 years) in one scheme. All the assumptions are discussed in detail in Chapters 2 & 3.

up-to-date numbers in Government publications. Finally, in Chapter 4, I briefly review the policy alternatives to address the problem.

Chapter 1 - Existing Unfunded Public Service Pension Schemes

Introduction

According to the Office for National Statistics (ONS), in March 2004, the latest period available, 5.7m people were employed in the public sector, compared with total UK employment of 28.3m – so 20% of all UK employment is in the public sector. Interestingly, when asked who they work for, some 6.9m (or 24%) people say they work for the public sector[4]. This (rather large) discrepancy arises from the definition of public and private sector: definitions, which are surprisingly difficult to pin down. For example, most University employees will say that they work in the public sector. However, on UK National Accounts definitions, Universities are in the private sector, not the public sector. So the 5.7m refers to National Accounts definitions, not what people generally think of as public sector[5].

Most employees in the public sector are offered a final salary pension scheme. There are six large employers' pension schemes which account for the vast majority of the occupational pension obligations of the government, five of which are unfunded, and one (the Local Government Pension Scheme) which is funded. The full list of unfunded schemes is shown in Appendix 1 (main five are in bold)[6].

All these schemes have pension obligations to their members that are not backed in any way by marketable assets (or indeed segregated assets of any kind). They rely wholly on the covenant of the UK Government.

Is Unfunded a bad idea ?

Is there anything inherently wrong in unfunded pension schemes in the public sector? Probably not. The arguments for funding public sector pensions *per se* are not strong. The main purpose of funding, after all, is to ensure that pensioners get paid, and the one employer who is certain to continue to be solvent, and to be able fulfil its promises to pensioners, is the Government. Its tax-raising powers make this a near certainty[7], rather than just highly probable.

The problem with non-funded public sector schemes is not lack of security for members. It is instead that (i) commitments made by one generation have to be paid for by subsequent

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[4] Source: Office of National Statistics (ONS) Labour Force Survey (LFS)

[5] Non-intuitive examples of public sector employers include Channel 4 Television Corporation Ltd and Hillingdon Homes Ltd (both of which are classified as Public Corporations and therefore in the public sector), whereas the National Air Traffic Services Ltd, a subsidiary of the Civil Aviation Authority, is classified as a private sector employer.

[6] Note that Scotland and Northern Ireland sometimes, but not always, have their own schemes

[7] In *extremis* (say a revolution) the will to pay might disappear – but we will stick in this paper to the idea that the UK Government has not credit risk attached to its promises.

generations (rather than paid for at the time of commitment) and (ii) the scale of the commitments may not be subject to scrutiny of the same rigour as that which applies to the funded pensions sector.

Point (i) is a general problem of unfunded pensions, which most European countries (including the UK) are facing in their State Pension arrangements. Much has been written about it, and I do not propose to add to that debate.

On point (ii), the funded sector, which was originally designed to put aside enough money each year to cover all pension liabilities, has had its own, much publicised, problems. The answer to the question "how large a fund do we need to cover our liabilities?" had been twisted slowly and subtly over time by a combination of wishful thinking, mis-aligned incentives, short-termism and client accommodation by Actuaries. The Government, in its role as pensions regulator, did little until recently to stem this tide. The result was the "pensions black hole", the approximately £100bn gap between the pension liabilities (measured by the FRS17[8] standard) of the FTSE100 companies, and the size of their pension funds[9]. However, market pressures apply to private pension schemes in a way that they don't to public sector schemes, the advent of the FRS17 measure, and the Pension Protection Fund, are evidence that reality can be avoided only for so long – in the long run it invariably makes itself felt.

Without clear knowledge of the cost, no sensible decisions can be made by either party – employer or employee – as to the right level of pensions (i.e. deferred pay) as compared to salary level (paid now !).

For the unfunded public sector, in place of accurate calculations of the real costs of pensions, as we shall see, is a series of "non-market" assumptions which distort the cost calculation, and therefore the decision-making process.

Some of the UK's public sector pension schemes use a model called SCAPE[10], in which a notional fund is maintained for each scheme, with 'contributions' invested (notionally of course) in Index-Linked Gilts. On the basis of the assumptions in each scheme, the amount of contributions by employees and employers is required to be sufficient, over time, to provide sufficient notional funds under SCAPE to cover the liabilities. The 'notional' nature of SCAPE, however, has allowed (notional) investment in Index-Linked Gilts at yields far higher than are available in the market, lowering the apparent cost of the pensions. We will come back to this point in much more detail later.

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[8] FRS17 is a new accounting standard which requires UK companies to value their pensions' liabilities using a discount rate equal to the yield on AA corporate bonds. While this not as stringent as either using a Gilts discount rate, nor as a buyout rate, it is much better than the now discredited Minimum Funding Requirement (MFR). A new international standard, IAS19, looks very like FRS17. In the past it has been possible for defined benefit pension benefits to be adjusted so that scheme members took some of the risk of under funding. Legislation has closed off some of these "safety valves", thus whatever the merits of techniques used in the past, in the current environment, defined benefit pension promises should be treated as promises and liabilities valued accordingly.

[9] This was the size of the gap at its peak – it is now lower.

[10] Superannuation Contributions Adjusted for Past Experience

Facts of Each Scheme

The following is a summary of the main unfunded public sector pension schemes. I have not included smaller schemes, and those listed below account for some 95% of the outstanding unfunded liabilities.

There are other pension schemes (all funded to a greater or lesser extent) which are also the responsibility of the taxpayer – examples are the Local Government Pension Scheme (LGPS), the Universities, Royal Mail, BBC, the Bank of England, and partial guarantees to many ex-nationalised industries such as Coal and Railways. However, I do not intend to refer to these any further in this paper, although it would be an interesting topic for another paper. Suffice it to say that in teasing out unfunded Government pension liabilities, we will not have got to the bottom of the total pension liabilities to which the taxpayer is ultimately committed.

Table 1

Main Unfunded Public Sector Pension Schemes					
Employer	***Coverage***	***Normal Retirement Age***	***Accrual Rate***[11]	***Lump Sum***[12]	***Widows/ Dependants***[13]
Teachers	England & Wales	60	1/80th	3x	50%
NHS	England & Wales	60	1/80th	3x	50%
Civil Service	UK – pre 2002	60	1/80th	3x	50%
	UK – post 2002	60	1/60th	Nil[14]	37.5%
Police	GB	55	0-20 yrs - 1/60th 20+ yrs – 1/30th Max 2/3 Sal	Nil[15]	50%
Armed Forces	UK – pre 2005	55	0-16 yrs - 1/56th 16+ yrs – 1/90th	3x	50%
	UK – post 2005	55	1/70th	3x	62.5%

This paper's plan

This exercise is surprisingly difficult, for a number of reasons. The first is that the Government traditionally accounts on a 'cash' basis, rather than an accruals[16] basis. Unfunded pensions are by their nature an 'accruals' item. In recent years, however, the Government has begun to apply accruals accounting to some areas, and this has helped

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[11] This refers to the proportion of final salary that is accrued as pension with each year's service.

[12] This refers to the multiple of *pension* paid as a tax-free lump sum.

[13] Refers to the proportion of pension paid to the widow/widower of a pensioner who dies while drawing his pension.

[14] Part of the pension can be commuted to a lump sum

[15] Part of the pension can be commuted to a lump sum

[16] In simple terms, 'cash' basis is the amount of cash spent or received in a year, irrespective of what good or service it is payment for, or the date of delivery or consumption of that good or service. 'Accruals' basis, by contrast, measures only the goods and services consumed in the year, whatever the terms or timing of payment. The accruals basis is a much better measure of the economic picture year-by-year, although in the long-run 'cash' and 'accruals' will coincide.

with finding some of the numbers needed. The second difficulty is that the 'Public Sector' is not one employer, and that the pension arrangements, and the assumptions that underpin their pension accounts, differ across employers. The third difficulty is that, despite the scale of the public spending that these pension schemes absorb, the amount of published information on them is slight, and what there is requires considerable expertise and diligence to find.

The final difficulty is that the very long horizons of pension liabilities, and the statistical elements within them, make understanding very difficult for lay people. To unravel this complexity has required the expertise of Actuaries. For several reasons, this has allowed the creation and maintenance of a 'mystique' around liability valuation that has become their almost exclusive preserve.

Without the full employment records of some 5m employees, the task of valuing from first principles the pensions' liabilities owed by a series of public sector employers is impossible. I therefore plan to adopt the following approach to reduce to task to manageable proportions.

Calculation of Outstanding Liabilities

- Use a "methodology" section in the paper to establish, from first principles, the financial mathematics of pension liabilities. This will be presented without assuming any Actuarial expertise on behalf of the reader.
- Use the public domain valuations of scheme liabilities provided by the Government Actuarial Department (GAD) and other official sources.
- Examine the assumptions in these estimates, and select a small number of critical assumptions which have a disproportionate effect on liability valuations
- Establish realistic values for each of these assumptions (many may already be realistic)
- Examine the likely effect of these new assumption values on liabilities using the financial mathematics methodology established in this paper

Calculation of Ongoing Pension Cost

- Use financial mathematics to estimate the current cost of pensions (expressed as a percentage of salary) at an aggregate level based on the new assumptions
- Compare this to the 'cost of pensions' calculated by GAD in the public domain.
- Consider the policy implications of the 'real' cost of pensions compared with 'official' costs

While I have no doubt that the newsworthy story that this paper may generate is the overall scale of the Government's unfunded liability (and it does make a great headline!), nevertheless this value is not of great importance from a policy perspective. Existing liabilities are just that – little can be done to reduce them short of expropriation[17] - whereas each day that passes, public sector employers are paying public sector employees large amounts of deferred pay in the form of pensions promises, while having a mistaken idea of how much these amounts are. Good decision-making between employers and employees needs at minimum basic facts (such as a knowledge of the monetary value of the salary and benefits package) to be clear. I aim to help to improve this clarity with this paper.

[17] Like raising the retirement age for existing employees

Chapter 2 – Methodology of calculating a pension liability

Introduction

Any employer who offers a 'defined benefit'[18] pension to any employee is making a promise to pay, in effect, part of the pay package in arrears. So much in arrears, in fact, that it is paid after the employee has retired – which could be 80 years[19] or more after the 'pay' was earned. The promise commits the employer to pay a defined amount *each year* as long as the retired employee lives rather than a fixed amount of money.

Unfunded – except Local Authorities

Generally speaking, as we have seen the Government has taken the line that it does not have to fund pensions in advance (i.e. create pension funds) because it will not go bankrupt. There is one exception to this – the Local Government Pension Scheme (LGPS), which is funded, and covers Local Authority employees not in other (unfunded) schemes such as Police and Teachers.

When an employer such as the Government undertakes to pay a pension, it takes on a debt[20]. The Government takes on future obligations in a number of ways, not all of which are classified by the Government as debt, but much of which is. The most explicit debts are Gilts and Treasury Bills – which together with National Savings obligations make up the vast bulk of what is colloquially know as the 'National Debt'. Some other types of debt – namely commitments under PFI and its occupational pensions are not officially classified as debt, even though they may be[21].

There are many other types of future expenditure to which the Government is committed (state pensions, education, health, military – indeed virtually all categories of public sector provision), but these are political, not contractual obligations. No one could have taken the Government to court for indexing state pensions to RPI not earnings, or could do so for making cuts in health provision – whereas an employee could in theory take his public sector employer to court for reneging on the terms of the pension scheme which had been promised, and to which he may have been contributing.

There is a nicer point here, too. Governments can often avoid legal obligations by changing the law. The point is not particularly the legal enforceability of a particular

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[18] In the UK almost all defined benefit schemes are 'final salary' based – hence the popularity of the expression. This naming convention may change if a significant proportion of schemes try to renegotiate to average salary arrangements.

[19] A 20-year old's 'deferred pay' still being paid (embedded within the pension) when he (or more likely she) celebrates her hundredth birthday

[20] There is a lot of rather mealy-mouthed semantics in this area. I will treat 'promise', 'debt', 'liability', 'commitment' etc all as synonymous – a contractual commitment by an employer to pay an employee the pension as defined in the scheme rules.

[21] PFI commitments may, confusingly, be a combination of debt (deferred payment for current services or consideration) and future payment for future services. I will not deal with PFI any further in this paper.

commitment, but the consequences to Government of default. The UK Government has always paid its Gilts commitments on time and in full because it wants to offer future investors an unblemished record, and thereby raise funds on the finest terms. Similarly, the Government in the role of employer is acting as an economic agent, not as a political entity. It needs to compete with other, private sector, employers for the best staff at the best price. Reneging on its pension obligations would wreck its credibility as an employer, and compromise its ability to attract the staff it needs.

This paper aims to highlight not just the size of the Government's current occupational pension liability (about which little can be done short of default), but also the current cost of future pension arrangements (about which a great deal can be done). This latter concept is quite sophisticated, and much of this chapter is dedicated to explaining it.

Calculating liabilities

If I am an employer, and I promise to pay you, my employee, £10,000 p.a. from retirement (say when you are 60) until your death, how much do I owe you? Let's call this "Promise 1".

This simple enough question has provided a colourful debate over fifty years, occupying until only recently purely the actuarial profession, but more recently accountants, regulators, politicians, economists and lawyers. It is surprising that there has been a debate at all, since the theory has been fully in place since the eighteenth century[22], and only some empirical data (mainly on longevity) has been significantly updated.

Life expectancy in the UK has been rising for 150 years. Very, very roughly, it has increased by 3 months for every year that has passed in the last 150 years, so that if life expectancy was aged 43 years in 1855, it is aged 80.5 years in 2005.

The pattern of death has changed a lot (much less death amongst the young), and this has meant that life expectancy of 60-year olds has not increased anything like as much as life expectancy of babies. There are a lot of complex concepts that actuaries like to wrap all the figures up in, but increases in life expectancy are not new, should be no surprise, and yet seem to have been continually surprising the profession. This has meant that life insurance has been over-priced and pensions or annuities have been under-priced.

An annuity is exactly "Promise 1" above, offered not by an employer, but by a commercial provider (invariably an insurance company in the UK). It can be bought for cash, either on the day the employee is 60, or before (a 'deferred annuity'). It is priced in such a way that the provider will make a very small profit (a few percent) if you live to exactly the planned life expectancy[23].

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[22] For the truly diligent, see History of Actuarial Science, ed Steven Haberman and Trevor A Sibbett, Chatto and Pickering, 1995, ISBN 1 85196 143 7.

[23] This is not strictly true in mathematical terms. In fact the insurance company does not care about individuals in the same way that a good bookie does not mind about individual race outcomes. But the insurance company does care that the outturn age at death of the population of customers matches the life expectancy curve on which they have priced the annuity.

Under-priced or not, the life insurance industry has managed to eke out a living from annuity business. It has done so because it has been clear-headed about how (with the exception of the longevity trend point) to price and hedge annuities. To eliminate the longevity point, and to keep the calculation simple in this example, I assume that life expectancy is aged 80 years, and that everyone dies at this age[24].

Table 2 shows the calculation the insurance company does to calculate the break-even price. Market interest rates in this example are 5% (i.e. the insurance company can always invest at 5%). In summary, if the insurance company charges £128,212 on the day the annuitant is 60, then it will invest this money at 5%, and at each year-end add the interest earned in the year[25], and deduct the £10,000 paid to the annuitant. By charging exactly £128,212 it will end up with precisely nothing when the annuitant dies at 80[26]. This is my definition of the 'fair price' for the annuity, and similarly is the amount that the annuity (or pension) provider 'owes' by making 'Promise 1'.

We can think of the relationship between the annual pension (£10,000) and the total liability on the provider (£128,212) as a ratio. £128,212 / £10,000 = 12.8 (the 'annuity multiple'), or alternatively £10,000 / £128,212= 7.8% ('annuity rate'). We will come back to these concepts later. Note that the total amount paid out (£210,000) is a lot more that the £128,212 needed to fully cover the liability – and this is all the effect of compound interest.

[24] Later on, in more accurate calculations, I will take into account the chance element in age at death, and its wide spread.

[25] I assume that the annuity provider will not pay tax on this interest. This is generally true in the UK, and certainly true for pension funds.

[26] In this example, the annuitant dies at the midnight before his 81^{st} birthday – so he gets the 80^{th} year's cheque.

Table 2

Simplified Example Annuity				£
Age	**Amount invested at start year**	**Plus interest**	**Less pension paid out**	**Total investment end year**
60	128,212	6,411	-10,000	124,622
61	124,622	6,231	-10,000	120,853
62	120,853	6,043	-10,000	116,896
63	116,896	5,845	-10,000	112,741
64	112,741	5,637	-10,000	108,378
65	108,378	5,419	-10,000	103,797
66	103,797	5,190	-10,000	98,986
67	98,986	4,949	-10,000	93,936
68	93,936	4,697	-10,000	88,633
69	88,633	4,432	-10,000	83,064
70	83,064	4,153	-10,000	77,217
71	77,217	3,861	-10,000	71,078
72	71,078	3,554	-10,000	64,632
73	64,632	3,232	-10,000	57,864
74	57,864	2,893	-10,000	50,757
75	50,757	2,538	-10,000	43,295
76	43,295	2,165	-10,000	35,460
77	35,460	1,773	-10,000	27,232
78	27,232	1,362	-10,000	18,594
79	18,594	930	-10,000	9,524
80	9,524	476	-10,000	0
Total Paid out			**- 210,000**	

When set out like this, the calculation of the £128,212 looks a bit like we reached it by trial and error. It is the right answer (since the amount left in the pot at aged 80 is zero, but it is not clear how we got there.

In fact, we can get there using the same principles, but a different technique which financial mathematicians call 'discounting'. Take the simplest possible example. I owe you £100 in exactly one year's time – how much do I owe you now? Or, how much could I pay you now instead of £100 in one year? The answer to this question is the amount that we need to invest to at the rate of interest to produce our £100 in one year. We can apply the same investment technique as above (i.e. invest an amount of money at 5%, which when added to the original amount will equal £100 is one year's time), but this time we can write out a simple equation to discover how much we need now:

(1) $A \times (1+r) = 100$ where A is the amount of money needed now, and r is the interest rate.

We can re-arrange the equation to find A:

(2) $A = 100 / (1+r)$

Since r = 5%, then A = 100/1.05, or 95.24

This value of A - 95.24 – is called the **present value** (PV) of the debt **discounted** at 5%, and is an absolutely crucial concept in pensions. Present value is the amount of money I need now to fully pay all the amounts I owe you in the future[27].

Present values can apply to multi-year distant liabilities. Let us suppose I owe you the money in two years' time, rather than one. Assume that the interest I earn on my deposit arrives at the end of the year in one lump, and that I can reinvest the interest to earn interest-on-interest in the second year[28]. Then A (I will now call it PV) can be calculated in the following equation:

(3) $((PV \times \underbrace{(1+r)}_{\text{Interest Year 1}}) \times \underbrace{(1+r)}_{\text{Interest Year 2}}) = 100$ where PV is the Present Value

Simplifying

(4) $PV \times (1+r)^2 = 100$, so

(5) $PV = 100 / (1+r)^2$

In fact we can make a general statement than any amount of money owed in n years time has a Present Value as follows:

(6) $PV = 100 / (1+r)^n$

This allows us to use the Present Value calculation to value any amount owed for any date in the future. So we can re-cast Table 2 as Table 3, using the Present Value concept as follows:

[27] It also applies symmetrically to assets. If you (or perhaps the Government) owes me a fixed amount of money at a future date, then the present value is what it is worth now, and in theory what I could sell it for to a third party if I needed the money now.

[28] Again, assuming no tax to pay on the interest. Not true for individuals, but true for pension providers.

Table 3

Present Value of a Simplified Pension £		
Age	**Pension paid out**	**Present Value of each payment**
60	- 10,000	- 9,524
61	- 10,000	- 9,070
62	- 10,000	- 8,638
63	- 10,000	- 8,227
64	- 10,000	- 7,835
65	- 10,000	- 7,462
66	- 10,000	- 7,107
67	- 10,000	- 6,768
68	- 10,000	- 6,446
69	- 10,000	- 6,139
70	- 10,000	- 5,847
71	- 10,000	- 5,568
72	- 10,000	- 5,303
73	- 10,000	- 5,051
74	- 10,000	- 4,810
75	- 10,000	- 4,581
76	- 10,000	- 4,363
77	- 10,000	- 4,155
78	- 10,000	- 3,957
79	- 10,000	- 3,769
80	- 10,000	- 3,589
Total Paid	**- 210,000**	**- 128,212**

Net Present Value (NPV)

The amount of money an annuity provider needs to invest to meet all these 'pension' payments turns out to be the sum of the present values of all the individual payments. This sum is commonly called the net present value (or 'NPV'), and is ***the*** fundamental financial concept which we need to understand to be able to answer the question 'how much is pension promise worth now ?'.

I mentioned that present values are calculated by 'discounting' future cash flows to today's values. I just note here, to revisit later, that the interest rate I have used (5% in this example) is called the 'discount rate'.

Index-Linking

I am about to make the pension promise more complicated. Let's stick with our current mortality assumptions, but change the pension promise – I want to give you an index-linked pension. An index-linked pension means a pension whose value rises each year in line with the RPI (i.e. inflation). So now if the promise is an annual payment of £10,000 p.a. ***index-linked*** from retirement at 60 until your death, how much do I owe you? Let's call this "Promise 2".

Fortunately for us (and anyone who wants to calculate the PV of an index-linked pension), there is a lively market in Index-linked Government debt (or 'Index-linked Gilts')[29]. The Government can borrow money, and the general public invest it, at a fixed 'real' rate of return. The 'real' rate of return is the guaranteed return over and above changes in the RPI[30] (i.e. inflation). The real interest rate varies with the length that the investor wants it fixed for. On the basis of prices on 21 June 2005, you could invest money for four years at 1.68% p.a.; for 11 years also at 1.68% p.a., for 19 years at 1.61%, and for 30 years at 1.49% p.a.[31]. These rates are not a guess – an investor can invest his money today and get these rates, unconditionally guaranteed in interest and principal by the UK Government. These rates are not set by the Government, they are set by the market. The price of Index-linked Gilts varies in the second-hand market (i.e. the stock-market) according to supply and demand. Real interest rates can vary widely. Since 1981 (which is when the Index-linked Gilts were first issued), real rates have varied both up and down in a range of approximately 1.4% to 4.5% p.a. So current real rates are at near the lows of the past twenty years.

With Index-linked Gilts we can answer the question of how much Promise 2 is worth today. Sidestepping a few technicalities, we can simply apply the current real rate of return (say 1.61% - the 19 years rate) to Table 2. Table 4 illustrates. Note that I have not increased

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[29] Bonds issued by the UK Government are called 'Gilts'. They generally pay a fixed rate of interest (coupon) twice a year until they mature, when the government pays the capital back in full. Index-linked Gilts do exactly the same, but both the capital and interest are uprated each month in line with the (8-month-lagged) RPI. This preserves their purchasing power.

[30] Note that the Government has recently created an unresolved confusion about what constitutes inflation. For the purposes of Index-linked Gilts, Public Sector Occupational Pension Schemes and the State pension, inflation is still measured by the Retail Price Index (RPI), and pensions & Gilts uprated in line with the RPI. However, the Bank of England now targets a measure called the Consumer Price Index (CPI), which is calculated on a different basis, and has had a fifteen year history of being around 0.85% p.a. lower than RPI. There is pressure (from the point of view of both consistency and the Government saving money) to change pensions and Gilts to CPI-linking, but this change is likely to be strongly resisted (with good reason) by the two affected groups – pensioners and investors.

[31] In September 2005, the Government issued the longest maturity ever index-linked Gilt, maturing in 2055. It was issued by competitive tender, and was priced on issue at a real return of just 1.11% p.a. real!

any of the payments by inflation – they are all still £10,000. But I don't have to – investing in index-linked Gilts means that everything I own (i.e. principal and interest) will rise exactly in line with inflation. So I don't have to guess inflation, but I can still make the promise to index-link the £10,000, and be able to satisfy it with certainty.

Table 4

Present Value of an Index-linked Simplified Pension £		
Age	**Pension paid out**	**Present Value of each payment**
60	- 10,000	- 9,842
61	- 10,000	- 9,686
62	- 10,000	- 9,532
63	- 10,000	- 9,381
64	- 10,000	- 9,232
65	- 10,000	- 9,086
66	- 10,000	- 8,942
67	- 10,000	- 8,801
68	- 10,000	- 8,661
69	- 10,000	- 8,524
70	- 10,000	- 8,389
71	- 10,000	- 8,256
72	- 10,000	- 8,125
73	- 10,000	- 7,996
74	- 10,000	- 7,870
75	- 10,000	- 7,745
76	- 10,000	- 7,622
77	- 10,000	- 7,501
78	- 10,000	- 7,383
79	- 10,000	- 7,266
80	- 10,000	- 7,150
Total Paid	**- 210,000**	**- 176,990**

So the answer to the question of how much Promise 2 is worth is £176,990. This is anannuity multiple of 17.7, and an annuity rate of 5.6%.

The simple act of index-linking has had a dramatic upwards effect on the NPV of the liabilities. But the 5% p.a. assumption was not the market interest rate – it was just a round-number assumption. On 21 June 2005, the Gilts yield for twenty years, for conventional (i.e. not index-linked, Gilts was 4.36%. A 4.36% interest rate gives an NPV of £135,753. So by index-linking a pension, we increase the current liability by 30%. But this is only half the story, as we shall see in a moment when we come to the 'final salary' section.

Mortality

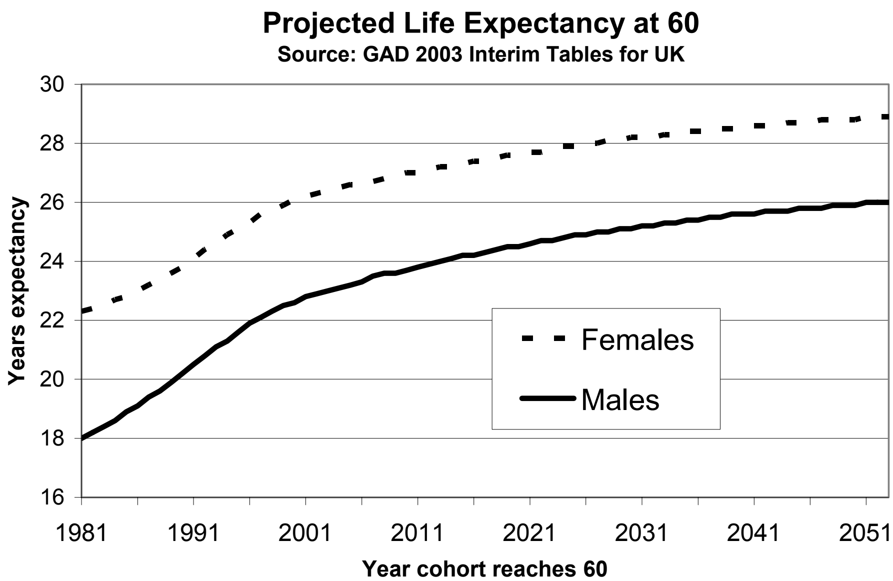
Life expectancy in the UK is rising; it has been rising for a century and a half, and it is still rising. By its nature, however, life expectancy is just that – an estimate of future death rates in the population, by age, based on past trends. Forecasting mortality (which is the mirror image of longevity, and the basic data we need) requires that we make assumptions. These will not be totally arbitrary (since we have a lot of data on past rates), but, just to illustrate the problem, do we assume that death rates at each age remain constant? That the rate of fall in the death rates at each age remains constant? Or that the change in the rate of fall in the death rates remain constant? Or do we base the forecasts on cohorts that experience particular mortality rates? And if none of these values have been constant in the past, what do we rely on? We will come back to this problem in Chapter 3.

The Government Actuary's Department (GAD) produces Cohort tables[32], which aim to extrapolate established mortality trends across cohorts[33]. Just to put some numbers on this theory, Graph 1 shows the life expectancy projections at aged 60 based on the UK cohort tables, prepared by GAD.

[32] Cohort life expectancy at age 65 in 2000 would be worked out using the mortality rate for age 65 in 2000, for age 66 in 2001, for age 67 in 2002, and so on…" Obviously, in cohort life tables, we run out of actual data in this example after 2004. However, if there have been consistent trends, these projections are likely to be closer to the future outcomes than just using constant death rates (called Period Tables).

[33] In this context a cohort is all the people born in a particular year.

Graph 1



The cohort information above assumes a continuation of reducing mortality rates, but also needs a different mortality table for each year's cohort. For the purposes of illustration, this is far too complicated. I therefore propose to use the GAD's 2001-03 interim Period[34] Tables to calculate the life expectancy – we will just accept that it will almost certainly underestimate longevity – under these tables males aged 60 have a life expectancy of 20 further years, and females 23 further years.

Using this data, I will make a new pensions promise and calculate its PV. This is "I promise to pay you (Mr & Mrs Average respectively) an index-linked pension of £10,000 p.a. from your 60th birthday until you die."

Table 5 shows the amount payable each year (and again I do not increase the payment by inflation) if the pensioners of this scheme die off in line with the UK averages. The reader will quickly see that the payment profile is very different from that of Table 2-Table 4

[34] Period table calculate e.g. life expectancy at age 65 in 2000 using the mortality rate for age 65 in 2000, for age 66 in 2000, for age 67 in 2000, and so on.

Table 5

Annual cost of £10,000 p.a. Pension Promise to a 60-year old Based on GAD Period UK Mortality Table 2001-3						£
Age	Male Pension	Female Pension		Age	Male Pension	Female Pension
60	9,906	9,941				
61	9,799	9,875		81	4,718	6,221
62	9,684	9,803		82	4,312	5,855
63	9,558	9,726		83	3,914	5,472
64	9,422	9,644		84	3,515	5,074
65	9,276	9,552		85	3,127	4,662
66	9,119	9,453		86	2,722	4,226
67	8,949	9,345		87	2,344	3,790
68	8,762	9,227		88	1,990	3,354
69	8,561	9,097		89	1,662	2,929
70	8,340	8,955		90	1,360	2,514
71	8,107	8,801		91	1,101	2,123
72	7,850	8,630		92	877	1,761
73	7,576	8,439		93	679	1,430
74	7,280	8,230		94	513	1,129
75	6,962	8,004		95	382	876
76	6,625	7,754		96	275	661
77	6,271	7,487		97	194	487
78	5,901	7,200		98	132	349
79	5,521	6,895		99	89	243
80	5,122	6,569		100	58	166

Note that the first payment (on the last day of their sixty-first year) is not £10,000 because a small (<1%) of pensioners will have already died.

All of the Public sector pensions we dealing with are index-linked. We can apply the same discounting methodology that we discussed earlier to calculate an NPV of this liability for both men and women, using the current market real return discount rate. We obviously cannot have a single maturity discount rate, but we can use an approximation of the maturity by mixing various maturity rates – 75% of the 19 year rate (1.61%) and 25% of the 30 year rate (1.49) = 1.58%.

Using 1.58% as the discount rate, the NPV of pension Promise 3 is **£167,346** for men and **£190,894** for women (multiples of **16.7** and **19.1** respectively). Since we will use these values in our calculations below, I will call them the 'cost of Promise 3'.

What is promised ?

But we have calculated the cost of a simple promise (Promise 3) – and this is very different from the pension promises actually made to public sector workers. In what respects is this so?

As a result of years of bargaining, negotiation and compromise, the promises include not only a pension, but also many of the following:

- A pension for the surviving spouse, or (lately) civil partner
- The ability to commute a portion of the pension to a tax-free lump sum, or in some cases a lump sum anyway.
- Widows or widowers pension and/or lump-sum benefit for death-in-service
- Early retirement in return for some pension 'give-up'
- Early retirement on health grounds
- Deferred pensions for those that leave employment
- An option for employees to transfer out of the scheme in return for a cash sum now, or benefits in another pension scheme

Almost all of these variations will add to the cost to the pension provider. The exceptions are the last two, and the last is the stark exception. Transfer values[35] in the past have under-priced the NPV of individual pensions, and have penalised transferees and benefited the employers.

In the methodology I will use to estimate public sector pension liabilities, and current pension costs, I will not need to analyse in detail these elements. I am going to concentrate on the small number of key areas (discount rates; mortality; salary rises) which may account for significant under-reporting of the liabilities. This means that I will have to rely on the scheme actuary (usually GAD) to cover these additional costs adequately.

Final Salary?

So far the calculations have been straightforward (if a little mathematically complicated), but not really difficult or uncertain. There can be little dispute that the NPVs we have calculated in the *Mortality* section are close to the index-linked annuity cost. We can check this with index-linked annuity providers for confirmation. Most do not provide exactly the same annuity as Promise 3, but multiples for the closest pension specification are about

[35] Except within the 'Public Sector Pension Club', where transfers can take place between these schemes without loss of value.

23.9 for men and 25.1 for women[36] – much higher than our calculated 16.7 and 19.1. This reflects (a) their more conservative mortality assumptions (they now include mortality trends, and also buyers of annuities live longer that the UK average – people who are in poor health do not have a strong incentive to buy an annuity) (b) the interest rate risk they will have to take even with the best portfolio of matching Index-linked Gilts and (c) the profit which they need to make to cover their costs and their committed capital.

But none of this covers the much more complex liability that the final salary provider takes on – linkage to final salary!

This commitment means that the promise to most public sector workers who retire while working in the public sector (I will deal with those that don't in a minute) is more like this: "Your employer promises to pay you a proportion of the best of the last (few) years' salary from your retirement date until you die. The proportion depends on your length of service, and the amount you retire on will be index-linked". Let's call this "Promise 4".

This section will try to work out the variables that determine the starting pension amount – i.e. the £10,000 p.a. in all our previous examples. Once we have got the 'starting pension', we can easily calculate, from the analysis above, roughly how much the pension liability is.

Let's take some stylised rules of a pension scheme, to see if we can work out what pension is promised: Accrual rate 1/60[37]; retirement age 60; based on final year's salary.

Let us suppose, firstly, that the employee is in a lower-paid, lower skilled job, in which there is no natural career progression. We will assume for this employee that his (also her on a separate column) wages go up with average earnings, but no more. We will assume also that this employee works in the public sector scheme for his/her whole career (40 years – from aged 20 to 60).

Average earnings rises have exceeded average price rises by around 2% p.a. over the past forty-odd years. Graph 2 illustrates.

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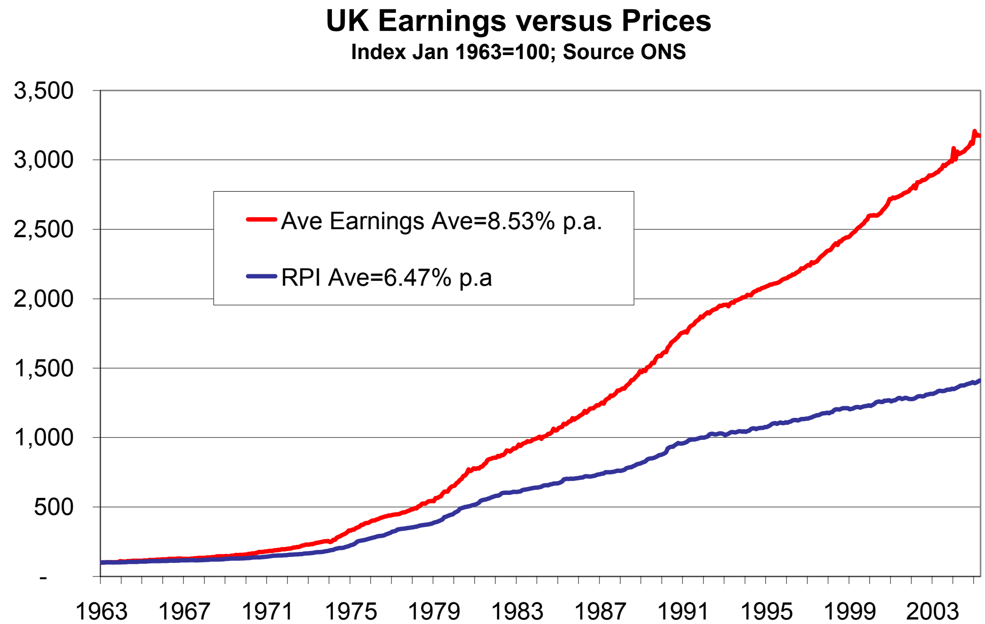
[36] Source: www.annuityadvisor.co.uk and www.prudential.co.uk

[37] 1/60th is the rate for the post-2002 Civil Service 'Premium' pension scheme. Most other large schemes have 1/80th, but they tend to give 3 times pension lump sums, which brings us quite close to 1/60th in economic terms.

Graph 2



This increase of 2% p.a. is close to the real growth rate of the UK economy (and also labour productivity growth over this period), so it is logical to use 2% as the 'assumed' earnings excess over RPI in this exercise. Let us also pick an assumed inflation rate (for illustration purposes) of 3%. Obviously over the past 20 or more years this has varied widely, but our assumption here is only for illustration purposes, because with Index-linked Gilts we will be able to eliminate this risk to the employer for the future.

Table 6 below shows simply the path of earnings for our fictional unskilled employee; I have chosen this employee's final salary to be £15,000 p.a., which they receive in their 59th year. This makes for some nice round numbers as we shall see.

Table 6

Salary Progression for an unskilled worker; 3% inflation; 2% real earnings £			
Age	Salary	Age	Salary
20	2,188	40	5,872
21	2,299	41	6,169
22	2,415	42	6,481
23	2,537	43	6,809
24	2,666	44	7,154
25	2,800	45	7,516
26	2,942	46	7,896
27	3,091	47	8,295
28	3,247	48	8,715
29	3,412	49	9,156
30	3,584	50	9,620
31	3,766	51	10,106
32	3,956	52	10,618
33	4,156	53	11,155
34	4,367	54	11,719
35	4,588	55	12,312
36	4,820	56	12,935
37	5,064	57	13,590
38	5,320	58	14,278
39	5,589	59	15,000

This table reminds us, if we needed reminding, that with good real growth in the economy, and even with modest inflation, "average" wages rise enormously over 40 years.

This employee worked forty completed years if he started work on his 20th birthday, and this entitles him to a pension of 40/60th of his final salary (£15,000), which is £10,000 p.a.

But this provides us with all the information we need to answer the question: "what proportion of salary, if paid as a constant percentage, will be needed to pay for this pension?"

Let's start with males. We know from the 'Mortality' section above that the cost of *Promise 3* (i.e. a pension of £10,000 p.a. index linked) is £167,346. So the simple question is "what fixed proportion of the annual salaries in Table 6 need to be invested each year to make

£167,346 on the day the employee retires. Remember that to take no inflation or investment risk, the employer will invest in the same instruments as for the annuity – namely Index-linked Gilts. For this average twenty year investment (ranging from 1 to 40 years), we will use the 19 year real interest rate (1.61% from my June 2005 data). Unfortunately for the employer, there is no investment which matches earnings[38].

This sets us up for the first calculation. Table 7 shows this calculation.

[38] If there were, for example, a Gilt that inflated with average earnings then, on current interest rates, the market would price the yield to be just negative (expected excess of earnings over prices of c 2%; current real yield 1.5%). So unless the employer chooses to take much more investment risk by investing in equities (which in the long run tend to give returns linked to GDP (and therefore earnings) growth), then he has to take earnings risk – risk which is related not to average earnings in the economy, but to earnings in their specific sector.

Table 7

Annual Contribution to provide a Male 2/3 Final Salary Pension							£
Final Salary £			15,000	Pension:		10,000	
Inflation Rate p.a.			3.00%	Amount Needed (Male)		167,346	
Average Earnings Excess over inflation p.a.			2.00%	***Contribution Rate***		***30.02%***	
Real Return p.a.			1.61%				
Age	Salary	Contribution	'Investment Pot'	Age	Salary	Contribution	'Investment Pot'
20	2,188	786	657	40	5,872	2,109	35,642
21	2,299	825	1,378	41	6,169	2,215	39,155
22	2,415	867	2,167	42	6,481	2,327	42,924
23	2,537	911	3,030	43	6,809	2,445	46,968
24	2,666	957	3,971	44	7,154	2,569	51,304
25	2,800	1,006	4,997	45	7,516	2,699	55,951
26	2,942	1,056	6,113	46	7,896	2,835	60,928
27	3,091	1,110	7,326	47	8,295	2,979	66,257
28	3,247	1,166	8,642	48	8,715	3,130	71,960
29	3,412	1,225	10,069	49	9,156	3,288	78,061
30	3,584	1,287	11,614	50	9,620	3,454	84,586
31	3,766	1,352	13,286	51	10,106	3,629	91,560
32	3,956	1,421	15,093	52	10,618	3,813	99,014
33	4,156	1,493	17,044	53	11,155	4,006	106,975
34	4,367	1,568	19,149	54	11,719	4,208	115,477
35	4,588	1,647	21,418	55	12,312	4,421	124,553
36	4,820	1,731	23,863	56	12,935	4,645	134,239
37	5,064	1,818	26,495	57	13,590	4,880	144,573
38	5,320	1,910	29,327	58	14,278	5,127	155,594
39	5,589	2,007	32,371	59	15,000	5,386	167,346

The 'investment pot' is calculated as the [prior-year 'investment pot' x (1 + inflation) x (1+ real return)] + the current year's contribution. I used the Excel 'Goal Seek' function to find the contribution rate that gave £167,346 at the end of the 59th year. Note that this calculation finds the average contribution rate over this 40-year period. We can undertake a more detailed approach to the same problem which can find the contribution rate for each year; this rises strongly with age and length in the scheme. I will not pursue this point further in this paper.

We can do the same for females: the calculation is exactly the same as Table 7, but with the higher amount needed at maturity (£190,894 rather than £167,346). The result is an annual average contribution of **34.25%** of salary for forty years.

So what these calculations are telling us is that either the employee, or the employer, or both, must set aside 30% of annual salary for a male, and 34% for a female, each year for forty years to achieve sufficient money in the 'investment pot' to cover the cost of a 2/3 index-linked final salary pension for an employee who experiences no career progression.

Before any reader jumps up and says "then invest in equities and other higher-yielding investments", I want to be clear what Table 7 represents. It represents the best answer to the question "how much does a pension ***cost***?". It does ***not*** attempt to answer the question "but what can I do to lower the cost, and at what risk?" That is a separate question, one that all *funded* final salary pension schemes have to address.

However, in the case of *unfunded* Government occupational pension schemes, not only is the second question irrelevant because there is no funding, but conveniently for this calculation, the cost to the government from deferring Index-linked expenditure now to some point in the future (and the return to the Government from bringing such expenditure forward) is exactly the current Index-linked Gilt yields (since the Government can both borrow and lend (by repaying borrowing) at exactly the current market rate.

I should note here that the in my opinion the question of the 'cost of a pension' has attracted an extraordinarily high level of debate for a question which has a definitive answer. Let me use this analogy.

I am an employer, and I pay an employee £15,000 per year. The employee receives £1,250 monthly in arrears. I would expect no debate on the question "how much does that employee cost to employ ?".

Now suppose that the employer has identified a particularly astute professional punter (a real, horsey, punter). This man has a good record of making more money on the horses than he loses, and, for a small fee (obviously too small!), lets the employer into his tips. The employer makes a practice of making bets at the start of each month with the £1,250 set aside for his employee's wages that month. Sometimes it is a disaster and all the month's wages are lost. Other months are terrific, and the employer makes several times the monthly salary as profit. The employer of course makes up (or pockets) the difference whatever the outcome, so that the employee never really knows what the employer is doing, and is perfectly content with his pay arrangements. Let us imagine that over the years the employer makes an average of 33% profit on each monthly bet (after the fee to the punter), so the average annual cost to the employer is £10,000. What is the cost of employment?

I would wish the reader to agree that the cost of employment be universally taken to be £15,000 p.a., and an offsetting credit (in this case of £5,000 p.a.) for successful betting (and reported as such). Indeed in these circumstances I would question whether the employer was not better off closing his business and spending more of his time at the races!

This debate has boiled down to the appropriate discount rate for liabilities. I am using around 1.6% real, because that is the current market price, and is available now to every investor in the UK who wishes to acquire an index-linked investment at no risk. Those who wish to have the employee's cost at £10,000, will wish to use higher rates of return (which may reduce the 'apparent' cost of the pension), but none of which are available without risk.

It is entirely logical for the sponsor of a funded defined benefit pension fund to choose to accept some investment risk in return for the expectation of higher returns for the pension fund over the longer-term. It is a business decision, and employers make and re-make these kinds of decisions all the time. However, what is not acceptable is to use this choice as a lever to argue that because of this the *liabilities* of the fund are somehow reduced. The liabilities are invariant with respect to the method of investment: they exist because of pension promises, and will have to be paid whatever the investment returns[39].

Actuaries in the UK until recently used 9% discount rate for active members; they now tend to use the AA nominal bond rate. This is now the rate required by FRS17, which is the Accountants' standard for company accounts (and which is a marked improvement on the previous regime). The Government's now largely defunct Minimum Funding Requirement (MFR) measure used a very interesting discount rate which varied inversely with the level of the equity market (but bore no relation to what could be guaranteed). The Government currently uses 3.5% real, although this is planned to go down – to 2.8% - in the financial year 2005-6[40].

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[39] There are some (including the UK Accounting Standards Board) who argue (implicitly) that pension promises are subject to default in the case of sponsor bankruptcy, and therefore pension liabilities deserve a higher discount rate than risk-free. To accept this is to accept the failure of the pension funding system – whose entire existence is to protect against this eventuality. The Government's regulatory weakness in this area is deplorable, and I argue strongly for a proper restoration of full funding at buyout/risk free liabilities. Whatever the merits of this argument, none of applies to Government pension liabilities, where non-payment through sponsor bankruptcy is not an option.

[40] These values are approved by the Government-sponsored Financial Reporting Advisory Board. Quoting from the Seventh report (my bold and italics!)

"…Section 2.10. …the Board noted that it had accepted that the discount rate for pension scheme liabilities promulgated by the Treasury on the advice of the Government Actuary's Department should remain at 3.5 per cent in real terms for accounting periods prior to 2005-06. ***This rate was based on a review of long-term historical patterns of real rates of return on gilts.*** However, as also noted in the Board's sixth report, the Treasury accepted the Board's proposal that the discount rate ought to be set in line with the requirements of the FRS: the AA corporate bond rate. The Board agreed that, in order to achieve budgetary certainty, the rate would be reviewed for each Spending Review period.

Section 2.11 The Treasury reported to the Board at its March 2004 meeting that the Government Actuary's Department had concluded its review of the discount rate for provisions for pension scheme liabilities. Based on the yields of AA corporate bonds with maturity dates of more than 15 years, measured over a three month period, the Actuary has determined that the rate to be used, with effect from 2005-06, in discounting pension provisions is 2.8 per cent real. The impact of a

Just how sensitive the cost of pension is to changes in the real interest rate we can see if we use 3.5% p.a. instead of 1.6% p.a. for Table 7 (and the annuity cost). We get annual contribution rates of 17% (males) and 19% (females). Compare these with 30% (males) and 34% (females) with exactly the same calculation, but at current market interest rates.

Career Progression

The story is about to get worse from the employer's point of view, because most government employees are not on fixed pay levels. Most grades have escalating pay scales, and many employees will achieve promotion to higher grades during their careers. Few (if any) will be demoted to lower grades later in life, and fewer, if any, will go down the pay scales within grades. Of course people will come and go, and I will look at that at the end of this section.

We can recalculate the figures in Table 7, but this time we can build in career progression. As an example of strong career progression (to illustrate the point), I will assume that a successful professional in the pubic service might expect to progress 3% p.a. above the rate of average earnings. This will give a 'real' increase (over average earnings) of about 3.2 times over a 40-year career. This means a young graduate who starts on £22,000 today would end his career earnings £71,000 in today's money. This seems reasonable for a professional career.

If we build this progression into Table 7 (but without reprinting the tables again to save space), we get annual contribution rates of **49%** for males, and **56%** for females. These are very serious contribution rates, and a different order of magnitude from those commonly believed to be sufficient to cover the accrual of liability for a 2/3 final salary scheme. Real high flyers (say on a 5% p.a. increase over earnings – that's someone who starts at £22k and ends at £147k in today's money) are up in the stratosphere as far as contributions required: **64%** (males) and **73%** (females) respectively.

Early leavers

All is not gloom and doom for employers, and in one area they have provided themselves with an attractive break – this is the area of early leavers.

There are two ways in which an employer penalises the employee upon departure from the pension scheme. The first is by the way that a pre-retirement leavers' deferred pension is calculated.

In most pubic sector schemes, the leaver's final salary is used as the base for the years' entitlement calculation, and that final salary is uprated each year by the RPI[41]. While this might seem perfectly reasonable, it denies the departing employee any benefit from rises not only in general earnings levels, but also his own salary. This is entirely understandable on the part of the employer, but it is damaging to the employee.

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reduction in the discount rate is an increase in the level of the provisions; the overall impact of the change will be accounted for in Central Government Accounts for 2005-06…."

[41] Until comparatively recently, there was no RPI uprating for deferred pensioners at all in many schemes. This was particularly penal in periods of high inflation.

As an example; on the assumptions I have made to date, assume an employee leaves public sector employment on his 40th birthday after 20 years' work.

While all this is only calculable with the benefit of hindsight, we find that the employer is only required to contribute **21%** of his salary for 20 years, rather than the **30%** of salary had the employee stayed in the scheme for his whole career (Table 7). Looked at in terms of the 'investment pot' required, the employee makes a gift to the employer (in this case) of £9,719 on his departure date, which is the difference in the 'investment pot' needed for continuing employment (£32,371 at aged 39 in Table 7) and £22,652 for the early-leaver. This is 1¾ years' salary at age 40 'given up'.

We can do exactly the same calculation for females, and the summary is that the *ex post* required contribution rate falls from **34%** of annual salary for continuous employment to **24%** p.a. for 20-year working/20-year deferral for a female.

Cash Alternatives

Almost all defined benefit pension funds, public and private, offer the opportunity for members to leave, and take a cash pot, supposedly equivalent to the value of their embedded pension. The idea is that this pot can be invested in another pension scheme to provide equivalent benefits.

The practice has been very different. Until relatively recently, cash payments for pension leavers were set way below their economic value, or perhaps more accurately, were calculated using patently unrealistic assumptions. While there is now legislation and standardised practice[42] which has tightened up the worst abuses, nevertheless it remains the case that early leavers who opt for cash will cross-subsidise continuing employees. The corollary, therefore, is that this is a source of relief for the hard-pressed employer.

Summary

This chapter has run through the various levels of calculation needed to make an informed estimate of the costs of providing a final salary index-linked pension. I have made no attempt to fully model any actual scheme; that is the topic of the next chapter.

[42] For example the Institute of Actuaries GN11 Practice Standard

Chapter 3 – Estimating current Public Sector Pension Scheme liabilities and running cost

Unrealistic assumptions

As I explained earlier in this paper, the approach I am going to take in this section is to use the maths we have developed in Chapter 2 to calculate estimates of the effect of varying assumptions embedded within official estimates of public pension liabilities. But which assumptions should we vary, and which not? Any estimate of an employer's pension liability requires a very large number of assumptions; many are employee-specific, many scheme specific, and many exert only a minor influence on liability valuations.

So my methodology will be as follows:

- Gather the latest official valuations of unfunded public sector liabilities.
- Gather key scheme assumptions
- Find official estimates of sensitivity to these assumptions (if any)
- Develop our own sensitivity estimates for both variables from first principles (using the Chapter 2 methodology)
- Choose realistic assumptions
- Use these values to calculate our own estimates of liabilities

I will then go on to calculate an estimate of the annual cost to the average public sector employer of providing a pension – i.e. the economic cost, not the 'cash' cost – expressed as a percentage of pay. It is this value which is really important, since it can be the legitimate subject of policy decisions, whereas existing liabilities are largely immutable without expropriating existing rights from members.

Finally, I will use official information on changes in liabilities over time to attempt to reconcile my estimates of 'economic cost' and official estimates of 'cash' costs and increase in liabilities.

Liabilities

I have collected the Unfunded Public Sector liabilities valuations reported by GAD over the years (mainly via Parliamentary Written Answers). There are (to my knowledge) two years' gaps in reporting. However, interpolating the years for which no consolidated data was published, we can build up seven years of data:

Table 8

Total Public Sector Unfunded Occupational Pension Liabilities

Source: Government Actuary's Department (various written parliamentary answers)

Year end	***£ bn***
Mar-98	295
Mar-99	*310*[43]
Mar-00	*330*
Mar-01	350
Mar-02	380
Mar-03	425
Mar-04	460

My intention in this paper is to reach an adjusted estimate for liabilities as at 31 March 2005, and as a base we need to make an assessment of the likely liabilities which GAD will report for this date.

Two schemes have already published their March 05 valuations. Table 9 shows this information.

Table 9

Official estimates of March 2005 liabilities Source: 2005 Resource Accounts			
	31 March 05 Liability	31 March 04 Liability	Percentage change
Civil Service	£84.1bn	£78.6bn	7.0%
Armed Forces	£66.5bn	£63.8bn	4.2%
Total	£150.6bn	£142.4bn	5.8%

However, we have another Government publication which helps us towards a March 05 forecast of the GAD estimate of public sector pension liabilities. The Public Expenditure Statistical Analysis 2005 (PESA) is a Government publication showing, *inter alia*, actuals and forecasts for Public Sector occupational pensions. Table B.1 of PESA gives a significant amount of information about past years, but also for 2004-05 estimated outturn. I have used the PESA information in two ways. In Table 13 in Appendix 2, I show a

[43] Data not available for 1999 and 2000 - author's estimates.

reconciliation, using PESA and GAD official figures, of the size of the annual adjustment required to reconcile inaccurate actuarial assumptions for the year to March 04. This provides us hard evidence of the scale of the inaccuracy of the actuarial assumptions.

To forecast the March 2005 value, I use this same format (Table 14 in Appendix 3), and the only estimate that I have contributed is to raise the annual error charge from £13.5bn to £20bn.

There are two reasons for this increase to the error charge. The first is that some Police and Fire authorities are adopting a lower discount rate (2.4% versus 3.5%) for their liabilities as at 31 March 05. This will have the effect of increasing their liabilities.

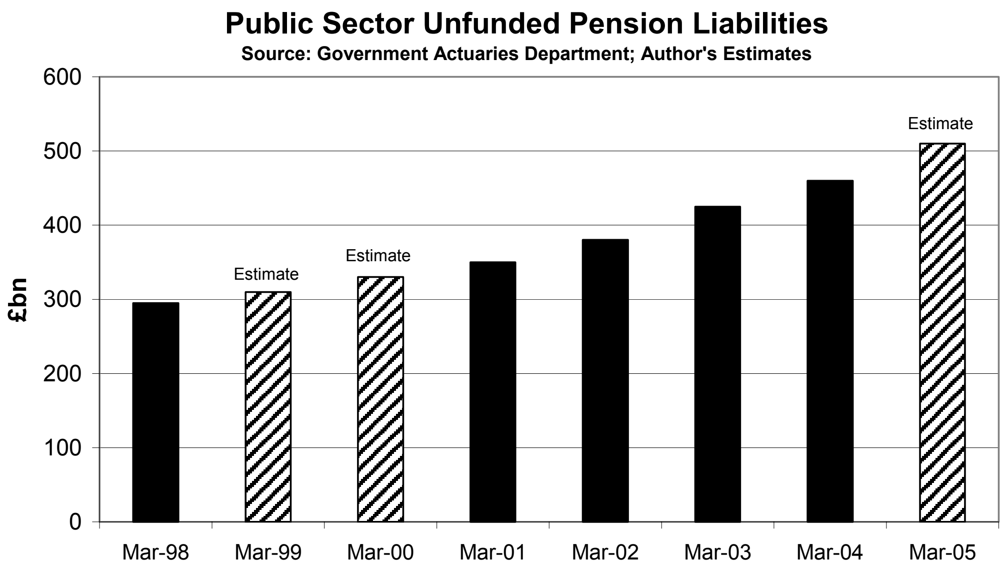
The second is because the NHS has conducted a much-delayed actuarial review in 2004-05, and the results will appear in the March 05 valuation. I confidently expect there to be a large rise in longevity assumptions, and adjustments to a number of other assumptions about ill-health and early retirement etc., to adjust over-optimistic assumptions nearer to recent outturns.

How do we know that the NHS has very optimistic assumptions? The increase in the already-published March 04 NHS liabilities (£104.3bn) over the March 03 liabilities (£94.6bn) was 10.2%. This is a rise in total liabilities was six times the rate of inflation (1.7%), and is only partly explained by the rise in employment in the NHS, and high earnings rises in the sector (4.8% year to March 04). The remainder of the increase is the adjustment required to account for worse outturns in the year than the assumptions predicted. The NHS 2004 Pension accounts were qualified by the Auditor (the Comptroller and Auditor General at the National Audit Office) in respect of the lack of an up-to-date actuarial valuation for the NHS scheme (which is more than four years out of date), and therefore we can expect the change in the over-optimistic assumptions to have a significant (upward) impact on the NHS liability valuation.

Using the information in Table 14 in Appendix 3, I therefore estimate that the GAD's estimate of liabilities at March 05 will rise by 10.8% to £510bn.

We can now show the progression of liabilities as a graph to March 2005 (Graph 3):

Graph 3



The first question to ask is "why are the liabilities rising so rapidly, when the Public Sector Pension Schemes are reasonably mature?" This is particularly odd when, according to the Government, new pensions liabilities taken on each year were lower than the pensions paid each year until 2003-04[44]. At first glance, one would imagine that this should have meant that liabilities were going *down*. However, remember that the Government has not set aside any money to pay these pensions. Therefore each year there is a large interest charge, raising the liabilities as the discount rate unwinds (see Chapter 2 for the theory, and the PESA 2005 for the numbers), without any investment returns from assets to compensate. One can think of pensions paid each year as including an element of rolled-up interest repayment, and therefore unless the pensions in payment are larger than the sum of new liabilities from service and the interest charge (which will include inflation), then the liabilities will keep rising.

Secondly, there is clearly a large gap between the assumptions under which the valuation of liabilities are made, and the actual experience in the public sector pension funds in recent years. These errors (the gap between assumptions and outturn) have been adjusted for each year (since actual experience cannot be denied). But the erroneous *assumptions* have largely not yet been amended, making the running 'error adjustment' each year at least as large as the previous year. As (and if) assumptions are changed to more closely match reality, then there will be a large jump in liability, and then lower running errors – i.e. a slower growth in liabilities thereafter.

[44] Source Public Expenditure Statistical Analysis (PESA) 2005 Table B.1. Compare the top line ('Change in liability' – basically the current cost of the year's additional service for members) and the penultimate line (Pensions in payment). For 2003-4 and prior years 'Pensions in payment' were *higher* than 'Change in liability'.

Once all the systematic errors have been corrected[45], one can think of pension funds' liabilities as being a very-long-lagged moving average of past earnings growth, which will in the very longest term keep pace with earnings, and therefore exceed RPI growth. So even if we account in 'real' terms (i.e. adjusted for price inflation), it still will appear that pension liabilities keep growing for ever.

Liabilities Estimate

Let us turn now to attempting a realistic (i.e. neither optimistic nor pessimistic) estimate of Public Sector occupational pension liabilities at end-March 2005. I see my task to strip out optimism in the assumptions that GAD makes for the main Public Sector schemes without introducing any elements of undue pessimism.

From the 'first principles' exercise in Chapter 2, we know that there are three overriding assumptions that dominate the liabilities' calculation – salary growth; longevity; and the appropriate discount rate.

Salary growth assumptions

In the case of salary growth, GAD have assumed 1.5% real growth in future salaries across the board (before accounting separately for career-progression related increases). With the benefit of hindsight, this is likely to have proved to be too low for the years 2000-05, when salary growth in the public sector has been exceptionally high. Over that period, average real earnings (i.e. subtracting the growth in RPI) have grown at 2.23% p.a. for the public sector as a whole, and 3.12% p.a. for the health sub-index[46]. In adjusting this assumption in my calculations, I will use 2% p.a. future increases over RPI, not 1.5% p.a. This is lower than recent history, but is broadly in line with long-term economy-wide real earnings growth. The effect of this change is to change the liabilities of all the Active members (i.e. those working in the Public Sector), but not Pensioners or members with Deferred pensions – the liabilities to these groups are not linked to salaries, only to RPI[47].

On my calculations, Active members account for approximately 54%[48] of the NPV of the Public Sector Schemes (discounted at a rate of interest of 1.6% real). The effect of raising

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[45] I say 'systematic' because all assumptions about future behaviour and economics are just that. Good forecasting requires assumptions which are equally frequently found to be too pessimistic as too optimistic. Systematically biased assumptions are always or almost always found to be wrong in the same direction.

[46] Source: ONS – Average Earnings Index – Public Sector (LNNJ) and Average Earnings Supplementary Tables Public Sector Series - Health series. I calculate compound returns for these over the five years to Aug 2005 (4.69% p.a. and 5.59% p.a. respectively) and subtract the compound growth of the RPI index over the same period (2.47%).

[47] In passing it is worth making the point that when pay increases in the public sector at a particularly high rate, for one reason or another, the whole stock of pension liabilities for active members, accumulated to date, including those liabilities for past years service increases in line with the increase in pay.

[48] Source: Weighed average of the Annual Reports of the four of the five main schemes (except Police), 2004 and 2005 (where available). The actives weight has been adjusted to take account of the artificially high discount rate the schemes are using. Without the discount rate adjustment, the Active weight is 47%.

the Salary growth assumption from 1.5% to 2.0% for Active members can be calculated using the principles in Table 7. This turns out to increase the contribution rate required (and hence the scale of the liabilities) by 9.9%, and so will increase overall liabilities by 54% x 9.9% = **5.3%**. This is the value I will use to adjust liabilities for the inaccurate Salary assumptions.

Mortality assumptions

Watson Wyatt[49], chose to increase the GAD-reported liabilities by 5% to account for GAD's over-optimistic mortality assumptions, although they gave no reasoning or data in their press release to support this estimate.

We have seen from data earlier in this paper that longevity has been on a long-term upward trend. Mortality assumptions in all the Public Sector schemes are determined at the time of the Actuarial Reviews, which occur at frequencies between 3 and 5 years. There are a lot of *vignettes* in the Actuarial Reviews which make it clear that many of the actuarial assumptions are being found to be over optimistic[50].

There are two effects of long gaps between Reviews combined with improvements in mortality. The first is that there are 'each-year' adjustments in between (i.e. line 7 in Table 13 & Table 14); and the second is that at the time of each Review there is likely to be a significant upward shift in liabilities as the 'each-year' adjustments are planned to be eliminated at the Review by changes in assumptions (to allow for lower mortality), and the adjustment is 'PV'd'[51].

Clearly increased longevity is capable of exerting a very substantial influence on overall liabilities, since an extra year's average life from 79 to 80 is not an addition of 1/80th to the liabilities, but more like 1/20th[52] (since retirement is at 60). Just taking the crudest observation the longevity in the UK has increased by 0.21 years (for men) and 0.18 years (for women) for every year that has passed in the past twenty (see Graph 1), this will tend to increase pension liabilities (very roughly and other things being equal) by about 0.9% p.a. for men, and by 0.65% p.a. for women). In the context of the end 2003 liability of £425bn, this is about £3.4bn p.a.

My estimate is that we are more likely to avoid having to alter mortality assumptions in the future if we assume, say, 0.5% per year higher liabilities than existing assumptions (lower than 1% to account for a slowing of the improving mortality trend and the existing trend

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[49] Watson Wyatt Press Release 17 Feb 2005.

[50] E.g. "*…mortality experience of the existing cohort of ill-health pensioners has been unexpectedly light"…; "…For Widows…..mortality experience was lighter than the assumptions adopted for the previous review"…;* March 2001 Teachers' Review (published March 2003)

[51] 'PV'd' means that the Present Value of the stream of future 'error charges' are taken into the liabilities' valuation; and thereafter the annual 'error charge' is eliminated.

[52] But not exactly because of the effect of discounting

assumptions). This is relatively easy to model: it is like reducing the real discount rate on liabilities by 0.5% pa. The effect this has on Public Sector liabilities (valued at market real interest rates) is to increase liabilities by **10.2%**[53], which I will adopt as my mortality adjustment factor.

Real Interest Rate assumption

I propose that Public Sector pension liabilities be discounted at the market real interest rate. By far the best market for this is Index-linked Gilts' particularly so because (as we have already seen) the schemes themselves run 'notional' funds comprising solely Index-linked Gilts to 'notionally fund' their liabilities. The real yield on Index-linked Gilts is variable, and therefore time-specific to Mar 2005; but there is a definitive value as long as we know the duration of the liability – and therefore the maturity of the Index-linked Gilt we need to look at. We need to calculate the average duration[54] of these liabilities – information we need to assess the sensitivity of the value of the liabilities to real interest rates.

I have found three recent sources of official estimates of the duration of public sector pensions' liabilities (and therefore their sensitivity to interest rate assumptions). The first is from the Pension Commission[55]; where their estimate of duration is 17 years at 3.5% p.a. real[56]. The elasticity is calculated from the footnote to their Figure 4.19, in which they say that the effect of adopting FRS17 on the GAD's 2003 Public Sector liability figure would be to raise it from £425bn to £475bn. The GAD's interpretation of FRS17 discount rate at this date is 2.8%, and the GAD's base assumption is 3.5%. Therefore the reduction in real interest rate is 3.5% - 2.8% = 0.7%. The increase in the liabilities in percentage terms is (£475bn/£425bn)-1 = 11.8%, and therefore the duration is 11.8%/0.7% = 16.8 years.

The second and third sources are the March 05 accounts for two of the main public sector schemes – the Civil Service and the Armed Forces. At the time of writing, these are the only two of the main schemes that have published their 2004-05 accounts (called "Resource Accounts"). The importance of the March 2005 accounts is that it has already been announced that the main schemes are moving to an 'FRS17' basis for 2005-6 and subsequent years – and this is interpreted as a 2.8% real discount rate[57]. In these

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53 See Real Interest Rate section below for details of the effect of changing discount rates on liabilities

54 'Duration' is a measure of the average maturity of a series of cash flows. A convenient feature of duration is that the duration in years roughly corresponds to the elasticity of the PV of the cash flows with respect to interest rates. So a liability with a duration of 20 years will experience a change in value of the NPV of 20% for every 1% movement in interest rates.

55 Source: Pensions Commission 1st Report, Nov 2004, Figure 4.19

56 It is important to record the interest rate at which elasticities are calculated, because the elasticities vary according to real interest rate – an effect (familiar to bond and swap traders) known as convexity.

57 It appears that 2.4% may be applied to some police and fire schemes

accounts, therefore, is a section on ‘post balance sheet events’, in which, in each case, a statement of the impact on the liabilities on the change in discount rate (from 3.5% to 2.8%) is made. The summary is as follows:

Table 10

Sensitivity of Liabilities to Real Interest Rates ***Source: 2005 Resource Accounts***				
	31 March 05 Liability	1 April 05 Liability	Percentage change	Duration
Civil Service	£84.1bn	£94.7bn	12.6%	18.01
Armed Forces	£66.5bn	£76.5bn	15.0%	21.48

It appears that the durations calculated are longer (i.e. more sensitive to interest rates) than the Pensions Commission’s estimate of the whole Public Sector. Both of these schemes are reasonably mature, with the Civil Service having equal liability weighting of Actives and Pensioners, and the Armed Forces having twice much liability weighting in Pensioners than in Actives. In the absence of further information, I have chosen to use at the moment the more conservative estimate (the Pension Commission’s) in calculating elasticities.

But before we can do this, we have to find an Index-linked Gilt which most closely matches the duration of the schemes. We need to do this to find most appropriate market rate with which to discount the liabilities. It turns out that, at current market interest rates, 17 years’ duration is most closely matched by the gilt 4.125% Index-linked Treasury 2030, whose duration is 16.9 years. The real yield for this on 31 March 2005 was 1.60%. However, due to a characteristic called ‘convexity’ the duration of pension liabilities rises as the real interest falls, and as we shall see this effect will bite when we apply market interest rates to this liability. This might justify using the 2% 2035 issue, which has a duration at current rates of 22.1 years and a market interest rate at March 2005 of 1.56%. On balance I have chosen to use 1.60% as the discount rate.

I have built a model of the timing of the future cash flows using all the information about the Public Sector Pension Schemes available in the public domain, and ‘tuned’ the model’s cash flow timing to display the exactly the elasticity shown in the Pension Commission’s 1st Report. This model displays convexity (as anyone familiar with Bond mathematics would expect), so the effect of applying the market discount rate is more than a factor of 17 on the interest rate change – in fact it is 20.0.

This means that the effect on liabilities of reducing the real interest rate from its current (arbitrary) 3.5% to 1.6% (the market rate on 31 March 2005) is to raise them by **38%** = [20 x (3.5% - 1.6%)]

Summary

I can now use these three key assumptions to adjust the March 2005 GAD estimate of Public Sector Pension liabilities:

Table 11

Adjusting Total Public Sector Unfunded Occupational Pension Liabilities for unrealistic assumptions

	£bn
Author's Estimate of GAD estimate March 2005	510[58]
Adjusted for Salary Growth (+5.3%)	537
Adjusted for mortality (+10.2%)	592
Adjusted for Real interest Rate (+38.0%)	**817**

This value for the total Public Sector Pension Liabilities at 31 March 2005 of £817bn is much higher than any previous number reported, even by independent observers. To put it in context, it compares with the £387bn as the market value of all outstanding UK Gilts[59], and £480bn for the total UK National Debt[60]. It represents 69% of GDP, and if we account 'interest' on this debt as the sum of inflation and the real interest rate[61], the Government's annual interest bill on this £817bn is £36.0bn, or 3.1% of GDP.

Headline outstanding liability

I think that very large numbers like this do not by themselves resonate with the public at large - they are too big to contemplate effectively. A couple of things are worth saying, however.

1. This liability is a debt – a Government debt just like Gilts
2. This debt will incur interest until it is repaid[62]

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[58] Should GAD's estimate turn out to be higher (or lower) then the author's estimates for the adjusted figure would be correspondingly higher (or lower).

[59] Source: DMO

[60] Source: ONS

[61] Assumed current RPI inflation of 2.8% p.a; real interest 1.6% p.a. = total interest 4.4% p.a.

[62] Insofar as pensions are deferred pay, one could regard the pension promise given to an employee as an alternative to a pay increase (see also the discussion later). For a given level of taxes, the government would have to borrow more to provide the employee with immediate rather than deferred pay. In a very real sense, the pension promise (a promise to workers of future pay in the form of pension rather than pay today) is a form of Government borrowing and, if the Government really intends to meet its pension promises, this debt should be valued at a real interest rate equal to the real interest rate on index-linked bonds.

The repayment of this debt is going to occur over a very long period. The payment of interest on pension debt is rolled up (rather than paid as cash each year), but it is finally repaid in the form of pensions. A pension promise is like a deep discount security – it increases in value every year as it gets nearer to the repayment date (when interest is paid at maturity along with the principal), but no interest changes hands in the interim. However, just because the interest is not paid in cash, policy-makers and employers need to be aware that the interest cost is a drain on the exchequer just like any other item of public expenditure. This drain will be apparent as ever-increasing levels of pension liabilities.

If this concept is difficult to grasp, we should remind ourselves that £817bn is not the amount of the debt that the Government has to repay. The amount that the Government will have to repay is the undiscounted value of all the pension liabilities. We can estimate this value by replacing 1.60% real with 0% real in our model, and uprating all the future payments by the market's current RPI expectation. We know 'implied inflation', which is the market's best estimate of inflation from the relationship between Index-linked gilts/conventional gilts, and this value was 3.0%[63] p.a. for the 2035 Index-linked Gilt at 31 March 2003. Using all the information derived in this study about the maturity structure of the pension liabilities, I estimate the raw nominal amount that the Government can expect to have to pay over the next 80-odd years on current liabilities (i.e. not including any future service from Public Sector employees) to be £2,511bn. Even if we exclude inflation (i.e. price the liability at today's prices), the raw liability is £1,135bn (96% of GDP).

A glimpse into the future

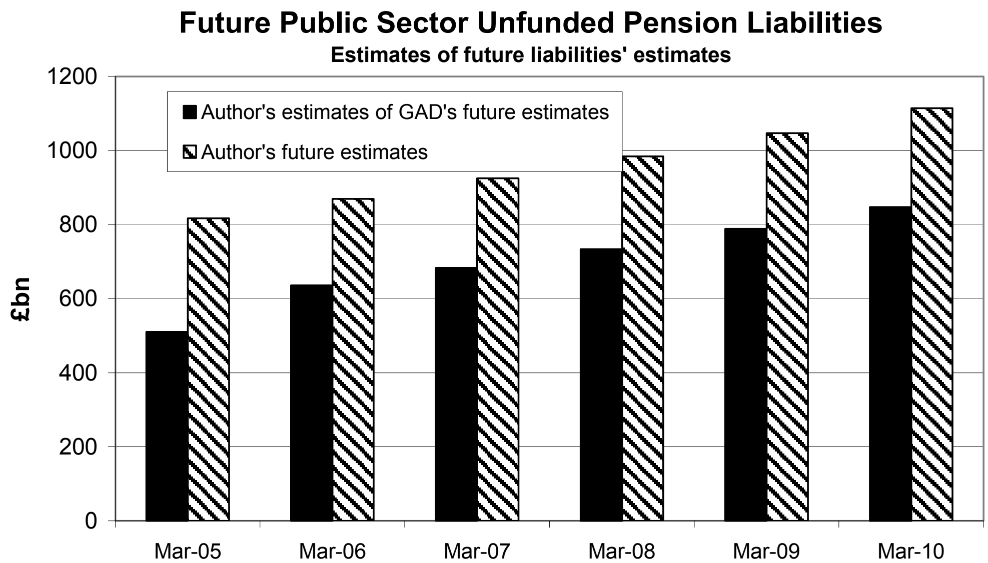
The value I have ascribed to the Government's pensions liability, and the official valuations, will tend to converge with the passage of time. If the Government maintains its higher-than market real discount rate (3.5%, falling to 2.8% for 2005/6 accounts), then the 'interest' payable on the pension debt it acknowledges will be 3.5% (or 2.8%) plus the rate of inflation. This interest will roll up in the official valuation, pushing it ever higher (and towards my valuation). My valuation will only accrue interest at 1.60% plus inflation – the market rate for index-linked debt. The picture is complicated by the relative maturity of each scheme – immature schemes will still generate future net liabilities, but may have more contributions than pensions payable, whereas schemes in equilibrium should pay out in pensions roughly the same as contributions (or actually a lot more in this case, since the contribution rate is too low), and mature pension schemes (e.g. those with a declining work-force) will see more pensions paid out than contributions, and a declining liability. The future path of each scheme's sector salary growth will also have an important influence.

I can summarise the likely development of the headline liability value over the next five years by using the data gathered in this study. Graph 4 shows my prediction for the likely path of (a) the Government's calculations of the liability and (b) my calculations. I have

[63] Source DMO

assumed that the Government will take all of the effect of next year's fall in the discount rate from 3.5% to 2.8% in the one year, which will mean a large rise in their own report of liabilities to well over £600bn. All these estimates assume that the basic terms of the Public Sector Pensions schemes remain the same as at the time of writing (September 2005) – in particular no change in the normal retirement age for existing members[64].

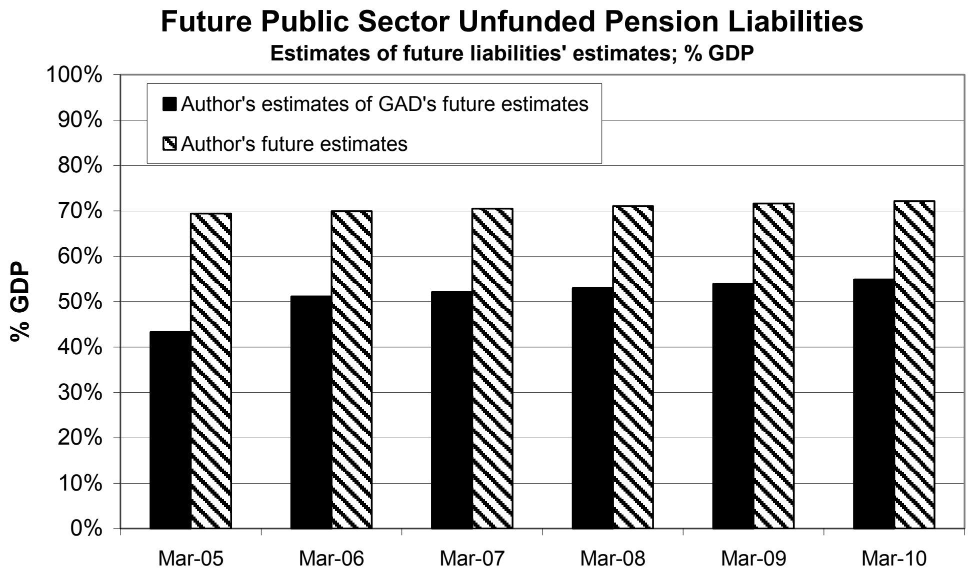
Graph 4



Again, these very large numbers in the future are hard to interpret. The same graph can be expressed as % of GDP – and I base GDP forecasts on the average of the last 10 years nominal growth rate of 5.6%. Graph 5 illustrates.

[64] Note that the impact on the path of liabilities of the Government's recently announced policy of introducing 65 retirement age for new entrants is negligible (<1%) over this six-year forecast time span.

Graph 5



This gives a clearer picture to the current position – that in my opinion (and assuming no further change to the benefits offered to current Public Sector Employees), the liabilities will grow slowly to around 75% of GDP, mainly reflecting the rolled up interest on the debt (salary growth will be largely offset by real growth in the economy). By contrast, the GAD estimates will continue to rise more rapidly (and particularly next year when the new discount rate comes into effect) as they continually adjust their too-optimistic assumptions to reality. The underlying growth rate is also higher, reflecting the higher-than-market discount rate they have chosen to use.

One caveat should be made, particularly of my estimates: the NPV of long-dated liabilities is very dependent on real interest rates. These future values could vary significantly if real rates change markedly either way.

Annual Cost of Pensions

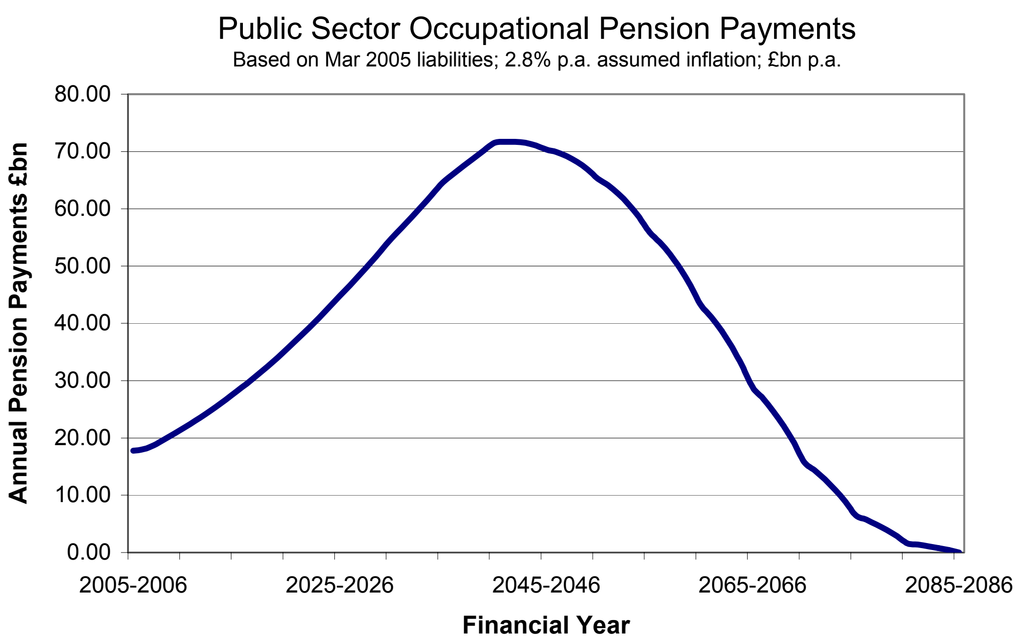
I have concentrated on the headline liability; but knowing this value accurately can do little but scare policy-makers, but it is unlikely to change the balance of power in negotiations between employers and employees (and their unions). Unless the Government changes the way it accounts for its occupational pension liabilities, and includes them in the National Debt, then little hangs on the scale of the liabilities except shock headline value. Most relevantly, the current outstanding liability has already been incurred, and apart from reneging on its promises (which later it may have to do), the Government can do little to mitigate this debt.

However, the government can act to reduce the liabilities' growth rate, and indeed with a thorough revision of its pension arrangements, it would be able to begin to bring them down. In my opinion there is only one way to do this – Public Sector *employers* need to be educated (which means charged!) to recognise the true annual cost of the pension promise, and Public Sector *employees* need to be educated to recognise this value. The greatest barrier to this at the moment is the artificial discount rate that all the schemes still maintain.

Cash annual cost

Still with our forecasting hat on, we can look at the expected cash cost of Public Sector occupational pensions over a longer time frame. This time, I will not assume that the pension schemes continue; instead I will look at what a liability of £817bn looks like in actual cash pensions costs spread over the future – this is the liability that has been accumulated to date - very little, if anything can be done to mitigate this. Graph 6 shows my estimate of future annual Public Sector Occupational pension costs[65] spread over the next eighty years. I assume an inflation rate of 2.8% p.a. over this period. Note that this graph shows only what is *already* committed, not what will become committed for future service.

Graph 6



Real annual cost

We can go back to Chapter 2, and our first principles' methodology to also work out what pensions are costing not in cash terms, but calculated to include changes in future liabilities, and more particularly expressed as a percentage of individuals' salaries. For this calculation, I go back to the assumption that the schemes continue in their current form. I will take the five largest schemes – Teachers; NHS; Civil Service, Armed Forces and Police, and for each one calculate the annual cost of each pensions promise. I will

[65] The figures quoted are comparable to line 'Pensions in Payment' line in Table B.1 in PESA 2005. The 2004-5 estimated outturn was £16,525m.

compare this with the combined employee and employer contribution currently being levied.

I will use a raft of simplifying assumptions for each scheme's cost estimate. In brief:

- Employees work until normal retirement age
- Employees work sufficient years to earn the maximum normal pension
- Employees do not buy extra years, or otherwise voluntarily alter the normal entitlements
- Employees' career paths give rise to average rises above the general salary growth in the economy (2% p.a.) – the assumed rises are 1% p.a. for Teachers and NHS workers, and 2% p.a. for Civil Service, Police and Armed Forces.
- The costs are calculated assuming no spouse pension, and no generous ill-health and early retirement options. While this is a crude offset, in my view this oversimplification probably compensates for the poor transfer and deferred benefits of the schemes, and for the effect of many employees not serving long enough to qualify for a full pension.
- Female employees do not take sufficient time off work to compromise their pension entitlements
- Employees continue to pay their current pension contributions
- Employers are charged the full annual cost (less the employees' contribution) by the pension-paying agencies, assuming these assumptions hold. They will operate under the principle that if they bought Index-linked Gilts at market prices with these contributions, then they would not accrue either any surplus or any deficit over time.
- Where there is more than one DB scheme operating, I will use the newest one - the one open to new entrants.
- The discount rate used is the market rate

In reaching the values shown below in Table 12, I have used the methodology from Table 7, adjusted in each case for the specific rules of each scheme. See Table 1 for the summary details of each scheme.

Table 12

Annual Cost of Pensions as % Salary Main Unfunded Public Sector Pension Schemes					
Employer	***Employees' Contribution***	***Current Employers' Contribution***	***Employees' Sex***	***Author's total calculated cost***	***Employers' Contribution required***
Teachers	6.00%	13.50%	Male	31.80%	25.80%
			Female	35.60%	29.60%
NHS	6.00%	14.00%	Male	31.80%	25.80%
			Female	35.60%	29.60%
Civil Service	3.50%	13.60%	Male	42.35%	38.85%
			Female	48.31%	44.81%
Police	11.00%	26.00%	Male	76.10%	65.10%
			Female	85.30%	74.30%
Armed Forces	0.00%	22.10%	Male	65.80%	65.80%
			Female	72.70%	72.70%

It is clear from the astonishingly high annual cost of these schemes (particularly the Civil Service, Police and Armed Forces) why the gross liabilities' figure is ballooning at such a rate. I do not believe that any of the main employers has any idea that the pensions they offer are costing this much, nor do I believe that Ministers are aware of these numbers.

In view of the latest compromise between the Government and the Unions (October 2005) over pension reform[66], I have calculated the impact of this reform on the annual cost of new employees. Assuming that new entrants work for 40 years up to age 65, (rather than 40 years up to age 60), then the total annual cost of the new pension on the same basis as the calculations above, as a percentage of salary, is, in the Teachers' and NHS case[67], 27.2% for men (down from 31.8%), and to 30.9% for women (down from 35.6%). This roughly 14% reduction in cost of the pension is clearly useful. But given that the

[66] Which is to raise the normal retirement age from 60 to 65 for new entrants, but to maintain the terms for existing employees as they are. It should be noted that there was never any intention of changing the value of pension rights already accrued, but there were negotiations regarding the accrual of future pension rights for existing members.

[67] These two schemes are the largest and most representative.

accumulated liabilities of new entrants is very low in their early years, the impact on total growth rate of liabilities is negligible in the near term.

Chapter 4 – Policy prescriptions – transparency to all parties

Policy Implications

The year-to-March 2005 Government deficit is not 3.1% p.a. of GDP as reported by the ONS; it is more likely to have been 7.3% of GDP. The additional 4.2% of GDP is the increase in Public Sector Occupational Pension liabilities (£50bn) in the year to March 2005. The final liabilities value has not yet been published by the Government, but it is unlikely to be much lower than my estimate, and may be higher. This deficit is not 'academic', or 'not in cash terms', or 'to be paid in the future' – as I have painstakingly explained, pension liabilities are the 'money-now' equivalent of a much larger future debt. In any case the 3.1% deficit is no more 'real' than the 4.2% pension deficit – the effect of the 3.1% deficit is to require the Government to issue 3.1% of GDP-worth more Gilts (i.e. debt) over and above redemptions to cover the gap. They are identical concepts, and to treat them as different is a fundamental, and highly damaging, mistake.

What can be done about this enormous problem that has crept up on us? I think that the following policy changes are necessary:

a) Require an Actuarial firm or firms, independent of Government, to prepare assumptions which would allow an independent agency to run a solvent funded scheme without the Government's guarantee. The fund would only be allowed to invest in UK Government securities. This is similar to SCAPE, but with market values not 'administered' values.

b) Armed with these assumptions, ask the GAD or an independent Actuarial firm to calculate the total liability of the Public Sector Schemes, and the ongoing cost to employers. Both these figures will vary with market rates.

c) Charge the Public Sector employers the full cost (less the employee's contribution) of the pension promise.

d) For really full transparency (and this is a radical solution!), the Government would issue a raft of new Index-linked Gilts, and endow a new agency with both the Public Sector occupational liabilities and these new Gilts assets. This agency would be required by statute to break even, and to maintain a near zero (not negative) net worth.

e) The Government may choose to unilaterally reduce some pensions benefits (particularly for new entrants – which it has already done to an extent). This would be the route of choice if, with the new transparency, it became clear that the overall rates of pay in the public sector were above equivalent jobs in the private sector.

f) Finally, let the employers negotiate with the workforce how they wish to split the (now apparently much larger) pension cost. My guess is that the unions (or at least their members) would accept higher basic salaries and lower pension promises.

Appendix 1

Main Unfunded Public Service Pension Schemes

[Large schemes in bold]

Armed Forces Pension Scheme

Principal Civil Service Pension Scheme (Great Britain)

PCSPS (Northern Ireland)

NHS Pension Scheme (E&W)

NHS Pension Scheme (Scotland)

Health and Personal Social Services Superannuation Scheme (Northern Ireland)

Teachers' Pension Scheme (E&W)

Scottish Teachers' Superannuation Scheme

Northern Ireland Teachers' Superannuation Scheme

Police Pension Scheme (administered locally by Police Authorities)

Firefighters' Pension Scheme (administered locally by Fire and Rescue Authorities)

UK Atomic Energy Authority Pension Scheme

Research Councils Pension Scheme

Judicial Pension Scheme

Source: GAD

Appendix 2

Reconciliation of annual changes in liabilities – 2003 to 2004

In this Appendix, I reconcile the changes between two adjacent sample years – 2003 and 2004.

Table 13

Reconciliation of yearly change of Unfunded Liability March 2003 to March 2004

		£ bn
1	End year liabilities March 2003	425[68]
2	+ PV of new pensions commitments (i.e. pensionable service)	15.5[69]
3	– pensions paid in year	-16.1[70]
4	+ real interest on liabilities (3.5% real in this case)	14.9[71]
5	+ Inflation (RPI) (1.7% to Sep 02 – triggering April 03 increases)	7.2[72]
6	Sub total	446.5
7	**+/- Difference between outturn for 2003-04 and assumptions (i.e. forecasting error)**	**13.5**
8	End year liabilities March 2004	460[73]

In Chapter 3, I argue that the 3.5% discount rate is flawed; however while it creates a much lower capital value of the liability, it generates a higher 'running rate' of liability increase.

More interestingly, this reconciliation highlights just *one-year's* effect of the difference between the assumptions in the actuarial valuations, and outturn for the year 2003-04 – namely £13.5bn. It appears from a reading of the official publications for these two years that there have been no major changes in assumptions – i.e. neither assumptions on mortality, nor salary growth, nor ill-health or early retirement have been changed. This means that reality has moved quite a long way from the assumptions, and this has not yet

[68] Source GAD

[69] Source Public Expenditure Statistical Analysis (PESA) 2005 Table B.1 "Change in liability" line 2003-4

[70] Source PESA 2005 Table B.1 "Pensions in payment" line 2003-4

[71] = 3.5% x £425bn

[72] = 1.7% x £425bn. The sum of the interest and inflation charge (=£22.1bn) reconciles reasonably closely with the "unwinding of discount rate" line in PESA 2005 Table B1 (£22.5bn).

[73] Source GAD

been accounted for. If £13.5bn adjustments, or thereabouts, became the norm each year (because inaccurate assumptions were not corrected), then the 'real' liability should take this into account. Of course the simplest way is to change the assumptions to more closely match experience. However, just on a purely mathematical basis, it is possible to add several hundred billion pounds to the GAD estimate by assuming that the annual £13.5bn charge is a fixture, and taking a Present Value of this stream of future annual charges into the current liability value. I will not pursue this line or argument, but in answering the question "how can the GAD and the author generate such different liability values?", this would be one highly defensible answer.

Appendix 3

Forecast of GAD-reported annual change in liabilities – 2004 to 2005

Table 14

Forecast of yearly change of Unfunded Liability
March 2004 to March 2005

		£ bn
1	End-year liabilities March 2004	460[74]
2	+ PV of new pensions commitments (i.e. pensionable service)	17.5[75]
3	– pensions paid in year	-16.5[76]
4	+ real interest on liabilities (3.5% real in this case)	16.1[77]
5	+ Inflation (RPI) (2.8% to Sep 03 – triggering April 04 increases)	12.9[78]
6	Sub total	490.0
7	**+/- Difference between outturn for 2004-05 and assumptions (i.e. forecasting error)**	**20.0**
8	Forecast end-year liabilities March 2005	510

I have used a £20bn error to cover the effect of changing assumptions arising from the NHS actuarial review as well as the continuing mismatch between the assumptions for the other schemes (i.e. £13.5bn is 2003-04) and the likely 2004-5 outturn; and my feeling is that if anything this £20bn might be too low.

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[74] Source GAD

[75] Source Public Expenditure Statistical Analysis (PESA) 2005 Table B.1 “Change in liability” line 2004-5

[76] Source PESA 2005 Table B.1 “Pensions in payment” line 2004-5

[77] = 3.5% x £460bn

[78] = 2.8% x £460bn. 2.8% is the relevant increase in the RPI (Sep 03 headline rate). The sum of the interest and inflation charge (=£29 bn) does not reconcile that well with the “unwinding of discount rate” line in PESA 2005 Table B1 for 2004-05 (£24.5bn). Since both the figures I use were known at the date of publication of PESA 2005, this is a mystery.