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PENSION FORUM TABLE OF CONTENTS

Page

Reinventing Pension Actuarial Science 1
by Lawrence N. Bader and Jeremy Gold

Discussions on Reinventing Pension Actuarial Science
Back to the Future: Is the cure worse than the ill? 14
by Thomas B. Lowman
Reinventing Pension Actuarial Science 17
by Robert T. McCrory and John E. Bartel
Bodie's Perspective 24
by Zvi Bodie
Response to McCrory-Bartel Discussion of Bader-Gold 25
by John Ralfe
North's Perspective 26
by Robert C. North, Jr.

Authors' Responses 28

Selection of Asset Valuation Methods Letter 35
submitted to the Actuarial Standards Board

Defined Contribution Plans and Equitable Distribution 39
by Ralph Garfield

Designing an International Pension Program for Mobile Employees 45
by Lisa A. Larsen

Turnover Rates and Compensation Levels 55
by Alan C. Pennington

Reinventing Pension Actuarial Science

by Lawrence N. Bader and Jeremy Gold

Abstract

The 1974 passage of ERISA halted the evolution of the actuarial pension model. This frozen model was unable to incorporate the emerging science of financial economics, which in turn revealed fundamental flaws in the model. Contrary to the teachings of financial economics, the actuarial pension model anticipates expected outcomes without reflecting the price of risk. It then camouflages the risky distribution of outcomes by various smoothings and amortizations.

The flawed pension model has caused widespread, though rarely recognized, damage to pension plan stakeholders. This paper illustrates the flaws and the injuries they cause.

To protect the pension system and the vitality of our profession, we urge pension actuaries to reexamine and redesign the model. The new model must incorporate the market value paradigm and reporting transparency that is rapidly becoming a worldwide minimum standard in finance.

Introduction

At ERISA's enactment in 1974, the pension actuarial model was highly developed but still evolving. In the previous two decades, actuaries had adapted the model to handle the migration of plans from insurance companies to trustees and from fixed income investments to equities. Pension actuarial methods and assumptions were well suited to providing smooth contribution budgets for sponsor funding.

The actuarial model was less suited to financial measurement and reporting, and it did not adequately protect the members of plans with weak sponsors. Further, the model had not incorporated the nascent science of financial economics. (Also known as "finance," financial economics is a branch of microeconomics that comprises two fields often identified as "corporate finance" and "investments").

The timing of ERISA was inopportune for the continued development of the actuarial model. ERISA froze many aspects of the model into law and critically altered the pension actuarial culture. Subtly but certainly, the focus of pension actuarial creativity turned away from evolving the model to satisfying clients who needed to cope with ERISA.

Over time this new focus became a "game" played by consulting actuaries (trying to achieve client objectives despite, but notionally within, ERISA's strictures) and regulators and legislators (often reacting clumsily to the "creativity" of some actuaries). The result has been a myriad of overlapping, all but contradictory, rules that have made the operation of defined benefit plans excruciating. At the Enrolled Actuaries meeting, Segal and Manning (2002) summed up the resulting debacle in a presentation entitled "Stop the Insanity," which expresses the common exasperation of actuaries, sponsors, regulators, and participants.

With the ERISA freeze and the shift of creative focus to the ERISA game, the model had little room, and the practicing actuary had little will, to incorporate important lessons from financial economics. Some elements of financial economics[1] did not conflict with ERISA and the

[1] Especially the efficient frontier of Markowitz (1952) and the Capital Asset Pricing Model of Sharpe (1964), Linter (1965), and Mossin (1966).

existing pension actuarial model. Many pension actuaries have mastered and employed these tools.

Other teachings of financial economics (beginning with Modigliani and Miller (M&M, 1958)) conflicted with ERISA and have not been integrated into the actuarial model. Black and Scholes (1973) provided a sophisticated way to deal with financial options. Merton (1974) applied the option approach to the valuation of corporate securities and Merton (1977) analyzed financial guarantees like those offered by the ERISA-established PBGC. Pension actuaries have never, to our knowledge, used option technology to value options embedded in defined benefit plan liabilities, nor even to value plan liabilities in the context of the financial relationship between defined benefit plans and their sponsors.

Most pertinently, a sequence of work applying financial economics to defined benefit plans arrived during ERISA's first decade and was ignored by the actuarial profession.[2]

The lessons of M&M, Black and Scholes, and the defined benefit sequence challenge and threaten the existing actuarial model. Since the mid-1980's, financial engineers (i.e., those who profitably apply financial economics to the design of securities and transactions) have shown that they can exploit financial systems that ignore the teachings of finance. Because financial engineering is grounded in the world of markets (and the no-arbitrage model of pricing financial assets and liabilities), it can dominate the exploited disciplines.

As other financial professions have adapted to and capitalized on these developments, the response of pension actuaries has been dilatory. Although we have introduced the principles of modern corporate finance and investment into our syllabus, we have yet to test the actuarial pension model against these principles. Such a test would reveal pervasive fault lines in the model. Its lack of transparency hinders and misdirects plan sponsors and investors in their decision-making. Better informed market participants are able to exploit the arbitrage opportunities offered by the actuarial work product. The following problems are illustrative:

- Pension accounting conceals volatility and risk and anticipates unearned risk premiums.
- Public pension plans transfer risk to future generations through flawed funding practices, noneconomic transactions such as pension obligation bonds, and misguided design features like skim funds.
- Pension benefits are mispriced in negotiations and other compensation decisions, to the detriment of taxpayers and shareholders.
- Huge unfunded pension liabilities ("legacy costs") remain in the steel industry and elsewhere.
- Plan participants bear creditor risk that they are unable to evaluate or diversify.
- The assumption selection process unduly influences investment decisions and has an unhealthy connection to executive compensation.

This paper illustrates the impact of financial economics upon the venerable and vulnerable actuarial model. We call upon practicing actuaries to prepare for the inevitable application of financial economics to defined benefit finance (and to recognize several exploitations that have already occurred). The professional response must be to learn the science, recognize where it must be applied, support informed legislation and regulation, and direct our creativity to designing defined benefit structures that build upon the science of finance.

Part I: Some Corporate Finance Principles

In this section, we state several principles that are universally accepted in financial economics and almost as universally violated by the actuarial model.

[2] Treynor (1972), Sharpe (1976), Black (1980), Tepper (1981) and Harrison and Sharpe (1983).

Principle 1: $1 million of bonds has the same value at $1 million of equities. This is a tautology, of course, and no actuaries would dispute it. Yet the actuarial pension model, by focusing on expected returns while ignoring the market price for risk, implies that higher *expected* future values can be translated into higher present values. Consider a $1-million portfolio of 10-year zero-coupon Treasuries yielding 5% annually, and a $1-million portfolio of equities expected to return 10% annually. They have different 10-year expected values, $1,629,000 for the Treasuries and $2,594,000 for the equities. Yet, the present values of the returns of the two portfolios, *when correctly discounted to reflect risk*, are equal, because the value of a portfolio must equal the value of its returns.

The equality of the value of returns of all marketable securities is not an arbitrary quirk of financial economics; it is a fact on which financial transactions such as swaps are based. Swaps are agreements between two parties to exchange the return on two market instruments, and they give powerful insight into the arbitrage pricing that underlies financial economics. Understanding why swaps have a zero value, and why the actuarial model fails to show this fact, would lead pension actuaries far toward understanding the fundamental flaws of their current model.

Suppose a securities dealer offers you the following transaction. (We assume that there are no taxes or other frictions and no credit risk on either side.) Ten years from now, she will pay you the 10-year accumulation of $1,000,000 invested today in the S&P 500 Index; and you will pay her the 10-year accumulation of $1,000,000 invested today in 10-year zero-coupon Treasuries.

How much will you pay up front for this deal? Quite a lot, if you look at your expected net payoff: an expected accumulation of $2,594,000 of equities minus $1,629,000 for the Treasuries. The fair price, though, is zero. If you pay anything more than zero, the dealer can assure a profit as follows:

a. She pockets your up-front payment.
b. She borrows $1 million at the Treasury rate, with all interest and principal due in 10 years.
c. She invests the loan proceeds in the S&P 500. During the next 10 years, she earns the S&P return on her $1-million investment.
d. At the end of 10 years, she receives your payment of the Treasury accumulation and repays her loan.
e. She pays you the equity accumulation to fulfill her obligation under the swap.

The dealer has profited by your up-front payment without risking any capital. Therefore, in financial economics terms, the present value of the return on $1 million of equity, minus the present value of the return on $1 million of Treasury bonds, must equal zero. You can not get this answer by applying an actuarial discount rate to the expected payoff.[3]

Another way to see that the correct up-front payment is zero is to note that, as a riskless borrower, you could do the borrow-to-invest-in-equity transaction yourself, without the help of the dealer.

These results can easily be generalized by substituting corporate bonds or any other market portfolio for the equities or the Treasuries.

Principle 2: A fair trade of a marketed security or portfolio must occur at a market price. There are many exceptions of course, in which the party buying higher or selling lower than the market price does so voluntarily to gain an advantage not available in a regular market transaction. In the absence of such special circumstances, a trade away from market price should not be acceptable to a party who could have transacted in the public markets.

To illustrate this principle, we consider again the equivalence between a $1-million equity portfolio and a $1-million Treasury portfolio. Only the marginal investor is neutral between

[3] Gold (2002) illustrates the distribution of the swap outcomes, while Bader (2001) explains a correct discounting method.

these two portfolios. Those with greater risk tolerance will prefer the $1-million equity portfolio. They may even prefer, say, $800,000 of equities to $1 million of Treasuries as a long-term holding. Suppose that such an individual inherits a $1-million Treasury portfolio and wants to exchange it for equities. He would have a right to a full $1 million of equities. Although he would regard even a lesser amount as an improvement over the Treasury portfolio, if he gets anything less than $1 million of equities, he is surely being cheated by a counterparty who is enjoying an unwarranted profit.

Note that this principle does not depend on the investor's risk preferences. Nor does it depend on the efficiency or rationality of market prices; it depends only on their availability.

Principle 3: All parties to market transactions are entitled to full current information on the market prices of the relevant assets and liabilities. Transparent and timely financial reporting is necessary to ensure the application of Principle 2 in the financial markets.

Principle 4: A liability is valued at the price at which a reference security trades in a liquid and deep market. A reference security (or portfolio) has cash flows that match the liability in amount, timing, and probability of payment.[4] This principle follows from the fact that a company's pension liabilities are similar to debt. Their fair value should be found by discounting at the rates applicable to debt with similar creditworthiness, after factoring in the collateral provided by the pension fund.[5] Suppose that an investor is choosing between two corporations that differ only in that one must pay $1,629,000 to pensioners in ten years while the other must make an identical payment to financial creditors. (We assume that any collateral and covenants afford equal protection to the recipients of the two obligations.) These companies are in the identical financial position and must have the same value.

We begin by illustrating this principle with the pension liability of a sponsor with no default risk. The liability consists of a single pension payment of $1,629,000 due in ten years. Our reference security for this riskless liability is a 10-year zero-coupon Treasury, which is currently priced to return 5% annually. A $1-million portfolio of such Treasuries would mature for $1,629,000 and match the liability. The liability therefore has a value of $1 million. We arrive at the same result, of course, by discounting the pension payment at the 5% market rate of the reference security.

Pension liabilities comprise a series of cash flows rather than a single flow. Theory suggests that we should use zero-coupon securities to discount each cash flow, thus using a full discount rate curve. In practice, we use a reference portfolio that approximates the liability cash flows in amount, timing, and probability of payment. We then discount the entire liability cash flow at the internal rate of return of the reference portfolio, a process that is functionally equivalent to using an entire discount rate curve.

The reference portfolio must reflect the risk of the liabilities. Riskless liabilities, as in our illustration, must be measured with a riskless reference portfolio. Pension liabilities that are subject to default require a reference portfolio of comparable creditworthiness. Note that we use reference portfolios specifically to measure liabilities; we do not put them forth as *recommended investments for the pension assets*.

The actuarial pension model departs significantly from the finance model when it values plan liabilities using the expected return on plan assets. Suppose that equities are expected to return 10%. Then a $628,000 equity

[4] "Probability of payment" refers to the entire probability distribution of payments, from zero to full payment.

[5] The FAS 87 double-A rate may be reasonably close to the correct rate for the well-funded pension liabilities of strong sponsors, but is too low for unsecured retiree medical benefits or supplemental executive retirement plans of weak sponsors.

portfolio would have an expected 10-year value of $1,629,000, and many pension actuaries would regard such a portfolio as fully funding the plan. The actuarial pension model discounts liabilities at the expected return on the assets held to fund these liabilities; it ignores the risk.

The expected return on assets held to fund a debt does not affect the value of the debt. If a corporation borrows $1 million and invests in its business, its debt at the date of issuance is clearly $1 million. We do not discount the debt at the expected return on general corporate assets, even though the debt proceeds may have purchased those assets and those assets may in turn provide funds for servicing the debt.

Alternatively, suppose that instead of investing the entire $1-million proceeds in the operating business, the company sets aside $628,000 in a "Debt Repayment Fund" invested in equity. It expects this equity to grow sufficiently to meet the debt service schedule. May the company now report that the $628,000 Debt Repayment Fund fully offsets the debt, and the remaining $372,000 of the proceeds represents an increase in net worth? Of course not, no more than the company could persuade its bondholders to exchange their $1 million of bonds for $628,000 of equity.

Changing the words "Debt Repayment Fund" to "Pension Fund" does not alter the financial reality. The valuation of the liability does not depend on the expected return of the assets from which the company expects to meet the liability, whether they are earmarked bonds, equities, or internal investments in the company's business.

Consider two companies with identical balance sheet strength and identical pension obligations, but different pension asset allocations. These companies do not have different pension liabilities; they have different assets. If one generates higher returns, it does not thereby lower its liability and expense; it raises its assets and revenue. And it does so only *after* the higher returns have been realized, not when they are merely expected.

Although the expected return on plan assets is not pertinent to the measurement of liabilities, asset allocation can have a second-order effect on liability value. This "collateral effect" derives from the benefit security role played by plan assets when the sponsor is subject to default risk.

For example, if a below-investment-grade sponsor puts up matching Treasury securities as collateral for its pension promise, the promise becomes riskless and valuable. If the same sponsor underfunds the plan or mismatches the assets and liabilities, a junk bond discount rate may appropriately reflect the lower value of the promise. The importance of the collateral effect varies with the creditworthiness of the sponsor – for a very strong sponsor it is minimal, and the value of the liabilities will be high and almost independent of the asset allocation.

To summarize: Financial economics measures a liability by using the discount rate curve embedded in a reference portfolio – a portfolio that matches the liability. Such a portfolio is used because of its similarity to the obligation, not because it is a recommended investment policy. It is incorrect to use the expected return on riskier, non-matching assets to discount the liability payments.

Although we recognize the theoretical and practical difficulties in developing a precise discount rate curve, actuaries should agree that like liabilities must be valued at like rates. We may then focus on selecting discount rates within the relatively narrow range implied by this principle, instead of estimating irrelevant equity risk premiums.

Principle 5: Risks are borne and rewards are earned by individuals, not by institutions. Intergenerational risk transfers often go unnoticed because observers think of the pension fund or the plan sponsor as both the bearer of the risk and the beneficiary of the risk premiums. Public plan risks, though, are borne by taxpayers, not by governments. Private plan risks are borne by shareholders, not by

corporations.[6] Risk preferences are not a property of institutions, and it is not enough for the *plans or the sponsors* to receive the risk premiums for the risks they run. Those risk premiums rightly belong to the *specific individuals* who bore the risks.

Part II: Actuarial Violations of Corporate Finance Principles

Actuaries would agree that their practice departs sharply from most of the principles set forth in Part I. Even those actuaries who accept these principles may assert that as a long-term, self-correcting system, the actuarial pension model is sound despite its violations of the corporate finance principles. We now illustrate some of the practical and costly ways in which the actuarial pension model misleads users of the work product.

Violation 1: Transferring risk to future generations. Apart from theoretical issues, what is the practical problem with regarding $628,000 of equities as fully funding the pension liability that we valued at $1 million in Part I? Suppose that Generation 1 (today's stockholders for a corporate plan, or today's taxpayers for a public plan) receives $1 million of wage concessions from employees in exchange for the pension promise described in Part I. Following ASOP 27, but violating Principle 4, the liability is valued at only $628,000 under the assumption of equity investment. Gen 1 duly puts up $628,000, which is invested in equities. Ten years from now, Generation 2 will pay any shortfall, or receive any excess, of today's $628,000 of equities relative to $1 million of Treasuries. Gen 2 can expect the equities to grow to match the Treasuries over time, so its *expected* payment is zero. To value Gen 2's position, however, we must adjust the expectation to reflect the negative value of its risk position.

Is this adjustment necessary even if Gen 2 is a generation of financial risk-takers? Yes – let's even suppose that Gen 2 members are so exuberant about equity investment that they prefer a 10-year holding of $628,000 of equities to $1 million of Treasuries. In the public markets (through a dealer or through personal leverage), they could have gotten the deal described in Principle 1 – $1 million of equities versus $1 million of Treasuries. Under Principle 2, which sets a market value standard for transactions, they have been cheated out of $372,000.

Another way to illustrate the problem is to observe that Gen 2 members should have (or plan to have) personal portfolios with mixes of risky and riskless investments that reflect their personal risk preferences. Their responsibility for the new pension benefits adds risk but not expected return. To restore their optimal investment positions, they should now act to offset that leveraged pension risk by adjusting their personal portfolios.

How can Gen 2 members counteract this pension risk? They can sell $628,000 of equity from their personal portfolios and buy $1 million of the matching Treasuries to offset the gain or loss in the pension fund. Where does Gen 2 get the extra $372,000 needed to carry out this hedge? Sorry – the actuary gave that to Gen 1, who effectively collected $372,000 of future risk premiums on the equity investment without bearing any of the risk. So Gen 2 is either out of pocket $372,000 to eliminate the risk, or is left bearing risk that hedge or arbitrage pricing tells us is valued at $372,000 – the cost of converting to a risk-free position. This result of course follows from the fact that Gen 1 underpaid for its pension promise by $372,000.[7]

The equity investment does not, by itself, cause the intergenerational risk transfer. The problem

[6] Plan participants may also bear risk. For private sector plans, taxpayers and the shareholders of other corporate plan sponsors may also bear risk that is nominally borne by the Pension Benefit Guaranty Corporation.

[7] A longer chain of generations makes it more difficult to identify the winners and losers. Gold (2002) analyzes how each generation does unto its successor what its predecessor has done unto it. The first generation is a clear winner, the last a clear loser, and, in a stationary population, the other generations all suffer smaller losses.

lies in anticipating risk premiums to justify funding only $628,000 rather than $1,000,000. Suppose Gen 1 paid in $1,000,000 – the true liability – which was invested in equities. Then Gen 2 would be receiving the excess or paying the shortfall of $1 million of equities relative to $1 million of Treasuries. This position is identical to the swap described in Principle 1 and has a fair value of zero. Gen 2 members can run this risk, knowing that they are being fairly compensated for it. If their risk tolerance is already saturated by their personal portfolios, they can hedge the pension risk by selling $1 million of equities and either buying $1 million of bonds or paying down $1 million of debt. *Equity investment is not unfair to subsequent generations, if they receive market compensation for their risk and are able to hedge their risk in the public markets.*

Note the importance of distinguishing the two taxpayer generations from the pension fund and its sponsor, under Principle 5. In our illustration, the risk bearers are the Gen 2 taxpayers, not the plan or plan sponsor or Gen 1. Those Gen 2 taxpayers are entitled to any risk premiums earned in respect of the risks they run.

Violation 2: Underpricing pensions in compensation decisions. In the example above, Gen 1 received $1 million of wage concessions in exchange for the $1-million pension promise; it paid only $628,000, passing on a $372,000 cost to Gen 2. More likely, though, the sponsor and union actuaries agreed on an equity rate to value the $1-million pension at only $628,000. Because of this underpricing, Gen 1 exchanged $1 million of pension value for only $628,000 of wage concessions. For these wage concessions, Gen 1 paid $628,000 in pension cost and Gen 2 "paid" $372,000 (by carrying risk that was worth $372,000, the price the market would pay someone to bear that risk, or charge for eliminating it).[8]

To prevent this underpricing, we must follow Principle 4 and use a discount rate that recognizes pension plans for what they are: obligations that closely resemble debt and should be valued in the same way. This discount rate should be nearly riskless for well-funded plans of solid sponsors.

Violation 3: Actuarial/accounting processes biasing investment decisions. Advocates of a financial economics approach to pension investing are often accused of indifference to the expected risk premiums of equities compared to bonds. In fact, financial economics not only recognizes risk premiums; it demands them, as a reward for bearing market risk. Shareholders expect companies to take risks in pursuit of risk premiums, but the companies may have limits on their capacity for risk. The shareholder appetite for risk can be satisfied in various ways:

- Companies can take risk in their operating businesses – for example, investing in innovations rather than milking existing cash cows;
- Companies can leverage their balance sheets by borrowing money to repurchase stock;
- Companies can use pension plan leverage by investing pension assets in equities instead of hedging their debt-like pension obligations with debt securities.

Risk taken in one area may preclude more profitable risk-taking in another, so companies must be thoughtful about where they take it. Our purpose here is not to explore the pros and cons of risk-taking in the pension plan versus taking risk elsewhere.[9] Rather, we show how the actuarial and accounting processes bias the decision in favor of equity investment by pension funds.

[8] Note that in this example, Gen 2's loss has been captured by the employees rather than by the owner/taxpayers of Gen 1.

[9] Black (1980) compares pension leverage to balance sheet leverage, and Tepper (1981) compares pension leverage to action by individual shareholders to increase their equity holdings by selling bonds or borrowing. An interesting recent application of the Tepper-Black principle is the decision by Boots PLC, the UK firm, to eliminate its pension risk by moving from equity to bonds, substituting balance sheet leverage through a stock repurchase.

The actuarial model regards the use of an expected return for risky investments as unbiased. By ignoring the price of risk, however, this practice in fact produces a strong bias toward equities. Consider the management of a large plan sponsor that seeks to lower pension cost by shifting $1 billion of fund assets from bonds to equities, which will increase the expected return. Principle 1, however, tells us that trading $1 billion of bonds for $1 billion of equities does not change the true *economic* cost of the plan: the respective returns must each have the same $1-billion present value. In determining present value, financial economics does not recognize equity risk premiums not yet earned for risks not yet weathered.

But actuarial valuations and FAS 87 do. The shift will reduce pension expense by perhaps $50 million (using a 5% risk premium), and may reduce the required contribution by a similar amount. These rewards are certain and immediate; any failure of outcomes to match expectations will be revealed and dealt with in future years. The certainty and immediacy stand in contrast to other areas in which the company may take risk, where a favorable outcome must be achieved *before* it shows up in income.

A second advantage to management of taking this pension risk is that it need not attract attention. Increases in the other types of risk are disclosed in advance to interested parties. Changes in asset allocation and modest changes in the expected return on plan assets have, until recently, generally remained below the radar of investors. FAS 87 conceals the impact of pension risk by smoothing earnings and relegating investment performance to a footnote.

A third, and particularly troubling, "advantage" of pension plan risk-taking, is the very personal one that accrues to executives whose pay is linked to corporate earnings and therefore to the return assumption. They can hope for a boost in the value of their stock holdings and options, and they can be certain of a boost in their earnings-linked compensation.[10]

These advantages all arise from a transaction that has no economic benefit to shareholders, according to modern corporate finance. Of course, the advantages turn around to stand as firm obstacles to any *decrease* in the equity holdings of the pension fund. Only an intrepid subordinate addressing a highly principled CFO would recommend a change that cuts the company's earnings and cash flow and senior management's bonuses.

Violation 4: Hypothetical actuarial gains concealing real economic losses. The pension obligation bond (POB) is another manifestation of this actuarial error. The POB illustrates how current taxpayers and third parties (incumbent politicians and investment bankers in this case) can profit at the expense of future taxpayers from actuarial violations of finance principles.

Pension Obligation Bonds originated as a tax arbitrage by state or municipal plan sponsors. The sponsor would issue *tax-exempt* bonds at below-Treasury rates and contribute the proceeds to the pension fund. There they could be invested in Treasuries to lock in the arbitrage gains, or invested in risky assets in the hope of earning the arbitrage gains plus risk premiums.

Tax rule changes in the mid-1980s shut this loophole and removed the tax exemption for municipal bonds whose proceeds were contributed to pension funds. After some time, investment bankers realized that although these public sponsors could no longer arbitrage the tax code, they could still "arbitrage the actuary" by borrowing at taxable rates and investing in risky assets with expected returns that exceeded the borrowing rates.

Absent tax effects and transaction costs, borrowing at Treasury rates to invest in Treasuries inside a pension plan is an economically neutral transaction. Swapping the Treasuries for other marketable securities

[10] See Anand (2002). An equally disturbing aspect of the subjective assumption-setting process is that the executives can increase their pay by an increase in the return assumption that is independent of any asset allocation change.

increases risk together with expected return, and leaves the transaction with an economic value of zero.

States and municipalities that borrow to fund their pension plans must now issue taxable bonds at interest rates that are above Treasury rates. Borrowing at above-Treasury rates (and incurring issuance costs) to invest in Treasuries is clearly a negative-value transaction. Per Principle 1, exchanging the Treasury investments for other marketable securities is a valueless swap that does not change the negative economic value. But the actuary assumes a return on the non-Treasury investments that exceeds the sponsor's borrowing rate. The resulting drop in current and expected future contributions will exceed the sponsor's debt service cost. Thus the transaction appears to offer an economic benefit, camouflaging further injury to future generations of taxpayers who bear the risks. In short, POBs leverage the transfer of value from Gen 2 to Gen 1.

Violation 5: Concealing risk by smoothing. Many pension calculations smooth out volatility by relying on actuarial asset values and extended amortization of actuarial gains and losses. In Part III of this article, we refer to the proposed ASOP, *Actuarial Asset Values for Pension Plan Valuation*, and discuss some issues related to the elimination of asset smoothing.

Here we comment on how the actuarial model hinders investors in evaluating pension risk and understanding the value of the company. Many actuaries attempt to justify smoothing by noting that pension funds are very long-term enterprises, best measured by methods that focus on long-term expectations and treat departures from those expectations as short-term phenomena.

Pension plans may be long term, but the shares of their sponsors are traded minute-by-minute in the markets. We would not think of applying such actuarial measurement techniques to the rest of the sponsors' businesses. How useful would investors find financial reports that were permitted to reflect similar smoothing of operating results: reporting earnings based on expected rather than actual numbers of units sold, and amortizing the differences over future reporting periods? Smoothing misleads investors by disguising not only the current operating results but the historical patterns that would illuminate the business risk. There is no dispute about market value reporting by open-ended mutual funds, which may be quite similar to pension fund holdings. Fair prices must recognize the current value of the business and allocate the rewards of risk-bearing to the shareholders who actually bear the risk, under Principles 2, 3, and 5.

Even for committed long-term investors, the actuarial view can be justified only by the assumption of powerful mean reversion in equity returns, so that a long-term equity commitment will assure the realization of expected risk premiums as patience triumphs over risk. There is no empirical or theoretical evidence that would support such a view.[11]

Actuaries should understand the history and recognize the smoothing of assets and other cost elements as a practical convenience, rather than as a principle of actuarial science. In particular, actuaries should *never* claim that actuarial asset values convey greater truth or fairness than market value with its "unwarranted volatility." Nothing in their formal training gives actuaries the ability to discern a truer value than that set by a fair and active market. Surely such an ability cannot be embedded in our mechanical asset-smoothing formulas.

Violation 6: Extended Amortization. Financial principles recognize the immediate impact of actuarial gains and losses and liability increases due to plan amendments. Even accepting our existing actuarial funding methodology, however, amortization periods that are long and overlapping present practical problems when applied to frequently amended plans.

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[11] Bodie (1995) shows that equity risk is ever-increasing in magnitude (not in annual average) as the horizon lengthens. Wendt (1999) discusses the Bodie demonstration from an actuarial perspective.

Suppose that a plan offers a flat benefit that, by annual amendment, increases 2% every year. The actuarial methodology includes a 6% return assumption, unit credit method, and 30-year amortization of plan changes – common actuarial practice for decades and still acceptable under current standards of practice. Under these conditions, the funding ratio will stabilize at just 70%, forever.[12] Is this result professionally defensible?

ERISA's "current liability rules," adopted in 1987, have mitigated the problem, but its persistence is indicated by the recent publicity given to the steel industry's legacy costs. Practices that permit such massive funding failures should inspire a self-examination of actuarial standards and of the kind of rules that actuaries have fought for and against.

Part III: A Call For Change

We have set forth several theoretical problems and damaging consequences of the existing actuarial pension model. Now we turn to a discussion of the need for change, the obstacles, and the type of reform that would restore the actuarial profession to intellectual leadership in the pension community. We observe that:

- The insights of financial economics have made our science obsolete.
- Other professions, versed in these insights, have moved beyond us in their understanding of pension finance. Their ability to deliver – or extract – greater value in the capital markets makes radical revision of our science a matter of urgency.
- The current process for setting actuarial standards of practice (ASOPs) is dominated by practitioners and protects existing mainstream practice. It often prevents the use of practices that would reflect modern corporate finance.
- This standard-setting process is unlikely to produce changes adequate to the challenges we face. The profession should organize a separate effort to reconstruct an actuarial pension model that is informed by the teachings of financial economics.

Falling Behind

In Parts I and II, we have laid out the case for the obsolescence of the actuarial pension model. Pension actuaries were once a force for progress in financial thought: During the 1960s, for example, actuaries led the change from valuing pension assets at book value to partial recognition of market value. Actuaries aspire to recognition as "the leading professionals in the modeling and management of financial risk and contingent events."[13]

In the world of pension finance, this aspiration contrasts with the progress made by other professions. The accounting profession, both worldwide (through the International Accounting Standards Board – IASB) and in the US (via FASB), is on track to overturn its core paradigm (historical cost) in favor of a radical revision (fair value) for financial instruments by 2005.[14] Financial executives understand how to manage the actuarial model to produce desired appearances with no change in the underlying reality. Financial engineers and investment bankers with CFAs, MBAs, or other corporate finance training are learning to manipulate the model to shed a positive light on transactions that are neutral or injurious to the pension plans' multiple constituencies.

Although modern investment actuaries are as well trained as these other professionals, the actuarial syllabus division has retarded the integration of financial economics into the pension discipline. Pension actuaries are now commonly seen fighting a rear-guard action against risk recognition, transparency, and other advances. We may find it difficult to admit that core actuarial methods and assumptions have now fallen behind those on which other financial professionals rely.

[12] Bader (1981)

[13] Society of Actuaries Strategic Plan (2002).

[14] Defined benefit pension and other post-employment benefit liabilities are identified as financial instruments that will be excluded from the 2005 project. They are likely to be folded in thereafter.

This failure to keep our core discipline up to date often harms those who rely upon us. Some or all of the problems discussed in Part II – underpricing of benefits, questionable asset allocation decisions, intergenerational inequities – have afflicted virtually all pension plans and their sponsors.

These problems usually derive from undervaluing risk rather than from direct draining of funds and are therefore difficult to discern through the actuarial pension lens. For example, traditional actuarial measurement does not reveal the mischief done by POBs and the bankers who promote them. This mischief has therefore not been widely recognized, so far. [15]

It is true that ERISA and FAS 87, to which ASOPs are naturally tailored, now dictate much pension work. Because actuaries were then the intellectual leaders in pension finance, APB8 (1966) and ERISA (1974) largely adopted the actuarial pension model, and FAS 87 (1985) carried some of the same baggage. With our own model written into the regulatory framework, our profession has both some responsibility for that framework and some influence to exert in guiding its reform.

Regaining Intellectual Leadership

The current standard-setting process is run by active practitioners whose everyday work enmeshes them in existing practice. (In contrast, the Financial Accounting Standards Board is part of a structure that is independent of other business and professional organizations). The actuarial standards structure is a recipe for incrementalism, focused on narrowing the permitted range of current practice. The resulting standards can even act as a bulwark *against* practices demanded by financial economics.[16] The nature of the process that establishes actuarial standards of practice thwarts radical revision of pension actuarial methods and assumptions. The lessons of corporate finance and the activities of our sister professions, however, make just such radical revision necessary.

The proposed ASOP, *Actuarial Asset Values for Pension Plan Valuation*, is a case in point, illustrating the incrementalism of our process. It outlines methods, goals, and limitations for nonmarket valuation of assets that trade every day in liquid markets. The proposal neither questions nor justifies the actuarial departure from traded values except to note that it is permitted by regulation, may serve sponsor objectives (paragraph 3.2.2), and may smooth "the effects of short-term volatility in market value" (paragraph 3.2.1).

The authors have joined with others in submitting a comment to the ASB[17] that reviews the origins of actuarial asset valuation methods, focusing on the Jackson-Hamilton (1968) paper and its excellent discussions. The proposed ASOP provides a timely opportunity for actuaries to begin leading the integration of financial economics into the pension system. We recognize that the ASOP must continue to permit asset smoothing as a plan sponsor expectation that is woven into the regulatory framework. Our major recommendation is that the ASOP define a ***best practice*** – using market value for liquid assets and fair value for other assets. Further, we urge the profession to encourage rather than oppose a legislative and regulatory phase-out of nonmarket values for pension assets.

The use of market value raises questions about the resulting volatility in contributions and financial reports. To the extent that sponsors desire contribution stability, we prefer the suggestion of Charles L. Trowbridge in his discussion of Jackson-Hamilton: Value assets at market and apply smoothing directly to the contributions. Doing frankly what we now do indirectly would reduce the artificiality and obfuscation of the current multiple smoothing levels. (It would also require a statutory change.)

[15] But, see Davies (2001).

[16] For example, ASOP 27 would generally rule out the use of a near-riskless rate to discount the well-funded pension liabilities of strong sponsors, where the assets are invested in risky securities.

[17] Bader, Gold et al (2002).

The use of market value would also increase financial statement volatility. Actuaries should consider the distinction between operating costs and financing costs and their separate sources of volatility. Financial economics and the developing "fair value" paradigm of accounting teach that:

- The operating cost of a defined benefit plan is the value of newly earned benefits.
- The financing cost of the plan is the decrease in accrued benefit surplus, before contributions and newly earned benefits.

Shareholders bear both the operating and financing costs. Each element corresponds closely to the value and the uncertainty of portfolios of publicly traded securities. The volatility of the pension operating cost is unaffected by asset valuation methodology; it relates primarily to the variability of interest rates and is small in comparison to overall corporate operating costs. The volatility of the financing cost is attributable largely to asset-liability mismatches.

Volatility is a property of markets; it is not a disease for which accounting is the cure. The volatility of defined benefit plan funding status and cost is real, and it is generated primarily by the mismatch of assets and liabilities. Asset-liability matching can sharply curtail the volatility of financing gains and losses, and the purchase of deferred annuities can eliminate it. Good accounting will follow the hedging and reflect the reduction or elimination of economic volatility. In any event, the financial reporting should separate the financing gains or losses from the operating earnings.

Conclusion

We urge the profession to a fundamental reform of the actuarial pension model that replaces principles based on history with principles based on science. The new model would rely on market value. It would reject the use of expected returns that ignore the market price of risk. In transition, practice standards could recognize the regrettable necessity of departing from these principles to satisfy plan sponsor expectations in accordance with existing regulation. The profession would take all opportunities to urge the regulatory regime into harmony with the principles it has newly enunciated. Actuaries would become a force to advance rather than retard the emergence of a sound and transparent pension system.

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