

Understanding and addressing the pension liabilities of regulated utilities¹

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1. Introduction

The position of occupational pension funds in the UK has attracted much public and academic attention over the last 5 years. One reason has been the disclosure of much more information about the state of such funds as a consequence of the requirement that sponsoring companies should implement the requirements of the UK accounting standard FRS 17 (more or less identical to the international standard IAS 19) when preparing their annual financial statements. A second reason has been the implementation of the Pensions Act 2005, which established the Pension Protection Fund as an insurance fund for occupational pensions and gave substantial powers to the Pensions Regulator designed to ensure that defined benefit pension schemes are adequately funded and properly managed.

Defined contribution (DC) pension schemes are little more than managed investment funds to which both employees and employers contribute, so that the implementation of FRS 17 has had a minimal impact on the nature of the information that is reported. The situation for defined benefit (DB) pension schemes is very different. These create long term liabilities for the pension fund and, potentially, for the sponsoring company. The nature of such liabilities has been a matter of substantial legal dispute, since it has never been clear where they rank in priority relative to the claims of other secured and unsecured creditors of the sponsoring company. While the Pensions Act does not resolve this legal uncertainty, it gives substantial powers to the Pensions Regulator that, in practice, have moved the liabilities of defined benefit pension schemes up in the order of seniority of creditors. Further, the introduction of a risk-based levy – or insurance premium - to fund the Pension Protection Fund increases the cost of supporting unfunded pension liabilities. Thus, in the remainder of this paper I will focus exclusively on defined benefit pension schemes. To avoid repeated use of the phrase “defined benefit”, all general references to pension schemes are restricted to defined benefit schemes unless explicitly stated otherwise.

The situation of the DB pension schemes operated by regulated utilities is somewhat more complicated. The companies provide essential services and they are regulated because they are natural monopolies. Thus, if an operator goes into liquidation the business does not close down but will be transferred to a successor. In European and UK law this constitutes a transfer of an undertaking and is covered by the provisions of what are usually referred to as TUPE regulations. Prior to the enactment of the Pensions Act 2005 there was scope for dispute about whether the UK regulations did or did not cover accumulated pension rights. The reason for the uncertainty was that the UK had failed to transpose the obligations

imposed by amendments to the relevant EU directive within the time period allowed, so it could be argued that pension rights were covered by TUPE under European law, even though the UK government had failed to amend its legislation appropriately. Nonetheless, since 2005 there could be no doubt that accumulated pension rights are protected following a transfer of an undertaking.

At the same time, all utility regulators have an obligation to set tariffs in a manner that ensures that an efficient operator is able to finance its business – i.e. to cover its operating costs plus the cost of the capital required to provide the regulated service as well as to fund any new investment. Since accumulated pension rights are protected, these are effectively a liability of the business rather than of the current operator. In practical terms, this means that it is the customer rather than the Pension Protection Fund which underwrites the liabilities of the DB pension schemes operated by regulated utilities. This point is reinforced by the fact that most of the schemes were instituted when the utilities were public enterprises. For example, the current Electricity Supply Pension Scheme (ESPS) is a successor to the pension arrangements in place prior to the privatisation of the electricity industry in England and Wales. In several cases, membership of the company sections was closed in the mid or late 1990s, but contributions are still being made for current periods of service and pensions will be paid for at least 50 years into the future. As a second example, in the UK National Grid operates (a) the National Grid UK Pension Scheme, which is the successor to the pension schemes operated by the former British Gas covering gas network employees of National Grid Gas (formerly Lattice/Transco), and (b) the National Grid section of the ESPS. The DB sections of these schemes were closed to new members in 2002 and 2006 respectively, but their liabilities will extend over 60 years or more. The final example is Royal Mail Holdings, a public company whose pension scheme remains open to new members. The company reported pension liabilities in March 2008 that were more than 3 times the total revenue of the company in its financial year 2007-08. In this case, it may be argued that it is the government rather than the customer which is the ultimate insurer for the Royal Mail pension scheme, but the distinction between taxpayer and postal customer has little practical significance.

Two consequences flow immediately from the fact that the customers of regulated utilities provide the ultimate insurance for their pension schemes. The first is that any insurance provided by the Pension Protection Fund is redundant and thus these schemes should not be required to pay a levy to the Fund – or at least nothing more than an amount to cover

administrative expenses. The second, more important, implication is that regulators ought to be very concerned about the nature of the liabilities of the pension schemes operated by the companies which they regulate. I do not mean to imply that regulators have neglected this matter, but the difficulty which they face is that the liabilities reported in most company financial statements are grossly misleading. This is because the valuation assumptions laid down in FRS 17 / IAS 19 are at best a compromise that do not measure what an economist would regard as the true cost of future pension liabilities. Two crucial assumptions concern (a) the discount rate that is used, and (b) the use of the projected unit credit method of valuation. Further, companies have taken advantage of way in which the standards are drafted to make assumptions in valuing liabilities that seriously under-estimate the scale of their pension deficits.

As an illustration, in recent years companies have tended to increase the expected real return on pension assets and the real discount rate applied to future payments – see Section 3 below. Their assumptions may be within the bounds of what FRS 17 permits, but the resulting figures are certainly no help to a regulator wishing to consider whether and how future pension obligations should be reflected in current tariffs. In addition, the companies are almost certainly misleading themselves about the cost of meeting these obligations. The consequence is intermittent but large shocks when shareholders are required to make catch-up contributions to close the reported pension deficits in the schemes. Better information and a clearer strategy on how to fund existing liabilities would be beneficial to both sides and should reduce the cost of capital for investment in the regulated businesses.

2. The conceptual framework for measuring pension liabilities

There have been extensive and sometimes heated arguments about the way in which the “fair value” of defined benefit pension liabilities should be measured. The heat is generated by the fact that technical assumptions can make a very large difference to the present value of past commitments to pay defined benefit pensions in future. Much of the debate has focused on the rate at which future liabilities should be discounted in deriving their present value. But, any economist with an interest in inter-temporal risk analysis – e.g. the theory of investment decisions or natural resource management – would conclude that large parts of the debate have been grounded on implicit assumptions that are known to be incorrect in all but a very limited range of circumstances.

The starting point of my analysis is the measurement of the liabilities of a pension fund from the perspective of an economist rather than an actuary. The distinction is important because it concerns the allocation of risk between various parties. At the risk of over-simplification, the actuarial approach focuses on the management of a pension fund – that is, the level of contributions and the management of pension assets to meet future pension payments. However, for an economist a pension is simply a form of deferred compensation. Rather than paying a current wage, the employer must be thought of as buying a deferred annuity that will be paid once the employee reaches a specified retirement age. The employee is not an investor in the pension fund and does not expect to bear any of the risks associated with, for example, the future return on pension assets or the length of time for which the annuity will be paid. Thus, the actual management of the pension fund should be entirely irrelevant to any valuation of its liabilities, since these are fixed and independent of any matters of investment strategy.

The basic problem is that the discount rate is too often used as a shorthand way of taking account of two interrelated but nonetheless distinct concerns. A pure discount rate is the inter-temporal price for converting money or values at some future date into money or values in the present. Such a discount rate should reflect the risk-free cost of such inter-temporal conversion or, equivalently, the risk-free return on investing money for a period of time. Quite separately, the discount rate is often used as a rough and ready way of reflecting the fact that future values are uncertain. Thus, in appraising investment projects the weight given to future earnings is “discounted” because the projections of such earnings tend to be over-optimistic and in reality the net revenue generated by an investment is subject to substantial uncertainty. The same would apply to the acquisition of any asset whose income stream is uncertain.

This distinction is mirrored in the analysis of the returns on assets on the assumption that markets are efficient.³ One direct consequence of that assumption is that any long run differences in the returns on different classes of assets must reflect differences in the risks of holding those assets. So, for example, the higher average return that can be earned by holding a market portfolio of equities is compensation for the period to period variability in

³ While there is room for dispute about whether financial markets are efficient in the strict economic sense of reflecting all of the available information, it seems implausible to assume that there are inefficiencies that could be exploited by the managers of many or all pension funds. So, while individual investors or fund managers may be able to outperform the market, we cannot make that assumption for the universe of pension funds and as a basis for policy analysis.

return that accompany the higher average return.⁴ As a matter of definition, the difference between the expected average return on equities and the expected average return on a risk-free asset – e.g. UK government bonds – is the equity risk premium. Similarly, the difference between the average returns on corporate bonds and government bonds is compensation for the risk of losses due to defaults that may affect a well diversified portfolio of corporate bonds.

This is trivial financial economics, but it implies a default assumption that all pension liabilities should be discounted at the risk-free rate of return. The only reason for modifying this assumption is that the liabilities themselves are not certain. One of the difficulties in thinking about the economics of pension funds is that it is easy to be overwhelmed by the complexity of the factors that affect the operation of actual pension funds. Thus, it is helpful to think in terms of a stylised DB pension fund.

- A. As a first step, we can strip out the effects of inflation and carry out all of the calculations in real terms. The major advantage to employees of offering a pension based on final salary is that this arrangement results in more or less automatic indexation of their expected pension. By law, deferred pension rights are adjusted in line with inflation (measured by the RPI or RPI-X) subject to a cap.⁵ Similarly, most pension schemes operated by regulated utilities adjust pensions in payment in line with inflation, though the law permits a cap to be imposed on such adjustment.
- B. An additional simplification is to set aside adjustments for early retirements and differential pension ages, pension payments to dependents, and similar features. So long as the relevant adjustments are actuarially fair on average, they do not make any difference to the aggregate position of a pension fund though they may redistribute benefits between members – e.g. pensioners with eligible dependents do better than single pensioners.
- C. The final adjustment is to examine the liabilities of the pension scheme on the basis that it is closed completely on the date of the valuation. The critical issue concerns the impact of future increases in the real level of wages paid to current members of

⁴ I will follow the convention of assuming that the return on equities may be measured by the return on a portfolio invested in accordance with some broad market index – e.g. the FTSE 100 or the FTSE 350. For large collective pension funds there are important questions about how the risks and returns on different asset classes should be measured, but these can be set aside when dealing with pension funds covering individual companies.

⁵ The cap was 5% from 1986 to 2008 and has been lowered to 2.5% for periods of service from 2008 onwards.

the scheme. The reason for adopting this assumption is a matter of applying accounting concepts rather than following actuarial practice. As a general rule, actuarial valuations are most useful when considering the level of future contributions that may be required to sustain the fund. Thus, the liabilities of the fund are based upon an assumed real rate of increase in the average level of wages paid to current members of the scheme. One consequence is that it is necessary to make explicit assumptions about the rate at which existing members will leave their jobs before retirement, i.e. converting from current membership to deferred membership. Unless real wage growth is very low, changes in these assumptions can have a significant impact on the level of future liabilities. This is counter-intuitive from an accounting perspective, since it is unsatisfactory that “fair values” should depend on assumptions about future behaviour which may be affected by the decisions of the sponsor.

Under these assumptions we can write the present value of the liabilities of the pension fund at date t as the sum of three components – for current members (L_c), deferred members (L_d), and retired members receiving pensions in payment (L_r).

Current members:

$$L_c(t) = \rho \sum_{a=1}^{R-1} n_c(a,t) s_c(a,t) w_c(a,t) \frac{c(R,t+R-a)}{(1+\delta)^{R-a-1}}$$

Deferred members:

$$L_d(t) = \rho \sum_{a=1}^{R-1} n_d(a,t) s_d(a,t) w_d(a,t) \frac{c(R,t+R-a)}{(1+\delta)^{R-a-1}}$$

Retired members:

$$L_r(t) = \sum_{a=R}^{\infty} n_r(a,t) p(a,t) c(a,t)$$

In these equations: (i) a denotes age, (ii) $n_x(a,t)$ is the number of members of age a at date t in category x , (iii) $s_x(a,t)$ is the average length of accumulated service for members of age a at date t in category x , (iv) $w_x(a,t)$ is the average current or deferred wage for members of age a at date t in category x , (v) $p(a,t)$ is the average pension paid to retired members of age a at date t , (vi) $c(A, T)$ is the expected cost of buying an annuity paying £1 per year for a member

of age A ($A \geq R$) at date T ($T \geq t$), (vii) δ is the real risk-free rate of return, and (viii) ρ is the pension right earned per year of service expressed as a fraction of the current wage.⁶

The essential idea underpinning these equations is that at the valuation date either (a) the pension scheme has to put aside funds in order to purchase annuities for the accumulated pension rights of current and deferred members when they reach retirement age or (b) it has to purchase annuities to cover the pensions in payment to retired members for the remainder of their lives. The cost of purchasing annuities in future is discounted at the real risk-free rate of return since stripping out inflation implies that the money which is set aside should be invested in index-linked bonds. In this way, the present value of the pension liabilities is independent of uncertainty about future rates of inflation.

The cost of buying annuities that would cover pensions in payment (L_r) is directly based on market evidence and should correspond more or less exactly to the payment that an insurance company would require in return for taking over the current pension liabilities of the pension fund. The same should be true for the cost of deferred pensions (L_d), though in practice the market in future annuity rates appears to be very thin and insurance companies are reluctant to take on the risks involved. This is slightly surprising because insurers can invest in 50 year index-linked government bonds, which would remove most of the risks over future rates of return and inflation. What is left is mortality or longevity risk that insurers may be reluctant to absorb over a period of more than 50 years.

With respect to the pension liabilities for current members (L_c), the usual argument is that no insurer will take on an obligation whose magnitude they cannot control – i.e. to pay pensions that are based upon future pay increases. The argument demonstrates that it is simply wrong to calculate current pension liabilities on the basis of projected but unknown future increases in real wages. Once this point is accepted, then there is no analytical difference between the liabilities for deferred and current members of the scheme.

Thus, the key risk for either the pension fund or for an insurer taking over the liabilities of the fund concerns the future evolution of the cost of an annuity paying £1 to someone of age a from date t for the rest of their life – $c(a,t)$. Clearly this depends upon future changes in life expectancy and the state of the market for annuities. In principle, this risk can be covered by purchasing call options that permit it to purchase annuities on fixed terms in future,

⁶ The formulation of the equations in terms of discrete time assumes that every member's birthday coincides with the valuation date while member's pension rights are adjusted annually on the valuation date.

assuming that someone is prepared to underwrite longevity risk. In that case, the present value of the future cost of annuities would be replaced by the current price of the call options plus the present value of the exercise price of the options. While there is no current market in options on future annuity rates, the conceptual exercise demonstrates that the existence of risk about these future rates increases the value of pension liabilities because of the cost of insuring against uncertainty. One immediate consequence is that the common practice of increasing the discount rate to allow for future uncertainty is patently wrong. While it is very unlikely that any adjustment in discount rates will accurately reflect the cost of annuity insurance over time, it is clear that the discount rate would have to be lower – not higher - in order to reflect the impact of such uncertainty.

Assuming that the number of current employees remains constant, the cost of an extra year of service for all current employees of ages $a < R-1$ may be calculated from:

$$\Delta L_c = \rho \sum_{a=1}^{R-2} n_c(a,t) \left\{ [s_c(a,t) + 1] (1 + \lambda) w_c(a,t) \frac{c(R,t+R-a)}{(1+\delta)^{R-a-2}} - s_c(a,t) w_c(a,t) \frac{c(R,t+R-a)}{(1+\delta)^{R-a-1}} \right\}$$

in which λ is the growth in the average level of real wages, i.e. $w_c(a,t+1) = (1 + \lambda) w_c(a,t)$.

The formulation shows that the cost of offering a defined benefit pension increases as employees become older because the discount factor applied to the cost of the annuity falls as their age increases. However, the increase is much less than is generally assumed because the real discount rate δ is likely to be very low and the future annuity rate depends solely upon the employee's date of retirement. The other component of the increase in liabilities is depends upon terms of the form $\lambda s_c(a,t) w_c(a,t) + (1 + \lambda) w_c(a,t)$. The first element reflects the interaction between higher real wages (for $\lambda > 0$) and past years of service, while the second is the straightforward accumulation of an additional year of service in year $t+1$ at the current wage.

In general, the cost of current years of service that is charged as an operating expense only reflects the second element, thus understating the true cost of wages and pension benefits paid by the company. This point may be qualified to the extent that the contribution rate for current service is adjusted to reflect the impact of increases in real wages on the liabilities for past years of service. FRS 17 requires that companies use the projected unit cost method of calculating actuarial liabilities and most companies set their contribution rates on the same basis. One feature of the projected unit cost method is that the average contribution rate for

a group of employees will increase over time as the average age of the group increases – partly due to the discounting effect discussed earlier, but largely because of increases in real wages. Hence, an unfortunate side-effect of FRS 17 is that it leads to companies under-estimating the impact of current wage and pension benefits.

This outcome could be avoided if financial statements were to record three categories of pension costs:

- A. Current service cost, referring solely to the impact of the current year of service on pension liabilities and calculated using the current average wage without any adjustment for future growth in real wages.
- B. Past service cost, which covers the treatment of pension rights that are vested over a period of time rather than immediately. FRS 17 explicitly states that the impact of growth in real or nominal wages should not be treated as a cost of past service on the grounds that the actuarial assumptions permit the projection of future wage growth.
- C. Wage growth cost, which would cover the impact of growth in real (not nominal) wages in respect of past years of service by current employees. Nominal wage growth should be excluded for consistency with the treatment of deferred pensions.

The objection may be raised that if companies were forced to record the impact of increasing real wages then either they would be unwilling to increase real wages or they would make such increases non-pensionable. The observation may be correct, but little is gained by hiding the impact of real wage increases on the company's net operating income. That is precisely the hole that car, steel and airline companies in the US dug for themselves by substituting benefit improvements for higher real wages in negotiations with their unions and then not recording the true cost of those improvements as operating expenses. The point is even stronger when dealing with regulated utilities because sooner or later utility customers are going to pay for pensions or similar long term benefits that have been promised.

3. How do regulated utilities measure their pension deficits?

While FRS 17 (IAS 19) specifies a general framework for dealing with pension assets and liability, they do not attempt to prescribe all of the details. In practice, there are important differences between companies in the manner in which the standards are applied. Further, there are systematic biases in the actuarial assumptions that are made which arguably

violate the general principles laid out in the standards. Hence, this section examines the actual practices followed by utilities in managing their pension funds and reporting their pension deficits. The quantitative analysis is based on a database of information extracted from the annual reports of more than 50 quoted and unquoted regulated utilities operating in the United Kingdom for financial years ending in 2004 to 2008. Details of the data are given in Appendix A, but it is worth noting the following key points.

- A. Most regulators require that the companies which they regulate should report financial data for years ending on 31st March. However, in some cases it is only possible to extract financial information from the accounts of parent companies with financial years ending on 31st December. In the present analysis, figures from the balance sheet at either 31st December 2007 or 31st March 2008 are referred as 2008 assets or liabilities, while figures from the income statement for 2007 or 2007-08 are referred to as 2007 revenues, expenses, etc. In a very small number of cases companies have changed their accounting years during the period examined, so that balance sheet dates have shifted from March to December or vice-versa and the income figures refer to 9 month or 15 month periods. I have converted the figures from the income statement to annual equivalents, but I have not attempted to adjust any of the balance sheet figures.
- B. Reporting practices have changed over time. Under FRS 17 companies were required to report their pension assets and liabilities in accordance with the new standard for financial periods starting on or after 1st January 2005. There were transitional provisions for disclosure prior to full implementation of the standard, but some companies did not provide any relevant information in their reports for years up to 2004-05. Further, the nature of the information provided and the units for which it is provided has evolved as companies have complied with the requirements of FRS 17 in different ways. Since retrospective information is almost always given for at least 1 year, it is generally possible to obtain balance sheet figures for the periods 2004 to 2008 and income statement figures for 2003 to 2007. Exceptions include the gas distribution companies divested by National Grid in mid-2005.
- C. Few companies provided concrete details on their assumptions about life expectancy before 2007. Even now the information given in annual reports is sometimes incomplete and may be specific to the circumstances of the pension scheme which

can complicate comparisons between schemes. Since the standard retirement age varies across schemes (and may change), companies tend to report life expectancy from the standard retirement age for their scheme. I have adjusted life expectancies to a standard retirement age of 65 using the differences between current and projected life expectancies for 2005 at various ages published by the Office of National Statistics.

IAS 19 - Introduction, paragraph 6(e) - states that the financial assumptions used in valuing pension assets and liabilities should be based on "market expectations, at the balance sheet date, for the period over which the obligations are to be settled". If this means anything, it must require that assumptions about inflation, future pay increases, the corporate bond rate, etc should reflect a view of what these values will be not over the next year or 5 years but over a period of 50 or more years. Except in quite extraordinary circumstances, such expectations ought to be very stable from year to year. The fact that the actual rate of inflation may have increased or fallen in the last year ought to be irrelevant to what is assumed in valuing pension liabilities.

Table 1 – Distribution of economic assumptions used by utility pension funds

Year	Median	Inter-quartile range	10th percentile	90th percentile
A. Expected rate of inflation				
2004	2.80	0.30	2.50	2.90
2005	2.80	0.15	2.60	2.90
2006	2.90	0.25	2.50	3.00
2007	3.10	0.20	2.90	3.20
2008	3.50	0.20	3.30	3.70
B. Expected real discount rate				
2004	2.70	0.25	2.60	3.00
2005	2.50	0.15	2.50	2.80
2006	2.10	0.20	1.90	2.25
2007	2.20	0.20	2.10	2.40
2008	2.90	0.80	2.40	3.40
C. Expected real return on equities				
2004	5.10	0.65	4.25	5.60
2005	4.95	0.50	4.40	5.60
2006	4.80	0.60	4.20	6.20
2007	4.90	0.83	4.30	5.85
2008	4.60	0.70	4.00	5.50

Year	Median	Inter-quartile range	10th percentile	90th percentile
D. Expected real return on gilts				
2004	2.00	0.40	1.80	2.50
2005	1.85	0.30	1.80	2.20
2006	1.40	0.43	1.30	2.00
2007	1.50	0.30	1.30	1.90
2008	1.10	0.30	0.70	2.00
E. Expected real return on fund assets				
2004	4.25	0.61	3.26	4.90
2005	3.96	0.91	3.30	4.64
2006	3.61	0.61	3.02	4.37
2007	3.71	0.60	2.96	4.11
2008	3.20	0.56	2.43	3.69

Source: My calculations using data described in Appendix 1.

Contrary to this clear guidance, the actual assumptions made by actuaries in valuing pension liabilities have tended to track year to year variations in the relevant variables. Table 1 shows the evolution of assumptions about inflation, the real discount rate and real returns on assets from 2004 to 2008. I have focused on the real discount rate and real rates of return because the effective indexation of most liabilities means that it is convenient to examine movements in the real value of liabilities over time.

Table 2 – Average implied rates of expected inflation derived from yields on gilts

Date	Maturity (years)				
	5	10	15	20	25
31 Mar 00	3.09	3.02	2.67	2.53	
31 Mar 01	1.98	2.23	2.36	2.44	2.48
31 Mar 02	2.84	2.77	2.82	2.84	2.80
31 Mar 03	2.49	2.49	2.52	2.53	2.52
31 Mar 04	2.94	2.91	2.91	2.90	2.89
31 Mar 05	2.81	2.85	2.90	2.93	2.95
31 Mar 06	2.74	2.87	2.95	2.97	2.98
31 Mar 07	2.89	3.03	3.15	3.19	3.17
31 Mar 08	3.13	3.47	3.66	3.68	3.63

Source: Bank of England yield curves and expected inflation.

It is particularly striking that the median of the assumed rate of inflation has increased from 2.8% in 2004 & 2005 to 3.5% in 2008.⁷ It is not difficult to identify the source of this change.

⁷ In this paper inflation is measured by changes in the RPI rather than the (harmonised) CPI, because this is the usual index used by pension funds and it provides the basis for adjusting index-linked bonds. Over 20 years from 1989 to 2008 for which the Office of National Statistics publishes comparative figures, the average difference between 12 month inflation measured by the RPI and by the CPI has been 0.87 percentage points. On this basis,

Table 2 shows how the curve of implied inflation rates calculated by the Bank of England from the yield curves for nominal and index-linked gilts has shifted from 2004 to 2008. But this is potentially a very unreliable source of information about inflation expectations. The Bank of England's notes on the yield curve warn of the difficulties – in particular, illiquidity in markets for certain maturities and types of bonds and the assumption that the inflation risk premium is zero. A related observation is that the implied rate of expected inflation can differ significantly across types of bonds at a particular date – e.g. for March 2008 the implied inflation was 3.94% for 10 year bonds using implied forward rates (series IUMAMIIF) and 3.42% using zero coupon rates (IUMAMIZC). The differential was negligible in March 2004 but had increased to 1.5% in October 2008.⁸ It is clear that either liquidity or other factors – such as the market preferences based on differences in tax treatment for different classes of investor – changed radically over this period.⁹ This would be a notable change if it reflected a genuine change in expectations about the future rate of inflation in the UK.

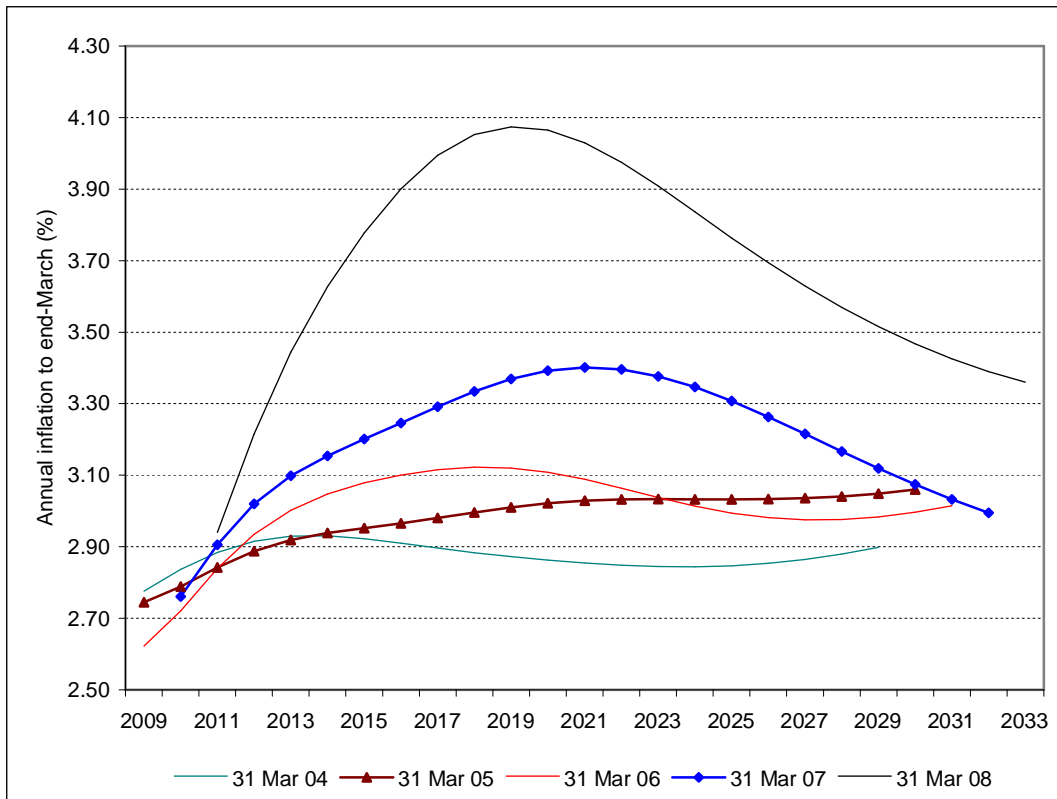
Figure 1 shows the implied annual rates of inflation derived from the Bank of England's yield curves for years from 2009 onwards as at 31st March 2004, 31st March 2005, etc. The calculations use data for medium and long dated gilts, so the projected rates of inflation only start 3 years ahead – i.e. from 2011 onwards for 2008 – and continue up to 25 years ahead. The striking feature of the figure is the sharp rise in annual inflation in the middle part of the next decade implied by the inflation projects for 2008 and, to a lesser extent, for 2007. It seems reasonable to question why and how inflation is expected to increase from about 2013 to the end of the decade. Without this increase, the average expected rate of inflation would be very stable over time – falling in the range 2.9 to 3.1%.

the middle of the Bank of England's target range for inflation – a CPI figure of 2% - would translate to an expected rate of RPI inflation of roughly 2.9%.

⁸ The reported statistics show similar though smaller differential for 5 & 20 year bonds for various months in 2008 with especially large differentials in October 2008. These may be reporting errors, but the lack of consistency between movements in implied expected inflation suggest that market liquidity and other factors may have a substantial impact on calculations of expected inflation rates.

⁹ The Bank of England's implied inflation calculations assume a zero inflation risk premium and no taxation of interest or capital gains. The inflation adjustment of index-linked gilts is not taxable for any holder, whereas both interest income and capital gains on nominal gilts may be taxable at different rates for some holders and some bonds. As a consequence, the expected rates of inflation that equalise post-tax rates of return for different holders will not be identical across types of bond, so that it is necessary to take account of the tax position of the marginal investor in the market. Since the market for zero coupon bonds – i.e. gilt strips – is heavily dominated by pension and insurance funds seeking to immunise themselves against interest rate risk, it would be logical to use expected inflation from zero coupon bonds.

Figure 1 – Implied forward rates of inflation from bond yields



Source: Bank of England yield curves and expected inflation.

It is possible that the recent spike in inflation might have led to an increase in the expected rate of inflation over the very long run, but other evidence such as consensus forecasts does not suggest this. There are two possible explanations.

- A. The inflation risk premium is not zero and it increased sharply in 2007-08, especially with respect to the variability of inflation looking 5 to 10 years ahead. The yield curves in Figure 1 are consistent with a fairly modest premium in 2008 of about 0.4% per year over the long term combined with much premium of up to 1% over the medium term.
- B. Liquidity, tax and other market factors have affected both nominal and index-linked gilts of various maturities in different ways so that the method of inferring implied rates of inflation over different periods from nominal and index-linked yield curves cannot be relied upon. This is consistent with the observation that there are

significant differences between implied inflation expectations for zero coupon and regular gilts of different maturities.¹⁰

It is likely that both explanations have some validity, but for present purposes it is not really important why the implied inflation curves changed so markedly in 2007-08. The central conclusion is that pension funds should be very careful about changing their assumptions about fundamental long term parameters without examining the evidence very carefully. In what follows I will adopt a fairly conservative figure of 2.9% for the long run expected rate of inflation as this is directly consistent with the Bank of England's inflation target and correspond to the median figure over the years examined in Table 1.

In Section 2 it was argued that the real discount rate used in to calculate pension liabilities should be the real risk-free rate of return. Table 3 shows the Bank of England's yield curve for the real return on index-linked gilts for maturities for 5 to 25 years. Focusing on the long end of the spectrum it is clear that the risk-free return has fallen from about 2% in the early years of the current decade to little more than 1% over the last 3 years. This trend is quite distinct from the market anomalies which might have caused the U-shaped patterns of expected rates of inflation.

Table 3 - Real return on index-linked gilts (%)

Date	Maturity (years)				
	5	10	15	20	25
31 Mar 00	2.77	2.13	1.97	1.82	
31 Mar 01	2.86	2.49	2.30	2.16	2.02
31 Mar 02	2.47	2.47	2.36	2.24	2.14
31 Mar 03	1.47	1.86	2.01	2.06	2.04
31 Mar 04	1.67	1.80	1.80	1.75	1.69
31 Mar 05	1.80	1.79	1.72	1.64	1.55
31 Mar 06	1.66	1.47	1.30	1.17	1.04
31 Mar 07	2.24	1.82	1.51	1.28	1.13
31 Mar 08	0.82	0.95	1.00	0.93	0.82

Source: Bank of England yield curves and expected inflation.

It is sometimes argued that the yields on index-linked gilts have been pushed down to artificially low levels by the conjunction of increased demand from pension funds and

¹⁰ An article by John Dizard in FTfm on 17th November 2008 illustrates the large distortions to implied inflation estimates that have occurred in the US as a result of liquidity constraints affecting the market for TIPS (US Treasury inflation protected securities) and the massive bid/ask spread (more than 180 basis points) which these constraints have caused.

limited supply because the Debt Management Office has failed to respond to the shift in the market. This may be correct as a description of the factors underpinning the decline in the real return, but nonetheless the demand for insurance against inflation risk appears to have increased and would be even higher if pension funds were to value their liabilities properly. Thus, there can be little justification for adopting a discount rate that is significantly higher than 1% in real terms – or than 4% in nominal terms - in current circumstances. The much higher figures for the expected real discount rate shown in Section B of Table 1 are clearly too high, even at the 10th percentile, and lead to a substantial under-estimation of the true scale of pension liabilities. On the other hand, the expected real returns on gilts shown in Section D of the table are broadly consistent with the figures in Table 3, though with a lag in responding to the decline that has occurred.

Apart from the real discount rate, the other key variable in assessing pension liabilities is the assumed life expectancy at retirement. It is well known that life expectancy has been increasing more rapidly than previously anticipated, but it is important to put the impact of greater life expectancy in context. With a real discount rate of 2.9% an increase in average life expectancy of 1 year in life expectancy at retirement has a weight of 0.56, while a similar increase in life expectancy for someone who will retire in 20 years time has a weight of 0.31. However, with a real discount rate of only 1%, the weights are 0.82 and 0.67 respectively. This is why the correct level of the real discount rate is so important, because it reinforces the impact of other changes in actuarial assumptions that may be required.

Less than one half of the pension schemes in the sample report usable information on their assumptions concerning life expectancy. Median life expectancy for males at age 65 increased from 20.0 years in 2007 to 20.85 years in 2008, accompanied by a reduction in the inter-quartile range from 2.0 years to 1.55 years. In parallel, median life expectancy for males at age 65 in 20 years time increased from 21.3 years in 2007 to 22.5 years in 2008, implying that trend increase in life expectancy was expected to continue. Only one-third of scheme provide details of their assumptions for both males and females, but the broad pattern is to assume that the gap between male and female life expectancy will decrease slowly to about 2.3 years in 20 years time. The overall impact of the revised assumptions is equivalent to an increase of 0.9 to 1.0 years in weighted average life expectancy at retirement for pension scheme members. As a crude upper bound, this change increases pension liabilities in real terms by about 3.5% for a real discount rate of 2.9% or about 4.5% for a real

discount rate of 1%.¹¹ As a comparison, reducing the real discount rate from 2.9% to 1% increases pension liabilities by about 20%.

The valuation of pension liabilities and deficits is not directly affected by the assumptions made about the real return on equities and fund assets overall, but it does affect any assessment of whether the level of contributions is adequate. In this respect it is interesting to note a minor irony in the assumptions shown in Section C of Table 1. For a market portfolio, the capital asset pricing model implies that:

$$\text{Real return on equities} = \text{Real return on risk-free bonds} + \text{Equity risk premium}$$

The classic LBS study by Dimson, Marsh & Staunton suggests that for the UK the ex-post equity risk premium (ERP) relative to bonds has an arithmetic mean of 5.6% and a geometric mean of 4.4%. Their estimate for the full sample of world markets is somewhat higher with an arithmetic mean of 6.7%. However, they suggest that a forward-looking estimate of the ERP should be lower than the ex-post outcome and adopt a range of 4-5%. Regulatory precedent in the UK implies a range of 3.5-4.5%, though regulators in the US and Australia have generally adopted higher estimates of the ERP in the range 5-7%. Even at the lower end of the regulatory range for the ERP the expected real return on equities should have been 5.2% in 2004, while the mid-point of LBS analysis would have indicated a figure of 6.2%. The decline in the real return on risk-free bonds has reduced the latter figure to 5.5%, which corresponds to the 90th percentile of the assumptions made by utility pension funds for the 2008 valuations.

Table 4 - Reported assets and liabilities for all regulated utilities (£ billion)

Year	Assets			Total	Liabilities
	Equities	Gilts	Other		
2004	32.45	13.31	4.17	49.93	60.22
2005	34.68	13.11	7.85	55.63	65.98
2006	42.78	15.50	8.97	67.25	77.30
2007	39.11	21.35	10.70	71.16	79.09
2008	31.91	26.76	11.30	71.14	74.74

Source: My calculations using data described in Appendix 1.

¹¹ These figures are obtained by assuming that all retired members live for exactly 20 or 21 years after retirement at age 65. Of course, this is an over-simplification, but it exaggerates the increase in pension liabilities because the major impact of greater life expectancy is to increase the weight in the upper tail of the distribution. The discount factor applied future liabilities, even for a low discount rate, means that the increase in pension liabilities due this change in the shape of the distribution will be less than the increase in liabilities caused by an equivalent but uniform movement of the whole distribution to the right.

The fundamental problem is a mispricing of the risks of investing in equities relative to gilts, especially index-linked gilts. The consequence is that the pension funds hold a large share of their assets in equities and undervalue the true cost of their liabilities. Table 4 shows the composition of the assets of the pension schemes for regulated utilities as well as the reported value of liabilities. The share of gilts in total assets has increased from 27% in 2004 to 38% in 2008. But in terms of risk management it is more interesting to examine equity holdings relative to total liabilities - even on a basis that underreports the latter. This has declined from 54% in 2004 to 43% in 2008, but note that it was 49% in 2007.

Much of the apparent improvement from 2007 to 2008 was due to the net impact of revised actuarial assumptions that reduced total liabilities by 5.5%, whereas allowing for inflation alone would have increased them by 3.8-4.0% depending upon the exact date of valuation. Similarly, the aggregate reported pension deficit for the funds fell from £7.93 billion in 2007 to £3.60 billion in 2008, but again the net impact of the changes in actuarial assumptions on liabilities was at least £7.4 billion, nearly two times the magnitude of the reduction in the aggregate deficit.

The central point that comes out of this examination of the actuarial assumptions made by the pension schemes operated by regulated utilities is that the real level of the discount rate which they use is much too high. Considerations of the nature of pension liabilities and the evidence on the real risk-free rate of return in the UK point to a real discount rate of about 1% in 2008, whereas the median real discount rate adopted by the pension schemes in 2008 was 2.9%. A second observation, which is a corollary of the first, is that the share of equities in pension scheme assets seems to be much too high, given their own assumptions about the relative returns on equities and gilts. Even with a risk-free real return of 1%, the assumed nominal return on equities is less than the level that would be consistent with most reasonable estimates of the equity risk premium. If the risk-free real rate of return is considerably higher than 1%, as implied by the discount rate used by most pension schemes, then the expected return on equities is far too low relative to the returns on government and good quality corporate bonds to warrant investing pension scheme assets in equities rather than bonds.

4. Recalculating pension liabilities and deficits for regulated utilities

Since the assumptions adopted by the regulated utilities in the sample do not provide a reliable basis for assessing the condition of their pension funds, it is necessary to recalculate the present value of future pension obligations. The adjusted estimates can only be an approximation since exact recalculation requires detailed information on the time profile of expected pension payments broken down by member characteristics. Still, it is possible to make a reasonable approximation provided that the actuarial assumptions about future pay increases, lump sum payments, mortality rates and survivorship patterns remain unchanged. On that basis the expected real values of payments in years from 2004 to 2008 onwards will not alter, but the resulting present value will be affected by the inflation and discount rates that are used. As explained later in this section, the sensitivity measures reported by a few companies demonstrate that these are critical variables in any assessment of current deficits.

In its 2008 Annual Report BT publishes a graph showing its expected profile of pension obligations at 31st March 2008 for financial years starting in 2008, 2009, ... The profile shows that expected payments increase from about £1.5 billion in 2008-09 to about £3.5 billion in the years 2029-31 and declines from 2031 onwards.¹² After conversion from nominal to real terms the time profile may be approximated by a truncated normal density function with a maximum in 2021-22. As an alternative I have also used negative binomial and Weibull density functions to approximate the real profile of BT's pension obligations.¹³

This profile applies to a pension scheme that was closed to new members in 2001 and had a normal retirement age of 60. The scheme is therefore fairly mature in the sense that calculations of life expectancy for new members or members aged 40 or less are not major factors in determining the scheme's liabilities. It should be noted that the maximum level of future payments in real terms occurs about 20 years after the scheme was closed to new

¹² There is an obvious error in the published version of the graph in Note 29 on page 127 of the Annual Report. The x-axis, which represents time, is marked 2008, 2015, 2023, 2039, 2047, 2055, etc. The irregular spacing from 2023 to 2039 is not reflected in the graph itself and must be an error. I have assumed that the labels should be 2008, 2015, 2023, 2031, 2039, 2047, etc.

¹³ The approximations to the time profile using different density functions were estimated using non-linear least squares applied to the real payment profile for the BT pension scheme. The residual error for the estimate of the truncated normal density was much smaller (adjusted $R^2 = 0.999$) than the residual errors for the other density functions (adjusted $R^2 = 0.975$ for the negative binomial and 0.981 for the Weibull). Since the difference between the negative binomial and the Weibull is relatively small, the negative binomial was used as an alternative to the truncated normal because it is a generalisation of the Pascal distribution over discrete integers, which fits more naturally with projections for discrete numbers of years ahead.

members. It is likely that the peak of future pension payments will be later for pension schemes that are still open to new members or which were closed more recently than the BT pension scheme. A simple rule of thumb is to assume that the peak will occur 20 years after closure or in 2028-29, whichever is later.

Table 5 - Sensitivity analysis of pension liabilities

Company	Standard discount rate (%)	Sensitivity analysis		Implied peak year for real pension payments	Standard retirement age	Pension scheme open or closed in
		Reduction in discount rate (%)	% increase in liabilities			
BT	6.85	0.10 ¹⁴	1.20	2021	60	Closed in 2001
E-ON UK	5.80	0.25	3.90	2022	65	Closed in 2005
National Grid Electricity Transmission	6.60	0.10	1.46	2021	65	Closed in 2006
National Grid Gas	6.60	0.10	1.43	2021	65	Closed in 2002
Network Rail	6.90	0.25	4.59	2029	65	Deferred entry since 2004
Pennon	6.90	0.50	8.50	2029	62	Open

Source: My calculations using data described in Appendix 1.

It is possible to test this assumption. A small number of pension schemes report the sensitivity of their pension liabilities to changes in certain key assumptions. While the nature of the sensitivity test is not uniform, all of them show how liabilities would increase for some increase in the discount rate – usually between 0.1 and 0.5 of a percentage point. Assuming that the distribution of future real obligations can be approximated by a truncated normal with the same standard deviation as that for the BT scheme it is possible to calculate the mean of the underlying normal distribution that would generate the reported sensitivity outcome. The results are shown in Table 5. They show that pension schemes which are open to new members are likely to have a later peak for the real value of expected pension payments than those which have been closed for some period. However, the simple rule of thumb may not be reliable. For this reason I have examined two alternative variants:

¹⁴ BT's Annual Report for 2008 states that an increase of 0.25 of a percentage point in the discount rate implies a 1.2% reduction in the value of its pension liabilities. However, this figure is completely inconsistent with the time profile of pension payments given in the same document. I have assumed that this is another error and it should have referred to the impact of increasing the discount rate by 0.1 of a percentage point, in which case the various figures are more or less consistent.

Variant A - The peak of the real payment profile will occur in 2022 for all companies.

Variant B – The peak of the real payment profile will occur 20 years after the scheme closed to new members or in 2029, whichever is earlier.

These variants provide a reasonable basis for assessing how far different assumptions about the profile of pension payments affect the overall pension liabilities of the companies in the sample. The results of recalculating the pensions liabilities for regulated utilities using the standard assumptions for inflation and the discount rate discussed in the previous section are shown in Table 6. To allow comparisons across time all money values have been converted to March 2008 prices using the RPI. The differences between the estimates of liabilities recalculated using the truncated normal and negative binomial distributions are well within the likely errors of estimation. Variant B (assuming that the peak of the payment profile is 20 years after the closure of the pension scheme) yields somewhat higher estimates of the liabilities but is, in my view, a more appropriate assumption. Hence, the remainder of the analysis will focus on liabilities estimated using Variant B and the truncated normal distribution.

Table 6 – Pension assets and liabilities for regulated utilities
 (£ million at March 2008 prices)

	Assets	Reported liabilities under FRS17	Recalculated liabilities using Variant A		Recalculated liabilities using Variant B	
			Truncated normal	Negative binomial	Truncated normal	Negative binomial
2004	67,988	81,830	113,883	110,832	117,533	113,282
2005	72,779	85,934	115,590	112,857	119,389	115,695
2006	85,786	97,653	118,244	116,376	120,680	118,392
2007	86,941	95,258	116,562	115,506	119,069	117,885
2008	83,332	85,700	116,866	115,488	120,774	119,374

Source: My calculations using data described in Appendix 1.

If one were to rely upon estimates of pension deficits calculated using FRS17 it would appear that the aggregate pension deficit for regulated utilities has narrowed from £13.8 billion in 2005 at 2008 prices to £2.4 billion in 2008. Further, that aggregate figure is entirely due the deficit in a single scheme – Royal Mail, which had a deficit of £2.9 billion in 2008. The picture provided by the recalculated liabilities is very different. The aggregate deficit for all regulated utilities in 2008 was £37.4 billion and total pension liabilities were about

145% of total pension assets. The overall pension deficit has narrowed from £49.5 billion in 2005, largely as a result of an increase in the value of pension assets. However, the 2008 deficit was significantly worse than the deficit of £32.1 billion in 2007, so that the apparent improvement in the situation of utility pension funds from 2005 to 2007 was quickly reversed. This reversal emphasises how vulnerable pension funds are to short term movements in stock market and other asset valuations. Further, the substantial decline in equity and bond prices after March 2008 has exacerbated the worsening of pension deficits when these are calculated properly.

In parallel with the decline in asset prices, pension liabilities increased by about £1.7 billion from 2007 to 2008, largely because companies adjusted their assumptions about current and future life expectancy. It is difficult to ensure that adjusted estimates of pension liabilities treat life expectancy in a consistent manner, because many companies provide very partial or no relevant information. Increasing the estimates of current and future life expectancy has three effects on the profile of future pension payments in real terms.

- A. The peak level of pension payments will be greater relative to its value in 2008 because more retired members will survive to draw their pensions.
- B. The date of the peak may be pushed forward in time, though generally by a fairly small amount.
- C. The standard deviation of the distribution will be increased because retired members (or their dependents) will, on average, draw their pensions for more years.

These effects may be captured by assuming that the mean and the standard deviation of the truncated normal distribution used to model the future pension profile both increase with life expectancy. Since the starting level of payments is kept constant, this change has the effect of increasing the peak payment and extending the period until, say, the profile of pension payments falls to 10% of the peak level. The sensitivity tests reported by the companies in Table 5 are broadly consistent with the assumption that mean and standard deviation of the truncated normal distribution increase by the same percentage as the increase in life expectancy.¹⁵

¹⁵ The actual elasticities fall in a range 0.85 to 1 with a median of 0.95, though this involves some interpolation because some companies report the impact of changes in life expectancy on their pension obligations in a manner that does not match the way in which they report their base assumptions about life expectancy.

Table 7 – Pension assets, liabilities and deficits by sector
 (£ million at March 2008 prices)

	Assets	Reported liabilities under FRS17		Recalculated liabilities using Variant B		
		Liabilities	Deficit	Liabilities	Deficit	Deficit as % of assets
Communications						
2004	29,914	37,202	7,288	55,002	25,088	84%
2005	32,564	39,076	6,512	55,654	23,090	71%
2006	39,321	46,477	7,156	58,204	18,883	48%
2007	40,419	45,716	5,297	57,122	16,703	41%
2008	38,922	40,693	2,927	57,858	18,936	49%
Electricity						
2004	9,832	11,448	1,702	16,104	6,272	64%
2005	12,095	14,329	2,344	19,611	7,516	62%
2006	14,246	15,581	1,433	19,212	4,966	35%
2007	14,161	15,054	1,117	19,047	4,886	35%
2008	13,576	13,682	759	19,227	5,650	42%
Gas						
2004	14,217	15,851	1,633	21,336	7,119	50%
2005	13,778	14,788	1,010	19,373	5,594	41%
2006	14,568	15,256	688	18,122	3,554	24%
2007	14,090	14,186	134	17,164	3,075	22%
2008	13,428	12,615	44	16,778	3,350	25%
Transport						
2004	6,348	7,831	1,482	11,358	5,010	79%
2005	7,331	9,350	2,020	13,055	5,725	78%
2006	9,153	10,875	1,722	13,488	4,335	47%
2007	9,619	11,247	1,628	14,221	4,602	48%
2008	9,353	10,427	1,224	15,102	5,749	61%
Water						
2004	7,676	9,499	1,823	13,733	6,057	79%
2005	7,011	8,392	1,383	11,697	4,686	67%
2006	8,498	9,463	971	11,654	3,157	37%
2007	8,652	9,056	537	11,514	2,862	33%
2008	8,053	8,283	494	11,810	3,757	47%

Source: My calculations using data described in Appendix 1.

Table 7 breaks down the aggregate figures by sector. Expressed as a percentage of total pension assets, the recalculated pension deficits have fallen in all sectors. The relative magnitude of pension deficits is greatest for transport, for which the reduction from 2004 to 2007 has been least, while it is lowest for gas. Table 8 shows that the relative magnitude of pension deficits is greatest for pension schemes that remain open to new members, while progress in reducing pension deficits has been greatest for those which have been closed to new members. This outcome is heavily influenced by the Royal Mail pension scheme, which

is the largest scheme still open to new members, but it reflects the fact that it may be easier for companies to address pension deficits once they have closed schemes to new members.

Table 8 – Pension assets, liabilities and deficits by sector
 (£ million at March 2008 prices)

	Assets	Reported liabilities under FRS17		Recalculated liabilities using Variant B		
		Liabilities	Deficit	Liabilities	Deficit	Deficit as % of assets
Closed to new members						
2004	31,747	36,772	5,025	50,281	18,534	58%
2005	31,172	35,509	4,340	47,235	16,063	52%
2006	42,358	45,773	3,416	55,662	13,304	31%
2007	44,527	45,774	1,399	56,662	12,135	27%
2008	44,424	43,523	1,562	60,183	15,758	35%
Open to new members						
2004	36,241	45,058	8,904	67,253	31,011	86%
2005	41,606	50,425	8,929	72,154	30,548	73%
2006	43,427	51,879	8,555	65,018	21,591	50%
2007	42,415	49,484	7,314	62,407	19,992	47%
2008	38,908	42,177	3,885	60,591	21,683	56%

Source: My calculations using data described in Appendix 1.

As an illustration of the sensitivity of aggregate pension deficits to changes in asset values, I have examined the impact of changes in assets values from March 31st 2008 to mid-March 2009. This can only be a rough exercise since information is only available on the aggregate composition of pension assets at the latest valuation dates. However, the pension funds of regulated utilities are too large in aggregate to have experienced changes that are very different from the relevant market indices. I have applied the changes in the following indices from 31st March 2008 to 13th March 2009 with one exception:

- Equities - the FTSE All Share index;
- Corporate Bonds - the iBoxx Sterling Corporate Bond index;
- Gilts – the FTSE All Gilts index;
- Property – the IPD All Property capital value index from December 2007 to December 2008; and

- Other Assets – no change.¹⁶

The results are shown in Table 9. The total pension deficit for regulated utilities has increased from £37.4 billion to £52.1 billion or, more importantly, from 45% to 76% of the current value of pension fund assets. Of course, it may be argued that this is the worst possible view of the situation, taken at the trough of the economic cycle. That argument assumes the long run value of equities should be significantly higher than current valuations. Perhaps, but it is yet another variant of the tendency to underplay the risks associated with a heavy reliance on equities to fund long term pension commitments.

Table 9 – Impact of changes in asset values from March 2008 to March 2009
 (£ million at March 2008 prices)

	Assets		Recalculated liabilities	Pension deficit	
	2008	2009	2008	2008	2009
Communications	38,922	31,579	57,858	18,936	26,279
Electricity	13,576	11,647	19,227	5,650	7,579
Gas	13,428	11,453	16,778	3,350	5,325
Transport	9,353	7,494	15,102	5,749	7,608
Water	8,053	6,461	11,810	3,757	5,349
Total	83,332	68,634	120,774	37,442	52,139

Source: My calculations using data described in Appendix 1.

5. What is required to eliminate the pension deficits?

The total value of regulated revenues for the companies in the sample was £43.7 billion in 2007-08, of the same order of magnitude as their total pension deficit in 2008. Thus, any attempt to eliminate the pension deficit in a short period of time would imply a very large adjustment either to regulated prices or to the return on capital for the companies. The standard approach of the Pension Protection Fund is that companies should implement actions to eliminate their pension deficits over a period of 10 years, so I will use this as a reference point in considering the options open to the companies and regulators.

Table 10 examines the total contributions by sector that the companies made to their pension funds in relation to both (a) costs charged for current and past years of service, and (b) regulated revenues. It is important to qualify the figures shown for service costs, since these

¹⁶ This assumption is generous. The Other Assets category covers both cash and alternative investments such as private equity and hedge funds. The overall value of private equity and hedge fund investments have tended to follow equities.

are based on the costs charged in accordance with FRS 17 rather than a correct estimate of the liability created by additional years of service. The previous sections have shown that the recalculated liability is approximately 40% higher than the FRS 17 estimate in 2008. On that basis the contributions made by companies in communications and transport would have to be increased substantially in order to cover service costs before any impact is made on their pension deficits. In contrast, electricity companies have contributed substantially more than the amount required to cover service costs. The balance is favourable for gas and water, but not by enough to make a large impact on their pension deficits.

Table 10 – Service costs, pension contributions and regulated revenues by sector
 (£ million at March 2008 prices)

	Service costs	Values for year		End-of-year Pension deficit
		Contributions	Regulated revenues	
Communications				
2004-05	780	932	10,104	23,090
2005-06	822	746	12,258	18,883
2006-07	996	1,242	12,450	16,703
2007-08	931	1,146	12,247	18,936
Total	3,529	4,065	47,058	
Electricity				
2004-05	153	241	5,899	7,516
2005-06	172	494	6,563	4,966
2006-07	163	402	6,372	4,886
2007-08	129	256	6,438	5,650
Total	617	1,393	25,272	
Gas				
2004-05	101	104	2,499	5,594
2005-06	100	128	3,624	3,554
2006-07	103	125	3,674	3,075
2007-08	103	269	3,829	3,350
Total	407	625	13,626	
Transport				
2004-05	343	316	8,649	5,725
2005-06	404	350	8,800	4,335
2006-07	428	351	10,953	4,602
2007-08	448	410	11,090	5,749
Total	1,624	1,427	39,492	
Water				
2004-05	195	327	9,156	4,686
2005-06	178	312	9,866	3,157
2006-07	199	310	9,885	2,862
2007-08	182	225	10,119	3,757
Total	753	1,174	39,027	

Source: My calculations using data described in Appendix 1.

I have calculated the top-up payments that would be required to eliminate the pension deficits by assuming that 10 equal payments (in real terms) are made in the middle of each financial year. The

value of the payments is the amount required to yield a present value equal to the pension deficit either in 2008 or as recalculated in March 2009 with the same discount rate as that used in calculating pension liabilities. The total additional contribution at 2008 prices that would be required is then the adjusted service cost (= actual service cost x 1.40) minus the actual value of pension contributions made in 2007-08. The result of these calculations is shown in Table 11.

Table 11 – Impact of changes in asset values from March 2008 to March 2009
(£ million at March 2008 prices)

	Actual pension contributions in 2007-08	Additional contributions required to cover service costs and eliminate pension deficit		Regulated revenues in 2007-08	Additional contributions as % of regulated revenues in 2007-08	
		2008 deficit	March 2009 deficit		2008 deficit	March 2009 deficit
Communications	1,146	2,153	2,927	12,247	17.6%	23.9%
Electricity	256	324	480	6,438	5.0%	7.5%
Gas	269	229	437	3,829	6.0%	11.4%
Transport	410	823	1,019	11,090	7.4%	9.2%
Water	225	426	594	10,119	4.2%	5.9%
Total	2,305	3,955	5,457	43,723	9.0%	12.5%

Source: My calculations using data described in Appendix 1.

The figures show that the additional contributions are at least 17.5% of regulated revenues for communications to eliminate the 2008 deficit and nearly 24% if 2009 is used as the base. The scale of additional contributions is 4% - 7.5% of regulated revenues to eliminate the 2008 pension deficits for the other sectors. Such contribution payments would imply significant initial increases in tariffs or other charges. An alternative approach might be to adjust the X factors for each sector so as to mitigate the immediate impact of higher pension contributions. If 2009 is used as the base for the pension deficits, then the scale of additional contributions for electricity, gas and transport would make some initial adjustment in tariffs essential

Table 12 – Composition of pension assets of regulated utilities
(£ million at March 2008 prices)

	Values of pension assets			% shares of total pension assets		
	Equities	Gilts	Corporate bonds	Equities	Gilts	Corporate bonds
2005	45,686	14,874	5,626	62.8%	20.4%	7.7%
2006	55,001	16,863	6,522	64.1%	19.7%	7.6%
2007	49,395	21,719	6,685	56.8%	25.0%	7.7%
2008	39,974	26,569	7,584	48.0%	31.9%	9.1%

Source: My calculations using data described in Appendix 1.

There is another change that would be required. Steps to eliminate pension deficits could be undermined by future volatility in the value of pension assets, as has happened in the last 12 months. Table 12 shows that the share of equities in the pension assets of regulated utilities fell from over 60% in 2005 & 2006 to less than 50% in 2008. Nonetheless, if the role of customers – and/or the government – in underwriting the pension obligations of utilities is recognised, then it is reasonable to conclude that the risks of continuing to hold large investments in equities can be justified. This is particularly true for schemes that are closed to new members and are being run down over an extended period. Thus, there is a strong argument for regulators to insist that larger contributions to remove pension deficits that are funded out of tariffs should be accompanied by a shift in investment strategy that leads to a large reduction in the share of equities in pension assets.

Table 13 – Composition of pension assets by sector in 2008
 (£ million)

	Values of total pension assets			% shares of total pension assets		
	Equities	Gilts	Corporate bonds	Equities	Gilts	Corporate bonds
Communications	18,973	11,519	2,847	48.7%	29.6%	7.3%
Electricity	5,990	5,614	837	44.1%	41.4%	6.2%
Gas	4,740	3,997	3,406	35.3%	29.8%	25.4%
Transport	5,717	3,064	0	61.1%	32.8%	0.0%
Water	4,553	2,373	492	56.5%	29.5%	6.1%

Source: My calculations using data described in Appendix 1.

Table 13 shows that there were already significant differences in the composition of pension assets across sectors with the largest shares of equities in transport and water. The pension fund for current and former workers in the gas industry has gone furthest in reducing the share of equities but both it and other pension funds for regulated utilities could go much further in order to lower the riskiness of their investments.

6. How should regulators deal with the pension liabilities of regulated utilities?

The fundamental feature of present arrangements for funding the pension schemes of regulated utilities in the UK is that they hide a classic one-sided option on the future performance of equities, primarily in the UK. The reality is that pension liabilities are substantially understated while pension assets are heavily allocated to high risk investments. If the future return on equities is above the historical average, then the gamble may turn out well without any action being required to make up for a potential shortfall in assets and contributions to cover pension liabilities. However, a much more likely outcome is that the pension funds will have to be shored up at some point by some combination of higher current contributions and lump sum payments.

The situation of Royal Mail Holdings is somewhat special, because the government as its owner has been unwilling to allow it the commercial freedom to take the actions that would be required to scale down the magnitude of its pension liabilities. The consequences of this reluctance have become larger as the prospect of fuller liberalisation of the postal markets looms larger as a consequence of European legislation. There is little prospect that Royal Mail will be able to generate from its own operations the funds that will be required to cover its pension deficit if this were properly assessed. The reality is that Royal Mail is a pension fund with a postal service attached, rather like the US car and steel companies – at least until the latter transferred their pension liabilities to PBGC. In practice, the taxpayer – in one way or another – will have to bear the cost of dealing with the Royal Mail pension deficit, since there would be enormous resistance to any attempt to transfer this cost to other pension schemes via the Pension Protection Fund. Arguably, the same remarks apply to Transport for London, even though its deficit is much smaller, because of its dependence on various forms of public subsidy.

For other regulated utilities the cost of covering pension liabilities will ultimately fall upon customers. This is because over the medium and longer term the UK system of regulation has evolved into one that is equivalent to rate of return regulation with the rate of return set equal to the cost of capital calculated assuming some conventional debt-equity ratio for the industry concerned. Setting aside short term shocks or effective confiscation, the owners of regulated utilities will not bear the cost of covering pension deficits via a lower return on equity, since the outcome will be either a shortfall in investment or an increase in the return on capital that is required. So, the present arrangement is one in which customers are writing the option on equity returns discussed above. In exchange for lower utility prices today customers may face the prospect of considerably higher prices in future to cover the pension obligations that are unfunded if equity returns are lower – or more volatile – than required to cover the true level of existing liabilities.

The question for regulators is whether they should acquiesce in the continuation of this option or take steps to ensure that pension deficits are funded in a different way. It is far from obvious that utility customers should be in the business of writing financial options on the long term return on equities, so that the starting point of any discussion must surely be that this is not the right way of dealing with pension deficits. But there is also an even more powerful argument. Current arrangements allocate risks in a highly uncertain manner. Even if one accepts the argument that customers will sooner or later have to bear the cost of existing deficits, the manner in which that happens may have large short term consequences for both investors and bondholders. That creates substantial uncertainty about future returns which must raise the current cost of capital. Thus, strictly from the perspective of current customers there may be a case for resolving uncertainty about how the pension deficits of regulated utilities will be addressed.

If this argument is accepted, then this paper suggests that regulators and regulated utilities will need to adopt the following principles.

- A. Irrespective of accounting standards, regulated utilities should be required to calculate their pension liabilities in real terms using a real risk-free rate of discount which would be prescribed by the regulator. An appropriate discount rate in current circumstances would be 1%, but this might rise or fall in future. The reason for reporting liabilities in real terms is that the regulatory framework assumes that regulated prices follow an RPI +/- X type of adjustment over time, so that companies and pension schemes can benefit from the inflation protection which this provides.
- B. All parties should recognise that customers and/or the government provide the ultimate guarantee for the pension liabilities of regulated utilities. Since almost all utilities have large pension deficits when pension liabilities are properly calculated, this means that tariffs must be increased sooner or later to fund the elimination of the deficits. It is better that this should be done now rather than allowing further delay to increase the risks that are borne by both investors and future customers.
- C. Finally, in return for larger contributions to pension funds that are financed from revenues regulators must insist that the riskiness of pension assets is reduced by a shift from equities to gilts and, perhaps, corporate bonds.

Appendix – Sources of data

The data compiled for the analysis in this paper was extracted from the statutory Financial Statements for regulated entities or their parent companies for years ending on or after 31st December 2004. The requirement to account for company pension schemes in accordance with FRS 17/ IAS 19 came into effect for financial years beginning on or after 1st January 2005 but companies were required to provide transitional information for prior years even when they did not reflect movements in pension liabilities and assets in their balance sheet and income statement. In practice, most companies included some but not complete information on the implications of adopting FRS 17 in their financial statements for the financial year starting in 2004. Further, many companies included retrospective information for 2004 – or 2004-05 – in their first set of financial statements which implement FRS 17.

The population of companies covered for this analysis has been defined as regulated network or infrastructure operators in electricity, gas, water and transport. In all of the cases examined, regulated companies operate with financial years ending in December or March. Thus, in the second half of 2008 it is possible to compile relatively complete figures on pension valuations for the end of years from December 2003 or March 2004 (referred to as 2004) to December 2007 or March 2008 (referred to as 2008). This gives 5 annual observations (subject to changes in the end of the company's financial year) of the balance of pension funds plus 4 observations of flows identifying how the balances changed from beginning to end of year. Company splits or mergers – e.g. the sale by National Grid Transco of 4 gas distribution networks or the take-over of Mid-Kent Water by South East Water – complicate the sample. In the case of mergers, it is common for the merged entity to report separate information for the component entities. The treatment of spin-offs

It has been necessary to exclude some regulated network companies from this analysis on the grounds that either the balance between regulated and non-regulated business has been changing over time or the company's financial statements provide no basis for identifying the pension balance for its regulated activities. The largest company in this category is BT. Following an agreement with Ofcom in 2005 its main regulated business is BT Openreach, which is responsible for local loop access. However, BT Openreach operates with limited accounting separation and there is no realistic way of identifying what proportion of BT's pension assets and liabilities should be allocated to BT Openreach. Similar problems arise with Kingston Telecommunications.

In the transport sector, there is a case for including the rail operations of companies like National Express, Stagecoach, Go-Ahead Group and First Group in the sample. However, there are two complications. One is that most of the companies do not break down the contributions of their rail operations to the aggregate company figures for pension assets and liabilities. It is possible to examine the accounts for franchise subsidiaries, but the information provided is often rather sparse. The second difficulty is that special accounting provisions are required to deal with pension deficits or surpluses for franchises of limited duration. Each train franchise has a specific section of the Railways Pension Scheme (RPS). At the beginning of its franchise the train operating company takes on an obligation to fund any initial deficit for the franchise section over the life of the franchise and takes this into account when bidding for the franchise. This leads to the inclusion of substantial changes in pension assets and liabilities at the beginning and end of franchises together with annual franchise adjustments as inherited surpluses or deficits are written down. What one would really want is a record of the evolution of pension assets and liabilities for each franchise, but this is hard to construct because of changes in franchise operators.

Network Rail's decision to bring most maintenance in-house in 2003-04 means that the Network Rail section is the largest active section of the Railways Pension Scheme. The second largest active section is EWS Railways, the rail freight operator which is not regulated. Many of the larger sections in the Railways Pension Scheme cover contractors, service providers and non-regulated operators – e.g. Eurostar and Freightliner. The pension assets for the RPS sections covering franchised train operating companies amounted to £4.87 billion at the end of 2007 as compared with £3.55 billion for the Network Rail section. Since the RPS operates through an investment pool, it is unlikely that the circumstances of the train operating company sections is significantly different from that of Network Rail, which may be taken as representative of the regulated operating companies.

A separate problem concerns the reporting arrangements for parent companies and their subsidiaries. In the electricity sector, 13 of the 14 electricity distribution companies are owned by 6 companies - CE Electric, EDF, E-ON, Scottish & Southern, Scottish Power (now Iberdrola), and Western Power Distribution – while Electricity North West (formerly United Utilities Electricity) is the only independent distribution company. In most cases the pension schemes have been merged, either as sections of the Electricity Supply Pension Scheme (ESPS) for longstanding members or in new company-wide schemes. Some distribution subsidiaries – or their parent companies - provide separate information on their

pension assets and liabilities, but more usually it is only possible to obtain information for the merged ESPS sections or company-wide pension schemes. The situation is similar for some of the water companies, though this applies to water only companies (WOCs) rather than the water and sewage companies (WASCs). Mergers mean that Veolia Water UK owns three WOCs - though the combined entity is dominated by Three Valleys Water - while South East Water has incorporated Mid-Kent Water.

Since regulators must deal with regulated entities rather than their parent companies the database includes both the separate regulated units and their parent companies. Because many of the WOCs are very small, the database excludes companies with pension assets of less than £50 million. Each entry in the database is identified by (a) whether it refers to a regulated entity, and (b) whether it is included in the sums of pension assets and liabilities. This permits the construction of different samples that are used to examine the assumptions made by regulated entities and the aggregate values of pension assets and liabilities for all of the companies in a sector or in the whole sample.

Two telecommunications companies required special treatment. The key concern focuses on British Telecom (BT) which operates a regulated business – largely now under the BT Openreach name – as well as a variety of non-regulated businesses. The boundary between BT's regulated and non-regulated businesses has been gradually shifting as Ofcom has relaxed the regulatory controls applied to line rentals, etc. Since BT has the largest pension fund of any regulated or partly regulated company, it cannot be omitted from the sample. Equally, including the whole of BT's pension fund in the totals would give a misleading impression when constructing aggregates for all regulated companies. The assumption adopted to deal with this problem is that 40% of BT's pension fund should be treated as being linked to its regulated business and the remainder to its non-regulated business. This is a conservative assumption since Openreach employees accounted for 43% of BT employees excluding BT Global Services in March 2008. The main BT pension scheme (BTPS) was closed in 2001, while BT Global Services is a business that has grown rapidly (partly by acquisition) since that date. Hence, it is very likely that Openreach and other regulated BT activities account for more than 50% of the membership and liabilities of BTPS. Kingston Communications is a much smaller company than BT, but it is in a very similar position with regulated and non-regulated activities. Again, it has been assumed that 40% of Kingston's pension fund should be allocated to the regulated business.

A similar exercise is necessary for E-ON UK's regulated distribution business – Central Networks. The annual accounts of the two distribution companies – Central Networks East and Central Networks West - do not provide separate information on their sections of the ESPS but simply refer to the E-ON UK accounts. At the end of 2004, the last year for which E-ON provides disaggregated information, the two Central Networks sections of ESPS accounted for about 45% of the total assets of the 4 E-ON sections of ESPS. I have assumed that this share can be applied to later years. Further, the regulated revenue for E-ON UK used in the analysis is based upon the revenues of the company's distribution businesses and excludes revenues from its generation and supply businesses.

The table below lists the companies included in the database for the year 2008. There are multiple entries for Western Power Distribution (WPD) and its subsidiaries because it operates two significant pension schemes, one a combined section of ESPS, the other inherited when it took over the electricity distribution business in South Wales from Hyder. Similarly, Veolia Water UK – represented by Three Valleys Water – has two separate pension schemes, one a company scheme and the other a section of the former Water Supply Companies Pension Plan.

Table A1 – Companies included in the database for the year 2008

Ref	Company	Sector	Regulated entity	Proportion included in value sums
1	Anglian Water (incl Hartlepool)	Water	1	1
2	BAA	Transport	1	1
3	Bristol Water	Water	1	1
4	Central Networks East (E-ON UK)	Electricity	1	0
5	Central Networks West (E-ON UK)	Electricity	1	0
6	EDF Energy	Electricity	0	1
9	EDF Energy Networks (EPN)	Electricity	1	1
10	EDF Energy Networks (LPN)	Electricity	1	1
11	EDF Energy Networks (SPN)	Electricity	1	1
12	E-ON UK	Electricity	0	0.45
13	Mid Kent Water	Water	1	1
14	National Grid Electricity Transmission	Electricity	1	1
15	National Grid Gas	Gas	1	1
17	Network Rail (RPS)	Transport	1	1
18	Northern Electric Distribution	Electricity	1	1
19	Northern Gas Networks	Gas	1	1
20	Northumbrian Water	Water	1	1
21	Royal Mail	Comms	1	1
22	Scotland Gas Networks	Gas	1	1
23	Scottish & Southern Energy	Electricity	0	0
24	Scottish Hydro Electric	Electricity	1	1
25	Scottish Power	Electricity	0	1
26	Scottish Power Distribution	Electricity	1	0
27	Scottish Water	Water	1	1
28	Severn Trent Water	Water	1	1
29	South East Water	Water	1	1
30	South Staffordshire Water	Water	1	1
31	South West Water	Water	1	1
32	Southern Electric Power Distribution	Electricity	1	1
33	Southern Gas Networks	Gas	1	1
34	Southern Water	Water	1	1
35	SP Manweb	Electricity	1	0
36	Thames Water	Water	1	1
37	Three Valleys Water (VUKPP)	Water	1	1
38	Three Valleys Water (VWSCPP)	Water	1	1
40	Transport for London (TFLPF)	Transport	1	1
42	Electricity North West	Electricity	1	1
43	United Utilities Water	Water	1	1
44	Wales & West Utilities	Gas	1	1
45	Welsh Water	Water	1	1
46	Wessex Water	Water	1	1
47	WPD - combined (ESPS)	Electricity	0	1
48	WPD - South Wales (ESPS)	Electricity	1	0
49	WPD - South Wales (WPUPS)	Electricity	1	1
50	WPD - South West (ESPS)	Electricity	1	0
51	Yorkshire Electricity Distribution	Electricity	1	0
52	Yorkshire Water	Water	1	1
53	Kingston Communications	Comms	1	0.4
54	British Telecom	Comms	1	0.4