Risk Transfer in Public Pension Plans

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Abstract

Actuaries and sponsors of public sector defined benefit pension plans agree that each generation of taxpayers should bear its fair share of the long term plan cost. Actuarial methods and assumptions incorporate expected investment returns in order to equate expected costs across generations.

Actuaries consider the use of expected investment returns unbiased because, on average, returns are neither under- nor overstated. Financial economists deem the risky discount of riskless promises to be biased because the resulting liabilities are systematically understated compared to the market value of similar promises.

This paper uses arbitrage principles to show that equating expected costs unfairly lowers risk-adjusted costs for early generations and raises them for later generations. The use of expected rather than risk-adjusted returns on risky assets leads to sub-optimal decision making in re asset allocations, wage/pension negotiations, granting of valuable options (skim funds), and costly financing strategies such as Pension Obligation Bonds.

Risk Transfer in Public Pension Plans[1]

Introduction

Actuaries perform annual valuations of public pension plans in order to determine plan liabilities, costs and cash contributions. Over time the cash contributions develop asset levels sufficient to secure the benefit promises made to the plan participants and beneficiaries.

The actuarial methods and assumptions used are designed so that each generation bears a fair share of multigenerational costs. It is intended that risks be fairly allocated and shared between generations as well. There is no intention to transfer costs, wealth and/or risks systematically between generations.

We show that, while actuarial processes may appear intergenerationally fair on an expected basis, there is a systematic transfer of risk away from early generations and towards later generations. The result is that equal expected costs imply unequal risk-adjusted costs whenever risky assets are included in the plan. This inherent bias always favors current taxpayers, plan participants and politicians at the expense of future taxpayers.

We begin with an abstract example of an investment opportunity that illustrates the essential actuarial valuation flaw. The example is drawn from Bader (2001).

We then tell a tale in which the machinations of a clever politician attempt to take advantage of the inherent actuarial error. The politician is later challenged by a well-educated member of a generation that will be injured by the combination of actuarial error and risky investment.

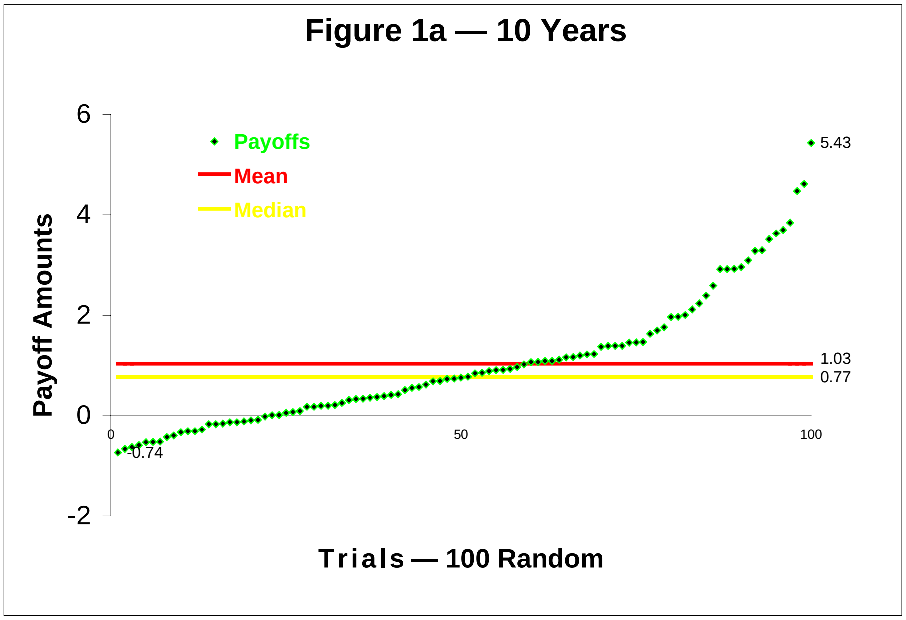
The inherent intergenerational bias in the presence of risky investments is shown more generally to lead to sub-optimal decisions, all of which burden future taxpayers: poor trade-offs of pension benefits for current wages in labor negotiations, skim funds and pension obligation bonds (POBs).

Finally we look to sources of a changing actuarial/accounting paradigm derived from financial economics. This corrected approach faces an uphill fight due to the ways in which the current methods and assumptions favor entrenched powers. Nonetheless, there are battles being won in the debate over worldwide accounting standards, among Wall Street analysts and in an exemplary and visible transaction effected by The Boots Company (U.K.).

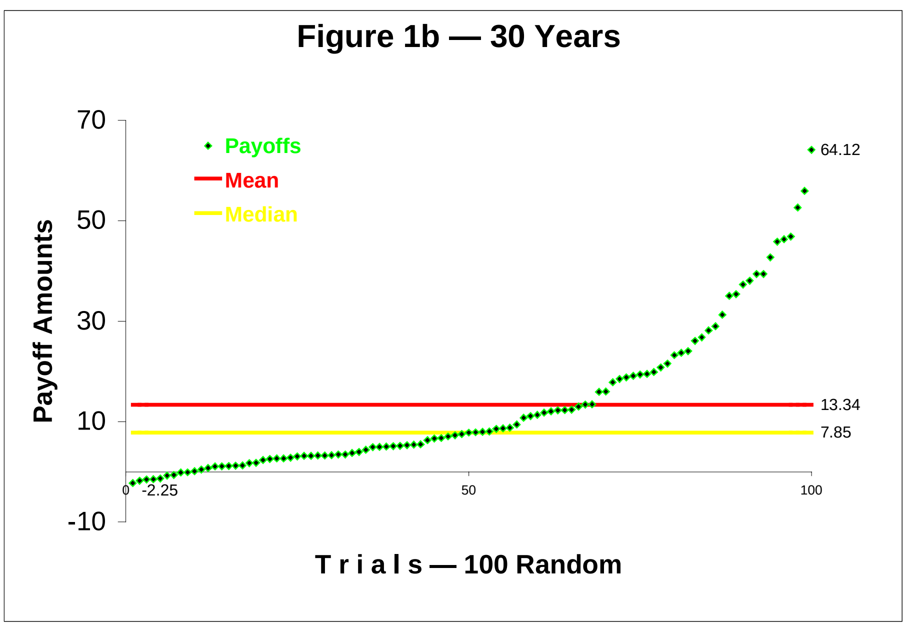
[1] In the US, the term "public" refers to plans established by governments and their agencies to provide retirement benefits to their former employees.

An Investment Opportunity

Figures 1a and 1b show the simulated results of an investment strategy over 10 and 30 years respectively. Each payoff point represents one trial. The trials, which occurred randomly, are shown in rank order. The mean payoff after 10 years is 1.03; the median is 0.77. There are 22 negative outcomes (worst = -.74) and 78 positive (best = 5.43).



Over 30 years the corresponding statistics are 13.34, 7.85, 9 (-2.25) and 91 (64.12).



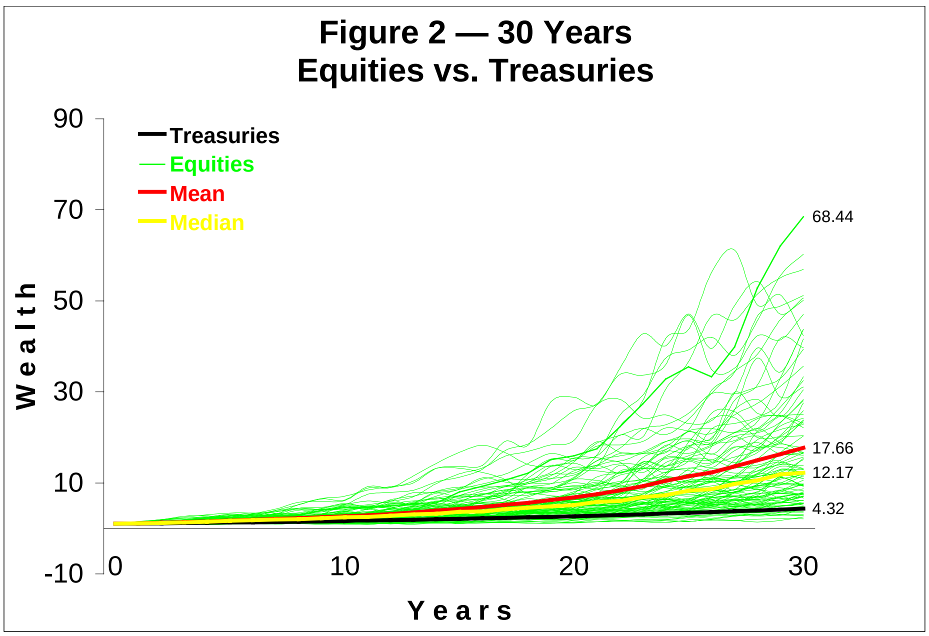
These look like attractive payoffs. How much would you pay today for the opportunity shown in Figure 1a?[2] How much would you pay for the process in Figure 1b?

Is it fairly clear that you would be willing to pay a positive amount for each? Is one or the other clearly more valuable?

I assure you that the generating process is fair and objective and that the results shown are based on mainstream assumptions with respect to return and uncertainty. Let us assume that you and I have perfect credit and that we will pay each other when and as required. What other information would you like before you make me an offer?

A Bader Swap

Each of the 100 outcomes in each figure represents the end of a path. Let us look at the paths that underlie the 30-year case (Figure 2).



The 100 equity paths represent the random results from a $1 investment using a lognormal distribution with an expected annual return of 10% and an annual standard deviation of 16%. The mean and median paths are shown for the equity trials. The Treasuries earn 5% annually starting with a $1 investment.

How do these paths relate to the outcomes in Figure 1b? Each of the outcomes in Figure 1b represents the result of an equity investment offset by a short position in Treasuries, a net cost of $0 today. From each of the equity endpoints in Figure 2, I have subtracted the endpoint of the Treasury path to get the corresponding payoff point for Figure 1b. The Treasury path always ends with $4.32. The best equity path ends with $68.44 and thus the best payoff point shown in Figure 1b is $64.12. Notice that some of the equity paths end up below the Treasury endpoint. These represent the nine

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[2] Note that if you pay a positive amount today and the payoff is negative, you pay once today and a second time after 10 years.

negative payoffs. In particular, the worst case equity outcome is $2.07 leading to a payoff of minus $2.25.

In other words the results in Figures 1a and 1b simulate a long S&P-like investment short a zero coupon Treasury. What, then, should any of us be willing to pay today for the outcome opportunities? Exactly nothing.

Can you really buy these outcome distributions for $0? For a funded pension plan, the simple answer is: Yes.

Bader (2001) illustrated how pension plans could develop such distributions without cost. Starting with a plan whose sole obligation might be[3] $4.32 thirty years hence and a Treasury asset of $1 that will exactly meet that future obligation, Bader's plan sells the Treasury bond and buys a diversified equity portfolio each with a $1 current price. Bader indicates that this is equivalent to a swap contract and thus I dub Figures 1a and 1b "Bader Swaps". Bader Swaps are worthless at inception but may have high expected future values. Algebraically:

$$P(t=0)=0$$
$$EP(t=10)=1.03$$
$$EP(t=30)=13.34$$

Where P is value (price) and EP is expected value[4].

Suppose that we have a municipal pension plan with the same starting position as the Bader plan. How shall an actuary value that plan's liabilities, assets and current surplus or deficit? Pension actuaries, establishing economic assumptions, are subject to Actuarial Standard of Practice 27. It specifies that the actuary will estimate the expected return on assets and will use that to discount the liabilities. Thus, using the initial plan asset allocation, the actuary will assume a 5% return and discount the future $4.32 obligation to $1 today. This will match the plan's asset value and the actuary will report no current surplus or deficit.

The Mayor, a graduate of the Harvard Business School, sees an opportunity to improve the situation. He directs the plan's asset manager to sell the Treasury bond and buy the S&P index. Now our actuary estimates that the plan will earn 10% annually and thus he revalues the liability at $0.25. The plan has a surplus of $.75. In effect, the Mayor has revalued the Bader Swap in accordance with ASOP 27, such that $P(t=0)=.75$. The Mayor takes the plan surplus and cuts today's taxes by $.75. And the pension plan lock box holds all the money ($.25) that the actuary says is necessary.

Well, that is surely a winner. If it were not for the title of this paper, we could all stop right here. In fact, that is pretty much where every municipal pension plan in the U.S. stops today.

But, per the paper title, we have an obligation to examine risk transfers. Who wins? The Mayor, the taxpayers and the actuary. Who loses? Does anyone have to lose? The

3 Bader had a $1 million obligation. Here we adjust to be consistent with our payoffs.
4 These are sample means. Population means are .96 and 13.13.

capital markets tell us that the Bader Swap is worthless; the Mayor and the actuary say it is worth $.75. If it is really worth $.75 then they should surely be able to get someone to pay $.60 for it. Would you accept the pension plan obligation, the $1 in plan assets **and** pay the taxpayers $.60 for the privilege?

Why would you not? Because you know that you could short $1 in Treasuries and buy $1 of the S&P and pay no one for the privilege. You would be taking a substantial risk by doing so and you know that the expected future value on the Bader Swap is exactly the market compensation for taking that risk. If you do take that risk, you will demand the full compensation and will have nothing to share with the taxpayers.

Harvard Mayor meets Wharton Taxpayer

That intuition may be formalized with a model that shows us how the risk may be measured and who bears it.

Our model compares the fortunes of successive generations of taxpayers in order to detect systematic risk/wealth transfers among them. The generations are identified as Gen1, Gen2, … Gen(n), … GenN and each has the same number of members, M. When the model begins, in Period 1, Gen1 is actively working and paying taxes. Gen2 is attending school. A number, G, of each generation's M members spend their work time as employees of the local government.

In Period 2, Gen1 members are no longer working nor are they paying taxes, Gen2 members are working taxpayers and Gen3 members are in school. In Period 3, Gen1 is deceased, Gen2 is retired, Gen3 is working and Gen4 is in school.

As the model commences, Gen1 designs a public pension plan that will make a Period 2 payment of $M/G to each of the G former governmental employees of Gen1. The plan continues period by period without amendment. The $M/G payment to each of G recipients translates to $1 from each of $M taxpayers.

But which taxpayers will pay how much and when?

Some members of Gen1 suggest a PAYGO plan, saying "Let Gen2 members each pay $1 next period." Under the PAYGO plan, each Gen(n>1) taxpayer will pay $1 to the retirees of Gen(n-1).

Gen2 members disagree, "The services provided by Gen1's public workers go to Gen1. Gen1 must set aside enough money to fund the plan fully."

How much shall each Gen1 taxpayer contribute to the plan to prefund the pension benefit? At HBS we learned that the present value of $1 due one period from now is:

$$PV = \frac{1}{1+r}$$

where r is the rate of return. In actuary school (ASOP 27) we learned that r is the expected rate of return on the money in the plan. For convenience we modify the 5% Treasuries and 10% equities that were used above. Let the return on Treasuries be

5.2632% and let the expected return on equities be 9.8901%. If we invest in Treasuries, the actuary says we must set aside $.95; if we invest in equities, $.91 will suffice.

Because our town wants to remain in business, that retiree is going to receive $M/G next year, come hell or high water. So each future retiree has a riskless promise worth $.95M/G today.

But our Mayor and our actuary tell us that the city and its pension plan are long term investors and can afford to take risks that will average out in the long run. Each Gen1 taxpayer contributes $.91 and the plan buys the S&P index. The $.91 is expected to grow to $1 next year. If the assets are greater (or lesser) than $1, the taxes of Gen2 will be lesser (or larger) by the difference.

Because, on average, the assets will be sufficient to pay the required $1, members of Gen2 expect to pay the same tax that Gen1 must pay today. Our actuary says that that is right and that Gen2 members can expect to pay $.91 next year.

Seems fair. Each generation **expects** to pay the same amount.

But one member of Gen2, a Wharton student, senses a problem. Whereas Gen1 is certain to pay $.91, Gen2 may pay more or less than $.91 depending on how the S&P performs. Is that fair? She develops a balance sheet for Gen1 (Figure 3a) and a projected balance sheet for Gen2 (Figure 3b).

Figure 3a
Gen1 Balance Sheet, Period 1

Assets	Liabilities
Personal portfolio[5]	$.91 payable now

Figure 3b
Gen2 Balance Sheet, Period 1

Assets	Liabilities (due Period 2)
Personal portfolio:	$.91 expected
$X S&P	
Y T-bills	Risk of Gen1's S&P investment

The student reformulates the risk in terms of exposure to the pension plan (Figure 3c).

Figure 3c
Gen2 Balance Sheet, Period 1, Analyzed

Assets	Liabilities (due Period 2)
Personal portfolio:	$.91 for Gen2 employees
$X S&P	1.00 for Gen1 retirees
Y T-bills	-(.91 S&P in plan as of Period 1)

5 Invested as Gen1 sees fit. The personal portfolio for Gen2 (initially $X in the S&P Index, $Y in T-bills) is shown with greater detail in her balance sheets.

Our Wharton student has learned about hedging and arbitrage. She also has planned for her own future with a portfolio that includes just the amount of risk and expected return that makes her comfortable (represented by an exposure to $X of equities). She decides to set up a hedge that will eliminate any extra risk thrust upon her by the pension plan. The hedge must be such that no matter how the $.91 set aside by Gen1 performs, she bears the risk that she intended to take.

Her S&P exposure is effectively $(X+.91)[6] while her tolerance limits her to $X. In order to establish her hedge, she realizes that she must sell $.91 of S&P and invest the proceeds in T-bills (Figure 3d).

Figure 3d
Gen2 Balance Sheet, Period 1, Hedged

Assets	Liabilities (due Period 2)
Personal portfolio:	$.91 for Gen2 employees
$(X-.91) S&P	1.00 for Gen1 retirees
(Y+.91) T-bills	-(.91 S&P in plan as of Period 1)

Now her total S&P exposure is $X as she intended. She projects her balance sheet forward to Period 2 (Figure 3e) so that she may compare to Gen1 in Period 1.

Figure 3e
Gen2 Balance Sheet, Period 2, Projected

Assets	Liabilities
Personal portfolio	$.91 for Gen2 employees
	$.042105 for Gen1 retirees

where the negative $.91 in S&P exposure has cancelled out across the two sides of the balance sheet. The extra $.91 she held in T-bills has grown by 5.2632% to $.957895 which cancels out all but $.042105 of the $1 that must be paid to Gen1 retirees.

Comparing to Gen1's balance sheet (Figure 3a) reveals that Gen2 is worse off by $.042105. Each future generation will be in the same position as Gen2.

How may we interpret this $.042105 difference between Gen1 and later generations? We consider that the Gen1 public employees have riskless promises worth $.95G/M equivalent to $.95 per taxpayer. Gen1 taxpayers have been told that they need pay only $.91 to provide $.95 of riskless value. They were told that this is possible because the plan will take the equity risk. But our student has taught us that she is the actual risk bearer. If the plan had invested risklessly in T-bills to meet its riskless promise, Gen1 would have had to pay $.95. Gen2 would have suffered no imposed pension risk and Gen2 would have had to pay $.95 too.[7]

This suggests that Gen1 has a risk-adjusted free lunch equal to $.04 and that subsequent generations have to pay $.002105 more than the fair value of the benefits

6 $X in her personal portfolio PLUS the effect of having a liability of minus $.91 in S&P.

7 Equivalently, had the actuary assumed a riskless discount (violating ASOP 27), regardless of the actual investments, Gen2 would face a risk-hedged or risk-adjusted cost of $.95.

for their governmental workers. In effect, the $.04 shortfall left by Gen1 grows at riskless interest to $.042105 (equals .04 times 1.052632). Gen2 pays the interest and passes on the $.04 shortfall to Gen3. This continues until the final GenN is forced to pay $.992105 representing the $.95 needed to prefund GenN retirees, the $.04 “borrowed” by Gen1 and one year’s interest of $.002105.

One last way to assess this risk/wealth transfer across generations is to recognize that Gen1 might have invested the full $.95 value of its promise in T-bills. A decision by the plan to sell those T-bills and invest in the S&P would be recognized as a worthless Bader Swap and Gen1 would not have received the $.04 windfall contrived by the mayor and made possible by the ASOP 27 actuary.

In this example the intergenerational transfers of risk have been converted to their certainty equivalents and we have found a $.04 windfall for Gen1 that makes all subsequent taxpayer generations losers. This seems like a small “bad”. Why does the author make a big deal out of it? When we first met the Mayor, he and the actuary were telling us that the work of $1 in Treasuries could be matched by only $.25 in equities. That **does** seem like a big deal. In this latter example, we have $.91 in equities doing the work of $.95 in Treasuries.

Consider, however, that this example assumed that retiree benefits are due one year after the civil service employee provides service to the taxpayers. In a typical pension plan, however, the average worker may be forty something years old and the average retirement promise is kept some thirty years later. This means that the discount process is more like the 30-year Bader Swap than it is like the one-period pension example.

When we consider taxpayer and worker generations that are thirty years in length, we find that the intergenerational wealth transfer is very large. When we suppose a $1 promise thirty years in advance, we find a riskless cost of $.214639. Our actuary calculates a contribution requirement using equities equal to $.059053. As in the Bader Swap example, we see that the actuary’s adherence to ASOP 27 enables an understatement of liabilities[8] by about 75%.

Now I have overstated the impact by assuming that the plan might be invested entirely in the S&P instead of in Treasuries. A more typical plan might invest about half of its assets in bonds and half in equities and ASOP 27 would lead to an understatement of liability values by about 50%.

Implications of Liability Mismeasurement

The process defined by ASOP 27 is considered unbiased by actuaries because, on average, investment returns are neither under- nor overstated. Financial economists deem the risky discount of riskless promises to be biased because the resulting liabilities are systematically understated compared to the market value of similar promises.

[8] Actuaries and others will note that the liabilities discussed here amount to benefits newly earned. The corresponding liability might be called the “Unit Credit Normal Cost” or the “Service Cost”. These liability items may well approach the 30-year duration implied by the text. Aggregate pension liabilities more typically show durations that are about half as long.

Understatement of the value of promises made to government employees leads to valuable risk transfers between generations and inferior decision making by taxpayer representatives. Three prominent examples of such poor decision making are negotiated wage/pension trade-offs, skim funds and Pension Obligation Bonds (POBs).

Negotiated Wage/Pension Trade-offs

Because actuaries undervalue promised future retirement benefits, governmental financial officers are prone to promise excessive retirement benefits in exchange for insufficient wage give-ups at the bargaining table. A $1 retirement benefit to be paid 30-years hence may have a riskless discounted value of $.21 but will be actuarially discounted to a value of $.06. How much of today's wage should be given up by the employee in exchange for that future benefit. Any value less than $.21 represents a real gain to the employee; any value greater than $.06 creates an apparent gain to today's taxpayers. As we have seen the cost of this apparent gain is always paid, with interest, by future taxpayers.

A simple test of this proposition may be made by asking insurance companies to offer deferred annuities to cover the promises made. Pension actuaries have a mythic belief that insurance companies systematically and egregiously overprice such contracts. The shareholders of insurance companies will not, however, accept the risk of equity investment to fund fixed income annuities without full market compensation for the risk.[9] Since the full market compensation for the risk is priced in expectation by a Bader Swap, the insurance company shareholders must charge at least a riskless price for a riskless promise.

Skim Funds

Retirement promises are made to employees in lieu of current wages. It is an economic truth that the wages given up are exchanged for the liabilities (promises) of defined benefit plans and not for the plan assets. This is very different from the defined contribution plan case where it is reasonable to equate wages to plan contributions and thus plan assets. This economic distinction, generally reinforced at law as well, has not been well communicated to employees generally and has been particularly poorly communicated to employees subject to wage and benefit negotiations.

In the private sector, the primary economic purpose of plan contributions and plan assets is to secure (collateralize) the promised benefits. In the governmental sector, this primacy of purpose may be surpassed by a budgeting goal designed to minimize intergenerational wealth transfers.[10] In neither situation, however, is it reasonable to believe that the assets of the plan represent deferred wages. Plan liabilities have been

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[9] As shown by Bodie (1995), the price for equity risk is an increasing function of the period of time over which the risk is taken. Actuarial myth holds that the risk of equity ownership declines with time and that the equity risk premium is more truly a reward for patience than it is compensation for risk.

[10] As we have argued above, the goal of intergenerational fairness may be served in expectation but is often poorly served in value.

exchanged for wages, assets have not. The financial validity of this assertion lies in the observation that the taxpayers bear the risk of asset underperformance.

At least that was true until the politics of poor understanding overtook the economics of the defined benefit design.

For many years, public pension plans trailed their corporate brethren in their allocation of assets to equities. In the last two decades, public plans have drawn even with the private sector. The public sector began to emulate the private sector with the intention of lowering the cost of benefit promises to the taxpayers who made the promises. With the fundamental actuarial error represented by ASOP 27's treatment of the valueless Bader Swap, this seeming cost reduction could be brought to taxpayers immediately.

If we view the taxpayers of all generations ensemble, it may be possible to conclude that the expected cost reduction is a fair recompense for the added risks of equity investment. We may not, however, reasonably conclude that the taxpayers have received a windfall because they can execute a Bader Swap. The taxpayers exchange wages for benefit promises. Then the taxpayers elect to engage in a Bader Swap. Since the benefits promised remain unchanged, the risk inherent in the swap has not been shared with the participants.

Nonetheless, as public sector pension plans began to reduce their holdings of bonds and to increase their holdings of equities, negotiators for the plan participants, taking advantage of the fable that ties wages to plan assets, demanded that the rewards from equity investments be shared between the participants and the taxpayers.

Municipal politicians and managers, anxious to lower current costs by switching into equities, were willing to share the "gains" with the participants despite the risk that was borne entirely by taxpayers. The structure that emerged is the "skim fund".

A skim fund is an option granted to participants by taxpayers. This option says that in good times (high equity return periods), some of the "excess" returns will be used to provide previously unscheduled benefit increases. No downward symmetry exists. When equities underperform, taxpayers lose.

The very same actuarial error that encourages equity investment, and encourages undervaluation of promises made in lieu of wages, and transfers risk from today's taxpayers to tomorrow's, is used to justify an asymmetric game in which today's taxpayers share rewards with tomorrow's participants, once again to the detriment of future taxpayers.

Pension Obligation Bonds

The third implication deriving from the fundamental actuarial misvaluation of the Bader Swap is Pension Obligation Bonds. In a fashion designed to add injury to insult, the winners once again are today's taxpayers and politicians and the losers are tomorrow's taxpayers.

It is a law of the modern financial jungle that smart predators will devour the lunches of all complacent inhabitants. It has been occasionally remarked that "the lion's share is ALL."

In the early 1980's some bright Wall Street public finance specialists found a loophole in the Federal tax system that allowed states and municipalities to issue tax-exempt bonds in order to make past service contributions to underfunded public pension funds. Without taking on any net risk, a governmental entity could borrow at its below-Treasury tax-exempt rate and could place the proceeds in the pension plan where it could be used to purchase comparable Treasury securities. This procedure provided a net gain to the local government that clearly came at the expense of the Federal. In a short period in the mid-1980's billions of dollars of such transactions were undertaken.

In order to deliver the advantages of this arbitrage to the taxpayers immediately, the pension plan actuary had to recognize that the pension plan assets purchased with the borrowing proceeds could be used to reduce the current plan contributions by more than the debt service cost incurred by the borrower. Since there were true arbitrage gains available, the actuary could establish methods and procedures to lower contribution costs for the life of the borrowing while remaining certain that the pension plan would be at least as well funded as it otherwise would have been over the same period.

In effect, the pure arbitrage met two useful constraints: i) the municipality's total cash flow for debt service and pension contributions could be reduced, and ii) the plan would always have assets at least as great as if the transaction had not been undertaken.

The IRS was not terribly far behind this public finance legerdemain and within a few years, the IRS grandfathered the outstanding pension bond issues as tax-exempt and declared that any future bond offerings used in such schemes would have to be taxable.

The Wall Street lions and wolves of public finance took a postprandial nap.

But the managers of the public pension plans decided that holding Treasury bonds was not consistent with their long-term risk-return goals. Naturally they undertook to redeploy the assets. What better way to redeploy than to Bader Swap? As a result of the actuarial treatment of Bader Swaps, the reduction in the current level of contributions far exceeded the cost of the debt service. The net reduction was so good, in fact, that the tax-exempt status of the bonds was only the smaller of the values added.[11]

The Wall Street lions and wolves woke up.

"We don't have to generate true arbitrage gains. We can do as well or better by generating 'actuarial arbitrage' gains."

In the dozen or so years since the predators awoke, the volume of Pension Obligation Bonds has swelled. It is only in the last two years, since the March 2000 market peak that the wisdom of POBs has been called into question. An example of just such questioning may be found in Philadelphia (Davies, 2001).

Let us review how the use of taxable POBs works. The municipality borrows at its taxable rate which is greater than the comparable US Treasury borrowing rate and contributes the proceeds to the pension plan where the investment managers invest the proceeds in diversified assets including equities. For the sake of illustration we will

[11] The true value added derived from below-Treasury borrowing to invest in Treasury securities was often far outweighed by the apparent value added by the Bader Swap.

assume that all of the proceeds are invested in the S&P 500. The actuary credits the expected return on the S&P and reduces the required plan contributions by that amount.

Gold (2000) breaks down the taxable POB transaction as follows:

Pretend that the proceeds are invested in US Treasury securities that proportionally match the cash flows of the new municipal indebtedness. Since the municipality's borrowing rate is higher than that of the Treasury, the net cash flows would be unfavorable and the borrower would be a loser.

In fact that is the economic truth of the matter. Without significant risk modification, the transaction is a loser for taxpayers.

The second step of the pretense is a Bader Swap thus achieving the goal of the POBs. The actuarially generated gain on the Bader Swap generates more in <u>apparent</u> winnings than the first step <u>really</u> lost.

Once again the loss is reflected in the increased risk borne by future taxpayers and once again today's taxpayers and politicians are the winners.

Conclusions

A flawed understanding of the risk of equities and the improper valuation of market-to-market swaps is embedded in pension actuarial methods and assumptions. It arose as plans abandoned insurance companies and adopted trusteed arrangements after World War II.

The flaw has been propagated as the accountants (FAS 87, GAS 25 and GAS 27) and Congress (ERISA) incorporated actuarial principles into their prescriptions.

Because recognition that the error exists requires a substitution of financial economics for actuarial science, few are aware of the problem. Because it favors today's generation of managers, shareholders, taxpayers, politicians and actuaries, even those who perceive the problem are not well-motivated to correct it.

But there are symptoms. And these symptoms need to be recognized as the natural result of risk transfer across generations. Consider the "legacy" pension obligations of the steel industry that received some attention in March 2002 when President Bush chose to protect the industry with tariffs. A companion proposal, not adopted, would have had federal taxpayers bail out the underfunded pension plans of failed steel companies.

Consider the actions of The Boots Company (U.K.) which chose to place its £2.3 billion plan in U.K. bonds matching the plan's projected outflows. They chose to forego the illusory gains from a Bader Swap and are presently explaining their decision to shareholders, rating agencies and other interested parties. A small group of U.K. actuaries sympathetic to the themes of this paper have expressed support for Boots.

Boots has said that their motivation was to reduce risks associated with mismatches between plan assets and plan liabilities. The Boots transaction has coincided with the adoption of Financial Reporting Standard 17 in the U.K. This standard provides a market-based liability valuation model and may serve to expose the risks of asset/liability mismatches. FRS 17 has been credited with increasing accounting transparency, motivating a slight shift in asset allocation to bonds from equity and has been blamed for discouraging final average defined benefit plan formation and maintenance (Capleton & Cleary, 2002).

Who will first act to remedy the errors in pension actuarial science? As an actuary, I would hope that actuaries would step up to the challenge. It seems much more likely at this juncture, however, that the accountants will be the first to recognize, acknowledge and act to eliminate the "actuarial arbitrage" that places significant positive value on worthless swaps. The worldwide effort by the accounting community to implement a "fair value" accounting model three years hence has, for now, chosen to exempt pension and welfare plans from its purview. But the fair value paradigm will inform the analysis of pension plans by securities analysts and I am hopeful that pension plans will be folded into fair value in relatively short order. I would have to be Pollyanna-like in my longevity hopes to believe that I will see ERISA fixed in this regard.

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