SOCIETY OF ACTUARIES

Article from:

The Pension Forum

January 2003 – Volume 14 – Issue 2

Messrs. Robert McCrory and John Bartel

Reinventing Pension Actuarial Science
A Critique

Introduction

We agree with Messrs. Gold and Bader (the authors) that progress is needed in actuarial science in general and in pension actuarial science in particular. Furthermore, we think that discussing the models and methodologies that underlie our work is of vital importance. Such discussions must take place within the community of practicing actuaries, rather than solely within the academic community. Practicing actuaries understand in detail the problems and frustrations faced by plan sponsors and by the actuarial profession.

However, as Carl Sagan pointed out: "Extraordinary claims demand extraordinary proof." The implications of the reasoning put forward by the authors are breathtaking in their scope and import. Significant thought, discussion, and especially testing must take place before actuaries can consider making the changes the authors recommend.

In this discussion of the paper, we will:

- Start with a quick check of the conclusions drawn by the authors against current realities;
- Present some simulation data relating to the investment of plan assets in equities;
- Discuss the underlying model used by the authors and how it might not be appropriate for pension plans; and
- Suggest what actuaries, the profession, and the authors should do next.

Quick Check

Conclusions must always be tested against reality. The authors conclude that actuaries should:

- Use risk-free discount rates to value pension plan liabilities;
- Avoid asset smoothing; and
- Avoid long amortization periods (no mention was made of amortizing unfunded liabilities as a level percentage of payroll, but that is presumably bad as well).

Systematically funded public sector pension plans, over the last 30 years, have generally violated the above rules. If the authors were correct, public sector pension plans should be in deep trouble. Our experience is that public sector pension plans are in far better shape today than they were 30 years ago, despite apparently violating the above rules. If public sector pension actuaries had followed the above rules then prior taxpayers would have paid far more for services rendered than current taxpayers are paying now.

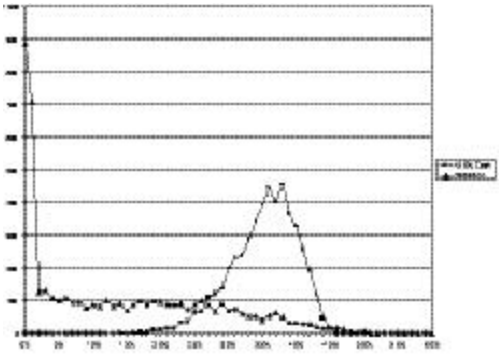
The relatively good condition of today's public pension systems should at least give one some reason to believe that current actuarial funding methodology has not been too far off the mark.

Some Data

The authors invoke the name of science frequently. It is important to recognize that there is only one principle in science: You start with data, you form preliminary conclusions or theories based on the data, and you test your theories with more data. The process of science begins and ends and begins again with data.

So, let's start with some data. Graph 1 below is a distribution of the employer cost 20 years in the future for a large state retirement plan.

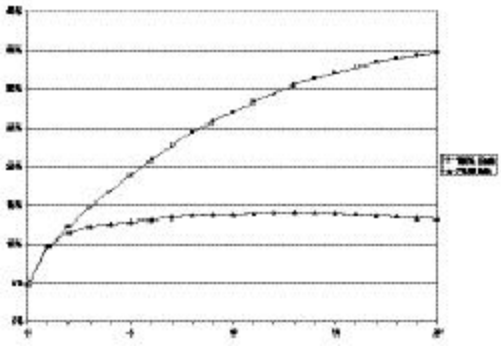
The horizontal axis is the cost of the plan in 20 years as a percentage of active member payroll. The vertical axis is the number of simulation trials, out of 5,000 trials, that produced the cost on the horizontal axis.



Graph 1: Distribution of Plan costs as a Percentage of Active Member Payroll 100% Cash vs. 70%/30% Mix of Equity and Fixed Income

Two scenarios are shown in Graph 1: The plan assets are fully invested in cash equivalents, and the plan assets are invested 70% in U.S. equities, 30% in fixed income securities.

Under either scenario, the plan actuary's behavior is the same: He continues to compute liabilities and costs each year based on the assumption that assets will return 8.25% and inflation will be 3.5%. The cost under either investment scenario is the same at time zero. Over the next 20 years, actuarial gains or losses accumulate and change the plan cost. Graph 2 below shows the average plan cost over the next 20 years under the two scenarios.



Graph 2: Average Plan Cost as a Percentage of Active Member Payroll 100% Cash vs. 70%/30% Mix of Equity and Fixed Income

The increase at time 1 is due to investment losses being recognized in the actuarial value of plan assets and to scheduled increases in the pay of active members.

A similar simulation compared the employer costs with all assets in fixed income securities with the 70%/30% mix. Table 1 below summarizes some results of these simulations.

	100% Cash	100% Fixed	70%/30% Mix
Mean Employer Cost at 20 Years	34.64%	26.77%	13.19%
Standard Deviation	5.00%	16.23%	13.38%
Probability of Higher Cost	93.1%	83.1%	

(For the curious, the above plan is the California Public Employees' Retirement System (CalPERS). The simulation model used was constructed by one of the authors (McCrory) in connection with the Asset/Liability Management Workshop held periodically by the CalPERS Investment Office for the CalPERS Board. Assumptions concerning future returns for the various asset classes were arrived at using a Delphi technique involving the Investment Office and its consultants. Future returns by asset class were produced by an asset simulation model developed by a consulting firm not associated with either of the authors of this discussion.)

Some Conclusions

What conclusions can we draw from the above analysis?

1. Based on the simulations above, there is a very strong case for a large equity component in the investments of any ongoing retirement plan (more will be said later about terminating or capped plans).

   - Investment in equities produces a lower future average employer contribution than fixed income securities;
   - The average employer contribution is level with an investment in equities; and
   - The transfer of risk to future generations that so concerns Messrs. Gold and Bader is very small; in less than one out of five cases will the equity-laden portfolio produce costs higher than a fixed income portfolio.

   Therefore, there is a good and substantial set of reasons why the investments of pension plans include large equity portfolios.

2. The risk to the plan sponsor – measured by the likelihood of increased employer costs – drops when fixed income securities are supplemented by equities.

3. Given that the assumed return of 8.25% produces costs that are roughly level on average, it is a reasonable assumption to use in computing the liabilities and long-term cost of the plan.

Alternative Models

The authors of the paper would undoubtedly dispute the conclusions above. The key point we wish to make is that the authors and we differ not because one of us is right and the other wrong, but because we are viewing a pension plan using different mental models.

The model used by the authors of the paper is one of debt: "…a company's pension liabilities are similar to debt." In the case of a capped or terminating pension plan, for which payments will end in 20 or 30 years, and whose payments can be predicted accurately, this is not a bad model to use. In fact this is exactly the model used by insurance companies in terminal funding situations. Clearly, it would take a brave plan sponsor to fund payments ending in say, 10 years with common stocks. However, in the case of an ongoing plan, particularly an ongoing government plan, we feel the debt model has serious limitations.

1. The duration is wrong. An ongoing pension plan has pension payments scheduled for as long as 90 years in the future for current members and their beneficiaries, before even considering future new hires. No debt has a term this long.

2. The dynamics are wrong. When inflation increases, pension liabilities increase: The actuary does not immediately change assumptions, but salaries and cost of living adjustments drive up projected benefits, increasing plan liabilities. In contradistinction, the value of debt decreases as inflation drives up interest rates.

3. Payments are not determined in advance. Pension payments depend on inflation, salary increases, rates of retirement, death, disability, and termination, personnel and plan administration and on a host of other factors. We have seen cases in which the appointment of a new chief of police doubled disability rates in one of our

plans. Therefore, benefit payments are much more variable than debt.

4. There is no market. Because payments are difficult to determine in advance, there is no market for pension plan liabilities, other than for retirees or for terminating plans. No insurance company is willing to underwrite a system in which future pay increases or administrative changes could increase its payment stream.

5. What the plan sponsor cares about is costs, not liabilities. Any actuary who has presented an actuarial valuation is aware of this. This is particularly true for public sector plans. If you don't believe that, then try telling a Director of Finance who just budgeted for a 6% of pay pension contribution that her contribution rate needs to increase to 8%.

6. If pension payments are debt, then so are any other contingent payments. By this logic, a $5 million key man life insurance policy would be a $5 million debt, at least until the policy expires. The existence of an insurance company to bear the risk should provoke some thought, and it brings us to the next point…

7. Lastly, and most important, the fund plays a key role of risk reduction. Under the debt model, each year's payments must be made by assets allocated to that year. Any asset other than the safest – a zero coupon Treasury – runs the risk of not being able to cover the payment due, and a type of insolvency results.

   An ongoing pension plan has more flexibility than that. With assets that can cover several tens of years of payments and that are not allocated to any particular member or year, a pension plan can wait out bad markets. Even if sales occasionally occur in depressed markets, they will be compensated for by sales in good markets. The plan is an ongoing, permanent entity that can stand market risk and that will be compensated for the risk it takes.

The mental model used by actuaries in their work is the pension plan as an insurance company. This is natural enough, given our roots. The outlines of this mental model are as follows:

1. The pension plan is regarded as a subsidiary insurance company that provides deferred annuities to employees of the plan sponsor at cost.

2. The role of the plan actuary is to set a reasonable long-term premium for the plan sponsor to pay, usually expressed as a percentage of active payroll. The computation of plan liabilities and the actuarial or smoothed value of plan assets are only tools in the calculation of the premium.

3. The plan sponsor's obligation is to pay the annual premium. One might argue that the plan sponsor could also have a contingent liability in the event the sponsor or the plan shuts down. We have no objection to recognizing such a liability, but we note that for most ongoing plans it would be zero; they are very well funded with respect to accrued benefits.

4. The plan sponsor's liability is not the same as the plan's liability. The plan sponsor's liability is for contributions due and unpaid, with the possible addition of a contingent shutdown liability. The plan's liability is a working number used to generate the actuary's best estimate of a long-term stable premium, nothing more.

5. The trustees of the plan have an interest in ensuring that the plan sponsor's contributions are as low and stable as possible. Like an insurance company, the plan competes for other uses of the plan

sponsor's funds. If required contributions are high or vary excessively, the plan sponsor may seek another arrangement to provide retirement benefits for its employees.

If we recognize the insurance company model as a valid one (though certainly not the only valid model), current actuarial and pension investment practice is seen as natural and appropriate.

1. As shown in the simulation above, investment of plan assets in equities is eminently sensible.

2. Computation of employer costs using assumed rates of return consistent with equities in the portfolio is reasonable and necessary: It is the best way to calculate long-term stable employer contributions.

3. The employer's risk is variation in the employer contribution to the pension plan. As shown in the above simulation, for at least some plans at least very little of this risk is transferred to future generations.

4. Since stabilization of the premium charged the plan sponsor is desirable, smoothing of plan assets and long amortization periods are understandable practices. However, we agree with the authors that such approaches may not be "best practice".

From the standpoint of our current mental model, many of the transactions ("violations") that the authors find so troubling are instead appropriate and correct. We don't have the time and space to discuss each of the "violations" the authors cite. Let's look at just one, Violation 3, biasing investment decisions.

The authors claim that reducing the employer contribution based on the expected return on plan assets biases investments in favor of stocks. They are absolutely right: It does, and it should. Stocks are simply a better long-term investment, particularly for an ongoing pension plan with an indefinite time horizon. As pointed out in the simulation example above, the chances are far better than even that the plan sponsor will be better off with lower contributions after investing in stocks.

Now the authors suggest we should ignore this and compute the plan cost using a risk-free set of interest rates regardless of the asset allocation policy. Their rationale is that the rewards of risk should be taken only after they have been realized. There are two points that should be made here:

1. This approach would force the actuary to compute and the plan sponsor to contribute according to a funding pattern that will probably decrease over time as actuarial gains emerge. If anything, the current generation of stakeholders pays more than it should so that future generations can benefit. This is contrary to the ideal of generational equity the authors espouse.

2. The idea that the rewards of risk should only be taken after the risks have been run is a value judgment. It is not a principle of finance, though it may be a moral or religious principle to some.

The example of Boots PLC cited in the author's footnote is chilling. This company decided to "eliminate its pension risk" by moving from stocks to bonds in its portfolio. Boots may have reduced or eliminated the *variability* of its pension contribution for its current retirees and some of its current employees, but it did so by virtually guaranteeing itself higher pension contributions than would have been the case with a significant equity portfolio.

Which Model to Choose?

When one of us (McCrory) was a very young actuary, he attended a presentation of a paper in which the author asserted that pension plans were a form of deferred compensation. Based on that assertion, the author concluded that all pension plans should be career average plans with full cost of living protection. In reading the paper, it occurred to Mr. McCrory that a conclusion so far from current practice is a symptom of an incorrect or incomplete model.

Pension plans are not deferred compensation, though they have some attributes of deferred compensation. Pension plans are, well, pension

plans, with their own characteristics, history, and practice. Defined benefit pension plans are big enough and important enough to be regarded in their own right.

Pension plans aren't debt either: They have some characteristics of debt, but they are not debt. If the financial community wishes to regard pensions as debt, this is not an indication of any deep thought or arcane knowledge. Instead, it is just the natural tendency of people to extend concepts with which they are familiar to new situations, even when the fit between the existing concepts and the new situation is imperfect.

What Actuaries Should Do

In our practice we have become too accustomed to presenting discounted expected values as single point estimates of liabilities and costs. We omit telling our clients about the error bars around the numbers we provide. It is not unusual to hear a client refer to their plan as "103% funded" and then make decisions based on that single, precise, but possibly very inaccurate number. Even the authors base their conclusions on the discounting of expected future cash flows to compute liabilities. They take issue mainly with the discount rate.

If we are to be the "leading professionals in the modeling and management of financial risk," we should improve our models. Specifically:

- Our models should be stochastic, reflecting variability in both assets and benefit payments.
- Where the plan is ongoing, our models should reflect the impact of future new members.

We can use our stochastic models to check our deterministic calculations. Furthermore, we should use our models to inform our clients of the variability in our cost and funding estimates.

We might take a cue from our casualty cousins. Casualty actuaries provide information to clients based on the client's risk tolerance. For example a worker's compensation liability might have a 50% confidence or a 90% confidence level that the actual liability is less than that shown by the actuary. Pension actuaries should begin to provide funded status or pension contribution levels with similar confidence levels. At the very least, a frank discussion on the variability in our computations is certainly in order.

What the Profession Should Do

We agree with the authors that our professional practice needs to be improved. Whatever our disagreements with the authors, we commend them for provoking discussion about our basic practices. In our view, the following are some important steps that should be taken by the profession as a whole.

- ***Be a light unto ourselves.*** We will not "regain intellectual leadership" by following the principles of another profession. Whether the dictates come from financial economics or accounting, they can result in the misapplication of principles developed in another field to pension plans, which have their own unique characteristics. This was discussed above.
- ***Adopt more empirical approaches.*** Actuaries tend to come from mathematical backgrounds, rather than from science. This means that our reasoning tends to be axiomatic – we reason from principles – rather than empirical – reasoning from experimental data. The authors' reasoning is an excellent example of this.

The proliferation of cheap computing power means that we can build reasonably accurate open group, stochastic models of our pension plans. Using these models we can experiment with the plans, testing the impact of asset allocation, funding methods, assumptions, legislation, and regulation in seconds. Such models would also enable us to test the impact of the authors' proposals.

Moreover, stochastic models help us improve our communications with our clients. Our clients know – even if we don't tell them – that our estimates are uncertain. Seeing the simulation results displayed graphically and

quantifying the degree of uncertainty can aid our clients' understanding of their plans immeasurably, and make our job communicating results easier in the bargain.

- ***Rely on our practicing professionals.*** We find it unfortunate that the authors chose to disparage the process of setting actuarial standards. We prefer to have actuarial standards set by practicing actuaries. We feel that men and women who massage the data, do the cost calculations, meet with plan sponsors, and generally try to keep the pension system (what is left of it) alive are in the best position to apply hard-nosed scrutiny to proposed changes.

- ***Fight for the pension system.*** The authors of the paper are right when they cite the damaging effects of ERISA on the private pension system. Actuarial technique was frozen in place before the advent of cheap computer power. The mind space of consulting actuaries became full of IRS Code section numbers and provisions; application of financial and simulation technologies lagged. Top corporate management opted out of the pension system altogether, inflating their pay instead. Ham-handed government legislation and regulation has increased the cost of running a pension plan and has driven many employers out of the pension system. Savings plans – 401(k) plans and their kin – have replaced defined benefit pension plans; few expect they will prove to be adequate as the baby boom retires.

Only one in five Americans is covered by a defined benefit pension plan. If government and Taft-Hartley members are excluded, the coverage is lower. It may be too late to save what's left. The profession needs to be very clear about the need for legislative simplification and reform.

We continue to believe defined benefit pension plans are the best and most efficient way to provide retirement income. If the profession agrees with this, then we must communicate this to others.

What Messrs. Gold and Bader Should Do

Obviously we are unconvinced by the paper. We acknowledge that we may be mistaken. What could Messrs. Gold and Bader do to convince us? They could present us with some data.

We suggest Messrs. Gold and Bader build a small simulation model of a pension plan and, if necessary, the plan sponsor. This need not be an overly elaborate undertaking, but it should be complete enough to capture the key elements of an ongoing pension plan. Then, using the simulation model they should demonstrate the impact and superiority of the approaches they espouse.

This would be some work; we volunteer to assist them. But in the end, we will have real examples with relevance to real pension plans to consider. That will be a much firmer basis for decision than the small examples presented in the paper.

Conclusion

Practices and procedures developed over decades are due some deference; there are reasons for their evolution. The intellectual and institutional genesis of current practices must be carefully analyzed before they are replaced. On the other hand, there is certainly room for improvement in pension actuarial modeling.

Messrs. Gold and Bader have done well to point out to us what they believe are the implications of financial economics on pension actuarial practice. It is up to us to evaluate their claims critically, test them carefully, and adopt those that past muster.