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## Editor's Introduction

by Martin McCaulay

The topic of risk management is core knowledge for actuaries in the pension field. This edition of *The Pension Forum* is on the Concept of Retirement Plan Risk from the Plan Sponsor Perspective. It includes three papers, discussions of the papers, and responses from the authors. "The Intersection of Pensions and Enterprise Risk Management," by Jeremy Gold was originally published in from April 2007 and focuses on asset/liability risk, asset allocation, and using hedging to add value.

Companies can increase their value by hedging systematic risk. Most company's defined benefit (DB) plans should manage their assets and liabilities to develop a net short equity position represented by a negative beta. Efforts to apply enterprise risk management (ERM) to DB plans often focus on the mismatch of assets and liabilities. There is often a presumption that a mismatch is desirable if the assets have a higher expected return than the liabilities, such as when the assets include stocks compared to the liabilities that are like bonds. The opposite is true. DB plan equity investments destroy shareholder value.

The second paper, "Risk Management for Pension Funds" by Jon Hatchett, David Bowie, and Nick Forrester, from October 2010 discusses the different risks and outlines a practical approach to the risk management process. The lessons of ERM are applied to DB pension schemes in the United Kingdom. The paper explores what ERM is, how it fits with DB pension funds, and how actuaries could incorporate it into their advisory process. Risk management by companies can increase shareholder value; reduce income volatility and therefore lower taxation costs; reduce cash flow volatility and increase a company's credit rating, reducing the cost of capital; reduce the probability of bankruptcy and the associated direct and indirect costs, such as the destruction of the value of intangible assets; and help reduce the likelihood of requiring external financial capital.

"Pension Investing and Corporate Risk Management" is by the late Robert Haugen and originally published in 1990. Two techniques for pension fund risk management discussed in the paper include (a) preserving funded status relative to the liability and (b) diversifying the pension investments relative to other investments to maintain funded status relative to the underlying corporate strength. Managing pension assets consistent with the overall corporate risk management is beneficial to customers, employees, and suppliers. Stockholders are largely unaffected. Stockholders can adapt to changes in corporate risk by adjusting their portfolios. Customers, employees, and suppliers are more concerned about the firm's survival and maintaining a long, stable relationship with a healthy corporation than they are about maximizing shareholder value. Customers want a continued source of supply. Employees want stable jobs. Suppliers want a long-term relationship.

*Martin McCaulay, FSA, EA, FCA, an actuary at the U.S. Department of Energy in Washington, D.C.*

# The Intersection of Pensions and Enterprise Risk Management

By Jeremy Gold

## Abstract

For most of the last forty years, corporate defined benefit pension plan assets have been managed to balance risk versus reward in more or less the same way that a risk averse individual would do with his own portfolio. Recently liability cognizant strategies have been developed, but these also attempt to balance risks and rewards.

But pension plans are not individuals; they, much like their widely-held corporate sponsors, are pass-through institutions. The economics of such entities are found in the corporate finance literature rather than in the literature of portfolio choice. The corporate finance (and thus the pension finance) objective is *economic value added* rather than *return for risk*.

Enterprise risk management is a corporate finance activity too and its goal should also be value added rather than return for risk. The intersection of enterprise risk management and pension finance leads to a value-based discipline with two startling results:

- Widely-held corporations can increase shareholder value by hedging away their own systematic risk (e.g., CAPM  $\beta$ ).
- Very many corporate defined benefit pension plans should define their liabilities and manage their assets to develop a net short equity exposure (negative  $\beta$ ).

## 1. Introduction

Defined benefit (DB) plan investing and much of today's practice of enterprise risk management (ERM) suffer from the same weakness. Managers and consultants present each as a tradeoff between risk and reward, implying some optimal balance. This is a legacy deriving from a failure to distinguish between two major branches of financial economics:

- The portfolio management branch<sup>1</sup>, applying to investment by individuals modeled as risk-averse expected utility maximizers; and
- The modern corporate finance branch<sup>2</sup>, applying to institutions which pass their performance through to individual investors; such institutions are modeled as value maximizers.

The Fisher (1930) Separation Theorem shows that these are different, but compatible, roles: value-maximizing firms best serve the needs of expected-utility-maximizing individual investors.

Defined benefit investing and ERM properly belong to the latter branch. In practice, and in their language, they are almost always treated as belonging to the former. This paper will not dwell on why this is how things are but will, instead, look at how ERM and DB plan management might operate and cooperate as corporate finance disciplines.

ERM may be broadly divided into financial and operational risk management, where the latter may be broken down into a variety of subcategories. Financial risk management often refers to capital structure and hedging decisions – areas that may be considered to be two sides of the same coin. This paper will deal primarily with financial risk management, although some of the same principles can be applied to real project management and operational risk.

Section 2 briefly looks at the history of risk and DB plan management. Section 3 develops the corporate finance (economic value added) approach to risk management and DB asset allocation. Section 4 shows that many corporations can increase shareholder value by eliminating their own market exposure (e.g., CAPM  $\beta$ ) and how the pension plan can leverage these gains. Section 5 concludes.

## 2. History

### 2.1 Risk Management

Certainly human beings have made great gains from taking risk and have surely experienced much pain as well. In a very basic sense, risk management amounts to pursuing some risky endeavors and avoiding others; the “management” is in the choosing. Individuals seem to balance risks and opportunities in very personal ways implying idiosyncratic preferences for risks and potential rewards.

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<sup>1</sup> E.g., Markowitz (1952), Sharpe (1964).

<sup>2</sup> E.g., Modigliani and Miller (1958), Stiglitz (1969), and Jensen & Meckling (1976).

Corporate risk management, in practice, seems to follow from the individual. Companies and their managers may be characterized as more or less risk tolerant, with risk aversions and appetites spread across a continuum from Caspar Milquetoast to Evel Knievel, from the highly prudent New York Life to the bet-it-all game plan of the next Yahoo wannabe. Individual attitudes towards risk are the essence of utility theory, a basic building block of modern economics; corporate attitudes towards risk are more problematical for economists. Whose risk tolerance shall the corporation serve? Is there an objective corporate utility function?

Financial economics describes individual risk takers, especially investors, in terms of risk preferences and utility functions; we say that individuals are expected utility maximizers. We then say, however, that corporations are value maximizers. Individuals are modeled as balancing risks and rewards in order to maximize utility while corporations accept the market price for risk and seek to maximize value, without regard for the risk preferences of their investors. As Fisher (1930) demonstrates, this is a compatible separation of duties. A widely held corporation that based decisions on non-market prices for risk – reflecting its “own” risk aversion or appetite – would not maximize value and would ill serve its investors’ efforts to maximize utility.

Nonetheless, in practice, we hear of corporations with *risk appetites*, *risk tolerances*, and *risk budgets*, feeding these into quantitative models of enterprise risk management. Do these models misrepresent corporate duties and badly serve their investors? Often, the simple answer is yes. Subjective risk management can signify the ascendance of managers’ private interests over the welfare of investors. But it is also true that risk management, which may appear merely to reflect the risk tolerances and aversions of managers, can protect and increase investor value. This is discussed further in Section 3.321.

The use of sloppy language and concomitant sloppy thinking about risk is especially rampant in the corporate management of defined benefit pension plans. Cleaning up the language of risk management – substituting the value-oriented analysis offered by modern corporate finance – could go a long way towards reconciling the academic and the practical. It would also discipline the practice and the practitioners in valuable ways.<sup>3</sup>

## 2.2 Pension Risk Management

Ask any pension manager in the last 50 years: are you managing risk? and the answer would be: “yes.” In 1955, we would have been told “our plan is insured by the great XYZ insurance company.” In 1965, we would be told “we are no longer insured, we are now investing in equities for their long-term high returns, diversification allows us to minimize risk, Harry Markowitz (1952) showed us how to diversify, have you heard about the efficient frontier?” In 1975, we would learn: “our risk management is even more diversified and we are better able to tell which of our asset managers are adding value after adjusting for risk; Bill Sharpe (1964) showed us how to measure risk ( $\beta$ ) and performance ( $\alpha$ ), have you heard of the Capital Asset Pricing Model (CAPM)?”

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<sup>3</sup> Nocco and Stulz (2006) bridge the language of risk management and corporate finance, translating concepts like “risk appetite” into objective measures based on the deadweight cost of financial distress.

By 1985, “we continue to diversify because we believe in equities for the long run, but we have immunized some of our liabilities using long duration bond portfolios; this allows us to insist that our actuaries raise their discount rate and lower our liabilities; matching some of the liabilities lowers our risk, so we can increase our allocation to equities; Marty Leibowitz (1986) at Salomon Brothers showed us how, have you read his research reports?”

1995, “our strong commitment to equities has really paid off, we think our surplus (assets less liabilities) gives us two benefits: no contributions today and a large enough risk buffer to weather almost any market downturn, do you have any hot stocks to recommend? you know, hi-tech with a great eyeballs-to-burn-rate ratio.”

And today, “we weathered quite a storm from 2000–2002 and are paying even more attention to risk than ever; we have added high  $\alpha$  investments including hedge funds (those hedge fund managers are expensive, but wow), private equity and absolute return strategies; we manage our interest rate risk using derivative overlays; this liability driven investing (LDI) strategy protects us against another perfect storm and we use portable  $\alpha$  to get the excess returns we need for the long run; yep, we are managing risk and generating real performance.”

## 2.3 Integration of ERM and Pensions Today

Efforts to apply ERM to DB pension plans focus on plan risk – the mismatch between plan assets and liabilities. There is often a tacit assumption that a mismatch wherein the assets have a higher expected return than the liabilities (e.g., equity investments to fund bond-like liabilities) is desirable as long as the risk is not too large to manage. A comparison of the size of the corporation to the size of the plan may be invoked to demonstrate that mismatching in a relatively small plan will not be too risky for the plan sponsor. Similarly, reference may be made to a risk budget, suggesting that the plan can take mismatch risk within limits defined at the sponsor level.

This kind of approach might be useful if the basic mismatch were generating shareholder value that could not be achieved by the shareholders themselves. In most cases, however, quite the opposite is true; Tepper (1981) and Black (1980) show that in a transparent environment with a tax regime found in many nations,<sup>4</sup> DB plan equity investments destroy shareholder value. There should be no risk budget for value destroying activities.

## 3. The Corporate Finance Approach to Risk and DB Asset Management

### 3.1 Why Not Manage Risk and DB Asset Allocation

Financial risk management comprises capital structure, hedging and insurance decisions. Under the Modigliani-Miller (1958) conditions (no taxes, no contracting cost, no financial distress cost, no relationship between financing choices and investment decisions), financial risk management adds no value:<sup>5</sup>

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<sup>4</sup> Where: 1) the effective tax rate on bond returns is higher than that on equity returns for investments held in taxable individual accounts; and 2) tax rates are identical for these two asset types held in a pension plan. This is common in Anglo-Saxon countries.

<sup>5</sup> Doherty (2000).



- **Systematic risk** – by definition, this is risk that must end up in investor hands no matter how much they may diversify. Because each investor chooses how much risk to bear, systematic risk ends up being borne by those most willing to hold it at the lowest market-clearing price.
- **Idiosyncratic risk** – although firms can shed idiosyncratic risk (e.g., by buying insurance), diversified investors (who also invest in the insurance sector) end up on both sides of the trade, losing transaction costs along the way.

Defined benefit plan assets are traded in the same markets as well. Any decisions made to allocate such assets may be offset by diversified shareholders in their own portfolios.

Note that operational risk management can add value: consider the chief risk officer who picks a banana peel off the shop floor and disposes of it cheaply. His action adds value; his decision does not depend on his or his investors' risk preference, appetite or aversion.

### 3.2 Why Manage Risk and DB Asset Allocation

If markets where risk is perfectly priced and traded make financial risk management and DB asset allocation unnecessary, we must look to market imperfections:

- Black (1980) and Tepper (1981) show that tax effects should influence DB plan asset allocation. In tax regimes where some assets (e.g., bonds) are more heavily taxed than others (e.g., equities) and where DB plans are tax sheltered, investor wealth can be increased by investing DB plans in highly taxable assets.<sup>6</sup>
- Smith and Stulz (1985) explore several exceptions to the perfect model, each of which leads to a value-based rationale for corporate risk management (hedging): taxes, contracting costs and financial distress. In each case, the exception leads to a convex cost for unhedged risk and, as elaborated on below, a net value gain when hedging cost is low.

### 3.3 Managing Risk in a Corporate Finance Framework

Why do corporations take risks? Folk wisdom has it that you must take risks in order to earn rewards. Although this is generally true, it puts the cart before the horse. Under the value paradigm espoused by modern corporate finance, firms pursue rewards by undertaking projects offering positive net present value (NPV); inevitably risks come along with each project.

Maximizing firm value is an ex-ante activity occurring at time zero when decisions are made with respect to the projects to be undertaken, the financing of those projects, and risk management via hedging and insurance. Suppose a project requires a single cash investment at time zero which leads to a single uncertain cash outflow (proceeds) at time one. Additions to firm value are measured by discount-

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<sup>6</sup> Exley (2005) points out that this is not a net gain in equilibrium but represents a benefit to investors at the expense of taxpayers.

ing the proceeds and subtracting the investment. This discount must reflect the uncertainty of the proceeds. There are two levels of discount:

- By reference to the capital markets, we will value the uncertain proceeds in accordance with an asset pricing model. To preserve generality, we posit a “pricing kernel”<sup>7</sup> such that the market value of the proceeds is equal to the expectation of the kernel-weighted cash flows. For convenience, we will also use some of the language (e.g.,  $\beta$ ) of the very much more restricted CAPM.
- We will also examine the internal firm cost that derives from the uncertainty of the proceeds. Consistent with the “E” in ERM, we will consider the portfolio of contemporaneous projects of the firm.<sup>8</sup> We will consider this aggregate portfolio in conjunction with taxes, contracting and financial distress costs in order to determine a second level of discount for risk. This discount will also have to be assessed ex-ante in order for it to guide corporate risk management decisions.

Investor value consists of the discounted proceeds from the project portfolio (I will refer to this as *level one value*) less the *level two cost* of firm risk.<sup>9</sup> Although the market discount of project outcomes (level one) reflects risks, this is not the arena for risk management. The pricing kernel will ignore firm specific (idiosyncratic) risks and will charge the minimum price for systematic risk. Consistent with the why-not-manage-risk section above, if transaction costs are nil or ignored, level one value is unaffected by market transactions.

All financial risk management activity will have to be designed to minimize the indirect (level two) cost of firm risk. Interestingly, despite the internal nature of level two, it is these costs that can be affected by otherwise value-neutral market activities.<sup>10</sup>

### 3.31 Risk Retention/Disposal

Under the prevailing risk-versus-reward framework, we would ask whether each marginal risk that remains (after accounting for cross-hedging in the enterprise portfolio) should be taken in light of corporate risk appetite or aversion. The question “is this risk worth taking?” or, for a proposed new project, “is this marginal addition to our risk portfolio worth taking?” would be answered in utilitarian terms. The modern corporate finance framework, however, would rephrase the question as “which is more valuable: retaining this risk in the enterprise risk portfolio or disposing of it in the marketplace (e.g., by insuring or hedging)?” The cost of disposition is determined outside of the firm; the cost of retention must be determined internally.

<sup>7</sup> Also called “the state price deflator” and “the stochastic discount factor.”

<sup>8</sup> This implies that project risks that are less than perfectly correlated will offset each other – an internal hedge that may reduce the corporate demand for external hedging or insurance. We proceed as though the entire portfolio were a single project subject to net risks after taking account of these cross hedges.

<sup>9</sup> It may be convenient, but not necessary, to think of the first level of valuation as being entirely cash based and the second to reflect the impact on a firm’s franchise value (its ability to find and finance value-added projects in subsequent periods).

<sup>10</sup> Although we are continuing with an essentially financial risk management story, we can, as an aside, note that some operational risks may be eliminated from the risk portfolio at negative cost – i.e., the effort to eliminate the risk is less costly than any price to hedge or insure it. The example of the shop floor banana fits in this category. We can consider this to be a project choice activity: the project with the banana peel on the floor has a lower NPV than the project without the banana peel and so the latter is chosen.

Because the “retain” versus “dispose” decision is properly made at the portfolio level, we have a sequencing problem. The retention cost of risk needs to be determined as the marginal cost in the enterprise portfolio context. Thus the projects that will constitute the portfolio must already be chosen. In order for the projects to be chosen, however, we need to know their NPV. But the NPV must be discounted for the cost of risk. There are two ways out of this box. In theory, the entire set of decisions is undertaken simultaneously. Each possible project and risk can be considered with a tentative decision as to whether disposal or retention leads to more value. Then the portfolio of projects and risks is optimized to maximize value over the set of decision variables which includes a vector of project weights and a matrix of retain-versus-dispose decisions. In practice, the problem is usually simpler: a new project is considered against a backdrop of existing projects. In this context, the marginal cost of risk retention is more easily determined as the project, if undertaken, will retain or dispose of the marginal contribution it makes to the enterprise risk portfolio – choosing the cheaper approach.

### 3.32 The Convex Risk Penalty Model

We develop the level two cost of risk in a model where the secondary cost that follows a negative shock to level one value is always absolutely greater than the secondary benefit that follows a positive shock of equal magnitude.

#### 3.321 Binary variation of outcomes

In the simplest case, let us assume two equally likely outcomes. The level one value of the bad outcome is \$750 million below expectation and the good outcome is \$750 million above. What can we say about the indirect (level two) costs or benefits that ensue? Some of these indirect effects will be cash, others will have an impact on intangibles, e.g., franchise value. The corporate finance and risk management literature offers several reasons why the indirect damage will exceed any indirect benefits (i.e., why the level two cost will be convex). Smith and Stulz (1985) begin with a convex tax schedule that charges a higher rate as corporate income increases. Taxes might, for example, increase by \$200 million when the outcome is positive but decline by only \$125 million when negative.

Smith and Stulz’s second example identifies the deadweight costs of bankruptcy which are more likely to be incurred when project returns are shocked to the downside. The literature often uses the term “financial distress” as a generalization of the increased likelihood of incurring bankruptcy costs. Froot, Scharfstein and Stein (1993) identify two threats to franchise value: when internally generated cash is less than expected, the firm must abandon otherwise positive NPV projects and/or finance the projects in the face of higher external capital costs. When a company chooses its projects based on NPV, the least positive projects are abandoned first and the “cost” of abandonment increases thereafter. The NPV-ordered project opportunity set is concave and the abandonment cost is thus convex. Borrowing costs increase with weakened credit and with the amount borrowed and so this second threat implies a convex cost as well.<sup>11</sup>

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<sup>11</sup> Faced with convex costs, value-oriented decision makers will mimic the behavior of risk averse investors. This can give credence to the idea that the firm itself is risk averse.

We can get similar implications with even a single measure of financial distress (e.g., deadweight bankruptcy cost) that either occurs or does not in accordance with a probability distribution of level one results. As shown by Almeida and Philippon (2007), if the distribution of outcomes is positively correlated with the market via the pricing kernel (or, more simply, project outcomes exhibit positive CAPM  $\beta$ ), financial distress will be more likely to occur in bad times (when prices in the capital markets are down) than in good, and thus should be priced ex-ante using a below-risk-free discount rate.

Smith and Stulz (1985) add a third example based on the personal risk-aversion of corporate managers. One might be tempted to look upon any ensuing risk management as an example of misbehavior, an agency cost created by managers serving their own interests before those of their shareholders. But this need not be the case. Suppose that we (the readers and the author) are acting as a board of directors on behalf of our fellow shareholders and that we are simultaneously developing risk management strategy and managerial compensation policy. We solve a classic principal-agent problem which endogenizes a risk-reducing hedge and a managerial incentive compensation scheme. Our managers demand more if compensation is risky and less if it is certain. Because we want to tie future compensation to future shareholder value, our managers will carry substantial project risk. To the extent that project risk may be reduced, our ex-ante compensation may be lowered – i.e., compensation cost increases with project outcome variation.

### 3.322 Convex risk penalty

The common thread in the literature is the observation that there is a convex penalty for risk which may be estimated ex-ante so that a decision may be made whether or not to hedge. The risk penalty illustrated in Figure 1 is a function of possible variations in project outcomes. For convenience, I have shown a zero penalty for project outcomes that meet or exceed expectations.<sup>12</sup>

Suppose, as shown in Figure 2, that there are two equally likely outcomes with ex-ante values \$750 million above and below expected. If the inferior result occurs, we estimate \$34 million in secondary cost attributable to the causes outlined in the literature. One interpretation would be that financial distress reduces franchise value by this ex-ante amount. Under these circumstances, the expected financial distress cost is \$17 million, as shown in Figure 3.

### 3.323 Hedging

We next suppose, Figure 4, that a hedge may be effected at a cost of \$4 million which will eliminate the plus or minus \$750 million uncertainty and thus the potential \$34 million risk penalty. The decision to hedge adds \$13 million in shareholder value. Thus, by reducing level two costs, risk management adds value that is independent of risk preferences or tolerances.

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<sup>12</sup> The penalty value for the expected outcome could be positive or negative and the curve need not be linear at any point. The only necessary quality of the penalty is its convexity.

In Figure 5, we suppose a project-outcome distribution that is normal, rather than binary. From now on we will integrate, rather than sum, in order to compute the expected risk penalty.<sup>13</sup> In Figure 6, we suppose that the expected penalty is \$20 million. If, as illustrated in Figure 7, we can find hedges that sharply lower the distribution variance, we will be able to reduce the level two cost by more than the cost of the hedge, thus generating shareholder value.

Many of the uncertainties in project outcomes may depend on variables for which market hedges exist: interest rates, energy and other commodity prices, foreign exchange rates, and general equity exposure ( $\beta$ ). Hedging transactions in these variables can usually be implemented at very low cost – which in Figure 8 we will treat as cost free. Only the most efficient market hedges come close to this ideal.<sup>14</sup>

#### 4. Shorting the Market

The cheap hedges discussed above have generally been aimed at well-defined narrow exposures such as interest rates, energy and currency. For such narrow exposures, the relationship between the hedging instrument and the exposure will be quite tight and the hedges will contract the range of project outcomes.

The goal, however, is ex-ante reduction of the variance of project outcomes and therefore a broader hedge with the same statistical implication can be just as effective at increasing investor value. Most publicly traded companies engage in projects whose outcomes correlate positively with states of the world as represented by broad market indices; in short, their projects have positive  $\beta$ . It is this property that underlies the observation by Almeida and Philippon (2007) that financial distress has negative  $\beta$ – it is inherited from the positive project  $\beta$  of the company.

Suppose we hedge our project  $\beta$ <sup>15</sup>. We wish to determine how much to hedge when project outcomes, with an ex-ante investment value of \$1 million, are normally distributed with variance  $\sigma^2$  and  $\beta$  equal to  $b$ . We will hedge this portfolio by shorting \$ $c$  million of the market portfolio.<sup>16</sup> We are looking for the value of  $c$  that will minimize the variance of the firm's hedged project portfolio, where::

$$Var^{uh} = \sigma_p^2$$

$$Var^h = \sigma_p^2 + c^2 \sigma_m^2 - 2c \rho_{pm} \sigma_p \sigma_m$$

$$\rho_{pm} = b \frac{\sigma_m}{\sigma_p}$$

<sup>13</sup> This suggests further research into the combination of risk penalty shapes and outcome distributions that result in positive and negative level two costs.

<sup>14</sup> Insurances and private contracts will be less efficient. Asymmetric insurances and options may also change the distribution providing shareholder gains in exchange for premiums. Under the Smith and Stulz (1985) tax model, this may introduce additional costs.

<sup>15</sup> We will hedge the residual  $\beta$  after narrower hedges have been implemented.

<sup>16</sup> This may be implemented using various tools such as swaps and futures contracts.

$$Var^h = \sigma_p^2 + c^2 \sigma_m^2 - 2cb \rho_{pm} \sigma_m^2$$

$$\frac{\partial Var^h}{\partial c} = 2c \sigma_m^2 - 2b \rho_{pm} \sigma_m^2$$

$$\frac{\partial^2 Var^h}{\partial c^2} = 2 \sigma_m^2 > 0$$

$$\frac{\partial Var^h}{\partial c} = 0 \Rightarrow c = b$$

where  $Var^{uh}$  and  $Var^h$  represent the project variance without and with hedging;  $\sigma_m^2$  is the variance of the market portfolio; and  $\rho_{pm}$  is the correlation coefficient between the project and market portfolios. The positive second derivative indicates that we have minimized variance and the final implication is that this is achieved when project  $\beta$  is fully hedged.

Notice that  $\beta$  need not be positive for optimal hedging. For the rare firm with negative project  $\beta$ ,  $c$  will be negative and the firm will implement its hedge by buying rather than shorting the market portfolio.

Shareholders may adjust their portfolios to restore expected returns and risk by taking the opposite hedge position, generally by buying the market portfolio. The net gain for shareholders will then be measured by the reduction in deadweight (level two) financial distress cost.

## 4.1 The Concave Zone

Figure 9 differs from Figure 1 for unexpected project losses greater than \$750 million. Figure 9 reflects a limit on the convexity that can be postulated for the risk penalty of a limited liability corporation. At some point bad project outcomes consume all the value (tangible and intangible) held by the corporation. Although a firm financed entirely by equity investors might destroy all of its value along a convex curve, it is more realistic to assume that diminishing franchise value and a sharing of damage with other parties (lenders, guarantors, suppliers, etc.) will create a concave penalty zone as shown on the left side of Figure 9.

This shape is consistent with models of approaching bankruptcy (e.g., Merton 1974) where control remains with shareholders whose ownership interest becomes manifestly option-like. Sharpe (1976) identifies a similar optionality in the context of defined benefit plans guaranteed by

the U.S. Pension Benefit Guaranty Corporation (PBGC). A company whose forward prospects are dire may find that the bulk of its likely project outcomes will fall in the concave zone as shown in Figure 10.

Such companies increase shareholder value by increasing the riskiness of their underlying projects – playing a “heads our shareholders win tails somebody else loses” game. For these companies, prospective level two costs have become negative. Such companies might be advised to forego hedging and take every gamble. It is interesting to note that one very solid U.S. airline has hedged its fuel costs in recent years while its more troubled sisters have generally taken their chances.

## 4.2 The Pension Gambit

Using common assumptions about transparency and investor diversification and rationality, Tepper (1981) and Black (1980) show that investor value increases when corporate defined benefit plans sell equities and buy bonds. They rely on tax rules in many countries where: 1) bond returns are more highly taxed than stock returns in taxable accounts, and 2) special tax rules treat pension plan stock and bond returns identically. Using Modigliani-Miller style arguments and taking advantage of this differential tax treatment, they conclude that shareholders (Tepper) or the corporations themselves (Black) can reproduce the investment risk ( $\beta$ ) and expected equity premiums while reducing taxes in their own accounts.

Twenty five years after publication, the lessons of Tepper and Black have yet to achieve significant traction with practitioners. The emergence of LDI and impending changes to plan accounting rules suggest that the future may be different from the past. Gold (2005) argues that the prevailing accounting treatment<sup>17</sup> creates spurious financial reporting benefits from equity investments that stand as a barrier to economic value maximization via  $\beta$  reduction.

When the liabilities of the plans are modeled as zero- $\beta$  cash flows, Tepper and Black maximize value and minimize mismatch risk by setting pension asset  $\beta$  to zero. Gold (2001) extends Tepper and Black in a model where the sponsor choose the asset  $\beta$  and defines the liability  $\beta$ , each in the range [0,1]. Under these circumstances, shareholder value is maximized when asset  $\beta$  equals zero and liability  $\beta$  equals one. There is nothing magic about the [0,1] limitation and level one value continues to grow as the net (asset minus liability)  $\beta$  decreases. But any non-zero net  $\beta$  indicates mismatch risk and we have seen that risk can cause level two costs.

For the great majority of companies that have positive  $\beta$  project portfolios, we have seen that shorting  $\beta$  actually reduces level two cost. Gold (2001) then implies that such firms should not only hedge away their project  $\beta$  but should do so by establishing a net negative pension  $\beta$  position. This layers two sources of economic value enhancement on top of each other. Overall risk reduction lowers level two cost and the net negative  $\beta$  in the pension plan adds tax benefits. Those companies with negative project  $\beta$  cannot achieve this double benefit and should acquire their long  $\beta$  hedges on their balance sheets.

### 4.21 The Concave Pension Gambit

A company in the concave zone can take risks, including  $\beta$ , almost anywhere but we can identify two reasons why the pension plan may be a good location: 1) the “independence” of the pension plan may

<sup>17</sup> FAS 87 in the US, CICA 3461 in Canada, FRS 17 in the UK, and IAS 19 internationally credit immediate earnings for expected returns on risky assets, smoothing actual return deviations over time.

limit the ability of the sponsor's creditors to invoke leverage-limiting covenants; and 2) plan losses may be borne by guarantors such as the U.S. PBGC and the U.K. Pension Protection Fund (PPF).

## 5. Conclusions

The corporate finance approach to risk management identifies a convex penalty that derives from the common exceptions to the perfect markets of Modigliani and Miller (1958). This leads to hedging activities that reduce the variation of project outcomes, increasing investor value by lowering deadweight costs. The literature has not appeared to notice that hedging systematic risk can similarly narrow the distribution of project outcomes. This paper argues that such hedging can increase investor value.

Pension risk management has typically been addressed in an environment where taking market risk to generate expected returns has been assumed to add value. Thus risk reduction has generally been perceived as a restriction to this return seeking activity. The potential to add value by eliminating market risk, identified twenty-five years ago by Tepper (1981) and Black (1980), has not been widely embraced. Recent concerns about pension risk have revived some interest in their work, but little action. This paper argues for an extension of Tepper and Black to establish net negative market exposures in defined benefit pension plans under tax regimes common in Anglo-Saxon nations.

Hedging systematic risk increases investor value and using defined benefit pension plans to do so can add a second layer of value. The reluctance of defined benefit plan sponsors to reduce equity exposure is strong and persistent. For numerous reasons, plan sponsors are exceedingly unlikely to follow this course. It is therefore presumptuous of me to point out that an interesting piece of follow up research might begin with the equilibrium question: what if every sponsor wanted to short their own market exposure? Who would hold systematic risk and what equity risk premium would be required?

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Figure 1  
Convex Risk Penalty  
(\$ Millions)

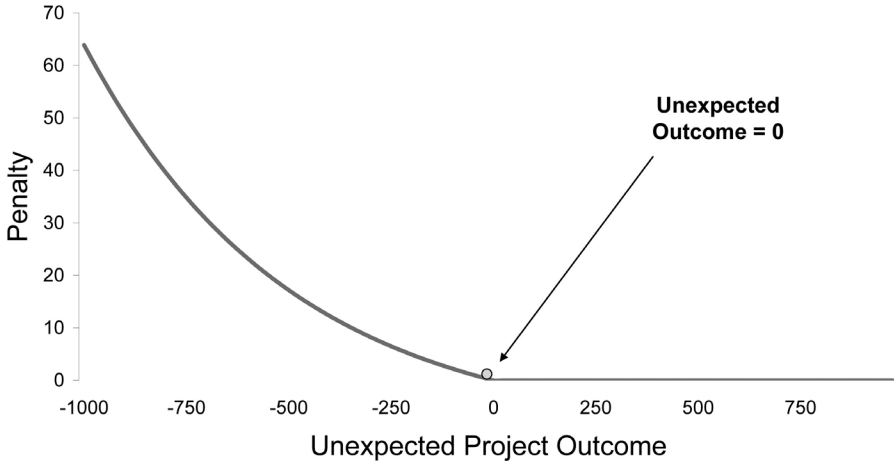


Figure 2  
Binary Outcomes  
+750 / -750

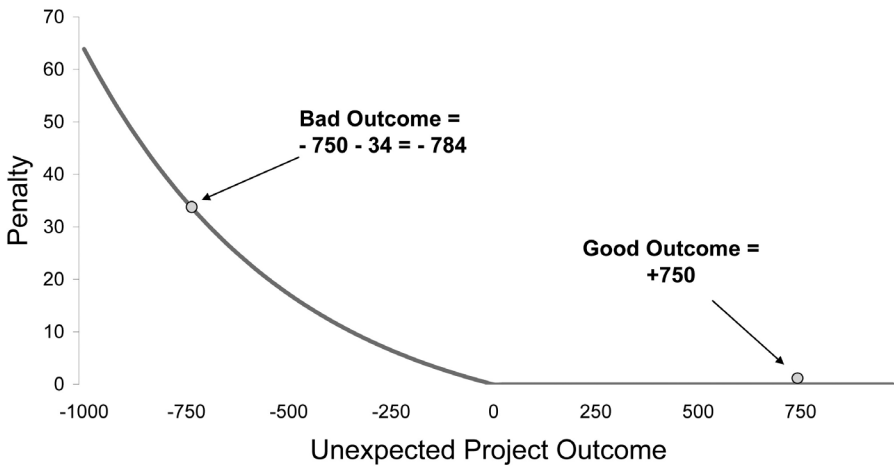


Figure 3  
Cost of Risk

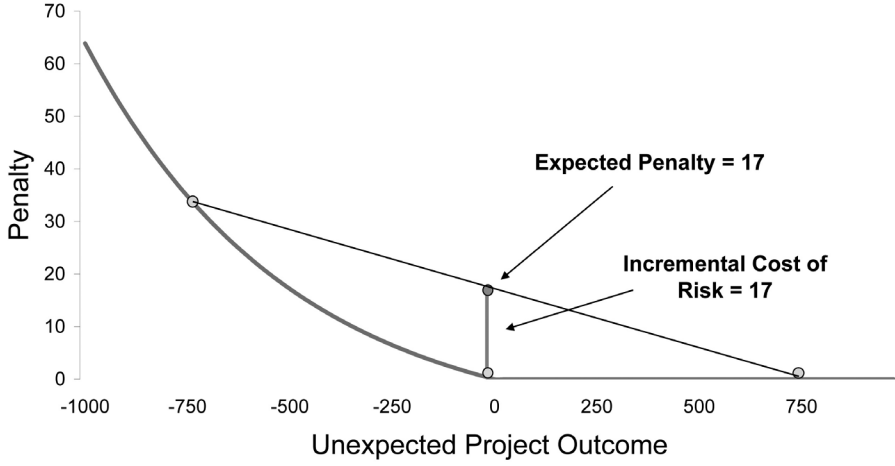


Figure 4  
Cost of Risk  
(Hedged)

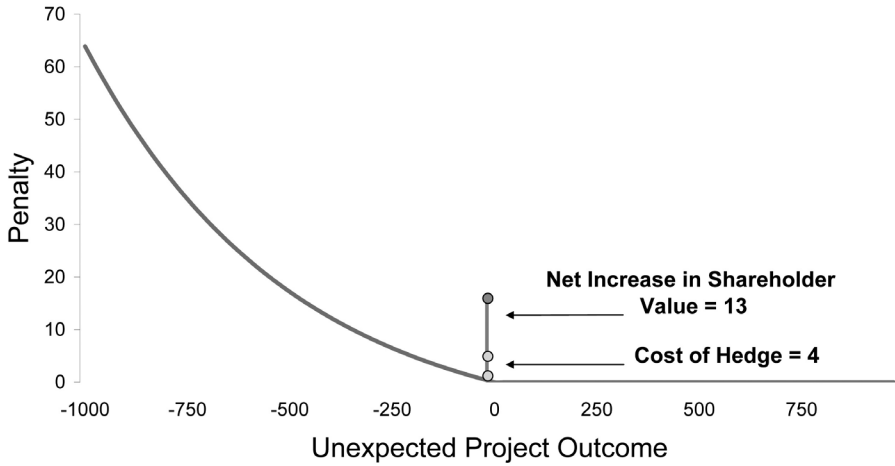


Figure 5  
Symmetric Distribution  
(Normal)

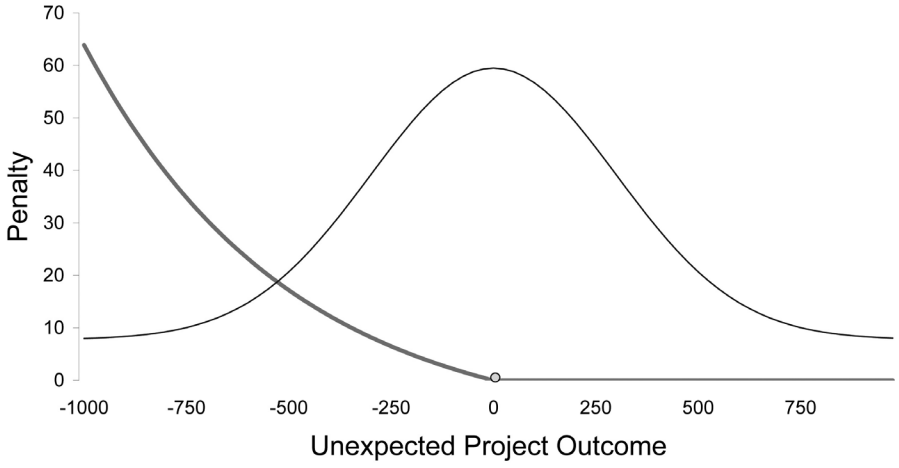


Figure 6  
Expected Cost of Risk

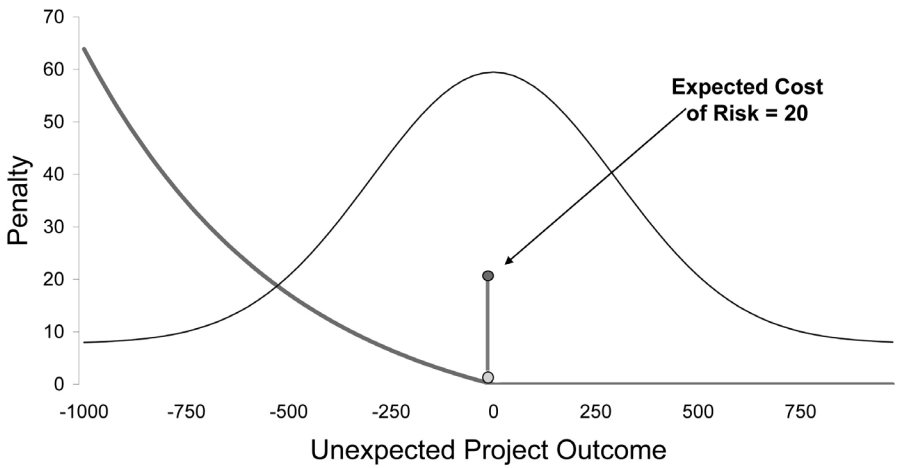


Figure 7  
Expected Cost of Risk  
(Hedged)

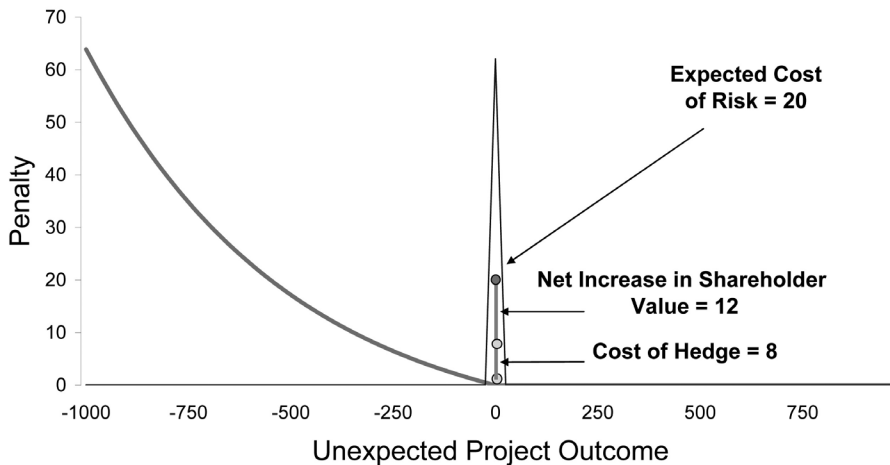


Figure 8  
Expected Cost of Risk  
(Reduced by Costless Hedging)

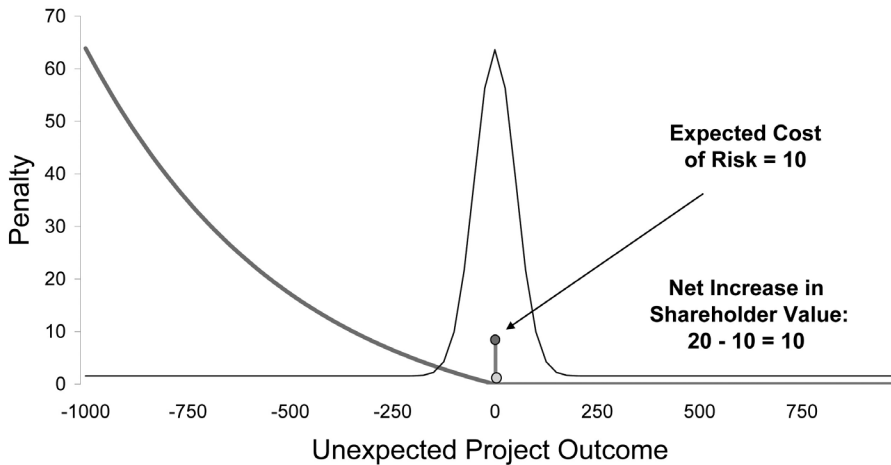


Figure 9  
Concave Zone  
(\$ Millions)

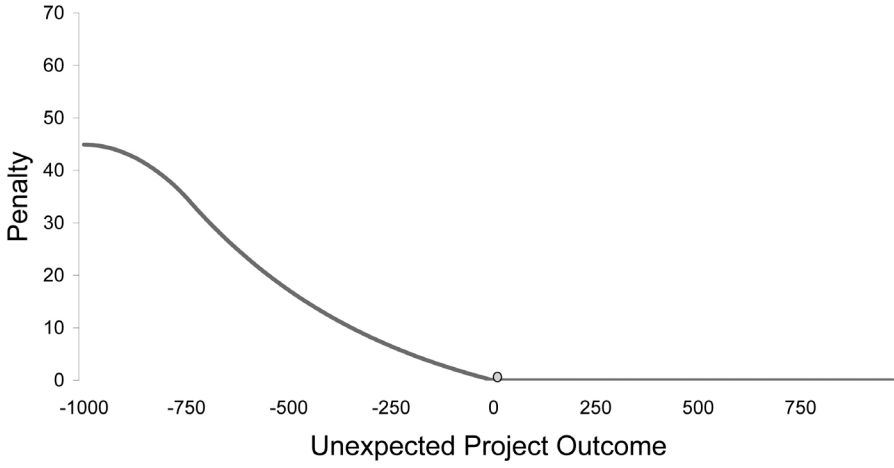
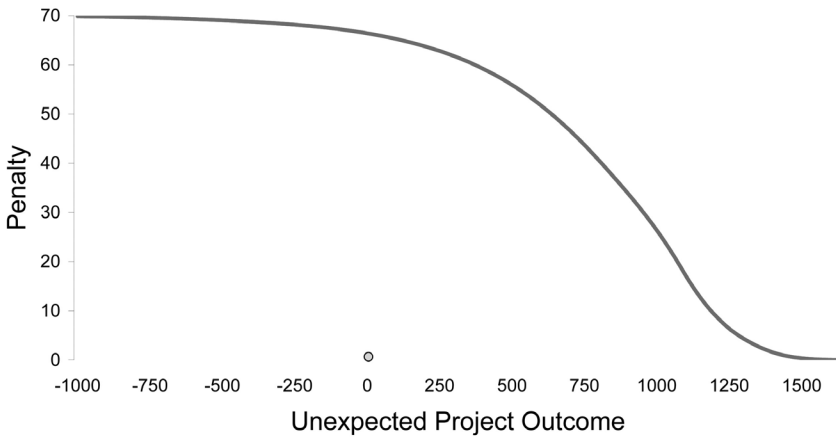


Figure 10  
Concave Zone  
(\$ Millions)



Comments on

## “The Intersection of Pensions and Enterprise Risk Management”

By Faisal Siddiqi

Jeremy Gold has written an excellent paper on how corporate defined-benefit (DB) pension plans should be viewed in a risk management context. He reviews many of the common and accepted fallacies associated with pension plan risk management and helps to establish a more appropriate and perhaps correct context for pension plan risk management. At the very beginning, Gold states that pension plans are pass-through institutions and therefore their economic objective is “economic value added” versus “return for risk” since pension plans should be reviewed in a corporate finance framework versus the framework of portfolio choice. He then takes the position that since enterprise risk management (ERM) is a corporate finance activity too, then combining ERM with pension risk management results in two startling results: (a) widely held corporations can increase shareholder’s value by hedging away their own systematic risk (CAPM  $\beta$ ); and (b) very many corporate DB pension plans should define their liabilities and manage their assets to develop a net short equity exposure (i.e., a negative  $\beta$ ).

Note that under the Capital Asset Pricing Model (CAPM) asset returns are divided between a performance component ( $\alpha$ ) and a risk component ( $\beta$ ).

### Overview of the Paper

In the introduction of the paper, Gold explains that there are two major branches of financial economics. The first is the portfolio management branch applying to individuals modeled as risk-averse expected utility maximizers. The second is the modern corporate finance branch applying to institutions that pass their performance through to individual investors; such institutions are modeled as value maximizers. Under the Fisher (1930) Separation Theorem, value-maximizing firms are compatible with expected-utility-maximizing individual investors. Therefore, pension risk management and ERM should be viewed in the corporate finance branch of financial economics versus the commonly held view that they belong to the portfolio management branch of financial economics. As we know, much of the literature and common understanding of many actuaries are that pension risk management and ERM belong to the portfolio management branch. Further, Gold explains that ERM is broadly divided between financial and operational risk management, and that his paper will focus on financial risk management that concentrates on capital structure and hedging decisions.

In Section 2 of the paper, Gold reviews the history of risk and DB pension plan management. He discusses individual utility maximization versus corporations who should be value maximizers, and the confusion between these two paradigms (e.g., corporations with risk appetites, risk tolerances and risk budgets). Gold suggests that the correct use of terminology will go a long way to remove sloppy thinking in this area. He then provides a very entertaining history of how pension risk management has



evolved from 1955 to 2005 (using insurance companies for risk management in 1955 to using liability-driven investment (LDI) strategies in 2005 and everything in between). Gold then discusses the use of equities in a pension plan and how that has not seemed to pan out in creating shareholder value in the current era. It was previously assumed that funding bond-like liabilities with equity investments is desirable as long as the risk assumed is not too large to manage. In these examples, corporation size and plan size were considered important factors. However, Tepper and Black (1981, 1980, respectively) showed that DB plan equity investments could destroy shareholder value.

Section 3 is the heart of the paper. Gold develops the corporate finance (economic value added) approach to risk management and DB asset allocation. In Section 4 he concludes that many corporations can increase shareholder value by eliminating their own market exposure (CAPM  $\beta$ ) and discusses how pension plans can leverage these going forward. Section 5 provides concluding comments.

In Section 3, Gold begins to explain that financial risk management consists of capital structure, hedging and insurance decisions. Under Modigliani-Miller (1958) conditions (no taxes, no contracting cost, no financial distress cost, no relationship between financing choices and investment decisions), financial risk management adds no value. Gold then reviews systematic risk (risks that must end up in investors' hands no matter how much they try to diversify them away) versus idiosyncratic risk (risks that are unique to a specific security or plan and can be diversified away); and risk management activities such as purchasing of insurance are not of much value). Since DB pension plans are traded in the same markets as individual investors trade in, any decisions to allocate DB plan assets may be/ can be offset by diversified shareholders in their own portfolios.

Gold goes on to explain that if the assumptions of Modigliani-Miller are not realized in real markets then overall investor wealth can be increased by investing DB plans in highly taxable assets (where bonds are taxed more heavily than equities) and that Smith and Stulz (1985) show that a value-based rationale for corporate risk management leads to a convex cost for unhedged risk and a net value gain if the hedging cost is low. He then discusses that corporations do not necessarily take on risks to receive rewards but instead pursue projects offering a positive net present value (the "reward"), and inevitably risks come along with each project. If maximizing firm value is the goal, then risk management will affect financing projects, hedging and insurance. Additions to firm value are measured by discounting the proceeds of a project from its initial investment. In discounting future cash flows for various projects, the discount must reflect: (a) a reference to capital markets—uncertain proceeds are valued under an asset pricing model (time value of money and risk value from the market); and (b) the internal firm cost that derives from the uncertainty of the proceeds (i.e., picking the project from the portfolio of projects and the ability to find and finance value-added projects. This gives the "E" in ERM; that is, which enterprise-wide projects a firm's investments should go into). Investor value is the level one value (cash flow based) less the level two value (value on a firm's franchise value). Even though the market discount of a project reflects interest rates and risks, this is not part of risk management.

The pricing approach will ignore firm-specific (idiosyncratic) risks and charge the minimum for systematic risk. Financial risk management activity will be designed to minimize indirect (level two) cost of firm risk in order to maximize firm value. Gold states that despite the internal nature of level two, it is these costs that can be affected by value-neutral market activities.

He then discusses risk retention or disposal with respect to the marginal risk of each corporate project an enterprise might pursue. That is, what is more valuable: retaining risk in the enterprise risk portfolio or disposing via insurance or hedging? The cost of disposition is external and the cost of retention is internal. He then reviews the convex risk penalty in determining the level two discount and illustrates it in Figures 1, 2 and 3 of his paper, where poor unexpected outcomes hurt more than the benefit from similar unexpected good outcomes because of the financial distress a poor project outcome can have on firm franchise value. Via a straight line between these two outcomes, Gold connects a positive and negative outcome, equal in magnitude, and calculates the expected penalty to the firm. He then shows how hedging can add to shareholder value by removing the expected financial distress cost to be a lower value (Figure 4) and extends the theory using a Normal Distribution Curve for project outcomes in Figures 5 through 7, again using a hedging approach. Interestingly, if the distribution variance of project outcomes can be lowered, the level two cost can be further reduced. (Hedges exist for interest rates, energy or commodity prices, foreign exchange rates, or general equity exposure  $\beta$ .)

Gold then discusses the shorting of the market in light of the goal: reduction of the variance of project outcomes and using a broader hedge. Typically firms have positive  $\beta$  for various projects (project outcomes correlate positively with states of the world). Based on the various hedged and unhedged projects, he derives that a project variance can be minimized (he shows that the second partial derivative of the variance of a hedged portfolio is positive relative to the cost of shorting the portfolio) and achieved when a project is fully hedged.

He then looks at concave risk penalties for certain project outcomes where the loss pattern changes from convex to concave if results are really bad. These loss patterns are more like DB plans guaranteed by the U.S. Pension Benefit Guaranty Corporation (PBGC). Figure 10 illustrates that companies that are in dire straits can increase shareholder value by increasing the riskiness of their underlying projects since prospective level two costs are negative.

Toward the end of Section 4, Gold refers to two papers by Tepper (1981) and Black (1980) that show that investor value increases when corporate DB plans sell equities and buy bonds (based on assumptions for transparency, investor diversification and volatility). However, pension practitioners are not buying into this or agreeing with this approach. Tepper and Black indicate that if pension plans have a pension asset  $\beta$  equal to zero, shareholder value is maximized. Gold goes even further, and shows that if  $\beta$  is shorted, the level two franchise cost is reduced since the net negative  $\beta$  in the pension plan adds tax benefits.

## Overall Comments On The Paper

This is a difficult paper to read even though it is short in length. The introduction to the paper provides the main content and underlying message. However, it is worth reading the paper in its entirety to understand what Gold is getting at. The introduction will not give you, the curious actuary, what you need to know to understand the big picture and deeper outcomes of this paper. An expanded explanation of level one and level two costs would help make this paper understandable, though after a couple of re-readings I came to see that Gold had written his concepts clearly.

For those who are interested, Gold presented this paper at the 2013 Investment Symposium, "Pension Investment Strategy from a Corporate Finance Perspective."

Finally, if an update of the concepts in this paper is possible, I think it would be great given the changes that occurred in world markets in 2008 and 2011.

*Faisal Siddiqi, FSA, FCIA, is principal and consulting actuary at Buck Consultants in Toronto, ON.*

## Author's Response to Comments by Faisal Siddiqi

By Jeremy Gold

I want to thank Faisal Siddiqi for his kind comments and careful read of *The Intersection of Pensions and Enterprise Risk Management*. I also want to thank Edward Elgar Publishing Ltd. for its permission to reprint the paper that appears in *Frontiers in Pension Finance*.

Siddiqi has given my paper a very careful read. Through discussions with Siddiqi, I have come to agree with his assessment that the paper requires a careful read because the concepts are arguably subtle and because the paper is terse. I tried to choose my words carefully, and I appreciate his conclusion that I have written my concepts clearly.

I am reminded, however, of the math professor lecturing at a blackboard (whiteboard, touchscreen?) stepping through a rather lengthy theorem. He asserts that the transition from line 27 to line 28 of the proof is obvious. He is challenged by one of his better students who asks, "Is it really obvious?" After a few moments' contemplation of the equations, he excuses himself, returns to his office, and returns 20 minutes later to announce confidently, "Yes, indeed, it is obvious."

My paper makes a point that has not really been made in the corporate finance or risk management literature before, and it is not an obvious point. It is this: Most corporations that sponsor defined-benefit (DB) plans can enhance shareholder value by running a net-negative beta (equity) exposure in their plans. I get there in two steps. The first is the difficult one: A corporation can enhance shareholder value by hedging away its own systematic risk (beta). The second is the well-known Tepper-Black argument that, under tax systems regularly encountered around the world, positive beta in DB plans destroys shareholder value.

In order to get to the difficult first assertion, I identify two value-impacting issues.

- The first is identified in the paper as the "level one discount." It is the familiar idea that expected future cash flows from investment need to be discounted for the time value of money and for a risk premium. The discount for risk is related positively, under the Capital Asset Pricing Model (CAPM), with beta (including a potential negative risk premium for negative beta).
- The second, the "level two discount," arises from the observation that negative variations in future cash flows away from those expected are more harmful to shareholders than positive variations are beneficial. This is not a statement about marketplace risk, reward and utility preferences. It is about the idea that corporate losses create financial distress costs that are not fully offset by corporate gains.

Siddiqi has done me the favor of reading Section 3 several times in order to distill the last point in the sequence of points above. It falls upon me to make Section 3 as clear as I possibly can. Sadly, I have

done my best and it is still a difficult read and a subtle point. My brief paragraphs above are merely my latest attempt to 'splain myself (are you listening, Lucy?).

I can only hope that interested actuaries will follow Siddiqi's kind suggestion that they read the paper carefully, ready to be confronted by subtle arguments, perhaps unartfully articulated. Any reader who does such a careful read is welcome to call me at my phone number listed in the actuarial directory.

# Risk Management for Pension Funds

By Jon Hatchett, David Bowie, Nick Forrester

## Abstract

The promise of enterprise risk management is that it provides increased organisational effectiveness of disparate risk management functions through a central coordinating function that has clear ownership and accountability for overall risk management. The central function can identify and assess dependency between different risks. It can then take a holistic approach to dealing with each risk based on the overall risk profile and appetite of the organisation. Through coordinating the various risk management functions, a central function can increase homogeneity of reporting giving improved clarity and consistency of risk reporting which should lead to improved management decision making. Senior management will be better informed when making material decisions and should be better able to assess risk/return trade-offs, as well as having an alternative insight into emerging risks and opportunities.

In this paper, we seek to apply some of the lessons of enterprise risk management to the challenge of managing a defined benefit pension scheme in the UK, to try and develop a framework for understanding the current approach to financial management. We seek to draw out the key stakeholders and their objectives; since their objectives are different they have different perspectives on risks. We also examine some of the regulatory guidance and constraints in the UK and seek to judge its effectiveness against its stated goal of managing pension scheme funding risks.

## 1. Context for this paper

One of the big shifts in the actuarial world of recent times has been the debate about financial economics (FE) and its integration into our way of thinking. One or two papers using FE ideas from actuaries in the 1970s were the precursor to a fierce debate that kicked off in the 1980s and raged in the 1990s, with FE finally entering our examination syllabus a decade ago.

The introduction of financial economics into the actuarial world has accompanied a massive change in what we do: actuaries are working in banks, the heartland of FE; pension funds and insurance funds are now very active in Liability Driven Investment (LDI), swap overlays, and protection strategies.

However, some of the risks that drive the big decisions for pension schemes are regarded as second, third or even high order departures from the core theoretical framework of modern finance. In a wider context, there have been increasingly vocal claims from eminent business people and academics that modern finance theory has the wrong starting point, because the 'primary' insights seem to be dominated by anomalies and exceptions.

Various other frameworks for financial management exist: for example, the actuarial control cycle, behavioural finance, real options, game theory, etc. These frameworks offer partial help to actuaries in

advising their clients. None has gained particular traction despite providing specific insights to particular problems.

Enterprise Risk Management (ERM) has seen tremendous growth in industry, particularly the financial services sector in the US. Increasingly Chief Risk Officers (CROs) are being appointed within such companies. Regulators and legislators (as reflected in, for example, Sir David Walker's review into corporate governance in UK banking, Solvency II, Basel III) are taking an increasing interest in placing risk management centrally within the system. In parallel, we have seen ERM enter the actuarial space, probably most noticeably in the introduction of the ST9 examination and the Chartered Enterprise Risk Actuary (CERA) qualification. For some it will probably seem like a fad, a hot phrase with nothing really new or substantial about it. For others it will be a boon, allowing them to widen their sphere of influence or give them the confidence to see past the decline of many of the traditional actuarial areas of work. Or maybe it will strike fear and terror into actuaries, as the Greek letters and esoteric statistics of the past come back to haunt them.

But ERM is not just about adding Value at Risk (VaR) to a valuation report, or using a stochastic scenario generator to calculate the probability of achieving a discount rate.

The purpose of this paper is to explore what ERM is, to discuss how it fits with defined benefit pension funds and to provide some thoughts on how actuaries might actually build it into their advisory process. The holistic approach championed by ERM will generally lead to a superior solution because it will reflect, rather than ignore, the interrelationships between different facets of the risks.

The following introductory section sets the scene by outlining the commonly described benefits of risk management in general.

## **2. Introduction: the promise of risk management**

### **What risk management is**

The future is inherently uncertain. Risk management is applied by entities that recognise that uncertainty and seek to succeed despite it, or even because of it. It is often applied best by entities that seek to thrive by harnessing the opportunities that uncertainty gives rise to, as well as mitigating its more harmful aspects.

Clearly, before an entity can start managing something, it must first decide what it is that it wishes to manage. Risks do not exist in a vacuum; or alternatively, not all uncertainty gives rise to risks. While the winner of the next football world cup is uncertain, it is not a risk for most entities outside the leisure and gambling industries. The first step in a risk management process is to understand the nature of an entity and its objectives. Risks can then be defined as future uncertainties that could impact on the entity's achievement of its objectives. It is worth emphasizing that the impact could be positive as well as negative.

A common adage is that for companies there can be no return without taking some risk. A straightforward corollary of this is that the goal of risk management should not be to eliminate risk. For a company

with shareholders, an accepted interpretation is that the goal of risk management should be to optimise risk-adjusted financial returns. The institutions which have tended to take this approach furthest are banks and insurance companies. This is for a variety of reasons including regulatory pressures (such as Basel II and Solvency II), the quantifiable nature of the management information available to these companies, and the quantitative skill sets typically present within these institutions.

As long term institutional investors, pension schemes might believe they ought to be able to easily borrow from the tool kit of insurance and other financial services companies. However, for a variety of historical reasons pension schemes have taken a different approach to financial management. It is, moreover, difficult to see the immediate translation of ERM principles to a pension fund where there is a very clear cap on upside value and so the 'payoff' function, however defined, is highly asymmetric.

### **The benefits of risk management**

For financial institutions, systemic risk has proved to be a real and present danger to the functioning of modern economies and even society as a whole. While extensive coordinated government action appears to have mitigated some of the most immediately threatening consequences of failure of the banking system, the cost of the risk management failures is eye watering. It is not clear what the eventual consequences will be on risk management within financial institutions, nor is it clear what regulatory approach governments will take in future. It would not be a surprise if there were increasing requirements on financial companies to implement improved approaches to risk management.

Beyond basic compliance requirements, risk management by companies can improve shareholder value. There is some empirical evidence for this [1, 2, 3] as well as the theoretical arguments that:

- 1 Risk management can reduce income volatility and hence lower taxation costs.
- 2 Risk management can reduce earnings and cash flow volatility, or increase a company's credit rating, and hence lower a company's cost of capital or improve terms of trade.
- 3 While in theory shareholders can invest accordingly to maximise their own utility functions and carry out their own risk management, in practice companies are better informed of the risks they face and have better and cheaper access to capital market instruments. Companies can therefore better manage some risks than individual shareholders and arguably part of the board's remit from shareholders is to do exactly that.
- 4 Risk management can reduce the likelihood of bankruptcy and the associated direct and indirect costs, such as the destruction of intangible asset value.
- 5 External capital raising is often more costly than retaining and utilising earnings, due to information asymmetries as well as frictional costs. Risk management can help lessen the likelihood of requiring external financial capital or lower the quantum of capital required though providing greater control over corporate finance.



6 Management decisions can be based on a worldview that recognises uncertainty; from deciding on approaches to pricing, profitability measurements, capital structure and capital allocation as well as designing performance management systems and job descriptions that seek to optimise overall risk adjusted performance.

Risk management literature is often full of apparently unconnected lists to describe risks and their treatment. We have tried to give a more discursive treatment in this paper, at the cost of omitting some of the details which we expect the reader is already familiar with. As we discussed above, an enterprise wide approach to risk management does not have fundamentally different goals to those listed above but rather seeks to achieve these goals in a more coherent and effective way.

The promise of enterprise risk management is that it adds value by centrally coordinating disparate risk management functions with clear ownership and accountability. The central function can identify and assess dependency between different risks. It can then take a holistic approach to dealing with each risk based on the overall risk profile and appetite of the organisation. The clarity and consistency of reporting is improved through homogeneity of approach. Senior management will be better informed when making material decisions and should be better able to assess risk/return trade-offs as well as having an alternative insight into emerging risks and opportunities.

In section 2 we outline some of the challenges in the financial risk management of a pension scheme. In section 3 we go on to describe one approach to a risk management framework to help overcome some of these challenges. Aspects of the framework are considered in more detail and brought to life by some case studies in section 4. We briefly mention some additional areas highlighting the link between risk management and pension schemes in section 5 before concluding.

### **3. What risk management has to offer UK defined benefit pension schemes**

#### **How we got here**

In our view, it is not possible to understand how pension schemes have reached their current financial position, and their understanding of that position, without considering the changes to the industry in the past few decades.

Pension regulation was historically much more benign, making economic costs lower. In combination with this, the long running equity bull market through the 80s and 90s, in conjunction with a non-economic actuarial approach to funding, reduced the cash cost to sponsors. Companies were not charged for providing a 'guarantee' because to a large extent there was no ultimate guarantee, and much more of the value of the benefit promise was discretionary (for example, see [7]). There was also greater financial encouragement from the government than there is today, whether in the form of the advanced corporation tax credit or generous National Insurance rebates, relative to the benefits provided. The gradual encroachment of legislation (guaranteeing formerly discretionary benefits, preservation requirements and turning a best endeavours promise into a guarantee via the debt on employer regulations), increasing longevity, lower interest rates and poor equity returns have essentially removed any private sector desire to run a pension scheme. According to the Pension Regulator's 2009 Purple

book [11], only 27% of defined benefit schemes are open to new members and we expect this number to drop significantly by the time the 2010 results are published.

The proportion of total liabilities that are guaranteed has been steadily increasing both due to these legislative changes (making formerly discretionary benefits guaranteed) and the consequential closure of schemes to both new members and accrual (which removes the 'discretionary' salary link to benefits). As pointed out in [15], when a large proportion of the liabilities are discretionary (with the level of benefits dependent on the asset performance) a wide range of investment strategies could be appropriate. This is because much like in a unit-linked fund, the (discretionary) liabilities match the assets.

A second important aspect of history is the balance of power between sponsors and trustees which has steadily been shifted by legislation in favour of the latter, from the change in employer debt regulations to the overriding powers of scheme specific funding set out in the Pensions Act 2004 and the accompanying regulatory regime.

In judging current behaviour of trustees, sponsors and their advisors this context is important. Many actions taken today may not appear at face value to minimise the risks of members receiving their benefit entitlement in full; sponsors might argue that they never intended to make a 'risk free' promise (and indeed, in reality no promise can be risk free). Attempts to lower the risk of the benefit promise have raised the cost of the promise. As the legislation attempts to drive the risk ever lower the costs have risen ever higher; while it may be politically difficult to talk about these trade-offs they are core decisions of policy that are best faced transparently rather than avoided until the point at which the risk manifests itself in the form of a crisis.

### **Communication**

We believe that the question of the economic cost of the liabilities has been essentially solved, see for example [6]. In terms of communicating the funding position of pension schemes to members, our sympathies lie with [7]; it does not serve actuaries well to communicate that a scheme is fully funded (or that the assets are greater than the liabilities) at the point at which members see benefits cut due to lack of funds. Many words have been written and heated arguments exchanged about the 'correct' number to place on a pension scheme's funding position. We would tend to agree with [8] that the purpose of a calculation should inform the number that is calculated, *provided that the number is communicated in a way that leads the decision makers to draw appropriate inferences from the analysis.*

Having said that, one of the tenets of financial economics is that the economic value of a liability is the value of an asset with matching cash flows (if one exists). Therefore, barring second order effects such as tax, default etc, it matters not what actual asset portfolio you might hold to meet a liability when considering the value of the liability. As noted in [8], it is an unfortunate coincidence that actuaries choose to use the word 'value' in at least two ways. The ongoing-funding version of the word 'value' when applied to liabilities can be highly unintuitive for non-actuaries.

As a simple example, it seems more informative to say that “a scheme has sufficient assets such that based on its current investment strategy there is, say, a 70% chance that all of the benefits will be paid off over the lifetime of the scheme with no further contributions being required” than saying “it is ‘fully funded’ on a prudent basis”. Important ancillary that ought to be communicated alongside the former statement is that:

- i) There is a likely requirement for the sponsor to back the scheme by at least promising contributions (even if it does not make any) until the scheme reaches an appropriately defined self-sufficient funding level (even if that self-sufficient funding level happened to be just immediately prior to the final benefit payment being paid).
- ii) If the sponsor was to become insolvent tomorrow members would only receive, say, 65p in the £ of the promised value of their benefits (and possibly to give further information on the typical impact of different groups of members).
- iii) There is, say, a 15% chance of the scheme running out of money if no further contributions are paid based on its current investment strategy and in that scenario 35% of members benefits would go unpaid.

### **Risk and security**

The risks faced by pension schemes are not theoretical; as at 14 July 2010 some 160 schemes had entered the PPF while another 372 schemes were in the assessment period (over 200,000 members). [4]. These figures ignore the schemes that have already completed assessment but may have wound-up underfunded but PPF solvent. To give a sense of scale, as at July 2010 there were a little over 6,500 schemes in the PPF 7800 index [5].

Members’ accrued pension benefits, under the current legal framework, effectively treats the DB promise as a debt due from the employer. In financial terms, the credit risk (to the pension scheme members) in the debt is reduced by the employer providing asset backing to the debt through pension scheme funding. Pension legislation requires this pension scheme debt to be funded in advance.

Depending on the asset strategy adopted, there is a greater or lesser amount of uncertainty about the quantum of funds required to pay the promised benefits. A pension scheme has recourse to the employer (whilst it is solvent) to request additional funding if and when it is deemed to be required.

*Ceteris paribus*, if a scheme holds a greater level of assets there is greater security for members. However, the act of targeting high levels of funding may generate adverse shareholder or creditor reaction directly, let alone any operational and financial strains caused by consequential increases in employer contributions. This tension between scheme funding and affordability is a key constraint for the trustees to manage.

### **Managing risk: the limitations of the current approach**

As mentioned in section 0, a modern Scheme Actuary has a wealth of technical tools to aid in the

financial management of pension schemes, from traditional actuarial approaches, through modern corporate finance theory, financial economics and stochastic modelling, to game theory and negotiations, to behavioural finance techniques such as prospect theory (which to our minds seems to at least partially explain the drive for de-risking triggers to ‘capture’ gains, while often ‘ignoring’ losses). On top of these tools one could rightly ask what, if anything, risk management theory has to offer?

The fact that the bridge between the idealised theory of FE and real world observation is long and wobbly has led to considerable disquiet being expressed with this paradigm, so perhaps FE alone is not the answer. Stiglitz and other eminent economic theorists and commentators are now participating in INET [9], funded by George Soros in the wake of the recent financial crisis and the apparent failure of current thinking to manage risks. FE also does not seem to reflect how most pension schemes manage themselves in practice.

On the other hand, the conventional actuarial approach, even when supplemented with actuarial control cycles and other devices, provides a very unsatisfactory, partial framework for supporting strategic advice to pension funds. Financial economics offers a complete and elegant framework, but one that seems to have little empirical support.

We think that behavioural finance could help to explain many of the behaviours observed in pension scheme funding; agency costs, prospect theory, the challenges in understanding tail risks etc all give insight into why trustees and corporate sponsors seem to make decisions that do not maximise economic wealth. Alternatively, you could say that behavioural finance theory (and possibly conflicts of interest faced by trustees and actuaries, as set out in [7]) leads to agents making non-optimal decisions in an economic context – none of us are a hyper-rational, economic agent with full information!

### **Managing risk: the benefits of ERM**

ERM is an approach based on making optimal use of risks taken and ensuring that this optimality applies at an aggregate level for the enterprise (entity), i.e. it allows for co-dependencies and inter-dependencies. ERM is similar to the actuarial approach because it is somewhat myopic and entity-centric. It is very different from the actuarial approach in that the decision-making process starts with identifying risks being taken and risks that could be taken, rather than acknowledging them as an afterthought.

ERM is similar to FE in that risk is not only integral to but also the starting point for any decisions that get made. It is different because it is not a ‘theory of everything’ (i.e. it does not attempt to incorporate pricing and financing and investing coherently in one framework) and is relatively silent on how decisions get made. ERM also holds up as equal some of the risks that would be regarded as second-order within a more typical theory-driven approach.

The risks depend very much on what assets you hold in seeking to meet the liability. Of course, the FE and ERM views are complementary. An input to a risk management process ought to be the economic value of the liabilities and the corresponding hedge portfolio, recognising that there is a degree of

subjectivity in these due to the lack of perfectly matching assets traded in deep and liquid markets. The analysis in [10, 11, 12] is relevant to investment strategy decisions in many cases for well-funded schemes or those with strong sponsors. On the other hand there are many schemes where the sponsor's "Merton Put" is highly valuable and so both funding and investment decisions need to be taken in that context. (In very simple terms, if the sponsor cannot afford the benefits should the scheme look to risky investment returns to try and bridge the gap at the risk of making it worse and to what extent should it do so?)

We believe that not only is risk management relevant to the question of how to best financially manage a pension scheme's strategy, it is also the appropriate structure for advising on pension scheme strategy. Not only does it give a broad context for analysing and informing strategic decision making, it also helps to communicate the limitations of that analysis. After all, any financial analysis of pension schemes will typically depend on some model; whether it is a simple discount rate model or a very sophisticated stochastic asset-liability model with stochastic demographic decrements. The experience of the PPF shows that there are serious risks to many pension schemes in the UK today.

There are lots of competing and subtle artefacts to trying to manage pension scheme funding in the 'real world'. A risk management approach can help to identify these subtleties and treat them according to their perceived impact. Importantly, while analysis and risk measurement is certainly part of a risk management approach, no single number can tell management how they should manage their scheme's financial strategy – a proper governance process is required. As actuaries we should be encouraged, while the challenge is there, we have the tools to be best suited to help our clients with this challenge.

Although ERM has made huge strides in recent years towards gaining acceptance in the wider corporate world, there have also been significant hurdles. Perhaps key among these is the lack of flexibility in the application of ERM by its adherents. The Society of Actuaries article by Alice Underwood and David Ingram provides a categorisation of ERM adherents and applications [14]. According to them there is a need for enterprises to recognise that 'risk steering' is not always optimal: quantification is always imprecise and there are always the unknown unknowns (good or bad) that may strike. Too much reliance on an over-engineered ERM framework without pragmatic oversight results in under performance in good times, unnecessary under performance in bad times and a susceptibility to shocks.

In our view, ERM offers actuaries (and their clients) a way of thinking about what they want to achieve and want to avoid, what might stop them from getting those successes, gathering the pertinent information coherently, analysing possibly outcomes consistently and then setting out advice. In many ways it is 'common sense', but it goes further in linking that common sense to analysis that enable an audit trail and demonstrable process and consistency of decision-making – if decisions differ from those in the past, then there is a record of why they are different.

## **4. Risk management applied to pension funds**

### **The risk management process**

Risk management is a process, as can be seen from the COSO definition of enterprise risk management [16]:

*Enterprise risk management is a process, effected by an entity's board of directors, management and other personnel, applied in strategy setting and across the enterprise, designed to identify potential events that may affect the entity, and manage risk to be within its risk appetite, to provide reasonable assurance regarding the achievement of entity objectives.*

This approach is familiar to actuaries who have long worked with the actuarial control cycle. Different authors take different approaches to describing the process. The key is not the exact details of the description of the process, but rather that as far as possible:

- The background to the risk management exercise is understood. Risks cannot be understood without reference to an entity's objectives. Therefore we believe that the first step in a risk management process should be identifying the objectives of the stakeholder we are helping manage risk for (noting that stakeholders whose risks are not fully aligned will have different objectives and so may well prefer a different approach to managing risk). Often different objectives may be contradictory for a single stakeholder or between different stakeholders. This stage will also identify constraints on actions.
- The risks to the achievement of the objectives are identified. At this stage it is important to isolate the cause of a risk from its outcome. As a simple example, equity prices dropping may lead to a fall in the funding level which could pose a risk to a sponsoring company's contribution requirement. The risk in this scenario is equity prices dropping, rather than the funding level dropping, which is merely the outcome. It is helpful in turning risk management analysis into a decision tool to identify a risk appetite at this stage: what tolerance does management have for failing to meet its objectives? While the question is certainly challenging, ignoring it and hoping for the best does not facilitate good decision making.
- The risks are analysed, as is the capacity for the risk bearing entity to absorb downside risk (its risk capacity). With regard to pension schemes many of the financial risks can be quantified and their co-dependencies analysed. On the other hand, operational and regulatory risks (from historic data, poorly executed deeds, changes in legislation etc) are less quantifiable but no less important. Overall this gives the risk profile of the pension scheme and it is important, given the history of debates about modelling liabilities, that quantitative analysis of the scheme is seen in this context. One of the biggest risks to scheme members generally is the failure of their sponsoring employer, a risk that can at least be partially quantified. Scheme members are typically exposed to the financial performance of a single sponsoring entity, and as such the statistical properties of that entity defaulting, even if they could be accurately calculated, would not negate the fact that some schemes would pay benefits in full and some would not – there is no averaging out effect for the individuals involved.
- A strategic decision is taken on the approach to managing the pension scheme, in the context of constraints (e.g. affordability, governance requirements, legal or regulatory) and within the context that the approach may be the result of negotiations between parties who have different objectives. This financial strategy will implement the decision on the treatment of each risk, whether it is to accept, transfer (e.g. through insurance), reduce or remove the risk. This implementation decision will mitigate those risks it is affordable, possible and desirable to mitigate and retain the others.

- The position is monitored over time and adjustments to the strategy are made in the light of emerging experience and changing financial conditions (either for the financial markets generally, or the sponsoring entity in particular). The one thing we can say with certainty is that whatever assumptions are made in setting the strategy will not be borne out in practice. This stage also allows for feedback to earlier stages as new risks are identified or the understanding of different risks and their interrelationships is updated or the opportunity set for managing risk is altered.

Our framework for describing the risk management process is shown graphically below. We should emphasize here that other processes could be just as, or even more, effective for managing risk. The important point is that they capture the steps necessary, including the feedback loops, to consider and manage all the risks facing the entity achieving its objectives.



In the remainder of this section we introduce some case studies that we will make use of in section 4, where we explore these steps in greater detail. We would note that the example companies we have mentioned in introducing the case studies are intended only to provide some link back to the real world; any comments we make in later sections are not specific to these companies.

### Case study 1 – Strong and large sponsor relative to the pension scheme

The story of Lehman Brothers’ demise has been well covered and we do not seek to repeat it. One aspect of it though is its pension scheme. The latest available accounts from Companies House for Lehman Brothers Limited (company number 00846922) are to 30 November 2006. They show that in that year profit after tax was c£125m and a dividend of £35m was paid. At 30 November 2006 the scheme of c£250m was fully funded on an accounting basis but had some 73% of its assets invested in equities. It seems unlikely to have been fully funded on a solvency basis. On 22 October 2008 the scheme entered an assessment period for the PPF [17].

We do not know the details of the negotiations held between Lehman Brothers and the trustees of the scheme over the scheme’s financial strategy. Nor do we know the financial constraints Lehman Brothers was working under. Nevertheless, there will be a number of pension schemes where the size and strength of the sponsoring employer could result in the level of funding of the pension scheme at any point in time being viewed as a second order issue.

### Case study 2 – Small sponsor relative to the pension scheme

Uniq plc is one example which has made the headlines regularly this year [18,19]. Uniq has, over the years, reduced in size through business disposals but has been left with large legacy pension liabilities

scheme from its days as a much larger business. This has left Uniq in the position of having to support a pension scheme that is many times larger than the business. Earlier this year, its initial plan to close the shortfall in its pension scheme through an extended 50 year recovery plan fell short of the requirements of the Pensions Regulator. Shortly after the announcement, the market capitalisation of the company was £17.8m against a reported shortfall in its defined benefit pension scheme of £436m (as at March 2009).

Very recently, Uniq announced a plan which involves transferring 90% of the equity in the business to the pension scheme. It's not clear if the plan will be endorsed by all of the key stakeholders, but it shows the extent to which the pension scheme impacts on the value of the equity. Interestingly, although the market capitalisation of Uniq increased modestly after the announcement, it is now only around half of what it was at the time that the first announcement was made on pensions earlier this year.

There are a number of schemes in the UK which are economically underwater, even if the full value of the sponsor was allocated to the pension scheme. On an economic basis, the benefits are unaffordable. Clearly, in these situations some extreme compromises are inevitable. Discussions between the stakeholders are best supported by actuarial advice ensuring a clear awareness of the various pros and cons of any compromise solutions being considered; hiding behind a debate about the appropriate discount rate to use to value the liabilities serves no-one.

**Case study 3 – Sponsor and pension scheme of broadly comparable size**

Having considered two more extreme situations, our third case study perhaps presents more of a challenge for the risk manager. The complexity of the interaction and the feedbacks between the pension scheme and its sponsor should play a greater role in the risk management process.

An example, in this category is Rolls Royce, with a market capitalisation nearing £12bn and pension schemes valued at around £7bn at the last full year accounts [20]. The sponsor's contributions into its pension scheme are around one third of net cash flow from operations; so the pension schemes are affordable, but also a material financial risk to the sponsor.

**5. Risk management applied to pension funds**

In this section we will explore the steps introduced in section 3 in more detail. Where appropriate, we will use the case studies to draw out areas of specific interest, although some areas will be common to most situations.

**The key stakeholders, their objectives and constraints**





## **Scheme members**

The objectives of non-employee members are well aligned with those of the trustees, which we will focus on in due course, although of course the only benefit non-employee members derive from an open scheme is the extent to which contented employee members strengthen the sponsor covenant.

For employee members the situation is more complex. They will focus on the perceived value of total remuneration they receive; they might not be best pleased if their employer was put into receivership to improve the lot of fellow pension scheme members. To the extent that contributions are high, it may also impact on their salary or security of employment. Also, if their defined benefit scheme were discontinued they may receive higher remuneration in other ways.

Utility theory would suggest that even if members understood the ‘economic’ value of the pension promise, they may still not weigh it equal to other economic benefits of the same value (e.g. many might choose a higher salary of less financial worth, given the choice). Further, few scheme members are even given or would recognise the information needed to judge the economic value of their pension promise for themselves.

This information asymmetry between scheme members and other key stakeholders should not be under-estimated. We imagine that this consideration will have played a part in the recent guidance from the Pensions Regulator on transfer incentives [21]. On the other hand, it does not help clear decision making for members to value all final salary benefits from any given sponsor as if they were as low risk as a deferred annuity from an FSA regulated insurer.

## **Trustees**

A trustee’s primary objectives derive from their basic duties which come from the law. In summary they are to:

- collect the right amount of money at the right time;
- decide the investment strategy and invest accordingly; and
- pay the right amount of money to the right person at the right time.

A trustee will need to bear in mind that there is no method of meeting their duties in a manner that is devoid of any risk whatsoever. One question requiring judgement from the trustee is the appropriate and affordable level of risk to aim for, given the constraints placed on scheme financing by legislation, regulation and sponsor affordability. For the avoidance of doubt, we are not discussing risk in relation to the volatility of the funding level here; we are discussing the risk of the trustees failing to meet their duties.

Trust law stipulates that trustees should act fairly, in the best financial interests of all beneficiaries.

Typically, in the current climate, discretionary increases to pensions seem a remote prospect for almost all schemes. However, not yet all schemes are closed to future accrual and so prospective benefit improvements seem to be a reasonable consideration for some trustees.

It follows that members' financial interests are best served by trustees taking actions which lead to:

- more or higher benefits being accrued
- members being more likely to receive the benefit entitlement in full
- members' financial loss, if they do not receive their benefit entitlement in full, being lower.

In seeking to fulfil their duties the trustees need to be mindful of the membership as a whole, as many strategic actions will have different implications for the security of different groups of members. The objectives above may, however, lead to the trustees having to reconcile themselves to trade-offs between the different objectives.

For a closed scheme in particular, the core objective is to ensure that members receive their full, or higher, benefit entitlement as and when it falls due. To do this a pension scheme will at some point be required to have sufficient assets such that the benefits can be met without further recourse to the sponsor, even if that is simply trivially just before the final benefit is paid.

Assuming the aim is to pay the benefits in full then this we might conclude that the trustees should aim to ensure that current assets plus the current covenant is greater than the economic value of the liabilities. The trustees' key decision then lies in determining how the balance of this inequality should change over time, and negotiating with the sponsor to make it so.

### **Sponsoring employers and their investors**

Company management historically have had a wide range of objectives relating to the company pension scheme. From HR related recruitment and retention, through paternalism and broader peer group benchmarking, there was a wide range of reasons for offering a pension scheme to staff.

There are also the potential agency costs of executive staff being members of the scheme, as well as the more general agency issues that feature in the running of corporate entities, particularly the role of management to act on behalf of shareholders. Whilst dealing with this fully is beyond the scope of this paper, to give a simple example, in the cases of privately held companies and firms where the managers and investors are the same, it is important to be aware that there are other benefits available from the way the pension scheme is run. For example, there may be diversification benefits to the overall wealth of the owners from having access to other asset classes.

Along with the changes in legislation, regulation and hence closure of schemes, the key corporate stakeholders have tended to become financial rather than humans resources. For over 70% of schemes

which are closed to future accrual [13], there is no benefit being provided to current employees at all, other than increasing security for pensions already accrued.

In the UK it seems to us that the vast majority of corporate sponsors have the goal of minimising the impact of the scheme on the company through some combination of minimum contributions, deficits or time spent. Such a characterisation of corporate objectives is clearly at best a broad approximation for many companies who retain paternalistic and governance objectives alongside financial ones, or whose brand values could be tarnished by treating employee benefits in a purely transactional way. However, this still leaves a complex problem and in our view does provide a fair, if simplified, representation of the state of play for many, if not most, UK corporates.

### **The Pensions Regulator's objectives**

The Pensions Regulator ('tPR') is an important stakeholder as an arbiter between trustees and sponsoring employers as well as an enforcer of various aspects of regulation. As such, part of tPR's role is to overcome the differences between the objectives of other stakeholders, in line with the law. tPR has three statutory objectives [22]:

- to protect the benefits of pension scheme members,
- to reduce the risk of calls on the Pension Protection Fund ('PPF'), and
- to promote the good administration of work based pension schemes.

We believe that the first objective marries well with the objectives of trustees, although there could be different interpretations of the word 'protect' which could lead to some misalignment.

The second objective is more complicated. In some scenarios this will marry well with trustee objectives and in some cases it will not. The courts have recently decreed that in certain circumstances, it would be counter to public policy to allow trustees or other parties to 'game' the PPF in their decision making to improve members' benefits. We are not lawyers and cannot comment on the legal interpretation of the ruling. From a common-sense perspective, it seems hard for trustees and their advisors to not take actions which they believe are in members' best interests due to the existence of the PPF.

There are of course a variety of other stakeholders who will have different objectives, from financial backers of the company (shareholders and debtholders) as well as a range of advisers and at a macro level the PPF and Government. The issues for these stakeholders are beyond the scope of this paper, as are some of the agency and other 'softer' objective issues that we have not touched upon above.

### **Case study 1 (Strong and large sponsor relative to the pension scheme)**

With the backing of a seemingly secure sponsor with substantial financial resources available then there would seem to be a great deal of flexibility open to trustees in determining the balance between assets in

the pension scheme and continuing reliance on the sponsor. From the sponsor's perspective, the pension scheme is likely to have only a second or even third order impact on the company financial performance.

The key drivers of the risk management objectives may therefore be dominated by agency issues as well as behavioural ones; we would not under-estimate the role that the history of funding defined benefit pension schemes has to play in these matters. In some cases, we might go so far as to speculate that where both trustees and sponsors have experience of making profits through investment via their day jobs, there may be an element of belief that they should be equally capable of making profits through the pension scheme.

### **Case study 2 (small sponsor relative to the pension scheme)**

In this situation, there are clear intergenerational issues for the trustees to contend with. If a scheme is underwater, short of winding-up it still needs to pay current pensioners 100p in the pound. This is at the expense of non-pensioner members who will see the assets backing their liabilities eroded. The alternative of triggering a wind-up (either because the trustees have the express power or via fully investing in gilts and seeing the resultant contributions become unaffordable) guarantees a loss for all. How should the trustees decide between these two outcomes?

We believe that each trustee will need to consider the issues in depth. They will need to try and understand the utility that members place on their income and come to a decision that is in the best interests of the membership as a whole (noting the intergenerational issues described above). For example, in a simplistic approach say that a scheme could guarantee every member 79p in the pound, or could take on a risky investment which could leave the scheme fully funded after a year or funded to 60p in the pound after a year (allowing for a risk premium due to the general belief that the marginal investor is risk averse).

Many members (and advisors) will likely have anchored on receiving their benefits in full. There can also be significant costs in winding-up underfunded (especially for smaller schemes). Without some kind of utility function it is not obvious to us how to decide between the two simple options above, and pensions schemes are far from that simple. However, from a governance perspective we believe that in these scenarios it is vital that the trustees understand the risks to members' benefits and make their decisions accordingly.

### **Case study 3 (sponsor and pension scheme of broadly comparable size)**

For most schemes in this situation, it is likely that there will be a gap between the actual assets held and the amount of assets that the scheme would require to hold such that there would be a very high likelihood of meeting members' promised benefits in full, with no further recourse to the sponsor.

Furthermore, even should they wish to change the balance between assets in the pension scheme and reliance on the covenant in the short-term, there are likely to be significant affordability issues

associated with this which could in turn feedback and impact on the strength of the covenant. In this type of case study, the constraints are likely to be as significant as the specific objectives, if not more so.

As an aside, trustees have not yet been given clear direction on the extent to which future accrual should feature in their strategic planning. For any sponsor with a finite covenant, it is clear from a narrowly financial perspective that the act of increasing the liabilities by allowing accrual increases the risk to all members. In many cases such risk increases are imperceptible in the short term and may well be offset by avoiding potentially damaging employee relations caused by changes in benefits that in turn affect the sponsor strength. However, for much weaker sponsors, the trustees may feel that there is a material decrease in risk for all by sacrificing accrual for active members and indeed one of the regulator’s powers is the ability to modify accrual [23].

For actuaries who have to take into account a wider perspective, an additional element of risk management is to help clients decide on the extent to which it is felt that a widely offered promise of good benefits is better or worse than a narrowly focused ‘guaranteed’ benefit.

**The key risks facing the Scheme**



There are myriad ways of categorising the financial risks faced by a pension scheme, and we set out one possible approach here. The categorisation itself is not especially important, although some approaches may be more easily communicated, but it is important that key risks are not missed. We would hope that, on reading through this section, it is clear why these risks should not be considered in isolation from each other.

**Sponsor covenant risk**

We begin with the sponsor covenant because, subject to the level and type of assets held in a pension scheme (see ‘level of funding risks’, below), without the continuing ability and willingness of the scheme sponsor to support the pension scheme, the trustees’ core objective of ensuring members receive their benefit entitlement in full will be subject to material risk of failure.

The main risks associated with the sponsor covenant are:

- The sponsor defaults due to poor business performance whilst the scheme is underfunded on a buy-out basis (or self-sufficiency basis for larger schemes) after the recovery of any statutory debt placed on the employer.

- The contributions to the scheme become unaffordable and trigger a wind-up.
- The business is restructured in such a way as to diminish the level of company assets that are available to back the pension scheme going forward

The sponsor should be aware that any weakening of their covenant could have implications for the way trustees seek to fund the scheme, perhaps with demands for cash to improve the funding of the scheme in the short-term. There may be additional implications from a weakening covenant, such as an increase in PPF levies.

### **Level of funding risks**

For trustees, the risk associated with the level of scheme funding should be seen in the context of the sponsor covenant; volatility in the scheme's funding level (or any other relevant financial metric) is not in itself a risk to the trustees if the sponsor is willing and able to make good any downside outcomes. Nevertheless, the greater the level of assets in the pension scheme the greater the security for pension scheme members.

We note, mainly as an aside, that it is not strictly necessary to place a value on the liabilities in order to assess risk relating to the level of funding. For example, one could consider the likelihood that a specific amount of assets, invested in a specific way, would be sufficient to meet the promised benefits as they fall due, without further recourse to the sponsor. In doing so, actuaries would have no need to value the liabilities at all.

However, the benefits do have to be valued for a variety of purposes – funding, reporting, risk management, etc. – and the very act of placing a value on the benefits introduces risks. For example, a large increase of pension cost reported in the sponsor's account may affect its covenant.

Furthermore, the reported values do not depend only on observable facts, but also the uncertain way in which actuaries make assumptions about the future. For example, although changes in longevity probably occur in relatively small steps on a near-continuous basis, trustees, sponsors, and their advisors are more likely to recognise the changes as significant step-changes. A large change that is suddenly recognised may have a much bigger impact than if a series of smaller changes had been allowed to feed through. This step change is a key risk associated with any type of 'smoothed' approach; ultimately the truth will out whatever a model says.

Moreover, from the sponsor perspective, a volatile funding level is likely to result in volatile contribution requirements. A requirement to pay, and / or promise, greater levels of contributions at a time that does not fit well with other corporate objectives could result in missed opportunities for projects that would otherwise have added shareholder value or, in extremis, could damage the ongoing viability of the company.

The key drivers of the future level of scheme funding will be the cash flows into and out of the scheme (contributions paid from the sponsor and benefits paid to members) and the relative performance of the assets and the liabilities.

### **Asset-liability risks**

The benefits paid to scheme members depend inter alia on the state of health, date of retirement, longevity, marital status, date of leaving scheme, salary increases of the members as well as less individual-specific risks such as inflationary-links for pension increases and revaluation. Because these are all uncertain, they are all sources of risk.

Of course, the liabilities do not exist in isolation - pension schemes can and do invest in a wide range of assets, from traditional equities and bonds to exotic derivatives such as interest rate, inflation and even (in a few cases) longevity swaps as well as annuities.

With the exception of annuities, the other asset classes do not provide an exact match to individual pensions. Although annuities on their own have highly unpredictable returns, relative to pension benefits they are a very close, if not exact, match. There remains some residual level of default risk, and the implications of deflation or the Government's announcement on linking statutory pension increases to the Consumer Prices Index rather than the Retail Prices Index are yet to be fully understood. Such assets are also (almost entirely) immune to the indirect 'change of assumptions' risks. The asset-liability risks are therefore very low.

Some other asset classes (e.g. bonds and swaps) can be used to create approximate matches to aggregated pension cash flows, or at least an estimate of what these might be. These approximate matches are a lot less precise than annuities – they depend on the projected cash flows and are subject to risks of experience being different to the cash flow model as well as changes to the model or assumptions underlying it.

Other asset classes are subject to greater levels of uncertainty in absolute terms as well as relative- to-liabilities terms. Some of these asset classes are held by pension schemes seeking the upside risk from the asset class; we might classify the associated risks as “strategic” risks.

Some key strategic risks that a pension scheme might have, or choose to have, are:

- Equity risk
- Credit risk
- Other asset risks (for example, property, hedge funds, etc.)
- Duration risk
- Inflation risk
- Active management risk

### **Operational risks**

In the above high level analysis we have not discussed some of the practical risks associated with the asset strategy. For example, as well as asset price risk, the recent financial crisis has highlighted risks such as fraud (for example, as perpetrated by Bernard Madoff), funding (liquidity) risks in running a derivative strategy, counterparty risk in swaps contracts, market (liquidity risks) in structured assets etc. These risks all need to be managed and the extent of these operational risks will depend on the complexity of the asset strategy adopted. However, we do not view them as strategic risks in the sense

that the risks are not being actively taken to provide any specific benefit in themselves; rather, they are run as a consequence of the asset strategy adopted.

### Legislative risks

As is clear from the history of defined benefit pensions, changes in public policy, while difficult if not impossible to quantify, can have significant implications for the risk management of pension schemes. Examples of these include: preservation, statutory pension increases, equalisation, introduction of the PPF and levies, or the recent pronouncements on the change in statutory indexation from the RPI to the CPI.

### Catastrophe risks

Whilst these are, by definition, extreme risks they should at least be considered by both trustees and scheme sponsors. These are broadly extreme stresses of the various risks mentioned above, whether that is in relation to asset prices, inflation rates, sponsor distress etc. For schemes with stronger sponsors, catastrophe risks are the key risks to manage as other risks will tend not to have a material impact on the likelihood of meeting objectives.

### Analysis of the risks facing the Scheme



The nuts and bolts of the analysis of the risks within a pension scheme are very familiar to actuaries and investment consultants. The key characteristic of an enterprise risk management approach is that the analysis of the risks is done as part of the decision-making and not tacked on at the end as part of the report.

It is not essential that a stochastic model is used to implement the analysis, but in our experience, the discipline of using such a tool has a lot to commend it. We do, however, recognise clearly the danger that stochastic tools can sometimes seduce the adviser and/or trustee into not applying the right level of thinking. Stochastic models rarely attempt to measure all risks and it would be folly not to recognise the myriad model risks in any modelling paradigm.

In addition, some asset/liability variables only have a relatively minor impact on overall risk and it may be disproportionate to model them stochastically in some cases (e.g. on the liability side, age difference between spouse's and members or proportion of members with a spouse). Having said that, smaller schemes should be wary of assuming that the law of large numbers applies to the demographic assumptions implicit in the model of their liabilities. For example, when a significant proportion of the projected benefits relate to a few large value members, demographic effects may not 'average out' when comparing actual cashflows to expected cashflows.



One of the central tenets of enterprise risk management is that risks should be treated in a holistic fashion. While it is common best practice to treat asset and liability risks together (which takes account of the fact that the asset strategy can dampen, increase or otherwise modify the effects of volatility in the liabilities) it is less common to do the same with the sponsor and its covenant. Many schemes undertake covenant reviews (and tPR is being encouraging in this regard [24]) and the position has become clearer since the change in employer debt regulations in 2003. Nevertheless, it is a hard challenge to capture the dependency structure between corporate and pension scheme asset and liabilities; and the link between a deficit in the scheme and contributions required from the sponsor is highly complex.

Furthermore, each scheme is typically exposed to risk from a single sponsor or corporate group. While in many other aspects of scheme financing statistics are useful guides and experience will 'average out' to a greater or lesser degree, a sponsor will either survive or it will not. As well as the lack of efficacy of statistics in risk planning, companies are unique and even generating reasonable proxy probabilities for default risk will require judgement and will be subject to a reasonable degree of uncertainty.

Examples of issues that arise from a siloed approach to considering the pension scheme and sponsor include for example:

- Pension schemes often value contributions under a recovery plan as certain (i.e. ignoring sponsor credit risk) placing too high a value on a given contribution schedule, especially longer or back-end loaded plans.
- Pension schemes often only superficially consider the impact of the level of downside investment volatility on the strength of the sponsor's covenant.
- So while we accept that modelling the sponsor is a challenging problem, we feel it is better to have an approximate analysis of the risks in a holistic manner than a more credible model of the pension scheme only risks (it is better to be approximately right than exactly wrong).

As an aside, we would note that in the wider financial markets there are number of avenues of research around credit risk from a 'structural model' of the company perspective; these may provide insights into dealing with the feedback issues which are so important. The technical research opportunities notwithstanding, communicating the complexities of any model is likely to be a significant challenge.

### **Case study 1 (Strong and large sponsor relative to the pension scheme)**

Provided that the sponsor can make good any shortfall (and is available to do so), continued underperformance of the assets does not impact on benefits received by members. However, it may strain the relationship between the sponsor and the trustees.

The key issue here is the extent to which the catastrophe risk of the sponsor going bankrupt is considered in conjunction with the funding and investment strategy of the pension scheme. There is a risk that, because of the strength of the covenant and the low probability attached to its failure, that these tail risks are ignored, or misunderstood, rather than specifically managed.

As an aside, we note that buy-out typically appears to be the ‘safest’ option for trustees seeking to gain the greatest security of the delivery of members’ benefits. In this case, the primary residual risk is of insurance company default, which based on FSA regulations and historic performance we take to be at the lower end of risks facing members. In this case study, it would be essential to compare against buy-out providers, the covenant and risks associated with the scheme sponsor continuing to support the scheme, before considering such a change in strategy.

### **Case study 2 (small sponsor relative to the pension scheme)**

In this scenario, the pension scheme will be one of the key business risks. While in extremis there are certain compromises that can be made with the pension scheme as a creditor, there are many UK companies that have been brought to their knees by their pension schemes.

From the corporate perspective, management need to start by recognising the risk that the scheme poses to begin to manage that risk. Companies in this situation typically lack the financial muscle to mitigate the risks in their schemes entirely. One of the trade-offs is between the amount of business risk they are willing to run due to a significantly mismatched investment strategy. There is an opportunity for financial markets to bail-out the pension scheme, but on the other hand pension scheme investments could destroy an otherwise profitable company. Due to the current approach taken to scheme funding, there are also short term opportunities to return cash to shareholders, even when the overall entity is economically underwater. So even in these situations shareholders can get short term return as paying dividends shields wealth from creditors, but all financial stakeholders are subject to material medium and long term risks.

From the trustee perspective, there is unlikely to be any low-risk way to meet their objectives of paying members benefits in full. Therefore, the key challenge is to work out a strategy that balances the risks appropriately given the trustee’s view on equity between different classes of members and potential upside from either the schemes investment strategy or the sponsor outperforming expectations. If the trustees decide to run the scheme on, it can be a case of crossing their fingers and hoping for the best.

Case study 3 (sponsor and pension scheme of broadly comparable size)

Of the three case studies we are considering, this is perhaps the most difficult to deal with in terms of analysing the risks since the interaction between the sponsor and the scheme is key.

### **Sponsor’s perspective**

We could simplify the analysis by assuming that the key pension risk is in relation to the deficit contributions that the sponsor has to pay. There are other financial risks, for example the cost of debt increasing due to higher leverage if the pension scheme deficit increases. There are other metrics a company could use. If the metric is economic then the decision should help optimise economic value (subject to modelling limitations); if not, then not. However, economic value ought to be calculated from the point of view of the sponsor (i.e. using its own cost of capital, appropriately adjusted for the risks inherent within the pension scheme) recognising the shareholder value in the right to default on the pension scheme.

In terms of analysing risks, it can be difficult to predict how shareholders and debt-holders of a company will react to different approaches taken within a pension scheme. Economically, shareholders should be fairly neutral to the investment strategy of the scheme (except in relation to options relating to boundary conditions such as trapped surplus or direct or indirect bankruptcy costs and taxation costs) except for the effect it has on funding plans (see below) and due to non-fair value accounting standards that are generally applicable for pensions [26]. However, anecdotally and based on schemes current investment strategies, this seems not to be the case [11, 12].

The trade-off for most companies is typically between paying a low level of contributions today (which simplistically meets their objectives) against the possible levels of contributions in future. Simplistically, few sponsors would not wish their schemes to ultimately be well funded at some future point (for both financial and paternalistic reasons). For harder nosed employers, while they may hope for their scheme to be well funded they would prefer not to have to pay for that outcome. Taking investment risk within the scheme is one practical route to slow down the pace of funding, irrespective of whether the sponsor truly believes that it adds to shareholder value via any expected asset outperformance. It adds to shareholder value by increasing the value of the Merton Put and may also provide capital at a lower cost than available from other sources, due to the lack of transparency associated with pension scheme financing.

### **Trustees' perspective**

The limits to risk capacity are essentially the limits to the sponsor's affordability to its pension scheme. If the sponsor is cash rich, the scheme well funded, and funding volatility is low, the scheme may well be in a fairly sustainable position, subject to catastrophic sponsor risk.

There are a variety of metrics that could be used to analyse the sponsor risk. It can be done for larger sponsors by considering their credit rating, credit spreads, CDS spread, equity volatility (via a Merton model approach) etc [25]. It can be more challenging for smaller sponsors where market based information is not available, but some default statistics are available e.g. split by industry.

A pension scheme centric approach which ignores other business risks and correlations could focus on:

- the sponsor's free cash flow relative to some deficit contribution requirement, or
- the economic value of the sponsor and pension scheme as a combined entity.
- Risk limits could be put in place in relation to metrics based on the above. This still leaves open the challenging problem of what action to take if funding deficits materialise and the sponsor cannot readily make them up: take further investment risk in the hope that markets 'come good', or secure the scheme's underwater position.

Questions that the trustees might wish to ask of their advisors include:

- Given the current financial strategy, what is the likelihood that contributions reach various critical levels (as a proportion of the sponsor's free cash)?
- What asset backing would members benefits have in future scenarios (i.e. what are the projected solvency funding levels)?
- Given the current financial strategy, what is the likelihood that the economic value of the sponsor including the pension scheme goes below various critical levels (including zero)? In the current environment, we would not be surprised if a material proportion of schemes and their sponsors had negative overall economic value.
- To make the issue of sponsor failure less emotive, the trustees could conduct the following *Gedanken-experiment*. What level of money would the trustees feel comfortable with in an escrow account if the sponsor could then cut all further responsibilities for the scheme? This forces trustees and sponsors to quantify the extent that the company is underwriting the scheme's current funding and investment strategy beyond any agreed schedule of contributions and recovery plan.

### Risk mitigation strategies



This part of the process includes the conscious decision not to mitigate a risk, particularly strategic risks. We would also note that mitigating a risk does not necessarily involve hedging, as risks can be mitigated simply by reducing exposure. However, part of a good risk management process is the need to appreciate that mitigating one risk can increase another; often risks are transformed from one type to another rather than simply 'reduced' in a one-dimensional way.

To give an example of the necessity of a holistic approach to risk mitigation, consider a manufacturing company whose business risks include an exposure to oil price rises with limited potential to pass on costs to consumers. From a narrow risk management perspective, hedging the exposure to oil price moves could be seen as a sensible precaution to stabilise the company's profits. However, if the company's peers retain their exposure to oil price shifts and if oil prices fall, then the company's competitors would be better placed to cut prices to increase market share whilst retaining the same profit margins.

An alternative example for pension schemes might be the pursuit of liability reduction techniques such as pension increase exchanges without a greater awareness of the overall risks. For example, removing

the exposure to future inflation risk associated with index-linked benefits by exchanging these increases for higher initial pensions which receive no increases may appear to be mitigating risk. However, if the scheme is poorly funded then consideration should be given to the potential increase in risks and volatility drag on funding that could arise from the scheme having to pay out a greater proportion of the available assets in the short-term.

### **Case study 1 (Strong and large sponsor relative to the pension scheme)**

In this case, the key risk is the catastrophic risk of sponsor failure. In general, the only avenue available to trustees to as far as possible mitigate this risk is to fund to a solvency level and seek to match the assets to the solvency liabilities. In practice matching buy-out pricing (except via a buy-in) is not likely to be possible so an additional reserve would be required. (We are aware that some have speculated about trustees buying single name credit default swap (CDS) protection against their sponsor however, this would only be available to the largest schemes, likely at the cost of very strained relations with the sponsor, and we are not aware of it being used in practice.) If this were the case members' benefits would not be at risk. In practice, in our experience even those schemes that can afford such a strategy rarely choose to do so.

The trustees may also be concerned, on the sponsor's behalf, about the risk of an irrecoverable surplus arising. However, given a matching investment strategy the size of any such surplus should be modest in relation to the size of the scheme. An additional reserve may also be desired for risks that cannot be matched (in a fair valuation approach) such as longevity (at least until recently and now only typically for larger schemes).

### **Case study 2 (small sponsor relative to the pension scheme)**

As discussed in the previous section, in this scenario underfunded schemes are typically exposed to a range of risks and there is no low-risk approach to paying the benefits in full. Rather the trustees will need to take a view on which portfolio of risks they feel is most appropriate (with one portfolio being the possible choice of triggering a wind-up to provide an insurance guarantee that funding would not deteriorate further).

### **Case study 3 (sponsor and pension scheme of broadly comparable size)**

Again, the fundamental risk to the trustees' objective of paying the benefits in full is that the sponsor defaults whilst the scheme is underfunded on a buy-out basis (or self-sufficiency basis for larger schemes). The trustees' strategy needs to attempt to steer the scheme to this well-funded position before the sponsor defaults. Many schemes in this scenario have sponsors who could afford, over time, to achieve this goal. However, many sponsors simply do not want to.

[6], amongst others, have highlighted the tax benefits for a public company of "fully funding" a scheme and investing in bonds if one considers the shareholders position in an holistic, economic way. The fact that so few schemes do this highlights that either the model is incorrect or non-economic arguments are

swaying agents; we view the latter as a more likely hypothesis. Investors, regulators, rating agencies and some corporates fail to fully grasp the implications of pension scheme funding.

This means that many managers are not incentivised to maximise economic wealth in this way.

What often happens is that schemes seek to reach their goal via a combination of contributions and investment returns, and so deliberately take more investment risk than is 'necessary', in order to lower contribution demands.

To the extent that lower contributions make for a stronger sponsor, this is an example of a trade-off of risks. However, overall it is hard not to conclude for many schemes in this position that trustees are choosing, or being forced by circumstance (both the weight of history and the current regulatory environment play their part), to take more risk than is necessary.

### Monitoring risks and completing the control cycle



The risk management control cycle is completed by regularly monitoring risks and refreshing the work from earlier stages as and when required. The legislative framework naturally lends itself to at least a three year cycle, and generally we observe a fairly thorough one year cycle for larger schemes with greater governance budgets. Operational risk limits set around funding levels, manager performances against benchmark and perhaps sensitivities are often tested quarterly or more even for modestly sized schemes.

In all this however, it is not enough merely to measure some aspect of scheme financing. Unless there are clear management actions that are considered and taken to alter the schemes financial strategy to manage downside risks, or seize opportunities, no real impact is made. It is not enough merely to regularly measure risks, however sophisticated the measurement model or metric.

From a trustee perspective, we have argued that the key risk is a sponsor default where the size of the loss is related to the gap between the current asset level and the solvency level. In terms of opportunities, trustees increasingly appear to wish to take shorter term tactical investment decisions where they believe there are high risk adjusted returns available in the market. Many schemes appeared to be successful in implementing this in the fall out of the recent financial crisis.

As another simplified example, if trustees were taking investment risk purely because they believed that the sponsor could not afford to pay the promised benefits (as in Case Study 1), if the sponsor's covenant improved the trustees may wish to reduce their level of investment risk and rely more heavily on contribution payments to reduce the asset shortfall. What is apparent is that strategic decisions need to be taken with

cognisance of the sponsor's covenant, the funding position (relative to self-sufficiency or solvency) and investment opportunities, encompassing an understanding of the risks to the trustees' objectives.

From the sponsor's perspective, to the extent that they can influence the investment strategy, they may wish to try and seek a level of investment risk that fits with their broader objectives (which in many cases do not superficially appear to be maximising the economic wealth of shareholders) or because they take a certain market view. As we have discussed, key issues here are the value of the Merton put to shareholders for underfunded schemes as well as managing gearing levels and cash flow. It appears that the relative low cost and flexibility of pension scheme debt makes it a very attractive form of financing.

## **6. Additional thoughts**

There are undoubtedly many other avenues that could be explored when considering the application of risk management processes to defined benefit pension schemes. We briefly mention some of them in this section before drawing our key conclusions.

### **Public policy and provision of guaranteed benefits**

We do not believe that future guaranteed benefits can be provided in a wholly risk free manner. The attempt to enforce this by legislation and regulation has contributed in no small part to the demise of defined benefit provision in the private sector. If you take the law and trustee duties to a logical conclusion (that you should seek to minimise the risk of failing to pay the promised benefits) you would conclude that you should fund the scheme in the same manner as an insurance company funds annuities, with commensurate cash costs. Again, the pace of funding does not alter the economic cost of the (default-free) benefit promise. If a scheme were not funded this way, a trustee might conclude that it ought to immediately close the scheme to future accrual to spread the finite covenant over a lower level of benefits. It is hard to see that this is in members' best interests, or the best interests of society as a whole. It would be better to have an informed conversation about an acceptable degree of risk to benefits that are more certain than those provided by defined contribution schemes.

### **Model risk**

In the words of the statistician George Box, "no models are right, but some models are useful". Any quantitative analysis of pension scheme funding will require the use of models. Any outputs used for (risk) management decisions may therefore be useful, but only if overlaid with a layer of experience, pragmatism and common sense. No model can tell stakeholders what to do; but it can inform stakeholders of the possible consequences of their decisions. How trustees or sponsors choose to react to the information that actuaries can provide is a decision for them, which will be based on their objectives, biases, and the way the information is presented. Only part of the decision will be based on the management information contained in the model.

However, sophisticated models can be used quite inappropriately; some things are just statistically unknowable. For an eloquent description of the misuse of models to manage risk in banking (written

pre credit-crunch) see [27]. Slightly closer to home, vast effort is being applied by many actuaries amongst others to work towards solvency II and its 1 in 200 years risk metric. In passing, we would question the availability of data to begin to sensibly model such a target. From a statistical perspective, you would likely want at least several thousands of years of data from a stationary time series, more from a more complex time series; in reality for several markets you may have a few decades of data at best (e.g. UK corporate bonds, index-linked gilts, credit derivative markets etc).

### **Uncertainty in distribution of surplus**

Economic surplus should be shared between scheme members and the sponsor (and Her Majesty's Revenue and Customs). Following [11,12] we would note that surplus must accrue to one of these parties. However, the sponsor and the trustees may not place much value today on their share of the surplus as they are uncertain they would get (much of) it (for shareholders or members). Therefore, while £1 of surplus is worth £1, sponsors and trustees may in total place much less value on it than that. This is in part because of tax but also because they are uncertain about what proportion of that £1 they may be able to access.

### **Pensions risk management and the Board for Actuarial Standards (BAS)**

BAS has very recently issued the pensions technical actuarial standard (TAS). The aims of BAS are laudable, "that the users for whom a piece of actuarial information was created should be able to place a high degree of reliance on the information's relevance, transparency of assumptions, completeness and comprehensibility, including the communication of any uncertainty inherent in the information." [28]

However, in the initial consultation on the pensions TAS and following drafts, BAS has been engaged in heavy debate on terminology. We would note that both "best estimates" and "neutral estimates" lead to an overly pension-scheme centric world view. Neutral is now defined as [28]: "A neutral measure, assumption or judgement is one that is not deliberately either optimistic or pessimistic and does not incorporate adjustments to reflect the desired outcome."

A best-practice risk management approach cannot consider the pension scheme in isolation. Setting aside the varying interpretations that actuaries could reasonably take of the word neutral, it seems that the approach required by BAS requires a highly optimistic view on the covenant (i.e. that it will always be available to back the scheme) so that investment returns can potentially be earned for many decades to come.

Were an additional figure deemed to be useful in communicating risk, the solvency or self-sufficiency shortfall seems like a more relevant figure, perhaps in the context of the size of the covenant and including some appropriate risk metrics. BAS does not rule out providing additional information, but they are no doubt aware that by setting 'principles' at this highly granular level of detail, they will heavily influence actuarial practice.



## **Pensions risk management and tPR**

tPR has some major challenges in fulfilling its statutory role. It has to set an approach that fits schemes of hugely different sizes and governance budgets. As well as having to set guidance that is applicable to this wide diversity of schemes, tPR itself has limited budget itself to monitor the actions of over 6,000 UK defined benefit pension schemes. These schemes need to be managed in the context of sponsors and trustees who often believe their interests are misaligned and so many funding plans involve some degree of compromise. Further, tPR's powers relate most explicitly to scheme funding, despite the guidance it has offered on sponsor covenant and despite the importance of investment strategy in altering the risk profile faced by pension schemes.

We are supportive of much of the guidance given to trustees and the holistic approach suggested (in terms of considering the covenant). However, perhaps in no small part due to the constraint of having to cater to the smallest schemes, there are some areas of regulatory intervention that appear to have unhelpful consequences.

Firstly, there appears to be an excessive focus on deterministic approaches to setting strategy (although the funding regulations are at least as much at fault). While a single discount rate comparison may aid comparability between schemes, it simply fails to give the most pertinent information terms of managing risk. When the asset strategy and covenant are not quantified in a holistic way, a discount rate approach can hide important information about the true amount of risk to members' benefits.

Secondly, in terms of minimising risks to members' benefits, there is an excessive focus on technical provisions. Again, the legislation is not particularly helpful in this regard. By targeting a level of assets below solvency, members' benefits are subject to ongoing sponsor default risk for decades, even if the trustees reach their desired funding target. As the number of schemes entering the PPF shows, this risk is not hypothetical. As Michelangelo said, "The greater risk for most of us lies not in setting our aim too high and falling short; but in setting our aim too low, and achieving our mark". We feel this way about many technical provisions targets.

## **7. Conclusions**

Inspired by the Profession's recent introduction of ST9 (ERM) into the education syllabus, we have attempted to illustrate how something as traditional as DB pension scheme advice can be recast within an ERM framework. Indeed we believe that an enterprise risk management framework provides an ideal starting point for combining the scheme-centric, rather myopic traditional actuarial approach with the altogether more comprehensive theories of modern finance and decision-making. In common with several others [9], we observe that if we start with the typical assumptions underlying financial economic approaches, a lot of additional patches have to be applied to reach solutions that resemble what happens in the real world. However, we also feel that modern finance provides many key insights into the financial economy and appropriate decision making.

We have made the point that risk management is not just a GN9 report with enhanced sensitivity statistics and VaR analysis; it is a fundamentally different way to thinking about how the stakeholders should specify what they are trying to achieve (however multi-dimensional and complex). Risk management then provides a process or way of working to manage the inevitable uncertainties associated with success. More progressive actuaries and consultants will find much of this framework commonsense, or even just a different set of words to describe activities and approaches that they already use. The benefit of recasting it explicitly as ERM is that it moves the language in line with other management approaches in financial services and the wider corporate world. Moreover it forces a consistency and discipline of thought. In other words, we believe that this approach can help to make actuaries more understandable to their clients and will also provide confidence to actuaries that their technical and problem-solving skills are eminently transferable beyond our traditional domains. We also believe that the consistency enforced by an explicit ERM framework will lead to better and more understandable advice for clients and consequently improved decision making; risks and actions will be talked about in the language of the stakeholders, not immediately translated into jargon.

We are very conscious that many actuaries might think of ERM as a collection of statistical techniques and lists of sensible things to do. We empathise with those who think that ERM can look like a rather tedious exercise in writing down lists to demonstrate what they knew in the first place was a difficult problem. Once you get past the notions that ERM is not just the emperor's new clothes and is not just difficult formulae, we believe it provides a natural, stakeholder-based framework for making decisions in a way that allows the key insights from many disciplines to be incorporated.

We also believe that there is much to be said for interpreting ERM as being something dynamic and flexible, rather than an over-engineered management process that dooms us to moderation in all things. But maybe DB pension funds could have done with that...

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## “Risk Management for Pension Funds”

by Jacques R Gagné

### *A truly holistic approach*

Jon Hatchett, David Bowie and Nick Forrester state that the purpose of their paper is “to discuss how Enterprise Risk Management (ERM) fits with defined benefit pension funds and to provide some thoughts on how actuaries might actually build it into their advisory process” (p. 2). Most actuaries who read the full paper will agree that this is *mission accomplie* for the authors.

The authors skillfully and objectively bring the reader beyond the traditional (and limited) asset/liability risk analysis, and successfully bypass the debate about financial economics. The fundamental risk is simply, and clearly, presented as the probability that some benefits may not be paid when they become due. This is the risk to be communicated and managed.

The authors propose a five-step risk management process,<sup>1</sup> which, as they say, need not be followed in the exact details. Three case studies, which are used through the whole paper, help to present the process in a practical way: (a) strong sponsor relative to pension scheme, (b) small sponsor relative to pension scheme, and (c) sponsor of a size that is comparable to pension scheme. The main stakeholders who need to deal with risk are identified as plan members (both employees and former employees), sponsor (employer), trustee and pension regulator.

In this discussion, I will modify the notion of pension regulator that is presented in the paper (p. 14). In particular, I will ignore the protection guarantee offered by some governments in the context of wound-up plans, not only because that guarantee is not present everywhere, but also because the legal aspect of it goes well beyond the scope of the paper (as the authors have admitted). However, I will introduce, as a stakeholder, the pension legislator, because he has the authority to alter some of the rights held by the other stakeholders.

The path drawn by the authors suggests many opportunities for actuaries to introduce ERM into their advisory process. I will present one such opportunity: adding an ERM section in an existing (traditional) pension plan’s actuarial report. Along the way, I will often quote the authors, so that the reader can refer to their original paper, and I will also ask some questions, most of them pointing to the completion of the proposed approach.

The ERM section should be addressed foremost to the trustees because, as we shall see later, those trustees are the entity that can best take the lead in adopting a “holistic approach in dealing with each risk based on the overall risk profile” (p. 4). But because the employer and the plan members will also have access to that new section, it should be made easily understandable by those stakeholders as well.

For simplicity, let us assume that we are dealing with a traditional, non-contributory, final pay pension plan. Let us assume too that this is the first time that such an ERM section is presented to the trustees so that the actuary will need to provide some background information on the holistic approach. The ultimate objective of the new section is to teach the stakeholders how to deal with risk in a co-dependency way.

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<sup>1</sup> This process is shown in the paper in a diagram format as follows: (1) agree on objectives and constraints, then successively (2) identify, (3) analyze, (4) mitigate, and (5) monitor risks..

## **Preamble: The balance sheet does not tell the whole story**

It is very unfortunate that so often the communication starting point (if not the ending point) of the pension plan's financial situation is the plan funding position. Stating that a plan is x percent funded or that the deficit is y million \$ is at best ambiguous information. Rare are the plan members, or even trustees, who can understand the implication of those results, especially when mixed with expressions like "going concern basis," "solvency basis" and the like.

The authors suggest a few informative ways of presenting the financial situation of a plan that would be easily understandable by all stakeholders. Quoting the paper:

There is, say, a 15% chance of the scheme running out of money if no further contributions are paid based on its current investment strategy and in that scenario 35% of members benefits would go unpaid. (p. 6 also contains other suggestions)

This approach has the advantage of focusing on the present situation since it uses current investment strategy and ignores any further contributions from the employer as well as any future service from plan members.

Another approach that could be used, but that has been rejected indirectly by the authors (pp. 17, 26), is providing the value of guaranteed benefits, where the benefits are those accrued up to the valuation date. Using insurance company costing methods, that value would be the amount of assets now necessary to maximize the likelihood that all future benefits will be paid. This would certainly provide a clear starting point from which to introduce the topic of risk.

Still using this latter approach (guaranteed benefits), it might be useful to break down the total value of the benefits into what pertains to the active employees and what pertains to the former employees. Those two groups, who indeed are close to being two different stakeholders, may find this information useful in their risk analysis.

## **Part 1: The responsibilities of the stakeholders**

### **A) Employer**

As the authors write, "there is a wide range of reasons for offering a pension scheme to staff (p. 13)." However, since the purpose of the corporation is to create value to shareholders, it is not surprising that (still quoting the authors) "in the UK the vast majority of corporate sponsors have the goal of minimizing the impact of the scheme on the company through some combination of minimum contributions, deficits or time spent" (p. 14). This is certainly not unique to the U.K.

An essential element in using an ERM approach is the confidence attached to the future contributions that will have to be paid by the employer. The risks associated with the sponsor covenant are numerous (p. 16). As an image, would any young employee dare to assume that the pension scheme, which she just joined, will still be present when her final retirement benefit becomes due?

The possibility of the employer ceasing to make contributions to the pension plan should be part of the ERM section because this scenario will become reality ... sometime.

## **B) Plan members**

The plan members must stand ready to judge the value of their pension benefits. For active employees, this would occur when judging total remuneration, when terminating employment, when being offered a change to defined-contribution plan, etc. (p. 12). The ERM section should provide (and justify) the basis or assumptions upon which the values of the benefit communicated to each plan member should be determined. As the paper suggests, "it does not help clear decision making for members to value all final salary benefits from any given sponsor as if they were as low risk as a deferred annuity from an FSA regulated insurer" (p. 12). It would have been interesting to read in the paper suggestions on the choice of assumptions.

For both groups of plan members separately—active employees and former employees—the total value of pension benefits as disclosed in the Preamble subsection (under guaranteed benefits) can be compared to the value of the assets pertaining to their respective groups.

It should be emphasized that the active employees are stakeholders not only in their pension plan but also in their own employer business. This is present in the argument often heard in favor of minimizing the employer contributions: "The best guarantee for the financial health of the pension plan is the financial health of the employer." True, but the risk is that the health of both entities might deteriorate at the same time. The use of any of the two approaches shown in the Preamble subsection should help to isolate the individual's interest as a plan member from his interest as an employee.

## **C) Trustees**

The duties of the trustees, as derived from the trust laws, are clear: to collect, invest, and pay money (p. 12). Easier said than done, as the trustees have no control over the design of the pension plan (e.g., change of benefits) or the amount of contributions actually paid by the employer.

It is common for some of the trustees to be nominated by the employer, for some others to be nominated by the plan members, and for the rest to be so-called "independent." No matter how they have been nominated, all trustees owe their fiduciary duties to the plan members and not to any other entity. Having said this, the trustees *as a group* are proprietors of very useful information from both the employer and the plan members. That information happens to be essential in making good judgment in performing what is perhaps the trustees' most important role, namely weighting (i) plan funding and (ii) affordability to the employer; to quote the authors: "The tension between scheme funding and affordability is a key constraint for the trustees to manage." (p. 7)

The ERM section could emphasize the leading role that the trustees are called to play because of the unique information they gather.

## Part 2: The decision-making process of the trustees

In this part of the ERM section the actuary should provide the following information:

- a) Projection of liabilities and assets, in terms of cash flows, using stochastic models with different investment strategies
  - Note that this is in the traditional field of the actuary; still the actuary should be aware of some warnings from the authors: “it would be folly not to recognize the myriad model risks in any modeling paradigm” (p. 19); “some things are just statistically unknowable” (p. 26); “no model can tell stakeholders what to do” (p. 26).
- b) Presentation of the “dependency between corporate and pension scheme asset and liabilities” (p. 19).
  - Note that this is quite far from the traditional field of the actuary.
  - Notwithstanding the challenge of the task, it is essential to “relate investment volatility to the strength of the sponsor’s covenant” and ... “not to value contributions under a recovery plan as certain” (p. 19).
  - “It is better to have an approximate analysis of the risks in a holistic manner than a more credible model of the pension scheme only risks” (p. 20).

The presentation just mentioned in paragraph b is the crux of the ERM approach in a defined-benefit plan. Until more details are provided as to how this presentation can be written, some people might see it as a Gordian knot.

In addition to submitting the technical papers mentioned above, the actuary could, as a financial advisor, suggest to the trustees some guidelines to be used in their decision-making process:

- a) Collect the point of view of a financial analyst on the prospect of the employer.
- b) Ask the employer about the relative importance of plan funding compared to company investments; what increase in contributions would he accept to pay within the next three years, say, if the plan “became under water”?
- c) Survey the plan members (active and former employees separately) about their preference of a lower guaranteed benefit rather than a higher promised benefit.



- d) Develop the strategic decisions using all the information you have about the pension plan, the employer and the plan members; in other words, there is no need at all to copy any part of the strategy of other pension plans (like a “typical” reference portfolio).
- e) The decisions belong to the trustees but ... in every decision there is some regret.

Of course the trustees should make the link with the rest of the actuarial report but they should not use the actuary as a scapegoat for the trustee’s decisions. As the authors write: “no single number can tell management how they should manage their scheme’s financial strategy—a proper governance process is required” (p. 8). This warning is particularly applicable to the discount rate of return used in the actuarial valuation that so many trustees convert in a “required” rate of return in their investment policy.

### **Part 3: Beware of the pension legislator!**

The paper makes a brief mention of changes in pension legislation as a risk to be analyzed (pp. 9, 18). In this current period when so many defined-benefit plans are agonizing, this risk is not to be underestimated.

As an example of a sudden change in the paradigm of pension rights, I will outline part of the proposal that is now being discussed in the pension circles of the province of Quebec (Canada). At the time of writing, that legislation has a fair chance of being adopted.

In a great number of private and public pension plans, employers (employer means taxpayers in many cases) have found that they cannot afford to pay the contributions required to amortize past deficits, notwithstanding the fact that the legislator had already extended the amortization periods. In order to “save” the defined-benefit plans, the legislative proposal now goes as follows:

- For a period of five years, the reduction of all ancillary accrued benefits would be allowed, if there is an agreement with the plan members, active as well as former employees, union as well as nonunion employees. “Ancillary” here includes survivor benefit, final salary portion of the benefit formula, early retirement grant, and indexation.
- If there is no agreement within three years, the employer can unilaterally eliminate the indexation clause, for active as well as for former employees.

The ERM section cannot ignore legislative risk, in this period of uncertainty.

### **Other remarks**

Again, this is a very interesting paper on ERM applied to pension plans that was written by Hatchett, Bowie and Forrester: Let me just recall the elements of further study that could complete the paper:

- A model (no matter how imperfect it might be) for integrating the sponsor covenant risk to the asset/liability risk;

- The assumptions to be used in determining the value of accrued benefits for each individual employee plan member.

Without saying it explicitly, the content of the paper is directed toward private pension plans. It would be interesting to see an ERM approach applied to public pension plans that cover municipal, state (provincial) and university employees.

Similarly, the paper sort of assumes that the employees pay a fixed contribution (if any) rather than share the total contribution with the employer (say 50 percent employee/50 percent employer). It would be interesting to analyze how the employee risk would be managed in such a cost-sharing arrangement.

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## Authors' Response to Comments by Jacques Gagné

By David Bowie, Jon Hatchett and Nick Forrester

We are grateful to Jacques Gagné for his thoughtful discussion of our paper, “Risk Management for Pension Funds.” Gagné’s approach is to show how some of the ideas in our paper can be translated into an enterprise risk management (ERM) section in a traditional actuarial report. This approach is helpful in at least two respects: First, it shows how the ideas can be implemented in the business as usual activities of actuaries; and, second, it demonstrates how the ideas in our paper can be interpreted in a North American context where some of the details are quite different from the U.K.

In Part 1, Section B, Gagné states it would be helpful to see suggestions for the choice of assumptions, particularly in the light of sponsor covenant risk. This challenge raises some interesting issues about the application of risk management principles: The risks that an individual faces in respect of their pension plans can (in general) be cast in a quite different light from the risks of the pension plan as an entity. Some risks—e.g., the order in which individual members retire or die—may be relatively insignificant at the plan level, but highly significant for the individual or even smaller groups of individuals. The risks and opportunities for members will also depend in detail on the legislative framework under which the pension scheme operates. As one example, if individuals have an option to transfer out of the pension plan, then their risk profile is again quite different from the plan that they leave behind. These challenges are far from new for actuaries, but drive home the importance of establishing just which enterprise is being advised and exactly what the objectives of the enterprise are, taking into account all stakeholders.

Section C emphasizes the pivotal position of trustees in having access to a unique information set. It also highlights the differences that exist across different jurisdictions when it comes to the power of the trustees—this will vary by country and by plan. For example, the Pensions Regulator in the U.K. does give the trustees significant power in enforcing agreements about contributions with sponsors.

In Part 2, Gagné identifies as a Gordian knot the issue of interdependency between sponsor and pension scheme when it comes to the value of the assets and liabilities. In the U.K. at least, the blurring between sponsor and scheme is increasingly being brought to a head through the use of contingent assets, i.e., assets held by a third party, but which fall into the pension scheme if the sponsor defaults and fall back to the sponsor otherwise. The values of these assets may themselves sometimes be dependent on the sponsor itself (for example, a property that is used by the sponsor or even a loan note from the parent company).

Gagné further suggests a process that the trustees might use for gathering the requisite information and coming to a decision. He rightly points out that any decision-making is specific to the scheme and that benchmarking can be a flawed way of doing this. However, he recognizes the difficulty in behaving in a purist way: Every decision-maker fears a regret risk that with hindsight they would have made a better choice. However, a clear risk management process that includes a clear statement of objectives will go a long way to mitigating the pressures that trustees might otherwise feel if they rely on objectives that are

either too sweeping or too vague. We were delighted to see Gagné pick up on the dangers of trying to read too much into a discount rate, as if it were encapsulation of an entire strategy!

Gagné highlights the risks of legislative changes in Part 3, which we can only endorse. As increasing longevity and far-reaching changes to employment patterns and rights become more prevalent, pensions and retirement income become an increasingly political issue. Combined with the rough ride that the financial markets have given the industry over the past few years, this can lead only to more change in what can and can't, should and shouldn't, occur in plans. We agree entirely that any risk management approach should recognize that changes will occur and provide a methodology for responding to those inevitable changes.

## Pension Investing and Corporate Risk Management

By Robert A. Haugen, Ph.D.

Pension plan investments have grown to become a major asset of giant corporations. General Motors' pension assets are nearly twice the market value of its total outstanding stock. Interestingly, a portfolio of this size warrants but a footnote to the firm's balance sheet.

Since the corporation ultimately stands behind pension liabilities, risk management within the pension plan can now play a very meaningful role in the firm's overall risk management strategies.

Pension risk can interplay with operating risk to create real problems for management. For example, if the plan manager invests in assets expected to produce low returns in periods of economic difficulty, the plan may require additional cash contributions at a time when corporate cash flows are already at uncomfortably low levels. Given the potential magnitude of these required contributions, a significant change in the asset allocation of pension assets can have a pivotal effect on the firm's ability to weather economic adversity and on its financial well-being.

In spite of this, the investments of most pension plans are managed with little regard for the character of the liabilities they support, and with scant appreciation for the potential impact of the pension fund on the overall risk of the firm. Recently, Arnott and Bernstein (1988) discussed the implications of managing pension assets in relation to pension liabilities on investment choices between common stock, real estate, and short- and longterm bonds. In this article we expand the discussion to address (a) the role of pension risk management in the context of corporate risk management and (b) how pension risk management strategies might optimally be implemented to increase the probability that pension benefits can be financed from plan assets and that, when and if required, unexpected increases in corporate contributions can be made without financial discomfort to the firm.

### I. Corporate Risk Management

Corporations have a long-standing tradition of risk management. For example, they avoid interest-rate risk by matching up the term of debt financing with the expected life of the projects being financed. Inventory expansion is usually financed with short-term instruments, while long-lived projects are financed long-term. Moreover, firms also hedge against unexpected foreign exchange risk through forward and futures contracts to buy and sell foreign currencies. These contracts also hedge against unexpected changes in the prices of raw materials such as oil, copper, and steel. Maintenance agreements and insurance contracts on plant, equipment, and key personnel are also commonplace. The prices of nearly all these contracts are set in highly competitive markets. For example, in efficient markets forward and futures prices are fair prices, as are the relative interest rates on long- and short-term debt. It can safely be assumed that matched-term financing and hedging with forward and futures contracts are roughly zero net present activities, and, by definition, they have no effect on the *present* value of the firm's common stock. The risk eliminated by corporate risk management is usually

idiosyncratic to the individual firm, and it can be diversified away at little cost by its investors on their own account. Thus, even considering possible wealth transfers from bondholders to stockholders, the current stock price is largely unaffected by risk management within the firm.

Given the standard business school directive to manage so as to maximize the present market value of the common stock, what is the economic rationale for expending so much time and so many resources in corporate risk management?

The rationale is that management has many different constituents in addition to its *stockholders*, all with vested interests in the firm's well-being. Among the most important are the firm's *customers*, its *suppliers*, and its *employees* (including management itself). If managerial decisions are based on maximizing the stock price, while preserving the welfare of each constituent, how can corporate risk management, and in particular pension risk management, function consistently with this objective?

## II. Corporate Risk Management Within the Pension Fund

From the perspectives of each of the four constituents, a decision to manage pension assets in a manner consistent with overall corporate risk management is nearly a Pareto optimal strategy—it benefits customers, employees, and suppliers while leaving stockholders largely unaffected.

<p><b>Figure 1a</b>                  ECONOMIC BALANCE SHEET                  (CLOSED-END INVESTMENT COMPANY)</p>	
High-Risk Equities Low Risk Equities	Common Stock

Once again, stockholders can adapt to changes in corporate risk easily by adjusting the composition of their portfolios, including more bonds and less stock, or by exchanging high-risk stocks for low-risk stocks. *The stockholders want management to take actions that will increase the market value of their securities.* Since they can easily adjust, they don't care if these decisions increase or reduce the risk of the securities as well.

To see this, consider the asset-allocation decision of a closed-end investment company. The balance sheet for the closed-end company is given in Figure 1a. Its managers have divided its investments equally between blue chip common stocks and more risky common stocks. The stock of the closed end company is priced in the same market as the stocks in which it is investing, and is represented on the right-hand side of the balance sheet.

Now consider the expected effect on the *current* market value of the closed-end's stock of changing the composition of the investments to a 100/0 allocation to blue-chip equities. So long as transactions costs are small and it sells and buys the stocks at fair prices, the current price of its stock should be largely unaffected by the move. The change in risk is easily neutralized by the shareholders of the company.

We can reach a similar conclusion regarding asset reallocation within the pension plan if we consider the “economic balance sheet” of the corporation represented in Figure 1b. The *economic* balance sheet differs from the standard *accounting* balance sheet in that all entries are market, as opposed to accounting or book values. Thus, the balancing entry on the right-hand side is the market value of the firm's stock, rather than the book value of equity capital. Represented on the left-hand side of the economic balance sheet are the pension assets that, for many firms, are a sizable fraction of total corporate assets. Represented on the right-hand side is the market value of pension liabilities. Because the projected future cash flows (forming the basis of the market value of the firm's non-pension assets) are based on the future productive service of active employees, the market value of the pension liability goes far beyond the liability to retired workers. It reflects amounts expected to be eventually paid to active workers based on past and *future* service. Importantly, the economic value of the pension liability also reflects the probability of default on the pension promise, much as would the economic value of corporate debt reflect the potential for default on interest payments.

<p><b>Figure 1b</b>                  ECONOMIC BALANCE SHEET                  (CORPORATION)</p>	
Corporate Assets Pension Assets	Corporate Liabilities Pension Liabilities Common Stock

What is the expected impact on the stock price of a major restructuring of the asset allocation within the pension plan? Assume, temporarily, that there is no guarantee by the Pension Benefit Guarantee Corporation on pension benefits. Suppose there is a massive shift in asset allocation within the plan so as to change the risk characteristics of the equity component of the pension plan's portfolio, or a similar shift between equity and fixed-income securities. The consequences of such a shift will surely affect the *expected return* to the assets of the pension fund. However, if the assets are traded at fair prices, the change in the asset allocation should have no effect on the market value of the pension assets on the left-hand side of the economic balance sheet. Given this, will the shift in asset allocation leave the market value of the firm's common stock unaffected as well?

That depends. While the market value of pension assets remains intact, the reallocation of pension assets may trigger *secondary wealth transfers* between the employees and the stockholders of the firm.

Suppose, for example, the risk associated with the pension investments is substantially increased. To the extent that this increases the probability of default on the pension plan, the market value of the pension liability is reduced. Since common stock is the balancing entry in the economic balance sheet, if nothing else occurs, the value of the common stock should increase, reflecting a transfer of wealth from the employees of the firm to its common shareholders.

However, an important, countervailing effect can now be expected to appear. Since the market value of the employees' claim to their pension income has been reduced, unless their bargaining position has somehow been reduced as well, they can be expected to press for renegotiation of their compensation package to restore its former value. If they choose to renegotiate promised pension benefits, the market value of the pension liability can be restored. If they renegotiate for increases in direct compensation, or fringe benefits, expected future cash outflows to labor will increase, and the market value of corporate assets will be reduced, lowering the value of the firm's common stock to its former value. In any case, in the presence of a well functioning labor market, the market value of the common stock should not be significantly affected by the reallocation of investments within the pension fund.

Now suppose pension benefits are guaranteed by an agency such as the PBGC. Assume also that the premium schedule is such that insurance premiums paid to the PBGC by the firm increase as the funded status of the pension deteriorates. (This is indeed the case under the Omnibus Budget Reconciliation Act of 1987.) How are the secondary wealth transfers affected by the presence of the guarantee?

Given market confidence in the PBGC guarantee, the market value of the pension liability should remain intact even if the risk of pension investments, and the probability of default by the *firm*, is increased. The PBGC now bears the burden of any increase in the probability of default within the pension plan. Once again the common stockholders enjoy the prospect of a secondary wealth transfer, but this time the potential source is the PBGC rather than the employees and plan beneficiaries. Why only a *potential* wealth transfer? Because the increased probabilities of deterioration in the plan's funded status also increase the expected value of future premiums paid by the firm to the PBGC. Increased cash outflows- going to the PBGC in the form of additional premiums require a corresponding reduction in the present value of corporate assets. To the extent the potential wealth transfer induced by the increase in pension risk is recaptured by the PBGC through the nature of their premium schedule, secondary wealth transfers to common stockholders are once again mitigated.

Viewed in this context, the effects of risk management within the pension plan should have a relatively insignificant effect on the welfare of the firm's common stockholders. The firm's other three constituents, however, stand to benefit significantly from the activity.

### **III. Pension Risk Management and the Welfare of Management's Other Constituents**

Now consider the perspectives of customers, employees, and suppliers. Unless they own some stock, they are not very interested in maximizing its value. Instead, they are jointly concerned about maintaining a prolonged, stable relationship with a healthy firm.



Prospective customers want a continued source of supply of the firm's goods and services. This is especially true for firms with a lengthy expected product life. Customers count on a continuing relationship with the firm for future service. Thus, corporate risk management can be a potentially important determinant of product demand.

Employees want stable employment. Job stability may have an impact on the firm's ability to attract good people, as well as on the level of their required compensation. There are many elements of the total employee compensation package: In addition to direct compensation, these include fringe benefits, working conditions, and *job security*. There are significant transactions costs associated with changing employment, and given two identical positions—one with a volatile firm and another with a more stable firm—one would expect the required direct compensation to be smaller for the more stable firm. This keeps the *total* compensation package in balance.

The firm's suppliers also want a prolonged, stable relationship. With economies of scale in their own production, marketing, or distribution process, the expected term and stability of this relationship may affect the effort they are willing to expend in terms of service and the price they charge for their products.

All these people are interested in the firm's survival, and their welfare is enhanced by optimal risk management in the pension plan in the same way that their welfare is enhanced by insuring the main plant against fire. Moreover, their interest potentially can connect the firm's risk management activities to both costs and revenue.

## **IV. Risk Management in the Financial Sector and In the Firm's Basic**

### **Business**

The firm conducts its operations in both the real and the financial sectors of the economy. Pause and imagine the terrain—in terms of relative net present values—for different investment opportunities in these two sectors.

The real sector—where capital goods, consumption goods, and services are traded—is hardly characterized by perfect competition. Because of this, when the firm faces its array of real investment opportunities, some will be clearly more profitable than others. When picturing different investment opportunities in terms of their relative net present values, the terrain here has tall mountains and deep valleys. The consequences of selecting one production opportunity over another may go well beyond the secondary wealth transfers discussed above. If adopted, the more profitable projects of the real sector may dramatically increase the *current market value* of the firm's common stock relative to the less profitable projects. However, the most profitable projects may also be the ones which will increase the *risk* of the firm. Adopting these projects may put the firm at greater risk, but they must be adopted if the management is to benefit its stockholders. If the firm is to actively engage in risk management, it must find ways that do not significantly penalize its stock price.

The financial markets, on the other hand, are characterized by near perfect competition. These markets are relatively efficient in the sense that security prices usually reflect a reasonably fair assessment of the value of the claim being traded. The terrain here is nearly as flat as America's central plains. Aside from the secondary wealth transfers discussed above, management can select from a wide variety of investment opportunities in the financial sector without materially affecting the current value of its common stock. Thus, when trading in these markets, the firm can act to reduce the overall risk of its operations without materially affecting its stockholders.

In financing a capital investment, for example, the stock price should be relatively unaffected by a decision to finance with short-term, as opposed to long-term, debt. The *risk* of the firm is affected by this decision, however. If the investment being financed produces cash flows over a longer period of time into the future, management will reduce the risk of the firm by matching the term of the financing to the term of the cash flows produced by the investment. Financing with short-term debt exposes the firm to the risk that interest rates may be much higher when the short-term debt matures. The firm may have to refinance at an interest rate which can't be supported by the cash flows of the investment project. The firm's financial health may now be in jeopardy.

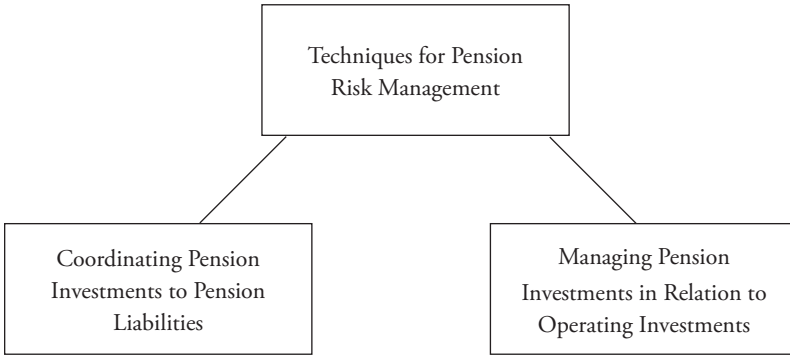
In reality, when management deals in the financial sector, it usually takes actions that are consistent with reducing risk because, although they are subject to the very same secondary wealth transfers discussed above, choices in the financial sector have little effect on the market value of its stock. Thus, if the firm has liquid funds that are to be used in the near future for short-term commitments, it usually invests these funds in the money market, matching the maturity of the investments with the timing or maturity of the commitments. When expanding inventories, it finances the expansion with short term debt instruments, and when constructing major, long-term investment projects, if it finances with debt at all, it usually finances with long-term bonds. In effect, it is seeking to coordinate the structure of its liabilities with the nature of its invested assets, much in the same way a pension fund might coordinate the structure of its investments in the financial sector with the nature of the pension liabilities.

## V. Techniques of Pension Risk Management

Figure 2 provides a basic organization for the techniques of pension risk management discussed in this article. Risk management within the pension fund may focus on (a) preserving funded status relative to some concept of the pension liability or on (b) diversifying pension investments relative to the firm's other operational investments. Setting aside contributions made by the beneficiaries themselves, pension benefits will ultimately be paid from the *returns from investments* made by the pension fund itself and from *cash contributions* to the fund made by the corporation. Strategy a focuses on enhancing the probability that pension benefits can be paid from pension assets, while strategy b attempts to increase the probability that, if the firm is called upon to increase its support for the plan, it will be in a comfortable position to do so. In essence, the first focuses on managing plan assets to maintain *funded status (surplus) relative to the pension liability*, while the second focuses on managing plan assets to maintain *funded status relative to underlying corporate strength*. Under the second strategy plan assets are

managed to reduce the probability that significant adverse developments in the firm's basic business will accompany significant increased required corporate contributions to the pension plan. Both strategies are consistent with the form and objective of the company's generalized risk management activities.

**Figure 2**



An example of type a risk management is the popular dedicated or immunized bond portfolio strategy. An example of type b risk management are investments in foreign securities by pension funds. To the extent that foreign markets and economies have low degrees of correlation with the domestic economy, increasing pension investments in foreign markets reduces the probability that deterioration in funded status and required increases in pension contributions will coincide with adversity in the firm's basic business.

The two strategies are not mutually exclusive. For example, to the extent that the firm is overfunded relative to the pension liability, the overfunded component of plan assets might be directed at the second strategy, while the remaining component might be managed to maintain and enhance its existing relationship to the liability.

## VI. Managing Funded Status Relative to the Liability

Figure 3 shows the economic balance sheet for a corporate pension fund. This balance sheet is best thought of as a component of the aggregate economic balance sheet for the firm as a whole. Pension liabilities are represented on the right-hand side of the pension balance optimal positions sheet, while the invested pension assets are on the left. The Xs denote the weights or positions in each of the investment components.

In modern portfolio analysis, weights are assigned to the various investments in the portfolio. They denote the fractions of the investor's wealth in each investment. Long positions carry positive weights and short positions, which would be represented on the right side of this balance sheet, carry negative weights.

**Figure 3** *Economic Balance Sheet for Corporate Pension Fund*

ASSETS	LIABILITIES AND SURPLUS
$X_1$ Small Stocks	$X_{n+1}$ Pension Liability
$X_2$ Large Stocks	<hr/>
$X_3$ Corporate Bonds	Surplus
...	
...	
...	
$X_n$ Venture Capital	

Pension funds rarely sell short, but through the pension promise, they have in fact taken negative positions in their pension liabilities. Should these short positions on the *right* side be considered in the allocation of the assets on the *left*-hand side of the pension balance sheet? It seems intuitively obvious that they should. Just as modern portfolio analysis takes the character of short positions into account in determining the nature of the long positions, so should a pension fund account for the properties of its liabilities in making allocation decisions for its invested assets.

However, most pension funds, if they manage risk at all, concentrate exclusively on the risk associated with the portfolio of invested *assets*. If, instead, liabilities are to be given their due consideration, the focus shifts from one of managing the risk associated with the assets to managing the volatility of the pension *surplus*.

Relative expected return considerations aside, surplus risk is minimized by investing in assets that correlate positively with changes in the value of pension liabilities. Ignoring changes in actuarial assumptions about early retirement and mortality, the dominant factor governing changes in the value of nearly all concepts of the pension liability is interest rates. Should interest rates fall, the appropriate rate of discount used to bring future benefit payments to a present value will fall as well, increasing the present value of the liability. Since long-term bonds are interest-sensitive, they are most commonly suggested as the type of investment that will reduce the volatility of pension surplus.

Unfortunately, long-term bonds also have relatively low expected rates of return. Thus, there is a significant reduction in overall portfolio return associated with reducing surplus risk by increasing the portfolio weights in long-term bond investments.

Optimal choices in asset allocation for pension plans require a careful balancing of *expected return* and the *correlation* between pension assets and liabilities. By the power of compound interest, increasing investments in high-return equities drives down the possibility of funding shortfalls in the long run. However, the volatility of equities and their low degree of correlation with pension liabilities drives up the possibility of funding shortfalls in the short run. Increasing investment in long-term, low-return, fixed-income securities, of course, has the opposite effect.

To extend the expected life of the firm, the relative investment in both must be carefully balanced, and this balance must reflect management's relevant horizon period. For example, if the relevant horizon extends only five to ten years out, the relative investment in bonds with maturities that are comparable to pension liabilities may be increased.

In this context, risk management in the pension fund may be viewed as a dynamic process where both the relevant horizon and the optimal pension strategy may change with (a) changing economic conditions and (b) changes in the firm's operational strategy. The pension strategy that is optimal in terms of risk management is also dynamic, changing with firm prosperity and strategy.

As discussed above, in perfectly competitive financial markets focusing on the long term, short-term focus on funded status relative to liabilities *at all* should be expected to have no effect on the current market price of the firm's stock. It is still the case, however, that given their lower compound return, increasing pension investments in long-term bond investments may still mean that surplus risk may be reduced in the short run, but increased in the long run relative to stocks, as their relatively high expected returns eventually compound to larger expected terminal values.

An alternative to bond investments is to construct a stock portfolio that has a dependably high degree of interest sensitivity. As it turns out, this strategy may reduce pension risk in both the short term and the long term.

## VII. Interest-Sensitive Stock Portfolios

Table 1 shows the results of a simulation that spans the period 1974 through 1987, whereby an interest-sensitive stock portfolio is constructed from a base sample of the 400 equities with the largest market capitalization on the NYSE at the beginning of 1974.<sup>1</sup> The portfolio is reconstructed at the beginning of each year and is designed to minimize the volatility of the differences between its return and the return to a 10-year, zero-coupon bond, (which has roughly the same interest sensitivity as an Accrued Benefit Obligation (ABO) under FAS 87). The weights in the portfolio are set based on rates of return on the stocks and the 10-year, zero-coupon bond during the 2-year period *prior* to portfolio construction. The weights are allowed to drift in the course of the year as relative market values change. At the end of each year the portfolio is reconstructed, again based on returns in the trailing 2-year period. The portfolio weights are constrained to be positive, with no more than 3% in any one stock and no more than 10% in any one industry. Thus, the portfolios are not dominated by holdings in utilities and financial companies. The results reflect an assumed transactions cost of 1%, a conservative figure for an institutional trader.

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<sup>1</sup> Source: Interactive Data Corporation database. Patent applied for on portfolio construction process.

TABLE I. Results for Simulated Period 1975-1987

	Interest Sensitive Stock Portfolio	S&P 500 Stock Portfolio
Average Return	19.2%	16.3%
Correlation with 10-Year Liability	70.0%	33.0%
Return Volatility	14.0%	14.0%

Table 1 shows that the portfolio has a significantly greater degree of correlation with the 10-year “ABO liability” than does the S&P 500 index. The superior correlation is shown clearly in Figures 4 and 5, which plot the returns on the two stock portfolios against the returns to the 10-year zero coupon bond.

Interestingly, the portfolio of interest-sensitive stocks also has a higher average return than its S&P 500 counterpart. Thus, pension funds adopting such a strategy in this period could have reduced surplus volatility without lowering expected return—the result associated with increasing investments in bonds. As discussed above, as long as both bonds and stocks are selling at fair prices, this means little to the current market value of the firm’s stock. Nevertheless, increasing the compounded expected return to pension assets does have a definite bearing on the relative ability of the pension fund to meet its obligations *in the long run*.

Figure 4a. Portfolio versus Liability (Annual Returns)

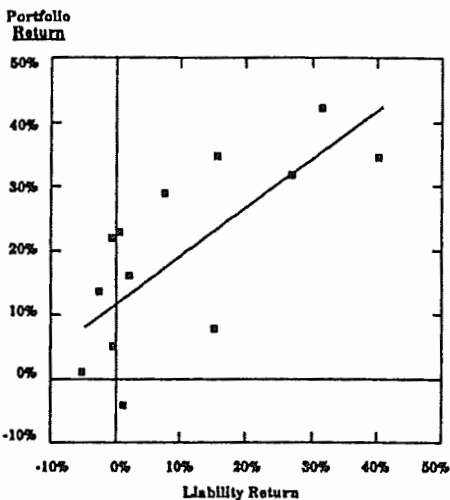
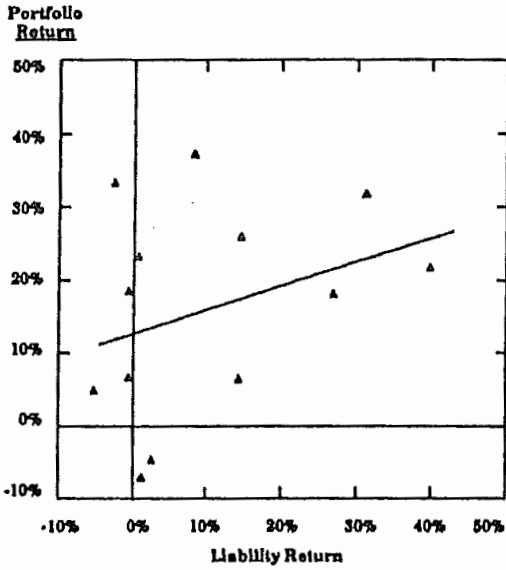
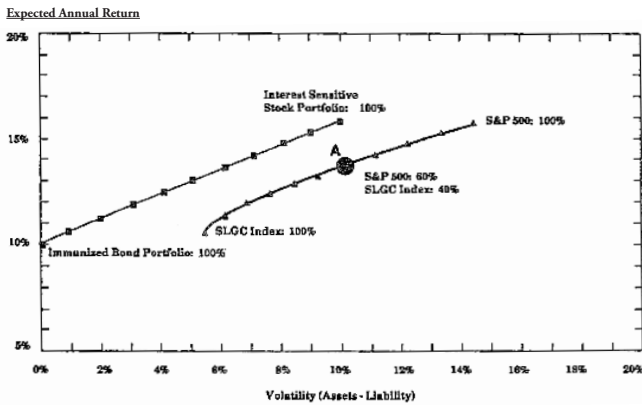


Figure 4b. S&P 500 versus Liability (Annual Returns).



The extent to which surplus risk can be reduced with interest-sensitive stock investments, both in the short run and in the long run, is considered next.

Figure 5. Efficient Frontier Comparisons



## VIII. The Effect of Shifting to Asset-Liability Management

The expected return to pension assets against expected volatility in pension surplus is plotted in Figure 5. We are focusing on sources of ABO volatility stemming from investment-related factors. Thus we do not consider changes in the ABO resulting from demographic changes in the work force, changes in early retirement experience, or changes in experienced mortality. Rather we focus on changes in the ABO present value stemming from changes in interest or discount rates. We also assume that the plan is fully funded relative to its liability. In terms of the economic balance sheet of Figure 3, this means that the weights on the left-hand side sum to 100% and the weight assigned to the pension liability is -100%. Surplus is zero.

First consider the point labeled “A”. This represents an asset allocation whereby 60% of the funds are invested in a portfolio of stocks perfectly indexed to the S&P 500 and the remaining 40% are invested in a portfolio of bonds indexed to the Shearson-Lehman Government-Corporate Index. The position of the portfolio relative to the *vertical* axis reflects an assumed expected return of 10.7% for the bonds and 16.30% for the stocks. These numbers are taken from the average rates of return to these investments during the period of the simulation discussed in the previous section, 1974 through 1987. Portfolio A’s position relative to the horizontal axis reflects the respective volatilities and correlation of the S&P and Shearson-Lehman indexes with the assumed 10-year duration pension liability, also during the period of the simulation.

The curve running through point A shows the impact of shifting away from a 60%-40% mix between the S&P 500 and the Shearson-Lehman Index. The lowermost point represents a 100% investment in the Shearson Lehman Index. The uppermost point, on the other hand, represents a 100% investment in the S&P. Other points on the curve represent intermediate positions at 10% portfolio weight increments.

Now consider the points along the straight line to the left of the curve. At the lowest extreme, we have a strategy where 100% is invested in 10-year, zero-coupon bonds—an immunized bond strategy. Since both the investment and the pension liability have precisely the same interest sensitivity, the periodic differences in their returns is always zero by assumption. The fact that the anchor point for this line is riskless accounts for its linearity. Note that the 10-year zero is assumed to have a 10% expected return, which is also its average return during the simulation period.

Now consider the other end of the line. This portfolio represents a 100% investment in interest-sensitive stocks. The portfolio is assumed to have the volatility and correlation characteristics of the interest-sensitive stock portfolio shown in Table 1, and to have the same expected return as the S&P 500. In moving from one extreme point to the other, we once again increase the investment in the interest-sensitive stocks in 10% increments.

Note that the standard 60%-40% allocation of point A is dominated by a number of the portfolios in the linear “efficient set.” In moving away from the standard allocation, the pension fund can actually increase its expected return to its assets while reducing the volatility of its surplus. Because of this the



risk of underfunding is reduced in the short run as well as the long run. The reduction in the threat of the pension fund to the survival of the firm is actually associated with an increase in expected return.

## **IX. Managing Pension Assets Relative to the Firm's Economic Strength**

Managing pension assets in relation to pension liabilities is an important factor in managing pension risk, but corporate risk must also be considered to complete the picture.

Obviously, each firm faces a unique set of potential problems in its business, so appropriate solutions to these problems will thus be peculiar to each firm as well.

To illustrate a single case, consider an aerospace company that has contracted to deliver a series of airplanes to a commercial airline corporation at a fixed price. The principle threat to the manufacturer is an inflation rate that turns out to be higher than expected during the period of the contract. This threat can be addressed by adopting investment strategies that are consistent with hedging against unexpected increases in the inflation rate with a portion of pension assets. Stock portfolios can be constructed that can be expected to outperform the market averages when the rate of inflation is above its expected value and underperform when it is below.

Now consider a different firm that is instead sensitive to swings in the business cycle. By investing in the equities of firms of quite the opposite nature, the cyclical firm can hedge against its own volatility. In this way, required increases in corporate contributions to the pension fund will be more likely to come in periods of corporate prosperity when they can be comfortably funded.

In both these applications the probability of meeting benefit obligations is enhanced by increasing the probability that the firm will be able comfortably to make additional cash contributions to the pension fund when and if they are needed.

How does managing pension assets in relation to pension liabilities *interface* with managing pension assets in relation to corporate strength? The horizontal axes of Figures 6a and 6b plot the firm's yearly minimum required contribution to its pension plan. This minimum level is unknown going into each year, being dependent on the year's investment results and actuarial experience. The minimum is determined by management, considering legal requirements as well as the economics of the funding situation. For purposes of this discussion, *management feels it imprudent to contribute less than the defined minimum, and they are willing to make sacrifices in the basic business to avoid doing so.* The vertical axes of Figures 6a and 6b plot the cash flow available for contributions after considering the firm's cash revenues and operating costs, capital expenditures and funds raised through optimal levels of external finance, as well as the costs associated with financing in place, including interest expense and the stockholder's annual dividend. This available cash flow is also unknown at the beginning of each year.

Figure 6a.

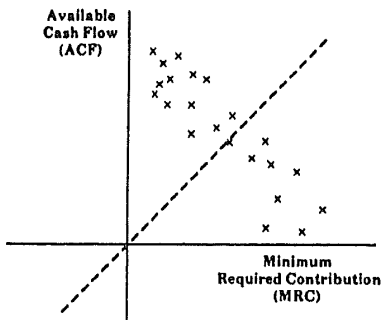
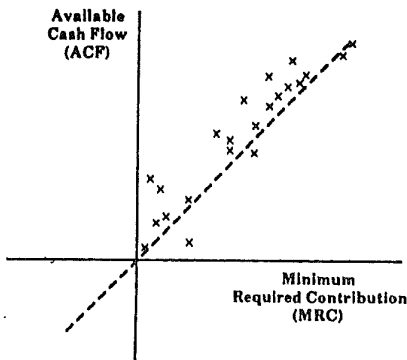


Figure 6b.



If, in a given year, management ends up in a position (denoted by an “X”) above the 45 degree broken line, available cash flow is more than adequate to meet the minimum required contribution. If, on the other hand, they find themselves below the broken line, management faces some hard choices. Either (a) the funded status of the pension plan must be allowed to deteriorate to what has been defined to be an unacceptable level, or (b) the firm must either trim capital spending, raise additional, and presumably sub optimal, amounts of money from external sources, or cut the common dividend. In short, if the firm finds itself below the broken line, the funding of the pension plan induces sub-optimal behavior in the firm’s basic business.

Each asset allocation selected by the pension fund implies an expected pattern of experience in terms of

cash required and cash available. The asset allocation represented in 6a is one where plan assets tend to produce high returns (and, thereby, reduce required contributions) when the firm is producing a relatively high level of cash flow (a domestic auto company investing pension assets in domestic auto stocks). On the other hand the asset allocation of 6b tends to produce high returns in times of corporate weakness (a domestic auto company investing in *foreign* auto stocks). Note that both allocation strategies have the same volatility of cash contribution requirements. Thus, the volatility of pension *surplus* is likely to be very similar as well.

As indicated in Figure 7a, both strategies may be on the efficient set when it is drawn in terms of the volatility of pension surplus. However, as we see in Figure 7b, where risk is defined in terms of the difference between cash available and cash required, the asset-allocation strategy B is dominant. The firm is likely to experience fewer funding problems with B, because higher minimum required contributions are more likely to come at times when the firm is better able to make them.

Viewed in this way, we can clearly see where the various components of the asset-allocation problem comes into play. Suppose first that fund managers concentrate on assets alone in making the decision. To the extent that they act to increase expected asset return, they reduce the expected minimum required contribution in Figures 6a and 6b, but, if they ignore pension liabilities and manage the volatility of asset returns, they leave the *volatility of the minimum required contribution* largely unmanaged. These pension funds are likely to take inefficient positions, even in terms of Figure 7a. If, on the other hand, liabilities are considered, efficient positions can be taken in terms of 7a, but these may still be inefficient in terms of 7b. To minimize the chance of interference in the basic business, and to maximize the expected life of the firm, pension asset returns must be simultaneously coordinated with both liability requirements as well as with corporate strength.

Figure 7a

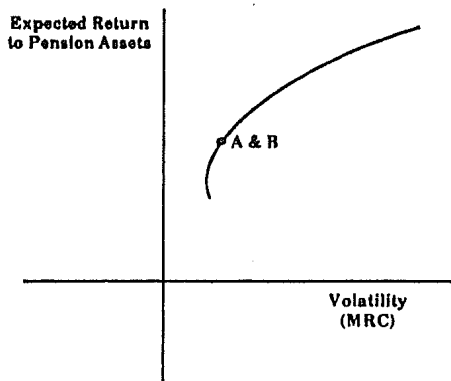
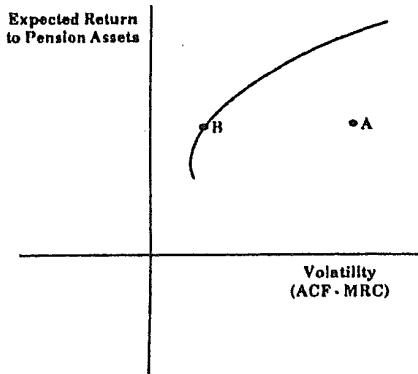


Figure 7b



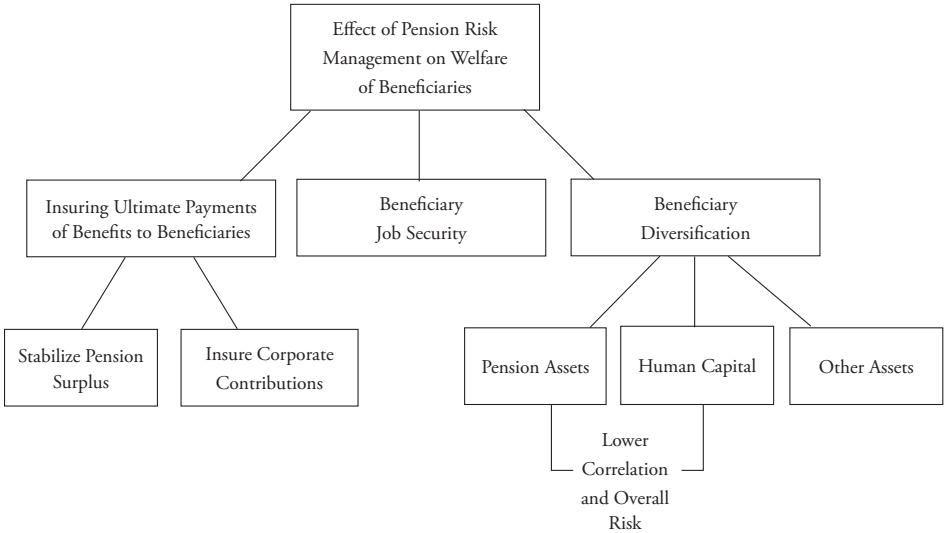
## X. The ERISA Law and Pension Risk Management

Managing pension assets to hedge against (a) unexpected changes in the value of the pension liability and (b) unexpected changes in the underlying profitability of the firm's other assets are *both* consistent with increasing the probability that pension benefits will ultimately be paid as promised. The first strategy increases the likelihood that invested pension assets themselves will be sufficient to cover promised benefits, while the second ensures that if additional corporate contributions are required, the firm will be able to meet them without difficulty. Thus, both strategies enhance the welfare of pension beneficiaries.

As Figure 8 shows, pension risk management has other implications for the welfare of beneficiaries. In addition to increasing their job security by extending the expected life of the firm, and, therefore, the expected value of future cash flows to their human capital, pension risk management also has desirable diversification benefits. We have broken the wealth of beneficiaries into three parts—pension assets, human capital (the present value of expected future earnings), and other assets or investments. Given the significant transactions costs associated with changing employment, changes in the “market value” of the beneficiaries' human capital are likely to be positively correlated with changes in the profitability of the firm. To the extent that pension assets are managed so as to reduce their correlation with the firm's basic business, this enhances diversification and reduces the risk associated with the beneficiaries' overall portfolio of assets. Quite the opposite would result if the firm were instead to make pension investments in its own stock. This increases the beneficiaries' stake in the firm, increases their risk, and

increases the risk of the firm at the same time. Such a strategy is obviously Pareto sub-optimal. We might also note that strategies of this type have, in fact, resulted in legal actions under ERISA.<sup>2</sup>

**Figure 8**



## XI. Summary

Pension assets have grown to become the most significant component of the economic balance sheet for many firms. They constitute a potentially powerful tool for reducing the overall risk associated with corporate operations and extending the expected life of the firm. Because most pension investments are priced in the highly competitive financial sector of the economy, this extension can be accomplished without material effect on the firm's stock price. However, the welfare of management's other significant constituents, including the pension beneficiaries, can be significantly enhanced by pension risk management.

## Reference

Arnott, Robert, and Peter L. Bernstein, "The Right Way to Manage Your Pension Fund," *Harvard Business Review* (January-February 1988).

*Editor's Note: Reprinted with permission from Managing Institutional Assets, edited by Frank J. Fabozzi, 1990, HarperCollins.*

<sup>2</sup> Section 407 of ERISA states that no company should invest more than 10% of plan assets in qualified employer securities.

Comments on

## “Pension Investing and Corporate Risk Management”

by Charlie Cahill

Today many pension consulting actuaries and investment consultants incorporate corporate risk management concepts when they advise their clients on the management of their pension plans and the plans' assets. It is safe to say that in 1990, when Robert Haugen, Ph.D., issued his article “Pension Investing and Corporate Risk Management,” these concepts were rarely incorporated in the advice given or the investment policies adopted by plan sponsors. Hindsight being 20/20, we know today that if plan sponsors and their advisers had reflected risk management techniques in managing their plans over the last 23 years, the security of those sponsors and their plans would have been stronger.

Haugen clearly lays out the basic concepts of corporate risk management, how those concepts can be applied to pension plans, and why it is important to sponsors to apply them. To quote Haugen, “Since the corporation ultimately stands behind pension liabilities, risk management within a pension plan can now play a meaningful role in the firm's overall risk management.”

The world has changed in many ways since 1990. Haugen bemoans that pension plan liabilities warrant only a mere footnote on financial disclosures on corporate balance sheets, pointing out that General Motors' assets were twice the size of its market value—oh the irony! The interest rate environment has certainly changed since the paper was authored as the author uses 10 percent as the proxy for the risk-free rate of return, as that had been the average rate on 10-year Treasuries for the prior decade. Today rates are much lower and most advocates of “financial economics” would use a spot rate for such calculations. However, while disclosure requirements have significantly increased and interest rates are much lower (and maybe somewhat less risky), the concepts and principles discussed in this paper remain important to actuaries and plan sponsors in today's world.

### Overview of the Paper

Haugen's paper is organized into 10 sections, essentially flipping between broader corporate risk management topics and then applying the concepts to pension plans. The paper focuses on the asset side of pension plans rather than on “risk management” from a liability perspective (e.g., plan design—final average vs. career average vs. hybrid designs, lump sum and annuity settlements ...).

Haugen states that corporations have a “long standing tradition of risk management.” (Section I—Corporate Risk Management). What was a tradition in 1990 has become institutionalized in many, if not most, corporations, which have now have added chief risk officers to the “C” suite. Corporations “avoid interest-rate risks by matching up the term of debt financing with the expected life of the projects being financed.” For example, short-term financing is used to increase inventory and long-term

financing is used for longer-term projects (e.g., building a plant). Further, corporations hedge against unpredictable events that will impact their business like foreign exchange rates and commodity prices.

While risk management does not theoretically change the value of the corporation (owners/stockholders can theoretically mitigate the risks on their own), corporations are compelled to take such interest to protect the interests of their customers, suppliers and employees (Section III ...the Welfare of Managements Constituents). These stakeholders are counting on the survival of the company and the company relies on these stakeholders; customers want a continual source of supply, employees want stable, attractive employment, and suppliers want long-term stable relations. Strong risk management increases a company's stability and the probability of survival, and therefore benefits these stakeholders.

On the pension side (Section II—Corporate Risk Management Within the Pension Plan), while allocating assets to lower risk has no impact on shareholders (the market value of a bond equals the market value of a stock), it does impact the other stakeholders as they can shift their investments in their personal accounts based on the asset allocation of the plan. Of course, this is theoretical and ignores different tax treatments, and assumes the shareholders have full transparency/awareness of the pension plan's asset allocation. Haugen points out that a "secondary wealth transfer" between shareholders and employees occurs by increasing asset allocation to equities rather than bonds. The equities have a higher expected return because they also have higher risk. For employees this means a higher probability of default on their pension promise, and therefore the promise has less value. Employees countervail this effect by demanding higher benefits or higher wages. Haugen again predicted the behavior found too often in the '90s—sponsors took on more risk and employees demanded higher benefits. When markets and rates turned we know what happened.

Haugen points out that the Pension Benefit Guaranty Corporation (PBGC) promise mitigates this "secondary wealth transfer." Consistent with the nature of PBGC coverage we now find bigger problems with Taft-Hartley plans that have lower PBGC coverage and higher premiums (MAP-21) for single employer plans that have better PBGC coverage.

Haugen discusses the difference in the risks companies face in the financial sector versus the "real" sector where the company operates (Section IV—Risk Management in the Financial Sector and In the Firm's Basic Business). The basic conclusion is that companies should take their risks in the "real" sector where they do business and those risks can lead to increasing the market value of the company. In the financial markets where investments do not impact the market value of the company, actions should be of lower risk.

Pension fund risk management (Section V—Techniques of Pension Risk Management) focuses on two aspects: 1) preserving funded status; and 2) "diversifying investments relative to the firm's other operational investments." The first focuses on the probability that benefits will be paid by assets and the second on the probability that the company can contribute when required. Haugen uses immunized portfolios (what have now evolved into liability-driven investment (LDI)) as an example of the first aspect. He uses investing in foreign securities as an example of a technique to address the second aspect due to the low correlation with domestic equities. In the last 23 years the world economy has become

much more integrated and highly correlated, so this approach is not as helpful. However, looking at a company's ability to make contributions when times are tough is certainly an important aspect to pension fund management.

In Section VI—Managing Pension Fund Status Relative to the Liability, Haugen adroitly discusses the nature of these risks. He points out that through the pension promise sponsors have taken a negative position in their pension liabilities. The character of this negative position should be reflected in the pension investments. In 1990—almost 20 years before the current interest in LDI—Haugen wrote, “Surplus risk is minimized by investing in assets that correlate positively with changes in the value of pension liabilities.” He discusses optimizing asset allocation by balancing expected return and correlation between assets and employing a dynamic process that reflects time horizon, economic conditions and the company's operational strategy.

Haugen discusses the merits of “interest sensitive stock portfolios” in Section VII—a technique that I do not believe was widely adopted and probably had more merit at the time retrospectively than it turned out to have prospectively.

In Section VII—The Effect of Shifting to Asset-Liability Management, Haugen analyzes the merits of this approach at a basic level and relying on the thinking of Section VII. The tools and analysis used today are much more sophisticated.

In Section IX—Managing Pension Assets Relative to the Firm's Economic Strength, Haugen incorporates the importance of corporate risk considerations in managing pension assets. He illustrates this by highlighting the risks of pension funding requirements for corporations that are inflation or interest rate sensitive. These companies need to hedge these risks as the pension cash calls are likely to occur at the same time the corporation is experiencing business strain. Haugen illustrates the difference in the timing of cash requirements for pension investments that match and do not match these risks. Haugen concludes: “To minimize the chance of interference in the basic business and to maximize the expected life of the firm, pension asset returns must be simultaneously coordinated with both liability requirements as well as with corporate strength.” This is certainly a worthy goal.

In Section X—The ERISA Law and Pension Risk Management, Haugen points out that inappropriately risky pension strategies can result “in legal actions under ERISA.”

## Conclusion

Professor Haugen passed away this year. We are thankful for the contribution to the pension industry made by this article. If plan sponsors and their advisers had better understood the concepts discussed in this paper in 1990, plans would have been better served. Pension risks are better understood and managed today due to the thinking and analysis presented in this paper.

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## Response to Comments by Charlie Cahill

By Aaron Weindling

This space would ordinarily have been reserved for Dr. Robert Haugen's response to Charlie Cahill's review of his paper. Because Haugen has recently passed away, I was asked by the SOA Pension Section Council to provide brief comments.

I became an actuary shortly after this paper was published, but I did not become familiar with the concepts described in the paper until much later. I suspect that those embarking on actuarial careers today will be exposed to these ideas earlier in their careers. As Cahill noted, many of these concepts have in some form become accepted principles of pension plan management.

Reading the article felt like reading an insightful, decades-old science fiction novel that predicts the present day. Some concepts that may have seemed unlikely at the time have now been validated. Others, as Cahill describes with regard to the "interest sensitive stock portfolio" concept, did not gain traction. Still other ideas were addressed differently by Haugen than they might be in today's literature, but are similar in essence.

The last decades were marked by dramatic capital market events, both positive and adverse. The impact of this volatility contributed to the recognition that risk management for pension plans was important, but this idea had been less generally accepted at the time of this paper's publication. Which thoughts of today—published and available, but viewed as only theoretical—will be confirmed by upcoming experience? What do actuaries overlook now that will seem obvious in retrospect?

The primary benefit that I gained from revisiting Haugen's paper was not technical; it was reinforcement of how important it is to stay abreast of the state of actuarial art, which would in 1990 have included this paper. It is interesting to consider what might be said about our profession 25 years from now, roughly the same time as has elapsed since Haugen's paper was written. I hope that discussion will celebrate theoretical advances, practical application of new ideas, and favorable results for plan sponsors and participants. An ongoing commitment to learning is an important step toward making that happen.

*Aaron R Weindling, FSA, FCA, EA, MAAA, is a senior consulting actuary at Towers Watson in Philadelphia, Penn.*



