

# **Pensions in the Public Sector**

Edited by

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## Chapter 9

# **Asset/Liability Management in the Public Sector**

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Michael Peskin

Public defined benefit pension plan investing is in a transitional phase, evolving from one that had an asset-only focus, to one that encompasses the full asset/liability relationship. This chapter argues that this shift may accelerate as politicians, sponsors, participants, trustees and others, realize that asset/liability management (ALM) within a finance framework is not just a theoretical nicety. Rather, it reduces cost and risk and thus enhances the efficiency of the retirement system. Additionally, ALM can help remedy the significant investment, funding, and benefit policy inefficiencies in the public sector pension system sometimes caused by a lack of integration of the system and weak accounting. This chapter also discusses the sorts of political imbalances that tend to pass cost and risk onto future generations in a public pension system, and how such imbalances are also ameliorated by ALM.

### **What Should a Public Pension System Maximize?**

Public pension systems are complex and dynamic. As in any complex system, everything impacts everything else. Unfortunately, common practice tends to compartmentalize and segregate benefit policy from investment policy from funding policy. This practice, coupled with unscientific accounting, produces substantial increases in cost and risk. Examples include improper asset allocation, insufficient bond durations, incorrect measurement of the price of benefits, especially options, inappropriate issue of pension obligation bonds (POBs) and inefficient funding. I argue that a public pension plan's proper objective should be to provide intended benefits at the lowest cost. Savings in cost and risk can be achieved by integrating assets, liabilities, and funding within a corporate finance framework.

TABLE 1. Comparing the Traditional Approach to the ALM Approach

<i>Policy</i>	<i>Traditional</i>	<i>ALM</i>
Investment objective	Maximizes return per unit of volatility; peer group comparison	Minimizes cost per unit of volatility of cost; overall peer group comparison not relevant
Equity exposure	Subject to risk tolerance of trustees	Virtually dictated by nature of liabilities and funded status
Bond duration	Intermediate duration provides highest return per unit of volatility	Long duration provides lowest cost per unit of volatility of cost
Funding policy	Set through regulations and "negotiated" assumptions	Integrated with investment policy to minimize risk adjusted PV of future contributions
Benefit policy	Maximize benefit per unit of cost on deterministic actuarial basis	Maximize benefits per unit of risk-adjusted cost as measured on fully integrated basis

Source: Author's compilation from data supplied by MSDW Global Pensions Group.

Key differences between an ALM framework and the traditional framework are outlined in Table 1. I recognize that the traditional approach is in a state of flux, with some public plans moving slowly in the direction of ALM. Nonetheless, the table affords an overview of problems and proposed solutions, with a perspective on the overall operation of a public pension plan.

## **An Overview of the Pension Contract**

A pension plan can be viewed as a contractual arrangement between the public employer and public sector employees that sets aside deferred wages in exchange for current service. The foregone earnings take the form of both indirect payments (employer provided benefits) and direct compensation (employee contributions). Deferred wages are usually determined by a formula based on pay and service (at or near retirement), with the policy objective of providing postemployment income that, together with personal savings, social security and medical benefits, will be sufficient to maintain living standards. Public plans generally have multiple benefit formulas (see Steffen this volume; Mitchell et al. this volume) that depend on date of hire and many other factors. Not only do the benefit formulas tend to be complex, but also public plans often provide alternate formulas that apply depending on an employee's circumstances (such as date of hire, circumstance

of retirement, etc). Public plan benefits are often also indexed to inflation after retirement, either fully or partly.

These defined benefit promises translate into a pension obligation, one that is typically a “general” obligation of the sponsoring public entity. What this means is that the benefits are seen as very secure, since they have the full backing of the public sponsor’s ability to tax to meet obligations. This applies irrespective of how well funded the plan may be at any given moment in time; to the extent that the plan has assets, the deferred wage promise is said to be collateralized with trust assets. From a capital market perspective, then, a defined benefit pension plan should be thought of as a collateralized general obligation bond of the sponsoring public entity. The collateral adds to the security of what, in most instances, is an already very secure bond. It is interesting to note that security is not the prime reason for the funding of public pension plans (although this may be a perceived advantage even if untrue). The key reason for funding public pension plans is to improve intergenerational equity—that is, to reduce the transfer of unfunded costs of currently accruing benefits to later generations of taxpayers.

The “pension contract” is an agreement between employees (plan participants) and the public sector employer. In the public plan case, the employer is a public entity typically represented by elected and appointed officials (administration and regulatory bodies; see Useem and Hess this volume). The group eventually at risk is, of course, the electorate—current and future taxpayers. Employee interests are generally entrusted to the unions (as employee representatives) and public plan trustees who exercise considerable control and usually hire an actuary and investment consultant to help make decisions and analyze alternatives. The primary stakeholders are thus the employees and taxpayers; the other key stakeholders are the elected administrators and regulators, unions, plan trustees, and the plan actuary. There are, of course, many other parties in interest including the professional staff (who are also usually beneficiaries), consultants, money managers and many others.

### **Cash Flow, Expense, Benefit, and Credit Issues**

There are four methods by which year-to-year changes in the financial status of a defined benefit pension plan affect the financial position of key stakeholders. These are as follows:

- Cash flow changes: contribution requirements are paid out of taxes.
- Expense changes: accounting expenses are recognized charges to budgets.
- Changes in benefit security and borrowing costs.
- Changes in participant promises.

Each of these is directly related to pension assets minus pension liabilities, or the funded status of the plan. Plan assets on a stand-alone basis have no economic impact on the key stakeholders. Consequently, proper management of the asset/liability relationship is critical. We delve into each in turn:

*Cash flow changes.* A defined benefit pension plan should be viewed as part of the capital structure of the sponsor. The plan participants have been promised deferred wages. This promise is met through payments from the pension trust and the trust is funded through required contributions as dictated by regulation and negotiation. The economic cost of the plan consists of the present value of future contributions; in this sense, future contributions are taxpayer liabilities.

Contribution requirements are usually calculated using a deterministic basis; that is, the expected benefit cash flows are discounted at the expected rate of return on the assets to yield a present value. Plan assets are then deducted from the liabilities to determine the unfunded obligation and hence the annual contribution requirements. In practice, plan assets are usually measured using a moving market average value. It is well known that current-period contributions are extremely sensitive to the assumptions, particularly the discount rate (see Husted this volume), which at times allows the system to be "gamed." For instance, a higher assumed discount rate would permit cuts in current contributions without any other change in policy, although this increases the probability of higher contribution requirements in the future. In addition, investment policy can be changed to increase equity exposure. If a higher expected rate of return is used to calculate contributions but the higher risk is not recognized, then current costs appear to be reduced, but there is a higher chance of needing additional contributions in the future.

Measuring liabilities deterministically ignores the asymmetry that almost always exists in pension systems. For example, benefits are often upwardly indexed to inflation, but benefits cannot generally be cut in a period of deflation; many plans raise benefits when plan funding rises, but cannot cut benefits when funding deteriorates; and finally, some employers have "skimmed" excess returns from one plan to provide benefits in an affiliated plan. The New York City Variable Supplements Funds are an example of such "skim" funds, albeit not particularly egregious ones.<sup>1</sup> These funds provide for supplemental retirement benefits funded entirely from returns in the pension plans in excess of a hypothetical fixed income return. There skim is limited to defined benefit caps on the supplemental benefits provided by these particular plans that limit the transfer of "excess" returns.

*Changes in expense.* In a public pension plan, the accounting objective is generally to assign a cost to the period in which it is incurred. It is usually the accounting cost that would be treated as the cost for administrative budgeting purposes. Most public systems consider the required contribution

amount as the accounting cost. In other words, the contribution requirement for any year is also the cost of the plan that the administrative budget must meet. This has the virtue of preventing gaming on two fronts—funding cost as well as accounting cost—but it makes plan funding more politically salient and more important for the administration to game. Funding, in its role as the accounting cost, is also the cost recognized for budgetary purposes and thus reduces the capacity of the administration to spend on other, more politically desirable, projects. Thus the elected administration would prefer the funding cost to be as low as possible (at least until the next election) so that more of the budget is available to finance the administration's goals.

Of course, any accounting system that does not mark assets and liabilities to market will be "gameable," and this is often a problem with public pensions. Assets tend to be kept at "book" value or some smoothed market value measure (such as a moving five year market average). Furthermore, an artificial discount rate (such as the long-term expected return on the portfolio, without adjustment for either risk or changes in the level of interest rates) is used to measure liabilities. It has been suggested that one way to avoid such gaming is to require that both assets and liabilities be accounted for on a market-value basis. The "market value" of liabilities would be the liabilities discounted at market rates of interest. One problem with this approach is that there is no "market value" of ongoing plan liabilities; public pension liabilities are politically influenced and not particularly transparent. A more important issue is that the degree to which the plan is prefunded is also determined by the discount rate and cost method used. Thus simply discounting the average or expected liability cash flows at market rates of interest is also an artifice and does not lead to optimal or efficient answers.

*Changes in benefit security and borrowing costs.* As noted above, public pension promises are a general obligation of the public plan sponsor and thus in most instances, deemed very secure. Of course, a pension liability may be at greater risk when there is also a significant general obligation risk. In my view, the key reason for funding public pensions is not to enhance security or manage borrowing costs, but rather to reduce the intergenerational transfer of wealth implicit in a pay-as-you-go financing framework.

*Changes in participant promises.* Many public pension systems have at least partial inflation protection through cost-of-living allowances (COLAs; see Mitchell et al. this volume). To some, it seems inappropriate to have one sector of the economy (state and/or local taxpayers) guarantee payment for inflation caused by macroeconomic policy. In any event, most public plans do provide partial COLAs, and those that do not try to provide ad hoc increases if investment performance allows.<sup>2</sup> This latter practice is encouraged by the widespread view that a defined benefit (DB) public pension surplus belongs to participants. This is contrary to the view expressed in the private pension

arena under the Employee Retirement Income Security Act (ERISA), since DB pension participants do not bear investment risk. In fact, the practice of delivering plan surplus to participants provides a costly option, one not typically recognized in pension budgeting.

## **Public Pension Stakeholders and Their Economic Interests**

To understand public pension systems, it is helpful to outline the economic interests of the major stakeholders.

*Plan beneficiaries.* This set of stakeholders seeks to maximize compensation, which is comprised of both earnings and pension income, subject to risk constraints. The constraints include the possibility of losing employment, the chance of losing current or deferred compensation, and the chance of losses in benefits caused by a loss in pension assets.

Table 2 provides a sketch of the "financial T account" of plan beneficiaries. Here, prospective pension benefits are divided into four different risk types (many other subdivisions are possible):

- Benefits secured by current funding including guaranteed COLAs (i.e., collateralized with plan assets as well as secured by general obligation of the sponsor)
- Accrued benefits (if any) in excess of the current funded level that are dependent on the ability of the sponsor to fund
- Future benefit accruals, dependent on both the sponsor's ability to fund and future employment
- Future benefit improvements and COLAs beyond those guaranteed in the formulas, also dependent on negotiation and in turn dependent on the plan's funded status. In other words, the participants own a partial call on any emerging plan surplus.

Some important observations that flow from this schema include the fact that benefits are very secure except for future negotiated benefit improvements. In addition, COLAs beyond those guaranteed and other benefit improvements may be easier to negotiate when the plan is well funded. This would appear to be the major reason why participants should have an interest in funding the plan.

This format also highlights the important but subtle distinction between the value of increased pension benefits to employees in active service in the public versus the private sector. In the private sector, benefit and wage costs are closely integrated, more so than in the public sector (mainly because total compensation costs appear to be set more competitively in the private sector). For this reason, private sector benefit improvements are likely

TABLE 2. Financial T Account of Beneficiaries with Respect to Pensions

<i>Assets</i>	<i>Liabilities</i>
PV funded accrued benefits (secured by trust assets)	Marginal future work to earn future accruals
PV unfunded accrued benefits (subject to sponsor risk)	PV employee contributions out of future wages
PV future accruals (as per current benefit formulae)(subject to sponsor and/or job risk)	
PV future benefit improvements including COLAs in excess of guarantee (subject to sponsor, job, and negotiation risk)	

Source: Author's compilation from data supplied by MSDW Global Pensions Group.

to be accompanied by offsets in other forms of pay. By contrast, unionization in the public sector constitutes a formidable political force, one that sometimes succeeds in enhancing both pay and benefits. Also, public sector wages are a direct cost against the budget of the public entity, so they tend to be sticky. In the past, public pension benefits have sometimes been used to boost compensation, inasmuch as pension costs are not as directly observable and can be "hidden" or deferred to some extent especially if the plan is well funded.

Significant employee contributions are common in public pension plans, and benefit improvements tend to be accompanied by an increase in employee contributions. It must be noted that such benefit improvements are not necessarily a wash from an economic perspective: older, longer service employees' gain as the value of the benefit increases often exceeds the cost of their additional employee contributions. This subsidy is not necessarily made up by contributions of new hires or younger mobile employees, since labor market competition will require that new hires be paid at market rates. High employee contributions also seem to give more weight to the participants' claim on emerging surpluses, which further reduces their value to taxpayers. In other words, if employees are paying half or more of the total contributions more of the emerging surplus is assumed to belong to them than if they were paying no or a small percentage of the contributions. The economic case for ownership of surplus should, however, be based on who bears the risk of investment returns. A fixed (nonrisky) employee contribution is more properly viewed as part of the defined benefit formula. An example may make this clear. Consider a benefit formula of 1.2 percent of final pay per year of service with employees contributing 0 percent of pay. Suppose an alternative benefit formula providing a larger pension, say, 2 percent of final pay per year of service, but requiring compensating employee

TABLE 3. Financial T-Account of Taxpayers with Respect to Pensions

<i>Assets</i>	<i>Liabilities</i>
PV of future work of participants financed by pensions	PV of future contributions in respect of pensions required to hire and retain staff on basis of efficient asset/liability management
PV of deferrals to future generations of taxpayers	PV of future contributions in respect of inefficient management
	PV of future contributions for benefit improvements based on emerging surplus and weak taxpayer representation
	PV of deferrals by past generations of taxpayers

Source: Author's compilation from data supplied by MSDW Global Pensions Group.

contributions of, say, 6 percent of pay, were proposed. These two formulations may be equally attractive to employees and employer. There would be no economic rationale for the view that the latter plan should share surplus with employees to a greater extent than the former plan, through reduction in employee contributions, if the employees are not equally at risk for an increase in contributions if investment performance is poor.

*Taxpayers.* It would be reasonable for taxpayers to seek to achieve the public services they require, at the lowest feasible cost. In other words, the goal of state and local governments in this arena should be to hire and retain needed staff, while minimizing the present value of future taxes needed to pay the pension obligations. Since pensions are an important component of the total compensation package, financing the pension sensibly ensures that public employees will ultimately be less of a taxpayer burden after retirement; pension funding also takes advantage of the federal tax-free buildup of pension assets prior to retirement. (Local taxes may also be deductible at the federal level). The financial T account of taxpayers with respect to the pension plan looks something like the matrix in Table 3.

The great challenge to taxpayers in the present context, of course, is how to manage a public pension plan efficiently in the face of enormous agency risk and with very little representation. It is important to design administrative structures that can successfully fend off often ingenious raids made on the large pool of assets built up to meet the pension obligations, and these generally occur in a highly politicized environment (Clark et al. this volume; Munnell et al. this volume). The basic problem arises from a key and very important asymmetry in pension finance: pension liabilities cannot be exactly hedged in the capital markets. For this reason, at any point in time there will be a perceived shortfall or surplus in the fund. Emerging shortfalls have to

be made up by taxpayers in higher contributions. Emerging surpluses, however, are only partly used to offset future contributions and partly used to finance enhanced benefits (or reduced employee contributions, which are the same thing).

*Elected administrators and regulators.* Taxpayers' key "agents" are the elected officials and those who run the public pension systems. But problems arise because public pension plans represent an extremely long bond obligation, poorly understood, not marked to market by anybody, and backed by an enormous pool of assets. In this regard, public pension plans are far less tightly governed by an economic bottom line than are their private sector cousins. For this reason they are more susceptible to political pressures, thus increasing complexity and long-term costs in exchange for short-term accommodation. The short-term accommodation is in the form of both higher benefits and lower current costs. The higher, longer-term cost is usually hidden in an unmeasured risk transfer to the next generation.

In practice, this means that everyone connected to the pension plan may be well intentioned, but the time horizon of elected officials rarely extends much beyond the next election. In hard-fought battles for budget resources, therefore, long-term concerns are least represented and lose out to nearer-term considerations. This political imbalance may manifest itself in numerous ways, including the issue of pension obligation bonds, benefit improvements with an underestimated current cost, and investments focused on specific constituent groups.

The solution to this political imbalance is to adopt a rigorous and disciplined framework within which to calculate liabilities and assets, and to establish policies. Such a framework must make the price of options and transfer of costs or risks to future generations transparent. It thus includes a comprehensive stochastic model of the plan going forward many years with explicit modeling of investment, funding and benefit policies. The core economic cost is the present value of contributions to fund the appropriate level of benefits. It is possible to reduce the present value of contributions with appropriate investment and funding policy and a tightening of benefit policy to avoid the provision of expensive options. The sources of these savings are discussed in the next section.<sup>5</sup>

## Sources of Public Pension Saving

A traditionally-managed public plan that changes its polity to minimize the present value of future contributions in a fully stochastic framework will experience several types of savings, listed next.

*Better asset/liability matching.* Designing the assets to move in tandem with the liabilities saves taxpayers money. The reason for these savings lies in the asymmetric payoff pattern described above. An example illustrates this

point. Assume a pension plan is 140 percent funded; that is, assets are 140 percent of the plan's accrued liability. Let us further assume that at this point no further contributions (taxes) are required. Now suppose an asset was available that would perform in tandem with the liabilities so as to maintain the ratio at 140 percent, regardless of what occurs with capital markets; that is, asset returns would be sufficient to pay out benefits for the period, and then assets would rise at exactly the same rate that the liabilities increased. Let us call this hypothetical asset the "liability asset." In point of fact, no such asset exists, but it is sufficient in practice to move in this direction to generate savings.

If the plan were fully invested in this "liability asset," no contributions would be required this year or in any future year. Therefore, the present value of future contributions would be zero. Suppose further that there was an alternative asset class, called the "risky asset," with an expected return of 4 percent per annum above the "liability asset." Unfortunately, this 4 percent premium also has a 15 percent standard deviation (i.e., the return differential between the risky asset and liabilities has a 15 percent standard deviation). If the plan invested in this "risky asset" in lieu of the "liability asset," the expected funded ratio would be well in excess of 200 percent after a period of thirty years or so. However, many scenarios would result in funded ratios substantially below 140 percent. Even on those paths that generate large funded ratios at the end of the period, there may be some years where the funded ratio drops below 140 percent. If these points coincide with the actuarial funding valuation, taxpayers will be called on to make contributions. Thus, the present value of contributions will be substantially higher despite the higher expected returns. This increase in cost can only be recouped if surplus at the end of the period can be recaptured by taxpayers. If surplus is used to increase benefits then the situation is even worse, as high returns will lead to higher benefits and higher future costs.

In practice, it is impossible to find a "liability asset." It is, however, possible to cause the assets and liabilities to move more closely in tandem than a traditional management approach can achieve. The "lowest risk" portfolio, as measured by present value of future contributions, is usually a combination of equities and long duration bonds. The actual mix for this "lowest risk" portfolio can vary substantially among plans and has ranged, in my experience for corporate plans, from a low of 20 percent equities to a high of 90 percent equities. The optimal bond duration is specific to each plan and each level of equity exposure. It usually exceeds ten years and is much higher than any of the commonly used bond indices.

*Extending the dollar duration of the fixed income portfolio.* One way of synchronizing assets and liabilities is to extend the dollar duration of the fixed income portion of the portfolio, by changing how much plan assets rise or

fall per 1 percent fall or rise in interest rates. Liabilities, like long duration bonds, are extremely interest sensitive (Leibowitz 1987). This is true even if the pension is partly inflation indexed. This sensitivity to real interest rates grows as the degree of indexation rises, but there are very few liabilities that are insensitive to nominal interest rates. Increasing the dollar duration of the assets not only reduces the riskiness of the asset/liability gap, but it also provides a higher expected return. This higher expected return results mainly from the move up the yield curve. This is based on the existence of an imbedded liquidity premium (i.e., it assumes that, on average, the yield curve is upwardly sloped).

Figure 1 illustrates the impact of increasing dollar duration through increasing the duration of the bond portfolio using a futures overlay (Gold and Peskin 1988). In the efficient frontier depicted in the figure and below, the vertical axis (the return measure) is the mean present value of future contributions over all 400 simulations. The horizontal axis (the risk measure) is the mean present value of future contributions in the worst 80 simulations. The simulations are obtained through stratified sampling. In the example above, the optimal duration is 18 years. Both the expected cost (the mean present value of contributions over 400 scenarios) and the cost risk (the mean cost in the worst 80 scenarios) rise as the duration is shortened or lengthened from the optimal 18 years.

*Amount of equity exposure.* The pension plan's equity exposure is critical to its cost. The traditional split (60 percent equities, 40 percent fixed income) is often not optimal and sometimes is not even on the efficient frontier. As indicated previously, the "lowest risk" portfolio has varied from 20 percent to 90 percent equities; however, the "lowest risk" portfolio is usually sub-optimal because decision makers have a utility function that leads them to accept the tradeoff in going to higher equity exposures. The optimal amount of equity exposure also varies dramatically from plan to plan; in my experience the optimal equity exposure has varied from no more than 30 to 90 percent.

In Figure 2, the efficient frontier extends from 40 to 90 percent equities. The trade-off between "expected cost" and "cost risk" is such that between 40 percent and 60 percent—the cost reduces substantially per unit of risk—the optimal equity exposure lies between 60 percent and 90 percent equities.

There are three key factors impacting the optimal amount of equity exposure. The first has to do with the "noise" in the liabilities. Fixed income assets are suitable "liability matching assets" if the liabilities are similar to bonds. When the liabilities look a great deal like bonds, a close match can virtually eliminate risk. When the liabilities look less like bonds, a residual risk remains even with the "best" matched portfolio. In this latter case, add-

**Optimizing Duration**  
**Present Value of Future Contributions**  
Equity Exposure = 10%

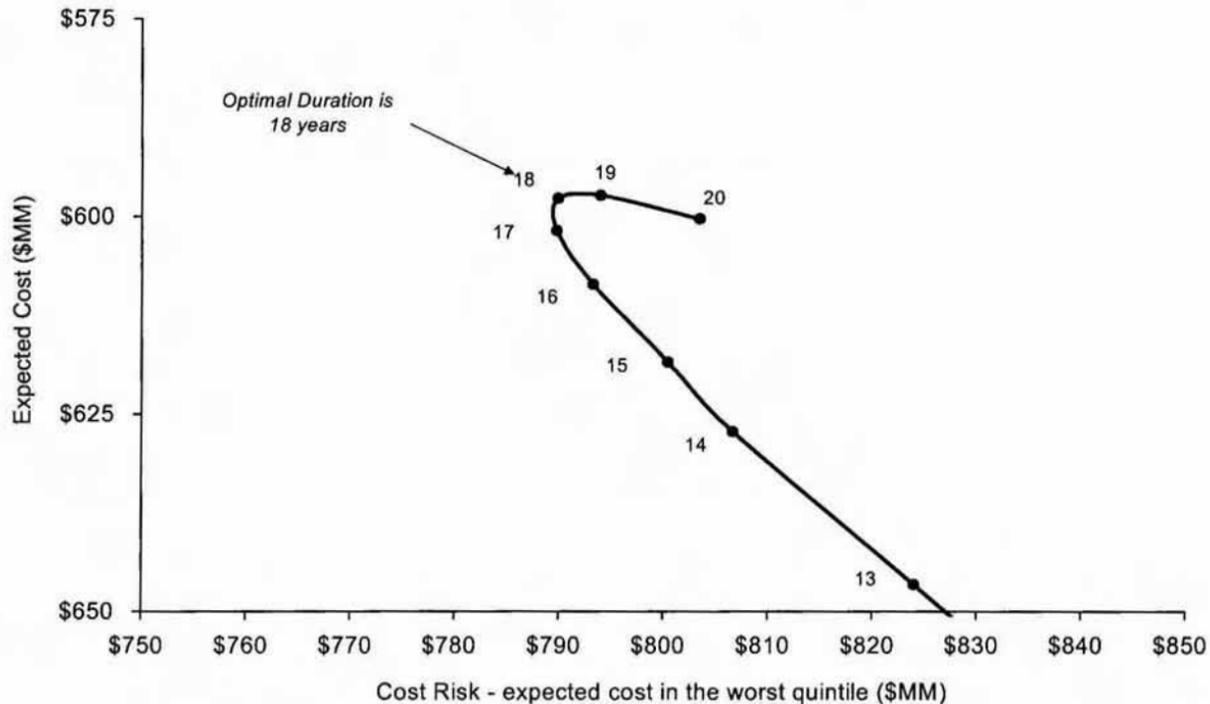


Figure 1. Optimizing fixed income duration. Source: author's calculations from data supplied by MSDW Pensions Group.

**Equity Exposure**  
**Present Value of Future Contributions**  
**Optimal Duration**

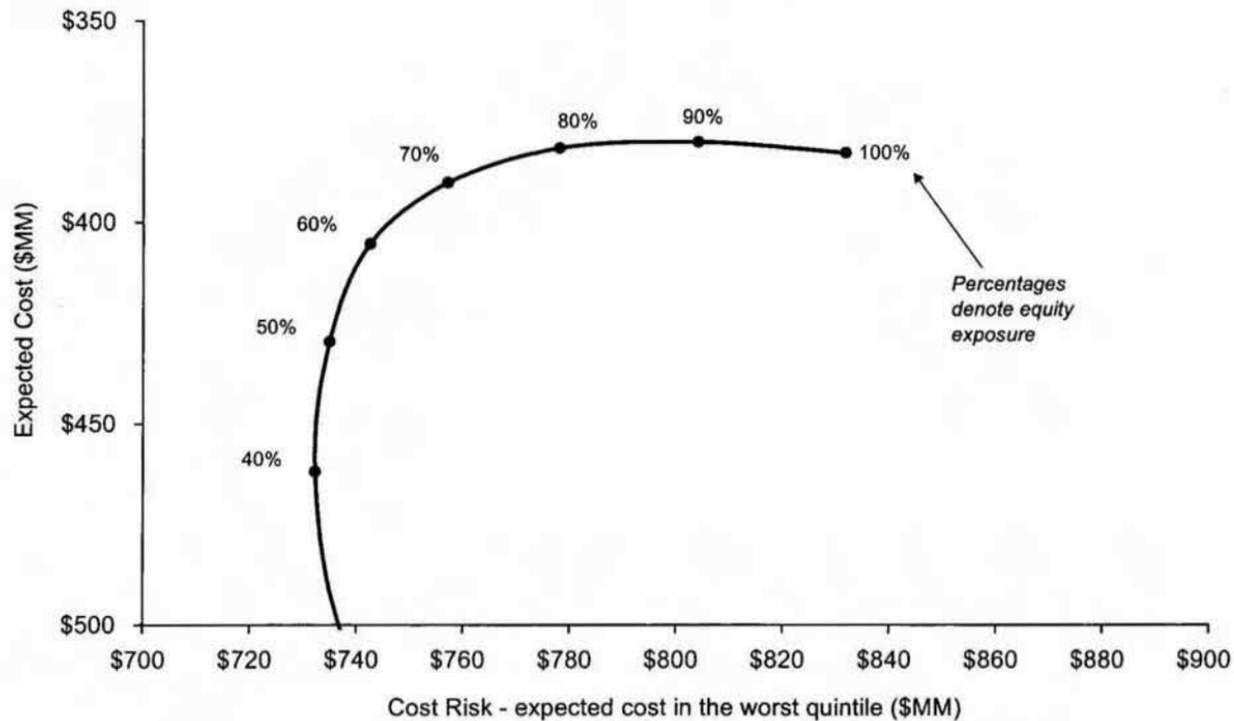


Figure 2. Equity exposure. Source: author's calculations from data supplied by MSDW Global Pensions Group.

ing equity increases returns more sharply than it increases risk. In fact, the equity risk and the liability noise are diversifying and the least risk portfolio will contain some equities.

There are many sources of "noise" including uncertainty in the future demographics in the plan, benefit formulas and design, future pay and future hiring patterns. For example, retiree liabilities are far more accurately represented by bonds than are active liabilities. Salary increases in active liabilities are only partly determined by the level of interest rates and thus create "noise" (volatility in the relationship between bonds and liabilities). The greater the "noise," the greater the optimal equity exposure. This tendency is increased because there is a relationship, albeit small, between the real return on equities over long periods and the real increase in wages that drive active liabilities. Thus the proportion of retirees to actives is an important factor.

Figures 3 and 4 develop the efficient frontiers for plans with identical assets and ABOs but very different "noise" levels. Figure 3 shows the efficient frontier if the liabilities consisted entirely of final pay active liabilities (very high noise). Figure 4 shows the efficient frontier if the liabilities consisted entirely of retirees with no COLAs (very low noise). In the case of the high-noise, efficient frontier, the cost risk increases slowly as equity exposure increases, leading to high optimal equity exposures. In the low-noise case, the efficient frontier ends at 20 percent equities with higher expected cost and much higher cost risk at higher equity exposures.

Also important is the "weight" attached to surplus value. As stated previously, the surplus in a pension plan may have value over and above the reduction in future contributions. It may be recaptured by taxpayers (very rare) or used indirectly to reduce costs elsewhere. The actual value is highly dependent on legislation and the balance of power in the struggle over who owns the pension surplus. Since the appropriate value of surplus is unclear, it is beneficial to examine what the optimal allocation is for a range of possible surplus weights. Generally, the larger the weight, the greater the value of the surplus generated by extraordinary equity returns and the larger the optimal equity exposure.

Figure 5 shows the efficient frontiers in the two extreme cases: that where surplus has no value other than decreasing future contributions (0 percent surplus value) and that where surplus can be recaptured at full value (100 percent surplus value). The efficient frontier in the 100 percent surplus value case is much steeper leading to much higher optimal equity exposures.

Finally, the funded status of the plan matters a great deal. In general, poorly funded plans and well-funded plans lead to higher equity exposures. For poorly funded plans, high equity exposures are necessary because the asymmetry discussed earlier disappears (and may even reverse with little

**Actives Only**  
**Present Value of Future Contributions**  
Optimal Duration

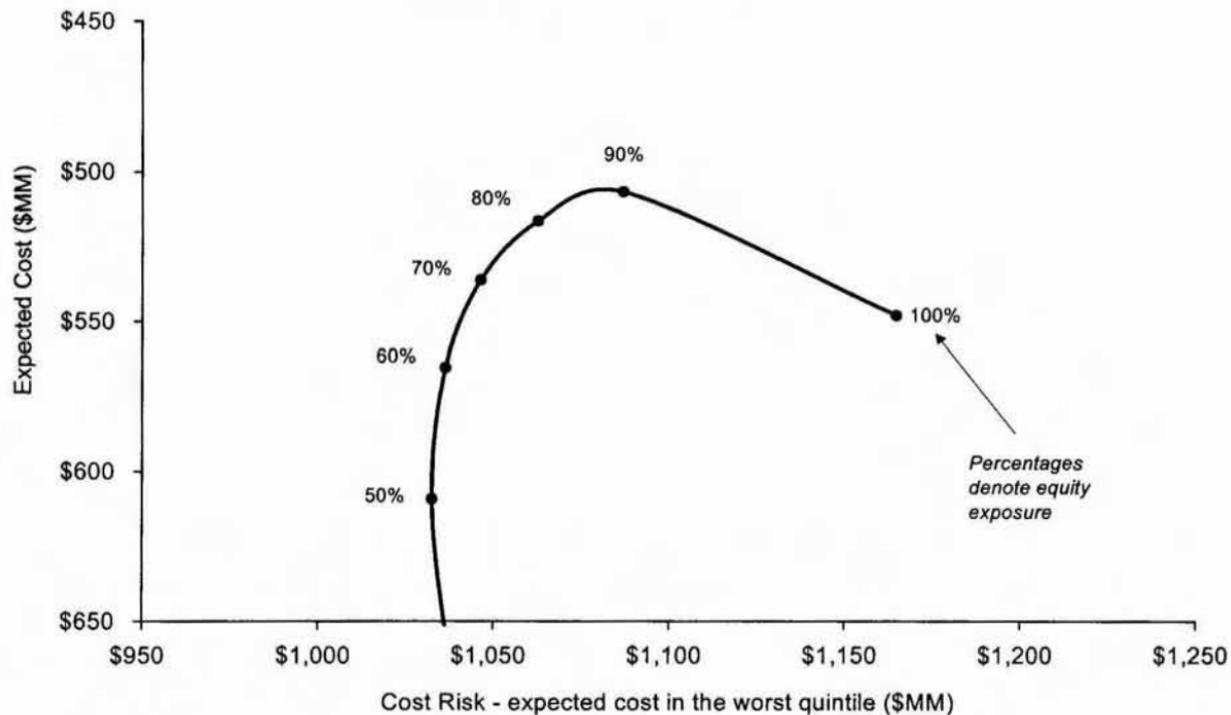


Figure 3. High “noise” liabilities. Source: author’s calculations from data supplied by MSDW Global Pensions Group.

**Retirees Only**  
**Present value of Future Contributions**  
Optimal Duration

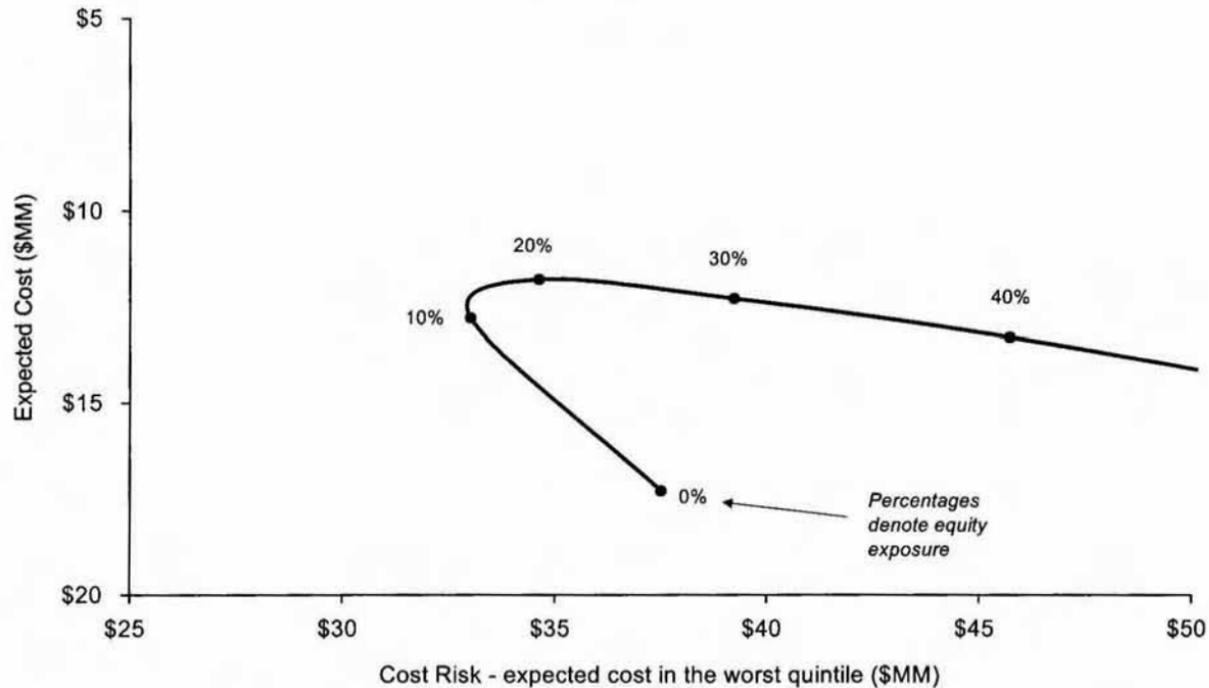


Figure 4. Low "noise" liabilities. Source: author's calculations from data supplied by MSDW Global Pensions Group.

**Surplus Value**  
Duration = 17

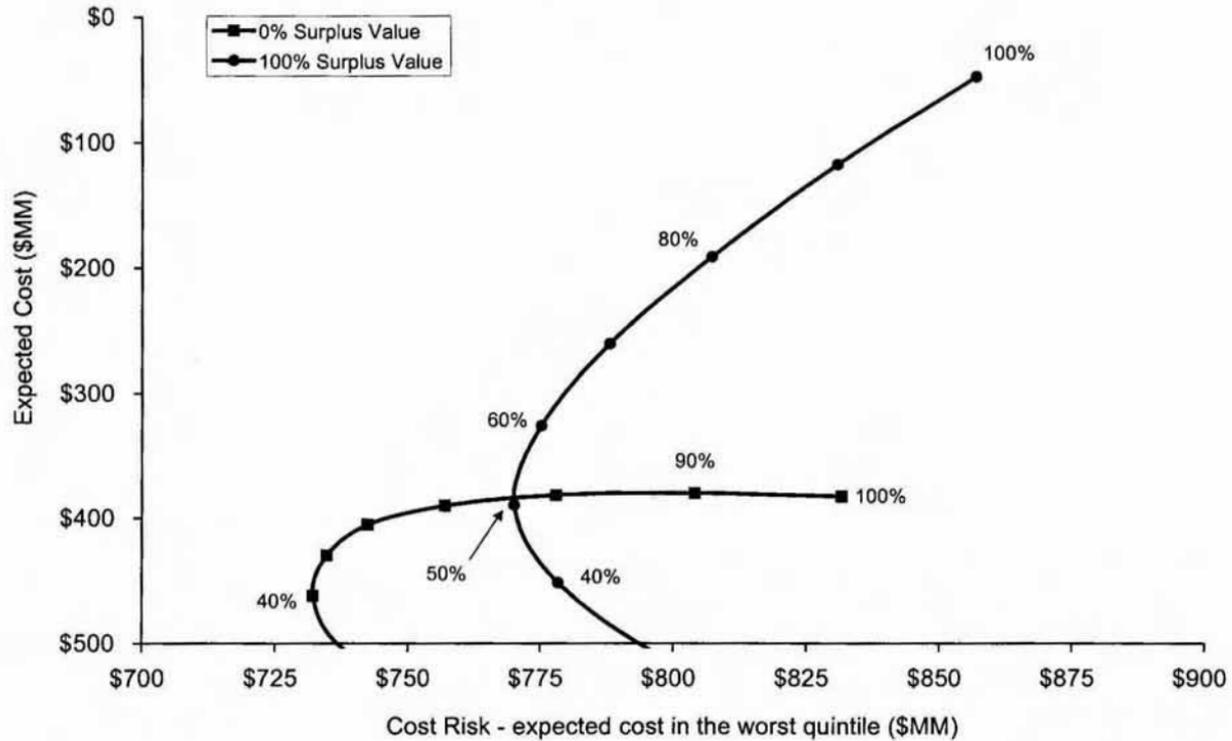


Figure 5. Who owns the surplus? Source: author's calculations from data supplied by MSDW Global Pensions Group.

**Valuation Rate**  
**Present Value of Future Contributions**  
 Optimal Duration, 0% Surplus Weight

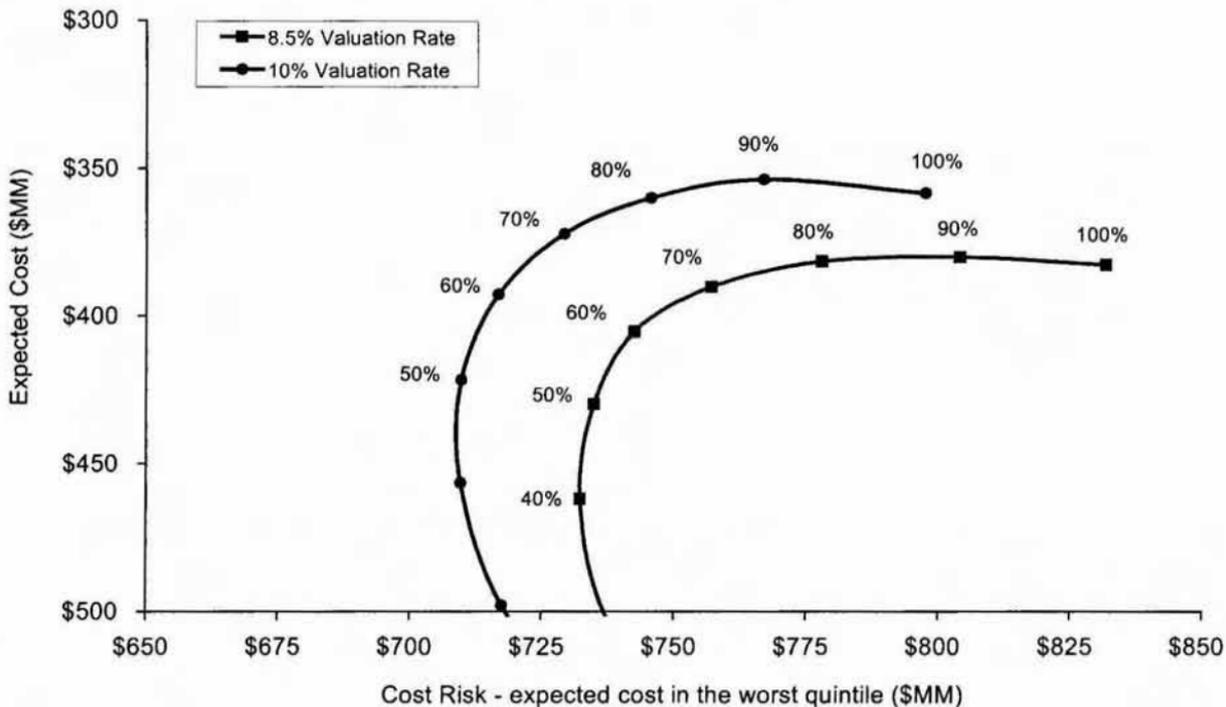


Figure 6. Funding policy. Source: author's calculations from data supplied by MSDW Global Pensions Group.

to lose and much to gain), causing all the upside to be valuable. For well-funded plans, there is a large cushion protecting the plan from future contributions. Thus, even though taxpayers cannot receive full value for the upside, the large cushion limits the downside risk to the extent that it makes the upside of a large equity exposure (a very happy workforce) an attractive trade-off. Plans that are neither poorly nor well funded will usually find that for a given liability noise level, higher equity exposures are economically unattractive.

*Rebalancing rules.* Another source of savings comes from selecting an appropriate rule for rebalancing the portfolio's optimal asset allocation as the capital markets and other events change the three factors mentioned earlier. It is important to rebalance the portfolio to the mix that is then optimal considering the changes that have occurred.

*Funding policy including funding methodology and assumptions.* It has long been a tenet of actuaries and financial economists that the pace of pension plan funding is not financially relevant. The cost of the plan is the benefits paid, and funding merely transfers money from one pocket to another. But once it is recognized that the sponsor, or risk bearer, lacks easy access to the surplus in a pension plan, this tenet breaks down. The present value of future contributions can be highly affected by the pace of funding. It is advantageous for taxpayers to make contributions so long as the cost of such additional contributions (the contribution minus the tax deduction) is less than the present value of the future contributions saved if such contributions were made. It is often possible to reduce the present value of future contributions with appropriate changes in funding policy.

Public plans have a tendency to be underfunded for many reasons. One is that surplus assets tend to be used to increase benefits, which in turn leads to increased costs and long run underfunding. Budgets tend to be sticky and once contributions are reduced, it is difficult to get them increased, again leading to long-range underfunding. Administrations tend to defer cost recognition and participants get larger benefit increases if their cost is underestimated. The burden of appropriate funding seems to fall mainly on the shoulders of the plan actuary who is usually a hired consultant and not in a very strong position. It is also usually economically more efficient for taxpayers to aim lower rather than higher given the asymmetries of bearing all the downside risk but not owning all the upside return.

This point is illustrated in Figure 6, where it can be seen that increasing the actuarial discount rate from 8.5 percent to 9.5 percent results in both reduced cost and reduced risk. (There are many situations, however, where it pays instead to decrease the actuarial discount rate and accelerate contributions rather than decelerate them.) Note that the actuarial discount rate is purely a mechanism for determining the pattern of contributions and beyond that has no significance in this framework (i.e., it is one of the outputs

from the process of minimizing the present value of future contributions rather than an input).

Many public plan sponsors have issued pension obligation bonds to increase the funding of their plans (Lang 1997). This has been motivated by a budgeting accounting system that allows the sponsor to reduce contributions by more than the cost of borrowing, assuming that the funding earns the expected rate of return on the assets and without adjusting the expected return because of risk. The borrowing cost is the actual borrowing cost. As long as the discount rate (the assumed rate of return) exceeds the borrowing cost, the pension bonds reduce budget outlays. The real financial picture is, of course, quite different and depends on the actual reduction in contributions that occurs over time rather than the assumed reduction using the expected rate of return. It is difficult to envision a situation where the real economics would support the issuance of POBs.

*Using a stochastic integrated approach.* Measuring costs using a current deterministic basis (expected liability cash flows discounted at expected return on assets) allows considerable gaming of the system through the addition of benefits containing an option feature; it essentially capitalizes the future risk premium on the assets without any cost associated with the risk. The stochastic basis is less "gameable," as it measures risk as well as return and thus assigns a cost to optionality in the benefits. Furthermore, benefits that are more easily matched in the capital markets (i.e., less liability noise) will be assigned an appropriately lower cost as the investment policy can be altered at the same time to reduce overall cost risk.

*ALM enforces investment discipline to help avoid political raids on assets.* There are advantages to extending the framework from merely minimizing the present value of future contributions to minimizing the present value of contributions as a percentage of tax revenues (i.e., avoid high contribution requirements when the tax basis has eroded). This would make clear that public plans should invest as negatively correlated to the public sponsors tax base as possible. This would help fend off raids such as loans to preferred local businesses. It would also likely lead to more international and other out of state investments.

## **Defined Benefit Versus Defined Contribution Pensions**

A defined benefit plan provides a predetermined level of benefits at retirement; the cost of which is an unknown and largely dependent on investment return. A defined contribution plan provides an unknown benefit at retirement (depending on investment returns) for a predetermined cost. There is a worldwide trend away from defined benefit toward defined contribution plans. A key point, but one frequently missed, is that from a national per-

spective, any system necessarily translates into a defined benefit system. This is the only system that can ensure that people remain off of welfare.

If a cohort retires under a defined contribution (DC) system with inadequate income (poor investment returns and/or depletion of defined contribution savings prior to retirement owing to economic bad times) then society is going to have to subsidize these retirees. This "insurance," which always becomes payable in particularly trying times (depressed capital markets), turns defined contribution plans into a particularly expensive form of defined benefit plans.

The main problems frequently cited with defined benefit plans are as follows:

- Assets may be insufficient to meet promised benefits (particularly at the national level), causing costs to skyrocket.
- DB systems are complex and can be gamed and manipulated.
- The large pool of assets built up has no direct assigned ownership and thus becomes an easy target for political and other raids.
- When employees change jobs, the vested accrued benefits erode through inflation unless there is inflation protection.

The key perceived advantages of a defined contribution plans are

- There is direct individual correspondence between assets and liabilities.
- There is less opportunity for political and other raids
- DC plans are portable.
- Employees control the investments.
- Employees bear the investment risk.

In fact, many of the perceived disadvantages of DB plans can be cured, or at least ameliorated, by a disciplined structure as outlined here. If these problems can be overcome, DB plans become more efficient for providing retirement income for several reasons. One is that benefit levels can be set to provide desired living standards, with little or no risk of a cohort of retirees needing public assistance. By contrast, in DC plans some fraction of retirees may have inadequate incomes and require public support; this is more likely when capital markets perform poorly and the public sponsor budget is also under extreme pressure. Another issue is that defined benefit plan sponsors generally have much longer time horizons and utility for returns over risk than individuals and are thus willing to take more risk (provide more risk capital). Over long periods, risk capital tends to produce higher returns, which probably lowers the cost of the deferred income (even on a risk-adjusted basis). Also, increased risk capital helps the economy (as-

suming that equilibrium is not so general as to make everything wash out). Efficiently run defined benefit plans are thus probably more economical. Finally, there is a danger with defined contribution plans that retirees will spend their capital in the belief that they will be subsidized by taxes thereafter.

## Conclusions

The economic goal of a public sector defined benefit pension plan should be to provide the promised level of benefits at the lowest present value of future contributions. Traditional management approaches to defined benefit pension plans in the public arena result in a present value of contributions and associated risk that is significantly higher than it need be. As we have shown, benefit, funding and investment policies should be integrated using a comprehensive stochastic model to reduce both cost and risk. Investment policy should more sharply focus on the nature and structure of public pension liabilities, and managers should explore more carefully the extent to which public plan assets can be designed to match public plan liabilities.

## Notes

1. I thank Robert North, Chief Actuary of the City of New York, for providing this example, as well as for his many helpful insights and comments that improved this chapter.

2. The advent of government provided inflation-indexed bonds will presumably make it easier to hold assets that back these inflation-linked promises; see Brown et al. (1999).

3. What follows borrows heavily from Peskin (1997) regarding the methods of reducing cost and risk in corporate defined benefit pension plans.

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