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Risk Transfer in Public Pension Plans

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 are designed to equate expected costs across generations. 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 asset allocations, granting of valuable options (skim funds), and costly financing strategies such as Pension Obligation Bonds.

Disciplines

Economics

Comments

The published version of this Working Paper may be found in the 2003 publication: *The Pension Challenge: Risk Transfers and Retirement Income Security*.

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The Pension Challenge

Risk Transfers and Retirement Income Security

EDITED BY

Oliva S. Mitchell and Kent Smetters

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Chapter 6

Risk Transfer in Public Pension Plans

Jeremy Gold

Public pension plans, as the term is used in the United States, are defined benefit (DB) plans established by governments and their agencies to provide retirement benefits to their former employees. In these systems, 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 (DC) 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 and has been particularly poorly communicated to employees subject to wage and benefit negotiations.

In the private sector, the primary economic purpose of pension plan contributions and plan assets is to secure (collateralize) the promised benefits made to the plan participants and beneficiaries. In the governmental sector, this primacy of purpose may be surpassed by a budgeting goal designed to minimize intergenerational wealth transfers.[1] In neither situation, however, is it reasonable to believe that the assets of the plan represent deferred wages. Plan liabilities have been exchanged for wages, but plan assets have not. The financial validity of this assertion lies in the observation that the taxpayers bear the risk of asset underperformance.

Whether the primary purpose is collateral or budgeting, annual actuarial valuations of public defined benefit pension plans are performed in order to determine plan liabilities, costs, and cash contributions. The incidence of cash contributions establishes the taxpayers' budget plan and the accumulation of the contributions is intended to build asset levels sufficient to provide benefit collateral. The actuarial methods and assumptions used are designed so that each generation bears its fair share of multigenerational costs. The actuarial process is intended to allocate risks fairly across generations as well. There is no intention to transfer costs, wealth, and/or risks *systematically* between generations.

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This chapter demonstrates that, while actuarial processes may appear intergenerationally fair on an expected basis, they systematically transfer risk away from early generations and toward later generations. The result is that *equal expected costs* imply *unequal risk-adjusted_costs*, whenever risky assets are included in DB plans. This inherent bias 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, drawn from Bader (2001), illustrates how a clever politician may attempt to take advantage of this flaw. 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. Next we show that such risk transfers can lead to suboptimal decisions (all of which burden future taxpayers), including: poor trade-offs of pension benefits for current wages in labor negotiations, skim funds, and pension obligation bonds (POBs). Lastly, we note that the suboptimal decisions flow from the actuarial anticipation of risky returns and not from the risky investments *per se*. Financial economics shows us how to amend the actuarial process to avoid intergenerational risk transfer.

An Investment Opportunity

In this section we step through an abstract investment opportunity to illustrate how actuarial anticipation of expected returns systematically transfers future returns to the first generation and foists risk upon subsequent generations. We later use the intuition from the abstract example in a more formal, more practical, model.

Figures 6-1(a-b) 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 twenty-two negative outcomes (worst = −0.74) and seventy-eight positive (best = 5.43). The corresponding 30-year statistics are 13.34, 7.85, 9 (−2.25), and 91 (64.12).

Because the mean and median are positive and because the number of trials with negative values is few, these payoffs appear to be valuable. Suppose that we were to offer this strategy in exchange for a certain payment today: what price might we receive? If, for example, the risk-free 30-year zero-coupon bond is priced at $0.23 per dollar of maturity value, might we be able to sell the random payoffs for as much as $0.90—that is, at about half of the present riskless value of the median payoff, well below one-third of the riskless price for the mean payoff?[2] What price might such a contract have in the existing capital markets?

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 6-2). The 100 equity paths represent the random results from a $1 investment using a lognormal

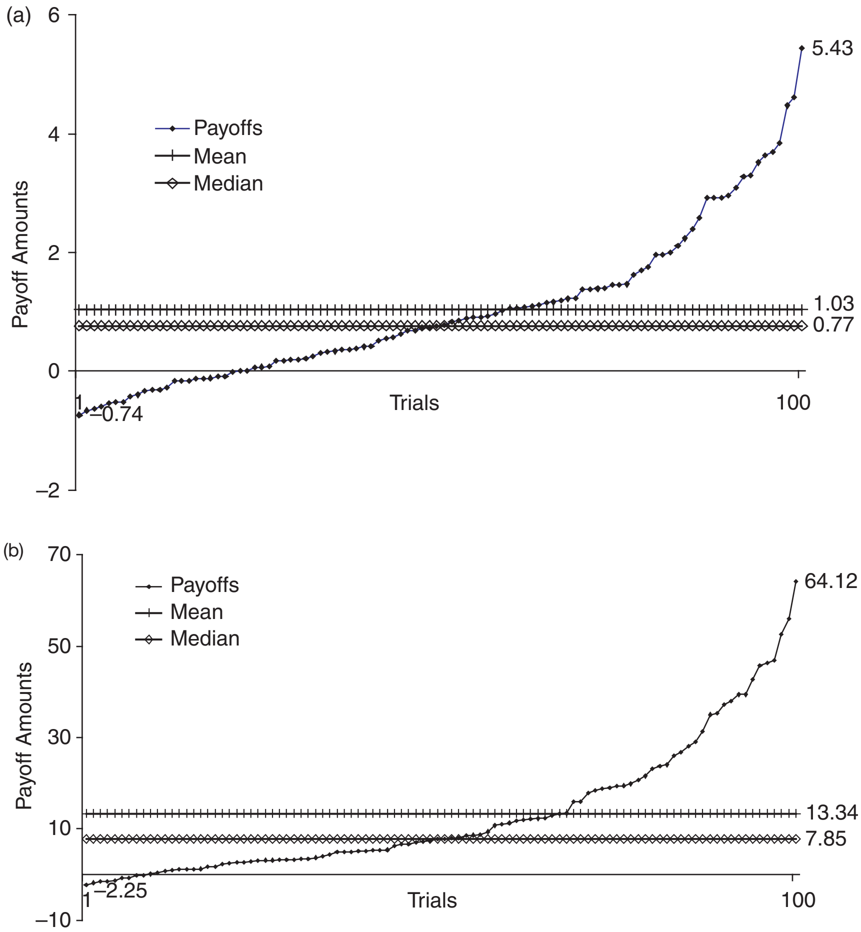

Figure 6-1. Investment payoffs over 100 random trials (ordered): (a) 10-year horizon, (b) 30-year horizon. (*Source:* Author's calculations.)

distribution with an expected annual return of 10 percent and an annual standard deviation of 16 percent. The mean and median paths are shown for the equity trials. The Treasuries earn 5 percent annually starting with a $1 investment.

How do these paths relate to the outcomes in Figure 6-1(b)? Each of those outcomes 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 6-2, I have subtracted the endpoint of the Treasury path to get the corresponding payoff point for Figure 6-1(b). 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 6-1(b) is $64.12. Notice that some of

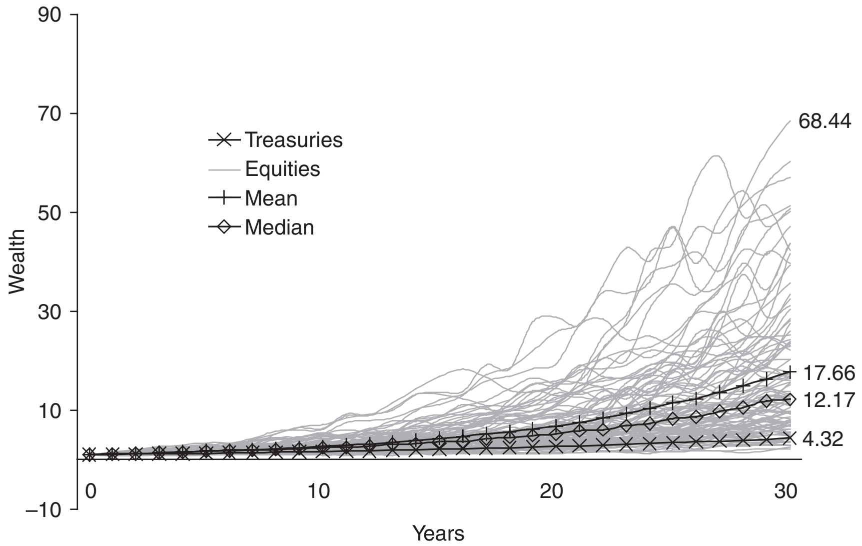

Figure 6-2. Investment payoff paths for equities versus treasuries: 30 year horizon. (*Source*: Author's calculations.)

the equity paths end up below the Treasury endpoint. These represent the nine 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 6-1(a-b) simulate a long S&P-like investment short a zero-coupon Treasury bond. What, then, should any market participant be willing to pay today for the outcome opportunities? Exactly nothing.

Can one really buy these outcome distributions for \$0? For a funded pension plan, the simple answer is: Yes. Bader (2001) illustrates how pension plans could develop such distributions without cost. Starting with a plan whose sole obligation might be \$4.32 due in 30 years 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.[3] Bader indicates that this is equivalent to a swap contract, so I have labeled Figures 6-1(a-b) "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 future value.[4]

Consider a municipal pension plan with the same starting position as the Bader plan. How will an actuary value that plan's liabilities, assets, and current surplus or deficit? When establishing economic assumptions, pension actuaries are subject to Actuarial Standard of Practice 27. This specifies that the actuary will estimate the expected return on assets and use that to discount the liabilities. Thus, using the initial plan asset allocation, the actuary will assume a 5-percent 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 surplus or deficit.

A hypothetical mayor may see an opportunity to improve the situation, by directing 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 percent annually, and thus he revalues the liability at \$0.25. The plan has a surplus of \$0.75. In effect, the Mayor has revalued the Bader Swap in accordance with ASOP 27, such that $P(t = 0) = 0.75$. The Mayor takes the plan surplus and cuts today's taxes by \$0.75, and the pension plan lock box holds all the money (\$0.25) that is actuarially necessary.

What is wrong with this approach? The plan is actuarially sufficient and the taxpayers save money. The problem is that ASOP 27 has no prescription for accounting for risk. Pension actuaries consider themselves fiscally conservative, and individual actuaries might trim the expected return to a "conservative" 9 percent in this situation. An actuary who expected equities to return 10 percent and, nonetheless, assumed a 5 percent return for the all-equity plan, would be out of compliance with accepted actuarial standards. We shall see that the use of any assumption exceeding 5-percent in this instance results in an unintended risk-based transfer of wealth between generations. This is disturbing, because the use of a 5 percent assumption is intergenerationally fair, financially sound, and actuarially *unacceptable*.

When the 10 percent assumption is used, who wins? The Mayor, the taxpayers, and the actuary. Does anyone have to lose? The capital markets tell us that the Bader Swap is worthless; the Mayor and the actuary say it is worth \$0.75. If it is really worth \$0.75, then they should surely be able to get someone to pay \$0.60 for it. Would any creditworthy market participant accept the pension plan obligation, the \$1 in plan assets *and* pay the taxpayers \$0.60 for the privilege? The answer is no, because the creditworthy market participant could short \$1 in Treasuries and buy \$1 of the S&P, and pay no one for the privilege. He would be taking a substantial risk by doing so. Financial economics explains that the expected future value on the Bader Swap is exactly the market compensation for taking that risk. If someone did take that risk, he would demand full compensation and have nothing to share with the taxpayers.

The Mayor Meets a Financially Astute Taxpayer

This intuition may be formalized with a model that illustrates 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 system 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 taxpayer 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? The present value of \$1 due one period from now is:

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

where r is the rate of return. Following the principles of ASOP 27, actuaries assume that r is the expected rate of return on the money in the plan. For convenience, we modify the 5 percent Treasuries and 10 percent equities that were used above. Let the return on Treasuries be 5.2632 percent and let the expected return on equities be 9.8901 percent. If we invest in Treasuries, the actuary says we must set aside \$0.95; if we invest in equities, \$0.91 will suffice.

Because the town wants to remain in business, that retiree is going to receive \$M/G next year. Each future retiree has a riskless promise worth \$0.95M/G. But the Mayor and actuary propose that the city and its pension plan are long-term investors so they can afford to take risks that will average out in the long run. Each Gen1 taxpayer then contributes \$0.91 and the plan buys the S&P index; the \$0.91 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 \$0.91 next year. The actuarial definition of parity is met when each

TABLE 6-1 Generational Balance Sheets

Sections	*Assets*	*Liabilities*
A: Gen1, Period1	Personal portfolio[a]	\$9.1 Payable now
B: Gen2, Period1	Personal portfolio: \$X S&P Y T-bills	(due Period 2) \$0.91 expected Risk of Gen1's S&P investment
C: Gen2, Period 1, Analyzed	Personal portfolio: \$X S&P Y T-bills	(due Period 2) \$.91 for Gen2 employees 1.00 for Gen1 retirees −(0.91 S&P in plan as of Period 1)
D: Gen2, Period 1, Hedged	Personal portfolio: \$(X−0.91) S&P (Y + 0.91) T bills	(due Period 2) \$0.91 for Gen2 employees 1.00 for Gen1 retirees −(0.91 S&P in plan as of Period 1)
E: Gen2, Period 2, Projected	Personal portfolio	\$0.91 for Gen2 employees \$0.042105 for Gen1 retirees

AQ: Pl. check footnote for the note 'a' is missing

generation *expects* to pay the same amount. But one member of Gen2, a finance student, senses a problem. Whereas Gen1 is certain to pay \$0.91, Gen2 may pay more or less than \$0.91 depending on how the S&P performs.

To show this, she develops a balance sheet for Gen1 (Table 6-1) and a projected balance sheet for Gen2 (Table 6-1). The student reformulates the risk in terms of exposure to the pension plan.

Since the finance student has learned about hedging and arbitrage, she 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 hedge to eliminate any extra risk thrust upon her by the pension plan. The hedge must be such that no matter how the \$0.91 set aside by Gen1 performs, she bears the risk that she intended to take. Her S&P exposure is effectively \$(X + 0.91) while her tolerance limits her to \$X.[5] In order to establish her hedge, she realizes that she must sell \$0.91 of S&P and invest the proceeds in T-bills (Table 6-1, Section D). Now her total S&P exposure is \$X as she intended. She projects her balance sheet forward to Period 2 (Table 6-1, Section E) so that she may compare to Gen1 in Period 1, where the negative \$0.91 in S&P exposure has cancelled out across the two sides of the balance sheet. The extra \$0.91 she held in T-bills has grown by 5.2632 percent to \$0.957895, which cancels out all but \$0.042105 of the \$1 that must be paid to Gen1 retirees.

Comparing to Gen1's balance sheet (Table 6-1, Section A) reveals that Gen2 is worse off by \$0.042105. Each future generation will be in the same position as Gen2. How may we interpret this $0.042105 difference between Gen1 and later generations? Consider that the Gen1 public employees have riskless promises worth $0.95G/M equivalent to $0.95 per taxpayer. Gen1 taxpayers have been told that they need pay only $0.91 to provide $0.95 of riskless value, 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 $0.95. Gen2 would have suffered no imposed pension risk and Gen2 would have had to pay $0.95 too.

Financial economics prescribes the use of a riskless discount rate for riskless liabilities, regardless of the actual investments. Had the actuary followed this prescription (in violation of ASOP 27), Gen1 and Gen2 would each face the same risk-hedged or risk-adjusted $0.95 cost. By paying only $0.91, Gen1 enjoys a risk-adjusted free lunch equal to $0.04 while subsequent generations have to pay $0.002105 more than the fair value of the benefits for their governmental workers. In effect, the $0.04 Gen 1 shortfall grows at riskless interest to $0.042105 (equals 0.04 times 1.052632). Gen2 pays the interest and passes on the $0.04 shortfall to Gen3. This continues until the final GenN is forced to pay $0.992105 representing the $0.95 needed to prefund GenN retirees, the $0.04 "borrowed" by Gen1 and one year's interest of $0.002105.

One last way to assess this risk/wealth transfer across generations is to recognize that Gen1 might have invested the full $0.95 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 $0.04 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 reveal a $0.04 windfall for Gen1 that makes all subsequent taxpayer generations losers. This seems like a small "evil," so why should taxpayers worry? One reason is that initially it appeared that the work of $1 in Treasuries could be matched by only $0.25 in equities. In this latter example, we have $0.91 in equities doing the work of $0.95 in Treasuries.

Consider, further, that this example assumed that retiree benefits are due 1 year after the civil service employee provides service to the taxpayers. In a typical pension plan, however, the average worker may be 40 + years old and the average retirement promise is kept some 30 + 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 30 years in length the intergenerational wealth transfer is very large. Supposing a $1 promise 30 years in advance, the riskless cost is $0.214639. Yet the actuary calculates a contribution requirement using equities equal to $0.059053. As in the Bader Swap example, the actuary's adherence to ASOP 27 enables an understatement of liabilities[6] by about 75 percent. This amplifies 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, so ASOP 27 would lead to an understatement of liability values by about 50 percent.

Implications of Liability Mismeasurement

The process defined by ASOP 27 is considered unbiased by actuaries because, on average, investment returns are neither under- nor overestimated. Yet 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. Understatement of the value of promises made to public 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 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 $0.21, but it will be actuarially discounted to a value of $0.06. How much of today's wage should be given up by the employee in exchange for that future benefit? As we have shown any value less than $0.21 represents a real gain to the employee and any value greater than $0.06 creates an apparent gain to today's taxpayers. The $0.15 cost differential is always paid, by future taxpayers, with interest.

A simple test of this proposition may be made by asking insurance companies to offer deferred annuities to cover the promises made. Pension actuaries uniformly believe that insurance companies systematically and egregiously overprice such contracts. 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.[7] 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.

Observe that the use of a near riskless rate of discount, independent of the allocation of plan assets, would result in wage/benefit exchanges made at the value of the benefits promised with almost no regard to how those benefits are financed.

Skim Funds

When public pension plans invest in risky assets, actual investment returns may exceed the assumed returns. So-called "skim funds" exist in many arenas to share the pension plans superior results with plan participants; no similar sharing is levied on participants when risky returns turn out to be inferior. Thus common skim funds designs look like financial call options. Defined benefit pension plans implement a portion of the employment contract under which employees accept reduced current cash contributions, in exchange for promises of conditional future retirement benefits. Employees "own" the pension plan liabilities; the assets stand to provide collateral for those liabilities. Risks taken with the assets are borne by the sponsor (or its constituent taxpayers) in the hopes of reducing the cash necessary to support the benefit promises. When the risks result in losses, the sponsor is responsible for increased future contributions. The justification for establishing skim funds frequently flows from a very different understanding of the nature of pension assets and liabilities. This view holds that plan assets represent employees' accumulated deferred wages. A view more consistent with the economic reality of defined contribution plans.

For many years, public DB pension plans trailed their corporate brethren in the proportion of their assets allocated to equities. Over the last two decades, however, public plans increased their equity exposure to the point where their equity exposure is, on average, not notably different from private sector plans. 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. The fundamental actuarial error represented by ASOP 27's treatment of the valueless Bader Swap allows this seeming cost reduction to be brought to taxpayers immediately.

If one were to view the taxpayers of all generations ensemble, it might be possible to conclude that the expected cost reduction would be a fair recompense for the added risks of equity investment. It would be incorrect, however, to conclude that taxpayers have received a windfall because they can execute a Bader Swap. Rather, taxpayers exchange wages for benefit promises, and then they elect to engage in a Bader Swap. Since the benefits promised remain unchanged, the risk inherent in the swap has not been shared with plan participants.

Nonetheless, as public sector pension plans began to reduce their holdings of bonds over time and increase their holdings of equities, negotiators for the plan participants demanded that the rewards from equity investments be shared between the participants and the taxpayers, taking advantage of the fable that ties wages to plan assets. Municipal politicians and managers, anxious to lower current costs by switching into equities, were willing to share the "gains" with participants, despite the risk that was borne entirely by taxpayers. The structure that emerged is the "skim fund," which redirects some of the “excess” returns earned by the taxpayers’ acceptance of risk to provide previously unscheduled benefit increases. The very same actuarial error that encouraged equity investment, encouraged undervaluation of promises made in lieu of wages, and transferred 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.

Observe that the use of a near riskless rate of discount, independent of the allocation of plan assets, would reduce the financial managers’ incentive to invest in equities. Then, faced with demands for shares of equity rewards, the managers would be required to recognize the symmetric sharing of equity risks as well.

Pension Obligation Bonds

A third implication deriving from the fundamental actuarial misvaluation of the Bader Swap has prompted states to issue taxable POBs. To understand the taxable POBs, it is useful to begin with an earlier period in which municipal taxpayers benefited from a tax arbitrage to the detriment of federal taxpayers.

This began in the early 1980s, when some Wall Street public finance specialists found a loophole in the federal tax system that allowed states and municipalities to issue tax-exempt bonds, to cover past service contributions to underfunded DB public pension plans. Without taking on any net risk, the governmental entity could borrow at its below-Treasury tax-exempt rate, and then it 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 governments that clearly came at the expense of the federal purse. In a short period in the mid-1980s, billions of dollars of such transactions were undertaken.

In order to deliver the advantages of this arbitrage to 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 plan contributions by more than the debt service cost incurred by the borrowed. Since there were true arbitrage gains available, actuaries 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.

Within a few years, the Internal Revenue Service (IRS) declared that any future bond offerings used in such schemes would have to be taxable though it grandfathered the outstanding pension bond issues as tax-exempt. For several years following this ruling, Wall Street's public finance departments did not market or underwrite the issuance of pension bonds. But then managers of public pension plans decided that holding Treasury bonds was inconsistent with their long-term risk-return goals, and they undertook to redeploy the assets. Using Bader Swaps, as a result, the reduction in the level of contributions far exceeded the cost of debt service. The net reduction was so important, in fact, that the tax-exempt status of the bonds was only the smaller of the values added.[8]

Wall Street's public finance departments soon saw a new opportunity to market and underwrite pension bonds.

In the dozen or so years since the invention of this "actuarial arbitrage," the volume of POBs has swelled. Only recently has the wisdom of POBs has been called into question, as recently in Philadelphia (Davies, 2001).

To review how taxable POBs work, the municipality first borrows at its taxable rate (which is greater than the comparable US Treasury borrowing rate) and contributes the proceeds to the pension plan. Next the fund managers invest the proceeds in diversified assets including equities. For the sake of illustration, we assume that all of the proceeds are invested in the S&P 500. The actuary then credits the fund with the expected return on the S&P and reduces the required plan contributions by that amount. Gold (2000) describes the taxable POB transaction by first assuming 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. Nevertheless, the fund undertakes a Bader Swap, thus achieving the goal of the POBs. The actuarially generated gain on the Bader Swap generates more in *apparent* winnings than the first step *really* 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. We observe that the use of a near-riskless rate of discount, independent of the allocation of plan assets, would eliminate the "actuarial arbitrage" gains from POBs, leaving nothing but the negative arbitrage that results from borrowing at above Treasury rates to earn near riskless rates.

Conclusion

We have argued that currently accepted pension actuarial methods embed a flawed understanding of the risk of equities and the improper valuation of market-to-market swaps. The existing approach was developed as

DB pension plans abandoned insurance companies and adopted trusteed arrangements after Second World War. The flaw has been extended by the accountants and by Congress when they incorporated actuarial principles into their prescriptions.

Few are aware of the problem because recognizing the error requires an integration of financial economics with actuarial science. Because the existing standards favor today's generation of managers, shareholders, taxpayers, politicians, and actuaries, even those who do perceive the problem are poorly motivated to correct it.

This problem has begun to be revealed, however. Consider the "legacy" pension obligations of the steel industry that received some attention in March 2002, when President George W. Bush chose to protect that industry with tariffs. A companion proposal, not adopted, would have had federal taxpayers bail out the underfunded pension plans of failed steel companies.

Consider too the recent actions of the Boots Company (2001), a UK firm elected to place its £2.3 billion plan in UK bonds matching the plan's projected outflows. It chose to forego the illusory gains from a Bader Swap but in doing so has had to explain its decision to shareholders, rating agencies, and other interested parties. The firm has said that its motivation was to reduce risks associated with mismatches between DB plan assets and plan liabilities. It is interesting that Boots transaction coincided with the adoption of Financial Reporting Standard 17 in the United Kingdom, a standard that 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 it has also been blamed for discouraging final average defined benefit plan formation and maintenance (Capleton and Cleary, 2002).

Unfortunately these are only small steps. The global accounting effort to implement a "fair value" accounting model for financial instruments by 2005 will require accounting to learn the lessons of arbitrage and proper risk-adjusted measurements. Nevertheless, the accounting project has thus far elected to exempt pension and welfare plans from its purview. The pension actuarial community has begun its own research and education effort designed to assess the implications of financial economics on the pension actuarial model. We should therefore begin to see the fair value paradigm influence securities analysts of pension plan finance.[9]

Notes

[1]Here we argue that the goal of intergenerational fairness may be served in expectation but it is often poorly served in value.

[2]Note that after paying such an amount, the final payoff will be negative 9 percent of the time, requiring a second payment at maturity. We assume that neither party will default.

[3]Bader had a $1 million obligation. Here we adjust to be consistent with our payoffs.
[4]These are sample means. Population means are 0.96 and 13.13.
[5]This equates $X in his personal portfolio plus the effect of having a liability of minus $0.91 in S&P.
[6]Readers may 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.
[7]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. See also Lachance and Mitchell (Chapter 8, this volume).
[8]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.
[9]See Bader (2002) and Capleton and Cleary (2002).

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