Discretion in accounting for pensions under IAS 19: Using the 'magic telescope'?

Abstract

We use a panel data set of UK-listed companies over the period 2005 to 2009 to analyse the actuarial assumptions used to value pension plan liabilities under IAS 19. The valuation process requires companies to make assumptions about financial and demographic variables, notably discount rate, price inflation, salary inflation, and mortality/life expectancy of plan members/beneficiaries. We use regression analysis to analyse the relationships between these key assumptions (except mortality, where disclosures are limited) and company-specific factors such as the pension plan funding position and duration of pension liabilities. We find evidence of selective 'management' of the three assumptions investigated, although the nature of this appears to differ from the findings of US authors. We conclude that IAS 19 does not prevent the use of managerial discretion, particularly by companies whose pension plan funding positions are weak, thereby reducing the representational faithfulness of the reported pension figures. We also highlight that the degree of discretion used reflects the extent to which IAS 19 defines how the assumptions are to be determined. We therefore suggest that companies should be encouraged to justify more explicitly their choice of assumptions.

Keywords: actuarial assumptions; IAS 19; liability valuation; managerial discretion

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Introduction

Recent accounting standards on pensions accounting require companies which sponsor defined benefit pension (DBP) plans to recognise their funded status on the balance sheet or disclose this status in the notes to the financial statements. Funded status is measured as the difference between the fair value of plan assets and the value of the related liabilities, and many companies report deficits, i.e. DBP liabilities exceed assets.

The compression of the funded status of a DBP plan into a single figure creates an 'illusion of certainty', whereas 'uncertainty is the distinguishing characteristic … uncertainty as to how much pay is deferred; uncertainty as to the amounts and timing of the future pension payments; uncertainty as to the discount rate to be used to calculate their present value; and uncertainty as to the future cash flows of the plan assets that will be used to settle those liabilities' (Blake et al. 2008, pp. 5, 37). The research reported in this paper is motivated by this uncertainty, and the opportunity that it provides for management of the reported funded status.

Uncertainty arises largely because of the challenge of measuring the size of the (very long-term) pension liabilities. The valuation of DBP liabilities depends on four key actuarial assumptions about financial and demographic variables: the discount rate used to convert future liabilities to a present value; the rates of future price and salary inflation; and mortality rates/life expectancy of plan members/beneficiaries. The sensitivity of the funded status to changes in these assumptions creates scope for the exercise of managerial discretion in their selection, and a former Chief Executive of the UK's Financial Reporting Council reportedly suggested that this facilitates the use

of ‘the magic telescope ... to make very big things appear very small’ (Williams 2005, p. 18).

The use of a ‘magic telescope’ may also apply in other contexts where the reliability or usefulness of accounting numbers is open to question due to the sensitivity of measurements to alternative assumptions. In the US under SFAS 106, the financial statements must include information about the obligations and costs to companies of providing postretirement health benefits for employees, the values of which, like pension benefits, are sensitive to variations in underlying assumptions about life expectancies, discount rates and other factors. Another example would be decommissioning costs in sectors such as the power industry, where companies must report provisions made for decommissioning assets such as gas storage units or power stations at the end of their useful lives. IAS 37 (IASB, 1998) defines such provisions as the best estimates of the present value of the anticipated future decommissioning costs. Like pension liabilities, provisions may be very large and highly sensitive to changes in assumptions such as environmental costs and the discount rate. Similar issues apply to the provisions for long term liabilities in accounting by insurance companies. We therefore suggest that the ‘magic telescope’ concept extends beyond pensions accounting and is of wider relevance to financial accounting researchers.

This paper seeks to establish whether managers apply a ‘magic telescope’ to DBP liability valuations in the UK. We test for systematic differences in companies’ choices of assumptions using multiple regression analysis on data for a panel of FTSE 350 companies reporting under IAS 19 over 2005-09, and conclude that some companies appear to exercise discretion in a manner that reduces reported pension

liabilities. More specifically, we confirm US findings (Thies and Sturrock 1988; Godwin 1999; Asthana 1999) that companies with relatively poorly-funded DBP plans tend to make assumptions that lower their liability valuations. We also find support for US evidence (Feldstein and Mørck 1983; Bodie et al. 1987) of a relationship between assumptions and the size of the pension plan relative to the company's size. Our UK evidence of reporting under IAS 19 does not, however, indicate any link between pension assumptions and company profitability, or debt ratio, contrary to the findings of three US papers (Bodie et al. 1987; Godwin et al. 1997; Asthana 1999) and one UK paper (Li and Klumpes 2013). We therefore add to the three UK papers which provide contradictory evidence on the factors influencing the choice of assumptions used in the valuation of DBP liabilities under earlier UK standards (see discussion below of these papers: Byrne et al. 2007; Sweeting 2011; Li and Klumpes 2013).

Our paper makes two contributions. Firstly, we address the literature gap identified by Glaum (2009, p. 306) that 'almost all existing studies on pensions accounting are based on US accounting and capital-market data ...'. Gordon and Gallery (2012, p. 18) use pension accounting to illustrate the possibility of 'comparability mirage' in apparently similar institutional settings. It is therefore necessary to test whether conclusions developed using US data apply in the UK because of some significant differences between the two countries in pension and accounting regulation and practice. For example, in the UK, but not the US, increases in pensions in the course of payment and deferred pensions are linked to price inflation. Consequently, UK DBP liability valuations incorporate an additional inflation assumption. Analysis of this requirement allows us to contribute to the literature by comparing the degree of

variation in companies' choices across three financial assumptions rather than the two - discount rate and salary inflation - that characterise the US literature. We find greatest variation in the assumptions for salary inflation, the selection of which is most flexible under the IAS 19 guidance.

There are other notable differences in the respective regulatory environments for pensions. For example, the specific rules on the level of employer contributions to plans in the US (Asthana 1999, p. 49) do not apply in the UK; US plans generally do not require employee contributions (Gordon and Gallery 2012, p. 16); and the US regulatory framework, although similar to the UK, is much more mature, with a minimum funding requirement and a national protection or guarantee fund in place since 1974. In contrast, these arrangements were not implemented in the UK until 1997 and 2004 respectively (Glaum 2009, p. 303). There are also differences in corporate law, for example regarding bankruptcy provisions, between the US and the UK which can impact on pension plans. In addition, UK reporting practice under IAS 19 differs from US GAAP in some respects: for example, in the US SFAS 158 (FASB 2006) requires actuarial gains and losses to be recycled into the income statement, whereas IAS 19 does not. IAS 19 also permits options, the take-up of which varies by country, and UK reporting practice may reflect use of the earlier FRS 17 (Fasshauer et al. 2008, p. 35).

Our second contribution is to build on US studies (for example Hann et al. 2007) which have sought to use standardised assumptions to overcome the 'distortion' that hampers comparison of the funded status of DBP plans across companies. This situation arises as a plan's apparently favourable reported funded status may itself

reflect a company's choice of assumptions. We introduce such standardisation to UK data, which previous research has not done, and demonstrate the importance of this in contrasting regression results obtained using the reported versus the standardised funded status. Further, the standardised measure of a DBP plan's liabilities which we derive incorporates price inflation assumptions in addition to the discount rate and salary inflation assumptions used by previous researchers.

Our findings have important implications for accounting regulators seeking to eliminate balance sheet management and encourage more transparent and comparable reporting practices. Financial reporting regulations are influential in determining both the absolute size of reported DBP deficits and companies' response to them (Kiosse and Peasnell 2009). The 'magic telescope' may influence how companies manage their pension deficits by closing plans to new entrants, limiting pensionable salaries, raising retirement ages or curtailing benefits by ceasing future accrual of pension benefits for existing plan members (Klumpes et al. 2009). Indeed, most companies have already taken such steps (Office for National Statistics, 2014).

These wider economic consequences of accounting practice are particularly important in the UK, where DBP plans remain significant in economic and financial terms for the sponsoring companies, investors, employees, and other stakeholders. In mid-2015, the pension liabilities of FTSE 100 companies were estimated at £553 billion and their pension assets at £528 billion, with the companies' contributions to these plans equalling £12.5 billion during 2014 (Lane Clark and Peacock 2015, p. 6). Additionally, at their 2014 financial year-end 63 out of the 87 constituents of the FTSE 100 with a DBP plan reported deficits, with six companies having pension

liabilities exceeding their market capitalisation, and 38 companies reporting pension assets of less than 90% of pension liabilities (Lane Clark and Peacock 2015, pp. 18, 41). When a company becomes insolvent its DBP plan assets are transferred to the Pension Protection Fund, the pension liabilities of which have increased from £4 billion in 2009 to £18 billion in 2015 (Pension Protection Fund 2009, 2015).

Understanding the significance of pension liabilities and plan deficits poses difficulties for investors (see, for example: Coronado and Sharpe 2003; Picconi 2006; Coronado et al. 2008). Glaum (2009) surveyed the wider literature on the 'credit-' and 'value-relevance' of pension accounting, and subsequent papers confirm its importance to UK companies: McKillop and Pogue (2011) found that pension plans' financial position is value-relevant and factored into credit ratings; and Liu and Tonks (2013) found evidence that higher company contributions to pension plans 'crowd out' dividends or reinvestment.

The remainder of the paper is structured as follows. We first outline the academic evidence on the management of reported pension liability values arising from the selection of key actuarial assumptions. The following section provides the regulatory background on accounting for pensions, paying particular attention to the extent of discretion available under IAS 19 in the choice of assumptions. We then use this preceding discussion to frame the hypotheses we wish to test before describing our methodology and how we derive our standardised measures of DBP plan financial strength. Details of the data set are included in the next section, followed by the reporting and discussion of our results. The paper concludes with a consideration of the implications of our findings for accounting regulators, and opportunities for future research.

2. Management discretion and pension accounting numbers – academic evidence

We now consider the academic evidence regarding the use of management discretion in the valuation of pension liabilities.

US evidence supports the notion that managers exercise 'opportunistic' (Glaum, 2009, p. 293) discretion in their selection of the assumptions that underpin the accounting for pension plans. Blankley and Swanson (1995) found evidence that discount rate changes lagged changes in bond yields, leading to underestimation of the value of future liabilities. Ghicas (1990) found that companies attempting to reduce contributions to their pension plan increased the discount rate and then changed their choice of actuarial method to further reduce liabilities. A survey by Klumpes (2001) concluded that management of the reported figures increased following adoption of SFAS 87. This standard imposed restrictions on assumptions about discount rates and the expected rates of return on plan assets, but allowed for the exercise of choice over other assumptions, including mortality, length of working life of plan members and projected rates of salary growth. Some researchers using US data (Amir and Benartzi 1998; Bergstresser et al. 2006; Comprix and Muller 2006; Asthana 2008) found evidence of management discretion in the choice of the assumed rate of return on pension assets, which impacts on reported earnings rather than the valuation of liabilities. Bias in assumptions in the US was found to be lower after the Sarbanes-Oxley Act (Comprix and Muller 2011). These issues are not specific to private sector companies: Eaton and Nofsinger (2004) observed that US public sector pension

plans vary assumptions in order to manage pension costs, with reference to political pressure and financial constraints. In contrast, Naughton et al. (2015) found that assumptions used to value the liabilities of a US state's pension plans depended on the financial well-being of the state.

Some studies of US companies have found that where plans are poorly funded assumptions tend to be less conservative, resulting in lower liability valuations. A survey by Thies and Sturrock (1988) found that companies with weak plans tended to use higher discount rates, and Gopalakrishnan and Sugrue (1995) found companies also used low salary growth assumptions. Godwin (1999) found that companies with plans where assets were low relative to liabilities used less conservative discount rate assumptions and that, when the Securities and Exchange Commission tightened specifications on how the discount rate was to be determined, companies responded by lowering their assumptions about future salary inflation. Asthana's (1999) study found that companies with well-funded plans applied more conservative assumptions than those with underfunded plans.

Some US results also suggest that managerial discretion is greater where the pension plan financial position is important relative to company size. Feldstein and Mørck (1983) reported that the discount rate was higher where the pension plan deficit was large in relation to the company's assets. Bodie et al. (1987) similarly found that companies where the deficit exceeded 30% of the market value of equity chose a higher discount rate than others.

Using US cross-section data from 1980, Bodie et al. (1987) found that less profitable companies tended to use relatively high discount rates, thus lowering reported pension liabilities. Godwin et al. (1997) used US data from 1981-83 and found companies were likely to increase the discount rate in response to declines in profits, increasingly restrictive dividend constraints and tightening debt covenants. In other words, managers used their discretion to choose assumptions that would produce an outcome that mitigated less favourable aspects of financial performance. Asthana (1999) found that companies made more conservative assumptions if they were more profitable, had higher cash flows from operations, or had a low level of debt.

Several authors have recognised the problem that the funding ratio (i.e. pension assets divided by pension liabilities) is influenced by the choice of discount rate. Companies' reported pension liabilities therefore need to be adjusted to a common basis to uncover the underlying relationship (Feldstein and Mørck 1983; Bodie et al. 1987; Francis and Reiter 1987; Gopalakrishman and Sugrue 1995; Carroll and Niehaus 1998; and Godwin 1999). Asthana (1999) and Hann et al. (2007) go further and also adjust for differences in companies' salary inflation assumptions.

We conclude from the US evidence that significant discretion is available to companies in the valuation of pension liabilities, and that there are systematic factors relevant to companies' choice of assumptions. In particular, the funded status of plans and the financial position of plans relative to company size appear to be relevant, while other factors such as profitability also play a part. It is reasonable to expect that such findings may also be relevant to UK plans, although this cannot be assumed

given the differences between the US and UK in pension provision and the regulatory and legal framework.

Three papers on UK practice produced some contrasting results from the US research. Sweeting (2011) examined FTSE 100 non-financial companies reporting under SSAP 24 over 1989-2005. He found no relationship between funding ratio and choice of discount rate, but concluded that large companies, measured by assets, used high discount rates. Li and Klumpes (2013) analysed the discount rate used by FTSE 350 companies reporting under SSAP 24 over 1998-2002 and concluded that high discount rates were associated with highly-leveraged companies and weakly-funded pension plans. Byrne et al. (2007) studied assumptions used by FTSE 350 companies reporting under FRS 17 over 2001-04 when calculations of assets and liabilities were similar to those under IAS 19; they found that companies with well-funded plans tended to use high discount rates. Larger companies, measured by market capitalisation, tended to use lower discount rates, which differs from the conclusion of the papers studying SSAP 24 (using assets as their proxy for size). This is, however, consistent with Ghicas's (1990) view, using US data, that large companies will use methods that decrease income and assets, to avoid attracting attention from regulators and politicians. However, none of the three UK papers standardised the value of pension liabilities to reflect their dependence on the assumptions made.

A complementary stream of research has used computer simulation models to test the scope for income smoothing as a result of changes in actuarial assumptions (see, for example, Amen 2007; and Morrill et al. 2009). More recently, a study has used simulation analysis to evaluate the relationship between accounting versus

economic measures of a company's pension liability in response to changes in the assumed discount rate (Klumpes, 2010). These simulation studies all indicate the sensitivity of the pension liability estimation to actuarial assumptions. They therefore confirm the findings of the empirical literature - that simplifying the funded status of a DBP plan into a single number creates uncertainty, and provides opportunities for the exercise of managerial discretion in the estimation process.

In his survey of pension accounting, Glaum (2009, p. 293) concluded that the evidence to date indicates that 'managers have scope for discretion, in particular, when setting assumptions. Findings from both US and UK research suggest that managers exercise this discretion in opportunistic ways'. Equivalent academic research evidence on pension reporting practice under IFRS is, however, lacking and the UK provides a setting in which to examine this gap in the literature. First, however, it is necessary to consider the extent to which IAS regulations offer scope for the exercise of discretion in the selection of assumptions.

3. Regulatory Background

In the UK in 2000 the Accounting Standards Board (ASB) introduced FRS 17, which required balance sheet recognition of the funded status of pension plans, although an extended transitional period allowed companies to defer full implementation until 2005. From January 2005, pension reporting by listed groups in the European Union has been regulated by IAS 19 (IASB 2004), which requires companies to recognise the funded status of their pension plans on the balance sheet or disclose this information in the notes to the financial statements.

The determination of the value of DBP liabilities is heavily dependent on four key assumptions – discount rate, price inflation, salary inflation and mortality rates – which are selected by management on the basis of expert actuarial advice. IAS 19 (IASB 2004, para. 73) described these assumptions as 'an entity's best estimates of the variables that will determine the ultimate cost of providing post-employment benefits'. IAS 19 required companies to disclose the principal assumptions used, including, where applicable, the discount rate, increases in an index that is the basis for pension increases (we regard price inflation as covered by this), salary increases, and any other material actuarial assumptions used. There was no explicit mention of mortality rates, which we would ordinarily regard as material, and disclosure of this assumption has been variable (O'Brien et al. 2010). For accounting periods beginning on or after 1 January 2013 a revised version of IAS 19 requires disclosure of 'significant actuarial assumptions' (IASB 2011, para. 144), although discretion will continue to apply in their selection (see later discussion).

DBP liabilities represent future cash flows and a discount rate is therefore required to derive their present value. The extended time horizon associated with such liabilities means that even small variations in the assumed discount rate can lead to significant changes in their present value. The ASB (2007, p. 17) gave an example of a 0.5% change in discount rate changing liabilities by 9.5%, a figure which may reflect the typical characteristics of a UK plan. Variation in the discount rate therefore represents a potential tool for the management of reported liabilities.

We take the view that IAS 19 constrains, but does not eliminate, the exercise of discretion in the selection of the discount rate. The future benefits are at a discount

which ‘reflects the time value of money but not the actuarial or investment risk’ nor the entity-specific credit risk (IASB, 2012). This carries forward the requirement of the previous version of IAS 19 (IASB 2004, para. 78) that the discount rate should be determined with reference to the market yields on ‘high quality’, low risk corporate bonds, which, while not defined, are typically interpreted to mean AA-rated bonds. In principle, this should constrain variability in discount rate assumptions, but the variation in yields on AA-rated bonds over time leaves scope for the exercise of some discretion in selecting the discount rate. For example, at the end of 2011 the range of discount rates used by companies was narrow, with over 80% of FTSE 100 companies using a rate of 4.7-4.9% (Lane Clark and Peacock 2012, p. 53). In contrast, for FTSE 100 companies reporting at 31 December 2008, in the midst of the financial crisis when bond yields were volatile, Lane Clark and Peacock (2009, p. 36) indicated that discount rates ranged from 5.6%-6.75%. They argued that IAS 19 therefore ‘fails a key test of an accounting standard; it no longer allows users of accounts to make a meaningful comparison between the pension plans of two companies, even those reporting at the same date’ (Lane Clark and Peacock 2009, p. 10).

US evidence also indicates the potential for differences in reported discount rates. D’Souza (1998) investigated health benefit costs in electric utility companies and suggested that the requirement of the Financial Accounting Standards Board that the choice of discount rate be linked to the long-term yield on high-quality securities restricted variability in discount rates chosen. Nevertheless, Grant et al. (2007, p. 28) found that a sample of 81 S & P 100 companies used discount rates for pension liabilities ranging from 5.5% to 6.3% in 2004, with such differences having a material impact on the size of the reported liabilities.

The assumption about future price inflation is important as pension liabilities rise with price inflation. UK pension law requires that payments to DBP plan beneficiaries be inflation-linked, although plan rules may cap inflation adjustments. It is also reasonable to expect that the assumed rate of price inflation will influence the company's assumed rate of salary inflation. IAS 19 requires the price inflation assumption, as a financial assumption, to be based on market expectations (IASB 2004, para. 77). FRS 17 suggested an approach which estimates inflation to be the difference between the yields on long-dated inflation-linked bonds and fixed-interest bonds of a similar credit rating. Although IAS 19 does not specifically mention this approach to determining the inflation assumption, UK companies, accustomed to FRS 17, would consider such an approach that, if used, should constrain the exercise of discretion.

Defined benefit liabilities to current employees will increase as their salaries rise, so the salary inflation assumption is an important element in the liability valuation. IAS 19 indicates that '[e]stimates of future salary increases [should] take account of inflation, seniority, promotion and other relevant factors, such as supply and demand in the employment market' (IASB 2004, para. 84). Companies operate in different sectors where labour market conditions vary, and it is therefore possible that salary assumptions may be wide-ranging for justifiable reasons. In practice, however, the imprecision of the standard renders it difficult to evaluate the validity of a company's chosen assumption, thus granting substantial discretion.

Mortality rate assumptions are essential for estimating future pension payments - the longer DBP plan beneficiaries live, the greater plan liabilities will be. Companies determine such assumptions using mortality tables, but may adjust them to reflect their own circumstances. For example, it is known that mortality rates differ between manual and non-manual workers (Johnson 2011), between different geographical regions (Office for National Statistics 2011), and between birth cohorts (Willetts 2004). There has been concern that companies' mortality assumptions may not be up-to-date, failing to reflect increases in life expectancy (Pensions Regulator 2006; Club Vita 2011). This suggests scope for management in the valuation of DBP liabilities, but we exclude this assumption from our empirical analysis as many companies fail to disclose their mortality assumptions over the period of our study. Additionally, inter-company differences in assumptions may be due to different occupational mixes. An external observer is therefore unable to differentiate between genuine versus discretionary inter-company differences in assumptions.

The four assumptions discussed above interact to determine the present value of a company's future pension liabilities, but we have noted differences in the scope for discretion in their selection. This analysis complements the evidence discussed earlier and provides the structure for analysing the issues to be discussed in the next section.

We mention one other regulatory issue; the trustees of each UK DBP must arrange an actuarial valuation of plan assets and liabilities to assess plan solvency in accordance the Pensions Regulator's rules, which allow the trustees to exercise discretion in their choice of assumptions in a way rather different from IAS 19. We do not investigate the exercise of discretion in the solvency assessment

valuation, although we acknowledge that such valuations may affect the management of plans (Klumpes and Whittington 2003).

4. Hypotheses

In this section we set out our hypotheses and their rationale. As argued above, IAS 19 differs in its strength of guidance on the choice of different assumptions. The discount rate has to reflect the yield on high-grade corporate bonds, and the price inflation rate would be expected to be based on the difference between the yields on fixed rate and index-linked bonds. In contrast, the rate of salary inflation assumption offers greater scope for flexibility. This suggests that companies have more discretion regarding this assumption, which will be reflected in greater variability, and provides the basis for our first hypothesis:

H1: Salary inflation assumptions vary more widely between companies than assumptions about the discount rate or price inflation.

The evidence summarised earlier suggests that companies may adjust their assumptions in response to the financial positions of their DBP plans, both in relation to the size of the plan and the market value of the company. Two indicators appear relevant. First, as found by Thies and Sturrock (1988) and other authors as referred to in section 2, is the funding ratio of the plan. This is the assets divided by liabilities, which we adjust to a common basis, enabling us to derive a plan's 'standardised funding ratio' (SFR, discussed further in section5). Second, we consider the importance of the plan's financial position for the company as a whole, as referred to

by Feldstein and Mørck (1983) and Bodie et al. (1987). We therefore calculate the plan surplus or deficit (assets minus liabilities) divided by the company's market capitalisation, and refer to this as the 'standardised solvency ratio' (SSR, also discussed further below). In each case, a relatively weak ratio may lead the company to choose assumptions which improve the ratio by reducing reported liabilities i.e. less conservative assumptions for the discount rate, price and salary inflation (respectively higher, lower and lower). Hence our hypotheses are:

H2: Companies where the pension plan has a relatively low standardised funding ratio tend to choose less conservative assumptions.
H3: Companies where the standardised solvency ratio is relatively low tend to use less conservative assumptions.

5. Methodology

We test hypothesis 1 by using difference in means and variance tests. In particular, the F-test is appropriate for testing whether the difference in standard deviations is significant. For hypotheses 2 and 3, our tests use six standard regression equations, in order to test whether companies' assumptions are related to the financial ratios as suggested. The dependent variables are the discount rate, price inflation and salary inflation assumptions and the independent variables are the funding ratio (either reported or 'standardised', as explained in section 5) and the SSR.

We include a number of control variables in the regressions (see Appendix for full definitions). First we note that IAS 19 identifies duration as relevant to selection of the term used to determine the discount rate. Similarly, the company's assumptions of

price inflation and salary inflation also depend on how far in the future are the liability cash flows. Few previous researchers have attempted to include duration as a control variable (Li and Klumpes 2013 is an exception), and a hindrance is that companies in this period were not required to disclose duration and rarely did. Our approach is to recognise that immature plans will have a higher duration than mature plans. We therefore include a proxy for immaturity of liabilities as a control variable: the ratio of the year-end plan liabilities to the cash benefits paid in the year (Liabs/Pmts).

The second control variable (pensions income effect or PIE) captures the impact of the pension plan on company income. IAS 19 offers companies the ability to exercise discretion in both the selection of assumptions and the treatment of actuarial gains and losses, which arise, for example, from changes in assumptions or when assumptions are not realised. Such gains and losses may be recognised immediately in the income statement or through other comprehensive income (i.e. the statement of recognised gains and losses (STRGL) in the case of our sample companies), or deferred and amortised subject to the rules applying to the 'corridor' method (IASB 2004, para. 95). Companies may therefore be able to manage the pension plan impact on the income statement. We therefore define PIE as the aggregate of pension-related entries to the income statement and actuarial gains and losses dealt with through the STRGL.

We also include three control variables following the work of Asthana (1999), who found that assumptions were less conservative if the company was making a high level of contributions to the plan, implying that the plan was a significant burden to the company or it was under financial pressure, as reflected in a high level of debt, poor cash flow and low profitability. We exclude cash flow as this was highly

correlated with profitability, meaning that we use contribution ratio, debt ratio and operating profits ratio. Finally, we include month dummies for each of the months in 2005 to 2009 to control for month-specific effects.

The standard regression equation we test in six different forms, omitting the month dummies for ease of presentation, is as follows:

$$\text{Assumption}_{it} = \beta_0 + \beta_1 \text{FR}_{it} + \beta_2 \text{SSR}_{it} + \beta_3 \text{Liabs}_{it}/\text{Pmts}_{it} + \beta_4 \text{PIE}_{it} + \beta_5 \text{Cont}_{it} + \beta_6 \text{Debt}_{it} + \beta_7 \text{OP}_{it} + \varepsilon_{it}$$

Where:

Assumption is either the discount rate assumption, the price inflation assumption or the salary inflation assumption; FR is one of two measures of funding ratio, either reported or 'standardised'; SSR is the standardised solvency ratio; Liabs/Pmts is the control for immaturity; PIE captures the pensions income effect; Cont is the contribution ratio; Debt is the debt ratio; and OP represents the operating profits ratio. ε represents the error term of the regression. The subscripts *i* and *t* represent company and time period respectively. Full definitions of the variables are in the Appendix.

Our estimation strategy addresses two econometric issues of interest in the above regression equation. First, as we have a panel data set, we need to control for the unobserved heterogeneity normally present when there are different companies with potentially different characteristics. Second, as the three equations of interest for each measure of funding ratio share the same right hand side variables, we need to consider the possibility that the individual equations are related through their error terms. This could arise because a company considers jointly whether to make changes

in its discount rate, salary inflation and price inflation assumptions. We therefore use the Seemingly Unrelated Regression method developed by Zellner (1962), after first-differencing all the variables in the equations to address the concern of unobserved heterogeneity.

As discussed previously, several authors have adjusted reported pension liabilities to an estimate of what they would have been had a common discount rate been used, while Asthana (1999) used an indirect method to adjust for companies' discount rates and salary inflation assumptions. We extend these approaches by standardising for all three assumptions – the discount rate, price inflation and salary inflation.

The reported funding ratio (RFR) of a company's pension obligations is the ratio of its reported DBP assets to its reported DBP liabilities. The use of fair values in accordance with IAS19 ensures that pension assets are measured on a common basis, which for many assets will be market value. As already indicated, however, the RFR reflects the assumptions made by companies in valuing their pension liabilities, and is thus 'distorted' by this self-selection process. We therefore adjust reported pension liabilities to eliminate the impact of variations in assumptions on the liability measure. The standardised value of liabilities, which we use in our SFR and SSR measures, is derived by adjusting the reported liability figure for each company to what we estimate it would have been had the company used the average assumption for all companies reporting in the same month. This methodology refines the approach of other authors (for example, Hann et al. 2007), who adjusted to averages for all companies reporting in a given year, which we regard as less satisfactory in periods subject to considerable variation in financial conditions.

The adjustment back to average is made by assuming sensitivity levels as illustrated by the ASB (2007, p. 17). For example, ceteris paribus, a 0.5 % increase in assumed discount rate, price inflation, and salary inflation will lead to a 9.5% decrease, a 5.5% increase and a 3% increase in liabilities respectively. This approach assumes a uniformity of sensitivity to assumption changes across all plans, and whilst we acknowledge that plans have different characteristics and so the impact of different assumptions will not be uniform, we expect these standardisation factors to be satisfactory for this purpose. Unlike Hann et al. (2007), we do not use averages that are industry-specific, as (at least for the discount rate and price inflation assumptions) we would not expect industry-specific features to markedly affect what are essentially financial assumptions.

6. Data source, variables and summary statistics

6.1 Data set and variables

Our data are drawn from an extensive proprietary data set provided by Towers Watson, a leading firm of consulting actuaries. This data set was compiled from publicly-available sources (i.e. published financial statements), and should therefore be reproducible. It is an unbalanced panel of listed companies in the FTSE 350 index with DBP plans and balance sheet dates from December 2005 to December 2009 inclusive. We excluded companies whose plans related mainly or wholly to non-UK liabilities. The number of companies in the data set therefore varies by year, and the composition of the data set also reflects changes in the FTSE 350 as companies joined and left the index.

We analysed the companies' IAS 19 disclosures of their assumptions for discount rates, price inflation and salary inflation. We omitted from the analysis three companies, which were the only companies to report in a particular month. We also omitted the salary inflation assumptions for eleven companies after they introduced a limit on the salary growth qualifying for pension purposes (the company's assumptions in such cases therefore depended on the plan rules rather than the normal exercise of discretion). Where a range of figures for an assumption was reported, we used the mid-point, consistent with the approach used by the consulting actuaries Lane Clark and Peacock (various years) in their annual analyses of trends in companies' assumptions.

6.2 Summary statistics

Table 1 provides descriptive data on the discount rate, price inflation, and salary inflation assumptions observed across the sample. The data show that there are ranges of values for all three assumptions, with the greatest spread relating to the assumed rates of salary inflation. The last three columns of the table report the absolute value of year-on-year changes in the assumptions. The means and standard deviations indicate that there are substantial variations in the values of the assumptions across companies and years, and the t-tests confirm that the means of the absolute values of the changes are significantly different from zero. We address the extent of variation in the assumptions in more depth below, and these statistics confirm existing research findings of a lack of uniformity and hence the possibility that discretion is exercised in the selection of assumptions.

INSERT TABLE 1 HERE

7. Results and discussion

In testing hypothesis 1, we take into account that the assumed discount rate, price inflation and salary inflation depend on market conditions, which change over time. We therefore test the variability of these assumptions for companies with a common balance sheet date, using the most popular date of 31 December. Table 2 shows the results. We use the F-test for differences in the standard deviations (SDs), comparing the ratio of the SD for salary inflation to the SD for each of the discount rate and price inflation. We find that, in each year, the ratio exceeds two and that F has a p-value of 0.0000 on each occasion, i.e. highly significant. These findings are consistent with hypothesis 1, confirming greater variation in salary inflation than the other assumptions.

INSERT TABLE 2 HERE

Table 3 summarises the data used in testing hypotheses 2 and 3 and the correlations between the variables are in Table 4. The results of the regressions are in Table 5. We note from Table 3 that the average funding ratio on both a reported and standardised basis is less than 1, showing that DBP plans tend to be under-funded on both measures. The minimum and maximum values for these ratios indicate considerable variation in funding levels, although the means and standard deviations of the ratios are very similar for the sample as a whole.

INSERT TABLES 3, 4, 5 HERE

The results confirm hypotheses 2 and 3. Companies where the pension plan is relatively weak, measured by the SFR, tend to use less conservative assumptions, i.e.

a high discount rate and low price inflation and salary inflation assumptions, each of which reduce reported liabilities (Table 5, models (1) to (3)). All three regressions showed a significant finding at the 1% level for all of the discount rate, price inflation and salary inflation. Similarly, in confirming hypothesis 3 we found that the SSR was statistically significant at the 1% level in explaining the discount rate and at 10% in explaining the salary inflation assumption. We conclude that companies tended to use less conservative assumptions where there was a pension plan deficit which on a standardised basis was large relative to market capitalisation. Given that pension deficits constitute a form of corporate debt, such 'managed' understatement of liabilities has potential implications for the (in-) accuracy of a company's credit rating.

In relation to the control variables, we find no significance in either the immaturity of the DBP plan or the effect of the plan on the company's income statement. This confirms the work of Li and Klumpes (2013) who used a different approach to duration; this suggests that further work in this area would be useful. Other company-specific control variables are not significant, contrary to the US findings of Asthana (1999). We suggest this may reflect differences between the UK and US markets and pension regulations. For example, the UK does not have the rules that the US has on employer contributions, which may explain why we do not find contribution ratio significant. Many of the month dummies (which we do not report) are, however, significant, which is not surprising, given the changes in financial conditions that were taking place.

The contrast between using the SFR and the RFR in our regressions is striking. Table 5 model (1) indicates that companies with a high SFR tend to use a low discount rate, whereas model (4) shows the reverse: companies with high RFRs appear to use high discount rates, with this evidence being statistically significant at the 1% level. But the RFR result masks the potential endogeneity problem that high discount rates lead to low reported liabilities and high RFRs. None of the previous UK papers used standardised ratios, and they found contrasting results: Byrne et al. (2007) found that companies with high discount rates reported stronger funding positions; Sweeting (2011) found no evidence of a link between funding position and choice of discount rate; and Li and Klumpes (2013) found that companies with weaker pension plans used higher rates. Table 5 also shows that the results for the price inflation and salary inflation assumptions are reversed when using SFR and RFR.

In order to explore further the degree of variation in assumptions, and exercise of managerial discretion, we categorise those companies reporting at a 31 December 2009 balance sheet date as having either 'low' (below median) or 'high' (above median) RFRs, SFRs and SSRs. We then use t-tests to establish whether the means of each of the discount rate, price inflation and salary inflation differ between the low and high groups. The results are shown in Table 6.

INSERT TABLE 6 HERE

We find that, compared to companies with high SFRs, those with low SFRs tend to use significantly lower price and salary inflation assumptions and higher discount rates. These choices tend to reduce the reported liabilities and increase RFRs. The analysis also shows significant differences in assumptions chosen by companies with

low versus high SSRs. However, if we were to compare companies with low and high RFRs (compared with the median), the differences in assumptions would not appear significant. Once again, this demonstrates the importance of standardisation of pension plan liabilities.

Our analysis shows that the greatest difference between companies is in the choice of salary inflation assumption, which supports our hypothesis that this is most open to the exercise of managerial discretion. But it is possible that companies with low salary inflation assumptions face labour market conditions which support such assumptions. It could be argued, for example, that companies with weaker pension plans seek to restrain future salary increases in order to limit liabilities, justifying assumptions of lower salary growth, although staffing issues may constrain such behaviour. Our finding (using the SFR, Table 5 model (3)) that companies' debt ratios and profitability are not significant determinants of the salary inflation assumption suggests that, consistent with prior evidence, there is a case for the interpretation that there is some 'opportunistic' selection of assumptions to take advantage of the discretionary scope offered by IAS 19.

To test the robustness of our results we use alternative standardisation factors, which are those found in a report which examined disclosures by FTSE 100 companies in 2009. This found that a 0.5% change in the discount rate, price inflation and salary inflation assumptions was associated with median changes in liabilities of 8.5%, 6.2% and 1.6% respectively (O'Brien et al. 2010, p. 31). These are the sensitivities for large companies and one year only, but provide a useful set of alternative standardisation factors. Table 7 summarises our results; we report only the signs and

levels of significance for the independent variables SFR and SSR. There are some differences in the significance levels compared with the findings in Table 5, but the signs remain consistent throughout. We therefore demonstrate that our overall conclusions are robust to the use of alternative standardisation factors.

INSERT TABLE 7 HERE

Various papers (Byrne et al. 2007, Sweeting 2011, and Li and Klumpes 2013 using UK data; Feldstein and Mørck 1983, and Bodie et al. 1987 using US data) included company size as an explanatory variable in determining assumptions. We therefore tested alternative measures of company size (assets, equity, number of employees), but none were significant and we do not report these results.

8. Conclusions

The aim of this paper was to investigate whether managers apply a 'magic telescope' to DBP liability valuations in the UK by testing for systematic differences in companies' choices of assumptions. Using multiple regression analysis on data for a panel of FTSE 350 companies reporting under IAS 19 over 2005-09 we found evidence that some companies appear to exercise discretion in a manner which reduces reported pension liabilities consistent with our hypotheses.

Our findings contribute to the literature by extending the non-US research base and providing new insights into pension reporting practice under IAS 19 in the UK. We are unable to confirm US research results which suggest that the assumptions underpinning the liability valuation are linked to a company's finances (profitability and debt) and plan contributions. The differing US versus UK results may reflect

country by country variations in pension provision and funding, accounting rules and corporate law, suggesting that country-specific research in this area is important.

We do, however, confirm US evidence (Feldstein and Mørck 1983; Bodie et al. 1987; Thies and Sturrock 1988; Godwin 1999; Asthana 1999) that assumptions are influenced by the funding position of a company's DBP plans, and plan size relative to the company's market capitalisation. Comparing the degree of variation in companies' choices across three financial assumptions rather than the two - discount rate and salary inflation - that characterise the US literature, we find greatest variation in the assumptions for salary inflation, the selection of which is most flexible under IAS 19. This suggests that less prescriptive regulations may encourage selectivity in the choice of assumptions.

If the International Accounting Standards Board aims to move to a more 'principles-based' approach to standard-setting, this increases the role of professional judgment and potentially provides greater scope for the 'management' of reported results (Wüstemann and Wüstemann 2010). Such management may be limited through the design of standards or through the issue of International Financial Reporting Standard Interpretations (IFRICs).

In view of the scope for less prescriptive regulation to encourage selective management of the pension liability value, one possible response could be for the IASB to provide more explicit guidance in IAS 19 on acceptable assumptions. However, variable economic conditions across the range of countries adopting IFRS, and specific company DBP plan rules may make a regulator-imposed assumption

inappropriate. We therefore suggest that standard-setters focus on ensuring that users can understand companies' assumptions and their significance. For example, national authorities could consider defining benchmarks, such as the government bond yield for the duration of the plan, and encourage or require companies to disclose this in addition to the discount rate used. They could also consider the scope to prescribe disclosure formats for mortality assumptions in order to facilitate comparability.

Another possibility, also designed to increase understandability, would be to encourage companies to be more precise in justifying their choice of assumptions. To the extent that companies fail to do so, and use varying assumptions, it is open to analysts to make adjustments such as those used in this paper to produce standardised measures. Such calculations should be easier under the revised version of IAS 19, effective from 2013, which requires companies to report the sensitivities of their liabilities to 'reasonably possible' changes in 'each significant assumption' (IASB 2011, para. 145). The revised standard also requires disclosure of the duration of DBP plan liabilities, which means that the effect of plan duration can be investigated without the use of proxies as we and other researchers have had to do. Users of financial statements may then be able to overcome any 'illusion of certainty' (Blake et al. 2008) which allows liability values to be managed downwards.

Accounting for pensions remains problematic and our work indicates several areas for future research. Firstly, there is scope to assess whether the revised IAS 19 impacts on the exercise of discretion in the choice of assumptions. Secondly, further analysis of mortality assumptions may be possible as overall disclosures in this area should increase under the revised standard. Thirdly, it will be important to assess the effects

on assumptions of changes such as the use of the Consumer Prices Index as the basis for indexation, the closure of DBP plans, the capping of pensionable salaries, and the post-crisis financial environment with persistent low interest rates. Finally, given the country-specific application of IAS 19, it would be interesting to see whether comparable research in countries other than the UK generates similar findings.

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Appendix: Variable definitions

Variables	Definitions
Discount rate (DR)	The discount rate reported by the company in valuing its pension liabilities
Price inflation (PI)	The price inflation assumption used by the company in valuing its pension liabilities
Salary inflation (SI)	The salary inflation assumption used by the company in valuing its pension liabilities
Reported funding ratio (RFR)	The assets of the company's pension plan divided by the liabilities of the pension plan as reported
Standardised funding ratio (SFR)	The assets of the company's pension plan divided by the standardised liabilities (liabilities of the pension plan as reported, adjusted to a standardised basis)
Standardised solvency ratio (SSR)	The assets minus the standardised liabilities of the company's pension plan, divided by the company's market capitalisation
Liabilities/Payments (Liabs/Pmts)	Natural log of reported pension liabilities at the beginning of the year divided by benefits paid during the year
Pensions income effect (PIE)	The aggregate of pension plan entries to the income statement and the statement of recognised gains and losses, divided by book value of equity
Contribution ratio (Cont)	Company's pension plan contributions divided by reported pension plan liabilities
Debt ratio (Debt)	Company's debt divided by book value of equity
Operating profit ratio (OP)	Company's operating profit divided by book value of equity

Table 1. Summary of data – discount rate, price inflation and salary inflation assumptions.

							Absolute value of year-on-year change	
Year	Assumption	Observations	Mean	Std. Dev	Minimum	Maximum	Mean	Std. Dev	t-stat
2005	Discount rate	128	4.808	0.145	4.475	5.750			
	Price inflation	109	2.766	0.126	2.250	3.000			
	Salary inflation	125	4.082	0.501	2.850	5.600			
2006	Discount rate	247	5.064	0.177	3.950	5.900	0.331	0.104	34.780***
	Price inflation	222	2.947	0.141	2.375	3.400	0.223	0.090	24.525***
	Salary inflation	236	4.187	0.574	2.000	6.100	0.276	0.252	11.583***
2007	Discount rate	231	5.628	0.264	4.900	6.900	0.558	0.182	44.552***
	Price inflation	209	3.232	0.254	2.600	5.800	0.279	0.118	32.555***
	Salary inflation	217	4.421	0.664	2.000	6.500	0.308	0.254	17.223***
2008	Discount rate	207	6.325	0.343	5.100	7.300	0.705	0.385	25.196***
	Price inflation	190	3.216	0.437	2.500	5.600	0.448	0.233	25.189***
	Salary inflation	190	4.356	0.761	2.000	7.300	0.460	0.347	17.586***
2009	Discount rate	200	6.022	0.483	5.290	7.200	0.511	0.329	20.594***
	Price inflation	189	3.369	0.319	2.000	3.900	0.586	0.281	26.868***
	Salary inflation	179	4.309	0.734	2.000	6.500	0.629	0.429	18.315***

Notes: *** indicates significance at the 1% level. The t-statistic indicates whether the mean value differs significantly from zero.

Table 2. Variability of assumptions for companies with 31 December year-ends only.

Year	Assumption	Observations	Mean	Std. Dev	Variability Factor	F-Statistic
2005	Discount rate	128	4.808	0.145	3.445	11.865***
	Price inflation	109	2.766	0.126	3.965	15.718***
	Salary inflation	125	4.082	0.501		
2006	Discount rate	133	5.117	0.150	3.562	12.685***
	Price inflation	117	2.991	0.123	4.346	18.884***
	Salary inflation	124	4.245	0.535		
2007	Discount rate	127	5.768	0.183	3.527	12.437***
	Price inflation	116	3.330	0.275	2.345	5.501***
	Salary inflation	117	4.510	0.645		
2008	Discount rate	110	6.223	0.282	2.343	5.487***
	Price inflation	102	2.887	0.184	3.588	12.876***
	Salary inflation	100	4.046	0.661		
2009	Discount rate	106	5.690	0.086	8.184	66.975***
	Price inflation	100	3.538	0.244	2.886	8.328***
	Salary inflation	95	4.544	0.705		

Notes: *** indicates significance at the 1% level. The variability factor is the ratio of the standard deviation of the salary inflation assumption to that for the discount rate or price inflation. The F-statistic indicates whether the variability factor differs significantly from one.

Table 3. Summary statistics for independent variables used in regressions.

Variables	Observations	Mean	Std. Dev.	Minimum	Maximum
Reported funding ratio	1016	0.884	0.140	0.234	1.605
Standardised funding ratio	858	0.888	0.141	0.230	1.493
Standardised solvency ratio	833	-0.059	0.151	-2.180	0.602
Liabilities/Payments	987	34.063	26.993	4.927	466.882
Pensions income effect	1009	0.020	2.105	-45.923	30.136
Contribution ratio	979	0.047	0.049	0.001	0.597
Debt ratio	1157	0.749	11.349	-224.234	97.937
Operating profit ratio	1385	0.119	2.866	-67.163	18.000

See Appendix for definition of variables.

Table 4. Pairwise correlation coefficients.

	Reported funding ratio	Standardized funding ratio	Standardized solvency ratio	Liabilities/ Payments	Pensions income effect	Contribution ratio	Debt ratio	Operating profit ratio
Discount rate	0.225***	0.147***	-0.090***	-0.142***	-0.019	-0.109***	-0.014	-0.019
Price inflation	0.162***	0.247***	0.138***	-0.016	0.037	-0.046	-0.034	-0.006
Salary inflation	0.022	0.252***	0.239***	0.107***	0.050	0.055*	-0.042	-0.014
Reported funding ratio	1.000	0.931***	0.272***	-0.103***	-0.003	0.024	0.010	0.014
Standardised funding ratio		1.000	0.368***	-0.015	0.003	0.033	-0.025	-0.011
Standardised solvency ratio			1.000	0.138***	0.187***	0.083**	-0.072**	-0.038
Liabilities/Payments				1.000	0.027	0.181***	0.011	-0.015
Pension income effect					1.000	0.025	-0.449***	-0.274***
Contribution ratio						1.000	0.019	0.003
Debt ratio							1.000	0.811***
Operating profit ratio								1.000

Notes: ***, **, * indicate significance at the 1%, 5%, 10% level respectively. The variability factor is the ratio of the standard deviation of the salary inflation assumption to that for the discount rate or price inflation. The F-statistic indicates whether the variability factor differs significantly from one.

Table 5. Seemingly Unrelated Regression results.

		Models using standardised funding ratio			Models using reported funding ratio		
		(1) Discount Rate	(2) Price Inflation	(3) Salary Inflation	(4) Discount Rate	(5) Price Inflation	(6) Salary Inflation
Standardised funding ratio	β_1	-0.3567***	0.5368***	0.9563***			
		(0.1275)	(0.1318)	(0.2655)			
Reported funding ratio	β_1				0.8253***	-0.3673***	-0.1833
					(0.1231)	(0.1335)	(0.2700)
Standardised solvency ratio	β_2	-0.1744***	-0.0020	0.1978*	-0.2879***	0.0998*	0.3418***
		(0.0569)	(0.0588)	(0.1185)	(0.0531)	(0.0576)	(0.1164)
Liabilities/Payments	β_3	0.0597**	0.0055	-0.0212	0.0393	0.0194	-0.0054
		(0.0299)	(0.0309)	(0.0622)	(0.0288)	(0.0313)	(0.0632)
Pension income effect	β_4	0.0021	-0.0004	0.0066	0.0018	-0.0002	0.0068
		(0.0042)	(0.0043)	(0.0088)	(0.0040)	(0.0044)	(0.0089)
Contribution ratio	β_5	0.0300	-0.3678**	0.0961	-0.4224**	-0.0186	0.5395
		(0.1761)	(0.1820)	(0.3666)	(0.1691)	(0.1834)	(0.3708)
Debt ratio	β_6	-0.0015	-0.0009	-0.0005	-0.0020	-0.0004	0.0002
		(0.0015)	(0.0016)	(0.0031)	(0.0015)	(0.0016)	(0.0032)
Operating profit ratio	β_7	-0.0012	0.0014	0.0050	0.0003	0.0004	0.0038
		(0.0065)	(0.0067)	(0.0135)	(0.0062)	(0.0068)	(0.0137)
Constant	β_0	0.4296**	0.1588	0.2236	0.3378*	-0.1436	0.2994
		(0.1848)	(0.2073)	(0.3848)	(0.1780)	(0.2103)	(0.3903)
R-Squared		0.886	0.812	0.539	0.894	0.808	0.526
Month Dummies		Yes	Yes	Yes	Yes	Yes	Yes
Observations		456	456	456	456	456	456

Notes: ***, **, * indicate significance at the 1%, 5%, 10% level respectively

$$DR_{it} = \beta_0 + \beta_1 SFR_{it} + \beta_2 SSR_{it} + \beta_3 Liabs_{it} / Pmts_{it} + \beta_4 PIE_{it} + \beta_5 Cont_{it} + \beta_6 Debt_{it} + \beta_7 OP_{it} + \varepsilon_{it} \quad (1)$$

$$PI_{it} = \beta_0 + \beta_1 SFR_{it} + \beta_2 SSR_{it} + \beta_3 Liabs_{it} / Pmts_{it} + \beta_4 PIE_{it} + \beta_5 Cont_{it} + \beta_6 Debt_{it} + \beta_7 OP_{it} + \varepsilon_{it} \quad (2)$$

$$SI_{it} = \beta_0 + \beta_1 SFR_{it} + \beta_2 SSR_{it} + \beta_3 Liabs_{it} / Pmts_{it} + \beta_4 PIE_{it} + \beta_5 Cont_{it} + \beta_6 Debt_{it} + \beta_7 OP_{it} + \varepsilon_{it} \quad (3)$$

$$DR_{it} = \beta_0 + \beta_1 RFR_{it} + \beta_2 SSR_{it} + \beta_3 Liabs_{it} / Pmts_{it} + \beta_4 PIE_{it} + \beta_5 Cont_{it} + \beta_6 Debt_{it} + \beta_7 OP_{it} + \varepsilon_{it} \quad (4)$$

$$PI_{it} = \beta_0 + \beta_1 RFR_{it} + \beta_2 SSR_{it} + \beta_3 Liabs_{it} / Pmts_{it} + \beta_4 PIE_{it} + \beta_5 Cont_{it} + \beta_6 Debt_{it} + \beta_7 OP_{it} + \varepsilon_{it} \quad (5)$$

$$SI_{it} = \beta_0 + \beta_1 RFR_{it} + \beta_2 SSR_{it} + \beta_3 Liabs_{it} / Pmts_{it} + \beta_4 PIE_{it} + \beta_5 Cont_{it} + \beta_6 Debt_{it} + \beta_7 OP_{it} + \varepsilon_{it} \quad (6)$$

Table 6. Mean assumptions according to relative strengths of funding ratios and solvency ratios for companies reporting at 31 December 2009.

Assumption	RFR				SFR				SSR			
	No. of Companies	Low (%)	High (%)	t-stat	No. of Companies	Low (%)	High (%)	t-stat	No. of Companies	Low (%)	High (%)	t-stat
Discount rate	97	5.683	5.689	0.372	84	5.694	5.669	-1.337	81	5.697	5.664	-1.761*
Price inflation	93	3.562	3.509	-1.007	84	3.521	3.587	1.555	81	3.481	3.645	4.403***
Salary inflation	88	4.551	4.566	0.100	84	4.326	4.757	2.846***	81	4.291	4.777	3.156***

Notes: *, **, *** indicates significant at the 10%, 5% and 1% levels respectively. RFR = Reported funding ratio (the assets of the company's pension plan divided by the liabilities of the pension plan as reported). SFR = Standardised funding ratio (the assets of the company's pension plan divided by the standardised liabilities i.e. the liabilities of the pension plan as reported, adjusted to a standardised basis). SSR = Standardised solvency ratio (the assets minus the standardised liabilities of the company's pension plan, divided by the company's market capitalisation). Companies with a 'low' or high' RFR, SFR or SSR are those where the ratio is lower or higher than the median for the relevant ratio. t-stat = test statistic for difference in means between groups of companies with 'low' (below median) and 'high' (above median) values for each of RFR, SFR and SSR.

Table 7. Summary of SUR regressions using alternative standardisation factors.

Row	Standardisation factors			Signs and levels of significance for independent variables SFR and SSR					
	Discount rate	Price inflation	Salary inflation	Discount rate		Price inflation		Salary inflation	
				SFR	SSR	SFR	SSR	SFR	SSR
(1)	9.5	5.5	3	- ***	- ***	+ ***	-	+ ***	+ *
(2)	8.5	5.5	3	- *	- ***	+ ***	-	+ ***	+
(3)	9.5	6.2	3	- ***	- ***	+ ***	-	+ ***	+ *
(4)	9.5	5.5	1.6	- ***	- ***	+ ***	-	+	+ ***
(5)	8.5	6.2	1.6	- **	- ***	+ ***	-	+	+ ***

Notes: *, **, *** indicates significant at the 10%, 5% and 1% levels respectively. SFR = Standardised funding ratio (the assets of the company's pension plan divided by the standardised liabilities i.e. the liabilities of the pension plan as reported, adjusted to a standardised basis). SSR = Standardised solvency ratio (the assets minus the standardised liabilities of the company's pension plan, divided by the company's market capitalisation). The results reported in row (1) reflect standardisation to factors taken from ASB (2007), i.e. summarise the regression results reported in Table 5. Rows (2) to (4) report results using one standardisation factor from O'Brien *et al*. (2010) and two of the standardisation factors taken from ASB (2007). Row (5) results reflect standardisation to the results reported by O'Brien *et al*. (2010).