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UK Pension Fund Management: How is Asset Allocation Influenced by the Valuation of Liabilities?

David Blake

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The Pensions Institute
Cass Business School
City University
106 Bunhill Row London
EC1Y 8TZ
UNITED KINGDOM

http://www.pensions-institute.org/

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Abstract

A single valuation basis (using market values) now dominates the valuation of pension scheme assets and has replaced the previously dominant actuarial and accounting bases.

The same cannot be said for pension scheme liabilities. There are three different valuation bases for liabilities currently in use: a statutory basis (specified in the 1986 Finance Act), an actuarial basis (the Minimum Funding Requirement, specified in the 1995 Pensions Act) and an accounting basis (specified in Financial Reporting Standard 17). Since each of these uses different underlying assumptions, the three bases are not consistent with each other and produce substantially different measures of pension scheme liabilities. None of these measures corresponds to an economic valuation. **Moves should be made to develop a single valuation basis for pension liabilities.**

A key difference relates to the discount rate used to calculate the present value of future pension payments. The Accounting Standards Board's new FRS17 and the recent MFR Review conducted by the Faculty and Institute of Actuaries have both proposed a bond-based discount rate. Anecdotal evidence suggests that this is pushing pension fund asset allocations towards bonds in an attempt to reduce the short-term volatility mismatch between assets and liabilities. **Moves should be made to ensure that the valuation basis for pension liabilities does not distort pension fund asset allocations.**

As a consequence, asset allocations are being pulled away from the asset classes most suitable for the long-term asset allocation of pension funds, namely equities and property. This raises the long-term cost to the sponsor of delivering defined benefit pensions, further encouraging the switch to defined contribution schemes.

Various insurance-based mechanisms have recently been proposed in the event of scheme insolvency, namely a central discontinuance fund and mutual or commercial insurance. Experience from the US suggests that moral hazard risks are such that **commercial insurance might provide the best chance of reflecting accurately the insolvency risk associated with a scheme's particular funding stance** should the MFR be replaced.

Executive Summary

- **The Economic Problem**

How should we value the assets and liabilities of a defined benefit pension fund when the assets are liquid and subject to market value fluctuations, while the liabilities are less liquid and potentially less volatile? How can we ensure that there are always sufficient cash flows from the assets to meet the promised pension payments when they fall due? And how can we deliver pensions at the lowest economic cost to the sponsor? These questions are currently being asked by actuaries, accountants and economists.

- **The Actuaries' Answer – The Minimum Funding Requirement**

The actuaries' answer to these questions is the Minimum Funding Requirement, which aims to ensure that the schedule of contributions into a scheme is sufficient to meet the obligations of current pensioners in full and to provide a reasonable expectation that active members will also receive their pensions. Assets are measured at market value, while the discount rate for valuing liabilities is based on the actuaries' assessment of long-run returns on the assets in the pension fund. The liabilities are measured using the current unit method and then rescaled by Market Value Adjustments to reflect current market conditions.

- **Assessing the Actuaries' Answer**

The MFR does not guarantee that the pension will be paid in full. It is also highly sensitive to changes in the MVAs as well as restricting pension funds from investing in an optimal mix of assets. Many of the assumptions underlying the MFR are out of date. Some of these weaknesses were recognised in the 2000 MFR Review, which proposed giving pension funds a longer time horizon to meet the MFR. Another crucial proposal is to change the discount rate for valuing liabilities to equal the market yield on an index of UK gilts and corporate bonds. The actuaries recognise that this might encourage pension funds to switch their asset allocations away from equities towards bonds to reduce the probability of failing the MFR test.

- **The Accountants' Answer – FRS17**

The accountants' answer is Financial Reporting Standard 17 issued in November 2000 and coming into full effect in 2003. Assets and liabilities will be valued by reference to current market conditions. Yet FRS17 values liabilities on a completely different basis from the MFR, using the projected unit method and a discount rate equal to the market yield on AA corporate bonds, the same yield used in the corresponding US and international accounting standards FAS87 and IAS19. Actuarial gains and losses will be recognised fully and immediately in a new statement of recognised gains and losses or STRGL.

- **Assessing the Accountants' Answer**

While reducing the volatility of the P&L, FRS17 will increase the volatility of the balance sheet due to the inclusion of the net pension asset or liability. This is likely to reinforce the shift of pension fund portfolios into bonds that was started by the MFR.

- **The Economists' Answer**

Economists argue that assets should be valued at market prices and that liabilities should be valued consistently using the market returns on appropriate assets. The optimal asset allocation would be determined using horizon matching. This uses bonds with their reliable cash flows to meet current and near-maturing pension obligations (using a strategy called cash flow matching) and equity and property with their growth potential to match long-maturing liabilities that grow in line with

earnings (using a strategy called surplus management). This second strategy is justified because of the long-run constancy of factor shares in national income (which make capital and land ideal long-term matching assets for a liability linked to the return on labour) and because of the positive long-run equity risk premium and mean reversion in equity returns (which implies that long-run equity returns are more stable than short-run returns).

What Happens in the Event of Insolvency?

A Central Discontinuance Fund has recently been proposed as a way of dealing with insolvent pension schemes. The Pension Benefit Guaranty Corporation is a CDF that has been operating in the US since 1974. There is a potential moral hazard problem with a CDF and the premiums charged by the PBGC had to be altered from the original flat-rate fee across all schemes to reflect the degree of underfunding in different schemes in order to deal with this problem. **Compulsory private insurance might enable premiums to reflect insolvency risk better.**

Conclusion

Few people would now justify valuing assets on anything other than a market basis. Yet there are currently three official valuation bases for pension liabilities in the UK: statutory, MFR and FRS17. **Moves should be made to develop a single valuation basis for pension liabilities.** Even more significantly, the discount rates that are being currently used or proposed by actuaries and accountants, based as they are on bond yields, are likely to push pension fund asset allocations towards bonds in an attempt to lower the short-term volatility mismatch between assets and liabilities, at the cost of lower long-term portfolio returns. **Moves should be made to ensure that the valuation basis for pension liabilities does not distort pension fund asset allocations.** Otherwise we are likely to find that the simplest solution to the economic problem is a further switch away from defined benefit towards defined contribution schemes.

1. Introduction

Until recently, UK pension fund managers paid only lip service to the liabilities of the company pension schemes whose assets they managed. The schemes were immature and there were no regulations in place requiring fund managers to limit the size of any surplus or deficit in the funds. Obviously scheme sponsors were concerned about deficits, but, given the immaturity of funds at the time, sponsors had a long time to correct any deficiency that emerged.

All this has changed over the last decade or so: pension liabilities can no longer be ignored. There are three key reasons: the increasing maturity of pension fund liabilities, Robert Maxwell's theft of his companies' pension fund assets, and the introduction of statutory regulations on the size and financial reporting of surpluses and deficits.

Pension liabilities have been steadily increasing in maturity as rising numbers of scheme members have retired and begun to draw pensions. While Maxwell's actions related to pension assets, the scandal nevertheless highlighted the crucial relationship between pension assets and liabilities and led to the introduction, by the 1995 Pensions Act, of the Minimum Funding Requirement from 1997. The MFR, a funding standard designed by the Faculty and Institute of Actuaries (FIA), requires pension assets and liabilities to be valued according to closely prescribed criteria and places strict limits on the size and duration of any deficit. In keeping with the remit from the Department of Social Security, the MFR is broadly a 'one size fits all' test. There was almost immediate dissatisfaction with the way that the MFR was operating and a *Review of the Minimum Funding Requirement*, published in September 2000, recommended changes to the prescribed criteria. Statutory limitations on surpluses have been in place since the 1986 Finance Act.

At around the same time, the financial reporting of pension schemes was undergoing a radical overhaul. Following on from US and international accounting standards, FAS87 and IAS19, the UK Accounting Standards Board (ASB) introduced an exposure draft FRED20 on the financial reporting of retirement benefits in November 1999. The official Financial Reporting Standard 17 was introduced in November 2000 and gradually comes into force between 2001 and 2003. The assets and liabilities of a company's pension scheme have to be reported on the company's balance sheet from 2003. As a result, investors will have much more information about company pension schemes and their funding arrangements.

The MFR and FRS17 have important implications for both the valuation of pension scheme liabilities and the composition of pension fund assets. There is strong evidence from the inversion of the yield curve since 1997:Q3 that the MFR (and the same is likely to be true of FRS17) has helped to move pension fund asset allocations towards bonds, mainly gilts. They are not the only factors, however: the increasing maturity of pension funds has also had an impact.

Yet despite being designed by bodies with key regulatory powers, the MFR and FRS17 are neither consistent with each other in the way that they value scheme liabilities nor compatible with the way that economists would value them. Of key significance is the fact that the FIA and the ASB use different discount rates for discounting future pension payments. Furthermore, both bodies have proposed major changes to these discount rates in recent years. The FIA in the 2000 MFR Review has proposed switching from a discount rate based on 'effective' (i.e. long-run) gilt and equity yields (assumed to be fixed and independent of term) to one based on current gilt and corporate bond yields. The ASB has analysed three different (although theoretically related) discount rates in recent years: a risk-free yield, a risk-adjusted yield and an expected yield (see Accounting Standards Board (1997)). FRS17 requires that pension liabilities are discounted using an AA corporate bond yield. Both the FIA and ASB have moved away from discount rates based on the returns on the assets held

in the pension fund to discount rates based solely on bond yields.

This article examines the different ways in which actuaries, accountants and economists value pension liabilities. The issue of pension liability valuation is of major importance, particularly if the asset allocation of UK pension funds is pulled towards the asset classes whose returns are used to discount liabilities. While this may help to reduce mismatches between assets and liabilities for regulatory and financial reporting purposes, it might lead to a suboptimal allocation for long-term investment purposes. There might also be a conflict between the asset allocation most appropriate for the MFR and the one most suitable for sponsors in terms of FRS17. We begin first with the underlying economic problem that generated these actuarial and accounting developments.

2. The Economic Problem

The economic problem facing a defined benefit (typically final salary) pension scheme has three parts:

- **How to value the assets and liabilities of the fund when the assets are liquid and subject to market value fluctuations while the liabilities are not (or more strictly are less liquid and potentially less volatile).**
- **How to ensure that there are always sufficient cash flows from the assets to meet the promised pension payments when they fall due.**
- **How to deliver the pensions at the lowest economic cost to the sponsor.**

The assets of a pension fund consist of the financial assets purchased with the accumulating contributions. In the UK, the liabilities of the fund are typically measured by actuaries using one of the two principal 'accrued benefits funding methods'. The value of accrued pension rights is calculated using the 'projected unit method' if the liabilities are measured on an ongoing basis and the 'current unit method' if the liabilities are measured on a discontinuance basis (Faculty and Institute of Actuaries (1984)).

Suppose a particular scheme member has five years of pensionable service and accruals are based on the 60^{th} scale. Then the accrued pension of the member is equal to $5/60^{th}$ of the member's projected final pensionable salary, payable for the remainder of the member's life (and possibly also the member's spouse's life) if the projected unit method is used. The projected unit method recognises that pension rights accrued to date will cost the scheme more to deliver if the member stays until retirement, since these rights will depend on the retirement salary which will typically be higher than the current salary: estimates of both future earnings growth and career progression are taken into account. The current unit method, on the other hand, is based on the current pensionable salary of the member. A variation on this is the 'current unit method with revaluation' which uprates the current pensionable salary by a price index (such as limited price indexation or LPI, i.e, retail price indexation capped at 5% and floored at 0%), rather than an earnings index: this method is used to determine transfer values between schemes. It should be noted that none of these methods takes potential future pensionable service into account, as 'prospective benefits funding methods' do.

The present value of the pension liability for this member (assumed to be aged t) is calculated as follows:

$$(1) \quad L(t) = a(t)W(t)R(t,T)A(T)D(t,T)MVA$$

where:

$a(t)$ Accrual factor for service by age t (e.g., $5/60^{th}$).

$W(t)$ Pensionable salary at age t.

$R(t,T)$ Revaluation factor for earnings between age t and retirement age T (= 1 if there is no revaluation of earnings up until the retirement age, = $(1 + x)^{(T-t)}$ if the revaluation rate x is constant).

$A(T)$ Expected annuity factor (the present value of a life annuity of £1 per annum) at retirement age.

$D(t,T)$ Discount factor between age t and retirement age T (= $(1 + r)^{-(T-t)}$ if the discount rate r is constant).

MVA Market value adjustment.

The pension scheme is fully funded when the current value of the financial assets in the pension fund is equal to the present value of the pension liabilities aggregated across all scheme members.

One aspect of the economic problem facing any pension fund is that the financial assets are subject to market value fluctuations, whereas the measured (although not the economic) value of the liabilities will not change unless the assumptions underlying the revaluation, annuity and discount factors are specifically changed.

In the past, the actuarial and accounting professions, the two professions most closely involved in the calculation of and financial reporting of pension scheme assets and liabilities, have dealt with the problem of the fluctuating market values of assets by 'smoothing' them and sometimes 'double smoothing' them out. Actuarial and accounting valuation methods employed 'actuarial valuation models' (such as the dividend discount model) and sometimes, in addition, 'arbitrary multipliers' or 'market value adjustments' to 'lower' the fluctuations in the market values of the financial assets in the pension fund's balance sheet in a such a way that significant surpluses and deficits did not materialise. More recently, the actuarial and accounting professions have begun to record financial assets at market value and instead have applied the market value adjustments to the liability values in an attempt to 'raise' the volatility of these towards those of the financial assets. Let us look in more detail at how this is done.

3. The Actuaries' Answer – The Minimum Funding Requirement

When Maxwell stole the assets in his companies' pension funds in 1991, the immediate regulatory issue was the custodial security of the assets in pension funds. However, the Department of Social Security's response to the Maxwell scandal was the 1995 Pensions Act which introduced a completely different concept of 'security' - the Minimum Funding Requirement. The issue of fraud was dealt with in the Act through a compensation scheme run by a new Pensions Compensation Board.

The MFR came into effect in 1997 and specifies a minimum level of funding for an occupational DB pension scheme and an associated schedule of contributions necessary to meet this minimum level of funding. If the pension scheme is showing a 'serious deficiency', whereby the value of the assets is less than 90% of the value of the liabilities, contributions have to be increased so that the 90% funding level is reached within one year. A deficiency of between 90 and 100% has to be corrected within 5 years. A pension fund with a funding level of 100% has to have an annual certificate from the appointed actuary confirming that the schedule of contributions remains satisfactory.

The MFR is calculated using the actuarial methods and assumptions set out in Guidance Note 27 of the FIA (see Appendix). In terms of equation (1) above, the MFR regulations require that the following assumptions are used to value pension liabilities:

- $R(t,T)$ is set to $(1 + \pi)^{(T-t)}$ where π is the assumed rate of retail price inflation (the MFR uses the current unit method with LPI revaluation).
- $A(T)$ is calculated using the effective yield on gilts (unless the scheme is a very large one in which case a mixture of gilts and equities is used: this is known as 'equity easement'), LPI uprating and survival probabilities derived from the mortality table for pensioner annuitants PA90 (downrated two years).
- $D(t,T)$ is calculated using the effective yield on equities for younger active members or a linear combination of effective gilt and equity yields if the member is within 10 years of the MFR pension age (the earliest age at which a member can retire without reduction of benefit). $D(t,T)$ = 1 for members above MFR pension age.
- *MVA* is the equity MVA for young active members (and for pensioners in large schemes on payments over 12 years) and is a mixture of the equity and gilt MVAs for older active members (within 10 years of the MFR pension age). The 'equity MVA' is the ratio of the long-run dividend yield (initially set at 4.25%) to the current dividend yield on the FT-SE Actuaries All-Share Index. The 'gilt MVA' is equal to the fair price of a notional 15-year gilt with an annual coupon of 8%. See Appendix for more details.

4. Assessing the Actuaries' Answer

4.1 The Current MFR

There are five key problems with the current MFR as has been recognised by the Faculty and Institute of Actuaries in their Review of the MFR (Faculty and Institute of Actuaries (2000)).

- **The MFR Does Not Guarantee that the Pension Will be Paid in Full**

Despite the requirement in section 56 (1) of the 1995 Pensions Act that 'assets not be less than the liabilities', the MFR does not guarantee absolute security for pensions: in short, it is not a solvency test. Mike Pomery, Chairman of the Pensions Board of the FIA, speaking at the 2000 NAPF annual conference, stated that the MFR gave scheme members only a 'reasonable expectation' that they would get their full pension, not 'absolute security'. The FIA has estimated that full funding for UK pension funds would cost an additional £100bn on top of assets valued at £830bn (Faculty and Institute of Actuaries (2000)).

A pension fund that fully meets the MFR might only have funds sufficient to purchase around 70 per cent of the pensions due to active members if the sponsor becomes insolvent. There are a number of reasons for this:

- The claims of retired members are met first.

- The insurance companies that provide both immediate and deferred pension annuities for members when a sponsoring company is wound up are likely to use lighter mortality assumptions than allowed for in the MFR regulations and hence offer lower annuities for a given purchase price.

- Long-term interest rates have fallen since 1997, raising the present value of scheme liabilities; even though the assets held by DB schemes, mainly equities, have in the past delivered very high returns, they have still failed to keep up with the growth in scheme liabilities.

- It values liabilities using the current unit method with LPI revaluation, so does not take into account future earnings growth.

As many as one in six pension funds are currently either at, or below, the MFR borderline of 90% funding. The weakness of the MFR was exposed in 2000 by the case of Blagden, a chemicals company whose pension fund fully satisfied the MFR, but which went into insolvency with funds sufficient only to meet two-thirds of its obligations to active members.

Even without the insolvency of the sponsor, a low MFR funding level reduces the transfer values of members who leave the scheme when changing jobs.

- **The MFR is Highly Sensitive to Changes in MVAs**

Since the introduction of the MFR in 1997, the equity MVA has been subject to three major distortions as a result of extraneous changes in the level of equity dividend yields:

- The change to advance corporation tax (ACT) in July 1997.

- The consequential change in dividend pay-out policies by companies.

- The takeover in 2000 of Mannesmann by Vodafone.

The abolition of the dividend tax credit on UK equities for pension funds in July 1997 reduced the equity MVA by 20% and meant that the actuarial value of UK equities for MFR purposes fell by the same percentage. The FIA responded to the abolition by reducing the numerator in the equity MVA from 4.25% to 3.25%. So although the income of pension funds from their equity investments fell by 20%, the MFR test was weakened: the value of pension scheme liabilities backed by equities was reduced by 20%.

Companies responded to the abolition by changing their dividend policy: they reduced dividends and instead rewarded shareholders through share buy-backs, the capital gains on which remain tax free to pension funds. The outcome was that actual share prices rose significantly, rather than fall as actuarial valuations predicted.

Following the Mannesmann takeover, the average dividend yield (measured by the FT-SE Actuaries All-Share Index) fell from 2.3% to 2.2%: Vodafone's dividend yield after taking on Mannesmann (which was not paying dividends) was just 0.4%. This meant that equity-related MFR liabilities (relating to younger active members, including their transfer values) immediately increased by 4.5% without any corresponding increase in asset values, with the result that schemes' MFR funding levels fell by up to 4.5% depending on their liability structure.

Despite there being no change in the long-term solvency of pension schemes or in the costs of delivering pension benefits, the sponsor of any scheme falling into an MFR funding deficit has a legal obligation to raise contributions to eliminate the 'deficit'.

The MFR and Statutory Valuations are Not Consistent With Each Other

In the past, actuaries had considerable discretion over how they valued the assets and liabilities in pension schemes. Guidance Note 9 of the FIA (*Retirement Benefit Schemes – Actuarial Reports*) states that the objective of an actuarial report is 'to enable the expected future course of the scheme contribution rates and funding levels to be understood' but that this is 'not intended to restrict the actuary's freedom of judgement in choosing the method of valuation and the underlying assumptions'. The actuary had the freedom to choose from a range of valuation methods as well as whether to value on an on-going, discontinuance or past-service basis. The Pension Research Accountants Group has shown that depending on the valuation method and basis used, the value of a liability created by a given benefit can vary between £5,758 and £42,667. This can lead to substantial differences in the measures of actuarial surpluses and deficits.

However, the actuary has virtually no discretion when it comes to the calculation of statutory surpluses and deficits. Statutory surpluses must be calculated on the basis of assumptions and methods prescribed by the Government Actuary's Department (GAD) and specified in sections 601-603 of and schedule 22 of the Income and Corporation Taxes Act 1988 and the Pension Scheme Surpluses (Valuation) Regulations 1987 (SI 1987/412). Schedule 22 valuations rely on conservative assumptions which tend to generate low asset values and high liability values, thereby providing a lower-bound estimate for the surplus. If a statutory surplus of more than 5% of liabilities arises, action to reduce it must be taken within six months or partial tax relief is lost.

The actuary also has almost no discretion when performing an MFR valuation, but the assumptions now tend to underestimate the liabilities in comparison with the statutory formula.

The fact that MFR and statutory valuation bases differ is somewhat surprising. Clearly one method and possibly both would not correspond with an economic valuation of pension scheme liabilities.

- **The MFR Restricts Pension Funds From Investing in an Optimal Mix of Assets**

The flexibility that actuaries previously enjoyed has enabled UK pension funds to employ a very high weighting in equities, currently around 70%, the highest in the world, peaking at 83% in the early 1990s. Pension fund sponsors have benefited from very high returns over the last two decades (averaging 18% per annum since 1980) and yet still been able to absorb the short-term volatility in equity values. US and continental European pension funds, many of which have been restricted to invest in government bonds, have look enviously at the performance of their UK counterparts and only recently have been permitted to invest in equities.

In addition, the true volatility was disguised since equities were reported using smoothed actuarial values (based on the dividend discount model or similar) rather than market values, in an attempt to pacify scheme trustees and corporate sponsors.

The MFR has encouraged pension fund managers to lower their weighting in equities and other 'volatile' assets

The obligation of pension funds, even young immature funds, to satisfy the MFR test every 3 years makes it more difficult for them to invest in more volatile asset categories, such as equities, that usually generate higher returns over long investment horizons. Although the MFR regulations allow the accruing liabilities of younger members to be matched against equities, it makes no allowance for the additional short-term volatility of equities.

Investment in other key asset categories, such as venture capital and technology stocks, is also discouraged. This is mainly because these categories pay little or no dividends (at least during their early phases) and, as a consequence, are subject to volatile price movements. Even investment in staple asset categories, such as foreign securities and property is discouraged, since the yields on these are not explicitly used in MFR calculations.

The MFR has encouraged pension fund managers to invest in bonds

While the MFR does not prescribe pension funds to invest in particular asset categories, such as gilts, some key discount rates used in calculating MFR liabilities are based on gilt yields, so pension fund managers have been drawn towards gilts as the natural matching asset for MFR liabilities, on the grounds that 'there is a reduced risk of failing the test if the asset portfolio reflects the discount rates required to value plan liabilities' (Faculty and Institute of Actuaries (2000)).

This has increased the demand for gilts at a time when the government has been repaying the national debt and the stock of gilts has been falling. Gilt yields have fallen sharply, making them more expensive to purchase, with the result that MFR liabilities have risen further, thereby exacerbating the problem.

- **Many of the Assumptions Underlying the MFR are Either Out of Date or Inaccurate**

Improvements in life expectancy and increasing early retirement and redundancy mean that the MFR assumptions relating to mortality and normal retirement are now out of date.

Just as important, the MFR liabilities are not discounted using the theoretically correct approach of discounting each future cash flow by the appropriate spot yield of equivalent term. The MFR approach of using the same fixed discount rate for all future cash flows is only valid if the yield curve is flat and unchanging. The MFR approach will overestimate liabilities if the yield curve is rising and underestimate them if the yield curve is falling as it has been since 1997:Q2.

4.2 The MFR Review

Dissatisfaction with the way in which the MFR was operating led the Department of Social Security to commission the Pensions Board of the FIA to conduct a review of the MFR. This review was published in September 2000 (although it was completed in May) together with a consultation paper published jointly by the DSS and HM Treasury.

The FIA report (Faculty and Institute of Actuaries (2000)) acknowledged that the current MFR 'cannot be made to work as a statutory standard'. It accepts that there is an 'inherent conflict between the MFR which imposes a risk of short-term fluctuations in funding requirements and the long-term asset allocation to produce the best financial results for pension fund members'. However, it also accepts that if assets are valued at market prices, then liabilities have to valued consistently, using 'market yields on appropriate investments' (i.e., matching assets).

Key Recommendations

It addresses these issues by recommending that:

1. Scheme members are told what benefits could be delivered if the scheme is wound up. Pensioners would have a 'very high chance' of continuing to receive their pensions in full and active members have a 'reasonable expectation' of eventually receiving their pensions.
2. The maximum time to remove a serious deficiency is increased from 1 to 3 years, while that to meet the MFR in full is extended from 5 to 10 years; annual recertification is also abolished.
3. The liabilities for pensions in payment should be discounted using the yield on the valuation date of:
   - A composite index of gilts and corporate bonds 'covering the whole of the fixed interest gilt and investment grade corporate bond markets combined',
   - Weighted by market capitalisation,
   - Covering all maturities, except short-term bonds on the grounds that they are too volatile and too poor a match for pension liabilities.

   The resulting yield was 50bp above gilts on 31 December 1999.
4. The liabilities for index-linked pensions in payment should be discounted using the yield on an index-linked gilts index plus the credit spread on the composite index (necessary in the absence of a suitable range of indexed corporate bonds).
5. Liabilities for active members should be discounted at a rate equal to a fixed premium of 1% per annum above the composite index (i.e., a gross premium of 2% per annum over the composite index less 1% per annum for costs). On 31 December 1999 this implied a real return on equities of 4.5% before expenses.
6. The FIA wants to be able to change these assumptions on a regular basis.

The result would be a more 'consistent level of security' for plan members, although:

Funds that retained current equity weightings would find that the new MFR test was more volatile and would need a higher level of funding to reduce the probability of failing the MFR.
Funds might still be encouraged to become more risk averse by switching into gilts and corporate bonds.

Interim Changes

The FIA also proposed some interim changes to the current MFR:

1. Reducing mortality rates by downrating PA90 by an additional 2 years:
   - Raises scheme costs by 6.5% or by £2.75bn up to April 2007 (the latest date for meeting the MFR).
2. Lowering the nominal yield to discount pension in payment liabilities in order to take account of the possibility that while the price level might fall in the future, pensions in payment cannot be reduced:
   - Raises costs by 3.5% or by £0.75bn up to April 2007.
3. Reducing the equity MVA numerator from 3.25% to 3%:
   - Reduces MFR liabilities by 7.7% or by £1bn up to April 2007.

Total additional costs of £2.5bn between the end of 2001 and April 2007.

Government Consultation

The MFR Review was part of a 'wide ranging' consultation process that lasted until 31 January 2001. The government was prepared to consider the following options:

1. Amending the MFR as recommended by the FIA.
2. Further amending the MFR by:
   - Allowing the equity discount rate to be determined by the average over a period prior to the valuation date.
   - Changing the valuation basis from discontinuance to on-going (although this would change the nature of the underlying test away from that of minimum funding).
3. Abolishing the MFR and replacing it with:
   - Prudential supervision by a regulator which might reduce the impact of volatility but not eliminate the need for a funding requirement.

Paul Myners, Chairman of the Treasury-sponsored Review of Institutional Investment, has described the MFR as 'seriously inadequate as a form of protection' and called for it to be replaced with 'tougher checks on fraud and a regime of transparency and disclosure' (open letter to the Chancellor of the Exchequer, 8 November 2000). He argued that there should be an extension of the industry levy scheme (operated by the Pensions Compensation Board) and a mandatory requirement for company pension fund assets to be handed to a custodian independent of the employer. To reduce the chance of underfunding, there should be an annual 'transparency statement' which lists the value of assets, asset classes held, and the assumptions underlying the calculation of the liabilities. The statement would have to be distributed to all members and to OPRA. Small schemes would have to obtain an additional certificate from an actuary confirming that the transparency statement is based on prudent investment principles. There would be provision for a second opinion if 5-10% of members were unhappy with the statement. The overall aim of these proposals is remove regulations that distort asset allocation.

5. The Accountants' Answer – FRS17

The accounting profession has moved much more rapidly than the actuarial profession to embrace market values.

In November 2000, the Accounting Standards Board (ASB) issued a new Financial Reporting Standard (*Financial Reporting Standard 17 – Retirement Benefits*) with the objective of replacing SSAP24, the existing accounting standard for reporting pension costs in DB pension schemes. The principal changes are that:

- Actuarial gains and losses will be recognised fully and immediately (rather than amortised over a period of up to 15 years).

- Scheme assets and liabilities will be valued by reference to current market conditions.

The consequence of this could be greater volatility of pension costs year on year and greater volatility in the balance sheet.

Prior to the introduction of SSAP24 (*Accounting for Pension Costs*) in 1988, employers accounted for pension schemes on a cash basis. Under SSAP24, the profit and loss account is charged with 'regular pension cost' which is designed to be a stable proportion of pensionable pay. Any variations from regular cost are spread forward and charged to P&L gradually over the average remaining service lives of the employees. Assets and liabilities are reported at actuarial value rather than fair value.

A number of problems emerged with SSAP24:

- Too much flexibility in choosing the valuation method and in accounting for the resulting gains and losses.

- Inadequate disclosure requirements and lack of transparency.

- Inconsistency between the pension assets and liabilities in the company's balance sheet and the actual surplus or deficit in the scheme.

- Inconsistent with international accounting standards (e.g., FAS87 (*Employers' Accounting for Pensions*) and IAS19 (*Accounting for Retirement Benefits in the Financial Statements of Employers*)) which had moved towards a market basis for valuing scheme assets.

The objectives of FRS17 are to ensure that:

- The employer's financial statements reflect the assets and liabilities arising from retirement benefit obligations and any related funding, measured at fair value.

- The operating costs of providing retirement benefits are recognised in the periods the benefits are earned by employees.

- Financing costs and any other changes in the value of the assets and liabilities are recognised in the periods they arise.

- There will be immediate recognition of gains and losses in the statement of recognised gains and losses, not in the P&L.

- The financial statements contain adequate disclosures.

FRS17 will have the following effects when it is fully in force for year-ends after June 2003.

- **Scheme Assets**

Scheme assets will be included at their fair value on the company's balance sheet date. This, in turn, will require an annual update of the scheme's actuarial valuation. The expected return on scheme assets will be calculated as the product of the expected long term rate of return and the market value (at the start of the period).

- **Actuarial Liability**

The actuarial liability will be calculated using the projected unit method and an AA corporate bond discount rate, although the actual discount rate used can be based on gilt yields with a constant risk premium of, say, 1%. This rate will generally be lower than that used under SSAP24 which is based on the assumed returns on the pension fund assets and so includes an equity component. The discount rate should be of equivalent currency and term as the scheme liability; however, the ASB argues that 'In theory, different discount rates should be applied to cash flows arising in different periods, reflecting the term structure of interest rates. In practice, acceptable results may be achieved by discounting all the cash flows at a single weighted average discount rate' (Accounting Standards Board (1997, p8)).

The AA corporate bond yield was chosen because this was the yield used in the equivalent US accounting standard, FAS87. FAS87 adopted this particular yield because it matched the asset class that a US insurance company, taking on the liabilities of an insolvent pension plan, would use to invest the scheme's remaining assets. The same yield was subsequently adopted by the International Accounting Standards Committee in IAS19.

At the end of each accounting year, a pension scheme member will have earned an additional year of service: this current service cost is classified as an operating cost in FRS17. Also by the end of the year, the member's pension liability will have risen because it is one year closer to being delivered (this is denoted the interest cost or pension liability discount), but this will be offset by the expected return generated on the assets backing the liability: the difference is denoted the net financing cost in FRS17.

The current service cost will be higher than the regular cost under SSAP24. On the other hand, under FRS17 the discount rate (and hence the interest cost relating to the liability) is likely to be lower than the expected return on scheme assets, so that the net financing cost for the pension scheme is likely to be a credit.

- **Surplus or Deficit**

The net defined benefit pension asset or liability, after attributable deferred tax, will be shown after other net assets in the balance sheet. FRS17 limits the surplus recognised by the employer to the amount that the employer could recover through reduced contributions and agreed refunds.

Past Service Costs

Past service costs arise whenever an improvement in benefits is backdated (e.g., the award of a spouse's pension). Under SSAP24, they may be set against any surplus, with any excess cost charged to the P&L. With FRS17, they are charged to P&L over the period of vesting. In most cases, the vesting of such improvements is immediate, so the cost is charged immediately to the P&L account without offset against the surplus even if it is funded from a surplus.

Profit and Loss Account

The P&L charge will be split between:

- Operating costs – which includes current service costs and past service costs.

- Financing costs – which includes interest costs (the pension liability discount) and the expected return on assets.

Any overpaid/unpaid contributions are represented as debtor/creditor due within one year.

Actuarial Gains and Losses

SSAP24 and IAS19 allow differences between actual and expected outcomes to be spread in the P&L over a number of years and to defer a hard core (the 10% corridor) indefinitely.

FRS17, in a radical departure from conventional practice, requires immediate recognition of actuarial gains and losses through a new account, the 'statement of recognised gains and losses' or STRGL. The asset returns in the pension fund are divided into two parts which are recognised separately in the P&L and STRGL. The financing item in the P&L will show an expected asset return, which is designed to be reasonably stable over time. The differences between realised and expected asset returns are shown in the STRGL, as are changes in actuarial assumptions and differences between these assumptions and actual experience in respect of the liabilities. A five-year history of these differences is required to enable users of the accounts to assess the accuracy of the forecast returns. The STRGL plays a similar role to the MVAs in the MFR.

6. Assessing the Accountants' Answer

FRS17 will have three major impacts:

- **It will reduce the volatility of the P&L but cannot eliminate it, since changes in realised market rates eventually flow through to the P&L via consequential changes in the long-term expected returns on both assets and AA corporate bonds.**

- **It will increase the volatility of the balance sheet due to the inclusion of the net pension asset or liability and this may trigger loan covenants or borrowing limits.**

- **There will be increased complexity of the financial statements arising from non-cash pension items, e.g. current service cost and amortisation of past service costs within operating cost, and the unwinding of the pension liability discount and the expected return on assets within financing costs.**

International accounting standards deal with this volatility by averaging the market values over a number of years and/or spreading the gains and losses forward in the accounts over the remaining service lives of the employees. But the consequences are that the balance sheet does not represent the current surplus or deficit in the scheme and that charges to P&L are infected by gains and losses that arose many years previously.

With FRS17, the P&L shows the relatively stable ongoing service cost, interest cost and expected returns on assets measured on a basis consistent with international standards. The effects of the fluctuations in market values, on the other hand, are not part of the operating results of the business and are treated in the same way as revaluations of fixed assets, i.e., are recognised immediately in the STRGL. This has two advantages over the international approach:

- The balance sheet shows the deficit or recoverable surplus in the scheme.

- The total profit and loss charge is more stable than it would be if the market value fluctuations were spread forward.

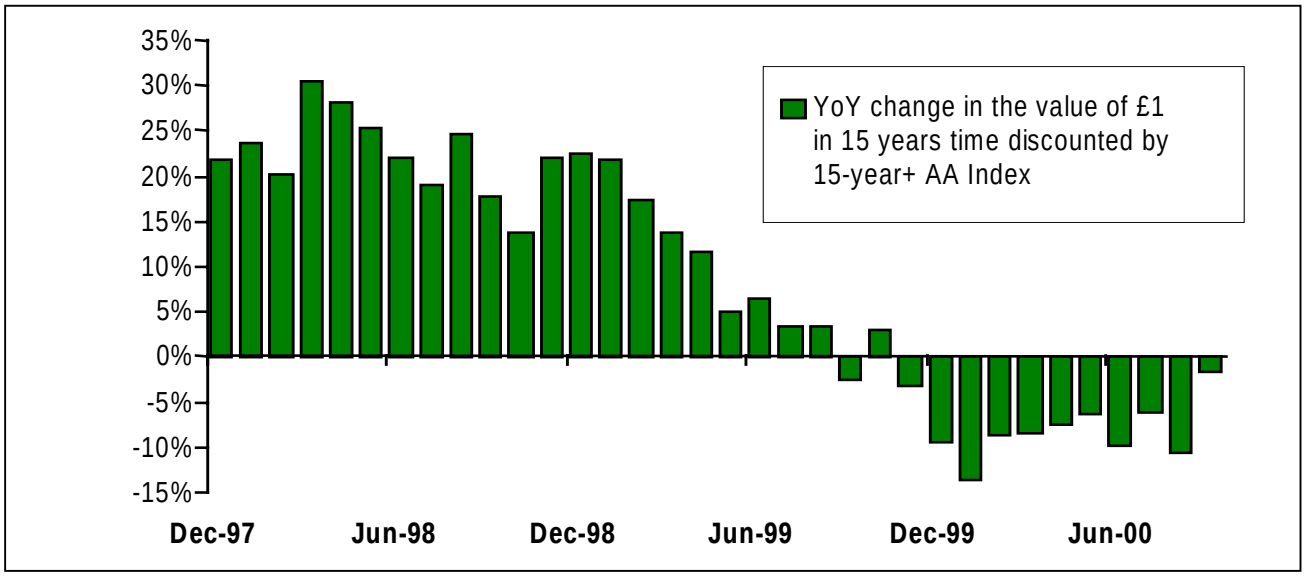
The Association of Chartered Certified Accountants (ACCA) argued that the spreading forward of gains/losses over average service lives is better than immediate recognition because of the long-term nature of pension costs, the uncertainty over the estimates of key yields, and the conformity with current international standards (e.g., IAS19). Although the various components might be separately disclosed, the ACCA preferred the pension cost to be charged as a single item in operating cost.

The FIA argued that, while FRS17 will make 'the respective risks and rewards borne by companies and shareholders more transparent to the shareholders', there would be 'adverse impacts on pension scheme members, because it will introduce new volatility into the assessment of pension costs and liabilities'. Chart 1 demonstrates this volatility in the case of pension scheme liabilities discounted using AA corporate bond yields. As a consequence, sponsors of DB schemes could become more reluctant to improve benefits since these would be immediately reflected in company P&L, even if funded from surplus assets.

The long-term effect of FRS17 on asset allocation is not clear. On the one hand, as in the case of the MFR, the use of a specific discount rate for liabilities (such an AA corporate bond yield) might induce funds to adopt a more bond-based investment strategy. On the other hand, by excluding the

impact of equity risk on the P&L, FRS17 provides companies with an incentive to raise the equity component of their pension fund in order to generate higher expected asset return and profit figures. However, anecdotal evidence suggests that pension funds are increasing rather than reducing their weighting in bonds in preparation for the introduction of FRS17.

Chart 1: The Volatility of Liabilities Discounted Using AA Corporate Bond Yields



Source: Merrill Lynch Global Index System, UN28

Other objections have been put forward:

- The P&L depends on an assessed or expected figure for asset returns.

- There are potentially two different valuation results, the trustees' funding valuation and the company's accounting valuation; companies prefer to align the two types of valuation, if possible using the weaker funding basis, thereby reducing the security of benefits.

- Despite the greater transparency from using market values, there can be substantially different investment conditions if companies use different measurement dates, even if these dates are only a short time apart.

- A pension scheme deficit has to be deducted from distributable reserves, thereby lowering dividend cover and possibly forcing a company to pass a dividend payment. Some commentators have suggested that this is what should happen if companies make a pension promise and do not have the resources to cover it.

- The use of the projected unit method to determine pension liabilities is inconsistent with the MFR, even though it gives a more realistic measure of the true eventual liability.

- Unlike the US, AA bonds are not a significant investment category in the UK: their weighting was just 7% of the total UK bond market in December 2000.

7. The Economists' Answer

7.1 What do Economists Mean by Value?

The Way Something is Measured Does Not Affect its Value

Economists argue that the value of an asset is determined by market forces. They would not accept that there is an 'appraised value' (determined by actuaries or accountants or indeed anyone else) which dominates that determined by market forces. In particular they would not agree with the following comments made by some actuaries and quoted by other actuaries in Exley et al. (1997):

- **'I see no reason why an appraised value . . . should necessarily take the viewpoint of a market trader' (p 23).**
- **'[T]he actuary is saying that the market has temporarily got it wrong, but in due course, it will get it right' (p 17).**
- **There is a 'long-term view [about asset values] that only actuaries can provide' (p 33).**

However, as the great economist John Maynard Keynes said: 'In the long run, we are all dead', so we may not be around long enough for the actuaries' long-term view to be realised.

Similarly, economists would not accept that the value of an asset depends on the way it is measured. In particular, it is not possible to change the value of an asset by artificial attempts to smooth out its volatility. In the past, actuaries and accountants have attempted to do just this using the devices of 'notional portfolios' and 'arbitrary multipliers' (Exley et al. (1997, p 28 and p 20 respectively)).

However, financial assets fluctuate in value, and in the past actuaries and accountants have disregarded these fluctuations. More recently, as a result of the internal inconsistencies that follow from assuming that assets do not fluctuate in value, actuaries and accountants have begun to report assets at market value and have attempted to 'introduce' comparable volatility on the liability side by applying the arbitrary multipliers, now renamed 'market value adjustments', to the liabilities. This is the approach behind the MFR and almost immediately the inconsistencies of this approach emerged.

However the Way Something is Measured can Influence Behaviour and Therefore Change the Value of What is Being Measured

Although the way something is measured cannot affect its value, it can alter behaviour. If actuaries or accountants use the returns on particular classes of asset to determine the discount rate for liabilities, then fund managers can lower the volatility of pension fund surpluses or deficits by investing in these assets.

As outlined in Section 4, there will be an incentive for fund managers to switch from optimal long-run asset allocations (or 'appropriate investments' to use the terminology of the MFR Review) to asset allocations designed to meet short-term regulatory standards. This may result in scheme sponsors being faced with the choice of having to make higher contributions into their schemes to keep them solvent or deciding to close them down and switch to defined contribution schemes as a way of controlling costs.

How Economists Value Assets and Liabilities

Economists are willing to accept assets valued at market prices, but they also accept that liquidity

matters as well. Quoted bid and offer prices are only good for trades of a limited size. For relatively small shareholdings in liquid companies, the latest bid price will provide a good estimate of market value.

If, however, a pension fund holds a substantial proportion of the shares of a company, the 'realisable market value' of those shares, if they were brought to the market immediately, might be lower than the quoted bid price. In this case, the valuation is more akin to that of a 'placing' than a standard trade. An obvious valuation analogy is that of the capital adequacy rules for commercial banks which require them to report the value of their assets on a risk-weighted basis, which amongst other things involves long-maturing assets being reported at a percentage discount to the bid price. The objective is to provide an unbiased estimate of 'realisable market value'. On the other hand, it is conceivable that the realisable market value might be higher if there exists an investor who values the opportunity to acquire a substantial holding in a single tranche.

Since it is difficult to infer the underlying investor interest at any moment, it is possible to argue that the best estimate of realisable market value is the latest bid price whatever the size of the pension fund's holding or the underlying liquidity of the share.

It is also possible to treat the pension liabilities as marketable. The market value of the liabilities would equal the price an insurance company would demand to take the pension obligations off the sponsoring company. This valuation would be no more difficult to determine than the shares of an unquoted company. An illustration of the procedures involved in the case where there are perfect matching assets is provided in the next subsection.

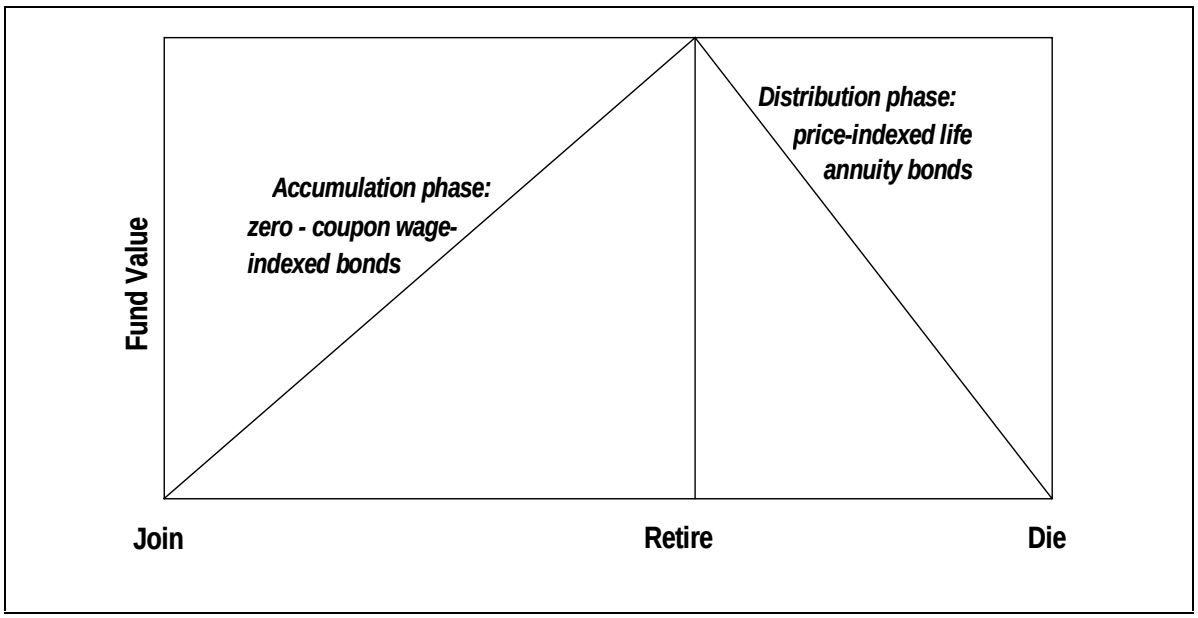
7.2 Valuing Liabilities When There are Perfect Matching Assets

To explain the principles behind the way that an economist would value pension liabilities, we will consider a simplified world of complete and perfect capital markets which contains an infinite supply of perfect matching assets tradeable on both spot and forward markets. A pension fund delivering pension benefits that are related to final salary and subsequently indexed to retail price inflation requires two types of asset:

- **Zero-coupon wage-indexed bonds.**
- **Deferred price-indexed life annuity bonds.**

Recalling that a funded pension scheme has an accumulation phase and a distribution phase separated by the retirement date of the scheme member (see Chart 2), contributions into the scheme are used to purchase units of the wage-indexed bond and so will grow in line with the member's earnings. We will assume for convenience that all workers earnings grow at the same rate. At the same time that the contributions are made, units of the life annuity bond are purchased for forward delivery at a price related to, among other factors, the forecast final salary of the scheme member. On the retirement date, the accumulated fund is exchanged at the agreed forward price for units of the life annuity bond, which then pays an inflation-linked coupon until the member dies. This forward transaction therefore perfectly hedges the interest rate risk that would otherwise be faced at the time of retirement.

Chart 2: Asset Allocation During the Accumulation and Distribution Phases



The investment in each type of bond is determined using dynamic programming. Working backwards from the member's (unknown) date of death to his retirement date, we need to determine the fund size at retirement necessary to deliver the requisite pension payments between these two dates. The first step is to calculate the annuity factor, the present value of one unit of an annuity that is indexed to inflation and payable for the remaining life of the scheme member from the retirement date:

$$(2)\quad A(T) = \frac{(1+\pi_{T+1})\,p_{T+1}}{(1+f_{T+1})} + \frac{(1+\pi_{T+1})(1+\pi_{T+2})\,p_{T+2}}{(1+f_{T+1})(1+f_{T+2})} + \frac{(1+\pi_{T+1})(1+\pi_{T+2})(1+\pi_{T+3})\,p_{T+3}}{(1+f_{T+1})(1+f_{T+2})(1+f_{T+3})} + \ldots$$

$$= \frac{p_{T+1}}{(1+\rho_{T+1})} + \frac{p_{T+2}}{(1+\rho_{T+1})(1+\rho_{T+2})} + \frac{p_{T+3}}{(1+\rho_{T+1})(1+\rho_{T+2})(1+\rho_{T+3})} + \ldots$$

where:

π_{T+s} Expected inflation rate at $T+s$ for $s = 1, \infty$.
f_{T+s} Forward nominal yield at $T+s$ for $s = 1, \infty$.
ρ_{T+s} Forward real yield at $T+s$ for $s = 1, \infty$ (= $(1+f_{T+s})/(1+\pi_{T+s})-1$)).
p_{T+s} Survival probability between T and $T+s$ for $s = 1, \infty$ (i.e., the proportion of pensioners alive at T who are still alive at $T+s$).

Unlike the annuity factor used by actuaries in Guidance Note 27 (see Appendix) which assumes a flat yield curve and constant inflation, equation (2) takes into account the precise shape of the yield curve and allows for variable inflation by using the forward real yield curve. The forward real yield curve will contain a credit spread if the annuity bond has a non-governmental issuer.

The key point to note is that equation (2) is both the present value of one unit of the liability and the fair price of one unit of a life annuity bond, the perfect matching asset for the liability. This implies that the appropriate discount rate for the liability is the discount rate on the *matching asset*, as

confirmed by the FIA in the MFR Review and the ASB in FRS17.

To estimate the fund size needed at retirement, we multiply the annuity factor in (2) by an estimate of the pension at retirement $a(t)W(t)R(t,T)$ where $R(t,T)$ is the revaluation factor for earnings between the current and retirement dates (i.e., we use the projected unit method):

$$(3) \quad R(t,T) = (1+w_t)(1+w_{t+1})\ldots(1+w_T)$$

where:

w_{t+s} Expected earnings growth rate at $t+s$ for $s = 0, T-t$.

Equation (3) is also equal to the inverse of the fair price of a zero-coupon wage-indexed bond purchased at date t and paying one unit at date T:

$$(4) \quad D(t,T) = \frac{1}{(1+w_t)(1+w_{t+1})\ldots(1+w_T)} = \frac{1}{R(t,T)}$$

Again the discount rate on this matching asset provides the appropriate discount rate for the liabilities.

If we substitute equations (2), (3) and (4) into equation (1) (and disregard the MVA), we derive the economist's valuation of pension liabilities in the presence of perfect matching assets:

$$(5) \quad L(t) = a(t)W(t)A(T)$$
$$= a(t)W(t)\{\frac{p_{T+1}}{(1+\rho_{T+1})} + \frac{p_{T+2}}{(1+\rho_{T+1})(1+\rho_{T+2})} + \frac{p_{T+3}}{(1+\rho_{T+1})(1+\rho_{T+2})(1+\rho_{T+3})} + \ldots\}$$

Apart from the term $a(t)W(t)$, the valuation depends only on projections of both mortality and the real spot yield curve from the retirement date of the member, since the accumulation phase is perfectly hedged.

If any other set of discount rates had been used, such as the flat-yield composite index of gilts and corporate bonds required by the MFR Review or the term-varying yield on AA bonds required by FRS17, the liabilities would not take the value given in (5) and the pension fund would show an artificial surplus or deficit.

We can also derive the contribution rate c that fully funds the pension. Suppose that an individual joins a scheme at age t and retires at age T. If a constant proportion c of earnings is invested each year in zero-coupon wage indexed bonds, then the fund accumulated at retirement age T will take the following value:

$$(6) \quad K(T) = cW(t)R(t,T) + cW(t+1)R(t+1,T) + \ldots + cW(T)$$
$$= c\{W(T) + W(T) + \ldots W(T)\}$$
$$= c\{T-t\}W(T)$$

The required contribution rate is found by equating equations (5) and (6) both evaluated at T and solving for c (assuming the 60^{ths} scale):

$$(7)\quad c = \frac{a(T)W(T)A(T)}{\{T-t\}W(T)}$$
$$= \frac{\{T-t\}W(T)A(T)}{60\{T-t\}W(T)}$$
$$= \frac{A(T)}{60}$$

Since current estimates of $A(T)$ are around 12 (see Table 1 below), this implies that c is around 20% of annual earnings.

To reiterate the key message from this simple exercise, the appropriate discount rate for determining the value of pension liabilities is related to the market-determined discount rates on the matching assets of the same term that are needed to deliver the pension liabilities, zero-coupon wage indexed bonds during the accumulation phase and price-indexed life annuity bonds during the distribution phase.

This is consistent with the Modigliani-Miller Theorem (1958), the foundation stone of modern corporate finance theory, which states that the value of a firm's assets is found by discounting the firm's expected future cash flows by the weighted average cost of capital on the liability side of the balance sheet. In terms of pension funds, the exact inverse practice applies, namely that the value of the pension fund liabilities is found by discounting the expected future pension payments by the weighted average return on the pension fund's assets.

7.3 Why the Actuaries and Accountants Have Got It Wrong

It seems reasonable to require some internal consistency in the method used to calculate pension scheme liabilities. The actuaries and accountants both fail on this score.

The actuaries in both the MFR and the MFR Review correctly accept that if assets are valued at market prices, liabilities must be valued consistently using the market yields on appropriate investments. However, this implies valuation on an ongoing basis. But the actuaries value liabilities using the current unit method which is a discontinuance basis method. In addition, Guidance Note 27 imposes:

- Arbitrarily determined and not market-determined discount rates.
- Discount rates that are constant and independent of current yield curve conditions.
- An arbitrary and constant equity risk premium which effectively treats equity like a corporate bond in terms of the resulting effective discount rate for equity (and thereby indirectly discourages equity investments).
- Arbitrary rescalings of liabilities using market value adjustments.

But the way something is measured does not affect its value. The use of MVAs to 'smooth out' fluctuations in asset or liability values cannot change the economic value of the assets and liabilities.

In comparison, the accountants correctly take into account the term structure when applying the discount rate (although they also argue that 'acceptable results' may be achieved using a point value discount rate). They also understand that liabilities should be discounted using the returns on the nearest available matching assets: 'If the expected cash outflows of a provision are exactly the same in terms of amount, timing and variability as the cash inflows of some identifiable asset or group of assets, the risk adjustment for the provision will be the same as for the asset, or group of assets' (Accounting Standards Board (1997, p14)).

Nevertheless, the accountants also fail the consistency test, because, although they use the projected unit method for valuing liabilities, which implies valuation on an ongoing basis, they treat pension liabilities like the senior debt of a corporation and discount using an AA corporate bond yield, a yield that is appropriate only if the liabilities are valued on an discontinuance basis, since this is broadly the asset class in which an insurance company (or at least a US insurance company) would seek to invest if it took over the liabilities of the scheme.

However, in the event of corporate insolvency, the claims of pension scheme members have lower priority than those of AA bondholders. This is because, in the UK, pension obligations are unsecured. If there are sufficient assets left over after meeting the claims of the Inland Revenue and those creditors, such as the banks, that have taken a charge over the fixed and floating assets, then the trustees of the pension fund have a claim in liquidation. This creates a statutory debt based on MFR calculations, although trustees are entitled to put in a claim for the full amount owed. If there are no residual assets, pension scheme members, like shareholders, get nothing, The discount rate for liabilities should reflect this.

The choice of discount rate for pension liabilities has important implications for both pension trustees and fund managers

As a consequence of the discount rate chosen by the accountants, the trustees and fund managers of highly solvent immature schemes might be led towards unsuitable asset allocations (e.g., AA corporate bonds) because of the discount rate specified by the actuaries and accountants. *The way something is measured can influence behaviour and therefore change the value of what is being measured*. Switching from equities to fixed-income AA corporate bonds is unlikely to be a suitable investment strategy for a young scheme with liabilities that do not mature for many years.

The choice of discount rate also has important implications for the size of pension liabilities

We saw from equation (5) above that one of the most important elements determining the size of pension liabilities is the annuity factor. Table 1 shows how the size of the annuity factor varies with the different discount rates specified in the MFR, the MFR Review and FRS17. At the time the calculation was made, the highest discount rate was that on AA corporate bonds: FRS17 therefore produced the lowest annuity factor of 12.36. The lowest discount rate was on long-term gilts: the original MFR for small schemes produced the largest annuity factor of 14.80. Depending on which assumption is used, the difference in the size of pension liabilities can be of the order of 20%, an enormous range. The table also shows that the difference between using the full term structure and the point value (see rows 3 and 4) produces a difference in the value of the annuity factor of 4%.

The ASB's original proposal had been to use a discount rate for liabilities that was based on the expected return on a matching portfolio of assets (matching the liability in terms of risk and maturity). However, the ASB rejected this idea on the grounds that the short-term correlation between earnings growth and equity returns was much lower than had previously been assumed. Instead, the ASB accepted the argument that the discount rate should reflect both the time-value of money (a risk-free rate of matching term) and the risks associated with delivering the pension

payments and, in line with FAS87 and IAS19, it selected an AA corporate bond discount rate.

Table 1: The Effect of the Discount Rate on the Size of the Annuity Factor

Valuation basis	Discount Rate Assumption	Annuity Factor	% of Original MFR (Large Schemes)
Original MFR (Large Schemes)	Gilts + Equities	12.55	100
Original MFR (Small Schemes)	15-Yr+ Gilt Point	14.80	118
MFR Review	Composite Curve	13.10	104
MFR Review	Composite Point	13.57	108
FRS17	AA Curve	12.36	98

Source: Merrill Lynch Global Index System (October 2000). The annuity factor is derived from equation (3) with mortality given by PA90 downrated 2 years, 3% p.a. inflation uprating and the discount rates as listed in the second column.

So the actuaries and accountants prepare valuations of liabilities on completely different bases. Trustees and fund managers determine their asset allocations on the basis of the value and maturity structure of the liabilities. Upon whose version should the trustees and fund managers base their asset allocations?

7.4 Horizon Matching

In reality, of course, the perfect matching assets of Section 7.2 do not exist, but the lessons of this simple exercise still apply. The optimal asset allocation will contain the most suitable matching assets that do exist. In the accumulation phase, this will comprise assets both highly correlated with and with returns matching the real growth rate in earnings in the long run. In the distribution phase, it will consist of assets that are capable of delivering regular cash flows that are highly correlated with inflation.

Once the value and maturity structure of the liabilities are known, the pension fund manager has the task of structuring a portfolio from available assets that:

- Ensures that there are sufficient cash flows from the assets to meet the promised pension payments when they fall due.

- Delivers the pensions at the lowest economic cost to the sponsor.

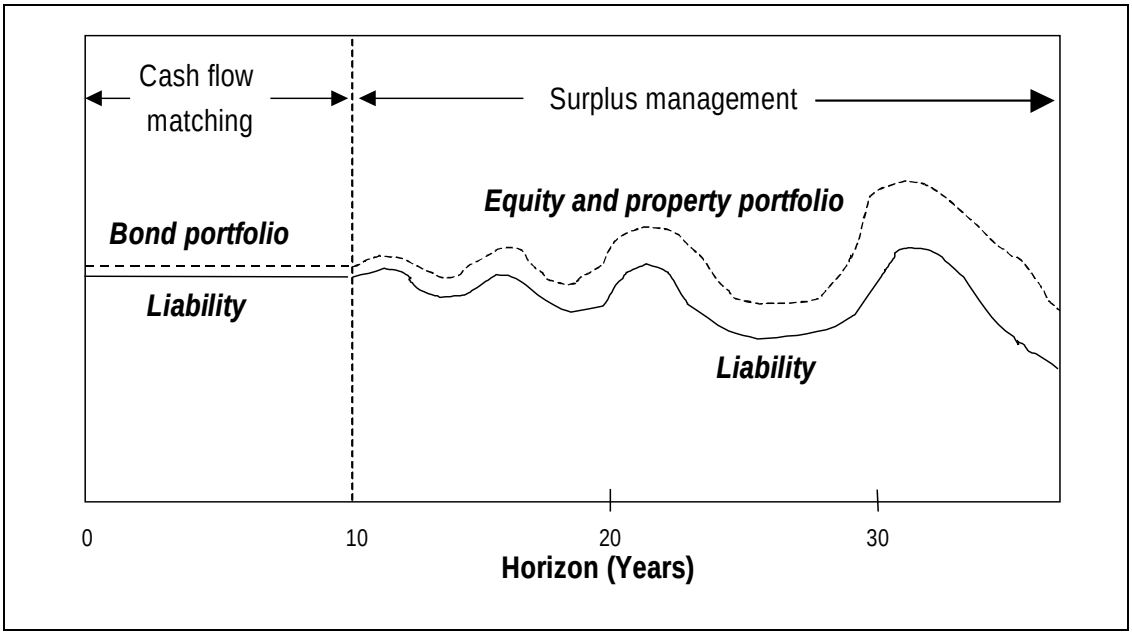
Economists would argue that 'horizon matching' is the appropriate vehicle for addressing these issues. It is also a well-established investment strategy within the actuarial profession (see, e.g., Wise(1984a,b, 1987a,b)).

Horizon matching (see, e.g., Blake (2000a, p 527)) is a fund management strategy that combines 'cash flow matching' for the near-horizon liabilities (i.e., the mature component of a pension fund's liabilities) and 'surplus management' for the distant-horizon liabilities (i.e., the immature component) – see Chart 3.

It is a particularly suitable strategy for highly mature pension funds with a high ratio of retired to active members since its aim is to guarantee to meet a schedule of liability payments at the lowest

economic cost in the absence of perfect matching assets. To achieve this, the stream of immediate pension payments is cash flow matched, i.e., the projected pension payments over a specified horizon (which might be 5 or 10 years) are met from the coupon and principal repayments from a 'dedicated portfolio' of bonds. This stream of liabilities must be discounted using the same discount rate as that on the matching bonds so that the value of the liabilities and the dedicated portfolio of bonds exactly net off, otherwise artificial surpluses and deficits will emerge. New bonds have to be purchased on a regular basis to maintain the length of the horizon.

Chart 3: Horizon Matching

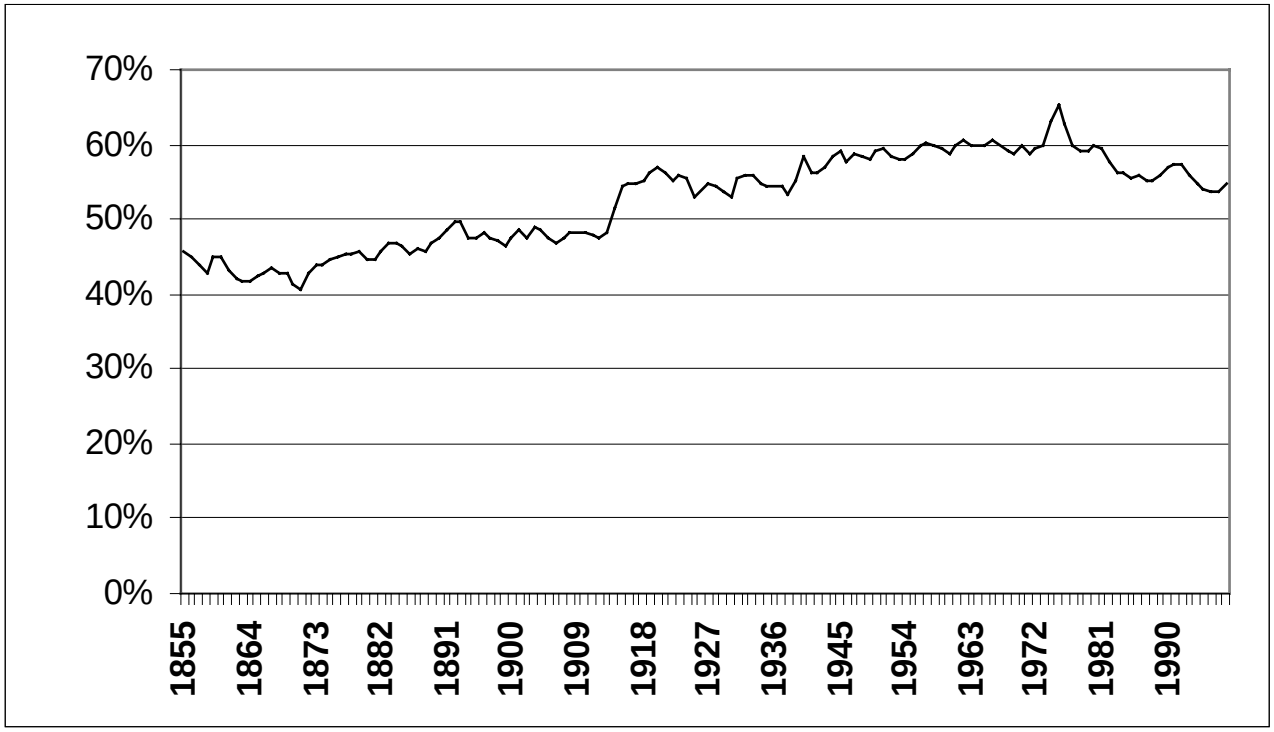


The remainder of the pension fund is invested in assets which match the liabilities most closely in terms of long-run expected growth and volatility. The objective is to manage the pension fund surplus (the difference between assets and liabilities) in such a way that both surplus risk (the volatility of the surplus) and the probability of the surplus becoming negative are minimised (this is examined in more detail in Section 7.5 below and also in Blake (1998)).

The principal assets in a pension fund portfolio will therefore be a well-diversified portfolio of equities and other 'real' assets such as property. This is because:

- The shares of the factors of production in national income tend to be relatively stable over time (or at least do not trend in a significant way), so that the returns to capital (equity) and land (property) should over the long run match that on labour (real wages) – see Chart 4. Pension funds (and other institutional investors) are important vehicles for channelling savings into investment and this helps the capital stock to grow. As a result, labour productivity is increased and this, in turn, raises national income and hence savings. In this way a virtuous circle is created, particularly if a portion of pension fund investment is allocated to venture capital projects.

Chart 4: Share of Labour in National Income 1855-1999



Source: Feinstein (1972) and ETAS (2000)

- Well-diversified portfolios have the lowest risk.

- There is a positive long-run 'equity risk premium' which reduces the long-run cost of funding a pension scheme: Siegel (1997) shows that US equities generated higher average returns than US Treasury bonds and bills in 97% of all 30-year investment horizons since 1802, while CSFB (2000) show that similar results hold for the UK. However, the short-term correlation between equity returns and earnings growth is very low (about 6% over the post-war period, compared with –35% for bonds and 52% for property), so any short term justification rests on their high relative returns (the equity risk premium) rather than their correlation with earnings growth

- There is evidence of 'mean reversion' in the returns on long-term assets such as equity: Poterba and Summers (1988) found that the returns on US equities were negatively correlated over long periods, while Blake (1996) found similar evidence for the UK. Only if asset returns are generated by pure random walks will it be the case that the optimal asset allocation does not depend on the length of the investment horizon and time diversification not be effective (Samuelson (1963) and Merton and Samuelson (1974)). Table 2 shows the effect of time diversification in equity portfolios: equities may have high short-term volatility, but long-run returns tend to be much more stable.

Table 2: The Effect of Time Diversification

Number of Years in Investment Horizon	Average Return (% Per Annum)	Standard Deviation (% Per Annum)
1	10.4	27.1
2	10.5	17.0
3	10.7	11.9
4	11.0	8.6
5	11.4	7.7
6	11.7	7.1
7	12.1	6.1
8	12.2	5.3
9	12.3	5.0
10	12.4	5.0
20	13.0	3.6
30	13.8	3.1

Source: CSFB(2000). The table shows the average annual return and the annual standard deviation on a UK equity index for selected investment horizons up to 30 years in length over the period 1948-1999.

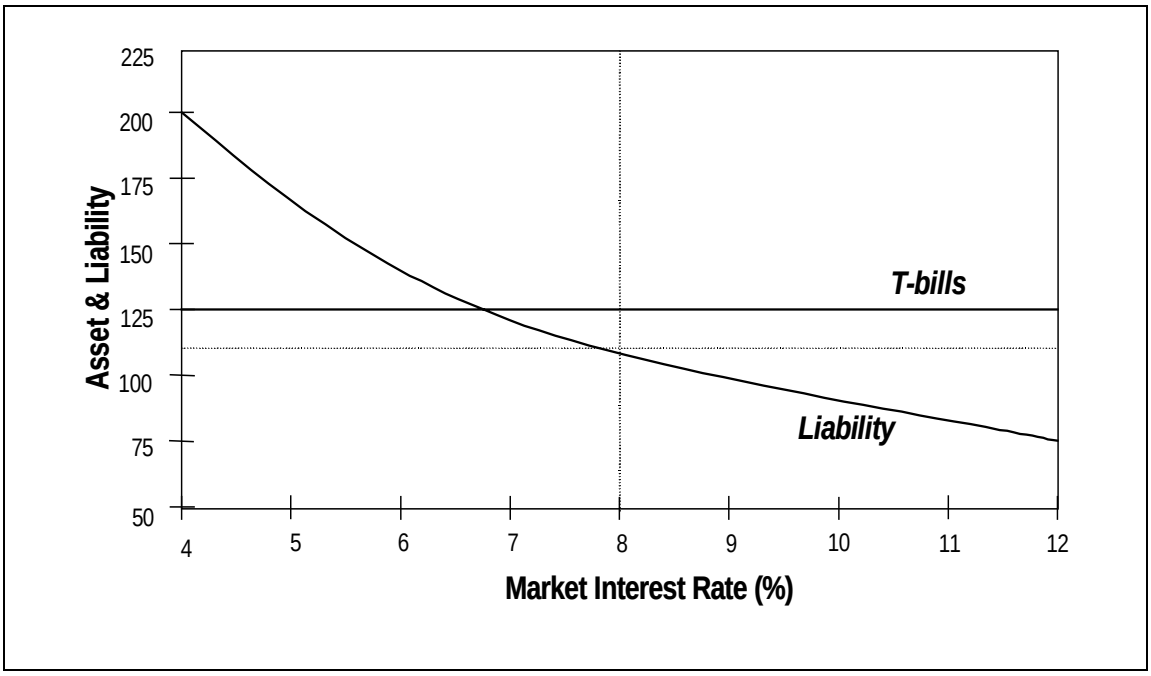
The last two points help to justify horizon matching (more commonly known as 'lifestyling' or 'age phasing'). The Nobel prize winning economist Paul Samuelson (1989, 1991) argues that when asset returns are mean reverting, it is rational for long-horizon investors, such as pension funds, to invest more heavily in 'high-risk' equities than in 'low-risk' bonds during the early years of a pension scheme (thereby benefiting from the equity risk premium) and then to switch into bonds as the horizon shortens.

Charts 5 – 8 examine the suitability of various assets in a surplus management strategy. Suppose that the current market yield on the liability is 8% and that its duration is 10 years. The liability varies inversely with market interest rates as shown in the figures. Charts 5 and 6 show that T-bills and low-duration bonds do not make suitable matching assets for the liabilities. Chart 7 shows that an immunised bond portfolio with a duration of 10 years provides a suitable matching asset for the liabilities, but this is likely to generate lower average returns than the equity portfolio strategy shown in Chart 8. The equity strategy does not provide perfect immunisation but it gives a reasonably close match for long-duration liabilities and at lower cost than the immunisation strategy.

There is another important property of equity returns that fund managers must take into account, namely leptokurtosis. The fat tails in the distribution of equity returns raises the likelihood of extreme outcomes, both positive and negative. Over the long life of a pension plan, a number of large positive and negative shocks to equity returns will be experienced. Of particular concern will be large negative shocks. The timing of these shocks is also important. If a large negative shock occurs early in the life of a pension plan, this will have a negligible impact on the fund value, while if the shock occurs just prior to the retirement date, the outcome could be disastrous. Horizon matching, with its systematic switch into bonds as the horizon shortens, is designed to reduce the impact of such an event.

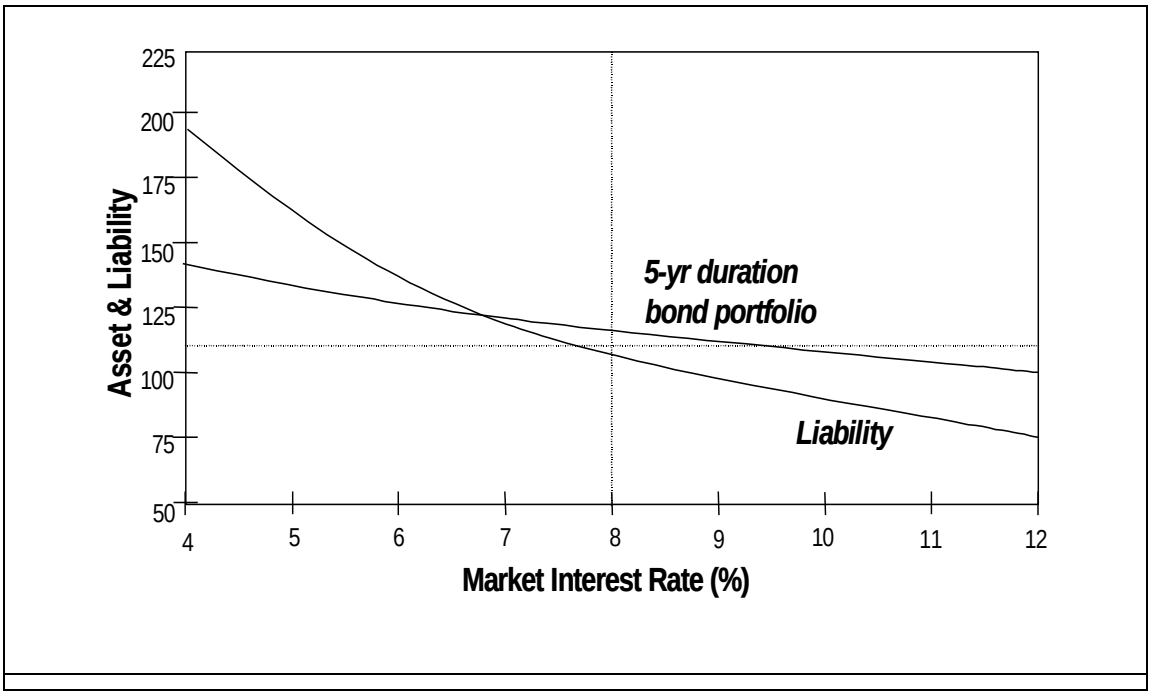
With horizon matching in place, rising asset values would be associated with falling yields and hence rising liability values without any artificial surplus emerging. Similarly, falling asset values would be associated with rising yields and hence falling liability values without any artificial deficit emerging.

Chart 5: Treasury Bills in Surplus Management



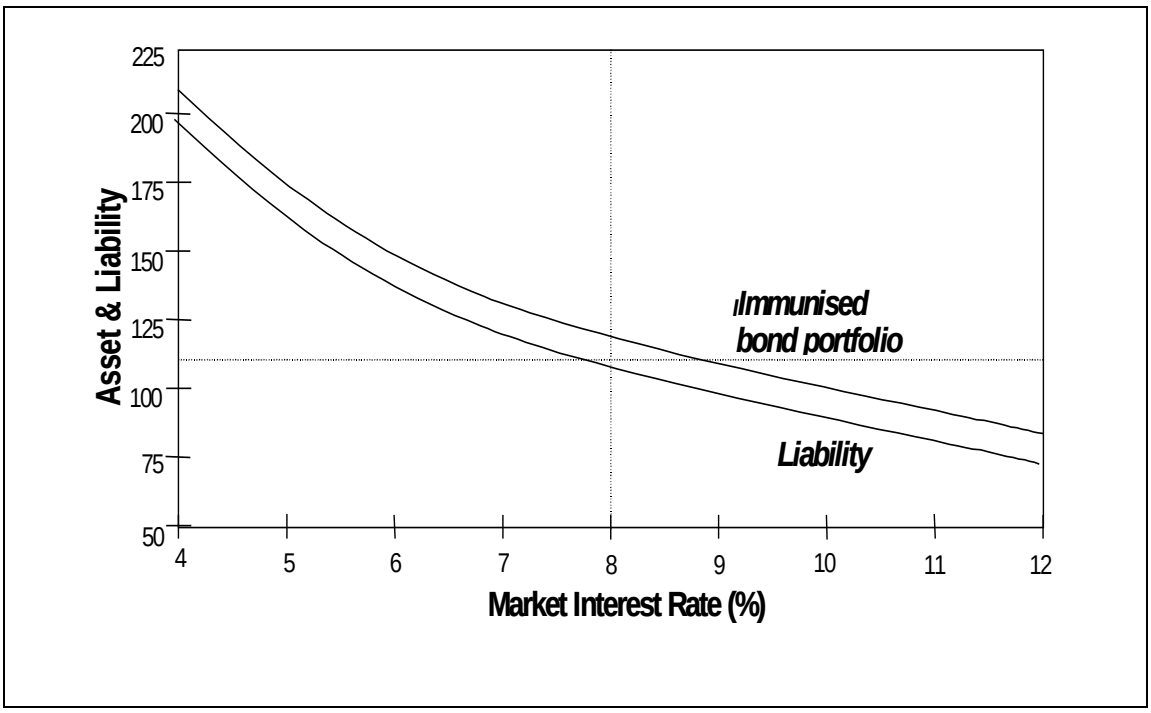
Source: Bader and Leibowitz (1987)

Chart 6: A Five-Year Duration Bond Portfolio in Surplus Management



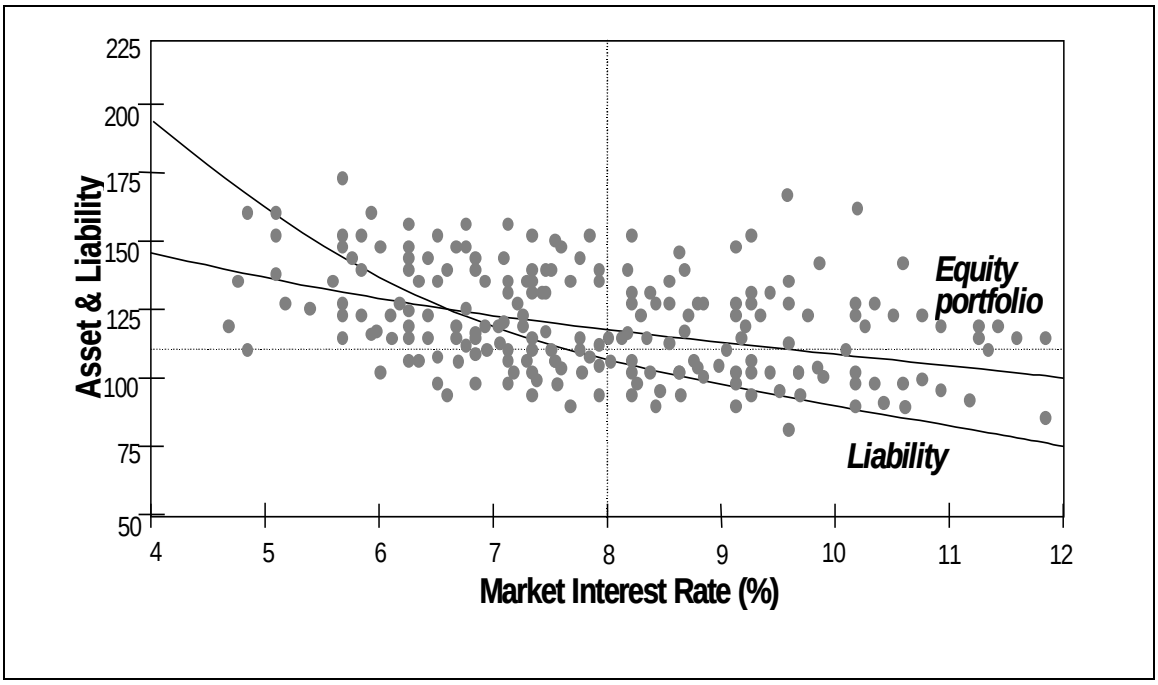
Source: Bader and Leibowitz (1987)

Chart 7: An Immunised Portfolio in Surplus Management



Source: Bader and Leibowitz (1987)

Chart 8: An Equity Portfolio in Surplus Management



Source: Bader and Leibowitz (1987)

7.5 Tradeoffs and Interior Solutions

Its rare for a corner solution to be the optimal solution to an economic problem. For example, it is unlikely, on the basis of a realistic set of assumptions, for the optimal asset allocation strategy for a pension fund to be either 0 or 100% in bonds. It is much more likely that the optimal solution will be an interior solution with a mixture of equities, bonds and other assets. This is because the optimal solution is likely to be the result of a tradeoff of one kind or another. We will consider two important sets of tradeoffs in respect of pension fund asset allocations.

The Tradeoff Between Risk and Expected Return

Some commentators argue that the point made above about the equity risk premium demonstrates a misunderstanding of the nature of the tradeoff between risk and expected return and that, once we correctly adjust for risk, all assets generate the same return, namely the risk-free return. Selling £1 of bonds and buying £1 of equity cannot therefore raise the present value of the pension fund. This argument has been employed by actuaries such as Exley et al. (1997) and Gordon (1999). Gordon (1999), for example, argues that equities only appear to be cheaper than bonds as a vehicle for funding pension schemes because actuaries fail to deal coherently with the equity risk premium. According to such commentators, the optimal investment strategy for pension funds is to invest entirely in index-linked bonds.

This argument is based on the version of the Modigliani-Miller Theorem (1958) that assumes:

- Complete and perfect capital markets.
- No costs in the event of corporate insolvency.
- The only tax is corporation tax and the coupon payments on corporate bonds are an allowable corporate expense against this tax.
- The only objective of the managers of a company is to maximise shareholder value.
- The pension fund assets and liabilities are included on the company's balance sheet.

With these assumptions (and for the moment ignoring their validity), the Modigliani-Miller Theorem states that shareholder value is maximised by the company's assets being financed entirely by bonds and the pension fund being invested entirely in bonds. This follows because:

- The cost of capital used to discount the company's future cash flows from operations is minimised (and hence the value of the firm maximised) when the 'tax shield' from issuing corporate bonds to finance the company's capital structure is maximised (which occurs when there is 100% bond financing).
- When the pension fund assets and liabilities are 'passed through' to the company's balance sheet and the objective of maximising shareholder value is recognised, the pension fund managers will not take risks with shareholders' funds by investing in anything other than bonds. This is because the optimal asset allocation for the pension fund cannot be determined separately from the optimal capital structure of the sponsoring firm. This argument follows from the principal-agent problem: managers are agents and have to be induced to act in the best interests of the shareholders as principals. 'Agency costs' are minimised when pension fund invests solely in bonds.

The original Modigliani-Miller Theorem was based on the particular institutional framework

operating in the US. However, in terms of pension schemes, the UK differs in two key respects from the US:

- The assets and liabilities of a UK pension fund are legally separate from those of the sponsoring company. The pension scheme is run by a board of trustees whose duty under trust law is to act in the best financial interests of the beneficiaries of the scheme, not to maximise shareholder value. The trustees therefore have no alternative but to choose the optimal asset allocation for the pension fund independently of the firm's capital structure. Also, shareholders are not the only stakeholders in the company and UK company law requires employers to take the interests of employees into account.
- The typical defined benefit pension in the UK is based on the product of final salary and years of service, whereas in the US, many (although not most) pension schemes are based on the product of a nominal monetary amount and years of service.

This has important implications for the optimal pension fund asset allocations in the two countries. In the US, the natural matching asset for liabilities fixed in nominal terms is fixed-interest bonds. In the UK, the perfect matching asset for liabilities related to final salary is wage-indexed bonds. Unfortunately, such bonds do not exist and the nearest alternative, price-indexed bonds, are not a good substitute for two reasons:

- While they will be highly correlated with nominal earnings growth, the returns on such bonds will be lower than nominal earnings growth by the rate of real productivity growth in the economy. The return on the bonds will systematically underperform the growth rate in liabilities by about 2% per annum or by 53% over a 40-year investment horizon. In addition, there is a powerful technical reason why the return on equities will exceed the return on index-linked bonds. It has to do with the 'dynamic efficiency' of the economy (see, e.g., Blanchard and Fischer (1989)). Economies are said to be in a state of dynamic inefficiency when the capital stock is too large: the rate of return on capital falls below the growth rate of the economy and everyone could be made better off by investing less and consuming more. A state of dynamic efficiency (which modern economies tend to exhibit) is characterised by the rate of return on capital (as measured by the rate of return on equities) exceeding the growth rate in the economy which, due to the long-run constancy of factor shares, will equal the long-run growth rate in wages. In turn wages grow by around 2% per annum more than prices. So for reasons of dynamic efficiency, we can be fairly confident that the return on equities will exceed the return on index-linked bonds over the long-run.
- The existing supply of price-indexed bonds is inadequate. The total value of index-linked gilts is around £40bn (the supply of corporate index-linked bonds is negligible), while the total value of UK pension fund assets is £830bn. So it is simply not feasible for UK pension funds to switch into index-linked bonds even if it were desirable: *what works in the small does not necessarily work in the large*. UK pension funds *in aggregate* have to look to alternative asset categories.

As we argued in Section 7.4 above, the natural matching assets for UK pension funds for their long-term liabilities is a well-diversified portfolio of equities and property. But this leaves pension funds exposed to the greater volatility of equity returns. Pension fund trustees should not be unduly concerned about this. The equity risk premium compensates investors for the risk of having to liquidate equity holdings at an inopportune time, e.g., following a large fall in the stock market. The financial markets will compensate investors for carrying this market risk. They will not compensate investors for that part of the insolvency risk of the issuing company that is unrelated to the business cycle. This is a specific risk and modern portfolio theory tells us that since specific risks can be diversified away at low cost, the financial markets will not compensate investors for carrying them.

However, if pension funds use horizon matching, this is not a problem that they ought to face. They should not find themselves in a position where they have to liquidate equities at short notice and so they can benefit from time diversification.

More significantly, the relevant measure of volatility in pension funding relates not to the assets but to the pension fund surplus, the difference between the values of the assets and liabilities. The 'surplus risk' (i.e., the volatility of the surplus) with a DB scheme depends on both the difference between the volatilities (or durations) of the pension asset and liability values and on the correlation between these values. The main sources of these volatilities are uncertainties concerning future investment returns, real earnings growth rates and inflation rates. This is because investment returns determine the rate at which contributions into the pension fund accumulate over time, the growth rate in real earnings determines the size of both contributions into the scheme and the pension liability at the retirement date, and the inflation rate influences the growth rate of pensions during retirement. It is surplus risk (*not* asset risk) that should be minimised and this requires a suitable asset-liability management strategy, such as horizon matching, that selects, from the set of assets whose returns are expected to match the growth rates in liabilities, those assets that have the closest matches in terms of volatility to that of the liabilities. Hence the need for both equities (the principal long-duration asset with the highest expected returns) and property and index-linked bonds (the assets whose returns are most highly correlated with earnings growth).

The optimal pension fund portfolio therefore involves a tradeoff between surplus risk and the expected return on assets. A high weight attached to the former encourages an investment in index-linked bonds (at the cost of expected returns below earnings growth), while a high weight attached to the latter encourages an investment in equities (at the cost of greater volatility than that on earnings growth). **This is the relevant tradeoff for pension funds, *not* the tradeoff between risk and expected return on the underlying assets.** This was shown above in Charts 5 – 8. The position on the tradeoff selected by the trustees influences the long-term economic cost of delivering pensions and this cost includes the volatility of pension contributions. This is important to the sponsor who funds the pension plan on a balance-of-cost basis.

Horizon matching therefore provides guidance on the optimal asset allocation of a pension fund. As shown in Chart 3, the near-horizon pension payments should be paid using bonds, while the distant-horizon pension payments can be covered by equities and property. Equities have higher expected returns but less certain cash flows than bonds which means they are not suitable for paying regular income streams, hence the need to switch to bonds, with their greater cash flow certainty, when the horizon falls below a preset level.

The sterling bond-based discount rate chosen by the actuaries in the MFR and accountants in FRS17 pushes pension funds towards domestic bonds for the entire investment horizon. This is not consistent with the principles of portfolio diversification, and will not even permit overseas bonds (or indeed any other international asset) to be held in pension fund portfolios without a mismatch risk arising.

If trustees and sponsors are extremely risk averse, they can either switch out of equities into bonds or abandon defined benefit pensions altogether in favour of defined contribution pension schemes. However, in each case, the expected cost to the sponsor of providing pensions will rise. On the one hand, if the pension fund switches to index-linked bonds, the expected contributions of the sponsor will rise and their volatility will fall, although, as Chart 1 indicated, not by much. On the other hand, if workers are now forced to assume the investment risk of their pension schemes, they are likely to demand higher wages to compensate.

A final justification for pension funds investing in equities has been pointed out by Bodie et al (1992): it lies in the ability of employees to work harder if a catastrophe befalls their pension fund.

The Tradeoff Between the Tax Shield, Insolvency Costs and the Equity Option

When a company is subject to corporation tax, there is a strong tax incentive for the company's pension fund to invest in bonds (see Black (1980) and Tepper (1981)). The tax incentive arises because the sponsoring company's contributions to its pension scheme are tax deductible. If the company borrows funds and uses these to purchase bonds for its pension fund, the company earns the pre-tax rate of return on the bonds held in the pension fund, but only pays the after-tax rate of interest on its borrowing. The company gains by the tax shield on the borrowed funds. The more the company puts into the pension fund, the more the company benefits from the larger tax shield.

However, the greater the percentage of bonds in the capital structure, the greater the risk of corporate insolvency. The perfect capital markets version of the Modigliani-Miller Theorem outlined above ignores corporate insolvency. If pension funds switched completely into corporate bonds and as a consequence companies responded by reducing the stock of equity outstanding relative to bonds (i.e., they issue corporate bonds and the proceeds are used to buy back equity in an attempt to raise shareholder value), corporate bonds, in the limit, become as risky as equity.

Apart from labour, the only 'real' assets in any economy are capital and land. It is the riskiness of the income stream generated by these two assets that affects the riskiness of any claim on this income stream. It is certainly possible to create a low-risk 'bond' with a relatively secure claim, but this is only possible if the size of the bond's claim on the income stream is low in relation to that of the residual claim.

When there are significant insolvency costs, there must be a 'residual liability' on the balance sheet of the corporation. That liability is called 'equity' and large institutional investors such as pension funds cannot avoid holding a significant weighting of it in their portfolios (either directly or 'indirectly' through highly levered bond holdings). *What works in the small does not necessarily work in the large*. While a small investor can switch between asset categories without any market impact, this is not true of large investors. The increase in gearing that accompanies the switch from shares to bonds in the balance sheet makes it more likely that the company will face liquidation: bondholders can force insolvency on the company if their coupon payments are not paid; shareholders cannot do the same if a dividend is passed.

On the other hand, there is an 'option value' from holding equity in the pension fund (see Bagehot (1972), Bicksler and Chen (1985) and Blake (1998)). The sponsoring company gains when equity performs well and, in the extreme, faces liquidation if equity performance is disastrous. Shareholders have the option of walking away from the pension fund in precisely the same way that they have the option of walking away from a highly geared company that is unable to repay its debt. Pension scheme members carry part of the risk but none of the benefits (although they can try to negotiate some share of the upside). This incentive is particularly strong when the pension liabilities are insured against the insolvency of the pension scheme as is the case in the US with the Pension Benefit Guaranty Corporation (see Section 8 below): if the liabilities are insured, there is a greater incentive to take risks on the asset side of the balance sheet.

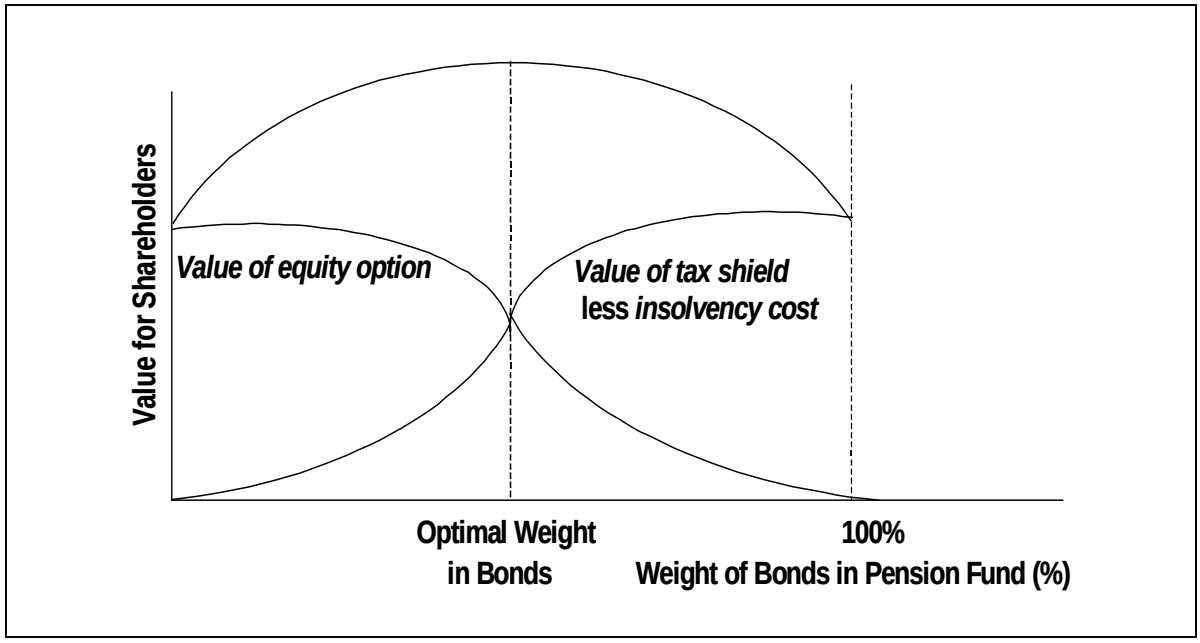
Bicksler and Chen (1985) demonstrate that the result of the tradeoff between the tax shield, insolvency costs, and the equity option value (which they call an insurance value) is for pension funds to have a mixture of equity and bonds in their portfolios. There are two reasons for this as demonstrated in Chart 9:

- As the weight in equity rises, the option value initially rises, but then begins to fall off as the weight in equity reaches very high levels. This is because of the deadweight costs associated with serious underfunding, such as the cost of borrowing to make good the deficiency and the demands for higher wages to offset the risk that the pension might not be paid.

- As the weight in bonds rises, the present value of the tax shield initially rises, but then begins to fall off as the weight in bonds reaches very high levels. This is because the value of the tax shield might eventually exceed the company's income and the company might be unable to use all the tax credits from carry-forwards or carry-backs. The insolvency risk and associated insolvency cost also rise as the weight in bonds increases.

If the tax effect dominates, the optimal weight in bonds will be high; if the equity option and insolvency effects are strong, the optimal weight in bonds will be low. The optimal asset allocation is therefore essentially an empirical issue. Altman (1984), on the basis of the difference between actual earnings and analysts' forecasts of earnings for a sample of US companies that subsequently became insolvent, estimated a fairly significant insolvency cost of up to 17.5% of firm value in the year leading up insolvency; insolvency costs of this size cannot be ignored. Bodie et al (1985) found evidence that US companies in financial difficulty were more likely to underfund their pension schemes and invest in equity, while companies in profit and paying substantial taxes were more likely to overfund their pension scheme and invest in bonds. Feldstein and Morck (1983), again on the basis of US experience, found evidence that a company's share price reflected its level of liabilities.

Chart 9: The Optimal Weight in Bonds with Tax Shields, Insolvency Costs and Equity Options



Source: Bicksler and Chen (1985, p951).

8. What Happens in the Event of Insolvency?

The government is prepared to consider the following options in the event of sponsor insolvency (The Department of Social Security and H M Treasury (2000)):

- **Compulsory mutual insurance.**

- **A central discontinuance fund, where discontinued funds are pooled and run on in a single closed scheme. The CDF would guarantee to pay the accrued rights of pensioners and non-pensioners.**

- **Compulsory commercial insurance.**

The first two options already exist in the US in the form of the Pension Benefit Guaranty Corporation. The PBGC is a federal government agency established by the Employee Retirement Income Security Act (ERISA) in 1974. It insures and guarantees a basic pension for 43 million US workers (about a third of the total) in 40,000 defined benefit pension plans, including 9 million workers in 1,800 multiemployer defined benefit pension plans, mainly industry-wide schemes such as textiles, construction and trucking.

The PBGC's objectives are to:

- Encourage the growth of defined benefit pension plans.

- Provide for timely and uninterrupted payment of pension benefits to participants.

- Maintain pension insurance premiums at the lowest level necessary to carry out these obligations

The PBGC guarantees a portion of the pension earned up to $16.25 per month times the worker's years of service. If a distressed company can no longer support a single-employer plan, the PBGC steps in and pays benefits based on the provisions of the plan. The maximum annual guaranteed benefit for a retiree with 30 years of service is $5,850.

In return for this, all single-employer pension plans pay a basic flat-rate premium of $19 per participant per year. Underfunded pension plans pay an additional variable-rate charge of $9 per $l,000 of unfunded vested benefits. The discount rate used to value the liabilities and hence assess the degree of underfunding is the spot rate for 30-year Treasury securities. Assets are valued at fair market value. In its first 25 years, 532,000 workers and retirees from 2,785 underfunded single-employer plans ended up with PBCG pensions.

When the PBGC first started in 1974, the premium was $1 per participant per year. As a result of underfunding, the premium was raised periodically, the last occasion as a result of the 1994 Retirement Protection Act. The upper limit on premiums for underfunded plans was abolished in 1997. As a result, underfunded plans account for about 50% of the PBGC's total premium income. Large underfunded plans will improve their funding from the current average of about 60% of vested benefits to more than 85% within 15 years.

The PBGC can force a plan to terminate if:

- The plan has not met the minimum funding requirement.

- The plan cannot pay current benefits due
- The loss to the PBGC is expected to increase unreasonably if the plan is not terminated

The PBGC's viability was improved by the 1980 Multiemployer Pension Plan Amendments Act (MPPAA) which made employers in multiemployer plans liable to the plan for their share of the plan's underfunding. If a multiemployer plan runs out of money, the PBGC does not take over the plan; instead, it lends the plan money so the plan can pay retirees their benefits up to PBGC's guarantee.

Since 1980, PBGC has paid out $57 million to 23 multiemployer plans and a total of $479 million is needed to cover future payments. The annual premium for multiemployer plans has been $2.60 per participant since 1988.

The total assets of the PBGC amount to $19 billion, divided between $11 billion of premium payments collected in Revolving Funds and invested in fixed income securities and $8 billion in assets from terminated plans collected in Trust Funds and invested mainly in high-quality equities.

The PBGC experience shows that there is a potential moral hazard problem with mutual insurance in the form of an incentive to underfund the pension scheme unless also accompanied by a funding requirement and risk-adjusted premiums. This is because the PBGC picks up the obligation of paying pensions if the scheme becomes insolvent. However this moral hazard problem is partly mitigated by the fact that in the event of scheme insolvency, the PBGC can claim up to 30% of the net worth of the sponsoring company. However, this will not help the PBGC if the sponsoring company is also insolvent, which is also often the case.

The *Financial Times* does not like the idea of mutual insurance or discontinuance funds at all. It commented on 15 August 2000: 'The idea is flawed. It would be subject to serious moral hazard problems. Prudent fund managers might have to bail out the profligate. There would still be the need for benchmarks and regulations to highlight funds taking inappropriate risks. The fund would be big enough to be a burden on the industry, but too small to resolve a crisis in the event of a major correction in the markets….It would raise questions that funds will make risky investments in the belief they will be bailed out by others'.

Compulsory commercial insurance might be a better alternative. It would allow a sponsor to compare the upfront cost of improving the funding of its pension scheme against a reduced insurance premium, and there is a greater chance that premiums reflect insolvency risk with private insurance.

9. Conclusion

Until recently, there were three valuation bases for pension assets: an actuarial basis, an accounting basis, and a market basis. Then very rapidly, as a consequence of the inconsistencies from using off-market valuations, the market basis for valuing pension assets came to dominate. This is the basis that economists have always preferred.

There are currently three official valuation bases for liabilities: statutory valuations, MFR valuations and FRS17 valuations. The MFR Review provides another potential basis. Clearly, not all of these can be correct. Nor does it really help to say that, since different valuations are used for different purposes, it does not matter how many valuation bases there are. This argument is no longer credible when it comes to valuing assets: it should not be credible when it comes to valuing liabilities. Only an economic valuation of the liabilities makes any sense. Certainly the valuation of the liabilities is a non-trivial exercise, since it depends on a whole range of contingent events such as the survival of the sponsoring company and scheme members leaving, dying in service, taking early retirement, or being promoted. A full economic valuation would take the probabilities of these events into account and produce a single valuation. Current practice in the UK assumes either that the sponsoring company will become insolvent today (the current unit basis) or that everyone will work to retirement age but receive no further service credits (the projected unit basis). Current practice does not assign probabilities to these contingencies as the economic valuation would.

What is even more important than accounting properly for these contingencies is the discount rate used for finding the present value of the state-contingent liability payments. Both the FIA and ASB accept that if assets are valued at market prices, then liabilities have to valued consistently, using 'market yields on appropriate investments' (i.e., matching assets). Yet the MFR Review and FRS17 propose something completely different. They both propose valuing liabilities using different classes of bond yield: the former applies a composite bond index to a current unit valuation basis, while the latter applies an AA corporate bond yield to a projected unit valuation basis.

There is no real justification for using these particular classes of discount rate, except in the case of FRS17, where the AA corporate bond yield was chosen on the grounds that it was the same rate that the Americans picked for FAS87. Nor is there any explanation why the FIA and ASB should, *in the very same year*, come up with such different solutions for valuing the same stream of pension liabilities. Why did they not collaborate on developing a single valuation basis? Further, why does the statutory valuation differ from both the MFR and FRS17? **There should be just a single valuation basis for valuing pension liabilities, and that is one based on economic principles, using the projected unit method and a discount rate equal to the weighted average return on appropriate matching assets in the pension fund.**

Neither the MFR (either in its original or proposed revised form) nor FRS17 is intended to influence the asset allocation of UK pension funds. Nevertheless, there will be pressures on trustees to move the pension fund portfolio towards the asset categories whose returns are used to discount pension liabilities, namely bonds, since 'there is a reduced risk of failing the [MFR] test if the asset portfolio reflects the discount rates required to value plan liabilities' (Faculty and Institute of Actuaries (2000)). So although it is recognised that there is an 'inherent conflict between the MFR which imposes a risk of short-term fluctuations in funding requirements and the long-term asset allocation to produce the best financial results for pension fund members' (Faculty and Institute of Actuaries (2000)), it appears that short-term considerations will have primacy over the long-term asset allocation. Funds with high equity weightings will need a higher level of funding to reduce the short-term probability of failing the MFR. So short-term considerations will dominate at the cost of lower

long-term average returns on pension fund portfolios.

We have argued that it need not be like this. By:

- Recognising the reality of market values,
- Using the appropriate yields on matching assets to discount the liabilities,
- Using appropriate asset-liability management techniques, such as horizon matching, and
- Ignoring the short-term volatility of equities,
-

then it is possible to:

- Value the assets and liabilities of the fund in a consistent fashion even though the assets are liquid and subject to market value fluctuations while the liabilities are not (or more strictly are less liquid and potentially less volatile),
- Ensure that there are always sufficient cash flows from the assets to meet the promised pension payments when they fall due, and
- Deliver pensions at the lowest economic cost to the sponsor.

In particular, it is important that regulations are not be put in place that move the asset allocation away from what is optimal for the particular maturity profile of a pension fund just to reduce the short term volatility in asset returns.

In this way, it will be possible to meet the government's objective of allowing pension funds to invest in more volatile assets, such as equities and venture capital (the Treasury's concern as reflected in the Myners (2000) terms of reference for reviewing institutional investment), while at the same time safeguarding employees' pensions (the DSS concern as reflected in the consultation paper *Security for Occupational Pensions*).

This, in turn, requires (as has been discussed in Blake (2000b)):

- Better incentives to engage in active fund management.
- Suitable benchmarks to promote wider classes of investment.
- Filling the gap between FTSE equities and gilts, e.g., with corporate bonds.
- Extending the notion of appropriate equity assets to include more than just FTSE equities, e.g. with venture capital (see, e.g., on performance benchmarks).

Despite this, companies and their pension funds will still become insolvent. **Commercial insurance, rather a central discontinuance fund, provides the best protection for pension scheme assets in this case.**

10. Appendix – Calculating the MFR

10.1 The 1995 Pensions Act

The rules and regulations governing the MFR are contained in sections 56 to 61 of the 1995 Act and in the Occupational Pension Schemes (Minimum Funding Requirement and Actuarial Valuations) Regulations 1996 (SI 1996/1536) as amended by paragraph 8 of Schedule 1 to the Personal and Occupational Pension Schemes (Miscellaneous Amendments) Regulations 1997 (SI 1997/786).

The MFR (which came into effect on 6 April 1997) establishes a minimum level of funding for a DB pension scheme (or for a defined contribution pension scheme which also provides salary-related benefits) and an associated schedule of contributions necessary to meet this minimum level of funding. It is the responsibility of the trustees to ensure that this schedule is delivered. The MFR can be satisfied either by the minimum level of funding being met currently or by having a schedule of contributions in place that will meet the minimum funding level within a specified time limit (a maximum of 5 years). Even then it may not necessarily be the case that the whole of a scheme's liabilities can be met in full if the scheme were to be wound up immediately. However, the MFR does establish a benchmark for measuring the funding level of a scheme and the trustees must ensure that any shortfall below the benchmark is eliminated over the specified time horizon.

Trustees had to receive the first signed MFR valuation report from the scheme actuary no later than twelve months after the effective date of the valuation as follows:

- For a scheme set up before 6 April 1997 which met the earlier requirements for scheme valuations - no later than three years after the effective date of the last scheme valuation before 6 April 1997 (or 6 April 1997 if later).

- For a scheme set up before 6 April 1997, but where there were no scheme valuations before that date (or the scheme did not meet the requirements for scheme valuations immediately before 6 April 1997) - no later than 6 April 1998.

- For a scheme set up on or after 6 April 1997 - within one year of the date on which the scheme started. The MFR valuation report must be made available to the scheme sponsor within seven days of receipt by the trustees. Subsequent MFR valuations must be carried out every three years.

A pension scheme has a 'deficiency' when it has insufficient assets to meet its liabilities. The schedule of contributions needed to make good the deficiency must be agreed between the trustees and sponsor. A 'serious deficiency' occurs when the assets are valued at less than 90% of the value of the liabilities. To reduce the deficiency, the assets must be increased to at least 90% of the liabilities, valued on the basis set out under the MFR rules, within one year. This can be achieved either through a cash payment to the fund by the sponsor or by the sponsor giving a financial guarantee to bring the scheme's assets up to at least 90% of the liabilities if the sponsor is insolvent and contributions to the fund must continue to be paid. If either of these solutions is not feasible, the trustees must inform the Occupational Pensions Regulatory Authority (OPRA) within 14 days and scheme members within one month.

If the deficiency is less serious, with assets worth between 90% and 100% of the liabilities, the assets must be increased to 100% of the liabilities by the end of the period covered by the schedule of contributions. Contributions may have to be increased to achieve this. Such increased contributions

may be spread evenly throughout the period covered by the schedule. It is also permissible for larger contributions to be paid early on in the period (this is called 'frontloading'), but the 'backloading' of contributions towards the end of the period is not permitted.

Following each MFR valuation, the trustees must establish a schedule of contributions within twelve weeks. This shows the rates of contributions and the 'due dates' on which the trustees must receive the contributions. Each schedule covers a five-year period and may need to be revised during this period to ensure that the MFR continues to be met. During the transitional period after the introduction of the 1995 Act, funds have until 5 April 2007 to satisfy the MFR.

The schedule of contributions must show the contribution rates and 'due dates' for all the contributions to be paid:

- By (or on behalf of) all active members (excluding additional voluntary contributions).
- By (or on behalf of) each sponsoring employer taking part in the scheme.
- By the sponsoring employer to rectify a serious shortfall in funding.

The contributions can be expressed in cash amounts or as percentages of pensionable salary. The trustees must confirm that all scheduled contributions are paid by the 'due dates'. It is the sponsoring employer's responsibility to ensure that the trustees receive the members' contributions within 19 days of the end of the calendar month in which they were deducted from salary. Even though additional voluntary contributions are not included in the schedule of contributions, they must still be paid by the 19th of the month following the calendar month in which they were deducted from salary.

The scheme's appointed actuary (appointed under section 47 of the 1995 Act) must prepare an annual certificate for the trustees confirming that the schedule of contributions has been met for the preceding year. The certificate must also confirm whether the actuary considers that the level of contributions shown on the schedule is sufficient:

- For the scheme to continue to meet the MFR for the remainder of the period covered by the schedule.
- If the actuary considers that the MFR is not currently being met, to enable the scheme to meet the MFR by the end of the period covered by the schedule.
- If the actuary believes that the level of contributions is insufficient to meet the MFR, this must also be stated on the certificate and this will trigger either a revision to the schedule of contributions or a new MFR valuation within six months of the date of the certificate. The trustees must hand the certificate to the sponsor within seven days of receiving it.

If the trustees have not received all the contributions payable within 10 days of each 'due date', as shown in the schedule of contributions, this must be reported to OPRA within 30 days of the 'due date'. The trustees must also report to members within 90 days of the 'due date' if the contributions have still not been paid 60 days after the 'due date'. If contributions are paid directly to an insurance company, investment manager or other adviser, trustees need to be informed if contributions are not paid on time.

If trustees do not take all reasonable steps to comply with their (individual and collective) responsibilities under the 1995 Pensions Act, they face the possibility of financial penalties and/or

disqualification from serving as a trustee. Financial penalties can be up to £5,000 for an individual trustee and up to £50,000 for organisations, such as corporate trustees. These and any associated legal costs cannot be reclaimed from the pension fund.

The sponsoring employer can face both civil and criminal penalties. For example, the late payment of contributions into the pension fund and the late submission of audited accounts are civil offences, while the fraudulent evasion of paying over contributions deducted from members' salaries is a criminal offence.

10.2 Guidance Note 27

The appointed actuary must use the actuarial methods and assumptions set out in Guidance Note 27 of the FIA to determine whether the MFR is being met. Assets are recorded at market values, and the following assumptions concerning asset returns are used in the MFR calculations of liability values, where the MFR pension age is the earliest age at which a member can retire without a reduction in the pension.

- **A – Current Financial Assumptions**

The current gilt yields to be used for valuing pensioner liabilities should be the gross redemption yield on the FT-Actuaries Fixed Interest 15 year Medium Coupon Index or the FT-Actuaries Index-linked Over 5 years (5% inflation) Index, as appropriate. In the case of LPI pension increases, either fixed-interest gilts with 5% pension increases or index-linked gilts with a 0.5% addition to the gross redemption yield should be used, whichever gives the lower value of liabilities. Similar principles should be applied for other pensions which are index-linked but subject to a cap other than 5%.

- **B – Long-Term Financial Assumptions**

	% Per Annum
Rate of Inflation	4
Effective Rate of Return on Gilts	8
Effective Real Rate on Index-Linked Gilts	3.85
Effective Rate of Return on Equities - Pre MFR Pension Age	9
Effective Rate of Return on Equities - Post MFR Pension Age	10
Rate of Increase of GMP Under Limited Revaluation	5
Rate of Statutory Revaluation for Deferred Benefits	4
Rate of LPI Increase in Payment	3.5
Rate of Increase in Post 1988 GMPs	2.75
Rate of salary growth	6

- **C – Market Value Adjustments (MVAs)**

1. The MVA in relation to equities should be the ratio of 3.25% to the net dividend yield on the FT-SE Actuaries All-Share Index.
2. The MVA in respect of gilts should be the value at the annualised yield on the FT-Actuaries Fixed Interest 15 year Medium Coupon Index or the FT-Actuaries Index-linked Over 5 years (5% inflation) Index, as appropriate, of a 15 year stock with coupon equal to the relevant long-term assumption, payable annually in arrears.

3. For liabilities which when in payment might be valued using either the yield on a fixed-interest gilt basis or that on an index-linked gilt basis, the MVA to be used should be that which produces the lower liability.

4. If the liability includes a retirement lump sum payment, for the lump sum liability the market value adjustment on the proportion (g) of that part of the liability deemed invested in gilts (e.g., 0.3 if seven years from MFR pension age) should be: g + (1 - g) x gilt MVA.

- **D – Demographic Assumptions**

1. Mortality (before and after retirement) – PA90 rated down 2 years.

2. In the case of schemes which have a pensioner liability (assessed on the gilt basis) of at least £100 million, the mortality basis to be adopted should be that which the actuary considers appropriate for that scheme in respect of current pensioners and other members who have reached MFR pension age. In the case of all other schemes, and for non-pensioners below MFR pension age, the standard mortality table specified above should be adopted.

3. Proportions married – 80% (men) or 70% (women).

4. Age difference between husband and wife + 3 years.

- **E – Expenses**

The allowance to be made for the expenses connected with closure of the scheme, continuation as a closed scheme and eventual wind-up should be 4% of the value of accrued liabilities for the first £50 million of such liabilities, 3% of the value of the accrued liabilities for the next £50 million of such liabilities and 2% of the remainder of the value of accrued liabilities.

- **F – Other Assumptions**

1. A maximum lump sum of 2.25 times the annual amount of member's pension at retirement.

2. Liabilities should relate only to benefits to which members are entitled, such as discretionary benefits already granted and survivors' pensions, but not future discretionary benefits.

10.3 The MFR Calculation

On the basis of these assumptions, the MFR funding level is calculated using the following steps:

1. For active members, the liability is the present value of the accrued benefits using the effective rate of return on equities pre MFR pension age as the discount rate up to payment and the effective rate of return on gilts throughout payment. The calculated value will then be adjusted by multiplying by the factor (1+0.005n) where n is the number of years before MFR pension age (with a maximum of 10).

2. This value is multiplied by a Market Value Adjustment (MVA) to allow for current market conditions. The MVA for a person 10 years or more below MFR pension age is the equity MVA and the MVA for a person within 10 years of MFR pension age is a linear combination of the equity and gilt MVAs assuming a linear switch from 100% equity investment 10 years before MFR pension age to 100% gilt investment at MFR pension age.

3. For pensioners, the liability is first calculated as the present value of all payments due after the MFR effective date (the date on which the MFR valuation takes place) using current gilt yields.

4. If the liability is greater than £100 million, the liability should instead be calculated as follows:
   a. The present value of the first £100 million of payments or the first 12 years of payments

from the MFR effective date using current gilt yields.

b. The present value of any remaining payments, using the effective rate of return on equities for post MFR pension age, multiplied by the equity MVA (this is known as 'equity easement').

5. Assets should be taken into account at their audited market value.

6. The effective rate of return on equities for pre MFR pension age should be used to calculate the values of contributions during the period of the schedule of contributions.

7. The MFR regular contribution due each year should be the rate calculated on the current unit method as at the MFR effective date.

8. To calculate the MFR regular contribution, the actuary should assume that any members past their MFR pension age retire immediately and allow for identifiable expenses due to be met by the scheme.

9. An MFR contribution adjustment is designed to meet any shortfall of past MFR liabilities.

10. The notional MFR surplus or deficit is calculated as the difference between:
    a. The notional market value of the actual assets and
    b. The MFR liabilities using the long-term financial assumptions and MVAs of 100% plus the difference between:
        (i) The aggregate value of the MFR regular contributions due.
        (ii) The value of the actual contributions paid during that period.

11. If the result is a surplus, the MFR contribution adjustment is a single negative contribution equal to the surplus. If the result is a deficit, the MFR contribution adjustment is calculated as the level of contributions to meet the estimated deficit before the end of the period of the schedule of contributions.

12. All other asset categories should be treated as the nearest equivalent of cash, UK equities and UK gilts.

Exley et al. (1997, p. 33) report Duncan Ferguson, the President of the Institute of Actuaries 1996-98, as stating that actuaries 'should preserve a certain amount of mystique and avoid absolute clarity'. Whether or not they intended to, they have succeeded admirably with their design of the MFR.

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