Pensions and economics

The way ahead

by Andrew Wise, David McCarthy, Jeff Neate, Michael Pardoe and Brandon Horwitz

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Pensions and Economics – the Way Ahead

1 Introduction

"Everything should be made as simple as possible, but no simpler", Albert Einstein

1.1 The provision of defined benefit pensions by employers in the UK developed and thrived in an era of great economic uncertainty. Threats of hyperinflation, stock market catastrophe, the collapse of capitalism, global thermonuclear war: all were survived. But now the system is at risk of collapse. Why? Because pensions are too important and the system too imperfect. Will the system collapse or will it survive, and if it survives then in what form?

1.2 The future of UK defined benefit pensions, if there is to be one, must be understood and discussed in the context of corporate finance and shareholder value. But the economics of pensions is not simple, and is not simply about theories of capital markets and shareholder value. Pensions are part of employee compensation and there is economic theory about that as well that we believe should be considered.

1.3 Our aim in this paper is to nudge forwards the ongoing reconciliation between the relevant economics and actuarial practice in pensions. Neither discipline has reached a state of perfection and, by going back to basics and indicating a more complete view, we try to show that practical progress can be made. Our approach is to reconcile actuarial practice with the underlying economics and we find that this is in general possible. From this base we offer suggestions about designing pension plans to meet the business objectives of companies, and about making better 'actuarial valuations'. We scarcely comment on equity investment for pensions - a topic that ranks as both a major issue and a mere detail in the bigger picture.

1.4 We make no apologies for stating the obvious in places. We hope that this paper and the discussion of it will point to a positive and realistic vision of how actuaries using the best economics thinking and tools can continue their leadership role in pension provision in this country. Anyway, that is the spirit in which the paper is written.

1.5 Views expressed here are those of the authors and do not purport to represent views of our respective employers.

2 Brief history of financial economics

We briefly review the basic principles of financial economics as applied to pensions, including the weaknesses and strengths in this dynamic and developing subject and its more recent developments.

2.1 The development of financial economics since the 1950's has come to change radically the way that financial markets operate and are understood. For example, the resulting explosive development of the derivatives markets has undoubtedly contributed to major efficiency improvements in national and international trade, whilst economic capital has undoubtedly been deployed to better effect. Therefore it is probably not an exaggeration to say that financial economics has made the world in 2004 a much richer place than it would otherwise have been. That said, financial economics is still a very young discipline, and many aspects of financial markets are still poorly understood.

2.2 Financial economics was developed mostly outside the actuarial profession. Its early findings (such as the Markowitz efficient frontier) were known to some actuaries but were not much used in UK pensions work (for example, because Markowitz theory did not address pension liability constraints). In the 1970s and 1980s there was some effort among US academics in applying financial economics thinking to the analysis of pensions. There were important contributions at that time from scholars such as Black **{1}**, Treynor **{2}** and Sharpe **{3}** as well as an active research program on pension finance at the National Bureau of Economic Research.

2.3 Because these contributions were largely US focused, some of the arguments used did not apply in a UK context. This academic work had little impact on actuarial practice until developments in the 1990s changed the rules of the game (see Section 5). The time was ripe – if not over-ripe - for financial economics principles to be imported into the actuarial mind-set. Happily our profession is open and eclectic, and is now applying these principles and perspectives in practical ways.

What is economics?

2.4 According to the textbooks, economics is the study of the interaction between limitless human desires and scarce resources. Neoclassical theory further assumes that the preferences of individuals underlie our entire economic system, and that individuals have the freedoms and the desire to choose the course of action that best suits their preferences.

2.5 Financial economics applies this modern neoclassical microeconomic theory to financial markets and financial transactions in those markets.

2.6 But note that in human endeavour - especially in the creation of knowledge - a certain humility is required. Accumulated knowledge is and can be no more than a set of working, well tried and tested hypotheses. Sometimes the knowledge is augmented, sometimes even overturned by a new paradigm. There is no absolute knowledge in the human world, with the possible exception of religious faith. All theories need to be subjected to the rigour of testing and experimentation. There is no place for dogma in imperfect science.

2.7 A convenient way to understand the scope of financial economics is to consider a simple model of an economy. There are three central markets in any economy: capital (including land), labour, and goods and services. In these markets, producers (also called firms or corporations) and households (who are employed by producers and who invest some of their savings in productive assets) interact with one another and with governments.

2.8 Financial economics is mainly concerned with the study of markets for capital. It can be divided into:

- the study of the capital markets themselves (called capital market theories and asset pricing),
- the study of how producers interact with the capital market (called corporate finance) and
- the study of how households interact with the capital market (called portfolio theory).

2.9 Defined benefit (DB) pensions are an unusual area for economists to study because they involve all three areas of financial economics. Firms profoundly alter their capital structure by offering DB pensions, DB pensions often form a large part of individuals' investment portfolios, and the plans themselves are invested in financial assets in the capital markets. In addition, pensions form part of the employment contract and therefore the branch of economics dealing with employment - labour economics - has a bearing on pensions as well.

Corporate finance

2.10 Corporate finance theory provides economic tools to study pensions from an employer perspective.

2.11 The foundations of corporate finance lie in the Modigliani-Miller (MM) theorem. The theorem says that the value of the underlying assets of a corporation do not depend on

the claims that are made upon it – in particular, upon the mix of debt and equity firms use to finance themselves.

2.12 However, this result depends on a number of very strong assumptions – free access to information, no transaction or bankruptcy costs, and no personal or corporate taxes. Unfortunately for the theorem, not one of these assumptions holds in financial markets.

2.13 A paradox lies at the core of the MM theorem, to do with the assumption of no transaction costs. As first explained by Coase **{4}**, firms themselves only exist because transaction costs make operating inside a command economy (in this case the firm) cheaper than operating in the free market economy outside it. Said another way, the very reason that firms exist is because one of the assumptions of the Modigliani-Miller theorem is violated in practice!

2.14 Furthermore, the statement of the MM theorem in 2.11 is also violated in the real world – perhaps not surprisingly in view of the stylised assumptions. The MM theorem predicts that there should be no systematic differences in capital structure between different firms. In fact, there are substantial systematic differences. Firms with many physical assets (e.g. airlines) tend to be more highly leveraged than firms with only intangible assets (e.g. technology start-ups); highly profitable firms tend to be less leveraged than less profitable firms, even in the same industry; larger firms tend to be more highly leveraged than smaller firms **{5}**.

2.15 Each one of these systematic differences can be traced to violations in the assumptions of the MM theorem. In fact, one of the main issues of corporate finance (and of finance directors) is to assess the implications of these different failures for the capital structure, dividend policy and governance of the corporation. This is why the MM theorem is such a powerful and famous result.

2.16 Two other theories have developed to explain observed patterns of capital structure.

2.17 The first includes bankruptcy costs - ignored by MM - and views a firm's capital structure as a trade-off between the tax shield generated by issuing debt and the costs of financial distress.

2.18 The second theory - called the pecking order theory - adapts the MM theory to include asymmetric information between managers and shareholders - in economic jargon it is called an 'agency theory' or 'principal-agent' model of corporate finance.

2.19 If managers have 'asymmetric information' about firms it means that they have more information about the state of the company than they disclose to shareholders. They might hide this information because it is in their interests to do so, or because a true disclosure of information is impossible (think of a used car dealer trying to sell a car:

nothing he says is trustworthy, even if he is the only honest used car dealer in London!). This asymmetric information has several effects on corporate finance. It may make the corporation less efficient, because managers may be able to run the company in their own interests rather than in the interests of owners, or it might cause shareholders to incur costs to monitor their managers.

2.20 The pecking order of corporate finance, described by Myers & Majluf **{6}** and Myers **{7}** states that because of asymmetric information problems, firms prefer internal finance over external finance and stable dividend policies over unstable ones. If external finance is required, according to this theory, firms issue the safest security first - debt - followed by convertible bonds and then only equity. Pension funds fit into this theory because one source of finance for a company - and one way that a company can stabilise volatile cash flows - is by using the pension fund as a corporate bank account. Whether such use increases corporate value or decreases it depends on how efficient are external capital markets.

Portfolio theory

2.21 Portfolio theory provides economic tools to study the pension fund member's perspective. It is the study of how households interact with financial markets and was in some ways the very beginning of financial economics. The problem: "how should I invest my portfolio?" was first examined in a modern setting by Markowitz **{8},** who examined the static, one-period mean-variance models with efficiency frontiers that are still found in many introductory textbooks. Markowitz's one-period model provided the basis for the Capital Asset Pricing Model (CAPM), which was the first equilibrium model of risk and reward. It has also been extended to include multi-period models, predictability in asset markets, incomplete markets, labour income, housing, and pensions.

2.22 Originally it seemed that portfolio theory had little in the way of useful insights for UK pension issues. Actuaries did not need it and pension fund investment policies were driven by other considerations. Simple applications were found in index-tracking funds and risk-measurement relative to investment benchmarks, and are being used by fund managers to this day. Liability-driven asset allocation for pension funds was not introduced until the late 1980's, by which time the necessary cost-effective computing power had become available.

2.23 More recently, portfolio theory models have begun to include the idea that markets are incomplete. This means that individuals are unable to remove their exposure to all the risks they face by changing their portfolio allocation of tradable securities. Examples of incomplete markets that affect most people are borrowing constraints, transaction costs, portfolio restrictions, and income risks.

2.24 Currently, portfolio theory is in a state of flux. New computer-aided techniques have allowed more complex problems to be examined, new data is being collected, and insights from behavioural finance and psychology have the potential to reinvent the field entirely.

Behavioural finance

2.25 Recently, some academic researchers have come to the conclusion that there is something fundamentally wrong with many of the models discussed here. This is that the very simple preference structures that neoclassical economists like to assume people have are not an adequate reflection of how people actually make decisions. Also people face costs and benefits that neoclassical economists tend to downplay or ignore. Recently, experimental economics has unearthed some regularities in this, and economists have begun to study how these regularities might affect asset prices, portfolio theory and corporate finance.

2.26 Potentially, this branch of economics has important applications for pension design and pension finance.

Theories and principles of market valuation

2.27 A brief summary of theories of capital markets (CAPM, APT, EMH) is given in Appendix A. A further brief summary of market valuation principles (no arbitrage, risk-neutral valuation) is given in Appendix B.

2.28 Some actuaries have criticised the principles and applicability of financial economics on the grounds that these fundamental theories and principles are based on unrealistic assumptions that do not apply in the real world. True: as we observe in the appendices, all these basic models are like the non-existent weightless pulleys and strings of school mechanics. But by the same analogy such idealised models give insights that did not exist before the models were devised and deliver roughly accurate predictions. Some would say that the best way to evaluate economic models is in terms of their predictions, not their assumptions. In a pension setting it has proven difficult to test some of the predictions empirically and hence evaluation of the reasonableness of assumptions is appropriate as a second-best approach to evaluating theories.

3 Economic rationale for company pensions

Why do companies provide pensions? One answer is: no National Insurance contributions. But labour economics offers more fundamental explanation. In this time of transition we need to go back to the rationale for corporate pensions and for pension funding in order to identify appropriate plan designs for the future.

Why do companies provide pensions?

3.1 There are some obvious and familiar reasons:

- because pensions are deferred compensation with no National Insurance (NI) cost to employees and employers;
- because employees want a company pension (see Section 4);
- Government incentives to reduce State pension provision (such as the former financial terms for contracting out).

3.2 Final salary pensions used to be very flexible for employers. Employers had wide discretion in determining the level of the benefits, such as early retirement terms, pension increases, commutation rates, as well as determining the level of wages. In addition, employers had wide discretion in determining the level of funding of schemes and could effectively use the scheme as a source of easy finance and a tax haven. Over time, these sources of discretion have been gradually removed and final salary schemes are now a burden.

3.3 We must dig deeper. Labour economics is the branch of economics that deals with the nature and terms of the employment contract. What does this theory say are the fundamental reasons why employers should offer pensions as a part of compensation? Why do employees want company pensions and are they right to do so?

3.4 **Influence job tenure:** The main argument of labour economics to explain employer pension provision is the 'wage-tilt hypothesis'. This says that employers wish to encourage employees to stay longer in jobs. Firms like long-staying workers because this reduces training and recruitment costs. To do this they tilt the compensation-tenure profile, deferring some pay to later in the employee's working life. Employees accede to this arrangement because their overall compensation under the arrangement is higher. One reason why it may be efficient to achieve this redistribution through a pension is that assets are set aside, making the promise to pay higher wages later more credible. Traditional DB pension benefits also accrue at a higher rate of cost later in

life - hence including the wage tilt as a natural feature, although there is no reason why the same effect could not be achieved in a DC or hybrid plan.

3.5 **Influence retirement timing:** Historically, employer pensions were introduced in less prosperous times to encourage and enable retirement. In the absence of State pensions and personal savings, employees may otherwise be forced to carry on working into old age, even if they are not able to meet their work responsibilities. The equivalent modern concept is that employers can use pensions to influence employee retirement timing to help manage their HR requirements and employment costs. This will be an important factor as State pensions become postponed, the concept of a 'normal retirement age' withers and legislation against 'ageism' appears. If employees are indeed to be encouraged to stay in jobs, firms would prefer if they are not encouraged to stay too long!

3.6 **Worker selection:** A further argument of labour economics is the 'sorting hypothesis': that pension funds sort workers into different types. This argument states that if employers offer a wage contract that is more attractive to workers with "desirable" characteristics than to workers with "undesirable" characteristics, then workers with these desirable characteristics will self-select into the job. An example of such compensation is a pension that rewards long tenure, which is clearly more attractive to a worker who believes that he will have a long tenure at the firm.

3.7 **Enhance Productivity:** Final salary pensions redistribute income away from those with flat wage profiles to those with steeper wage profiles. Accordingly they provide strong incentives for employees to increase productivity. The downside of this for employees is the redistribution of compensation in terms of pension.

3.8 **Market advantage:** Another reason that a company might want to provide a pension scheme is if it has a comparative advantage over other pension providers. That is, if there is something that an occupational scheme can do that an employee could simply never buy off the shelf, or at least, not at the same price. For example, we suggest in Section 8 that there are risk-sharing and risk-pooling design features that an employer is uniquely well-placed to offer, just by virtue of the fact that the scheme members will include only people who are employed by that company. Employer pensions also have significant administrative cost advantages over insurance-provided pensions in most instances. These cost advantages build up to significantly enhanced average benefits for workers at the end of their career relative to individually provided pensions.

3.9 Most of the behavioural effects in this section can be achieved whether a company offers DB or DC pensions - by changing either the terms of the pension or the rest of the firm's compensation structure. With the influences correctly applied to support the specific business objectives, the right pension plan should add to shareholder value through these behavioural effects.

Why fund company pensions?

3.10 We do not need to dwell on the reasons for funding: benefit security, regulatory enforcement of benefit security, smoothing of employer's cash-flow on pension cost and some tax advantages.

3.11 The pension fund exists primarily to provide collateral, to make the employer's pension promise credible. Changes in the funding status of pension plans affect the value of the pension promised – from the perspectives of both shareholders and plan members. The pension promise becomes more or less credible as the pension plan is better or worse funded. This needs to be considered with a few other factors, especially the strength of the employer's covenant.

3.12 With a slightly different perspective we could also say that funding serves a purpose as a risk-sharing mechanism. In the old days there was risk-sharing, in terms of discretionary pension increases for example. Now there is little employer discretion, and benefit security has become a dominant issue. In Section 8 we will argue that in future we need to re-introduce more transparent risk-sharing in new pension designs. Then the fund will again provide the dual role of collateral for the guaranteed part of a pension and risk-sharing mechanism for the discretionary part.

4 The members

Why do employees like company pensions?

4.1 Employees save some tax and NI when they are remunerated partly in pension form. This compensates them for the fact that pensions are illiquid savings vehicles and it incentivises them to save using the pension fund's tax-sheltered status.

4.2 But another message from labour economics is that wage levels should adjust in the market to compensate for tax differences. The evidence suggests that wage rates are 'sticky', that in fact they don't respond efficiently to changes in other terms of a compensation package. Anecdotal evidence of such labour market rigidity in relation to pensions points both ways:

- Employees value the provision of a company pension in contrast to non-provision.
- They don't value the pension offering in much more detail than that: witness new joiners to a company with lower cost DC pensions than former entrants but no adjustment to salaries. (Although this might be a reflection of the current solvency levels of many private sector DB pension schemes.)
- But companies have been able to use pension improvements in support of lower rates of salary increase.

4.3 On balance it seems likely that wages are sticky with regard to detailed aspects of pensions including the tax advantages. That would at least partly explain the attraction to employees – they share with employers some of the value of the tax and NI advantages relative to cash remuneration.

4.4 For DB pensions, the additional feature of a defined promise of future pension purchasing power may be attractive to employees – especially the older ones. Evidence for this is clear in the desire of employees to hold on to disappearing final salary pensions where they can, for example by agreeing to a higher employee contribution rate to help meet increased costs. (Though whether employees are holding on to those pensions because they are more generous than the DC plans that replace them or because of their defined pension purchasing power is debatable.)

4.5 But this apparent attraction of DB pensions is harder to rationalise in the terms of economic theory. Why do employees seem to prefer a portion of their wages to be given in an illiquid and risky form? In relation to final salary schemes, why are they willing to accept pension risk which is correlated with their employment and dependant on discretions of the employer?

4.6 Pensions should be considered in the context of the compensation contract as a whole. This point has been made by economists such as Sharpe, in his 1976 paper on pensions and corporate finance **{9},** and by Bulow, in his 1982 paper on pensions and the labour market **{10}**. Their focus is on the risk inherent in the promise rather than the promise

as given. If the DB pensions contract is extremely risky, a rational employee would not ignore this risk when assessing his overall level of compensation - the cash compensation would need to be higher to compensate the individual for the extra pension risk.

4.7 One aspect of risk in a final salary scheme is the link to final salary. The link to final salary is commonly seen as desirable on the grounds that:

- Salaries are viewed as being less variable than asset prices. (However, these arguments typically confuse aggregate wages with individual wages and assume equity investments when there is potential to invest in less risky securities.)
- Salary risk seems to be independent of financial markets, at least in the short run.
- The link between the pension and final salary protects individuals against consumption shock at retirement (based on the idea that individuals are used to a certain level of consumption which is close to their final salary).

4.8 According to portfolio theory this thinking is at best incomplete. There is a further perspective to be considered, which can be seen if human capital is defined as the present value of future earnings and salary risk is defined as the uncertainty associated with an individual's human capital. Viewed in this way, salary risk is like investment risk. Individuals dislike unrewarded investment risk and should dislike unrewarded salary risk too. Younger individuals have most of their wealth in this risky asset – their future wages. Final salary pension plans increase an individual's exposure to this asset, by replacing (safer) current income with (riskier) later income. This is not a desirable outcome.

4.9 Current DB designs partly mitigate this effect by various mechanisms - including averaging final salary and changing the definition of pensionable earnings. Career average and DC plans are not immune from wage risk either, because future contributions are based on future wages, but the benefit here is related to the average wages that workers earn over their working life, with revaluation that depends on asset returns or other indexing factors.

4.10 This argument is theoretical and most employees have probably never thought about their personal human capital. Perhaps they should! The point is certainly relevant to the design of hybrid pension plans which provide DC at younger ages and DB at older ages. The issue is about diversifying risk between invested and human capital.

4.11 Pension risk is a central theme of our paper. It may come in many forms:

- the result of actual or potential under-funding,
- a risky investment strategy in the pension fund,

- employer benefit discretions,
- the high correlation of default on the pension with job losses,
- the losses of pension expectations when individuals leave service early,
- the riskiness in pension benefits associated with wage increases.

In theory, rational employees would respond to adverse changes in their contract terms by demanding increases in cash wages to compensate.

4.12 That's the theory but does it work in practice in the UK? Do employees behave as if they understand and agree with this analysis? Our intuition is that the answer hitherto has been generally no, for these reasons:

- lack of information and transparency about pension risks
- inability and failure of employees to assess the value impact of pension risk
- 'stickiness' of wages, in general and relative to pensions generally as discussed in 4.2
- deferred members and pensioners are also vulnerable to adverse changes in pension risk and pension value but are unable to seek compensation.

Do employees require fully guaranteed DB pensions?

4.13 The attraction among some employees for defined benefit pensions is evident. But do they require fully guaranteed DB pensions? We suggest not:

- We don't think employees value pension risk accurately if at all at present, for reasons mentioned above.
- The marginal cost of extra pension security gets steep as confidence levels get closer to 100% (see illustration in 6.2).
- Circumstantial evidence in the insurance market: with-profit endowment assurance preferred to non-profit for example.
- Risk-sharing DB designs can be attractive to employees when they can see a tangible possibility of higher pension to offset the risk of a lower one.
- DC pension plans are heavily invested in equities.

4.14 There is a spectrum of alternative pension scheme designs ranging from pure DC to fully guaranteed DB. In Section 8 we refer to some risk-sharing designs within the spectrum.

Overview

4.15 Just as there is debate among financial economists as to how efficiently financial markets function, there is also considerable debate about the degree of efficiency and competition in labour markets. Our casual observation though is that the labour markets do not work very efficiently with regards to pensions. Much more work needs to be done in this area and actuaries need to focus more on it.

4.16 Financial economics has now found its way into actuarial thinking and work. We suggest that actuarial training will need to include labour economics in parallel with financial economics: in pensions work, both are important.

5 Brief history of pension finance

History offers context and, with luck, some pointers to the future. To see how pension provision will develop, first look at how we got to the present position. Why have final salary schemes been dominant, why have funding and investment policies been as they were and as they are now?

5.1 Final salary pension schemes

- Introduced by some major companies after the 1921 Finance Act and broadly modelled on the final salary concept of the Civil Service pension scheme.
- Became more prevalent in the 1960's when defined contribution and fixed money pensions were seen to be producing inadequate pensions.
- Given significant encouragement by the Government with the inception of contracting out in 1978.
- Reached their heyday in the 1970's and 1980's when inflation was high, employees who remained in service were rewarded with good pensions, but those who left the company lost out.
- Discontinuance position was usually well covered by the assets in the fund.
- Original design contained company discretions and flexibilities (for example on pension increases). These were steadily removed by legislation, or by benefit improvements anticipating expected legislation, so that the cost and risk of defined benefit pensions have been heaped up on employers.
- Real costs increased by falling inflation.
- Sustained through the 1990's bull market which, in conjunction with unchanged actuarial methodology, masked the increasing risks and cost.
- Entered major decline after 2000 thanks to massive regulation plus a three year bear market.

5.2 Why equity investment?

- The beginning in the 1960's of the "cult of the equity" is widely attributed to the late George Ross-Goobey, an actuary and pension manager at one of the UK's largest companies at the time. He considered the upside potential from equity investment to outweigh the downside risk and others came round to his view.
- The actuarial valuation model was adapted to provide a cash flow budgeting process that was sympathetic to equity investment.

- Approved pension funds were able to reclaim dividend tax credits.
- Pension funds survived the major stock market crash of 1974 and emerged with growing surpluses in the 1980's. Peer group comparisons of asset allocation via the performance monitoring services became a behavioural influence.
- Index-linked gilts weren't available until the 1980s and fixed bonds were not compatible with targeting discretionary pension increases in times of high and rising inflation expectations.
- Because of high inflation and low level guarantees in the event of winding up a pension scheme, companies were content to take the equity risk and the upside benefits that go with it. Ross-Goobey's original intuition was validated by the asymmetrical economics of risk and reward in final salary pensions.
- Members obtained discretionary pension increases and other benefit improvements from equity gains; companies took contribution holidays.
- Although the equity bull market continued beyond 1997, that was the watershed year:
  - Exley, Mehta and Smith published their paper **{11}**, which brought the financial economics analysis to the context of the more closely defined UK pensions of the 1990's;
  - statutory LPI pension indexation imposed for future service;
  - the dividend tax credit was ended.
- Subsequently the development of the new pensions accounting standard FRS17 enforced the bond-like perspective on pensions, especially those deferred or in payment.
- Some large pension funds embarked on strategies of increasing their bond weightings progressively over the 1990's, and the case of the Boots pension fund switching 100% into bonds was a more recent prominent example.

5.3 Actuarial valuation methodology

- Originally used book value of assets and discounted liabilities at a low rate of interest.
- General transition in the UK profession to dividend discount model for producing an "assessed value" of the assets to be compared with the liabilities valued at the same long term discount rate. The focus was on smoothing the funding rate.
- Discontinuance valuation was originally just a quick check as the position was so well covered. More care and attention was required when the margins disappeared.

- Recent further transition, prompted by the above developments, to comparing market value of assets or a smoothed market value with discounted value of liabilities, where the discount rate is "appropriately chosen" and is almost always above a risk-free rate. (The choice of discount rate is discussed further in later sections.)

6 Pension valuations defined

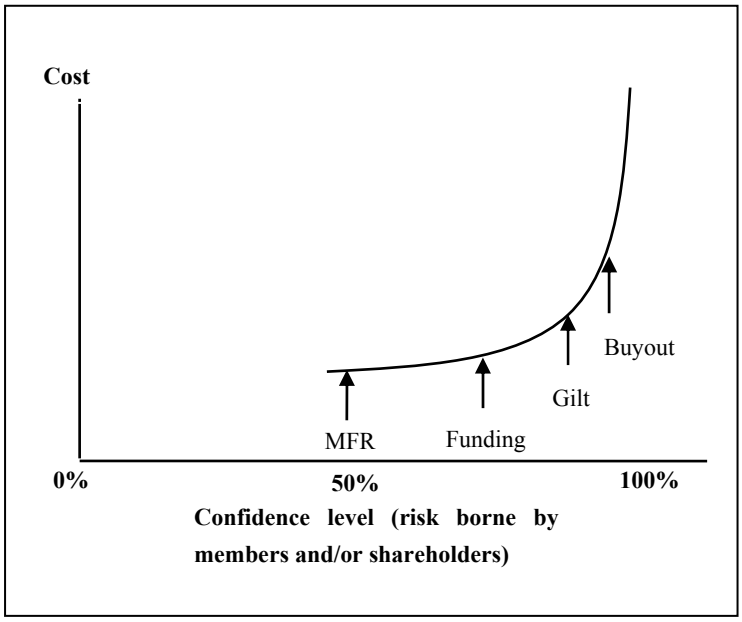
Definitions are important and essential for constructive debate. To help clarify matters we try to define the alternative concepts of economic valuation in relation to realistic pension liabilities. There is no risk-free valuation.

Valuation and risk

6.1 Currently most funding valuations are not risk-free, as we show in the next section. Strictly speaking, it is not possible for any funding valuation to be risk-free. Consider this:

- An MFR based valuation includes equity risk.
- A gilts-matching valuation includes longevity risk, usually reinvestment risk, and a degree of credit risk as not even sovereign debt can be completely risk-free.
- Valuation at insured annuity rates is not risk-free because any insurance company can fail.
- Absolute certainty is unattainable and its cost is infinite (for example, because we cannot withstand a massive asteroid strike that sends the human race back to primitive cave dwellers).

6.2 The following illustrates the point:



Valuations defined

6.3 Most valuations are (or are equivalent to) simple discounted cash flow valuations. The differences between them can be ascribed to the assumptions that are used to determine the value.

6.4 So, to understand the economics of pensions better, let's draw out the distinction between the following approaches to the economic valuation of pensions:

- Discounting at the risk-free rate
- Market-consistent valuation
- Risk-neutral valuation
- Market valuation of a firm's pension liabilities
- Valuation for company financial reporting

6.5 All the above are closely related aspects of economic valuation. Generally an actuarial funding valuation is not. We shall try to define these terms to make the distinctions as clear as we can.

Discounting at the risk-free rate

6.6 Much economic theory uses the concept of a "risk-free rate of return". The gilt yield curve is often viewed as the appropriate starting point, although, as discussed above, the gilt rate is not completely risk-free. Other instruments exist with similarly low levels of credit risk, such as supranational bonds, which can give higher yields. The interest rate swap curve is an alternative starting point that is widely used in banking operations; it also gives slightly higher yields, although even with collateralisation there could be very marginally more risk than with gilts.

6.7 In reality, the 'risk-free rate' is neither truly free of all risk, nor is it unique. The concept is slightly fuzzy. We will however continue to use the shorthand 'risk-free valuation' to mean a valuation using discount rates based on gilts or other very high credit quality instruments.

Market-consistent valuation

6.8 This concept was used in Tim Gordon's paper to SIAS "The price of actuarial values" **{12}**. As the name suggests, this is a valuation that is not inconsistent with the market price of related securities. If the liability profile is very close to that of a matching or hedging bond portfolio, then the no-arbitrage argument of financial economics brings

us back to the price of that bond portfolio. It is equivalent to valuing at the risk-free rate. If exact or close hedging is not possible, as is more often the case, then the definition would be thought of as a valuation near a bond-matching valuation. There is not a precise demarcation between valuations that are and are not market-consistent.

Risk-neutral valuation

6.9 However when exact hedging is possible (i.e. the liability can be completely replicated by a trading strategy in existing securities) a mathematical device allows the use of risk-neutral valuation. This involves discounting at a risk-free rate and also involves the technicality of shifting to risk-neutral probabilities (see Appendix B).

Market valuation of a firm's pension liabilities

6.10 Suppose that companies A and B are absolutely identical in all respects (employee numbers, profits etc) except that A provides pensions and has a pension fund whilst B does not (and pays higher salaries). Let Δ denote the excess market valuation of company A's issued equity capital over that of B (Δ being negative if B is worth more). In principle, Δ is non-zero only because of pensions. If A 'owns' any surplus or deficit in its fund (subject to tax at a rate t, which may depend on the circumstances) then the market's assessment of that surplus or deficit (subject to tax) should show up in A's share price. Then the implicit valuation by shareholders of A's pension liabilities can be derived as:

$$\text{MV(Pension liabilities)} = \text{MV(pension assets)} - \Delta / (1-t)$$

6.11 This estimator would be unreliable in practice:

- Identical comparative companies do not exist.
- The absence or presence of pensions creates other economic effects via employee motivation and behaviour which may augment or detract from shareholder value. (See, for example, the discussion in section 3)

6.12 An alternative approach to the shareholder valuation of pensions is to construct an analogous bond model with the right elements of term structure, credit risk etc, then to value using the analogue bond portfolio, making suitable assumptions about parameters where the company has discretion. To this would be added the value to the members of their call option on any potential surplus arising, to the extent that they may gain from ensuing benefit improvements. Then from this value including the call option would be deducted the value to the shareholders of the put option on the liability, to the extent that the company has the power to default by discontinuing an under-funded scheme. (The put option may be of little value since 11 June 2003, whilst the call option may be of little value following the bear market of recent years.)

6.13 Researchers such as Feldstein & Seligman **{13}**, Feldstein & Morck **{14}** and Bodie **{15}** have compared one approach against the other. Results (which relate to US funds) are mixed, possibly due to opaque disclosures, with fair agreement in some cases and not in others.

6.14 Market valuation of a firm's pension liabilities will normally be below the valuation at risk-free rate on account of credit risk, though there might be exceptions to this (where the value of the benefit improvement call is no less than that of the default put option). These option values will depend on the funding position and the investment strategy.

6.15 Market valuation of a firm's pension liabilities will be reduced if there is any correlation with the return on risky assets. For example, in the case of salary increases there has been some work by Smith {**16**} and Cardinale {**17**} pointing to a small positive correlation with equity returns, leading to justification for a very small allowance for equity premium.

6.16 Note that the definition in 6.8 of a market-consistent valuation refers to consistency of valuation within the pension fund, not consistency with valuation by a shareholder of the company. This means that the implied valuation by a shareholder differs from market-consistent valuation to the extent of any credit risk associated with the pension promise and the company's ability to default on it (and also possibly to the extent of any call option value).

6.17 "Market-consistent valuation" might alternatively be construed as consistent with the labour market or from a shareholder perspective. Such a definition would imply allowing for credit risk. For reasons of clarity we prefer to adhere to the one definition in 6.8.

Financial reporting valuation

6.18 Financial reporting numbers are of course very important because they transmit audited information about a company to the outside world. A valuation for FRS17 or IAS19 would use an AA corporate bond rate of discount, conforming to the established trend towards adoption of fair-value (meaning market value-based) accounting principles.

6.19 But accounting standards do not go so far as to mandate market values in balance sheet reporting. It would be nonsense to do so. Instead the accounting standards simply require financial reporting that harmonises better than before with market pricing. A certain imprecision is not only encouraged but necessary. Hence the AA bond rate instead of some more accurately specified benchmark.

6.20 It is up to the readers of company accounts what they do with the figures they see. Then the market will make its judgement via the company's share price. The collective assessment by the market might place a different credit rating on the pensions than that implied by the AA bond rate used for financial reporting, and there are information timing differences as well.

Actuarial funding valuation

6.21 In relation to pensions finance, the basic method for "making financial sense of the future" is to use a control cycle. Periodic deterministic projections go hand-in-hand with periodic assumption reviews and course corrections. The success or otherwise of the process depends on the assumptions used and the extent of the course corrections.

6.22 An actuarial value is a valuation of liabilities based on specific principles in order to meet specific objectives. There are several alternative objectives for which an actuarial valuation may be required, and a funding review normally deals with them all to varying degrees of detail. The most important in this discussion are:

- The discontinuance solvency valuation, measuring the position in the (usually hypothetical situation) of the company discontinuing future benefit accruals and all future funding. (This is market-consistent relative to either the annuity buy-out market or a hedging bond portfolio.)
- The ongoing valuation, providing an assessment of a long-term budget and funding plan, usually for agreement between company and trustees depending on the trust deed and rules. (This is not necessarily market-consistent because the calculation relates to a single scenario for one step in the funding control process.)

6.23 The funding objectives and the funding control cycle address the governance risk of pension funding and do not deal with investment risk or (except over longer time periods) the default risk experienced by the members.

6.24 To help establish the connection (or contrast) with financial economics, it is worth recalling that an economic valuation is an attempt to be consistent with the effective weighing-up by the market of all feasible future scenarios of return and investor perceptions of these. A formal actuarial report usually quotes on the basis of just one of that infinite variety of scenarios. Unless the fund is invested on a risk-free basis the chance of the actuarial assumptions - or any other set of assumptions - according precisely with investment experience over the next period is nil. The actual experience will be another one of the infinity of scenarios, and a further actuarial valuation will have to be made. The control cycle approach will take the results of this further valuation and produce an appropriate course correction.

Real-world pension liabilities

6.25 In the UK most pension liabilities are not a straight commitment from the company on behalf of shareholders to employees and beneficiaries. Tax-approved pension schemes have the intermediate instrument of a trust fund. The trust deed and rules which create the trust fund codify the interests of members. Theoretically, the trustees intermediate in the same way as a corporate board which represents the interests of shareholders. However, principal-agent problems, and the statutory requirements imposed on the trustees by the law of the land and the conditions of the trust deed may change this picture quite substantially. An economic analysis of pensions should therefore factor these into account. This in turn requires turning the pages of the trust deed and rules and working out where the governance powers lie - as indeed actuaries have to do in order to advise their clients.

6.26 Here is a list of ways in which the pension promise can diverge from a simple unequivocal guarantee:

- Salary increases relative to price-inflation
- Discretionary pension increases (some plans still have them for pre-97 benefits)
- Member options at retirement (e.g. 25% cash lump sum versus all as pension)
- Member option on timing of retirement (from age 50 to 65 typically, earlier for ill-health)
- Employer option at retirement (e.g. to allow favourable terms for early retirement pension).

6.27 A detailed economic analysis of pensions would show how economic valuation is affected by introducing one or more of these factors. The factors can be classified into types:

- Binary (e.g. retirement pension either reduced or unreduced at company discretion)
- Bounded and uncorrelated with asset return (e.g. range of possible early retirement pension amounts)
- Bounded and correlated with asset return (e.g. discretionary pension increases dependent on 'new valuation surplus' for pre-1997 accruals, min 0 max RPI)
- Unbounded (e.g. salary increases)

Comment on each of these cases is included in Appendix C.

Summary

6.28 To summarise this section:

- Risk-free pension valuation is an unattainable ideal which is not uniquely defined in relation to complex and fuzzy pension liabilities (and risk-free interest rates are themselves fuzzy).
- We have tried to define terms and distinguish between different aspects of economic valuation, namely: discounting at a risk-free rate, market-consistent, risk-neutral, market valuation of a firm's pension liabilities and financial reporting valuation.
- Actuarial funding valuations are single-scenario calculations that are not designed to produce economic or market-consistent values, though some may do.
- The definition of 'market-consistent' is fuzzy and has no precise boundary.

7 'Actuarial valuation' in 2004

How are actuaries carrying out their funding reviews in 2004? We comment on assumptions from a survey and on some approaches currently in use. We pose the question: if funding is to provide collateral or security, why aren't most funding valuations risk-free? Should they be?

Terminology

7.1 In the pension context, the familiar phrase "actuarial valuation", really means a "funding review". But we would not agree with a suggestion that the word "valuation" can only refer to market price or market-consistent valuation. There are, after all, different kinds of valuation in the accounting world such as book value or impaired value.

7.2 We gave our definition of an 'actuarial value' in 6.22. The concept of actuarial value has purpose and meaning which are to do with controlling the stability of funding rate and also, as we discuss later in Section 9, risk-sharing. An actuarial value should always be interpreted in the context of market principles. Thus, in today's conditions a pension fund with a 100% funding level on a typical actuarial funding basis is unlikely to be 100% secure on a discontinuance basis (except perhaps for Government-supported occupational pensions).

Funding review

7.3 An actuarial funding review is a complex exercise that formalises the funding control process discussed in Section 6 and assesses the financial position of the pension plan from a variety of alternative perspectives. These include statutory requirements, discontinuance valuation and risk assessments of varying levels of sophistication.

7.4 During the last few years there has been a rapid shift from the dividend discount model for funding valuations to the current approach of comparing market value of assets with discounted value of liabilities. Current funding practice is to value using discount rates that are considered relative to gilt yields. In some cases the premium to gilt yield is regarded as a fixed or stable parameter, in other cases it is not. The following is an extract from the forthcoming (unpublished) report of a Pensions Board working party.

"Information has been collated about the discount rates used in a survey of 685 valuations conducted during 2001 and 2002 by actuaries in the consulting firms represented on the working party. The information obtained from each firm related to the discount rate in excess of long-dated gilt yield used to value liabilities in the pre-retirement and post-retirement periods……

…….The average discount rate in excess of gilt yield (weighted by numbers of schemes) was 1.4% pre-retirement and 0.9% post-retirement. The medians are the same. Very few of the valuations used discount rates below gilt yield and very few used discount rates of more than gilt plus 3%……."

7.5 Towards the end of the 1990's bull market, many actuarial valuations using the dividend model were implicitly discounting (relative to market value of assets) at below gilt yields at that time, in contrast to the above survey of typical 2001 and 2002 bases. It would be interesting to repeat the survey for 2003 valuations, to see whether higher discount rates were more prevalent, perhaps as a reaction to asset falls. If and when equity markets rise again, will some actuaries again use discount rates below gilt? We refer later in this section and in section 9 to smoothing mechanisms in actuarial funding valuations.

7.6 A recent paper by Day {**18**} discusses financial economics and makes various recommendations about changing actuarial practice, including cessation of use of asset-based discount rates in funding valuations. Given that the primary purpose of a pension fund is to provide collateral against the pension promise, should funding valuations be risk-free?

Why aren't funding valuations risk-free?

7.7 The simple fact is that most private sector employers never intended to provide near-100% funded security 100% of the time. Had they done so no doubt they would have funded and invested accordingly. They normally have confidence in their own business futures and do not manage their businesses with a view to the contingency of failure. To employers, pension funding is a question of balance given their other priorities about cash flow.

7.8 In Section 6 we tried to clarify valuation definitions and showed that the 'risk-free' concept is imperfect anyway: not only is absolute security unattainable, it is ill-defined in relation to some of the pension realities.

7.9 From the economics context we see three other explanations:

- Corporate response to increasing burden of pension cost and risk;
- Corporate preference for smoothing pension costs.
- The employee's risk inherent in under-funding may reflect the effective or implied terms of the initial employment contract between employers and employees (see 4.6).

7.10 In 5.1 we noted the regulatory heaping-up of pension burden on employers. Consciously or otherwise, employers found a way to mitigate this impact: continue investment in equities and fund at below the cost associated with a risk-free rate. The result, as discussed above, is to leave some of the pension credit risk with pension fund members.

Smoothing

7.11 Related to this is the relatively stable progression, over time, of actuarial valuation results. Actuaries stabilise pension fund valuations because business managers, trustees and probably also scheme members prefer stability to volatility. Managers tend to like stabilised valuations over both short and longer time horizons, possibly because highly erratic pension cash flows might be misinterpreted either inside or outside the company. In theory, adequate disclosure of the pension situation (as in FRS17 or IAS19) should give the complete story to shareholders. In practice it might not.

7.12 Probably, the management preference for smooth pension contributions is related to a similar preference for smooth dividend distributions. The converse of smooth dividends involves sometimes large special dividends and sometimes raising finance from banks or the markets, and there is a frictional cost to these alternatives. Likewise there are frictional costs associated with raising finance to fund a large pension shortfall, or recovering a large pension surplus.

7.13 Despite the switch to market valuation of assets and increasing focus on discontinuance solvency, it appears that relative stability of the funding rate is still very much the norm for most scheme actuaries – subject to the solvency constraints. We are aware of different smoothing or stabilisation techniques in use:

- by choice of assumptions at each valuation (particularly the risk premium in the discount rate over gilts) or
- by adjusting the asset value from market to a 'smoothed value' or
- by disregarding or carrying forward part of the change in surplus or deficit since the preceding valuation.

7.14 This observation, coupled with the survey information on discount rates, suggests that most funding valuations – the actual calculations that derive or justify the agreed funding rate - are not market-consistent at the present time (accepting however that 'market-consistent' has a fuzzy definition). In Section 9 we take this discussion a bit further.

8 Future plan design

There is no risk-free pension. Plan design must always involve a trade-off between risk and cost. This consideration should be linked with the basic economic rationale for providing company pensions, discussed in section 3, in order to inform our work on future plan designs for the ultimate benefit of our clients.

8.1 In this paper we have reverted to basics. We began with an overview of the relevant financial economics, back as far as why companies themselves exist. We referred to labour economics to consider the fundamental reasons why companies would wish to provide pensions. We have studied the valuation issues. What better grounding now to consider future pension plan design? And what more important role for the pensions actuary?

8.2 In this section we argue that, in many situations, neither final salary nor Defined Contribution (DC) is an ideal way of providing for retirement. The flaws of the traditional design in conjunction with current pensions legislation have recently been painfully exposed, and experience of working through all the issues with some companies shows that DC may not be a universal ideal solution either. For example, how can ill-equipped members avoid making poor investment choices and taking on too much, too little, or the wrong type, of risk?

8.3 We are forced to conclude that the future lies in innovative risk-sharing and risk-pooling designs that bring together the best from each extreme. These can be DB with risk-sharing features or DC with appropriate guarantees. But who best to provide the necessary savings structures, and what should they look like? Cost and risk are as ever the key issues: how much cost and how should the risk be allocated?

8.4 In Appendix D we discuss the macro-economics of pension risk and conclude that final salary schemes worked in the past precisely because they were not fully guaranteed and that fully guaranteed DB pensions on current scales are unworkable. In Section 4 we argued that employees do not require fully guaranteed DB pensions.

So what do employees want?

8.5 Pension fund members mostly pay fixed known rates of contribution. For them the issue will focus and is focussing more on the risks. Before we can pin this idea down any further, we need to think a little bit about just what a *risk-free* position would be from a member's point of view.

8.6 The first stage here is: if risk had a zero price, what pensions would employees choose? Important issues that arise include:

- What function of employee's career salary progression really defines their needs for pensions. It seems fairly clear that a pension based very literally on final salary introduces too much salary risk. But is average salary the answer? Is there an intermediate option?
- What distribution of income through retirement is optimal? Inflation protection is a useful concept but this doesn't mean that a pension that falls in real terms after, say, age 75 might not better suit the needs of an individual who is likely to become less active in the later stages of retirement.

8.7 On the next level, if there is a price for risk, then we ask when and in what forms employees prefer to take it:

- Does appetite for risk increase once a basic level of reasonably secure pension has been built up?
- Does appetite for risk decrease as retirement nears and pensions begin to seem more important?
- Is it really the case that pensioners don't want to take any risk at all, even if they've just retired and half of their pension payments are over 10 years away? (Portfolio theory would suggest that this is not the case.)

8.8 Finally, there are design criteria that do not directly relate to taking economic risk, but nevertheless will be significant when evaluating candidate designs. These are things like:

- Simple to understand and administer
- Where members need to make choices, they should be able to do so in an informed way, ideally without expensive independent advice
- Transparent governance and appropriate accountability
- Flexibility: especially around pace of accrual
- The possibility of staged retirement (drawing part but not all of the pension)

8.9 An interesting final observation here is that, not only do today's final salary schemes provide too much certainty on these criteria, they also are quite likely to provide the wrong type of certainty for many people.

A framework for pension scheme design

8.10 For the current purposes, we consider a pension scheme to be any form of saving for retirement. Let us assume that we have the following:

- A concept of an ideal risk-free pension
- A stream of contributions to fund the pension
- A choice of assets to invest in, possibly including a guarantee provided by a sponsor (e.g. an employer or the State).

8.11 How close we get to providing that ideal pension will depend on whether the contributions and investment returns together are big enough to do so. The challenge for actuaries is to suggest structures which bring these three elements together in a way that gets as close as possible to fulfilling the design criteria.

8.12 Connected with this is the need to distinguish systematic risks (which are rewarded in expected return) from specific risks (which we should aim to diversify away).

8.13 It is useful to define a liability benchmark portfolio, being one which (in some sense) would minimise investment risks. We allow this to contain risk-free zero-coupon bonds of any duration and any type of inflation linkage, disregarding the current incompleteness of the markets in this respect.

8.14 Firstly, we have risks that the actual investment strategy does not do as well as the benchmark portfolio. Typically, these *investment risks* would include:

- Systematic investment risks borne via equity-like assets
- Specific investment risks resulting from inadequate diversification
- Interest rate and inflation risks

Some of these will be associated with reward in expected return; others will not.

8.15 Second, we have risks that mean that the income provided by the benchmark portfolio does not keep up with the pension specified by the risk-free position. These *non-investment risks* include:

- Salary risk (higher or lower than expected)
- Consumption risk (income replacement after retirement below expectations)
- Longevity risk (member lives longer than the actuarial assumptions)
- Mortality rate risk (actuarial assumption wrong)

- Event risks, such as retiring earlier or later than planned, change of family status, and so on.

8.16 Where risks aren't associated with a reward, it's clearly helpful to diversify them away where possible. Where risks are associated with a reward, the member may wish to retain them in order to reduce the expected cost of pension provision.

Risk sharing and risk pooling

8.17 For each of the risks associated with providing a pension, we have three choices: to *retain*, to *share* or to *pool*. In addition, on a micro basis, much of the investment risk can normally be avoided by investing in something close to the liability benchmark portfolio. (But as noted in Appendix D there is only a limited amount of low risk investments in the economy.)

8.18 By risk sharing, we mean that a plan sponsor bears a proportion of the risk. An example of risk sharing would be a DC plan with an investment guarantee provided by a sponsoring employer. We would also want the scheme to be able to survive adequately without the sponsor if there is a chance that they will default.

8.19 By risk pooling, we mean that members group together to bear each other's risks, hopefully reducing risk in the process. Examples include buying an annuity and saving in a with-profits fund. Risk pooling is often cross-generational. This is desirable but, to work properly, moral hazards must be mitigated or avoided, especially the risk that wealth is expropriated by one generation from another.

Applying the framework in practice

8.20 We have applied the framework to a few scheme designs but will not go into the details here – a full study could be the subject for another paper. We hope that others will be interested to follow the idea. This approach to risk attribution shows that, in many situations, designs that are intermediate between fully defined and straight DC may well provide the best potential for effective risk-sharing, risk-pooling and simplicity.

8.21 One such design is what might be called a semi-defined benefit (SDB) current salary design. In this the basic accrual works on a career average principle with indexation of past accruals under trustee or employer control according to stated ground rules for operation. The rules need to be properly transparent for good governance.

8.22 Another design feature involves an accrual rate or employer contribution to a DC plan that itself is variable and dependent on a stated measure of company performance.

8.23 These mid-spectrum designs can also be approached from the DC end, building in appropriate guarantees to meet members' needs and investing as appropriate in some of the modern investment vehicles that allocate investment and other risks as required.

Practical conclusions

8.24 In this section, we have barely begun to scratch the surface. We certainly have not arrived at any definite answers to the big questions of what type of pensions are best for society, and who should provide them. There is much more work to do in applying economics to these important matters, and we hope that our observations and suggestions will provoke thought and debate in the area.

8.25 But in Appendix E we outline the apparent pros and cons of allocating cost and risk between the various parties: the State, individual employers, groups of employers and insurance companies. If we were to venture a suggestion based on the approach outlined above, we might suggest future pension provision along the following lines:

- A basic level of defined benefit provided by the State, but still with some risk sharing in the long-term success of the economy via indexation related to trend GDP growth.
- A layer of SDB on top of this for the majority of employees. Large employers would have their own schemes and small to medium employers would club together.
- DC for rich and/or financially literate employees, either instead of SDB or on top of it. This would be a modernised version of DC incorporating features like investment guarantees provided via derivatives and investment-linked annuities.
- The self-employed and those working in small businesses could either use DC or a form of SDB provided by insurance companies (although this would be somewhat watered down compared with an occupational SDB scheme).

9 Better ‘actuarial valuations’

What will be the objectives of future actuarial valuations? Should the profession encourage risk-free discounting? An earlier point from labour economics has a bearing.

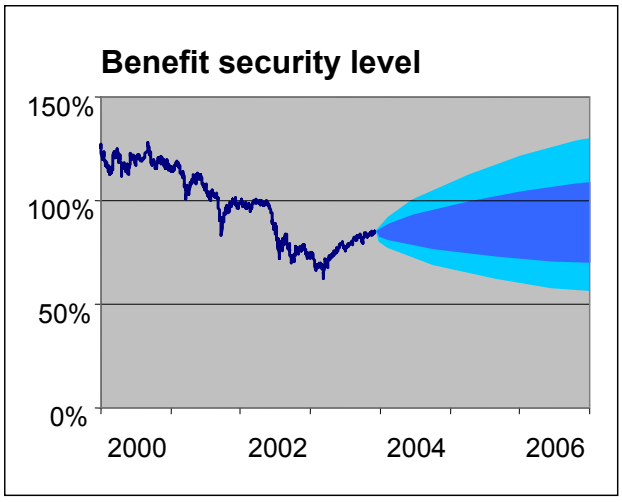
9.1 We refer in this section (as throughout the paper) to the practice of carrying out ‘actuarial valuations’ for the purposes of assessing an ongoing funding rate. The guidance in GN9 is in the process of changing to place more weight on the funding objectives. These objectives of an actuarial funding valuation will naturally differ from one situation to another for the reasons of governance discussed in 6.25. The rules on contribution rate, treatment of surplus and deficit and other factors can all feature.

9.2 Standing back from the detail and looking at the funding control process from a broad perspective, the choice of funding objectives amounts to the measurement and control of the two main variables of interest:

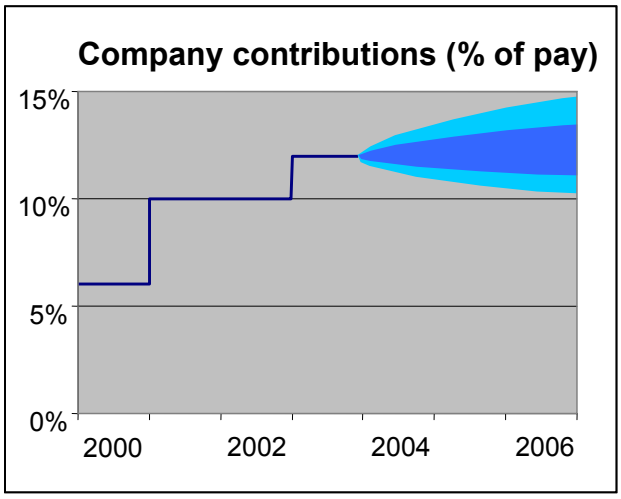
- the contribution rate
- the solvency position measured on a discontinuance basis.

9.3 In principle, at any point in time it is possible to graph the history of each variable. With suitable ALM modelling it is also possible to map out a probability distribution of the future path of each variable. The past and future can be combined into a single chart like the Bank of England charts of RPI, past and future:

Solvency position



Contribution rate



9.4 Risk in either variable is seen in the volatility of past results and the spread of anticipated future results. Aggregate risk to the employer is a function of the scheme design (explicit or implicit risk-sharing mechanisms as discussed in Sections 6 and 8) and the degree of asset/liability mis-match. The allocation of risk between contribution rate and solvency position is, in effect, determined by the choice of funding objectives and associated actuarial method and assumptions.

9.5 The allocation of pension risk amongst members will also be affected by the funding objectives and the relative weight placed on stabilising the funding contributions and stabilising the solvency position. Transparency to members regarding these risks will need careful explanation of the impact of the funding objectives on the future development of the solvency position.

9.6 If the capital and labour markets were perfectly efficient then in principle the volatilities of the contribution rate and of the solvency position would be compensated for (but this only applies to current employees) in terms of the market pricing of wage levels and the company's shares. But where markets are not perfectly efficient, and one market may be more efficient than the other, a question is how the risk allocation might affect these respective interests. This may be an interesting area for further study.

9.7 The funding objectives and the funding control cycle address the governance risk of pension funding and do not deal with investment risk or (except over longer time periods) the default risk experienced by the members. The main issue is stability of the funding rate (over both short and long time horizons) versus risk to the solvency position. The situation is broadly symmetric: more stability in the solvency position (at around 100%) means more risk to the funding rate. As noted in Section 5, in former times the solvency position was much less of a concern than it has now become, and actuarial valuations were made in a way that focussed on stabilising the contribution rate. Now that the solvency position is a major concern, what is the implication for the funding objectives and assumptions of actuarial funding valuations? How is the aggregate pension risk to be allocated? (This has been discussed by Haberman & Owadally **{19}**.)

9.8 Most DB pension schemes were established before the legislative constraints of recent years and without a policy of conveying 100% security at all times. We have not heard of or encountered a single company that would deliberately adopt such a policy now (though if there are any still using single premium deferred annuity contracts then they are the exception).

Should funding valuations be risk-free?

9.9 The EU Pensions Directive and the Government's proposals set the new framework. Working within the framework, actuaries will advise their clients with regard to their

respective objectives and the risks of not achieving them. Given the discussion in Section 7, should we be moving towards actuarial valuation on a market-consistent, gilt-matching type of basis?

9.10 Any valuation basis that is not transparent by definition hides information from members. Any valuation basis that is not consistent with published figures (e.g. FRS17 or IAS19) has the effect of making it look as though there are different standards for shareholders and employees, which cannot be good for employee-employer relations. Note that this is not the same as saying that pension funds should be fully funded on this basis - in particular, employees may not be willing to pay the high pension cost that this entails in the form of lower wages. A risk-free valuation basis disaggregated by member type provides employees with much more of the information necessary to assess the security of their individual pensions and the risks involved.

9.11 In short, valuation at a risk-free rate has considerable advantages for member communication. But company managers desire smooth contribution rates: a funding objective which creates highly variable contributions is likely to be very unpopular with managers and possibly also with shareholders. Only after some stabilisation or smoothing device has been built into the funding calculation can the stabilisation or smoothing objective be achieved. At least that is how actuarial funding valuations are now and probably will be for some time to come.

Stabilisation of funding rates

9.12 We have previously noted that:

- Company managers tend to like stability of funding rates.
- Adequate financial reporting via FRS17 or IAS19 should give the complete story to shareholders, so that the degree of stability or volatility of contributions should not matter to them (to first order effects).
- Current actuarial practice involves widespread continued use of stabilising techniques to determine or justify funding rates.
- Mechanisms being used include asset smoothing, choice of liability discount rate premium to gilts, and disregarding part of a surplus or deficit.

9.13 Employees have in the past been willing (consciously or otherwise) to bear the default cost associated with smoothing of the funding rate in return for the relatively high level of benefits that employers have been willing to promise.

9.14 Use of the dividend yield model in the past contributed to stability of valuation results in the face of market volatility. One of the oldest debates in financial economics is the extent to which market values correctly reflect fundamentals (e.g., discounted

dividends). Shiller **{20}** for instance found that stock market values fluctuate far more than dividend variation, suggesting a degree of short-run irrationality in the market.

9.15 If it is the case that the market does not reflect fundamentals in the short-run for behavioural finance considerations, there is at the same time little economic reason for the market to exhibit predictability in the timescales over which it reverts to fundamentals. There is indeed some evidence that dividend yields offer some predictability of long-term equity returns (summarised in Cochrane **{21})** but while these results are statistically significant in many cases, their explanatory power is low, reflecting the fact that one would expect long and variable lags in reversion to fundamentals.

9.16 Hence, to stabilise the funding rate in the long run by some mechanism for varying the liability discount rate premium over gilt yield in a way that correlates positively with equity dividend yield does not imply an ability to time the market. It is entirely about what are reasonable fundamentals for long-run calculations.

9.17 This is an area worth further study – to develop a proper economic theory of stabilisation of pension funding. In addition, there needs to be a more formal theory of actuarial discretion which ties the range of discretion to economic circumstances, agency theory and financial factors such as market completeness.

Presentation

9.18 In future there will have to be a more balanced presentation of the two results of an actuarial funding valuation – the funding rate and the solvency position. That is the direction of change and it is supported by the observation that any funding plan is essentially about allocation of risk between those two variables.

9.19 A balanced presentation of the two valuation results would be reinforced by showing the assumption linkages between the two calculations instead of treating them as if they were divorced and independent. The basis for calculating the contribution rate can be explained in terms of differences in the discount rate, salary increase and demographic factors relative to the basis for calculating the solvency position. Or the funding calculation can be the start and its assumption base can be deconstructed to arrive at the solvency basis.

9.20 The explanation of these differences would serve to illuminate the extent or otherwise to which the funding rate is expected to be stabilised and the solvency level is expected to fluctuate – both in the short term and the long term. This would be a natural extension of what actuarial reports must already explain about implications of the funding plan and strength of basis.

9.21 Incidentally, in the interests of good communication the solvency or discontinuance valuation could be renamed something more member-friendly, such as 'benefit security position'.

Risk-sharing pension schemes

9.22 An important message from Section 8 is that risk-sharing pension scheme designs are a desirable component of the future DB pension scene. In 9.4 we noted that the plan design affects the aggregate risk to the employer which is then allocated, via the funding objectives and actuarial method and assumptions, between contribution smoothing and solvency risk.

9.23 So, if there are any such risk sharing DB schemes to value in future, future actuarial valuations will need to address a three-way allocation of risk and associated cost or benefit, between discretionary benefits, solvency position and contribution smoothing.

Plan design

9.24 A question arises as to the discount rate to be used to value DB pensions when designing a new DC scheme for new employees. The company may wish to offer benefits of equivalent overall value, or at least to be able to benchmark future DC pension cost against a measure of existing DB pension cost. Should the discount rate here be that used for funding or the risk-free rate?

9.25 In general, the correct answer is neither. The funding basis may have some implicit or explicit smoothing or other off-market adjustment. The risk-free rate will not equate to the valuation of the DB pensions as perceived by recipients because of default risk and the other optionalities that we have noted in Section 6.

9.26 The correct answer would involve an assessment of the value of the DB pensions to the beneficiaries taking account of these factors. After all, in principle wage rates should compensate for pension risk to employees, although in practice we have noted that labour markets may not be very efficient at present in this respect. This is another aspect with scope for further work.

10 New MFR

10.1 Having noted the Government's intention to abolish the MFR and not replace it, let's close with a challenge to that policy. Our point for debate is that some kind of minimum funding standard is a necessary component of a successful pension protection system. The US regulators who set up PBGC and ERISA in the 1970's appreciated this, and it should be obvious now.

10.2 The problem is that the MFR has acquired a bad name for a variety of reasons. The main concern is to do with behavioural influences in the investment markets: the Treasury having a worry (which we think is misplaced) about anti-equity influence and financial economists criticising the pro-equity component. True - the MFR formula with its equity component and dual calculation method, using the worst of actual and notional market conditions, now looks cranky and hard to understand, with perverse effects when equity markets go down and bonds go up. True, quick fixes have also led to loss of confidence in the whole project. But those concerns do not address the fundamental issue.

10.3 The fundamental issue is moral hazard, or 'solvency abuse'. The world has good guys and bad guys. The good guys will say: let's fund our pension plan properly and avoid the risk-related levy to the Pension Protection Fund (PPF). The bad guys will go in the other direction, not necessarily because they are bad but by force of circumstances. Recent highly adverse experience at PBGC **{22}** shows that this problem lurks even with an MFR (the ERISA funding standard in the US).

10.4 The PPF proposals have been put forward on the basis that the MFR will be scrapped and replaced by scheme specific funding standards which would be accompanied by some stronger powers given to trustees in the event of failure to agree with the company. The CBI and others have argued that the risk-related component of the PPF premium should be related to sponsor credit risk as well as solvency level as far as reasonably possible. Would these measures be strong enough to prevent solvency abuse?

- **On the face of it, replacing the MFR by a scheme-specific regime is attractive: it allows flexibility for management and trustees to deal with the circumstances that only they know best. The heavy hand of legislation is stayed.**

- **But some degree of abuse of a flexible system is unavoidable, as the US experience shows.**

- **The right sort of DB pensions are attractive and useful to employers and employees, but employers are being given many reasons to switch to DC: regulatory burden, now PPF levies, and in future cross-subsidising the bad guys.**

- **The more that can be done to prevent 'solvency abuse' eventually destroying good company pensions, the better. It is surely mistaken to abolish MFR and not replace it with a more suitable standard to work in support of PPF?**

10.5 The required features of a new MFR would be:

- Enforce a reasonable common standard of funding to a minimum level, in order to protect good employers and the PPF from solvency abuse.
- No material impact on the investment markets beyond those that would happen anyway as schemes mature and sponsors and trustees become more risk-averse.

10.6 It is not hard to devise a workable idea. The seed is already contained within the requirement for the PPF to establish a common funding yardstick to determine whether or not a pension fund qualifies for admission on insolvency of the employer and as a basis for assessing risk-related premiums. Almost certainly the basis would be closely related to gilt-matching. Appropriate shortfall funding rules can be devised to reduce potential for investment market impact. (It is doubtful whether any financial constraints on occupational pensions could have absolutely zero impact on the markets.)

10.7 The idea is workable providing that the benefits covered by PPF are sufficiently below the average scheme's promised benefits, which it appears may be the case. Not only will trustees have the incentive then to ensure adequate funding of the whole of the promised pensions, also the new MFR can be designed to work without undue market impact.

The best way forward seems to be to apply the strongest funding standards to the basic levels of pension that concern most people.

Constraining actuarial bases generally is too crude a solution.

Increased transparency in future will mean greater clarity about:

- **how much pension is well protected,**
- **how much is not guaranteed and is subject to discretionary decisions with attaching ground rules,**
- **and, for higher earners, how much is more at risk.**

10.8 Risk-based PPF levy is a carrot, statutory minimum funding is a stick. For the system to work properly we need both. A new MFR based on a gilt-matching valuation of PPF-covered benefits can be made workable by suitable choice of the funding rules. For example a very weak funding rule would be to fund any shortfall of market value of assets below 75% of the new MFR over a period of five years, with no requirement to fund any MFR shortfall between 75% and 100%.

10.9 What would be the point of having an MFR with such weak funding rules? The PPF directorate could have a statutory duty to review its own financial operations in conjunction with the funding rules of the new MFR, and to make recommendations to the Secretary of State based on the following broad criteria:

- Evidence of significant abuse by low funding (notwithstanding increased PPF premium) would be a reason for requesting a strengthening of the funding rules (eg raising the 75% or introducing a funding rule about the other 25% of shortfall).
- Lack of significant abuse but evidence of supply and demand imbalances in the investment markets caused by the new MFR would be a reason for requesting a weakening of the funding rules.
- Lack of significant evidence of either abuse of the PPF or MFR-driven imbalances in the investment markets would be grounds for leaving the funding rules unchanged.

10.10 So, a weak MFR funding regime could be installed to begin with, initial market impact could be avoided, but employers would know that if they were to abuse the system there would be a risk of the funding rules being tightened up later. The existence of that power might be enough of an incentive without actually having to use it.

10.11 This is just one idea and others can no doubt be devised – for example based on the capital requirement instead of the funding rules or using mechanical instead of discretionary procedures for tightening up in future years. Our point is that feasible solutions exist.

10.12 Finally we had better find a new name. What about Pension Funding Standard – which of course will be called PFS?

11 Summary

11.1 We have written at length and apologise for doing so; time was limited and a more concise paper would have taken longer! So let us be brief in summing up.

11.2 The basic idea of the paper was to take a rounded view of the relevant economics and actuarial practice, and to use this as a platform for considering important issues such as how to design future pension plans. We hope we have succeeded to some degree; in going through the process we have noted the importance of labour economics as well as financial economics. Behavioural finance will also be worth watching.

11.3 Issues raised for debate and further work include:

- How 'sticky' are wages with respect to pensions, and will that change with increased transparency of pension costs and risks?
- Do employees require *fully guaranteed* DB pensions?
- What proportions of overall retirement income should come from the State?
- Are there objectively better ways of stabilising the funding rate?
- Should actuarial funding valuations use a risk-free discount rate?
- How to value DB pensions in a plan design context.
- And not least – should there be a new MFR?!!

11.4 We conclude by expressing thanks to various colleagues, especially Mike Orszag, for their valuable help and guidance in preparing this paper. Any remaining errors or omissions are entirely our own.

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A Theories of capital markets and valuation

1 The first theory of capital markets was the Capital Asset Pricing Model, which sprung directly from portfolio theory. For the CAPM to hold, it must be true either that returns are normally distributed or that investors care only about means and variances.

2 As with MM, each of these assumptions is demonstrably false. Indeed, the CAPM is not a very good model of security prices or of portfolio holdings. Like MM, it is so prominent not because it is an accurate model but because it provides a simple and convenient way to think about an underlying problem, in this case the equilibrium relationship between risk and return. The weaknesses of CAPM have not stopped investment professionals reporting on betas and "looking for alpha". The benefits derived from the theory despite its acknowledged limitations are palpable.

3 Serious empirical work has moved away from the CAPM to the Arbitrage Pricing Theory (APT). This views security prices as being determined by a large number of factors, rather than just market risk. The correlation between these factors and the security price determines the price of the security. Unlike CAPM, many more factors can be priced – and many have been identified. Complex models of this type are used by banks and asset managers for optimisation of investment strategy.

4 The deeper study of asset pricing has revealed that equity prices do not follow random walks. As described by Cochrane, **{21}** various financial ratios including dividend yield offer some predictability of long term equity returns. (However, equity return predictability is not a certainty so there is no certain free lunch.)

5 The risk aversion required to justify the high returns seen on equity (and the low variability of the risk-free rate) is extremely high – too high to be reasonable in classical models, which has implications for asset pricing and portfolio theory. The risk-free rate is also too stable to justify the massive fluctuations in equities prices. Several explanations for this puzzle have been proposed - these include limited participation in stock markets, investment in durable goods (such as housing), survival biases in observed stock market returns, and habit formation-type preferences. These solutions - but more importantly the rigor which with they are tested - are a sign that financial economics is a vibrant and healthy discipline.

6 Finally, this section would be incomplete without a brief mention of the efficient market hypothesis (or EMH). This defines a market as efficient if it is not possible to make profits by trading securities using available information. Depending on the information that is assumed to be available, one can generate different forms of this hypothesis. A great deal of effort has gone into trying to test the EMH. It seems unlikely that it can ever be firmly and finally disproved by empirical testing, but on the other hand it seems unlikely that researchers will ever stop trying to detect rewarding market inefficiencies.

B Market valuation principles

1 In contrast to most actuarial work, asset valuation principles in financial economics are all founded on the concept of valuation under uncertainty. The classical model of valuation under uncertainty dates back 30 years to Black and Scholes **{23}** when they described their now famous option pricing formula. This formula, like all micro-economic formulae, makes a number of assumptions which are contra-factual. Markets are assumed to be complete (meaning all relevant cash-flow patterns can be replicated by cash-flow matching or hedging investment strategies); trading is assumed to be costless and continuous.

2 However, this paper marked a new departure in finance and economics because it no longer required preferences to be specified – beyond assuming that investors prefer more to less. This alone is sufficient to justify, in a complete-markets frictionless trading world, the no-arbitrage condition, which states that securities are priced to prevent the possibility of risk-free profits.

3 Like every micro-economic model, the Black-Scholes options pricing model makes some errors in pricing (notably the "smile effect" where implied volatility is not constant). However, it is still one of the most influential models ever produced.

4 The idea of risk-neutral valuation lies at the heart of financial economics. Essentially, it says that one can value any payoff as though investors are risk neutral if one adjusts the probabilities of the event in a certain way. This in turn implies a way of calculating prices (especially of derivative contracts) by reference to the risk-free rate of return. Risk-neutral pricing can only work if it is possible to construct a replicating portfolio whose payoff perfectly replicates the payoff of the contract being priced and which requires no injection of cash at any time except the time at which the contract is bought. This is only possible if markets are complete. For most of the risks faced by most people, markets are incomplete, which implies that more sophisticated options techniques need to be used. These techniques will typically result in a range of prices rather than a single unique price for any asset. These ranges may be broad or narrow depending on how incomplete the market is.

5 The Black-Scholes solution contains no assumption about expected asset returns. It requires the risk-free rate and the assumed future volatility of the underlying stock. That is a consistent feature of markets in traded securities - the risk-return trade-off is reflected in the market prices of assets.

6 In his book **{21}** Cochrane uses utility principles to derive the fundamental market pricing formula:

p=E[mc] where:

- p is the asset or liability 'price'
- E is the statistical expectation operator
- m is the discount factor
- c is the future cash-flow.

7. Cochrane shows how this formula, almost Einsteinian in its simplicity and reach (we therefore changed his x to c!), is the prototype of other approaches to economic valuation. The variables m and c are dependent on future states of the world which are random. So m is sometimes called a stochastic discount factor or a deflator, as in **{24}**. In principle, as that paper showed, valuation by stochastic discount factors is a powerful approach to pension problems.

8. Risk-neutral valuation follows Cochrane's general formula in the form:

p=E*[rc]

where E* is the expectation assuming certain artificial 'risk-neutral' probabilities and r is the risk-free rate of discount which happily replaces all the scenario-dependent stochastic discount factors. At any one term of payment this is the same as p=rE*[c]. For pensions that do not have systematic risk the probability measure does not shift and so this is the same as p=rE[c], equivalent to saying that the market-consistent valuation is at the risk-free rate.

9. For comparison, actuarial valuation is usually presented in the form vE[c] where the discount factor v replaces the stochastic discount factors and comes outside the expectation operator. It may look like the preceding formula but the discount v is usually derived by reference to off-market criteria. So, unless v is designed to be market-consistent, this is not an economic valuation in the sense of 6.4 and does not provide the answer p other than by numerical coincidence.

C Valuation of pension features

This appendix discusses the economic valuation of the realistic cases listed in 6.27.

Binary

1 Since the benefit is paid at company discretion, we have no way of knowing in advance what benefit will be paid except that it is one or other of two specified amounts. Discounting the alternatives at the risk-free rate gives two alternative values. There is no single correct value.

2 On the other hand, in principle there is only one shareholder valuation of the pension at any time. This value might be the same as it would be if there were no discretion and the lower amount of benefit is always paid, on the grounds that the company should not be paying out any more than that unless it can get back the value through some corresponding benefit to itself. Or there might be a custom and practice giving rise to an employee expectation of favourable treatment on early retirement, which the market knows and factors into account.

Bounded and uncorrelated with asset return

3 As the payout is uncertain apart from being between two bounds, valuation at the risk-free rate gives a corresponding range with no unique answer. The shareholder value could be anywhere in the range, similar to the binary case.

Bounded and correlated with asset return

4 Again, valuation at the risk- free rate seems to give a range with no unique answer.

5 But in theory there is a special case where the correlation with asset return between the bounds is 100%. Suppose the payout can be identified as a cash amount equal to the accumulation of a present value X (representing the liability amount at the valuation date) invested in the specified asset and subject to a minimum payout of Y and a maximum payout of Z at the future time. In this case an economic valuation is obtained via the hedging argument, and amounts to:

$$X + P(X,Y) - C(X,Z),$$

where P and C are the Black-Scholes values of the put option and call option respectively on the asset X at strike prices Y and Z. (In the more general case of pension instead of single cash payment, the option-pricing approach can in principle be replaced by more general one of stochastic discount factors or deflators – see Appendix B paragraph 7.)

6 This value depends on the parameters X, Y and Z, and on the expected volatility of the specified asset. But, despite the 100% correlation with asset return, the market price of this liability does not depend on the expected return from the risky asset. It just depends on the risk-free rate, the asset volatility and the nature of the liability.

7 This option model gives a way of connecting the DB and DC concepts. At one extreme Y=Z and the payout is a pure defined benefit of that amount Y (=Z). The economic valuation is X + P(X,Y) – C(X,Y) which, by put-call parity, equals Y discounted at the risk-free rate. The values of X and its expected future growth rate drop out. This supports the statement that completely guaranteed DB pensions are more like bonds than equities.

8 In the opposite direction the two parameters may be moved apart so far that they have no material effect, the two option prices are negligible and the present value of the pension approaches X. Therefore funded DB pensions with substantial credit risk are more like DC pensions, subject to the way the priority rules apply to individuals. In the extreme the value is precisely X and you have pure DC.

Unbounded

9 Without any bound on the amount of benefit payment, there can be no hard bound on the economic valuation. A valuation at the risk-free rate of any expected future salary-related amount leaves open a chance that the liability payout will be greater than assumed.

D Macro-economics of pension risk

1 Financial economics has helped us better understand the costs and risks in conventional final salary pension plans. The lesson is that cheap pensions for all are an illusion (unless they are just small pensions!), high pension certainty has a high price and this price must be paid for.

2 There is a separate logic in saying that those who pay for high pension certainty should be those who benefit. That is fairest, and the latest Government proposals on pensions move us more in that direction. It is a direction that requires a free and fair market in certainty. Transparency and choice are key prerequisites and risk-transparent pension accounting a major element. The goal is an economically efficient distribution of the limited supply of certainty.

3 The alternative choice for society is to promise ourselves substantial high security pensions but not to recognise all the cost now. That's the natural course in a pay-as-you-go unfunded pension system and not that difficult in a funded system either, as we have seen. With the economics of pensions now clearer and the population profile ageing, cross-generational transfers of pension risk and cost will become an issue. The UK has experienced fairly good economic growth over the last 1,000 years, and may continue to do so. Why not leave some of the risk to our more fortunate descendants?

4 The ballot box will have to decide. In any case we presume that employee interest and understanding of their pension issues can only increase, leading to more need for information and more informed choices about their pensions and the risks involved.

5 If absolute pension certainty has infinite cost and is unattainable, what does that say about the provision of guaranteed defined benefits? It says that a high degree of certainty is potentially very expensive – with no limit to the possible cost.

6 It should be no surprise that UK bond yields lowered in real terms at a time when DB pension risks to companies increased in scale and transparency. It can be no accident that the market for equity-linked personal pensions in the UK far exceeds that for private deferred annuities. The obvious conclusion (though difficult to prove) is that individuals prefer a pension that is uncertain, but likely to be reasonable, to one that is certain to be inadequate. So why should the nature of occupational schemes be any different?

7 There are compelling macro-economic arguments why truly defined benefit pensions on present scales for all cannot work. The size of the current index-linked gilt market is around £80bn, of which only about half has longer than 10 years duration. In round terms this might be sufficient to provide the UK population with a pension of little more than £1 per week!

8 There is, if you like, a limited supply of certainty in the economy, the supply and demand for which gives it a price. This is another way of saying that future economic uncertainties have to be borne by someone who will require an expected reward for doing so. If those saving for retirement are to take so much of the certainty then other groups will have to bear all the risk.

9 Companies swamped by pension obligations will cut back on salaries and bonuses. And when some finally go into receivership, the employees of other companies will pick up the rest of the pension bill via the PPF levy. In extremis the taxpayer might have to pitch in too.

10 And another thing: even if we wanted to provide truly defined benefit pensions, would we actually be able to? Investing in corporate bonds could go badly wrong in the event of a severe downturn. Gilts would not be immune to political risk. In our democracy, how long would an impoverished working population put up with gold-plated pensions for a large section of the retired before doing something about it?

11 Final salary schemes worked in the past precisely because they were not fully guaranteed. Fully guaranteed DB pensions on current scales are unworkable.

E Who should provide pensions?

This is the question posed in 8.25.

State	
Pros: • Economies of scale • Effective diversification of investment and non-investment risks • Totally portable • No frictional costs of regulation or marketing, frictional costs of consumer education depend on the complexity of the design adopted.	Cons: • Political risks, most importantly around changes to accrued benefits. • Little chance for divergent approaches leading to improvements in best practice. This could lead to complacency and/or inefficiency. • There is a compromise between catering for all needs and making the plan simple enough to be understood. It is likely that in practice neither of these objectives would be adequately met, except if the State provision is designed as base onto which private provision can be added. • Lack of national diversification
Individual employers	
Pros: • Plan can be used for secondary purposes, eg workforce management, retention incentives • Potential for tailoring to needs of specific groups, because range of needs is less diverse than in the population as a whole. Hence can provide tailored pensions without adding a bewildering array of choices. • A range of salary-linkages are possible, eg final salary, which are difficult elsewhere because of moral hazard. (Though it can be argued that this is of little direct benefit to some members.) • Cross-generational risk pooling works well. • Low frictional costs of regulation, marketing, consumer education etc.	Cons: • Poor economies of scale for smaller employers • Poor portability (frictional costs of allowing portability, and portability may be restricted if the employer is using the plan to encourage certain behaviours) • Obtaining adequate diversification of investment and non-investment risks may be a problem, depending on the size of the employer. (Though reinsurance is a possibility.) • More risk sharing would lead to governance issues to address. • Credit risk in respect of any employer guarantees. • Cross-subsidies are hidden, so employers are freer to apply the wage-tilt hypothesis. (This is possibly an advantage from an employer point of view.)

Groups of employers	
Pros: • Economies of scale • Better diversification of investment and non-investment risks than smaller employers could obtain alone. • Cross-generational risk pooling works well. • Reasonable degree of portability, providing member stays within the same group of employers (eg within the industry). • Ability to provide tailored pensions without adding a bewildering array of choices. (Assuming there are similarities between the employers in the group.) • Lower frictional costs of regulation, marketing, consumer education etc.	Cons: • Individual employers have less say over plan design. • Plan design likely to be more static due to difficulty of getting agreement for changes. • More risk sharing would lead to governance issues to address. Additionally, there could be conflicts of interest between the employers. • Careful design needed to avoid inter-employer moral hazards. • Credit risk in respect of any employer guarantees.
Insurance companies (ie individual policies)	
Pros: • Good diversification of investment risks and certain demographic risks. • Segregation of funds into individual policies means fewer governance issues to address. • Totally portable.	Cons: • Impossible to diversify event risks (eg decision to early retire) because of moral hazard. • Salary link is restricted to being of the current salary type (eg DC, Career Average DB or SDB) • Cross-generational risk-pooling will only work at the expense of transparency. If the smoothing reserve of each fund is public knowledge then many customers will move their money or at least new contributions on the basis of this information. • High frictional costs of regulation, marketing, consumer education etc. • Credit risk of insurance company / industry

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