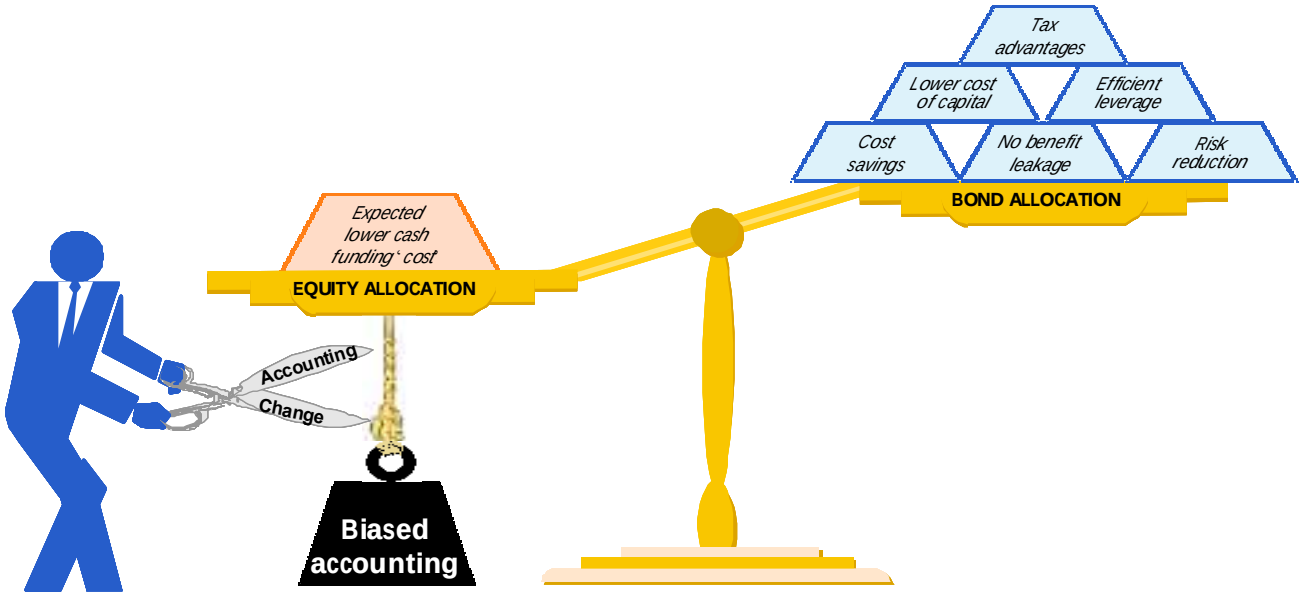
UBS Investment Research

Q-Series™: Pension Fund Asset Allocation



Should pension funds invest in equities?

September 2003

www.ubs.com/accounting

Stephen Cooper

stephen.cooper@ubs.com

+44-20-7568 1962

David Bianco

david.bianco@ubs.com

+1-212-713 9445

A key question in the current pensions debate

The question of whether a zero-equity approach could be appropriate for corporate defined-benefit pension schemes is often raised with us. We address this question and explain the case that can be made against equity investment. We believe the case to be robust and worthy of serious consideration, although we recognise the controversial nature of the subject and the wide range of opinions held, including amongst some of our colleagues.

Valid reasons to lower equity allocations

The case against equity investment suggests that equities merely inefficiently leverage the position of shareholders. From a shareholder value perspective, it would be better to replace pension leverage with more tax efficient financial leverage within the company's own capital structure.

A 'positive alpha' strategy for equity holdings

If a company does choose to invest in equities via its pension fund, only consistent positive alpha can offset the cost of the inherent inefficiencies. However, it can also be argued that more value would be created by individual investors pursuing abnormal equity returns while companies capture the benefits of a zero-equity policy.

Will a move to transparent accounting be the catalyst?

Pensions accounting is opaque and unduly rewards companies whose pension funds invest in equities with higher profit, while concealing the added risk. We expect that future changes to pensions accounting will remove this so-called bias and may well prompt companies to give more serious consideration to the zero-equity approach.

Contents

Stephen Cooper
stephen.cooper@ubs.com
+44-20-7568 1962
David Bianco
david.bianco@ubs.com
+1-212-713 9445

Executive summary

In this report we seek to answer the question of whether a valid case can be made for a zero-equity investment strategy by company-sponsored, defined-benefit pension schemes. We analyse the financial economics of pension provision and examine the common belief that significant equity investment adds to shareholder value. This report is NOT about whether equities are currently under or overvalued, nor whether equities will or will not deliver a certain return in the future. Also, the case against equity investment by corporate pension schemes by no means suggests a zero-equity allocation by individual investors or public sector schemes.

We recognise the conflicts that can exist between the sponsor and scheme trustees, particularly in distress situations, and that this may affect appropriate asset allocation. We do not seek to address these issues in detail but focus primarily on the impact of pension fund asset allocation on the shareholders of the sponsor.

The case against equities is based upon the assumption that a pension fund should be seen as an integral part of the sponsor's business and suggests that the ultimate effect of companies investing in equities via their pension funds is merely to inefficiently leverage the position of their own shareholders. Companies can increase shareholder value by replacing pension leverage due to equity investment with more tax efficient financial leverage in its capital structure. Therefore, this suggests that corporate pension funds should invest in bonds, and if the company's individual shareholders desire greater exposure to equities then those shareholders should buy more equities directly.

We recognise the controversial nature of this subject and the wide range of opinions held, including amongst some of our colleagues. However, we believe that the case against equity investment by company-sponsored, defined-benefit pension funds is robust and worthy of serious consideration. We hope this report stimulates debate and leads to a better understanding of the impact of pension fund asset allocation decisions.

We analyse the case against equities in three main sections:

(1) Limited benefit from equities

The argument that equities are less valuable than is commonly thought if risk is properly taken into account, and that the true cost of pensions is higher than merely the expected cash outflow

The cost of pension provision is commonly viewed as simply the expected cash payments for the sponsoring company and that equity investment and the expected superior long-term equity returns can reduce this 'cost'. This analysis is incomplete and should also take account of the impact of the pension fund, and the asset allocation thereof, on equity risk. The true cost of pension provision is higher than merely the expected cash outflow when a fund invests in equities.

The accounting treatment of pension funds as a separate entity, distinct from the sponsoring group, contributes to the lack of appreciation of risk arising from pensions fund investment. We believe that the full consolidation of pension

schemes is justified, and that this would probably change perceptions of pension fund risk.

One of the common arguments for equity investment within pension funds is that there is less risk to equities over a long investment time horizon – so-called time diversification. This effect is then potentially enhanced by mean reversion of equity returns. Since most pension funds have a very long investment time horizon, they are supposedly able to capture the superior expected equity returns without suffering high risk. We argue that this is not the key issue regarding asset allocation, and that even if the benefits of time diversification were completely true, this would not influence conclusions regarding equity investment. It can also be shown that equity investment is actually riskier over longer periods of time (it all depends on how risk is defined) and that mean reversion benefits are, at best, unproven. These are issues we discuss, with supporting data, in an appendix to this report.

(2) Asset allocation is irrelevant

The argument that equities and bonds have the same risk-adjusted returns, and no value is created through equity investment: asset allocation on this basis is therefore irrelevant

Although expected returns for alternative asset classes may well differ, it can be argued that on a risk-adjusted basis (and assuming pricing efficiency), these returns are identical. An investment of $1 in equities is worth the same as an investment of $1 in bonds, even though the expected returns would probably differ. If we make certain assumptions (such as no taxation distortions) then it is possible to demonstrate, supported by an arbitrage argument, that asset allocation is irrelevant from a shareholder value perspective, in the same manner as Modigliani and Miller did for capital structure and dividend decisions.

One of the common arguments for equity investment is the beneficial impact it has on the sponsoring company's profit and EPS. We demonstrate that a switch to bonds can leave EPS unaffected, as long as the reduction in leverage in the pension fund (sales of equities and purchase of bonds) is offset by an increase in leverage in the sponsoring company by a share buyback (sale of bonds and purchase of equities). We further demonstrate that even in a bull market when equity returns are high, the strategy of 'leverage in the company', on average, produces EPS growth that is just as high as it would be if the leverage were in the pension fund via equity investment.

If equity investment were such a good way of reducing the 'cost' to companies of defined-benefit pension provision, we question why we do not see this technique applied to other expense items. For example, a company could subsidise the cost of a *defined-contribution* pension scheme by issuing long-dated bonds and investing in a portfolio of equities. We postulate that the reason companies do not do this is that they realise that such actions typically do not create value and would not reduce the true risk-adjusted cost Therefore, we question why value is supposedly created by equity investment specifically to subsidise defined-benefit pension costs.

(3) Equities reduce shareholder value

The argument that after allowing for tax and other externalities, equity investment in defined-benefit pension schemes actually reduces shareholder value

It is upon consideration of tax implications that the scales are tipped decisively in favour of fixed income, such that it seems there is no justification for a pension scheme to hold equities. We put forward the argument that although equity investment by the pension fund does not in itself destroy shareholder value, such 'pension leverage' reduces the ability of a company to make use of more value-creating leverage in the company itself. For example, financial leverage gives taxation benefits because of the debt interest tax shield. The reduction in pension leverage, combined with a bond issue to fund a share buyback in the company, can leave overall equity and company risk unchanged, but nevertheless can create additional shareholder value. We believe this is true even for US companies where recent changes in equity-return taxation, relative to investor taxation on fixed-income returns, may have reduced the value of using leverage in the corporate capital structure.

The duplication of investment management at the shareholder level and at the pension fund level also creates difficulties for investors and added costs. Although a portfolio of equities may well outperform when held by a pension fund, ultimately shareholders themselves could capture that same outperformance by employing the same advisor.

The case for equity investment

Value creation from positive alpha strategies not indexation

If a company does choose to invest in equities via its pension fund, in spite of the lost tax advantages and other costs, it is critical that it pursues positive alpha strategies, such as market timing or stock selection. In our view, it is not rational to forgo the benefits of a zero-equity strategy and then index pension equity investments. If the managers of the pension fund can successfully generate long-term alpha, then it is true that equity investment adds value. However, in this case, alpha should be determined using a hurdle that factors in the opportunity cost of forgone interest tax shields. Also, more value could be created by individual investors pursuing abnormal equity returns, while companies capture tax and cost efficiencies by not investing in equities via their pension fund. In essence, a company with a pension fund invested in equities has an 'investment management division'; shareholders should evaluate whether this activity is really creating value for them.

The case against equities for corporate pension schemes does not suggest that equities are inappropriate for other investors. We believe equities provide a valuable investment for many capital market participants. In particular, we believe that individuals investing for their own retirement through defined contribution, or other personal pension arrangements, should consider equity investment – the weighting depending upon their own personal circumstances including time to retirement, future earnings potential and attitude to risk.

Reasons for past equity investment and catalysts for change

If the case against equities is so strong, why then have so many pension schemes maintained such high equity weightings for so long? We identify six factors that may have contributed to the current and past high equity weightings in defined-benefit pension portfolios**:**

(1) Immature pension schemes where the ability and assumed benefit of taking a 'long-term view' was unquestioned, particularly in a bull market environment.

(2) A biased and opaque method of accounting for pensions that highlights the rewards of equity investment while hiding the true risks.

(3) The common application of what is arguably a flawed actuarial model that does not incorporate the advances of the past 40 years or so in financial economics.

(4) A lack of education regarding the economics of pension provision on the part of company management, plus a failure by analysts and investors to correctly see through the opaque accounting methodology for pensions, such that stock prices fail to reflect the true economic position, and also the past failure of credit rating agencies to properly allow for the asset allocation of pension funds.

(5) The failure of investors and companies to fully appreciate the real long-term risk of equity investment owing to the sustained high equity returns (with minor corrections only) from the mid-1970s to 1999.

(6) The lack of any explicit recognition of asset allocation by the PBGC in the US when determining fund insurance payments.

Catalysts for change will be the increased transparency from changes in pensions accounting plus increased acceptance of the 'financial economics' approach in the actuarial profession

We believe there is, or will be, change in respect of each of these issues. However, the main catalyst that prompts the greatest questioning of equity investment could be a change in pensions accounting that would make the true risk and cost of pension provisions transparent. Change is not imminent, but the International Accounting Standards Board (IASB) plans a new standard on pensions and has already stated that it intends to remove the use of expected equity pension asset returns in the income statement, and make actual returns (and the resulting volatility) more prominent. The US Financial Accounting Standards Board (FASB) is also reviewing pensions accounting, and although this is likely to only lead to a change in presentation this year, this will also contribute to transparency and, in our view, is the start of more fundamental change in the US.

Many of the ideas we express in this report are not new. Others have either explicitly advocated such an approach, or have produced papers that give support to the conclusions. Indeed the academic work on this topic goes back to at least the 1970s. However, practical application of non-investment in equities by corporate-sponsored plans is rare. Only the UK company Boots has taken this extreme step. In early 2001, Boots switched a £2.5 billion portfolio comprising c70% equities into one entirely composed of a combination of fixed-rate and inflation-protected bonds. To date, this is the only large-scale practical example of a complete switch out of equities.

Introduction

Significant equity investment by pension funds is common…

It is conventional wisdom that funded, defined-benefit pension schemes should invest in equities. Typical allocation to equity investment in both the US and UK is currently about 60%, and, even following the recent equity falls, few companies have actively reduced equity weightings. Although asset allocation in other countries varies, equity investment is often significant. The most common basis for recommending the level of equity weighting is the maturity of the scheme, with higher equity weightings thought appropriate for those less mature. The most commonly quoted rationale for equity investment is the higher return that is likely from these assets in the long term and the consequent reduction in the 'cost' to the company of pension provision; this being to the benefit of shareholders and also, indirectly, to employees (since the company is therefore more likely to be able to offer generous pension arrangements).

…but does this really enhance shareholder value?

However, actuaries, academics and others increasingly challenge this presumption that equity investment adds value. In particular the so-called 'financial economics' faction of the actuarial profession has raised important questions about equity investment in recent years. We believe that these issues have not received the attention they deserve within the investment community.

The ideas we present in this report are not new[1]. Others have either explicitly advocated such an approach or have produced papers that give support to the conclusions. Indeed the academic work on this goes back at least to the 1970s. However, practical application of non-investment in equities is rare. Only in the case of the UK Company Boots has a fund taken this extreme step. In 2001 Boots switched a £2.5 billion portfolio comprising approximately 70% equities into one entirely composed of a combination of fixed rate and inflation-protected (index-linked) bonds. To date this is the only large-scale practical example of a complete switch out of equities.

The ideas are not anti-equity investment generally. Equities provide a valuable investment for many capital market participants. In particular, individuals investing for their own retirement, through defined contribution or other personal pension arrangements, should consider equity investment – the weighting depending upon their own personal circumstances including time to retirement, future earnings potential and attitude to risk. This could potentially result in a high equity weighting for a personal pension portfolio. We merely question whether equities are appropriate specifically for company-sponsored defined-benefit schemes.

Does this mean we are arguing that equities will offer a higher investment return? Surely equities must be good for a pension fund, as one would generally expect higher returns compared with bonds and other investment opportunities? We agree that there is a positive equity risk premium and that

[1] For example, Black, Fisher. 'The tax consequences of long-run pension policy.' Financial Analysts Journal. July/August 1980. A list of significant papers and further reading on this subject is given at the end of this note.

one's best estimate is that future equity returns will exceed those of bonds. Historical and current market data would point to a forward-looking equity risk premium of perhaps 3% to 5%. We agree with this. It is just that we are questioning whether capturing this equity risk premium in a defined-benefit pension scheme is of any benefit to the company and its shareholders.

A shareholder perspective on the impact of asset allocation

Our analysis, and the proposition that equities are an inappropriate investment for a defined-benefit pension scheme, is given from the perspective of the sponsoring company. There are other stakeholders involved in the pension issue, particularly the scheme members, but also bondholders and perhaps even the government via taxation. These groups are also affected by asset allocation, but we do not seek to examine these effects in detail in this report. Notwithstanding that trustees supposedly control asset allocation, we are working from the company and its shareholders' perspective. We are assuming that the sponsoring company does in reality have effective control over the pension scheme and its policies. Our conclusions are not affected if, in practice, the company does not actually effectively control asset allocation, but it may mean that it is impossible for the company to achieve an efficient position regarding defined-benefit pensions. Although this then raises the question of whether that company should not be offering other forms of employee benefits, including defined-contribution pensions, over which the companies' directors do have control.

So does the case against equities mean that there is any situation where equity investment by a pension fund is justified from the sponsoring company's perspective? Well perhaps, if a fund can generate positive alpha then value can indeed be created. However, these gains would have to exceed the costs inherent in an equity investment approach, including the lost taxation benefits provided by a reduction in pension leverage and an increase in financial leverage.

Pensions, asset allocation and equity valuation

Separation of operating and financial effects of pensions in equity valuation

The UBS accounting and valuation research group have previously focused on the accounting treatment of pensions and the impact of pension schemes on equity valuation. We have provided data on pension funding and the effect on earnings data, particularly for the US and UK markets where this is a major issue, and have also provided detailed advice on how analysts and investors should deal with pensions within different equity valuation approaches. This new report is merely an extension of that work.

We believe that two aspects of pensions should be considered separately in equity valuation:

(1) The cost of future pension benefits: The ongoing cost of pensions should be the service cost; the present value of benefit promises. This should be measured independently of, and should be unaffected by, the method of funding. The service cost should be included in all performance measures such as EBIT, NOPAT and free cash flow that are used to value a business. No other pension items, such as expected asset returns or

amortisations of past actuarial gains or losses, should be included in these metrics.

(2) The funding status of the pension scheme: The funded status should be considered in absolute terms as at the date of valuation and should be measured on a current market value basis without any artificial smoothing. Fund liabilities should be measured independently of the asset allocation of the fund (that is, a valuation using an appropriate bond based discount rate allowing for credit risk). A net pension deficit should be deducted from and a surplus (to the extent recoverable) should be added to estimated enterprise value in order to determine equity value.

Funding status not asset allocation is key for equity valuation

Our advice on equity valuation does not include any direct allowance for potential value gains due to different asset allocations within the fund. Although, there could be an indirect effect through the impact of the scheme and its funding on the cost of capital applied in valuing the enterprise. In addition our advice includes no direct reference to the cash flows required to fund a scheme or to potentially correct a surplus or deficit. This is because the cash flow effects (suitably adjusted for the related risks) are automatically captured within the process we describe.

Where equity is valued directly, rather than in a two stage 'enterprise value' approach described above, capturing pensions is more complicated (which is one reason why we favour an EV approach to equity valuation in the first place). In particular, there are problems with an equity flow approach, such as a dividend discount model. It is true that expected dividends in this model are affected by asset allocation (more equity would result in higher expected dividends). However, this must be considered in the light of an appropriate adjustment to the cost of equity to allow for the resulting pension risk. Ultimately, as all equity valuation approaches are just mathematical variations of each other, the answer must be the same.

Also an impact on credit analysis

Although most of our work has been on the impact of pensions on equity valuation, we also believe that pension fund equity allocation is important in credit analysis. Added leverage through equity investment operates in much the same manner as financial leverage and has a similar impact on credit risk. We do not believe the credit rating agencies pay enough attention to this issue.

The organisation of this report

The case against equities is given in three sections below. Firstly, we examine why equity investment may not add as much value as one might believe, given the high historical returns from equities versus bonds; this is essentially an analysis of risk and the concept of time diversification. Secondly, we consider the argument that asset allocation in pension funds is actually irrelevant when certain external effects and taxation are ignored. Thirdly, we examine the arguments, which suggest that equity investment actually destroys shareholder value. Following this we consider whether there are any circumstances where equity investment can have a positive impact on shareholder value and, in particular, examine gains from positive alpha investment strategies and potential wealth transfers involving employees and other stakeholders. In the final section we discuss why most companies continue with high equity weightings in spite of the arguments we put forward and examine the potential for the likely changes in pensions accounting to be a catalyst for change in asset allocation.

Limited benefit from equities

The cost of pensions is more than just the cash payment

There are only two sources for the assets from which pensions are paid: the contributions by the company (and perhaps employees) plus the investment returns earned on those assets prior to the assets being sold to fund pension payments. It therefore would seem obvious that higher investment returns would automatically reduce the future company contributions and hence cost to the company of pension provision. This would in turn increase the cash available to investors in the sponsoring company and hence, given that the stock price is the present value of expected future cash flows, would presumably increase the stock price. Pensions, it is assumed, cost the company (and hence shareholders) less if pension assets are invested in equities, due to the higher expected return from this asset class. This may seem logical, but this analysis is incomplete. It fails to properly address the issue of risk and also ignores other effects associated with pensions.

Equity investment may reduce expected pension funding payments but does not reduce the true cost of pension provision

Equity investment is more risky than investment in bonds. Although not entirely a truism, it is certainly the case that according to most measures the returns from equity investment are more risky. Equity returns, both in the short term and over longer periods, are more volatile than those of bonds. The return of a fixed rate bond over the full period to repayment is fixed and hence, in the absence of credit risk, can be said to be risk free in nominal terms. The same can be said of the real returns from inflation-protected (index-linked) bonds. Neither the future nominal or real return from equities can be forecast with any confidence, whatever the time horizon. It is this higher risk of equities that is the reason for the equity risk premium; investors are generally risk averse (or at least loss averse) and demand a higher expected return in compensation. Part of the function of the capital market is to price and facilitate the transfer of such risk. If part of a pension portfolio is invested in equities then the sponsoring company, and consequently the equity investors in that company, suffer higher risk due to the uncertainty of future pension contributions. While expected future cash flows of the company and its shareholders can indeed be increased by higher equity investment via the pension fund, we argue that the resulting increase in risk negates this benefit and does not actually increase the value of the company.

The consequence of the above is that the true cost of a pension promise is determined by the nature of that promise alone and not by the method by which the pension liability is funded.[2] The cost of the pension promise (the service

[2] This is not strictly true since the value of the promise depends upon the likelihood that the promise will be kept and the likelihood that it may be varied (either to the detriment or benefit of employees). For example, if fund assets are invested in bonds one could argue that the payment of the pension is more secure and hence more valuable. However, on the other hand, equity investment provides the prospect of enhanced pension benefits of equity returns are high. The exact impact of asset allocation due to these effects will depend upon the precise circumstances of the company. However, these are incidental effects and do not affect the main argument above.

This is also the reasoning behind the use of a bond yield to value pension liabilities. The traditional actuarial approach has been to value pension liabilities using a discount rate equal to the expected return on the related

cost in accounting terms) is the cost to the company, assuming the pension is funded on the basis that there is no consequent increase in risk for the company or its shareholders. This can be calculated by determining the cash that would need to be invested in a perfect hedge portfolio in order to effectively provide for the obligation. The hedge portfolio comprises assets with characteristics that exactly match those of the corresponding liability. In practice this is difficult to determine accurately. However, for most pensions a close approximation would comprise a combination of high quality, fixed and index-linked bonds. The pension cost can alternatively be calculated directly by applying a discount rate equal to the expected return on this hedge portfolio to the expected future pension payments. Of course, if the higher equity return could be obtained without added risk then this higher expected return would be the discount rate and the cost of pension would indeed be lower. However, we do not believe that the equity risk premium can be captured without suffering added risk.

There are two key counter arguments against the above analysis: (1) the assertion that equities become less risky with a longer investment horizon, so called time diversification; and (2) only equity investment provides an effective hedge against salary inflation. We discuss time diversification below and inflation in the next section.

Should pension funds really be consolidated?

The fund is legally separate and not part of the group

One of the sources for the confusion about defined-benefit pensions stems from the belief that the fund is entirely separate from the sponsoring business. We think this is one of the reasons why asset allocation is generally considered in isolation (without thinking of the full impact on the sponsoring company) and, on the same basis, that asset allocation decisions might be considered for an individual's portfolio. This view is reinforced by the current accounting treatment where the assets and liabilities of the fund are not consolidated with those of the rest of the group, but where it is only the net position that is reflected in the balance sheet.[3] Pension accounting treats pension funds in a similar way to an associated company over which there is influence and not control, and not like a subsidiary that is part of the overall group economic entity. We believe that there is a strong case for pension funds being treated as a subsidiary with the assets and liabilities each being separately consolidated with the rest of the group.

While the pension fund may legally be a separate trust run for the benefit of employees, we believe that the economic reality is generally very different. It is the company that effectively suffers all (or at least the vast majority) of the

portfolio of assets. Hence a higher expected return on the pension portfolio produces a lower value for the liability. However, this is not the approach used by accounting standards, FAS 87, IAS 19 and FRS 17 - all require the use of a bond related discount rate unconnected with the asset portfolio. While current actuarial thinking in part accepts this principle, there is a significant element of the actuarial profession that still contends that the cost of a pension promise is determined by the returns on the related portfolio of assets.

[3] Current accounting practice means that often it is not actually the net pension fund surplus or deficit that is reflected in the balance sheet. Under both US GAAP and IFRS (international standards) a process of amortising pension gains and losses means that the balance sheet position lags the true funded status.

risks associated with the fund. If investment returns are poor it is the company that would be obliged to make up the difference. The sponsor is also the primary beneficiary of the potential rewards from the fund if investment returns are high through a reduction in contributions. Not only does the sponsor effectively have the 'risks and rewards of ownership' – a characteristic that itself often justifies consolidation – but, in many cases, the company also has effective control of the fund, given that there is often dominant influence over trustees and effective control of investment and funding policy.

But the sponsor shoulders most of the associated risks and rewards

The trust status of pension funds is valuable since it provides protection for the interests of employees due to the oversight of the trustees and due to the effective 'ring-fencing' of the pension assets. However, in our opinion the trust status is not sufficient to justify non-consolidation.

We believe the consolidation of a pension fund throws a very different light on the pension assets and liabilities. Pension liabilities should be viewed as a source of finance for the company (borrowings from employees), whereas pension assets would be simply part of group assets (albeit ring-fenced from the employees' perspective). The employing company makes the pension promise and the pension assets are simply a means for planning for future payment. Investment in higher risk equities in the pension fund clearly increases the overall risk of all consolidated assets and hence must increase both the risk of the parent company shareholders and consequently their required return.

Consolidation may demonstrate risks more clearly

Time diversification – equity risk in the long run

Pension liabilities have a very long duration. The discounted weighted average time to payment is generally more than 15 years and payment of some of the accrued liability may not fall due for many decades. It is therefore possible, and we think appropriate, for pension funds to take a long-term view in setting investment policies and strategic asset allocation.

Is there a 'free-lunch' for pension funds and other long-term equity investors due to time diversification?

Many advisors have put forth the argument that there is less risk to equities over long investment time horizons, often referred to as time diversification. This notion is the most popular rationale for advocating high levels of equity investment by pension funds as a means of creating shareholder value. However, time diversification is a very complex issue involving many uncertainties and, we believe, is usually overly simplified when used in support of equities.

First, based on certain important measures of risk, such as variability in aggregate nominal return, it can be shown that equity investment is actually riskier over longer periods of time. Second, we do not see why lower volatility, which is the most frequently cited statistical evidence of the risk diminishing benefits of a long time horizons is unique to equity. Long-term bond returns are also less volatile over long time horizons or time to maturity. More important, if equities were less risky over longer periods of time owing to lower volatility and/or mean reversion, such a benefit should be priced into the offered equity risk premium. Long term investors, which most equity investors are, should bid the risk premium down to a level acceptable to them.

Claimed risk reduction due to time diversification depends on how one measures risk

If equities are indeed truly less risky the longer they are held, it may be possible for a pension fund to effectively capture part of the equity risk premium for free, but only if the pension's investment time horizon is longer than the dollar weighted average investor's time horizon. In this case, pensions would benefit from the higher expected equity return without suffering all of the related risk – a true 'free-lunch'. But realize only a part of the ERP is captured for free, not all of it and probably far from most of it. The part of the ERP captured for free, if any, would still need to be compared to lost capital structure and other advantages of fixed income to justify equity allocation.

Investment on behalf of shareholders

However, whether a long time horizon actually reduces equity risk is actually not relevant for our overall analysis and the argument that equity investment does not add value. This is mainly due to the concept that the sponsoring company should see pension fund investment as being investment on behalf of its shareholders (not employees) and that it is therefore best that shareholders themselves choose how much risk they are willing to take for a given level of return, because only they know their own time horizon. A shareholding in a company with a defined-benefit pension scheme invested in equities is effectively equivalent to a combined holding of an investment in an operating business and an investment in a mutual (closed end) fund. The potential time diversification benefits of the pension fund are no different from those available via a mutual fund.

It is also not entirely true that short-term investment volatility is irrelevant, as advocates of time diversification would suggest. Companies cannot ignore short and intermediate term volatility owing to minimum funding requirements for pensions in most countries and would need to show employees the capability of funding even if such minimum funding requirements did not exist.

We know that time diversification and mean reversion is one of the key issues that is always raised concerning pensions fund investment. Therefore we have included an analysis of this issue, and our interpretation of its relevance to pension fund asset allocation, as an appendix to this note. The issue is complex and highly contentious. Part of the problem is the difficulty of proving anything, given the large statistical margin of error due to the relatively small number of independent observations of long-run equity returns. There is also the question of how statistics are presented and whether this fairly shows the risks of long-term equity investment; something we try and demonstrate.

A bet on mean reversion is a risky strategy

In presenting the case against equities we suggest that the benefits of time diversification are usually overstated, probably priced in and uncertain altogether. Also we suggest that the (weak) empirical evidence of mean reversion is **not** enough, in itself, to justify significant equity weightings in pension portfolios. A bet on future mean reversion would in itself be a risky strategy[4].

[4] This theme is further developed by our Alternative Investment Strategies team in their report 'Fireflies before the storm' UBS June 2003

Equity risk, beta, the cost of equity and value

One of the methods for demonstrating that the risk of equity investment offsets the benefit of higher expected equity return is to consider the impact of different pension funding strategies on company cash flows and cost of capital. Higher equity weightings do produce higher expected cash flows, but the increased cost of equity due to the pension risk should exactly offset this (ignoring externalities and taxation, which we will come to later).

Risk of equity investment can be analysed into three principal components, business risk, financial risk and pensions risk[5]. Business risk relates to the uncertainty of returns from the underlying operating assets of a business. This is related to the uncertainty of future revenues and costs, the degree of operational leverage and exposure to other risk factors such as regulatory risk or tax changes. Financial risk is caused by financial leverage. If a company finances partly through the use of debt finance, then the prior claim debt-holders enjoy serves to magnify or gear up the variability of returns for equity investors. Finally pension risk represents a further element of leverage for the equity investors if pension assets are not invested so as to provide a perfect hedge for pension liabilities. Equity investors are not only affected by the (geared) returns from the underlying operating assets, but also suffer variations in their returns, given fluctuations in the level of pension funding and hence in the future pension costs. High equity investment by pensions effectively produces a more highly levered exposure to equity returns for shareholders.

Pension risk contributes to equity betas and therefore to cost of capital

It is possible to represent operating, financial and pension risk in the form of beta factors. Beta represents the measure of non-diversifiable risk that is used in the capital asset pricing model (CAPM) to determine cost of capital and required returns. While there are limitations with CAPM, it provides a basis for illustrating the concept of pension risk and how higher equity investment in pension funds does not add value. If business risk is measured as an 'asset beta' (β_{OA}) then equity risk, including financial risk, can be calculated as follows (this particular formulation is simplified to ignore default risk and taxation):

$$\beta_{Equity} = \beta_{OA} \times \left(1 + \frac{D}{E}\right)$$

Where: D = value of debt and E = value of equity

If, in addition to financial leverage, a company has a funded pension scheme invested such that the beta of the pension assets is β_{PA} with the value of pension assets equal to PA and pension liabilities PL, then, assuming operating assets valued at OA, the equity beta is:

$$\beta_{Equity} = \left(\beta_{OA} \times \frac{OA}{(PA + OA)} + \beta_{PA} \times \frac{PA}{(PA + OA)}\right) \times \left(1 + \frac{D + PL}{E}\right)$$

[5] Although if, as we advocated above, pension funds were fully consolidated then pension risk would not automatically be a separate category; the pension fund assets would then more logically contribute to overall business risk and the liabilities would contribute to financial risk.

This calculation clearly demonstrates the link between pension funding and the risk of pension assets and the risk suffered by equity investors. Equity investors should demand a higher return from investment in companies that invest in equities via their pension fund.

Unfortunately there is no clear empirical evidence for the link between equity beta and pension fund asset allocation. The main reason is that the asset allocation of funds tends not to vary greatly and that few companies have pension funds that are large relative to the size of the business, such that a meaningful statistical analysis is possible. Although we have some evidence that large equity investment by pension funds increases beta, we cannot say that the market behaves in exactly the manner predicted above.

Conclusion

We question the value of equity investment by pension funds when one takes account of both expected equity return and equity risk. If equity risk, and its impact on shareholder value, were fully appreciated, then we believe companies would not value the higher expected return of equities as highly as they appear to. This in itself would likely lead to lower equity weightings. We also suggest that part of the reason for a lack of appreciation of risk is due to the accounting methodology for pensions. A theme we return too later.

Asset allocation is irrelevant

The propositions of Modigliani and Miller (M&M), in respect of capital structure decisions and dividend policy, are well known and a standard element in modern corporate finance. They demonstrate that, given certain assumptions concerning frictionless markets and a lack of distorting factors such as taxation, value cannot be created by merely changing the balance of debt and equity in a company's capital structure or changing the balance between dividend distributions and reinvestment in the business. These concepts are well accepted and focus both academics and practitioners on market imperfections such as taxation, agency costs or the cost of financial distress when considering these decisions in practice.

Modigliani and Miller irrelevancy argument applied to the pension fund asset allocation decision

The exact same approach can also be adopted in respect of pension asset allocation. The Modigliani and Miller irrelevance hypothesis applies in the same manner as long as one makes similar assumptions. One approach to demonstrating that the value of a business cannot depend upon capital structure is to devise an arbitrage transaction, which shows that an immediate risk-free profit is available if value actually did differ due to capital structure differences. We have extended this process to the pension fund asset allocation decision.

Applying a Modigliani and Miller arbitrage style 'proof'

Assume that there are two companies that have identical underlying businesses, identical capital structures and identical pension fund liabilities. The pension fund assets of each have the same value, but for one company (company A) these assets are invested purely in equities and for the other (company B) there is a bond investment strategy. Advocates of the superiority of equity investment would suggest that company A would have the higher value and higher stock price. It would be argued that the equity investment approach would, in the long run, produce superior investment returns at relatively modest risk (due to time diversification), such that funding requirement of the pension scheme is reduced. This would give higher profit (under existing accounting rules) and cash flow for company A and hence higher value. However, if this were indeed the case then it is possible for investors in company A to obtain a 'risk-free' profit by switching to the lower priced company B.

The arbitrage works by investors selling company A and then buying the same percentage shareholding in company B to get the same exposure to the underlying operating assets. To counteract the effect of the change in exposure to the pension assets, the investor makes an equal but opposite change in asset allocation within the rest of its investment portfolio. The investor sells bonds and buys equities equal to the proportionate share of the change in pension portfolio resulting form selling A and buying B. This results in exactly the same exposure to overall equity and bond returns, in addition to the same exposure to the operating assets of the businesses of A and B. The only economic effect of this transaction is that the investor has pocketed the difference between selling a holding in company A and buying the same percentage holding in company B but at a cheaper price.

This is a version of the well-known arbitrage argument of Modigliani and Miller used to prove their irrelevancy hypothesis for capital structure decisions. Our 'pension asset allocation arbitrage' proof suffers from the same limitations of depending upon perfect markets with no distortions from say taxation. However, we believe that it provides a similar foundation upon which to discuss the practical aspects of such a decision. Questions of capital structure should focus on agency costs, bankruptcy costs and taxation effects since M&M have proved (and it is well accepted) that, in the absence of these factors, simply cutting up the corporate cake into equity and debt claims of different sizes cannot affect the size of the cake itself. Although debt may appear to be a cheaper source of finance, this is an illusion once risk is taken into account. Similarly questions of pension fund asset allocation (again in the absence of market imperfections and taxation) should not depend upon the expected return on different asset classes. Risk-adjusted returns are identical. The focus for considering pension fund asset allocation should also therefore be on market imperfections and, in particular, taxation. Issues we consider below.

$1 of equities is worth the same as $1 of bonds

On a risk-adjusted basis equity returns are worth the same as bond returns

It is of course evidently true that $1 of equities is worth the same as $1 of bonds; both can be sold for $1. However, in the traditional actuarial model, the focus on expected return rather than the associated risk effectively means that the higher future expected value provided by equity investment actually translates into a higher present value as well. The traditional actuarial model does indeed effectively value $1 of equities higher than $1 of bonds, which in part explains the bias towards equity investment. This cannot be true though; when the higher expected future cash flow from equities is discounted at the appropriate risk-adjusted discount rate its present value must be the same as the present value of the future expected bond cash flow. This is not just a theory, but can actually be observed in financial markets in the form of equity swaps.

As evidenced by equity swaps having a zero value at inception

Assume you are offered a swap transaction whereby you pay the future value of US$1 million invested in a 10-year zero-coupon bond, but receive the future value of US$1 million invested today in the S&P 500 share index. Given the higher expected equity return you would expect that this transaction should have a positive value, but should you actually pay anything for this swap today? We suggest that you should not, and that if you did then you would seriously dent your wealth and provide a risk-free windfall gain to the party with whom the swap was transacted. This can easily be demonstrated through a simple arbitrage transaction. The party receiving the payment could pocket the payment from you while hedging the future swap by borrowing US$1 million and investing the proceeds in the S&P index. The swap plus the actual cash market positions would exactly cancel in 10 year's time. Swaps must always have a zero value at inception and hence the present value of the expected cash flows from US$1 million invested in equities must be the same as the present value of the expected cash flow from US$1 million invested in bonds. We agree there is likely to be a higher return for equities, but there is also higher risk and a higher discount rate and hence always the same values today.

The equity swap transaction also neatly illustrates the problem with the traditional actuarial approach of applying an expected return on pension assets

when valuing pension liabilities. Although perhaps not explicitly doing so, this process effectively places a higher value on equity rather than bond investment. We explain below how arguably inappropriate actuarial methodology and biased accounting support the current practice of investing pension fund assets in equities.

The question of EPS

Higher expected equity returns reduce the reported pensions expense and increase EPS

Although earnings per share (EPS) is a simplistic measure of performance and changes in EPS do not necessarily correspond to actual changes in shareholder value, in practice much of equity analysis is indeed EPS focused. One of the main arguments for equity investment in pension portfolios is that it results in higher EPS for the sponsoring company. This is just another variation on the argument that the cost to the company of providing pensions is reduced through equity investment and could be answered using the other arguments against equity investment in this report. Nevertheless, it is possible to demonstrate how the EPS of a company can actually be maintained at exactly the same level whether pension investment is in equities or bonds, with equity risk also being equal.

But this does not represent an increase in shareholder value

If a company switches from equity to bond investment in the pension fund, it is true that, under current accounting rules, this is likely to result in a larger pension expense. However, if the asset allocation switch were accompanied by an offsetting share repurchase and bond issue by the sponsoring company (pension leverage replaced by financial leverage) it is possible to maintain EPS at the previous level.

We demonstrate the EPS impact and the process of maintaining EPS by replacing reduced pension leverage with financial leverage in the company in an appendix to this report.

What if equities rally?

Would not companies have looked very silly if they had not invested in equities in the 1990s?

One of the common arguments in favour of equity investment in pension funds is that companies would today (although this is perhaps questionable after recent market falls) be in a much worse position had they not been invested in equities in the 1990s. Those companies that did invest in equities clearly benefited from very high investment returns in that period enabling them to reduce or eliminate pension contributions thus increasing profits and cash flows for the benefit of their shareholders. Had these companies invested in bonds, then profits and cash flow would have been substantially lower and bond investment in this period would appear to have made management look very silly indeed.

Surely investors are better off being in equities in a bull market

A similar argument has more recently been used as a reason why funds should not switch to bonds at the 'bottom of the market'. Management of many companies feel that they should stick it out in equities and wait for a material recovery. The assumption that equities cannot fall for four consecutive years is very prevalent and seemingly a powerful argument to stick with equities. However, we question both of these arguments.

The case against equities makes no statement about whether equity markets are cheap or expensive, whether equities will rise or fall this year or what the future long-term expected return on equities will be relative to bonds. Whatever happens to equities and whatever one's belief about future equity returns, the appropriate investment for a defined-benefit pension scheme would not include equities. The argument is that a company should be viewed as merely an extension of the ultimate beneficiaries of economic activity – the shareholders. Hence any equity investment by the company through the pension fund (remember we are looking at this from the company/shareholder perspective – we will come to the members/trustees later) is really simply being made on behalf of shareholders.

But shareholders do not need company investment in equities via the pension fund to benefit from high equity returns

Why would shareholders want the company to undertake equity investment on their behalf, surely that is what they would wish to decide upon themselves? If investors wish to delegate responsibility for such activity then they can invest via an investment fund. The added exposure to equity markets, which equity investment in the pension fund gives, is merely duplicating what the shareholders already have. Such equity investment can be seen as merely corporate cross-shareholdings, which have no real impact on the ultimate investors. This would become evident if pension funds were fully consolidated in the group financial statements.

One way to demonstrate how shareholders are no better off, if the company they invest in itself invests in equities rather than bonds in the pension fund, (presuming the equities outperform) is to develop our EPS analysis where we compare bond investment in the pension fund plus a share buyback with a pension fund invested in equities. In Appendix 2 we demonstrate that even where equities rise strongly, there is no shareholder value or (potentially) EPS benefit, from pension fund investment in equities. Equity investors are no better off as a result of sponsoring companies investing in equities via pension funds, even in situations where equity investment provides returns substantially higher than those from bonds.

If there really is a 'free lunch' why not use it to subsidise other costs?

Equity investment in pension funds supposedly subsidises the cost of the pension promise

If companies are so confident in their ability to invest for the long term and hence benefit from the supposed reduced risk available for investors with a long time horizon, then why not make more use of this than to just subsidise the cost of defined-benefit pensions? Many companies today are refusing new members into their defined-benefit (DB) schemes on cost grounds and offer an alternative defined-contribution (DC) plan. Generally the company contributions to the DC plan are significantly less then the value of the benefits available to those fortunate enough to still be in the DB scheme (assuming good funding, a solvent sponsor and a secure company covenant). As a rough rule of thumb, the service cost of a typical DB scheme averages about 15% to

20% of payroll[6], whereas typical contributions by companies to DB plans are generally less than 10% of payroll.

So why not use equity investment to subsidise other costs?

The contributions to a DC scheme have to be met in full from the cash flow of the sponsor. However, the cash funding costs of a DB scheme have, at least in the past, been significantly lower then the true value of the benefits provided. The cost of DB benefits (the service cost) has been met in part by contributions and in part from the excess return on the pension assets driven by the premium return on equities. For a typical fund, the sponsor may well expect to have cash contributions set by the actuary at an amount considerably below the true service cost, given the subsidy from high assumed equity returns on plan assets.

We have just repeated the most common argument for equity investment in DB schemes: 'cost' reduction. We have previously tried to explain why the true cost of the DB promise may not be the expected cash once one also allows for risk. However, let's just focus on this 'cash cost' here. As we said above, why not use the 'cross-subsidy' of income from an equity fund to offset ('reduce') costs other than just the cost of DB pension provision? For example, why not use the same technique for DC schemes as well? Here is how it would work. A company could pay cash directly into a DC or personal pension for employees, but at the same time could lever itself up to create additional income, which could be used to supplement the DC pension contributions. The leverage would come from issuing debt and investing the proceeds in equities. Interest on the debt would be met from the equity income and in periods where the equity return was too low, equities could be sold. At present this would not be a problem since dividend yields would probably be higher than the post-tax cost of the debt interest, but this could always be avoided by issuing the bonds at a discount to reduce the coupon cost. If the scheme is long term, and assuming a positive equity risk premium, we would expect a significant net gain to the company from this arrangement. An even simpler way to achieve the same effect is to buy an equity swap.

The equity return subsidy of defined-benefit pensions costs is an illusion

In economic terms, is not what we have described equivalent to equity investment in a pension fund? It would appear that our 'equity return cost subsidy scheme' has merit, given that it 'reduces' costs in the same manner as funded DB schemes invested in. So in that case why is it not used? The reason is that companies presumably realise that such a scheme does not really reduce costs – the cost of the DC pension contribution is unaffected by whatever other transactions a company enters into. The real question is whether a company can create value by borrowing and investing in equities, after correctly allowing for the risks of doing so. It may well be possible to create value from such a venture if the managers of the equity fund can outperform. However, the key question is whether it is one of the core competencies of the company concerned or whether companies specialising in such investment activities

[6] The cost of DB schemes does vary considerably depending upon the terms of the scheme, types of employee covered (life expectancy for different social groups is a key but often unsaid factor) and particularly the age of the employee since the cost accelerates rapidly as retirement approaches.

better undertake this. The fact that such schemes are not seen in practice provides a very clear answer.

Companies do not seem to believe it is in the interests of their shareholders to seek to profit from such investment returns when their core activity is as an operating business. This then raises the question of why companies are willing to do essentially the same thing within a pension fund.

What about inflation risk?

Pension obligations are generally at least partly linked to inflation

One of the key issues regarding pension liabilities is inflation and salary growth. Many pension schemes promise inflation-protected pension payments in retirement (although practice varies by country and generally in the US pension payments are not inflation protected). Also, the pension liability is often based upon final salary and hence the actual payment (whether subsequently indexed or not) is dependent upon salary growth in the period between the promise being made and the retirement date. Some schemes base pension payments on average salary or salary at the time the promise is made. However, in this case there is generally an uplift of this reference salary by inflation to retirement date (although often with a cap).

It is very rare to find pension obligations that are unaffected by inflation. An unexpected increase in prices can therefore produce a significant increase in the amount of the liability. The sponsoring company has inflation risk and higher-than-expected inflation would necessitate additional contributions, unless fund assets themselves grow as a result of that same inflation increase. This is one of the main arguments for the use of equities in pension portfolios.

Equity investment is a real asset; it represents a claim on underlying physical assets, the monetary returns from which are likely to rise with inflation.[7] Of course, real returns can be obtained in the bond market through the use of inflation-protected bonds, but the market is relatively small. Some additional protection could be obtained via swaps or even by buying short duration, fixed rate bonds. However, it is argued that equities provide such protection anyway with the added advantage of large and liquid market. Also, inflation-protected bonds are only linked to a general inflation index and not to salary growth. As stated above, at least part of the pension obligation is likely to be linked to salary growth and not inflation, which makes the use of inflation-protected bonds less than perfect. This is used as a further argument for the use of equities. It is argued that salaries and equity prices are both linked to the performance of the economy. The resulting correlation therefore makes equities a suitable 'hedge' to the company's exposure to uncertain pension payments dependent upon unknown future salary growth.

[7] This is not entirely true. While company revenues and cost are indeed likely to be rise if there is unexpected inflation it does not automatically follow that the value of equity investment will increase as well. Inflation can have negative effects on business performance and on cash flow. For example higher inflation increases the requirement to invest in the business since fixed assets and working capital investments itself more expensive the gain from inflation induced profit growth can be lost by the additional investment required to sustain that additional level of income.

A reason to use equities?

Although this may seem a convincing case for equities, we again provide an alternative view. Let us split the problem into two: the problem of unexpected inflation (expected inflation is not an issue since it would already be reflected in interest rates); and the problem of uncertain future real salary growth. We believe one or both is likely to be relevant to most pension schemes.

(1) Unexpected inflation

Hedge with inflation-protected bonds...

It is true that an unexpected increase in inflation would result in future pension payments that were higher in nominal terms than previously forecast. If this increase in the pension liability is not matched by a corresponding increase in asset values, then a deficit will ensue and the corporate sponsor is likely to face additional cash contributions. This could also have negative implications for employees, as a result of increased risk and possibly higher contributions or even reduced benefits. As stated above, the common approach, used to 'hedge' this risk, is investing in equities – matching real assets with the real liabilities. However, equities are not the only asset class that can provide real returns – inflation-protected bonds (TIPs, index-linked gilts, etc.) are issued in many countries and provide an even better match for the inflation-linked liabilities. Although, there is the problem of the limited size of the inflation-protected bond markets, it may well be that additional demand for these instruments generates additional supply.

...or fixed rate nominal debt issued by the sponsoring company

In practice it would seem that, in order to hedge the inflation risk, the use of equity investment is essential, but this is not necessarily so. From a shareholder value perspective there is not necessarily any disadvantage arising from the pension fund assets being in fixed rate bonds, even if there is a risk of unexpected inflation. The key to realising this is to view the pension fund as part of a consolidated group rather than as a separate entity. This is something we have argued for above. Also, one needs to remember that bond investment in the pension fund reduces pension leverage and hence increases the amount of debt a company can assume while still staying within its overall risk budget. If, as is likely, the additional debt issued by the company is fixed rate debt, then the unexpected inflation produces not only unexpected loss, in respect of the pension scheme (the deficit), but at the same time produces an unexpected gain on the company's own debt. In real terms, the debt burden falls: there is a purchasing power gain, although this gain is not actually shown in financial statements, simply because we follow a historical cost convention. This would indicate that unexpected inflation does not necessarily reduce shareholder value, even where investment is in fixed rate bonds.

(2) Uncertain real salary growth

Although some companies have changed pension schemes so that they are based on average salary (increased by inflation), most schemes continue to have pension liabilities linked to final salary. This means that while expected salary growth can be allowed for, there remains an element of salary risk. This is similar to inflation risk, but it is not exactly the same and one could not hedge just by using index-linked bonds. Indeed there is no security available that produces returns that would completely match the changes in the liability. It is for this reason, and because both salaries and equity prices are arguably linked to real economic growth, that equity investment is suggested as being most

appropriate for salary-linked liabilities. This is one of the common reasons why equities are suggested as the appropriate investment match for active scheme members, even if other asset classes are used to match liabilities in respect of pensioners and deferred members.

Not a risk that should be hedged anyway?

There are two objections to this. Firstly, there is actually no convincing evidence that equities are an appropriate hedge for these liabilities and secondly, it can be argued that this is not a risk, which should be hedged anyway. The salary growth risk affecting pensions is no more of a risk than salaries are generally. A decision to increase salaries should be seen as having a dual effect; it increases future ongoing expenses and has an impact on the accrued pension obligation. When considering a salary increase, the full combined cost should be taken into account in evaluating the underlying effect on the business. We suggest that the risk of actual salary growth differing from the expected real rate of growth does not justify an investment in equities. This is simply a business risk that should be allowed for when evaluating business activities.

ABO not PBO in financial statements

Related to the points above, we believe that future salary growth, as it affects pension payments, is actually a future cost and not a current obligation. If an employee were to leave, or if that employee did not receive any future remuneration increase, then the pension obligation clearly should not allow for any future salary growth. This 'accrued benefit' represents the current obligation of the company. For most employees future salary rises are likely, but they are not mandatory and, consequently, we do not believe their effects should be included in the current pension obligation. This approach, an accrued benefit obligation or ABO, is contrary to current accounting standards, but we believe gives a more realistic measure of the pension obligation. This is something of an accounting side issue though and not directly relevant to asset allocation decisions.

Conclusion

We demonstrate that when taxation, financial distress and external costs are ignored, the asset allocation decision is irrelevant. This mirrors the accepted finance theories concerning capital structure and dividend decisions. Shareholders cannot gain from a difference in company pension fund asset allocation when the effects on their portfolio can be replicated by changing the composition of the portfolio itself. We believe that these irrelevancy arguments are very convincing and that arguments in favour of equities based upon EPS effects or high equity returns are, in a pure shareholder value context, invalid.

Equities reduce shareholder value

Thus far, all of our arguments represent reasons why equity investment by pension funds does not add value. We have presented the argument that companies should be indifferent between different asset allocation policies, although we have stated that there are advantages in having leverage in the company and not the pension fund. Here we explain what we believe to be the three key arguments why equity investment should be limited (benefit leakage) and why it should positively be zero (taxation and costs).

(1) Taxation

Financial leverage is more valuable than pension leverage due to the debt interest tax shield

It is generally accepted that debt finance carries a tax advantage over equity. At the extreme, ignoring personal taxation, this equals the rate of corporate tax and produces the commonly quoted formula for the value of a levered company (V_L) as a function of the value assuming zero gearing (V_U) and the present value of the tax shield: $V_L = V_U + D.T_C$. The term $D.T_C$ assumes perpetual tax savings on debt finance and also assumes that this advantage is not offset by a personal tax disadvantage in respect of debt. Also, the calculation ignores other disadvantages of leverage due to the costs of financial distress. The financial distress issue is actually irrelevant in our analysis since we are not suggesting an increase in the total risk of the business, merely the replacement of pension risk with financial risk within a company's overall risk budget. However, the question of personal taxation is an important one. Much is made of the tax advantages of debt within corporate finance but, due to the complexity of the tax system, it is actually impossible to arrive at a definitive value. We would argue that the $D.T_C$ term used above overstates the real value of the debt interest tax shield when allowing for the influence of personal taxation. However, we believe that a positive value does in fact exist, albeit one that changes over time with changes in tax rules and one that varies between companies depending upon the domicile of the company and the composition of its shareholder base. Also, the reduction in the value of the tax shield, due to personal taxes, tends to cancel when considering the influence of personal tax on the gross returns to a pension fund, as we discuss below.

Leverage in the company enables a higher benefit from the debt interest tax shield

We believe that there is a positive value to the debt interest tax shield. Therefore, if a company can increase the amount of financial leverage in such a way that overall risk is unchanged, and hence there are no additional costs due to, say, an increased probability of financial distress, then value is created for shareholders. This can be achieved by (1) investing in bonds within the pension fund; (2) using the reduction in pension risk to facilitate the issue of bonds by the sponsoring company; and (3) using the capital raised to fund the repurchase of equity.

There is a further tax advantage to bond investment in pension funds, or rather a disadvantage to equity investment. While the return from debt instruments held by the pension fund is truly tax free, the same cannot be said of equity returns. Equity returns do not attract additional tax payments; in that sense they are tax-free. However, the pension fund may well not be able to reclaim the tax

deducted at source (withholding tax) or the corporate tax paid by the company. Bond returns come from pre-tax profits and are not taxed in the hands of the pension fund. However, equity returns come in the form of a share of post-corporate-tax profits and hence tax has actually been suffered even if no additional tax is paid by the pension fund. Only if the fund can reclaim this underlying tax is the equity income truly tax-free in the same manner as bond interest. The ability to reclaim tax credits varies by country, but is currently not possible in either the US or the UK[8].

Since pensions have a tax-free status, this would suggest that they should invest in the most heavily taxed financial instruments such as corporate bonds, rather than equities. It is likely that the demanded gross return on corporate bonds, relative to the more tax efficient equities, is at least partly influenced by the taxes many corporate bond investors pay. This would create a benefit for the pension fund that can capture the whole of this gross return. With equities there is less of a difference between the return for the taxable and tax-free investor. This gain depends on the assumption that security pricing is determined by tax paying investors. However, if this was not true and the value of this gain was lower, it would then mean a higher value for the debt interest tax shield.

Overall the tax gain is equal to the rate of corporate tax multiplied by the size of any share buyback facilitated by the asset allocation switch, plus, potentially, a further gain due to the higher gross return available on the bond investment (although limited to the difference between the bonds acquired in excess of the share buyback).

(2) Benefit leakage

A possible asymmetrical payoff for the company when the pension fund invests in equities

Equity investment in a pension portfolio leads to potential large gains in asset values and, as we have emphasised above, also the potential for loss. If variations in asset returns are small, then it is the company that would benefit or lose from higher or lower-than-expected investment returns through changes in contributions. However, this may not be the case where return fluctuations are large, and particularly where, in addition, the pension fund is large relative to the size of the company and the number of active employees is small relative to the total scheme membership.

A period of sustained high equity returns, such as those seen in the 1990s, may produce a surplus that is so large that it is not possible for the sponsoring company to effectively benefit from this. The surplus may actually exceed the present value of the potential reduced contributions into the fund (the contribution holiday). It may be possible for the company to obtain benefit from the surplus in other ways, such as a repayment or through trading benefit increases for say salary increases. However, it is likely that there will be an element of 'benefit leakage' where part of the high equity return effectively goes to the employees. This would not represent a net cost to companies as

[8] The position in the UK changed some years ago. Prior to 1998 pension funds were able to reclaim tax credits on dividends from UK companies. The ending of this practice was politically controversial and has been blamed in part of the poor funding status of pension schemes in the UK. Certainly this action reduced pension fund income but it has also had the effect of making equity investment by pension funds much less attractive relative to bonds.

long as there is equal potential for low equity returns to be 'put' onto employees in the form of benefit reductions. However, in many cases it would be difficult to achieve this, particularly when the majority of the benefits have already vested and are therefore fixed.

Benefit leakage is likely to be a material cost, and disincentive for equity investment, where a scheme is mature, well funded and large relative to the size of the sponsoring company. In this case any high equity return would primarily benefit scheme members, but any negative equity return could potentially require additional pension funding from the company. Equity investment in this situation is inefficient and essentially a one-way bet.

(3) Cost savings

A bond fund is substantially cheaper to manage (even with active rather then passive management) than an equity fund. A switch to bonds would result in a material cost saving for companies. For example, when the UK company Boots switched the entire £1.5 billion of equities in its pension fund into a portfolio of bonds, it estimated an annual saving in advisor fees of about £10 million, equivalent to 67bp of investment return.

The estimated benefit of a 100% bond strategy

Estimating the combined effect of the above three gains arising from an asset allocation switch out of equities and into bonds is not easy. However, we believe that for a typical company this could easily be equivalent to between 100bp and 200bp of return. This represents an additional effective return for zero risk compared with the potential and risky additional return from equity investment. We would argue that indexed equity returns offer no risk-adjusted benefit and that therefore only by equity investment producing consistent alpha of at least 100bp to 200bp could investing in equities be justified in shareholder value terms.

Leverage in the company and not the pension fund

In the discussions above we have referred to risk and, in particular, to pension and financial leverage. We have mentioned the concept of a 'risk budget' for a company and how pension risk is an integral part of this. It is very difficult to create economic value without taking on risk. However, it is not sensible, or value creating, for companies to accept ever greater amounts of risk in the pursuit of higher returns since this makes the company less stable, affects business relationships (such as the availability of supplier credit) and increases the cost of capital. Of course, companies can try to conceal risk via complex financial arrangements, such as off-balance-sheet finance, but this does not change the reality of risk and generally such things are eventually revealed.

Risk is a necessary part of business and some leverage can be value adding

Some aspects of business risk cannot be eliminated and are a function of the economic activity undertaken. For example, high operating leverage due to the high fixed cost base in some industries is difficult to avoid, although it can be managed by ensuring there is as much flexibility as possible, thorough outsourcing etc. Hedging can substantially reduce some aspects of business risk and (subject to the cost of hedging) is beneficial for a company if it allows for a greater use of more valuable leverage, while still staying within the overall risk

budget. By 'more valuable leverage' we mean leverage in the business that improves profitability – perhaps the use of longer-term leasing arrangements that may be cheaper than short-term leases or leases with break clauses. Alternatively, more use could be made of financial leverage from which valuable tax advantages could be obtained.

Pension leverage uses part of a 'risk budget' but does it create value?

Most companies would agree that value-adding risk, such as tax efficient debt, is better for investors than taking on the same amount of risk through, say, not hedging commodity price fluctuations. This is borne out in practice; companies borrow and many companies at the same time seek to hedge exposure to commodity prices.

But what of pensions risk? Equity investment in the pension fund is itself a form of leverage for shareholders. However, is pension leverage valuable like financial leverage with its tax shield or perhaps a longer-term lease arrangement with its specific business advantages? Or is pension leverage similar to exposure to commodity price fluctuations, something it is best to eliminate as far as possible so that greater use can be made of more value creating leverage? Our argument against equities suggests that pension leverage does not add value and, given that it uses up part of a company's risk budget, it should be eliminated. We believe pension funds should be invested in bonds and not equities and leverage should reside in the business where management can create value and not in the pension fund where arguably no value is added.

Duplication of asset allocation decisions is confusing and costly

The case against equities suggests that asset allocation decisions in respect of pension fund investment do not create or destroy value (ignoring tax and other externalities). Those taking these decisions should not be rewarded or congratulated for getting it right or indeed fired for getting it wrong. There is no such thing as market timing when it comes to investment decisions by a corporate defined-benefit pension scheme. Our argument is not that these things do not matter (we too believe that market timing is key to achieving high equity returns); it is just that they should only matter to ultimate investors – individuals or the agents of individuals employed by them to take such decisions (managers of retail investment funds, private banking advisors, etc). Asset allocation and timing decisions should not matter to intermediary investment management such as that of company pension schemes.

It is the ultimate investors that are the real beneficiaries of all investment management decisions

Suppose as an individual we invest in a managed fund. We are thereby delegating investment decisions to our agent the fund manager. This manager can select appropriate investments; decide on the timing of purchase, etc. Now suppose this fund invests in companies that themselves have equity portfolios within their pension schemes. We now have two people making investment decisions on behalf of the ultimate beneficiary, the individual investor. This cannot create value since the activities and investment decisions of one can always be replicated by the other. Perhaps two brains are better then one, but these people are not actually working together. It is quite possible that decisions by one are effectively negated by the other (assume the pension fund

manager goes overweight Japan in the pension fund then we effectively have exposure to Japan in our personal portfolio via by investment in the company with the pension fund invested in Japan. Now suppose our personal advisor is bearish on Japan and hence reduces the allocation to Japanese companies in our personal portfolio. The net of these two actions is that nothing has changed; our exposure to Japan is the same.

Since the private investor is the ultimate beneficiary of investment returns and the ultimate bearer of the vast majority of investment risk, surely our agent investing on our behalf should be able to take unhindered decisions about investing without having to second-guess the actions of the company pension fund manager.

But our pension fund will outperform

We question whether pension fund outperformance really adds to shareholder wealth when shareholders can replicate this through their own investments

The case for zero equity investment does not even depend upon the assumption of efficient markets and no expectation of excess return from the pension portfolio. It is true that if the pension fund reliably earns abnormal equity returns, then value is added, even allowing for risk (although remember the added income needs to cover the incremental investment management costs and the tax savings available from bond investment). However, why should the company be doing something that its shareholders could do for themselves? If a particular group of investment managers can add value by beating an index, then should not the shareholders themselves be investing their own money with these managers rather than the company investing pension money?

Should asset allocation be linked to fund maturity

A common approach to pension fund asset allocation is to link the investment in equities to the maturity of the scheme – a less mature scheme justifying a higher equity weighting. The allocation may be linked to say the percentage of retired scheme members or perhaps sufficient bonds are held to cover forecast pension payments for say the next 10 years, with the remainder invested in equities. The concept behind this approach is that it is safer to invest in equities to fund obligations that mature in several years time, as there is then sufficient time for equities to recover from a period of poor returns and that it is unlikely over a period of say 10 years that equities will perform poorly. A longer duration of liabilities enables the company to take a larger bet on equities, thus benefiting from the 'time diversification' available from long-term equity investment.

We believe that equity investment has questionable value even for immature schemes

We agree that equity investment by a more immature pension fund can present additional problems if equity returns were poor because of the immediate requirement for substantial amounts of cash payments. If a company does choose to invest in equities, then it makes sense to reduce the weighting as the scheme matures. However, the case against equities would suggest zero investment in all circumstances and that the maturity of the scheme is irrelevant.

Is it all just theory – where is the practical evidence?

One cannot just dismiss theory. Theoretical finance is used all of the time in the real world. Portfolio selection, asset pricing, risk measurement and option valuation all have their theoretical foundations in academic work done in the past 50 years, but these now form the basis of much of the day-to-day work in the investment industry. Financial economics is a very young social science and is evolving all of the time.

Perhaps the theory of today is the accepted practice of tomorrow

Although admittedly much of the work on pension economics has indeed remained theoretical to date, there are nevertheless practical examples of the approach we are advocating. The most visible example was the decision by the UK company Boots Plc to switch its entire pension portfolio into bonds in 2000/01 with an accompanying share buyback. The company cited financial reasons rather than market timing for doing so. Also, we are aware that other companies, while perhaps not abandoning equities altogether, are realigning asset allocation more towards bonds. For example, General Motors has become a major user of derivatives in its pension fund. We understand it has used collars to limit equity downside risk, but paying for this insurance by simultaneously giving up some of the upside. Effectively transforming equity investment into something much closer to bonds.

Conclusion

We believe that, from a shareholder value perspective, the case for zero investment in equities within company-sponsored defined-benefit pension schemes is very strong. Companies would be advised that better use can be made of a risk budget by utilising that risk in the business, rather then accepting risk via their pension fund. Also, there are very strong taxation and cost arguments against equity investment and, for some companies, potential losses due to benefit leakage.

Is there a case for equities?

Within the financial economics framework that we present in this report, it would seem that there is little room for equities. We believe there are two areas where equity investment could perhaps be justified, even if one were to accept the arguments presented above. These relate to positive alpha investment strategies and default option benefits.

Positive alpha investment strategies

The assumption inherent within our analysis is that equities are fairly priced and that although future returns are uncertain, the ex-ante expected return is fair, considering the level of equity risk. This being so, the analysis demonstrates that equity investment does not add value and indeed prevents the company from achieving other value-creating benefits. Clearly if a fund can reliably generate abnormal returns (positive alpha) then value can be created for shareholders. However, we question whether it would be more efficient if this 'search for alpha' were to be done by individual investors themselves.

We believe that, if a company does choose to invest in equities via its pension fund, despite lost tax advantages, it is critical that it pursue positive alpha strategies such as market timing or stock selection. In our view, it is not rational to forgo the benefits of a zero equity strategy and then index pension equity investments. If the managers of the pension fund can successfully generate long-term alpha then it is true that equity investment adds value. However, in this case, alpha should be determined using a hurdle that factors in the opportunity cost of forgone interest tax shields.

In essence, a company with a pension fund invested in equities has an 'investment management division', which for some may be quite significant. Shareholders should evaluate whether this activity really creates value. There is nothing wrong with trying to generate alpha; such an effort is akin to a company trying to earn economic profits on its core operations. However, it is important for investors to realise that if a company has a pension with actively managed equities then the competitive advantages of the fund's management must be assessed with the same degree of rigour that the competitive positioning of the core business is assessed.

Shareholder gains from default risk

Companies can increase the value of their 'put option' by investing in risky assets

If a company is in financial distress perhaps due to excessive debt or even due to the stress caused by its pension fund then one must consider the impact of options inherent in different stakeholder claims. While distress is likely to reduce the overall value of an enterprise for all stakeholders, it is often claimed that shareholders can gain at the expense of debt holders and, in the case of pensions, scheme members due to the value of their 'put option'.

The put option arises because, like other creditors of a business, the pension fund members suffer credit risk. There is a certain probability that debts will not be repaid or that a company will not honour pension promises. If a company performs well, debt and pension obligations are honoured, but the

gains made by these parties are limited to the legal obligation[9]. Equity holders, on the other hand, have unlimited gains. However, if the company does badly, debt and pension creditors may well lose part or all of their investment. Of course equity investors lose as well, but only up to the value of their holding. When a company does very badly then the shareholders can effectively 'put' the excess loss onto the creditors. The value of this put option depends upon how distressed the company is and importantly how volatile the underlying assets are. Higher volatility actually increases the value of the put.

But this just redistributes wealth from employees and bondholders to shareholders

In respect of pensions the value of this put option can be increased by leaving the fund in deficit and by investing in risky pension assets (equities). This ensures that the company obtains maximum benefit from high equity returns, but ensures that it is the employees who are most likely to lose if equity returns are low. It is curious to think that at the very time when employees would presumably want lower risk in respect of pension assets, (a time of high pension deficits) it is apparently in the interests of the shareholders to actually increase risk. However, we have missed something out – the potential actions of bondholders and employees themselves.

And is probably negated by the actions of employees and bondholders anyway

In practice it is very difficult for shareholders to profit by seeking to increase the value of their put option since counter-actions by debt holders and employees are likely to negate any gain. For example, if a company adopts a funding policy (equities) that reduces the value of pensions for employees in favour of an equivalent gain by shareholders, then the employees can respond by demanding compensation in the form of increased remuneration. This may well be unrealistic in the short term, but, even if an immediate increase in remuneration were not obtained, there would undoubtedly be a cost to the company – even if due simply to deterioration in employee relations caused by the realisation on the part of employees that their pensions are less secure.

It is often argued that equity investment by a pension fund can be beneficial to shareholders due to the existence of the put option. However, we believe that financial distress reduces the overall value of an enterprise and that any gains for shareholders are actually negated over time by the actions of employees and by the negative implications of employee pensions being put at risk.

[9] This is not entirely true for pension beneficiaries who may obtain enhanced benefits if the fund and company do well. I discuss this from the employee perspective below.

The position of employees

Employees are not generally directly affected by asset allocation

Everything we have discussed above has been from the perspective of the company. We have assumed in all of this that the company has effective control over the pension fund, and in particular the asset allocation decision. This is actually false, given that most arrangements leave asset allocation decisions to the scheme trustees. The position of the employees mirrors that of shareholders in many respects and hence the potential costs to shareholders can produce equal gains for employees. However, there is one very important difference between shareholders and employees – diversification.

Employees lack ability to diversify

We have asserted that, in the absence of taxation effects and other externalities, shareholders would be indifferent between equity and bond investment in a pension fund. Increased risk of equity investment is balanced by higher return and if a shareholder does not like that risk he/she can always change overall risk at the portfolio level by changing his/her own asset allocation. Unfortunately employees are not generally in a position to do this. Any change in risk relating to an employee's pension is very difficult to diversify, given that for most people pension rights make up a substantial part of overall wealth. A strategy of equity investment can therefore severely affect the security of employees' pensions, particularly where the scheme is underfunded and where the financial strength of the employer and its willingness and ability to continue to support the scheme is questionable.

One of the commonly quoted reasons for equity investment is that since this 'reduces the cost of pension provision' to the employer it makes the continued provision of such pension benefits more likely. The argument is that if a fund only invested in bonds, the expected cash outflow for the company would increase and hence the company would be more likely to close the scheme and move to a lower cost defined-contribution plan to the detriment of employees. Equity investment, and the associated risks, is therefore a necessary burden for employees to bear in return for the continuation of the scheme. This argument is false if we accept the proposition that the true cost of pensions is unaffected by the funding decision. If a company mistakenly believes that equity investment reduces the real cost of pensions, it may well be overpaying these employees anyway on the basis that the true cost is not properly factored into the compensation decision.

But potential gains from equity investment due to benefit leakage

While, considering risk, equity investment in a pension fund is unlikely to be to the advantage of employees, in circumstances where that risk is small there is a clear case for equity investment from the employees' perspective. Risk would be small where the scheme is well funded (a significant surplus) and where the company covenant (the support of the company) is secure considering the company's solvency and financial strength. In this situation there is little risk to employees' pensions if equity returns are low, but there is the potential for employees to gain from high equity due to benefit enhancements. This is the opposite of the 'benefit leakage' loss to equity investors described above.

Catalysts for change

The obvious question in response to what we have presented above is why have companies not realised that equity investment by pension funds actually reduces shareholder value, if indeed that is true? Surely in a competitive world where companies strive to add value, a move to bonds in the pension fund would happen quite quickly if it were indeed the right thing to do. So why, given the arguments above, have so many people apparently got it wrong for so long? How can we explain the current status quo, and perhaps more importantly what would be the catalyst for an industry-wide move by pension funds away from equities?

A change in asset allocation due to changes in perception, pension obligations and changes in accounting and actuarial practice are all needed

We believe that the current (inefficient) equity investment approach can be rationalised by six factors:

(1) Immature pension schemes where the ability to take a long-term view has gone unquestioned, particularly in an environment of a bull market in equities.

(2) A biased and opaque method of accounting for pensions that highlights the rewards of equity investment while hiding the true risks.

(3) The common application of what is arguably a flawed actuarial model that does not incorporate the advances in financial economics of the past 40 years or so.

(4) A lack of education regarding the economics of pension provision on the part of company management. Plus a failure by analysts and investors to correctly see through the opaque accounting methodology for pensions, such that stock prices fail to reflect the true economic position. Also, the past failure of credit rating agencies to properly allow for the asset allocation of pension funds.

(5) The failure of investors and companies to fully appreciate the real long-term risk of equity investment due to the sustained high equity returns (with minor corrections only) from the mid-1970s to 1999.

(6) The lack of any explicit recognition of asset allocation by the PBGC in the US when determining fund insurance payments.

We believe there is, or will be, change in respect of each of these issues

(1) Changing perception of DB pension provision

Although we disagree with the concept that time diversification and mean reversion automatically justifies equity investment by pension funds, it is nevertheless a very widely held view. However, this approach is itself being questioned simply due to the maturing of pension schemes. Many companies are reducing equity weightings. Not because they embrace the concepts of financial economics, but simply because the maturing of schemes reduces the investment time horizon. A further factor in this is that for many companies, pension

schemes have continued to grow but, particularly in some of the more mature industries, the sponsoring companies have actually gotten smaller. Therefore the impact of pension funds, and in particular equity investment via those funds, on risk has been made more obvious. Recent equity market falls and the resulting attention from the press, rating agencies and particularly investors, have then further intensified this focus on pension funds.

We believe that this change in perception of pension funds has in itself started a wide-ranging debate about pension provision and appropriate asset allocation. Something we have seen in our previous work with investors on the accounting and valuation implications of pensions.

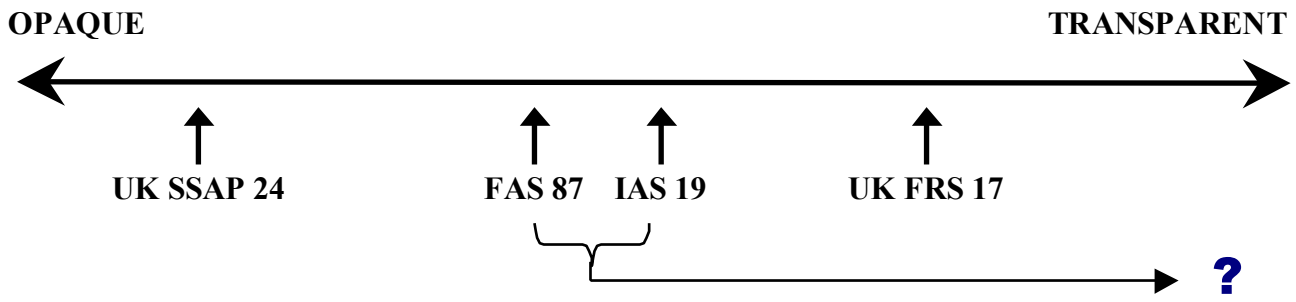
(2) Accounting

Current pensions accounting is opaque and unduly rewards equity investment

We believe that the current accounting methodology applied in respect of pensions is opaque and fails to show the true impact of pensions and the funding policy adopted on the company and the shareholders[10]. This is true for all pensions accounting systems currently adopted globally, although some are worse than others are. While it is true that under say FAS 87 it is possible to use footnote disclosures to very nearly fully get to the correct interpretation of pensions, this is a difficult process and in our experience something only practised by a small minority of analysts and investors.

The problem with accounting is both the failure to reflect the true funding position of a pension scheme in the balance sheet but, also, more importantly, the failure to reflect the true risk of pension fund equity investment in the income statement. Companies show the gains from equity investment through the recognition of an 'expected return' on pension assets (and indeed can exaggerate that return by the use of aggressive assumptions) but are insulated from the associated risks by an artificial smoothing process.

The diagram below highlights the accounting approaches of the US, UK and IASB and compares each in terms of an ideal 'transparent' pensions accounting model.



UK SSAP 24: SSAP 24 is the current accounting standard for pensions in the UK. Although a new standard (FRS 17) has been issued, its full adoption is not

[10] For a detailed assessment of how the current biased accounting system influences asset allocation see: Gold, Jeremy. 'Biased methodology enables equity investment by defined benefit pension plans' May 2000.

mandatory (although FRS 17 disclosures are required) and most companies continue to report under SSAP 24. Although by no means the least transparent model globally (in some countries there is often virtually no analysis of pension numbers given), SSAP 24 is, in our opinion, far less effective than either FAS 87 or IAS 19. Under SSAP 24 companies are permitted to use actuarial values rather than market values for pension assets and also a variety of liability valuations in determining funding. Assumptions and methodology are not explained and there is no reconciliation to market values. The balance sheet asset or liability does not represent the true funding position due to the amortisation of actuarial gains and losses and no reconciliation is given here either. The profit and loss account pension expense is given as one aggregated number with no analysis between service cost, financial effects and amortisations. Investment and other actuarial gains and losses are not recognised immediately, but are spread over a number of years thus distorting future profitability – the basis of the allocation is not generally disclosed. SSAP 24 is, in our view, very opaque and lacks even basic disclosures needed for investors to understand the true pension position.

Most of the necessary information is given by FAS 87 and IAS 19 but is hidden in the presentation

FAS 87 and IAS 19: The current US and international standards on pensions are very similar with just minor differences in methodology and disclosures. Funding is reasonably transparent since assets and liabilities are both stated on a market value basis. However, due to the use of amortisations, the balance sheet number is misleading and does not represent the actual pension surplus or deficit. This can only be found in the footnotes. Asset allocation information is not provided. The income statement charge is given as one aggregate number that means that financial effects of pension funding are wrongly included in operating profit. The pension charge is analysed in the footnotes though. The use of an expected return on assets, that includes an equity risk premium, results in the benefits of equity investment being recognised before the associated risks have been borne by the company and is also dependent upon varying company assumptions. Also, the volatility resulting from equity investment is concealed through the use of artificial smoothing techniques. FAS 87 (but not IAS 19) also permits the use of a 'market related value' to determine the expected return on assets and for this reason we classify FAS 87 as being slightly more opaque than IAS 19 in the diagram above. Overall, both IAS 19 and FAS 87 provide most of the information necessary to fully analyse pensions, but only if the user is willing and able to make certain adjustments

UK FRS 17 is an improvement on IAS and US GAAP

UK FRS 17: The UK certainly took a very big step forward in terms of the transparency of pension accounting when it introduced FRS 17 in 2001. Unfortunately its full implementation has been delayed, pending the UK move to IFRS in 2005. Pension assets and liabilities are stated at market value as in FAS 87 and IAS 19, but it is the actual resulting surplus or deficit that appears in the balance sheet; there are no amortisations. Disclosures regarding assets and liabilities are similar to FAS 87 and IAS 19, but there is additional disclosure of the asset allocation – essential if pension fund risk is to be correctly evaluated. The income statement charge separates the operating expense (service cost) from the financial effects of pensions (interest and expected return), the latter components being clearly displayed on the face of the income statement. The investment gains or loss in the period (difference

between actual and expected return) plus other actuarial gains and losses on the pension liability are immediately recognised and displayed as a component of comprehensive income, although they are not shown on the face of the income statement.

But a fully transparent pensions accounting system is needed

A fully transparent pension accounting model: The FRS 17 approach is a great improvement on FAS 87 and the others. Indeed, Bob Herz, the chairman of FASB has indicated his preference for the FRS 17 approach; although other members of FASB may not necessarily share this view. However, we do not regard FRS 17 as being entirely transparent. We would regard a fully transparent pensions model as incorporating the following:

- Assets at market value and clear disclosures of asset allocation and change in assets in the period.
- Liabilities valued using a bond based discount rate with clear disclosure of material assumptions and change in liabilities in the period. Expected inflation should be included where relevant, but not the impact of future salary increases where these are discretionary, even if the increases are probable. This ensures that the liability represents 'accrued benefits' only and that the full financial cost of future salary rises are recognised at the time the decision is made.
- The net funding position (surplus or deficit) is reflected in the balance sheet without amortisations and net of related deferred taxation. There should be separate disclosures of funding position of each major scheme.
- Only the service cost should be included in operating expenses with clear disclosure of unusual or non-recurring components.
- Interest cost and return on pension assets should be shown on the face of the income statement below operating income. Expected return on pension assets should be calculated using the discount rate with no recognition or anticipation of expected excess equity returns.
- Immediate recognition of the difference between the actual return on pension assets and the amount of return netted off against the pension interest expense. Also there should be immediate recognition of actuarial gains and losses due to remeasurement of pension liabilities. All these remeasurement gains and losses should be clearly stated as a component of overall gains or losses for equity investors although these 'remeasurement' effects should be clearly separated from other elements of performance and should not be included in any measure of 'operating earnings'.
- No amortisations or other artificial smoothing devices should be used to artificially hide investment volatility.

It is interesting to note that FASB was actually closer to this transparent model before issuing FAS 87. The preceding draft standard did not use amortisations and actually calculated expected returns based upon the discount rate and not the equity related return, as we have advocated above. The reason for the change

from this original position appears not to be conceptual, but a desire to eliminate volatility from the income statement.

We believe that a change in accounting practice to a more transparent model, and particularly the removal of the expected equity return from operating income, will have a major impact on the way in which companies view asset allocation. If the current artificial accounting bias is removed then we believe that many companies will quickly realise the strong financial case against equity investment.

Accounting change generating real changes to business practice

Can a mere accounting change precipitate a real change in company behaviour? After all, accounting is merely a matter of presentation. We believe it can and there is significant historical evidence to support this. For example in the early 1980s the UK introduced rules that required companies to capitalise financed leases in the balance sheet, thus removing the presentational advantage of off-balance-sheet financing. As a result, the value of new leasing transactions fell considerably in the following year as companies sought alternative financing structures. A current live example is the likely introduction of stock option expensing by the IASB and FASB. We have talked to many companies who have admitted that this will result in a major review of compensation policy. Far fewer options are likely to be issued in the future as has recently been illustrated by Microsoft's announcement that is will move from option to restricted stock grants.

(3) Actuarial practice

Traditional actuarial practice has arguably failed to incorporate many of the lessons from financial economics developed over the past 50 years. Many actuaries continue to question the relevance of market values, preferring their own (variously described and calculated) 'actuarial' values. Many also continue to value pension liabilities with reference to the expected return on some related portfolio of assets. Hence, implicitly saying that $1 of equities is worth more than $1 of bonds, when basic finance, and indeed common sense, would suggest this is wrong. Some do adopt, in our view, a more appropriate financial economic approach, but we believe that many of their colleagues still regard this as outside mainstream actuarial practice.

A split in the actuarial profession but with a move towards the financial economics approach

Actuaries seem to be split between the 'traditionalists' and 'financial economists'. Traditionalists appear to particularly advise that significant equity investment is generally appropriate for pension schemes and support actuarial values, smoothing and the general 'smoke-screen' approach. Traditionalists believe that investing in equities can reduce pension costs. The financial economists separate the cost element of pensions (the value of benefits given) from the impact of how this is funded. The funding would be evaluated based upon modern finance concepts and, as we have explained above, would often leave little room for equity investment. Feelings currently run high in the actuarial profession. This is something we have seen in the UK when attending various meetings and presentations, and in the arguments between the two groups that have been conducted through the press.

We believe any change in the actuarial profession will be slow and will not in itself be an immediate catalyst for a switch in asset allocation in pension funds.

(4) Lack of understanding by companies, analysts and investors

We have produced a number of reports in recent years on pensions accounting. These explain current accounting practice and give advice on how investors and analysts should interpret pension data and, where appropriate, adjust financial statements to correct for biases. We have also advised on how pensions should be incorporated in equity valuation, including the impact on DCF valuations and on multiples. However, in the many meetings, presentations and conferences we have conducted, it is clear to us that many investors fail to appreciate pension economics and still ultimately believe the data presented in financial statements. In practice there is little actual adjustment to reported earnings in respect of pensions. In defence of analysts and investors, it is, of course, somewhat unrealistic to expect them to undo the wrongs of accounting practice. We believe the problem stems from accountants (and actuaries) and not investors. Nevertheless, we believe that this lack of understanding by investors has contributed to excessive equity investment by pension funds. Companies are not only rewarded for equity investment by accountants in terms presentation in financial statements, but also probably in terms of their stock price, given that investors largely base investment decisions on the resulting biased measures of earnings.

Do investors unduly reward companies that invest in equities via their pension fund?

We believe that companies that choose to invest pension fund assets in equities find that the benefits of doing so – the higher equity return and hence higher profit and lower expected cash outflow – are rewarded by both equity and bond investors. However, we believe that these same investors do not adequately allow for the cost of equity investment, essentially the higher risk. In respect of bondholders, the problem lies partly with the credit rating agencies. Credit ratings do appear to take into account the level of funding of pension schemes, but we believe that the rating agencies do not explicitly take into account asset allocation.

A recent paper by Coronado and Sharpe, 2003, suggests that the market has rewarded excess pension income due to equity investment. They conclude that, in practice, it is the pension earnings rather than the (correct) pension net asset value that is priced. In their view: 'Complicated distortions embedded in bottom-line figures that are emphasised in financial statements and press releases can distort security prices substantially, even if the underlying details disclosed in the footnotes to financial statements can be used by experts to more accurately measure value'.

(5) Appreciation of equity risk

Up until the last three years equity investors have had it easy almost all the way from the mid-1970s. With a few blips, equity prices rose steadily and delivered very high average returns by historical standards. Any investors who started their careers in this period have perhaps had a misleading view of equity investment; a view of equities reliably outperforming bonds. This led some to make silly assertions in the late 1990s, such as the claim that equity risk

premium should really be zero. We believe that experience in the period to 1999 led investors to falsely believe that equities were really not that risky and that this contributed to the increased equity allocations in pension funds. The performance of equity markets in 2001 to 2003 has had a significant impact on this such that we believe investors have a better idea of the true risks involved in equity investment.

(6) PBGC insurance payments

Under the current structure of the PBGC system in the US, payments made by funds are based upon the funded status of schemes and are not affected by the underlying fund asset allocation. This is an omission that is recognised and we believe is something that is likely to be rectified in the future. If premiums were correctly valued then undoubtedly this would include consideration of equity allocations and further increase the costs associated with equity investment.

Conclusion

We believe that there are currently in progress, or that we will shortly see, changes in respect of each of the five factors above. Each one will, we believe, contribute towards a realisation that equity investment may be inappropriate for pension funds. However, we believe that the key catalyst for change will actually be a change in accounting practice, something we expect over the next couple of years. The IASB has indicated that it will produce a revised standard in 2004 and the FASB is also currently reviewing pension accounting. We expect both to move much closer to the fully transparent accounting model we have outlined above.

Change in accounting practice is imminent and we believe that this alone is sufficient to act as a catalyst for significant change in pension funding practice and produce a material shift from equity to bond investment by pension funds.

Appendix 1: Time diversification

Many advocates of equity investment in pension funds cite the benefits of time diversification and mean reversion. These concepts state that in the long term, equity investment has little risk and that investors with a long time horizon (pension funds) can capture the equity risk premium at little cost. We believe that the benefits of time diversification and mean reversion are overstated or, at best, are uncertain and do not believe that this alone is sufficient justification for equity investment. Even if such benefits could be proved, it would still not automatically favour equity investment, given the other arguments presented in this report.

Nevertheless these are topics that are frequently raised in connection with pension fund asset allocation, hence our brief discussion here.

Equity risk in the long run

Time diversification and mean reversion are controversial subjects, not least because of the difficulty of actually measuring equity risk in a meaningful manner. The common approach of focusing on volatility of returns may not actually be most appropriate when investors are more concerned about the risk of loss rather then the scale of any potential gain. We focus on volatility below. Not because we believe it is the best measure of risk, but because it is statistically convenient and a measure that we believe to be sufficiently closely linked to other possible approaches. Also, our analysis of these subjects is far from comprehensive, but we believe it is sufficient to cast doubt on the commonly held belief that equity investment, in the long term, offers a 'free-lunch'.

Is there a 'free-lunch' for pension funds and other long-term equity investors due to time diversification?

Pension liabilities have a very long duration. The discounted weighted average time to payment is generally more than 15 years and payment of some of the accrued liability may not fall due for many decades. It is therefore possible for pension funds to take a long-term view in setting investment policies and in asset allocation. If equities could be shown to be less risky when one has a long-term investment horizon, it would be possible to effectively capture at least part of the equity risk premium for free. Pension funds would benefit from the higher expected equity return without suffering all of the related risk – a true 'free-lunch'.

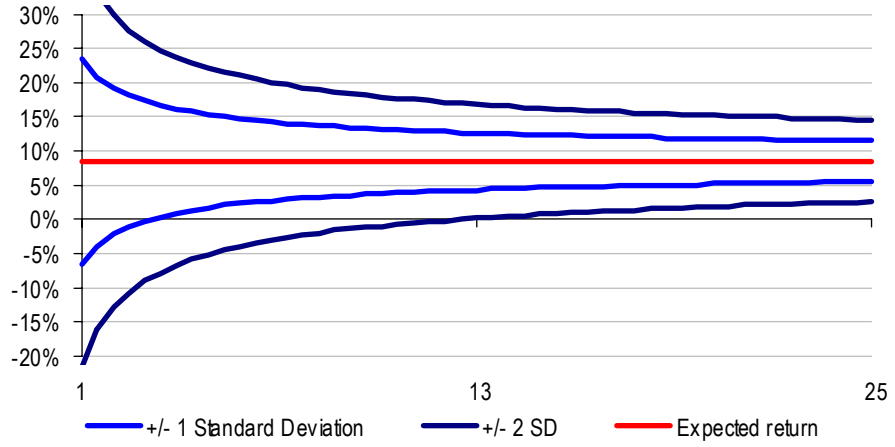
Part of the problem regarding time diversification is the difficulty of proving anything, given the large statistical margin of error due to the relatively small number of independent observations of long-run equity returns. There is also the question of how statistics are presented and whether this fairly shows the risks of long-term equity investment.

Time diversification reduces the probability of average annual return being less than a given benchmark

So is equity investment less risky in the long run? One method of supposedly demonstrating that this is indeed the case is to consider the variability of average annual equity returns over different time horizons. For example, for a one-year investment horizon, historical data for the US S&P 500 index for the

past 100 years would suggest that the realised real equity return in any one year is likely to fall somewhere between 51% and –49%[11]; these being the maximum and minimum annual (calendar) returns over the past 100 years. The average real return over this period is 6.1% and the standard deviation 18%. However, if we consider the average annual equity return over say any 10 consecutive years during that same period, the maximum and minimum are now 16.5% and –5.1% per year, respectively. The average return is still 6.1% per year, but the standard deviation of these 10-year averages is a much lower 5.4%. A longer time horizon clearly reduces the variability of this average equity return. The commonly used schematic chart shown below can also represents this effect.

Chart 1: Reduction in the variability of average annual equity returns over time



Source: UBS

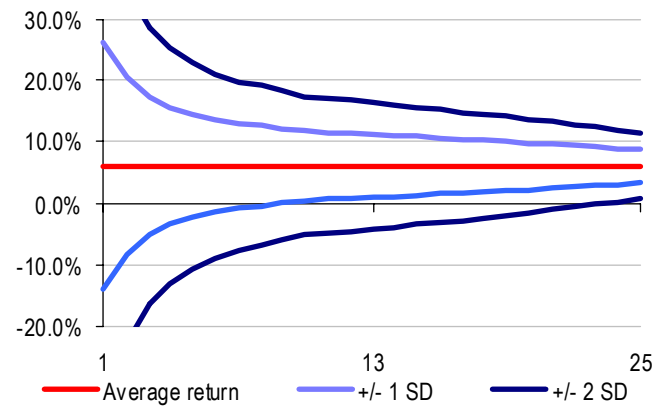
The reason for this effect is the impact of time on return and risk. Return (logarithmic return) increases linearly over time (nominal returns compound) so that return over say four years is 4x the average annual return. However, assuming no mean reversion, risk increases with the square root of time (variance increases with time) such that the volatility of say four-year returns is only 2x the volatility of annual returns. This means that the volatility of the average annual return over four years is only one-half of the annual volatility.

Chart 2 and Chart 3 show actual data for the US and UK equity markets. Both seem to support the argument above. In each case the charts give the average (logarithmic) annual real equity return over the 100 years to 2002 and the one and two standard deviation bands of the average annual return realised over different investment time-horizons. In both cases the volatility of average real returns declines for longer holding periods and very closely matches the pattern of our theoretical chart above (Chart 1). Our data shows that within the past

[11] These represent logarithmic or continuously compounded returns rather than simple nominal returns. A logarithmic return is calculated as $\text{Ln}(P_1/P_0)$ compared with the more common nominal return of $P_1/P_0 - 1$. The difference is small for modest returns but gets larger as returns increase. Logarithmic returns are used in the analysis to facilitate more valid and convenient statistical analysis of cumulative returns and volatility.

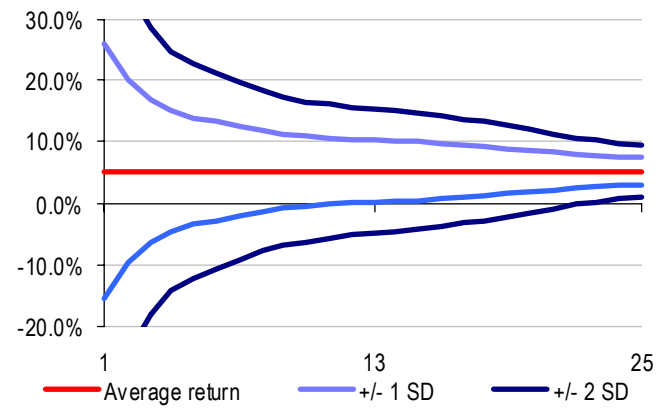
100 years there has been no period longer than 20 years in the US or 22 years in the UK for which there has been an aggregate negative real return

Chart 2: Distribution of US average real equity returns



Source: UBS estimates

Chart 3: Distribution of UK average real equity returns

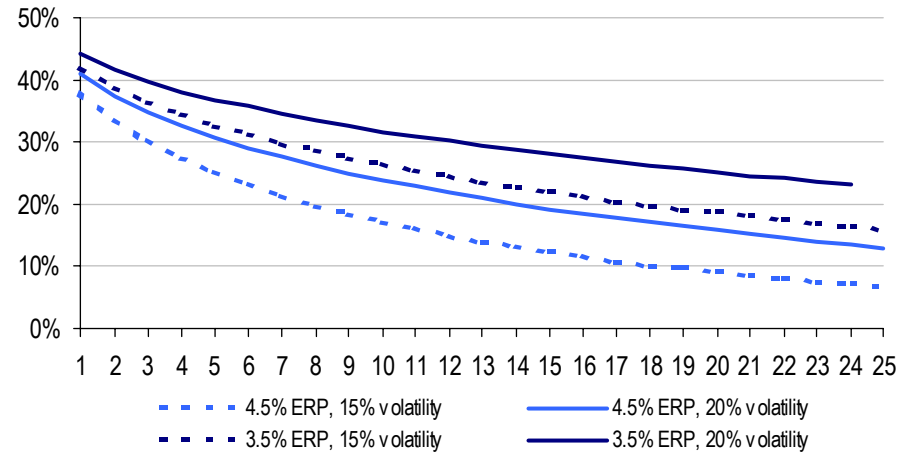


Source: UBS estimates

The analysis of long-run equity returns is fraught with difficulties. Chart 2 and Chart 3 show variations in average annual returns over periods of up to 25 years. Although by rolling the 25-year window forward one year at a time, we have 75 observations of such an average within the past 100 years, this does not really produce statistically robust results. We actually only have four truly independent observations of 25-year average returns. Variations in long-term average returns should be interpreted with caution.

Another way of presenting the same data, and giving a similar message, is to consider the probability that the average return from equities is less than a given benchmark, say zero or inflation or bond returns. Chart 4 shows the probability of a negative cumulative real return from equities over different time periods.

Chart 4: Probability of a negative cumulative real return



Source: UBS estimates

We can demonstrate that again the theory fits very well with practice by using UK market real equity returns. Table 1 shows the number of occasions on which, out of a sample of 100 different investment periods, and for different investment time horizons, the frequency with which aggregate real equity returns have been negative. This is compared to the theoretical frequency derived from the 100-year annual volatility measure of 20.5%.

Time diversification and a reduction in the probability of negative real returns for longer time horizons is supported by empirical data

Table 1: UK equities – negative real return frequency in the past 100 years

	Number of periods with an aggregate negative real return		
Time horizon (years)	Actual data	Theoretical based on overall observed annual volatility of 20.5%	Theoretical based upon reduced volatility of 17.5% (ignores 1974/75)
1	36	39	37
2	34	34	32
3	27	30	27
4	25	27	24
5	22	25	21
6	19	22	19
7	18	20	17
8	14	19	15
9	15	17	14
10	13	16	12
11	11	15	11
12	11	14	10
13	9	13	9
14	8	12	8
15	6	11	7
16	5	10	7
17	2	9	6
18	2	8	5
19	1	7	5
20	0	7	4

Source: UBS estimates
Note: The singe period of negative real return over a 19-year period is that ending in 1920. In the US there has not been a period of more than 18 years with a negative aggregate real return over the same 100 years.

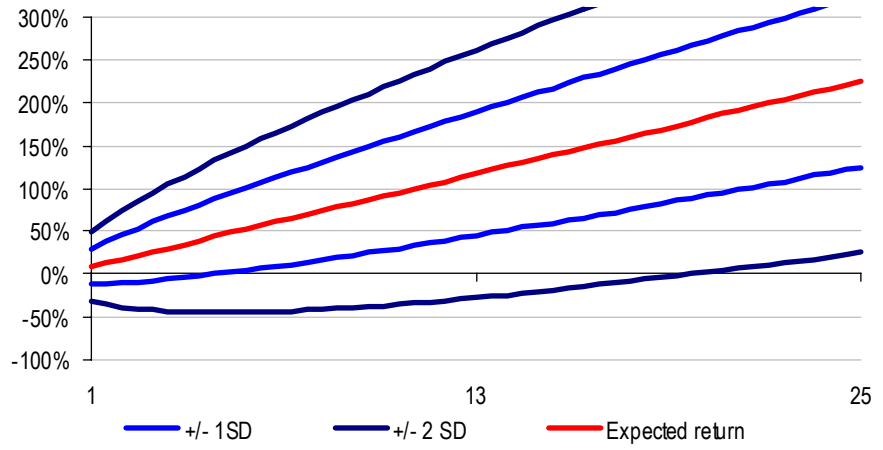
The actual frequency is less than predicted for most time horizons, although we believe the unusual negative return in 1974 and the immediate reversal in 1975 distort the prediction. Excluding this, the annual volatility is 17.5% and the match is much closer. Again we have used overlapping periods and therefore the statistical accuracy for the longer time horizons is questionable. However, in spite of the potential statistical margin of error, the message from the charts and data above would seem to be quite compelling. It seems to suggest that equity investment in the long run is less risky. But does this really prove that the equity risk premium is a 'free-lunch' for pension funds? We do not believe so.

It is all in the presentation

A focus on absolute returns gives a very different picture

We believe that the comparison of the variability of average annual returns over a long period with the variability of returns for a single year is incomplete, as is the focus purely on the probability of an average return less than a given limit. While it is clear that the average return is less volatile over a longer period, the total return is actually more volatile. Chart 5 uses the same theoretical analysis as used to produce Chart 1, but this time the focus is on the variability of total aggregate returns over a given time horizon.

Chart 5: Total return variability for different holding periods



Source: UBS

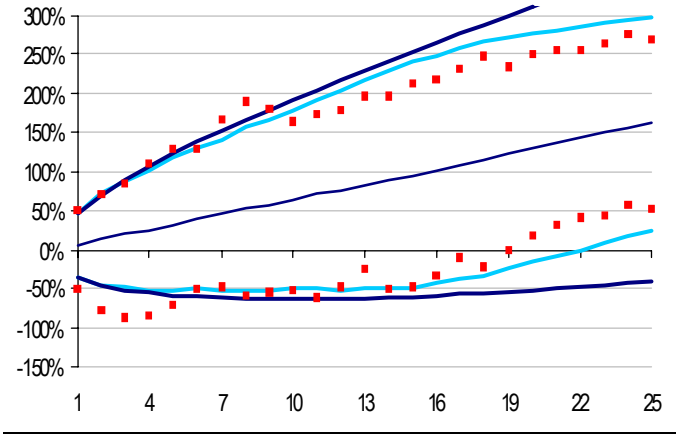
The variability of aggregate absolute returns increases over time

The range of potential outcomes, in terms of aggregate return, is greater for a longer investment time horizon based upon our theoretical (non-mean reverting) model. This is also supported by empirical data.

Below is the same 100 years of US S&P and UK FTSE data used earlier. However, this time aggregate total returns rather than the annualised average return are compared for different time horizons, resulting in a somewhat different picture.

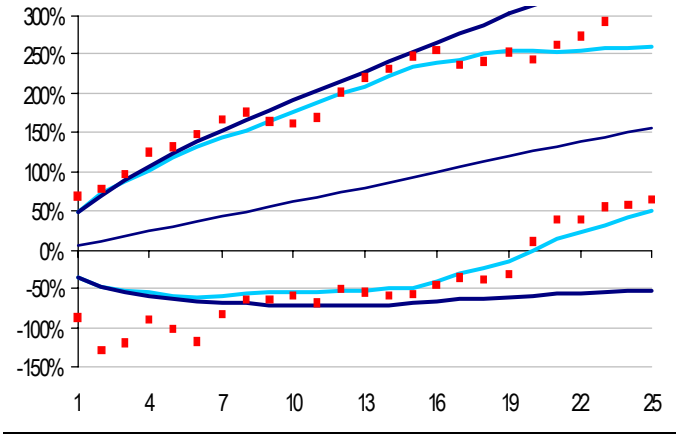
The analysis of very long time horizons is unlikely to be statistically reliable, given the limited number of independent periods, but we believe that Chart 5 shows that the range of actual aggregate returns diverges for longer investment periods and that this seems to closely match that predicted, given observed short-term volatility, at least for holding periods of up to about 15 years.

Chart 6: US realised total equity returns



Source: UBS estimates

Chart 7: UK realised total equity returns



Source: UBS estimates

Note: The dark blue line represents the theoretical two standard deviation (2SD) range of realised returns derived from observed annual volatility. The light blue line shows the actual observed 2SD volatility for different investment holding periods. The red points are the observed maximum and minimum real returns for the same holding periods. All returns are logarithmic (continuously compounded) and real (adjusted for inflation).

The above data uses logarithmic (continuously compounded) and not nominal returns – a standard approach for volatility analysis. For low returns over short periods, the difference between a log and nominal return is small, but over longer periods the difference is material. For example, the maximum observed return over a 25-year period is given above as 280%, which arises in the period 1974 to 1999. This actually translates into approximately a 1,500% return in the more familiar nominal returns (a given investment in equities in 1974 would have been multiplied 15 times by 1999 with income reinvested). It also explains why the chart for the UK shows a minimum return for some periods of less that –100%.

While we agree that the variability of average returns and the probability of equities generating a negative return or a return less than, say, bonds declines with a longer time horizon, we believe that this is just one aspect of risk. We believe that there is evidence that the variability of aggregate returns actually increases over time and that, therefore, the adverse consequences (the absolute effect on wealth) of there being a low equity return actually also increases over time. Even small underperformance by equities on an average annual basis could add up to a significant effect over many years. In the absence of mean reversion (which we discuss below), we do not believe that the risk of investment in equities necessarily falls, even if an investor has a long investment time horizon.

Evidence from derivatives

The cost of insuring against underperformance rises with longer investment horizons

A further piece of evidence suggesting that equity investment is more risky for a longer investment horizon can be derived from the derivatives market. If we were to hedge against the possibility of equity returns being less than, say, expected inflation or perhaps bond returns over a given time horizon through the purchase of an appropriate derivative such as a put option, then the cost of this hedging would increase with the length of the hedging period. This indicates that the market actually works on the basis that equity risk increases over time. Simplified derivative pricing models, such as Black-Scholes, work on the basis that volatility increases with the square-root of time (for example if annual equity return volatility is 20% then the volatility of aggregate returns over four years would be 40% (20% x $\sqrt{4}$). The fact that such models do reasonably accurately describe actual market based derivative prices (at least

for the maturities generally available) indicates this relationship approximately holds true.

Mean reversion

Do long-term investors get a 'free-lunch' due to mean reversion?

You may well have spotted in the actual data we have used above that there is some evidence of mean reversion. Mean reversion arises where a negative return in one period is more likely to produce a positive return in a subsequent period and vice versa. This results in a lower risk of loss and lower volatility of returns for longer investment time horizons. Mean reversion means that volatility would be expected to increase at a lower rate than the square root of time we described above. This gives long-term equity investors an advantage in that they participate in the same average equity return as short-term investors, but achieve that with proportionately less volatility. There is still likely to be a larger range of aggregate returns over a longer period, but the increase in risk is lower than the accumulation of the expected risk premium.

We show below the variance ratios (mean reversion factors) for the US, Japan and the UK using the real equity returns data we have been using in our analysis. These represent the ratio of observed volatility of n-year aggregate returns versus predicted volatility of n-year returns derived from observed annual volatility. A factor of less than 100% indicates mean reversion and more than 100% indicates mean aversion. For example the 80% factor for the US equity returns over a 20-year time horizon indicates that the volatility of aggregate equity returns for 20-year investment periods is only 80% of the annual volatility increased by the square root of 20.

Table 2: Variance ratios or mean reversion or aversion factors for different markets

Holding period (years)	US 100-year data (%)	US 50-year data (%)	UK 100-year data (%)	UK 50-year data (%)	UK 50-year data (excluding 1974/75) (%)	Japan 50-year data (%)	Confidence interval for 100-year data (5% significance level) (%)
5	94	105	95	80	94	99	78 - 122
10	89	120	87	82	99	98	67 - 135
15	92	136	88	89	106	81	60 - 146
20	80	136	69	89	107	78	54 - 155
25	67	111	51	72	80	85	50 - 164

Source: UBS estimates

Note: The variance ratio is the ratio of volatility of n-year holding period returns compared with annual volatility multiplied by $\sqrt{n}$. Confidence intervals for the variance ratio are estimated from a simulation exercise using 100 years of data. These would be wider for 50 years of data.

Empirical evidence is inconclusive

We would express caution over the reliability of this data. There is such a large statistical margin of error that we would expect a significant variation in these mean reversion factors even if there was no real underlying mean reversion (or aversion) at all. For example the UK market appears to be significantly mean reverting. (See for example the 20-year factor of 69% for 100 years of data and 89% for the past 50 years above.) However, if we remove the influence of the 1974/75 period on the past 50 years, the mean reversion disappears. The table also includes estimated confidence intervals at the 5% level for each time horizon. All of the observed variance ratios lie within these ranges and hence we are unable to reject our 'null hypothesis' that there is no mean reversion and

that the variations are simply due to an expected distribution of such a statistic due to the use of relatively small samples.

Conclusion

In presenting the case against equities we would argue that the (weak) empirical evidence of mean reversion is not enough, in itself, to justify significant equity weightings in pension portfolios. A bet on future mean reversion would in itself be a risky strategy[12]. However, the case against equities does not depend on disproving mean reversion. Even if mean reversion did actually exist and were likely to persist in the future, this is a benefit that can arguably be captured by investors themselves.

[12] This theme is further developed by our Alternative Investment Strategies team in their report 'Fire flies before the storm' UBS June 2003

Appendix 2: Impact on EPS

We explain above that we believe EPS to be a simplistic measure of performance and that changes in EPS do not necessarily correspond to actual changes in shareholder value. However, we also recognise that in practice much of equity analysis is indeed EPS focused and that one of the main arguments for equity investment in pension portfolios is that it results in higher EPS for the sponsoring company.

In Table 3 we provide an illustration of the impact of asset allocation decisions upon EPS and demonstrate that it is possible to offset the EPS fall, due to a switch to bond investment, by the issue of bonds combined with a share buyback by the sponsoring company itself. This is a useful way of illustrating that true pension costs are unaffected by the method of funding and supports the hypothesis of this report that equity investment by pension funds does not increase shareholder value.

Table 3: Impact of asset allocation switch and share buyback on EPS

US$m	Current	Switch to bonds	Switch to bonds plus share buyback	Switch to bonds plus reduced share buyback
	(A)	(B)	(C)	(D)
Share buyback	**-**	**0**	**279**	**111**
Summary balance sheet				
Net operating assets	1,000	1,000	1,000	1,000
Pension assets – equities	300	0	0	0
Pension assets – bonds	0	300	300	300
Total assets	1,300	1,300	1,300	1,300
Equity finance	1,000	1,000	721	889
Debt finance	0	0	279	111
Pension liability	300	300	300	300
Total capital	1,300	1,300	1,300	1,300
Summary income statement				
Operating profit	100	100	100	100
Pension expected return	30	18	18	18
Pension interest cost	(18)	(18)	(18)	(18)
Debt interest	0	0	(17)	(7)
Earnings	112	100	83	93
Number of shares	100	100	74	90
EPS (US$)	**1.12**	**1.00**	**1.12**	**1.04**
Market capitalisation	1,087	1,087	808	976
Share price (US$)	**10.87**	**10.87**	**10.87**	**10.87**
PE	9.7	10.9	9.7	10.5
Cost of equity (%)	10.30	9.20	10.30	9.56
Equity beta	1.08	0.80	1.08	0.89
Equity volatility (%)	27.8	25.0	33.6	27.8
Distance to default	3.59	4.00	2.97	3.59

Source: UBS estimates
Note: This analysis ignores taxation; the corporate tax rate is assumed to be zero.

But the 'gain' is an illusion

In the example in Table 3 we assume that a company switches its entire pension portfolio into bonds. If nothing else changes then we agree that EPS falls (see column B). However, the asset allocation change also reduces the risk of equity investment in this company; the equity beta is lower. Effectively the company has reduced leverage, not the financial gearing, but the leverage due to pension investment in equities. Pension leverage has a similar effect on the shareholders of the sponsoring company[13] as does borrowing by the company itself.

In column C we have combined the asset allocation change with a change in capital structure that is designed to exactly replace the pension leverage with financial leverage such that the equity beta of the company is unchanged. This scenario shows that EPS is maintained at its previous level with equity risk the same and hence it demonstrates that shareholders are no worse off in EPS terms than with equity based pension investment. Higher profits, due to equity investment by pension funds, are an illusion.

Increased leverage in the company can maintain EPS where leverage in the fund is reduced by a switch to bonds

The extent of the share buyback that exactly maintains EPS, and fully offsets the earnings dilutive effect of the pension asset allocation shift, depends upon a number of factors including the rating (PE ratio) of the company, interest rates and the existing level of debt in the company's capital structure. It is also possible that for highly rated growth companies the buyback that maintains the existing level of equity risk would actually still result in a fall in EPS. The analysis above is shown for a company that has a modest PE ratio (9.7x). It is not possible to replicate the EPS equivalence calculation for all companies, particularly those that are highly rated, since a share repurchase actually has the effect of reducing, not enhancing, current EPS for these companies.[14] In this case the compensation would come in the form of future EPS growth such that the two scenarios would produce the same EPS in some future period. We do not believe this invalidates our assertions; rather it illustrates the limitations of EPS as a basis for analysis. Also, even for highly rated growth companies the above analysis would demonstrate that the deserved share price is unaffected by a switch of pension assets to bonds even if the leverage change cannot fully maintain EPS.

Actually doing the share buyback is not necessary for the switch to bonds in the pension fund to be value neutral (or indeed value enhancing once effects are considered). The accompanying buyback transaction is merely there to illustrate how EPS can actually be maintained at the same level as when pension assets are invested in supposedly higher return equities. It also demonstrates, in our view, how the argument that equity investment by the pension fund benefits shareholders is false. Share buybacks and pension fund asset allocation decisions are both value neutral transactions assuming no taxation effects or other value implications of a change in capital structure.

[13] At least it does in economic terms even if this is not fully reflected in market prices. Only if there is full transparency in respect of pensions accounting, or investors are fully able to see through the currently opaque system, is pension leverage likely to be fully assimilated into prices.

[14] This arises where the PE is greater then the reciprocal of the debt interest rate (net of taxation).

However, combining the two transactions illustrates well that the naïve interpretation of the effects of differences in asset allocation is incorrect.

In that above analysis we have focused on equity beta as the relevant risk measure to focus on if a company switches its pension fund from equities to bonds. While beta is a fair measure of risk from the perspective of a diversified equity investor, we should also consider total risk as this has important implications for both bondholders and for determining optimum capital structure.

Total risk versus systematic risk

Although beta has been maintained following the share buyback in column C, volatility or total risk of equity differs as is illustrated by the data at the bottom of the table regarding equity volatility and distance to default[15]. The total assets of the enterprise (operating assets and pension assets) are more diversified in the case of equity investment in the pension fund. If we assume in the above example that the volatility of the operating assets is 25%, the volatility of the pension fund when invested in equities is 18% (lower because it is a diversified portfolio) but that the correlation between these two assets is just 0.5. The overall asset volatility can be calculated at 22%. If we then increase this for the effects of leverage then equity volatility is 28%. However, in the case of the bond portfolio, although the volatility of the total enterprise assets is lower due to the influence of the bonds, the equity volatility when the higher leverage following the buyback is applied produces higher equity volatility – in this example 34%.

Of course this should not concern diversified shareholders of this company for whom, assuming they are efficiently diversified, specific risk is irrelevant. However, it can have negative implications. In particular, higher total risk limits the ability of companies to make use of financial leverage (high total risk companies tend to primarily finance through equity) and hence limits the taxation benefits from debt. Companies should (not all actually do) think in terms of an overall risk budget for a company. This should include the effects of business risk, including operational leverage, financial risk due to debt financing and other off-balance-sheet debt such as leases, plus importantly pension risk. From the company's perspective, this risk budget needs to consider total risk as well as systematic risk or beta. A bond investment strategy coupled with offsetting higher financial leverage uses up more of this total risk budget than investing in equities, but with lower financial leverage. However, we do not believe this is at all a valid reason for equity investment in the pension fund. It merely limits the extent of the benefits from switching to bonds.

If we assume that the company in our example above regards its credit rating prior to the asset allocation shift as optimum and that this can be characterised by the distance to default measure, we can then calculate a share buyback that maintains the same distance to default. In the above example this is

[15] Distance to default is often linked to debt ratings. It equals the difference between the value of an enterprise and the face value of its debt liabilities divided by the volatility of the enterprise (expressed in absolute terms). A lower distance to default indicates more risky debt and hence a likely lower credit rating.

US$111 million. Although this will result in a lower EPS and lower beta factor, it would leave credit rating unchanged and (again assuming no taxation or other effects) will also give the same stock price.

EPS and high equity returns

We discussed in the main report the issue of whether past high equity returns were a justification for equity investment in pension funds and whether the potential for such future returns would persuade companies to stick with equities. From a shareholder value perspective, we question whether shareholders are any better off if companies effectively invest in equities via pension funds or through direct investment. The impact on EPS is nevertheless a key issue in practice and it would seem that high equity returns must enhance company profits and EPS if the pension fund invests in equities.

We develop our illustration above to demonstrate that shareholders are no better off if the company they invest in were to itself invest in equities in the pension fund even if equities outperform. We compare bond investment in the pension fund plus a share buyback with a pension fund invested in equities and demonstrate that EPS can actually be unaffected by whatever equity return arises.

Let us assume the following:

- That the position above is at the beginning of a three-year period of very high equity returns and that there is a 100% total return from equities over this period arising from a substantial increase in average profitability.

- There is no change in long-term assumptions or discount rate (that is, no change in valuation multiples) just a higher-than-expected increase in earnings in order to keep the numbers as simple as possible.

- That the benefit of the high equity returns in the pension fund (the fund surplus) accrues in full to the company and that employee benefits are not increased.

- That bond returns exactly match the unwinding of the discount on the pension liabilities such that the bond fund remains 100% funded but that, due to the higher equity returns, the equity based fund now has a surplus of US$243 million. The company, through reductions in contributions over the three years, may already have captured this surplus. In which case, the surplus now resides in the form of a higher cash balance. Alternatively, the surplus may be used to reduce contributions in the future. Either way we shall assume that the value of this surplus to the company is the amount of the surplus itself.

- That there is no ongoing service cost or other changes to the scheme.

All of these assumptions are just to simplify the example to make it clearer. None affect the validity of the message we are trying to illustrate.

If the whole equity market has performed well due to increasing profitability, we would expect, on average, our sponsoring company to have done just as well. In the example below we have assumed that operating profit increases by 65% over the three-year period. This, together with the cash distribution of the earnings over that period, means that the same 100% return is created by the business operations of this company.

Contrary to what perhaps would be expected, the example below shows that the equity investors in the sponsoring company are no better off with the pension fund invested in equities compared with the fund invested in bonds with the pension leverage replaced by financial leverage. The stock price in both cases rises to US$23.36. This, when including dividends, represents a somewhat higher return than the 100% total return on equities and the 100% return from the underlying business, but this is due to the leverage effect of either the pension investment or the additional debt finance.

We demonstrate that in EPS terms shareholders are no better off due to pension fund equity investment even when equities outperform

Table 4: Impact of asset allocation switch and share buyback on EPS after allowing for abnormal equity returns

				Three years later following 100% equity return		
US$m	**Pension fund invested in equities**	**Switch to bonds**	**Switch to bonds plus share buyback**	**Pension fund invested in equities**	**Switch to bonds plus share buyback**	**Further share buyback in year 3**
Share buyback	**-**	**0**	**279**	**-**	**-**	**80**
Summary balance sheet						
Net operating assets	1,000	1,000	1,000	1,000	1,000	1,000
Pension assets – equities	300	0	0	600	0	0
Pension assets – bonds	0	300	300	0	357	357
Total assets	1,300	1,300	1,300	1,600	1,357	1,357
Equity finance	1,000	1,000	721	1,243	722	642
Debt finance	0	0	279	0	278	358
Pension liability	300	300	300	357	357	357
Total capital	1,300	1,300	1,300	1,600	1,357	1,357
Summary income statement						
Operating profit	100	100	100	165	165	165
Pension expected return	30	18	18	60	21	21
Pension interest cost	(18)	(18)	(18)	(21)	(21)	(21)
Debt interest	0	0	(17)	0	(17)	(21)
Earnings	112	100	83	204	148	144
Number of shares	100	100	74	100	74	70
EPS ($)	**1.12**	**1.00**	**1.12**	**2.04**	**2.00**	**2.04**
Market capitalisation	1,087	1,087	808	2,036	1,515	1,435
Share price ($)	**10.87**	**10.87**	**10.87**	**20.36**	**20.36**	**20.36**
PE	9.7	10.9	9.7	10.0	10.2	10.0
Cost of equity (%)	10.30	9.20	10.31	10.00	9.79	10.00
Equity beta	1.08	0.80	1.08	1.00	0.95	1.00
Equity volatility (%)	27.8	25.0	33.6	25.1	29.6	31.2
Distance to default	3.59	4.00	2.97	3.98	3.38	3.20

Source: UBS estimates
Note: This analysis ignores taxation; the corporate tax rate is assumed to be zero.

You will notice that EPS actually differs in three years time even though the stock price is the same. This is because there is now a difference in leverage in the two scenarios due to the high equity returns. However, this does not represent a gain from equity investment compared with the bond approach. It shows merely that the two scenarios, while starting off with equivalent leverage, are not longer equal (as is evidenced by the difference in beta and cost of equity). To make the comparison complete we would need to do a further buyback of equity in the scenario with the pension fund invested in bonds to increase leverage to the same level as the equity scenario. This is shown in the final column and demonstrates that EPS is the same whether the company adopts a 'leverage in the pension fund' or a 'leverage in the company' approach.

Perhaps you are wondering if there is a catch, or if in some way the example has been fiddled to produce the identical results for the two scenarios. Well, we have only cheated in one respect. We have assumed that the sponsoring company produces returns (increase in profitability) to match that of the average company and hence the index. It is true that if the company underperforms the market then 'leverage in the pension fund' outperforms 'leverage in the company'. However, the opposite is true if the company actually does better than the market. Overall, the holder of a diversified portfolio is unaffected by this. Also, investing in equities in the pension fund, on the basis that the business is likely to do worse than other companies, does not seem to us to be a value-creating strategy for management.

Conclusion

The conclusion of the above analysis is that overall, equity investors are no better off as a result of sponsoring companies investing in equities via pension funds – even in situations where equity investment provides returns substantially higher than those from bonds. EPS, while not necessarily a good measure of shareholder value, can itself be maintained following a switch to equities by replacing pension leverage with additional financial leverage in the sponsoring company.

References and further reading

The following reading list is not exhaustive, but is intended to provide further support for the arguments put forward in this report.

Pension finance theory

There are many papers, mostly from academics, about the theory of pension finance. Perhaps the most comprehensive is Exley et al. (1997), but for a clear explanation of the key taxation issue which supports bond investment see Black (1980).

Black, Fisher. 'The tax consequences of long-run pension policy.' *Financial Analysts Journal,* July-August 1980. Demonstrates the tax advantage of selling stocks and buying bonds in the pension fund while at the same time issuing bonds and repurchasing stock in the company.

Exley, Mehta and Smith. 'The financial theory of defined-benefit pension schemes.' *BAJ* 1997. A comprehensive explanation of pension economics.

Treynor, Jack. 'The principles of corporate pension finance.' *Journal of finance*, May 1977. Challenges the common view that the value of pensions to beneficiaries exceeds the financial burden to the sponsoring company.

Actuarial practice

The following papers focus on the role of actuaries in respect of defined-benefit pensions and question traditional actuarial practice that has partly led to high equity weightings in pensions fund investment.

Bader and Gold. 'Reinventing pension actuarial science.' Claims that the evolution of the actuarial pension model was halted by the passage of ERISA in 1974 and has hence failed to incorporate the emerging science of financial economics.

Gordon, Tim. 'The price of actuarial values.' *Institute of Actuaries, Staple Inn Actuarial Socie*ty, February 1999. Comparison of the traditional actuarial approach and modern finance theory in respect of pension funding.

Time diversification and mean reversion

Ineichen. 'Fireflies before the storm.' UBS Alternative Investment Strategies research, June 2003. Risk and return in the context of alternative investment strategies.

Kritzman, Mark P. 'Puzzles of Finance – Six practical problems and their remarkable solutions.' 2001. A very readable explanation of time diversification.

Bodie, Zvi. 'On the risk of stocks in the long run.' *Financial Analysts Journal,* May-June 1995. Asserts that equity risk is not reduced by adopting a longer investment time horizon, but that the opposite is in fact true.

Pension accounting

As we have emphasised, we believe that pension accounting plays a key role in asset allocation decisions. We refer to our own papers on this subject but also to a paper by Jeremy Gold in which the bias in current accounting systems and its role in encouraging equity investment are highlighted.

Cooper, Sutherland and Deng. 'Pension obligations.' UBS Warburg, 2001. Discussion of pension accounting and how investors and analysts should correctly incorporate pensions in equity analysis, valuation and cost of capital calculations.

Cooper and Sutherland. 'UK pensions following FRS 17.' UBS Warburg, 2001. Analysis of the implications for equity analysis of the new UK pensions standard FRS17.

Bianco, Deng and Cooper. 'Pensions: S&P 500 update – Risks and implications for equity investors' UBS Warburg, 2002. Detailed data on US company pension positions and analysis of the FAS 87 approach to pensions accounting.

Gold, Jeremy. 'Biased methodology enables equity investment by defined-benefit pension plans.' May 2000. Claims that bias in respect of the actuarial approach and also the FAS 87 method of accounting for pensions contribute to an investment in equities that cannot be justified from purely a finance perspective.

Coronado and Sharpe. 'Valuing the earnings effect of defined-benefit pension plans: Did higher stock prices cause stock prices to rise?' Empirical evidence that security prices are affected by the earnings impact of pensions rather than the (correct) funding position.

Accounting standards

FASB. 'FAS 87 – Employers' accounting for pensions.'

IASB. 'IAS 19 – Employee benefits.'

UK ASB. 'SSAP 24 – Pension costs.'

UK ASB. 'FRS 17 – Retirement benefits'

■ Statement of Risk

The issues raised in this report are complex and subject to extensive debate. While we believe we have correctly interpreted the concepts behind the case against equity investment by defined benefit schemes, this analysis inevitably involves assumptions and simplifications. For example, the tax system in the real world is more complex than is possible to model and hence the assertion of tax advantages for particular financial strategies is based upon necessarily simplifying assumptions. Also, our analysis of time diversification is not intended to be comprehensive and its validity is limited by the difficulties of dealing with long-run return data.

■ Analyst Certification

Each research analyst primarily responsible for the content of this research report, in whole or in part, certifies that with respect to each security or issuer that the analyst covered in this report: (1) all of the views expressed accurately reflect his or her personal views about those securities or issuers; and (2) no part of his or her compensation was, is, or will be, directly or indirectly, related to the specific recommendations or views expressed by that research analyst in the research report.

Global ratings: Definitions and allocations

UBS rating	Definition	UBS rating	Definition	Rating category[1]	Coverage[2]	IB services[3]
Buy 1	Excess return potential > 15%, smaller range around price target	**Buy 2**	Excess return potential > 15%, larger range around price target	**Buy**	34%	43%
Neutral 1	Excess return potential between -15% and 15%, smaller range around price target	**Neutral 2**	Excess return potential between -15% and 15%, larger range around price target	**Hold/Neutral**	57%	41%
Reduce 1	Excess return potential < -15%, smaller range around price target	**Reduce 2**	Excess return potential < -15%, larger range around price target	**Sell**	9%	38%

Excess return: Target price / current price - 1 + gross dividend yield - 12-month interest rate. The 12-month interest rate used is that of the company's country of incorporation, in the same currency as the predicted return.
US Closed-End Fund ratings and definitions are: Buy: Higher stability of principal and higher stability of dividends; Neutral: Potential loss of principal, stability of dividend; Reduce: High potential for loss of principal and dividend risk.
UK and European Investment Fund ratings and definitions are: Buy: Positive on factors such as structure, management, performance record, discount; Neutral: Neutral on factors such as structure, management, performance record, discount; Reduce: Negative on factors such as structure, management, performance record, discount.
1: UBS Buy 1/Buy 2 = Buy; UBS Neutral 1/Neutral 2 = Hold/Neutral; UBS Reduce 1/Reduce 2 = Sell.
2: Percentage of companies under coverage globally within this rating category.
3: Percentage of companies within this rating category for which investment banking (IB) services were provided within the past 12 months.

Source: UBS; as of 30 June 2003.

Unless otherwise indicated, please refer to the Valuation and Risk sections within the body of this report.

This report was produced by: UBS Limited

Head Office: UBS Limited, 1 Finsbury Avenue, London, EC2M 2PP, UK Phone: +44-20-7567 8000