



“Pensions and Capital Structure: Why Hold Equities in the Pension Fund?”, John Ralfe, Cliff Speed, and Jon Palin, July 2004

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The notion of integrating corporate and pension fund assets into an augmented balance sheet for the purposes of firm valuation was first introduced by Treynor (1972). It elicited greater interest with the passage of ERISA which created the potential for contingent firm liability on plan termination. A large body of research in the general area of corporate pension finance and economics emerged, in part motivated by projects sponsored by the National Bureau of Economic Research (NBER). Amongst the issues addressed were the effect of unfunded liabilities on firm value, and the resulting implications for funding and investment policy. Standard texts in corporate finance such as Brealy and Myers (2002), Ross and Westerfield (1997), and Copeland and Weston (1988) began to include sections on the topic of pension fund management.

While academic interest in the topic has significantly diminished, actuarial awareness has increased, largely through the writings of Jeremy Gold and Lawrence Bader (2003). Ralfe, Speed, and Palin (2004) enhance the actuarial literature through a restatement of the tax advantages of funding with debt and the presentation of the Boots example, in which a firm took theory to heart through implementation. The purpose of this comment is to elaborate on the potential for tax based gains under both the Black (1980) model of leverage based gains used by Ralfe, Palin, and Speed and the Tepper (1981) model based upon transformation of interest income to be taxed as equity.

In the Black (1980) model assumed by Ralfe, Palin, and Speed (2004), pension funding with debt is superior to equity because debt in the fund creates more debt capacity for the firm. The advantage is illustrated through a hypothetical firm adjusting its integrated balance sheet to maintain a net amount of debt. For every dollar

of long debt held by the pension fund, the firm can short (issue) $1 - t_c$ of corporate debt where t_c is the corporate tax rate. The reduction by t_c represents the fact that money going into the pension fund is deductible and money coming out is taxable. Under the Modigliani and Miller (1958) assumptions of no personal taxes and no possible potential dead weight losses from debt, the value to the firm of a perpetual stream of tax deductions from its interest payments is t_c . The product, $(1 - t_c) \times t_c$ represents the theoretical increase in the value of the firm, created through holding a dollar of pension assets as debt as opposed to equity which is presumed to create no debt capacity.

A more general formulation of the leverage based gain is $\Delta V = MVD \times MDC$ where MVD represents the marginal value of the additional dollar of corporate debt and MDC is the marginal debt capacity created through the additional dollar in the pension fund. In other words, MDC would be the additional amount of corporate debt which could be issued without increasing the indirect costs of debt related to potential for financial distress. While pension fund assets cannot be accessed directly by debt holders, they create a form of financial slack that can be tapped in times of financial hardship through reduced future contributions. Thus a firm with a better, funded plan should be able to support a larger amount of corporate debt for a given cost of debt capital.

With this more general model, pension equity would also create debt capacity although to a lesser degree than with debt as the underlying assets are less secure. Under this more general model, all debt is not the same as higher quality bonds would be preferred to junk bonds again due to the greater debt capacity created. While the theoretical model suggests that a risk-free dollar in the pension fund can support $(1 - t_c)$ of corporate debt, actual debt capacity created is probably less as debt holders have no direct access to these assets. Estimation of this value however would be a difficult task.

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The second term, MVD, represents the net increase in firm value created through an additional dollar of corporate debt. Whether MVD is greater than zero is one of the fundamental issues of corporate finance that has been addressed under the general topic of optimal capital structure. Any text in corporate finance will generally spend several chapters discussing the issue, beginning with the irrelevance argument by Miller and Modigliani (1958) in a no tax world, and their adjustment for corporate tax deductibility of interest. In 1977, Miller in his presidential address to the American Finance Association introduced personal taxes into the gain equation. His motivation was the fact that corporate debt levels did not seem to be sensitive to the corporate tax rate, either over time or across different countries. His reasoning was that firm value is based upon after tax cash flows, including taxes at both the corporate and personal level. His adjusted gain equation per dollar of corporate debt is, $1 - [(1 - t_c)(1 - t_{ps})/(1 - t_{pb})]$ where the subscripts indicate rates for corporations, personal equity, and personal interest returns. As personal tax rates are progressive, the rates represent the rates of the so-called marginal investor that is indifferent between taxable and tax-free returns at market rates. The proportionate yield reduction of tax free relative to taxable can be used to estimate this for interest returns. For equity, the issue is more problematic although the reduction of share price on an ex dividend date can be used to estimate one minus the implied tax rate on dividend income.

Under a so called Miller equilibrium where t_{ps} is assumed to be zero and $t_c = t_{pb}$ gain from corporate leverage is zero. While this is probably an over statement, the existence of various forms of tax preference for equity returns does reduce the net tax from interest deductibility. Other reasons for reducing the leverage based gain from interest deductions includes the fact that the deductions may not be taken immediately—leading to a loss in present value on carry forward—or expiration due to time limitations or bankruptcy.

Recognizing that leverage based gains are somewhat tenuous, Tepper (1981) re-examined the question under the alternative assumption of personal portfolio as opposed to corporate level arbitrage. Under a transparency assumption, where corporate pension fund returns have a di-

rect reflection in the values of the shares of the owning firm, individual shareholders could swap personal debt for equity, maintaining the net level of risk in their portfolios if the firms issuing the equity that they owned would adopt a debt-based investment policy. Each dollar of debt held indirectly through the pension fund of the owned equity would allow the interest returns to flow to the equity investor to be taxed at the equity rate, with annual savings to the investor of $(1 - t_c)r_b(t_{pb} - t_{ps})$. Valuation as a perpetuity would involve discounting by an after tax rate of $r_b(1 - t_{pb})$. In the so-called Miller world, where leverage based gains are eliminated, Tepper based gains attain their maximum value of $t_c = t_{pb}$. In a Miller and Modigliani world without personal taxes, leverage based gains are maximized while Tepper based gains are zero. In an intermediate world, both sources of gain exist with the relative allocation varying with the specific values for t_c , t_{pb} and t_{ps} .

While the process of personal portfolio adjustment by individual investors is used to illustrate the gain, investors that do not make such adjustments should also realize the gain. As individual investors switch to equities from debt, they would bid up the price of the shares until there was no net gain from the personal portfolio arbitrage. Under the value additivity assumption, upon which valuation theory is based, the value of the firm is the net sum of the values of its component assets and liabilities. If the corporate pension fund were valued in the market as a stand-alone firm, it would be valued at $(1 - t_c)(1 - t_{ps})/(1 - t_{pb})$ per dollar of debt investment and $(1 - t_c)$ per dollar of equity investment. The net difference is equal to value previously present for the perpetual tax savings in the personal portfolio for arbitraging investors. Thus, in equilibrium gains to passive and active holders of equity should be the same.

Determining whether these proposed gains are real rather than theoretical will require more firms like Boots to adopt such a strategy. Researchers could then observe market reaction using the standard event study methodology. Whether this will occur remains to be seen.

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John Ralfe, Cliff Speed, and Jon Palin have described an important way of thinking about funded defined-benefit pension plans, basing their arguments on the “irrelevancy proposition” of Modigliani and Miller (1958). The core assumption of their paper is that the assets and obligations of the pension plan are similar in nature to the other financial assets and liabilities of the plan sponsor. Whether or not this model and its assumptions are valid (and we shall point out some fundamental problems with it below), it is surely appropriate that all pension actuaries should understand the arguments involved, and we commend the authors for their lucid presentation of these important ideas.

WHY INVEST IN EQUITIES?

Before dealing with the Modigliani and Miller (MM) theorem (1958), we refer to comments made by the authors at the start of their paper, in which they dismiss the standard justifications for equity investment in defined-benefit pension

funds. These justifications would be entirely moot if MM framework did indeed apply to the pension plan, so one presumes the authors included this critique for completeness. However, if there *are* problems with applying the MM theorem (as we believe), the validity of these justifications is of great importance

The long-term link between equity returns and wage growth, referred to in actuarial textbooks such as Lee (1986) and disputed by the authors, is in fact based on fundamental economics. The reason for believing that the two are connected is that both are driven by the same underlying cause, namely the accumulation of capital. The word ‘capital’ is here used in its economic sense to mean the aggregation of physical and intangible assets used for the production of goods and services. It is easy to see why the accumulation of capital must be linked to the appreciation of the equity market, as the price of a stock is simply the value that the market places on the net capital assets of the firm. The link with wages arises because the accumulation of capital is also the driving force behind the increase in productivity (i.e., the output per worker) that brings about the growth in wages. Standard economic theory tells us that, in equilibrium, a worker’s remuneration will equal his/her marginal product to the firm. This suggests that wages and profits should be fairly stable proportions of national output. In the United Kingdom this has indeed been the case—with the share of labour lying in the range 55–60% of national income for most of the last century.

The link between equity returns and wages is, of course, highly erratic in the short run. There are several reasons for this. First, in the business cycle, we observe that profits grow most strongly in the period of recovery following a recession, whereas wages grow most strongly at the end of the cycle when unemployment is low. The equity market, on the other hand, tends to anticipate the recovery in profits that occurs at the start of the cycle. Thus, we would expect a significant time-lag in the correlation between equity returns and wage growth. This lag mirrors the causal microeconomic relationship between profits and wages—profitable firms seek to expand by employing more workers, and once full employment is reached, they can only do this by offering higher wages. The authors cite Smith (1998) for

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evidence that the link between equity returns and wage growth is negligible; however the stochastic relationship used by Smith makes no allowance for the possibility of lagged correlations between equity returns and wage growth.

Another problem is the fact that the equity market can deviate from fundamental value in the short-run, temporarily displaying either abnormally high or abnormally low price/earnings ratios that have invariably reverted to more normal values that reflect the long-run return on capital with the passage of time. In examining the evidence for a link between equity returns and wage growth, we therefore require a statistical method that can test for evidence for a long-term relationship. Cardinale (2002) has developed a cointegration model that does precisely this, and he finds a significant long-term link between real equity returns and real wage growth in the United Kingdom. Cardinale concludes that a pension plan with salary-linked liabilities should invest a large proportion of its assets in equities if it is seeking to obtain the best possible match for its liabilities in the long run.

Another justification for equity investment is the belief that equities will outperform bonds (and most other asset classes) in the long run, although at the expense of greater price volatility. It is argued that long-term investors, such as pension funds, can ride out the volatility in equity prices in order to capture the equity risk premium. The authors claim that this view is a fallacy, pointing out that option premiums increase with term, and cite a statement by Samuelson (1994) to the effect that equities become more risky as the investment term increases. Neither of these objections, however, deals with the precise question of whether the equity allocation to a portfolio should increase or decrease with the investment term. In particular, it does not follow that the optimal equity allocation should reduce with term simply because the variance of a fund invested in equities increases with term.

Campbell and Viceira (2002) summarize the latest research on this topic in *Portfolio Choice: Strategic Asset Allocation for Long-term Investors*.¹ In the first chapter of their book, they ex-

plain the particular circumstances in which an investor should *not* increase the allocation to equities with the investment term, which are: (i) the investor has only financial wealth, i.e., he is investing a lump sum with no future contributions, (ii) he has a utility function exhibiting constant relative risk aversion, and (iii) equity returns follow a random walk. It is immediately evident that the first condition does not apply to most individuals who are saving for retirement. At the end of the first chapter, Campbell and Viceira state that they do not believe that the other two conditions hold in the real world. The random walk model implies far too much long-term equity volatility (which increases as the square root of time) to be consistent with the long-run stability of the share of capital in national income. The rest of their book is devoted to portfolio choice models in which the optimal equity allocation does increase with term. They conclude that there are sound theoretical reasons for the equity allocation of a portfolio to increase with the investment term.

It should be pointed out that the portfolio choice models previously referred to are primarily concerned with investors who have positive net worth, and their conclusions do not necessarily apply to an institutional fund set up to provide collateral for matching liabilities. The authors, Ralfe, Speed, and Palin, however, are not correct to imply that financial theory supports their counterintuitive claim that equities are not suitable assets for long-term investors. On the contrary, the most realistic financial models are entirely consistent with the common-sense view that the equity allocation to a portfolio should increase with the investment term.

THE NATURE OF THE PENSION PROMISE

In the second section of their paper, the authors argue that pension liabilities are bond-like obligations of the plan sponsor. While noting several differences between pension liabilities and bonds, they argue that these do not alter the underlying economics. One of these differences, however, is of great significance. The authors accept that pension liabilities “are not readily traded,” while omitting to mention that the MM argument depends crucially on the assumption that stockholders (and creditors) can neutralise any change

¹ This book was awarded the Paul A. Samuelson Prize for outstanding scholarly writing in lifelong financial security.

in the capital structure of the firm by adjusting their private portfolios. Clearly this is not possible for pension obligations, and we shall argue below that this fatally undermines the MM theorem for employees covered by the pension plan.

One of the differences between pension liabilities and corporate bonds that the authors do not mention is that defined-benefit pension promises are normally expressed in terms of the member's final salaries. This omission is not an oversight, but arises from their particular interpretation of how pension liabilities accrue with service. Essentially, the authors assume that the current unit cost method gives the "correct" method of calculating the pension liability. Smith (1998) states this explicitly.

The economic justification for the current unit method is a belief that the employees' pension accrual over any year is simply the change in the value of the benefit payable on leaving service. Thus, the pension accrual includes the revaluation of benefits arising from prior service in line with current salaries. The underlying assumption of this model is that the pension accrual, so defined, is taken into account into annual salary negotiations, so that the total remuneration offered for any year is equivalent to a one-year market "spot-rate" for the employment concerned. Thus, the rapid increase in value of an employee's pension accrual with service (under the current unit method) is not an anomaly, because the higher pension accrual of such employees would be offset by lower salary increases, if this model were valid.

This spot-market model of employee remuneration has been criticized on both empirical and theoretical grounds. McGill *et al.* (1996) summarize the empirical problems with the model—they point out that there is very little evidence that pension benefits figure in the renegotiation of salaries. More interestingly, Lazear (1979) explains why the existence of corporate pension plans negates the very concept of a labour spot-market. Lazear argues convincingly that the function of the pension plan is to encourage employees to make a long-term commitment to the firm by penalizing workers who choose to leave early. A final salary pension plan encourages loyalty by cancelling the anticipated salary indexation on the benefits payable to early leavers.

Under the spot-market model, the final salary promise is an illusion because the benefits provided are actually a series of deferred annuities linked to current salary. The employees could reproduce the same benefits if they were paid extra salary equal to their current unit pension accrual and used this extra income to purchase deferred annuities in the market. However, the fact that many employers have taken the trouble to set up final salary plans suggests that the spot-market model is not correct. No pension accounting standard has accepted the current unit method as the correct measure of a firm's pension liabilities for the simple reason that final salary plans do indeed provide benefits linked to final salary. And the link between pension benefits and projected salaries creates another important difference between pension liabilities and corporate bonds.

THE MODIGLIANI-MILLER FRAMEWORK

We now turn to the central argument of the paper, namely the application of the MM theorem to corporate pension plans. The authors note that the "irrelevancy proposition" was originally framed for the capital structure of corporations, and led to the conclusion that the market value of a business was not affected by changes in the mix of debt and equity capital employed. The essential insight behind the argument, given by the authors on page 107, is that any change in corporate gearing can be neutralised by a corresponding change in the stockholder's portfolio, provided that the equity and debt of the corporation can be freely traded in the market.

The argument generalises in a natural way to any financial assets bought or sold by the corporation. As long as the stockholders can buy or sell such assets on the same terms as the corporation, these transactions will be irrelevant to them. The authors note that under the MM theorem, "second-order" effects such as taxation become of prime importance. If the tax advantages of certain assets are relatively greater in pension funds than in private portfolios, investing in them is "value-creating" for the stockholders. This is the basis of the arguments made by Black (1980) and Tepper (1981), which is endorsed by the authors that pension plans should invest entirely in bond portfolios and that corporations should issue sufficient loan capital to make this possible. As the

interest accruing in pension funds is tax-free, whereas the interest payable by corporations is tax-deductible, the pension plan would benefit from a tax-arbitrage not available within private portfolios.

The authors, however, ignore the consequences of another difference between corporate debt and private debt: if a corporation defaults on its debt obligations, the stockholders are protected by limited liability. It follows that the stockholders receive an “option value” from holding equity in the pension fund [see Treynor (1972), Bicksler and Chen (1985) and Blake (1998)]. The plan sponsor gains when equity performs well and, in the extreme, faces liquidation if equity performance is disastrous. Stockholders have the option of walking away from a pension fund deficit in precisely the same way that they have the option of walking away from a highly geared corporation that is unable to repay its debt. Plan members carry part of the risk but none of the benefits (although they can try to negotiate some share of the upside). This incentive is particularly strong when the pension liabilities are insured against the insolvency of the pension plan, as is the case in the United States with the Pension Benefit Guaranty Corporation and the new Pension Protection Fund in the United Kingdom—if the liabilities are insured, there is a greater incentive to take risks on the asset side of the balance sheet.

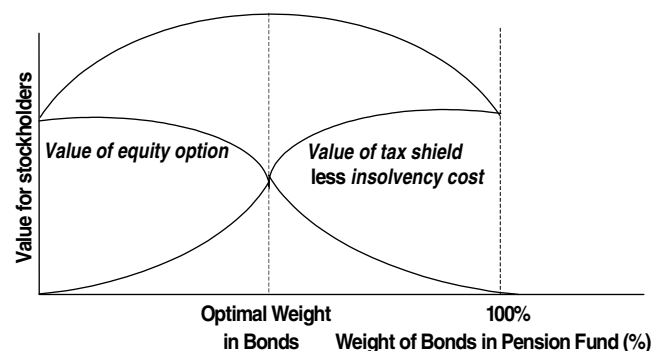
Bicksler and Chen (1985) demonstrate that the result of the tradeoff between the tax shield, insolvency costs, and the equity option value (which they call an insurance value) is for pension funds to have a mixture of equity and bonds in their portfolios. There are two reasons for this as demonstrated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

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

shield might eventually exceed the plan sponsor’s income and the corporation might be unable to use all the tax credits from carry-forwards or carry-backs. The insolvency risk and associated insolvency cost also rise as the weight in bonds increases.

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

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



Source: Bicksler and Chen (1985, p. 951).

In summary the argument that stockholder value is maximized, by investing pension fund assets entirely in bonds, is not as clear-cut as the authors appear to believe. The tax advantages have to be weighed against the lower value of the stockholders’ default option compared with an

equity-based investment strategy. Moreover, if all pension plans were to adopt a bond-orientated investment strategy, it is uncertain that stockholders would enjoy any reduction in their overall tax burden. The government would have to raise additional taxes to compensate for the loss in corporation tax revenues, and these additional taxes would ultimately fall on individuals, as all taxes do. It seems unlikely that the stockholders would escape these extra taxes.

THE PLAN MEMBERS

The above considerations are based on the assumption that the investment policy of the pension plan should be conducted in the interests of the stockholders. From a U.K. perspective, this assumption is untenable. The trustees of a U.K. plan have a legal duty to invest the plan assets in the best interests of its members. Can it be argued that a bond-only investment strategy would benefit the plan members?

The first point to note is that the MM framework does not apply to the members of the pension plan. The members are promised benefits that cannot be traded in a market. Moreover, any change in the investment strategy of the plan does not change the benefits it promises—the consequences for the members relate to the security of their benefits and the solvency of the plan sponsor (of particular concern to employee members, who want their jobs to be secure as well as their pensions). There are no market transactions that members can perform to neutralise the potentially far-reaching consequences of a change in the investment strategy of their pension plan. So, the authors argue that members will benefit from a bond-orientated investment strategy because their benefits will be more secure. For the sake of argument, let us accept their view that bonds are the better match than equities for final salary pension liabilities. Could all pension funds follow the example of Boots and switch to bonds?

UK pension funds own almost 50% of U.K. equities. It took the Boots pension fund fifteen months to switch its £2 billion equity portfolio to bonds without moving the market against it. If all pension funds attempted this strategy, this would induce a massive volatility in bond and equity prices. What works in the small does not always

work in the large. Pension funds have no alternative in aggregate but to hold equities in their portfolios. This is because given their size they have no alternative in aggregate but to hold a significant proportion of the country's capital stock.

Further, if corporations responded to falling equity values and rising bond values by buying back their equities and refinancing with bonds, leverage ratios will rise and the bonds will become as risky as the equities! The MM theorem tells us that each corporation's total risk will not change when its leverage ratio changes. But this only true if the MM assumption that bonds are riskless holds. This assumption is violated in the real world and bond holders, who do not get paid their coupons, can force a corporation into insolvency in a way that equity holders who fail to receive dividend payments cannot. A world in which pension funds hold only bonds turns out to be a riskier one for pension plan members than one in which it holds a mixture of bonds and equities.

It is certainly possible to create a low-risk "bond" with a relatively secure claim, but this is only possible if the size of the bond's claim on the income stream of the firm is low in relation to that of the residual claim. When there are significant insolvency costs, there must be a "residual liability" on the balance sheet of the corporation. That liability is called "equity" and large institutional investors such as pension funds cannot avoid holding a significant weighting of it in their portfolios (either directly or "indirectly" through highly levered bond holdings). While a small investor can switch between asset categories without any market impact, this is not true of large investors. The increase in gearing that accompanies the switch from equities to bonds in the balance sheet makes it more likely that the corporation will face liquidation, damaging the job security of employees without increasing the security of their pension benefits.

THE BOOTS PENSION PLAN

We have argued above that it would not be feasible for pension funds to switch to bonds *en masse* without a huge issuance of corporate bonds combined with an equity buy-back of equivalent magnitude, a self-defeating exercise that

would fail to reduce the aggregate risk in pension fund asset portfolios. However, suppose a single corporation, like Boots, could switch its pension fund to investment grade bonds while most other plans continued to invest heavily in equities. This is what has happened in the United Kingdom, so it is worth considering the merits of this strategy if it is limited to a small number of plans.

On the positive side, bonds are less volatile than equities, so the expected value of pension fund deficits will be smaller in the short-term, resulting in greater benefit security for the members, should the plan be terminated. There is a good case for investing in bonds if the plan is likely to be wound up soon. Long-term, however, we expect equities to provide higher returns. Although, the precise magnitude of the equity risk premium is uncertain, its existence is not in doubt. The MM theory tells us that the loss of the equity risk premium is irrelevant to the stockholders, who can simply increase the equity content of their private portfolios. But what are the consequences for the plan members?

If the plan sponsor contributes at the same level irrespective of the investment strategy, foregoing the equity risk premium will result in a smaller fund and a progressively increasing deficit. Long-term, the members' benefits will be less secure than if the plan had invested in equities. So let us assume the plan sponsor pays extra contributions to compensate for the loss in the equity risk premium. The pension benefits are now secure, but where has the money for the extra contributions come from? It is reasonable to assume that the plan sponsor would have to borrow more to finance its extra cash payments to the pension fund. If the equity risk premium follows past experience, these extra debts would accumulate to one-times the size of the pension fund after approximately 20 years. The extra benefit security for the members would come at the expense of a highly geared corporation, which means less job security for the employees.

It follows that optimizing the investment strategy of a pension plan for its members is about balancing risks. Short-term benefit security must be weighed against the financial health of the plan sponsor in the longer term, which itself is a precondition for the continuation of the plan. It

seems that even the trustees of the Boots pension fund are coming round to this view—in May 2004 they announced that they would be switching 15% of their bond portfolio back into equities. The Harvard Business School may have been premature in using the Boots Pension Plan as a case study supporting a bond-orientated investment strategy.

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