Chapter 5
Pension Benefit Guarantees in the United States: A Functional Analysis

Zvi Bodie and Robert C. Merton


I. Introduction

In this paper we use functional analysis to examine the pension benefit guarantee system in the United States. The functional perspective on financial policy making begins with the set of functions required, and then looks for the optimal institutional structure to perform those functions. Our analysis begins with a brief description of the functions served by the pension system and of the institutional structure currently in place to perform those functions in the United States. We explore the roles of the government and the private sector in providing retirement-income security and the complex interaction between them. The paper then focuses on the federal system for insuring private-sector defined-benefit pension promises against default risk. Finally, we consider how pension benefits might be adjusted for changes in both the cost of living and the standard of living.

The functions of a pension system are perhaps best described in the context of a household’s life-cycle consumption/savings plan. Institutions of many forms serve to facilitate life-cycle savings. The specific life-cycle purpose of the pension system (including the government-run Social Security system) is to provide households with income in the event that earnings stop due to death, disability, or retirement.

An often-used metaphor for describing the retirement-income system in the United States is the three-legged stool. The first leg is Social Security and government welfare programs for the aged, the second is employer- or labor union-provided pensions, and the third is direct individual saving. The relative importance of these three sources of retirement income varies significantly, both across households within the United States and among different countries. The Social Security part of the system provides a “floor” that is mandatory and nonassignable. The government actively encourages employers and households themselves to provide the other two legs of the retirement-income stool. Through tax incentives, it encourages employers to provide pension plans that—like Social Security—are mandatory and nonassignable. It also offers tax incentives to self-employed individuals and households who are not otherwise covered to provide a retirement fund for themselves, and imposes penalties on early withdrawal of money from the fund. Finally, in the United States, the government insures private-sector defined-benefit pension plans against default risk.

Some of the frequently cited economic justifications for having the government directly provide a layer of retirement benefits for everyone include:

Informational Efficiencies

It is costly to acquire the knowledge necessary to prepare and carry out long-run plans for income provision. Strictly, each person’s optimal lifetime financial plan depends on preferences known only to that person. But people may have enough in common in this regard that a standard retirement savings plan can prove to be suitably close to optimal for many. By providing a basic plan that saves enough to supply a level of retirement income that is at least the minimum that everyone would want, the government can help all people save more efficiently than they could on their own.

Adverse-Selection Problems

There is the risk that people will outlive their retirement savings. One way to insure against the risk of exhausting one’s savings during retirement is by saving in the form of life annuity contracts. But because the private market for life annuities is voluntary it has the problem of adverse selection: there is a tendency for people with a higher than average life expectancy to have a high demand for this kind of insurance. In the competitive equilibrium, the average individual will find the equilibrium price unattractive and will tend to self-insure against longevity risk by providing an extra reserve of retirement savings. Mandatory Social Security is one way of overcoming the adverse-selection problem. By making participation in the plan mandatory and offering life annuities as the only payout option, the deadweight cost of adverse selection is greatly reduced.
Free-Rider Problems

In virtually every country that has a national pension system, participation at some minimum level is mandatory. Some observers of government see such provisions for intervention as pure paternalism. But an alternative purpose for a government-mandated universal retirement-income system is to address the free-rider problem. That is, the citizenry may collectively feel an obligation to offer a "safety net" for everyone living in their midst. Thus, de facto there will be a safety net, even though no formal provision is made for one. But if this collective commitment were well understood by all, the existence of the de facto safety net would cause individuals to modify their saving behavior. For some, at least, there would be a tendency not to make full provision for their own retirement. Similarly, some may also take more risk in investing their retirement savings than they would in the absence of a safety net. Mandating participation by everyone forces people to pay for what they ultimately will receive from the system. Thus according to this view, the purpose of the mandatory system is to protect society against free riders. While this reasoning supports a mandatory minimum level of universal participation, it says nothing about what that level should be.

If those three reasons are the principal ones justifying the existence of the Social Security system, then what determines the level of benefits so provided? Differences in tastes and endowments among individuals argue for limiting the level of benefits provided by Social Security to an amount that is likely to be a minimum common to all; the other two parts of the retirement income system would provide the rest. Furthermore, direct government provision of retirement income has other potential drawbacks. In a strictly unfunded pay-as-you-go government-operated pension system, benefits are theoretically paid entirely from the stream of revenue generated by the payroll tax levied on currently active workers. If such were the case, benefits would fluctuate up and down with changes in collections. In most such systems, however, there is a benefit formula, and benefits accrued under that formula are viewed as a form of government debt. Without funding, however, a rising ratio of retired to active workers and/or large government deficits can lead to a concern that the level of future benefits will be reduced.

As a case in point, consider the 1983 reform of the United States Social Security system. A changing demographic structure for workers led many to become concerned that there could be dramatically reduced benefits in the future in a pure pay-as-you-go system. Hence, a key provision of that reform was to require substantial prefunding of future benefits. To do this, the Social Security payroll-tax rate was raised and the excess of current revenues over current benefit payments is invested in government bonds held in a trust fund. While this procedure apparently funds the plan, some are less sure about the purpose for such funding. In a private plan, funding is used to insure against default by the plan sponsor. Here the promise to pay benefits has the same level of full faith and credit of the government as the bonds used to fund the plan. Yet there seems to be a belief that this change may help to ensure that, when they reach retirement, workers will indeed receive benefits approximating those promised under the current benefit formula (i.e., the one in effect in 1992).

Even with the 1983 prefunding provisions, there is some question about whether current Social Security benefit levels will be maintained in the United States. Such questions highlight the political risk endemic to the government-provided leg of the three-legged retirement income stool and offer an explanation and additional role for the other two legs. The political risk associated with Social Security arises from a basic paradox of power: the government is too powerful to bind itself credibly to any set of existing rules. The current Social Security benefit formula or the method of financing those benefits can be changed. The U.S. Congress has changed both in the past, and it can do so again in the future. Even if those currently running the government are committed to paying promised Social Security benefits, they cannot fully bind future governments to do so.

This brings out an important difference between government and private-sector obligations. A private-sector plan sponsor cannot unilaterally repudiate its legal liability to make promised payments. It can default because of inability to pay, but it cannot repudiate its legal obligations without penalty. On the other hand, the government—because it has the power to legislate changes in the law—can sometimes find ways to repudiate such obligations without penalty. Indeed, an integrated system in which private plan sponsors supplement government-provided pension benefits to achieve a promised "replacement ratio" of preretirement earnings can be seen as a type of private-sector insurance against the political risks of the government-run system.

One can therefore view a mixed public-private system of retirement income provision as a way of reducing the risks of each separate component by diversifying across providers. Public-sector pension plans can change the law and reduce benefits already promised. Private-sector pension plan sponsors are committed by law (and perhaps repu-
of contributions and the way the account is invested. In principle, contributions could be invested in any security, although in practice annuity. The employee often has some choice over both the level of contributions and earnings on those contributions to purchase an one for each employee. Pension benefits are not specified, other than that at retirement the employee applies the total accumulated value of contributions and earnings on those contributions to purchase an annuity. The employee often has some choice over both the level of contributions and the way the account is invested. In principle, contributions could be invested in any security, although in practice most plans limit investment choices to bond, stock, and money-market funds. The employee bears all the investment risk; the retirement account is, by definition, fully funded by the contributions and the employer has no legal obligation beyond making its periodic contributions. For defined-contribution plans, investment policy is essentially the same as for a tax-qualified individual retirement account. Indeed, the main providers of investment products for these plans are the same institutions, such as mutual funds and insurance companies, that serve the general investment needs of individuals. Therefore, in a defined-contribution plan, much of the task of setting and achieving the income-replacement goal falls on the employee.

In a defined-benefit plan, a formula specifies benefits, but not the manner, including contributions, in which those benefits are funded. The benefit formula typically takes into account years of service for the employer and level of wages or salary (e.g., the employer pays the employee for life, beginning at age 65, a yearly amount equal to 1 percent of his or her final annual wage for each year of service). The employer (called the “plan sponsor”) or an insurance company hired by the sponsor guarantees the benefits and thus absorbs the investment risk. The obligation of the plan sponsor to pay the promised benefits is like a long-term debt liability of the employer.

As measured both by number of plan participants and by the value of total pension liabilities, the defined-benefit form dominates in most countries around the world. This is so in the United States, although the trend since the mid-1970s is for sponsors to choose the defined-contribution form when starting new plans. But the two plan types are not mutually exclusive. Many sponsors adopt defined-benefit plans as their primary plan, in which participation is mandatory, and supplement them with voluntary defined-contribution plans. Moreover, some plan designs are “hybrids” combining features of both plan types. For example, a “cash-balance” plan is a defined-benefit plan in which each employee has an individual account that accumulates interest. Each year, employees are told how much they have accumulated in their account, and if they leave the firm, they can take that amount with them. If they stay until retirement age, however, they receive an annuity determined by the plan’s benefit formula. A variation on this design is a “floor” plan, which is a defined-contribution plan with a guaranteed minimum retirement annuity determined by a defined-benefit formula. These plan designs usually take into account the benefits provided by the Social Security system.

With defined-benefit plans, there is an important distinction between the pension plan and the pension fund. The plan is the contractual arrangement setting out the rights and obligations of all parties;
the fund is a separate pool of assets set aside to provide collateral for
the promised benefits.16 In defined-contribution plans, by definition,
the value of the benefits equals that of the assets, so the plan is always
exactly fully funded. But in defined-benefit plans there is a continuum of
possibilities. There may be no separate fund, in which case the plan
is said to be unfunded. When there is a separate fund with assets worth
less than the present value of the promised benefits, the plan is under-
funded. And if the plan's assets have a market value that exceeds the
present value of the plan's liabilities, it is said to be overfunded.

Why and how does funding matter? The assets in a pension fund
provide collateral for the benefits promised to the pension plan benefici-
caries. A useful analogy is that of an equipment trust. In an equipment
trust, such as one set up by an airline to finance the purchase of
airplanes, the trust assets serve as specific collateral for the associated
debt obligation. The borrowing firm's legal liability, however, is not
limited to the value of the collateral. By the same token, if the value of
the assets serving as collateral exceeds the amount required to settle the
debt obligation, any excess reverts to the borrowing firm's sharehold-
ers. So, for instance, if the market value of the equipment were to
double, this would greatly increase the security of the promised pay-
ments, but it would not increase their size. The residual increase in
value accrues to the shareholders of the borrowing firm.

The relation among the shareholders of the firm sponsoring a pen-
sion plan, the pension fund, and the plan beneficiaries is similar to the
relation among the shareholders of the borrowing firm in an equip-
ment trust, the equipment serving as collateral, and the equipment-
trust lenders. In both cases, the assets serving as collateral are "encum-
bered" (i.e., the firm is not free to use them for any other purpose as
long as that liability remains outstanding), and the liability of the firm is
not limited to the specific collateral. Any residual or "excess" of assets
over promised payments belongs to the shareholders of the sponsoring
firm. Thus the larger the funding, the more secure the promised
benefits. However, whether the plan is underfunded, fully-funded, or
overfunded, the size of the promised benefits does not change.

III. The Nature of Defined-Benefit Pension Obligations17

As previously described, in a defined-benefit plan the pension benefit
is determined by a formula that takes into account the employee's
history of service and wages or salary. The plan sponsor provides this
benefit regardless of the investment performance of the pension fund
assets. The annuity promised to the employee is therefore the em-
ployer's liability. What is the nature of this liability?

Private-sector defined-benefit pension plans in the United States
offer an explicit benefit determined by the plan's benefit formula. How-
ever, many plan sponsors have from time to time provided voluntary
increases in benefits to their retired employees, depending on the
financial condition of the sponsor and the increase in the living costs of
retirees.18 Some observers have interpreted such increases as evidence
of implicit cost-of-living indexation.19 These voluntary ad hoc benefit
increases, however, are very different from a formal COLA (cost-of-
living adjustment). It is unambiguous that under current laws in the
United States the plan sponsor is under no legal obligation to pay more
than the amount promised explicitly under the plan's benefit formula.

There is a widespread belief that in final-pay formula plans pension
benefits are protected against inflation at least up to the date of retire-
ment. But this is a misperception. Unlike Social Security benefits,
whose starting value is indexed to a general index of wages, pension
benefits even in final-pay private-sector plans are "indexed" only to the
extent that (1) the employee continues to work for the same employer,
(2) the employee's own wage or salary keeps pace with the general
index, and (3) the employer continues to maintain the same plan. Very
few private corporations in the United States offer pension benefits
that are automatically indexed for inflation. This lack of inflation
indexation gives rise to the portability problem. Workers who change
jobs wind up with lower pension benefits at retirement than otherwise
identical workers who stay with the same employer, even if the em-
ployers have defined-benefit plans with the same final-pay benefit
formula.

Both the rulemaking body of the accounting profession (the Finan-
cial Accounting Standards Board [FASB]) and Congress have adopted
the present value of the nominal benefits as the appropriate measure
of a sponsor's pension liability. FASB Statement 87 specifies that the
measure of corporate pension liabilities to be used on the corporate
balance sheet in external reports is the accumulated benefit obligation
(ABO)—that is, the present value of pension benefits owed to em-
ployees under the plan's benefit formula, absent any salary projections
and discounted at a nominal rate of interest. Similarly, in its Omnibus
Budget Reconciliation Act (OBRA) of 1987, Congress defines the cur-
rent liability as the measure of a corporation's pension liability and sets
limits on the amount of tax-qualified contributions that a corporation
can make as a proportion of the current liability. OBRA's definition of
the current liability is essentially the same as FASB Statement 87's
definition of the ABO.

Statement 87, however, recognizes an additional measure of a
defined-benefit plan's liability: the projected benefit obligation (PBO).
The PBO is a measure of the sponsor’s pension liability that includes projected increases in salary up to the expected age of retirement. Statement 87 requires corporations to use the PBO in computing pension expense reported in their income statements. This is perhaps useful for financial analysts, to the extent that knowing the excess of the PBO over the ABO helps them to derive an appropriate estimate of expected future labor costs to use in valuing the firm as a going concern. The PBO is not, however, an appropriate measure of the benefits that the employer has explicitly guaranteed. The difference between the PBO and the ABO should not be treated as a liability of the firm, since those additional pension costs will only be realized if the employees continue to work in the future. If those future contingent labor costs are to be treated as a liability of the firm, then why not book the entire future wage bill as a liability? If this is done, then shouldn’t one add as an asset the present value of future revenues generated by these labor activities? It is indeed difficult to see either the accounting or the economic logic for using the PBO as a measure of pension liabilities.

We can perhaps further clarify the issues involved by considering a numerical example. Suppose the plan pays a benefit equal to 1 percent of final salary per year of service. To keep the mathematics simple, we make additional assumptions that do not affect the basic qualitative conclusions. Plan participants enter the plan at age 25, retire at age 65, and live until age 85. There is immediate vesting, no early retirement option, and no employee turnover. These assumptions allow us to ignore the actuarial adjustments necessary to account for mortality risk and turnover.

We further assume that the typical employee’s salary increases at the rate of inflation. This implies no change in real wages over an employee’s career and allows us to avoid the complications arising from the spread between nominal wage growth and inflation. Finally, we assume that the interest rate appropriate for discounting nominal annuities is 9 percent per year (the riskless real rate of 3 percent per year plus an expected rate of inflation of 5 percent per year plus a risk premium of 1 percent per year).

Under a final-pay formula of this sort, there is a “wage-indexation effect” that is central to understanding the difference between the ABO and the PBO. Consider an employee who has just turned 26 years old and who has received a salary of $30,000 for the just-completed work year. He has therefore accrued a deferred pension annuity of $300 per year for twenty years starting thirty-nine years from now when he retires. The present value of this deferred annuity is $95. This is the ABO. With inflation at 5 percent, if he works for another year he will receive a salary of $31,500. The pension annuity that he then is entitled to is 2 percent of $31,500, or $630 per year starting thirty-eight years from that date. This is $330 more per year in pension benefits than the $300 pension annuity he was entitled to after working only one year. We can decompose this $330 increase in pension benefits into two parts: (1) $315, which is 1 percent of the second year salary of $31,500; and (2) $15, which is the increase in the pension benefit arising from the increase in the salary base for computing the pension benefit. We call this second part the “wage-indexation increment.” Had he not worked the additional year, he would have been entitled to only $300 per year at retirement. Thus he has earned the $15 indexation increment to his pension benefit through continued employment.

By contrast, if the pension benefit were automatically indexed for inflation up to the age of retirement, then whatever happens in the future, the employee’s projected pension benefit after one year of service is $300 x 1.0540 or $2,112 per year. The present value of this deferred annuity is $669. This is the PBO. The PBO would be the correct number to use for the firm’s liability if benefits were tied to some index of wages up to the age of retirement, independent of whether the employee stays with the employer. Because private plans in the United States do not offer such automatic indexation, however, it is a mistake to use the PBO as the measure of what the sponsor is contractually obliged to pay to employees.

IV. The Role of Pension Guarantees

As has been noted, a major putative advantage of a defined-benefit pension plan over a defined-contribution plan is that it protects the employee against investment risk. The economic efficiency of this protection against investment risk is enhanced by the provision of guarantees against default risk. To understand the efficiency gains from guarantees of pension annuities, it is critical to distinguish between employees and investors (stockholders and bondholders) in firms that provide pension annuities. The distinction is that, unlike the firm’s investors, the employees holding the sponsor’s pension liabilities strictly prefer to have the payoffs on their contracts as insensitive as possible to the default risk of the firm itself. The function served by a pension annuity is for the beneficiaries to receive a specified benefit upon retirement. That function is less efficiently performed if the contract instead calls for the benefit to be paid in the joint event that the employee retires and the firm is still solvent.

Even if the sponsoring firm offers an actuarily fair increase in the employee’s cash wages to reflect the risk of insolvency, it is still
likely that an employee would prefer a pension annuity with the least
default risk. Employees typically have a large nondiversified stake in
the firm already. They may have invested in firm-specific human
capital, which loses value if the firm does poorly. Thus few employees
would consciously agree to accept default risk on their pension benefits
in order to increase their expected cash wages. This is true even when
the employee has all of the relevant information necessary to assess the
default risk of the firm. In most cases the employees do not have the
relevant information, and this fact makes the welfare loss even greater.

For example, consider the profile of a "typical" defined-benefit plan
beneficiary. The vast majority of those covered by PBGC guarantees
are blue-collar and white-collar workers for whom pension benefits
constitute a large portion of total retirement savings. Such employees
are unlikely to have asset portfolios of sufficient size or the investment
expertise necessary to hedge the nondiversifiable risks of their defined-
benefit pension asset. Only the most highly compensated managerial
employees of the firm might have the financial wealth and knowledge
required to diversify away the risks of their defined-benefit pension
claims. But to hedge this risk they would effectively have to take a short
position in the sponsoring firm's equity. Typically, managers and em-
ployees are prohibited from short-selling the firm's securities by the
provisions of their incentive compensation package.

In contrast, an investor in the stocks or bonds issued by the sponsoring
firm voluntarily and explicitly takes a financial interest in the fortunes of the firm itself. The function of these securities is to allow
investors to participate in the risk and return prospects of the firm.
Investors can diversify away much of the default risk associated with
any one specific firm as part of their total portfolios. Employees with a
substantial part of their wealth in firm-specific defined-benefit pension
annuities usually cannot achieve such optimal diversification. They are
like investors who are constrained to hold a large fraction of their
wealth in the form of long-term bonds issued by a single firm, which is
also their employer. Thus both their tangible and human capital are
significantly exposed to the fortunes of a single firm.

A firm sponsoring a defined-benefit pension plan can provide as-
surances against default risk to plan beneficiaries in three different
ways:

1. By funding the plan or assuring that plan beneficiaries have a
priority claim to the firm's non-pension assets. Thus even em-
ployees of a firm with an unfunded pension plan can be protected
against default risk of their pension benefits if there are adequate
non-pension assets and the other stakeholder claims against the

2. By purchasing guarantees of its pension liabilities from a private-
sector third party. In the United States, private guarantees of a
sponsor's pension liabilities are generally not available as such.
However, some sponsors contract with insurance companies to
provide pension annuities, thus effectively making the insur-
ance company the guarantor of those benefits. If the solvency
of the insurance company is in question, however, then the goal
of guaranteeing employee pension benefits is not completely
achieved.

3. Through government guarantees of its pension liabilities.

V. The Pension Benefit Guaranty Corporation

The U.S. government provides insurance against default risk on
private-sector defined-benefit pension promises through the Pension
Benefit Guaranty Corporation (PBGC), a federal agency within the
Department of Labor. The PBGC was created under Title IV of the
Employee Retirement Income Security Act of 1974 to guarantee only
base retirement benefits. There is therefore a ceiling on guaranteed
benefits. All private-sector defined-benefit plan sponsors must par-
ticipate. The PBGC has two different pension guarantee programs:
one for single-employer plans and another for multi-employer plans.
We restrict our attention to the single-employer program.

Although not a profit-oriented insurance company, the PBGC is
intended to be self-financing and to operate on sound actuarial prin-
ciples. It is expected to cover its operating expenses and annuity pay-
ments to beneficiaries from the annual premiums set by the Congress
and paid by sponsors of defined-benefit plans, the investment earnings
on its asset portfolio, and recoveries from terminated underfunded
plans. In its annual report, the PBGC presents both an annual flow
measure of its financial situation called the "profit" (or "loss"), and a
stock measure called the "deficit". In 1991 the loss for the single-
employer program was approximately $600 million and the end-of-
year deficit was $2.5 billion.

When the PBGC was created in 1974, a uniform premium was
initially set at $ per yer per plan participant, regardless of the funding
status of the plan or the financial condition of the plan sponsor. Subse-
sequently, Congress legislated a series of premium increases, and in 1987
it made the premium depend on a plan's funding status. In 1992 the
annual premium was raised to $19 per participant plus $9 per $1,000
of unfunded vested benefits (up to a maximum of $72 per partici-
Firms sponsoring single-employer defined-benefit plans have the option under the law to contract with a qualified insurance company to assume all or part of their pension obligations. The sponsor then pays premiums to the insurance company, and the insurance company becomes the private-sector guarantor of the pension benefits. Almost all 50 states in the United States, however, have state-sponsored insurance company guaranty funds. Hence, these state funds are the final or "last-resort" guarantor of the annuities provided by insurance companies. Under current law the federal government does not assume any responsibility for guaranteeing these benefits. Thus the system of guarantees of private-sector pension benefits in the United States is a mixed government-private system.

A. The PBGC’s Deficit

The PBGC’s $2.5 billion year-end deficit for 1991 is based on accrual accounting concepts, and it represents the difference between the PBGC’s reported liabilities and its assets. The PBGC’s measure of its liabilities is the present value of only those benefits payable to beneficiaries of plans that have been terminated with insufficient assets. It ignores the existing vested guaranteed benefits that will have to be paid by the PBGC to participants in plans that default in the future. That is, it implicitly assumes that there will be no further defaults in the future. If the insurance program of the PBGC were frozen at its year-end 1991 level (i.e., no new benefits guaranteed and no new premiums collected), the $2.5 billion reported by the PBGC would not be enough (in present-value terms) to fully cover the expected future shortfall. Neglecting the liability for future failures is similar to a casualty insurance company not taking account of the payments it will have to make to future accident and malpractice victims on policies currently paid for and in force.

Although not part of the reported deficit, the PBGC’s 1991 Annual Report presents some measures of its exposure to future failures of underfunded plans. Thus it cites $31 billion as the total unfunded liabilities of all firms with underfunded plans. As the report points out, that number should not be used as a measure of the PBGC’s liability. The $31 billion figure is the present value of the total unfunded pension debt guaranteed by the PBGC, but not the value of the guarantee itself. As already shown in sections II and III, the obligation of a firm to pay future pension benefits is a form of corporate debt, and PBGC insurance is thus a government guarantee of that debt.

A firm’s pension debt is secured by the assets in the pension fund, but from the PBGC’s perspective the unfunded part of the pension obligation is essentially unsecured corporate debt. For a firm in financial distress, the PBGC guarantee of the firm’s unfunded pension obligation is the economic equivalent of a guarantee of “junk bonds.” The economic value of that guarantee is the difference between the market value of the bonds with and without default risk. Thus if a particular corporate bond has a market price of $600 without the guarantee and would be worth $1,000 if free of default risk, then the value of the guarantee is $400. By simply comparing actual market prices of junk bonds with their present values computed using U.S. Treasury bond rates (cf. Merton, 1990, Table 7), it is straightforward to show that government guarantees can have substantial market value and that this market value can change significantly over time. Loan-guarantee values in excess of 50 percent of the bond price are common, and wide swings in prices caused by changes in the level of market interest rates and the economic prospects of the debtor corporation are frequent. Since unfunded pension liabilities are not traded, we cannot observe a market price for them as we can for junk bonds. Nevertheless, because PBGC insurance is essentially a guarantee of long-term corporate debt, we would expect its value to behave in a pattern similar to that of implied market prices for guarantees derived from traded bond prices.

It is beyond the scope of this paper to provide numerical estimates of the PBGC’s true economic deficit. Considerable work first needs to be done to improve the quality of the raw data on corporate pension liabilities available to the PBGC. The PBGC currently uses pension data as reported by the sponsoring firms themselves. Those data are unreliable because management has considerable discretion in determining the actuarial assumptions used in computing them. For example, Smalhout (1991) points out that Chrysler Corporation reported an unfunded pension liability of $3.6 billion in 1991, while the estimate by the PBGC for that same unfunded pension liability was $7.7 billion.

B. Similarities Between the PBGC and FSUIC

If the only goal of the PBGC were to operate a system of default-risk insurance according to sound economic principles, then as will be shown in the next section, there are a number of alternative ways to manage the guarantee function efficiently through some combination of monitoring, asset restrictions, and risk-based premiums. Every guarantor, regardless whether it is a private-sector or governmental entity,
must employ some feasible combination of these three methods if it is to maintain economic viability without creating unintended and undesirable side effects. Among the possible side effects in the case of the PBGC is the prospect that overcharging the sponsors of well-funded plans in order to subsidize the underfunded plans of financially distressed firms might cause financially healthy sponsors to terminate their defined-benefit plans. The United States could then be left only with bankrupt defined-benefit plans with the benefits financed directly by taxpayers.

There are some significant similarities between the U.S. government system for guaranteeing pension benefits and the failed system for insuring savings and loan associations (S&Ls). The Federal Savings and Loan Insurance Corporation (FSLIC) was the government agency that insured the S&Ls until it was replaced in 1989. In FSLIC's case, poorly structured public policies and regulatory "forbearance" eventually led to misallocation of economic resources and an unintended and undesirable redistribution of wealth. In the case of the PBGC, there is a growing body of evidence that current public policy is leading us in a similar direction.

Among the similarities are the following:

- The existence of multiple and conflicting goals for the guarantee program.
- Failure on the part of many in the legislative and executive branches of government to fully recognize or disclose the true costs, benefits and incentives of the guarantee program.
- A tendency to attribute losses of the guarantee fund to idiopathic causes such as individual abuses or incompetence rather than to structural ones such as predictable responses to the incentives built into the system.
- Failure to act promptly to limit such losses because of fragmentation and conflict of interest within the government regulatory apparatus.

Like FSLIC, the PBGC has several objectives, which can at times be in conflict with one another. The expressed purpose of establishing the PBGC was to insure a base level of promised defined-benefit pensions against default risk of the plan sponsor. However, some observers believe that an important latent function of the PBGC is to help revitalize some key depressed industries through assumption of part of the burden of providing pension benefits to their workers. If firms can transfer their pension obligations to the PBGC, then the government effectively pays a portion of the workers' total compensation because these obligations are linked to workers' pay. The size of this government subsidy can be large. Similarly, PBGC insurance provides a less transparent way for the government to guarantee the debt of financially troubled firms than the direct guarantee of the bonds issued by these firms.

Beyond subsidizing depressed industries or financially troubled firms, the PBGC at times acts as if it has an additional charge to preserve defined-benefit pension plans in the face of the apparent trend to replace them with defined-contribution plans. ERISA assigns to the PBGC the goal of encouraging the growth of private pension plans, but it is silent on the issue of whether the institutional structure of such plans should be defined benefit or defined contribution. There are several indications, however, that the PBGC is reluctant to see the termination of defined-benefit plans even if they are to be replaced by defined-contribution plans.

Thus the PBGC appears to have at least two and possibly three different objectives: (1) to provide default-risk insurance of basic pension benefits to participants in private defined-benefit pension plans on a sound economic basis, i.e., without taxpayer subsidies and without cross-subsidies among plans; (2) to provide subsidies to financially troubled firms and/or to workers in distressed industries; and perhaps (3) to encourage the continuation of the defined-benefit form of pension plan. Fulfilling these often-conflicting objectives involves tradeoffs.

Fragmentation of regulatory authority and conflicts of interest among government departments that oversee the private pension system are also a potentially serious problem for the PBGC's efficient operation. ERISA dictates that three governmental bodies should regulate private defined-benefit pension plans: (1) the Department of Labor, Pensions and Welfare Benefits Administration, which oversees the maintenance of fiduciary standards; (2) the Internal Revenue Service (IRS), which sets funding standards; and (3) the PBGC, which collects premiums and pays benefits but has few enforcement powers.

There are inherent conflicts between the objectives of the IRS and the PBGC. The IRS understandably would prefer minimal funding to prevent the loss of tax revenue to the U.S. Treasury; the PBGC would like to see maximum funding to prevent large insurance claims. The IRS has the right to grant contribution waivers to firms in financial distress. In the past, the granting of such waivers has resulted in reduced funding of defined-benefit plans with a consequent weakening of the collateral position of the PBGC as a secured creditor. In December 1987, as part of the Omnibus Budget Reconciliation Act (OBRA), major revisions were made to ERISA. The new law imposes stricter minimum funding standards on underfunded plans, but iron-
cally it undoes much of the effect of these standards by enacting tough new maximum funding rules. The new maximum funding rules prevent over half of all pension sponsors from contributing anything to their plans for several years. Inevitably, some of those plans will become underfunded in years to come. 45

A third important conflict within government is the one between the PBGC and the courts. In addition to its claim to the pension-fund assets, the PBGC also has a priority claim on part of a sponsoring firm's other assets if the pension plan is underfunded. This claim would seem to imply that even if a plan is underfunded the PBGC is protected against losses, because it can be reimbursed out of the sponsoring firm's other assets. However, recently the courts have ruled that the claims of the PBGC on the assets of a bankrupt firm with an underfunded pension plan are to be treated pari passu with those of other creditors (under Chapter 11 of the federal bankruptcy code.) Thus, unless the bankruptcy laws are changed, the PBGC has less protection than was intended in the pension laws.

As in the case of the S&L crisis, multiple objectives and conflicts among regulators of pension plans can lead to unintended and undesirable consequences. For example, consider the case of one of LTV's pension plans, which had virtually all of its assets depleted several years before the firm went bankrupt in 1986. The plan was a large unfunded defined-benefit pension plan for salaried employees that LTV inherited when it acquired Republic Steel in 1984. Four years before, the plan was underfunded but it had about $300 million of assets. A year later senior officers of Republic Steel, some of whom were themselves approaching retirement age, changed the terms of the cash-out option in 1981 so as to make it particularly attractive to take a lump sum in lieu of an annuity. By the subsequent years preceding the merger of Republic Steel, some of whom were themselves exercising their cash-out option en masse. When LTV went bankrupt in 1986, the PBGC thus found itself obligated to pay guaranteed benefits on an essentially unfunded plan ($230 million in liabilities and $7,700 in assets). Despite the obvious effect of the cash-out provision, both the PBGC and the Department of Labor concluded that there was no violation of the law. Thus, while lawmakers clearly did not intend for the PBGC to guarantee the full value of benefits of highly compensated employees, that is what in effect happened.

VI. Alternatives for Reforming the PBGC

The PBGC has recently proposed a package of legislative changes designed to eliminate its deficit, or at least to prevent it from growing. 46

The main thrust of these proposals is to increase the funding of underfunded plans, to freeze future benefit increases in underfunded plans, and to enhance the priority of the PBGC's claims on a sponsor's non-pension assets in the event of bankruptcy. These changes however do not exhaust the range of economically feasible remedies available. 47 We have presented elsewhere a general framework for analyzing the management of guarantee programs. 48 In the next two sections, we use that framework to analyze prospects for more efficient management of the PBGC.

There are three basic methods available to any guarantor—whether private or government—to manage its guarantee of pension benefits against failure of the sponsoring firm:

- Monitor the value of the pension assets with the right to seize them if they fall below a certain minimum funding ratio. If the premium charged for the guarantee is held fixed, the funding ratio required for viability increases with increases in the variance of the value of the collateral assets and with increases in the time between audits.
- Restrict the asset choice of the pension fund to ensure an upper boundary on the riskiness of the assets serving as collateral for the promised pension benefits.
- Set a premium schedule for the guarantee commensurate with the risk exposure. Ceteris paribus, the premium rate required for viability increases with increases in the variance of the value of the collateral assets and the time between audits.

No one of the three methods can be effective if used alone. They do however substitute for each other in varying degrees. Hence, there is room for tradeoffs among them. We now consider, in some detail, each method as it relates to guaranteeing defined-benefit pension plans.

A. Monitoring

Monitoring is widely used throughout the financial system as a method of managing both explicit and implicit guarantees that are part of loans or other financial contracts. 49 Under a monitoring system, the guarantor has the covenant right to conduct surveillance and seize assets of the borrower. Losses to the guarantor can be controlled by making sure that the assets accepted as collateral always have a value at least equal to the value of the promised payment. As shown in Section V.A, the firm's defined-benefit pension obligations are clearly a form of debt. Hence, the guarantor of those obliga-
tions holds a position analogous to an investor in the firm's bonds. Under the PBGC system, the specifically pledged collateral for a firm's pension debt is the assets in the pension fund itself. When a corporation issues a bond, it obliges itself to make specific cash payments at specific dates in the future. The guarantor typically monitors the activities of the borrowing corporation, and moves as quickly as possible to seize the assets collateralizing the bonds in the event that the borrower misses a promised payment.

An example of an effective monitoring system for protecting the guarantor against default risk is the system used by the Federal Home Loan Banks in the United States for loans that they make to federally chartered thrift institutions. The twelve regional Federal Home Loan Banks require that their loans be collateralized by the borrowing thrift institution's highest quality assets. These are usually securities backed by mortgages guaranteed by the Federal government. The lending bank takes possession of the securities while they are serving as collateral. Even with the widespread failures of thrift institutions during the past decade, no Federal Home Loan Bank has lost money on any of these collateralized loans during the past sixty years.

The key elements of this system of monitoring are: (1) the guarantor has possession of the collateral; (2) the value of the collateral is marked to market frequently at readily ascertainable market prices; and (3) the guarantor has the right automatically to liquidate the collateral to pay off the guaranteed liability if the ongoing capital requirement is violated. Each of these elements is essential for the system to function properly.

Could a system that relies primarily on monitoring be effective for the guarantor of defined-benefit pensions? For the moment we ignore how the system actually works and consider instead how it might be made to work. In order for a monitoring scheme to be effective, several conditions must be met.

By comparison with effective collateralized borrowing arrangements, if a monitoring system is the principal method used by a pension-plan guarantor, then insured plans should be overfunded. That is, the market value of plan assets should exceed the present value of guaranteed benefits by some minimum amount—call it a funding "cushion." The guarantor must have the right to audit the plan's assets and liabilities at prescribed, frequent time intervals and, if the value of assets is insufficient to meet the cushion, the guarantor can terminate the plan and seize the collateral assets. Depending on the type of assets held, it can be very costly for the guarantor of a defined-benefit pension plan to audit the value of the plan's assets frequently. An increase in the required pension funding cushion can serve as a tradeoff alternative to greater frequency of surveillance.

A system of monitoring to control the risks faced by guarantors will work effectively only if there are mutually acceptable rules and valuation procedures to determine when the plan's assets can be seized and liquidated by the guarantor. If the collateral assets are traded in well-functioning organized markets such as national stock exchanges and government-securities markets, then reliable market values are readily observable, and marking to market is a relatively straightforward process. However, for assets that trade either infrequently or in significantly smaller lot sizes than the holdings of the fund, estimates of market prices are subject to significant errors, and reaching agreement on the proper mark-to-market procedure is more difficult. For example, if a pension sponsor were to collateralize its pension liability with corporate assets such as land, plant, and equipment, it would be difficult to estimate accurately the current market value of the fund.

In the context of a surveillance and seizure system, these estimation errors impose risks on both the guarantor and the insured pension plan. If the errors overstate values, the guarantor will not seize as quickly as it should, and the proceeds realized from seizure will be less than expected. If the errors understate values, the pension fund will be seized and liquidated when the plan is actually solvent. Thus, a "conservative" valuation method from the perspective of one party to the system will be an "aggressive" valuation method from the perspective of the other party. Hence, the valuation method should be unbiased. Protections for the parties from measurement errors in the prices can be provided by other rules of the monitoring system—such as the minimum size of the pension fund's surplus before seizure is permitted.

The relevant market price to use in valuing the assets for this purpose is the price at which they can be sold—the bid price. Any asset is therefore eligible to be held as collateral as long as it has a bona fide bid price for the quantity to be sold. If assets are marked to market at the bid price, illiquidity of assets serving as collateral is not a problem for the guarantor. Thus, in principle, a plan sponsor could pledge specific corporate assets as collateral—property, plant, equipment, etc. However, illiquid assets (which by definition have a large bid-ask spread) are probably not suitable because the plan sponsor is vulnerable to having the asset seized and liquidated when the bid price falls, even if the average of the bid and ask prices falls by a relatively small amount. The spread cost from this "bid-ask bounce" is a deadweight loss to the collectivity of the sponsor and the guarantor. Thus, if it is large and the chances of a violation are not negligible, this form of handling guaran-
appears inadequate for the task of careful monitoring of the pension liabilities it guarantees and the pension assets backing them. But a better accounting system is only a necessary condition for monitoring to work as an effective control device. There must also be the ability and the willingness to terminate plans and seize the collateral assets of sponsors that violate funding standards.

B. Asset Restrictions and Risk-Based Premiums

The PBGC has to date all but ignored the impact of an insured pension fund's asset mix on the PBGC's exposure. Yet, as we show in the next sub-section, when there is a mismatch between the pension assets and liabilities, the economic value of the guarantee provided by the PBGC, even for well-funded pension plans, can be quite significant. To continue a fixed premium policy independent of asset mix and remain viable, the PBGC must control the variability of the difference between the value of a plan's assets and the value of its promised payments. The pension benefits that are currently guaranteed in the United States are level-payment annuities fixed in dollar amount. Thus the plan sponsor could hedge all of the guaranteed annuities by investing in default-free fixed-income securities with the same cash flow pattern as the annuities—a procedure known as "immunization." If, for example, the plan sponsor has an obligation to pay $100 per year for the next 5 years, it can provide this stream of benefit payments by buying a set of five sequentially maturing zero-coupon bonds, each with a face value of $100. This asset-allocation policy eliminates the risk to the guarantor stemming from uncertainty about future interest rates and from uncertainty about the solvency of the issuers of the fixed-income securities. The only remaining risk to the plan sponsor and therefore to the guarantor is mortality risk. If funding requirements are set to provide an adequate cushion for the mortality risk, the guarantor can charge low premiums and still be a viable entity.

While simple in concept, the immunization of pension liabilities is less simple to implement in practice. For instance, one might believe that plan sponsors can hedge the interest rate risk of their benefit liabilities by investing in long-term fixed rate mortgages or bonds. However, at least in the United States, virtually all mortgages and bonds have prepayment or call provisions that allow the issuer to retire them early. Plan sponsors that attempt to immunize must therefore deal with this prepayment risk.

Starting in the 1980s, the development of trading in derivative securities—futures, forward contracts, options, and swaps—greatly enhanced the ability of pension funds to reduce their exposure to risk. Thus, by entering an interest rate swap contract, a pension fund can effectively convert a floating-rate asset into a fixed-rate one. Similarly, by entering an equity-for-fixed-rate-debt returns swap, a pension fund would have sold insurance on the fixed-rate stream of payments it will make to the plan's beneficiaries. However, derivatives have their own risks and may be inappropriate in some circumstances. It is essential to understand the nature and implications of derivatives before they are used.
can in effect convert its stock portfolio into a fixed-income portfolio that matches its benefit liabilities. Alternatively, the pension-plan sponsor can change its liability exposure from fixed to floating rates by entering swap contracts matched to the payment pattern on its annuity liabilities. However, just as pension funds can quickly reduce both the variability of their net worth and the exposure of the guarantor by entering into swaps or taking hedging positions in futures contracts, so they can quickly reverse the process and become unhedged. Indeed, a pension fund can even increase rather than decrease its unhedged risk exposure by taking positions in derivative securities that accentuate the imbalance between its asset/liability positions. Thus the very efficiency of the derivative-securities markets in permitting rapid and low cost hedging of positions can also put greater demands on the guarantor to keep track of the pension fund’s exposure to shortfall risk. If the guarantor is to monitor asset restrictions effectively, it must be able to observe and analyze the risk implications of the total positions held by the pension fund in derivative securities on a timely basis.

An alternative way for the guarantor to maintain solvency and create compatible incentives for plan sponsors is to charge risk-related premiums. The PBGC already has a premium structure that takes into account a plan’s level of underfunding, but the premium schedule is unrelated to the mismatch between pension assets and liabilities. The fair market premium for a fully-funded plan that is fully immunized is zero. However, if the pension sponsor invests the pension assets in common stocks or other types of equity securities instead of fixed-income securities that immunize the guaranteed benefits, then the exposure of the guarantor to a potential shortfall increases. The risk-related premium must therefore also be related to the future variability of the difference between the value of the pension assets (excluding the value of the guarantee) and the present value of guaranteed benefits. For risk-based premiums to work, the variability of net worth need not be reduced to zero, but it does have to be known (or at least bounded) and not subject to significant unilateral change by the insured pension plan after the premium has been set. If the insured pension-plan sponsor can unilaterally change the composition of its pension asset portfolio ex post, then the guarantor faces a problem of moral hazard.

C. A Hypothetical Example

In general, there are tradeoffs among the methods of insuring the economic viability of the pension guarantor. To clarify these tradeoffs, consider the following hypothetical example, which uses a simplifying modification of the system actually used by the PBGC. The stream of guaranteed benefits stretches over many years and is free of default risk to the employees. Each plan sponsor contracts with the PBGC to pay a risk-based premium once a year. The premium is set to reflect both the fund’s net worth—market value of pension assets less the present value of the guaranteed benefits—and its variability over the coming year. The variability of the fund’s net worth is determined by the fraction of the guaranteed benefits immunized. With none immunized, the assumed annual variance rate of the logarithmic change in the pension fund’s net worth is .04. If, on the other hand, the guaranteed pension benefits are fully immunized, then the net-worth variability is zero. At the end of the year, either the fund must pay another premium for the period to follow that reflects its new funding status and net-worth variability, or the plan is terminated and the assets are seized by the PBGC. If the plan is terminated, then the PBGC makes up the shortfall to plan participants.

This hypothetical system differs from the current system in five important respects: in the hypothetical system, (1) premiums are charged on the basis of the present value of the guaranteed benefits rather than on a per capita basis; (2) the premiums charged by the PBGC reflect the volatility of the pension fund net worth; (3) included in the measure of pension-fund assets are any of the sponsoring firm’s other corporate assets that are pledged as collateral; (4) there is no maximum charge for the premium; and (5) the plan is terminated if the sponsor fails to make a premium payment. Under these assumptions, we can use well-known techniques to compute the competitive market premium for any combination of parameter values. If the PBGC charges less than this premium, its guarantee operation will have a negative net present value.

Table 1 and Figure 1 are designed to show how the risk-based premium varies with the fraction of benefits immunized and the funding ratio. Figure 1 shows the tradeoffs between the premium charged and the fraction of benefits immunized for various funding ratios. Consider the case of full funding, for example, where the funding ratio is 100 percent. If the fraction of benefits immunized is zero, the premium is 8 percent of guaranteed benefits. The premium falls as the fraction immunized rises. If half are immunized, the premium is 4 percent of guaranteed benefits. As the fraction of benefits guaranteed rises to 100 percent, the premium falls to zero.

Figure 1 shows clearly that the value of the guarantee has its greatest sensitivity to the fraction of benefits immunized when there is full funding. When the plan is 20 percent underfunded, the value of the guarantee is by far the largest, but it is less sensitive to the composition...
TABLE I
Risk-Based Premiums as a Function of Fraction Immunized and Funding Ratio

<table>
<thead>
<tr>
<th>Fraction of benefits immunized (percent)</th>
<th>20% risk-based premium</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>underfunded</td>
</tr>
<tr>
<td>0</td>
<td>21.18</td>
</tr>
<tr>
<td>10</td>
<td>20.83</td>
</tr>
<tr>
<td>20</td>
<td>20.53</td>
</tr>
<tr>
<td>30</td>
<td>20.29</td>
</tr>
<tr>
<td>40</td>
<td>20.13</td>
</tr>
<tr>
<td>50</td>
<td>20.04</td>
</tr>
<tr>
<td>60</td>
<td>20.01</td>
</tr>
<tr>
<td>70</td>
<td>20</td>
</tr>
<tr>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td>90</td>
<td>20</td>
</tr>
<tr>
<td>100</td>
<td>20</td>
</tr>
</tbody>
</table>

Note: The value of the guarantee is computed using Merton's (1977) model. The risk-free interest rate is 10 percent per year compounded continuously. In the absence of immunization, the variance of the logarithmic change in pension fund net worth is .04 per year. The term of the guarantee is one year.

of the pension asset portfolio. The premium starts at 21 percent of guaranteed benefits when none of the liability is immunized, and it gradually falls to 20 percent as the proportion of benefits immunized rises to 100 percent. When the plan is overfunded by 20 percent, the premium, in the absence of any immunization, is just over 2 percent of the value of the guaranteed benefits. As the proportion of benefits immunized rises, the value of the guarantee gradually falls to zero. For the fully funded case, the value of the guarantee starts out at 8 percent of guaranteed benefits and declines approximately linearly to zero as the proportion of benefits immunized rises to 100 percent.

In reality, the majority of defined-benefit pension funds in the United States invest about half of their assets in equity securities. Ten percent is a rough estimate for the annualized standard deviation of the logarithmic change in net worth. In the calculations here, pension assets include the portion of corporate assets pledged to the guarantor. Under this definition of pension assets, the vast majority of real-world plans are more than 20 percent overfunded. If the plans were monitored once per year and those found to be underfunded were terminated and liquidated, then the actuarially fair risk-based premium for a 20 percent overfunded plan would be 15 percent of guaranteed benefits (i.e., 15 basis points or 15 cents for every $100 of covered pension liabilities).70

Note that this scheme implies that the premiums are adequate to cover any funding deficits that are created each year. Thus consider a plan that this year is 50 percent immunized and 20 percent overfunded. It pays a premium equal to .15 percent of the present value of guaranteed benefits. If, as a result of a decline in the stock market, it becomes just fully funded, then next year's premium will be 4 percent of the present value of guaranteed benefits. If the sponsor cannot pay the new premium, then the plan is terminated.

If the PBGC were to monitor more frequently than once a year—
and it can do so at low cost—then the premiums can be lower. Table 2 and Figure 2 illustrate the tradeoff between the risk-based premium and the term of the guarantee for various levels of funding. This tradeoff is calculated using a variance of the pension fund net worth \( \sigma^2 \) of .04 per year, which is approximately what it would be with no immunization.

The schemes just described rely primarily on adjusting the risk-based premiums at the end of each insurance period. Suppose, however, that the PBGC is constrained to charge a fixed premium—say 10 basis points or 10 cents per $100 of guaranteed benefits. In that case, the PBGC would have to rely exclusively on the other methods of managing the guarantee business: monitoring and asset restrictions. One approach is to require full funding and 100 percent immunization. In that case, minimal premiums required just equal the operating costs of monitoring compliance with the rules. However, if 100 percent immunization is undesirable, then the PBGC can allow a tradeoff between the funding ratio and the fraction of benefits immunized. If the term of the guarantee is fixed at one year, then the PBGC could set a required funding ratio to offset the risk in the pension asset portfolio—the higher the fraction of benefits immunized, the lower the required funding ratio.

VII. Indexation of Pension Benefits

While Social Security benefits and pension benefits under some public plans are indexed to the cost of living, the vast majority of private-sector pension plans offer no automatic inflation protection. This is true regardless of whether the employer’s plan is of the defined-benefit or defined-contribution type. Many plan sponsors have in the past offered ad hoc increases in payments to retired employees to help offset the effects of inflation. However, to the extent that inflation protection of private-sector retirement benefits exists in the United States, it is not guaranteed.

That real-world practice has pension annuities fixed in nominal
Rather than in real terms is incongruous with life-cycle models of household behavior. In that model, people are concerned about the purchasing power of their retirement income rather than its dollar amount. Nevertheless, in the United States, we find that it is nominal rather than real benefits that are promised by sponsors of defined-benefit plans and guaranteed by the PBGC.

Most people are probably aware of the fact that inflation will erode the real value of a money-fixed pension annuity. Many errors nevertheless occur because of failure to properly account for inflation effects. Even professional financial planners sometimes fall into the trap of treating pension annuities as if they were adjusted for inflation. For instance, a rule of thumb commonly used by financial planners and benefits specialists to judge the adequacy of retirement income is: add expected Social Security benefits and expected pension benefits together and compare their sum to pre-retirement income. If this so-called “replacement ratio” is greater than some target value such as 80 percent, then retirement income is judged adequate to maintain consumption based on preretirement wage or salary income.

The problem with this approach is that by ignoring the effect of inflation on pension benefits, it can lead to inadequate saving for retirement. For example, consider a 45-year-old employee who works for a firm that has a defined-benefit pension plan offering a benefit equal to 1.5 percent of final pay times the number of years of service. The employee’s salary is currently $50,000 per year, and she expects it to grow at the rate of inflation. By retirement time, she will have worked for the company 40 years, and the pension benefit will therefore be 60 percent of her final salary or $30,000 per year in today’s dollars. If Social Security is expected to provide a benefit of $10,000 per year, then her expected combined retirement income is $40,000, and the replacement ratio is 80 percent. Suppose that the inflation rate is 5 percent per year. The Social Security benefit has a COLA (cost-of-living adjustment), so the benefit increases in parallel with inflation. But the employee’s private-pension benefit does not. After 14 years, the $30,000 of pension income will have only about half of its original purchasing power. If the employee is fortunate enough to survive 28 years beyond the retirement age, her pension benefit will be worth only one quarter of its original value in real terms.

Short of offering automatic inflation adjustment of pension benefits, what can plan sponsors do to help plan participants cope with the problem of inflation? The first and perhaps most important thing is to increase employee awareness of the impact of inflation on pension benefits. An effective way to accomplish this would be to quote expected pension benefits on a “social-security-equivalent” basis. Pension benefits expressed this way would reflect the reduced starting level of benefits under a hypothetical retirement benefit option with a COLA that the employer could offer at the time of retirement at no additional cost. In a typical example, the COLA annuity option might be 60 percent of the starting value of the conventional pension benefit.75 Even if the employer did not offer such an option, and even if no employee would want to choose it, the quoted number would give a more accurate pension-benefit figure to use in computations of expected income replacement rates. Employees would have a more appropriate target to use in deciding how much to contribute to supplementary retirement savings plans offered by either their employers or other providers such as mutual funds and insurance companies.

The supplementary voluntary retirement savings plans now offered by many employers can be used to provide some inflation protection after retirement.75 These supplementary plans usually provide several investment options and often participation is encouraged by matching contributions from the employer. Employers could advise their employees to target their supplementary retirement savings plans to match the provision of a COLA. Employers could offer further guidance by computing the additional contribution rate required and offering an additional inflation-hedge investment option. Employers could of course offer outright inflation insurance of retirement benefits. To lower the cost of this inflation insurance, a deductible or a cap could be introduced.76

We believe that the government has a positive and perhaps unique role to play in providing innovations that improve the efficiency of risk bearing in life-cycle allocations. Over the years, a number of economists have considered it desirable, if not essential, for the U.S. government to issue inflation-linked bonds in order to lay the foundation for private inflation insurance. Indeed, Nobel laureate economists, Milton Friedman, Franco Modigliani, and James Tobin, who often hold very different opinions on other issues, are united in their enthusiastic support for the idea of the U.S. Treasury’s issuing CPI-linked bonds. The government is commonly seen as the only institution that could credibly guarantee default-free inflation insurance on a large scale, without the benefit of a traded CPI-linked instrument that could be purchased as a hedging asset.

An alternative to indexing retirement annuities to the cost of living is to index them to aggregate per capita consumption.77 The idea motivating this proposal is that it is standard-of-living protection rather than cost-of-living protection which is of prime concern to most individuals. With a cost-of-living-linked annuity, the benefit is fixed in real terms regardless of what happens to the standard of living in the economy.
Individuals receiving only a cost-of-living annuity over a long period of retirement may experience a substantial decline in their relative standard of living compared to the rest of the population. According to this alternative proposal, however, pensioners would receive a benefit that changes with per capita consumption, thus maintaining their relative standard of living.

Note that with indexation to aggregate per capita consumption, there is no need to distinguish between the inflation and the real-per-capita-consumption components of the change. The benefits are simultaneously protected against both. By linking the benefits to per capita consumption rather than the consumer price index, the pension scheme is made more consistent both with finance theory and common sense. As with CPI-indexing, there is also a potential role for the government as a financial innovator in making this type of product possible by providing consumption-indexed bonds that are free of default risk. In particular, the government could perfectly hedge its exposure on these bonds by instituting a consumption tax.

VIII. Conclusions

The retirement-income system in the United States employs a complex mixture of government and private-sector guarantees of retirement income. One can view a mixed public-private system of providing retirement-income as a way of reducing the risks of each separate component through diversification across providers. Government can change the law to reduce promised benefit levels on public-sector pension plans. Private-sector pension-plan sponsors are committed by law (and perhaps reputation) to pay promised benefits, but they may default. To insure against this, the PBGC provides guarantees against default.

Some in government have come to see the PBGC as defender of the defined-benefit form of pension plan in the face of contrary trends in the provision of retirement income. A positive role for government as ultimate provider of guarantees against default risk of retirement annuities is less controversial than the use of such guarantees to encourage defined-benefit plans over defined-contribution plans. Both plan types have advantages and disadvantages, and there is no clear economic reason (or official public-policy decision) to favor one type over the other. Moreover, we know of no apparent reason to use pension guarantees to subsidize firms or workers in distressed industries. Indeed, whatever the general merits of using government subsidies to help distressed industries, there are good reasons not to use "cheap" pension guarantees as the form for such subsidies. Subsidies provided by underpriced guarantees are less visible to the public than other subsidies; for that very reason, they can lead to large and unintended distortions in resource allocation, and they can result in a socially undesirable redistribution of income. We need do no more than mention "deposit insurance" to underscore the enormous costs that can be generated by the mismanagement of government liability-guarantee programs.

Notes

1. For a discussion of the rationale and methodology of functional analysis in finance, see Merton (1993) and Merton and Bodie (1992a).
2. There are other important functions served by pension plans. Pension plans are often used as an incentive device in labor contracts to influence employee turnover, work effort, and the timing of retirement. Key public finance issues surrounding pension plans are government guarantees of private pension benefits, the use of these plans to reduce or defer taxes, the effect of these plans on aggregate private saving, and the role of these plans as part of the social insurance "safety net." Corporate pension-funding and asset-allocation policies are also an important element in corporate financial management. For further details, see Bodie (1990a).
3. Indeed, in the United States, the part of the Social Security system that relates to this function is called Old-Age, Survivors, and Disability Insurance (OASDI).
4. For a comparison of sources of retirement income in 20 different countries, see the study by the pension-consulting firm Towers Perrin Inc. (1991).
5. See, for example, Atkinson (1991), Diamond (1977), McGill (1977), Wachtler (1988, chapters 2 and 8) and Merton (1983a, b).
6. See Rothschild and Stiglitz (1976) for an analysis of insurance company equilibrium with adverse selection. At least one study of the private annuities market seems to confirm this theory that private annuities are priced unattractively for the average individual. See Friedman and Warshawsky (1988).
7. The base to support the system was expanded by requiring more employees to join. The present value of benefits was reduced by gradually raising the age at which full benefits are payable. See Myers (1991).
8. Prior to the passage of the Employee Retirement Income Security Act (ERISA) in 1974, private defined-benefit obligations in the United States had a somewhat ambiguous legal status. ERISA, however, clearly established these as corporate liabilities.
9. See Merton, Bodie, and Marcus (1987) for a more complete development of this idea. Myers (1977) presents a similar argument.
10. Much the same point applied to deposit insurance in the 1980s: no one doubted that the government would cover all insured deposits even if the government insurance agencies, FSLIC and FDIC, ran out of funds.
11. Under certain conditions depending on both the age of the beneficiary and the size of the benefit, there is an additional tax surcharge above the
ordinary earned-income tax rate. Distributions to the employer as part of a reversion of excess assets are also subject to a surcharge.

14. For a detailed description of an interesting variant of the cash balance account called a multiverse pension plan, see Paul (1988).
15. For further details, see Bodie (1989).
16. For a survey of pension funding practices in various countries around the world, see Bodie (1990b).
17. This section of the paper draws heavily on Bodie (1990a, c, section 6).
18. See Clark, Allen, and Summer (1983) for a discussion of these ad hoc increases.
19. See, for example, Cohn and Modigliani (1985) or Ippolito (1986).
20. A benefit is vested if the employee is entitled to it even after terminating employment. Most employers require employees to work for some minimum number of years before their benefits are vested.
21. That this wage-indexation increment to the pension benefit can be achieved only through continued employment is well understood by plan participants facing the retirement decision. They will often delay the date of retirement if they anticipate inflation in the immediate future, in order to raise the salary base for computing their pension benefit.
22. In contrast to the situation in the United States, current law in the United Kingdom requires pension sponsors to index accrued pension benefits for inflation to the age of retirement, subject to a cap of 5 percent per year. Thus even a terminated employee has indexation for general inflation up to retirement age, as long as the benefit is vested. Therefore, under the UK system, the PBO is the appropriate measure of the sponsor's liability.
23. This section is adapted from a more general discussion of the role of guarantees in Merton and Bodie (1993).
24. For an alternative view, see Ippolito (1986, Ch. 10). Ippolito argues that when workers are represented by a union they accept default risk of the sponsoring firm (through the pension plan) as a way of binding the union to bargain more cooperatively with management. Under his assumptions, therefore, a defined-benefit plan with default risk is efficient.
25. Note that the risk exposure is especially large for a lifetime employee of a single firm. Even if the employee is willing to bear risk, we know from portfolio theory that efficient risk bearing calls for broad diversification across various firms and asset classes. Here the employee's entire pension benefit is tied to the fortunes of a single firm.
26. Should employees want to invest in the securities of their firm, they typically can do so through a variety of special employee stock ownership programs. These investment programs are usually voluntary. By contrast, participation in an employer's defined-benefit plan is usually a condition of employment.
28. Finland, Germany, Japan, and Sweden also have government pension-insurance schemes, although the rules are somewhat different.
41. Although many have expressed this view off the record, it has been presented rather forcefully on the record by one of the key architects of ERISA, Michael S. Gordon. He maintains that the actuarial soundness of the PBGC was deliberately sacrificed at its inception in order to gain political support for passage of ERISA. In his "Dissenting Comments" on Ippolito's The Economics of Pension Insurance (1989), Gordon writes: "The supposition that Congress was prepared to accept loss of jobs and further industrial decline in return for sound insurance principles is preposterous and is why, even today, there will be stiff resistance to redesigning pension insurance along the lines he [Ippolito] proposes."

42. Utgoff (1991, footnote 14) writes: "In 1987, I calculated that the termination of the Wheeling-Pittsburgh Plans reduced funding costs by enough to allow a permanent increase of $3 per hour."

43. Utgoff (1991, footnote 16) writes: "One little known aspect of the Chrysler bailout is that the company received funding waivers in addition to a government loan."

44. The inside cover of the PBGC's 1991 Annual Report states: "To fulfill its mission, PBGC has established a long-term goal of building a service-oriented, well-managed, and financially sound insurance company to provide a strong safety net for a healthy defined benefit pension system."

James Lockhart, then Executive Director of PBGC, in referring to the growth in the premiums charged by the PBGC said in a 1991 speech before the National Employee Benefit Institute: "We have to slow this growth, or we stand a good chance of killing the very thing we were created to protect—the defined benefit pension system."

Of course, this opposition to the trend towards defined-contribution plans may be primarily a reaction to seeing the PBGC's premium base deteriorate substantially as it approaches termination. Typically, a plan is 40 percent funded when it terminates but had been reporting 60 to 80 percent funding five years before.


47. We do not know the range of politically feasible ones.


49. In Merton and Bodie (1992b, 1993 section 1), lenders whose loans are not guaranteed are themselves guarantors. Hence, the management alternatives described here for guarantors also apply to lenders generally.

50. ERISA also gives the PBGC a priority claim on 30 percent of the firm's net worth. But in the case of a bankruptcy the firm's net worth is typically negligible.


52. For example, suppose that a sponsor buys an illiquid asset at an asked price of $100 when the bid price is $50. Suppose that the price subsequently drops to $75 asked and $25 bid. If this decline triggers a violation of the minimum cushion requirement and the asset is liquidated, the total loss in value is $100 - $25 = $75, even though the average of the bid and asked price has declined by only $25.

53. Thus Bodie, Light, Morck, and Taggart (1985, Table A1) report that the interest rate used by sponsors of large corporate defined-benefit plans in valuing their pension liabilities in 1980 ranged from a low of 4 percent to a high of 13 percent.

54. See Bader and Leibowitz (1987) for an analysis showing the enormous distortions in the reported under- and overfunding of pensions caused by the pre-FASB 87 rules.

55. See the PBGC 1991 Annual Report, p. 15.

56. Employees with a claim to pension benefits exceeding the limits guaranteed by the government are in the position of subordinated debtholders. Thus, by taking a lump-sum settlement instead of a life annuity, the highly paid employees of Republic Steel accelerated their claims at the expense of the guarantor. This is similar to the action bondholders would take if they had a put option. In general, the PBGC has found that in the period before a firm goes bankrupt, its pension plan's funded status deteriorates very rapidly. Thus, if the PBGC waits to seize the pension assets until the firm actually declares bankruptcy, there may not be much left.

57. Section 4042 of ERISA gives the PBGC the right to terminate an underfunded plan before bankruptcy, but this provision has rarely been used. In a recent case of its use, the PBGC's right to terminate the underfunded plans of Pan American Airlines has been challenged in the courts by Pan Am's other creditors.

58. See the auditor's opinion in the PBGC 1991 Annual Report, pp. 53–58.

59. As is well known in the finance literature, the guarantee provided by the PBGC is analogous to a put option. Using this analogy, one can use the known response of the value of a put option to a change in the risk characteristics of the underlying asset to gain insight into the sensitivity of the PBGC guarantee's value to the pension fund asset mix.


61. Unlike mortality risk, prepayment risk is systematically related to the level of interest rates, which affects all fixed-income security prices. Therefore diversification across different kinds of fixed-income instruments with different issuers will not eliminate or even significantly reduce this risk exposure. Many of the innovations in the U.S. fixed-income securities markets in the 1980s (such as collateralized mortgage obligations or CMOs) have been driven by the desire of pension funds and other intermediaries with long-term annuity liabilities to hedge the prepayment risk of mortgages. See Bodie (1990b).

62. See Merton and Bodie (1991a).

63. For a discussion and analysis of this moral-hazard problem for the PBGC, see Harrison and Sharpe (1985).

64. This is the approximate annualized variance of the logarithmic change in net worth (at market value) of a typical U.S. pension fund that invests 100 percent of its assets in common stocks and equity real estate.

65. Thus pension assets as defined here includes 30 percent of the sponsoring firm's net worth plus a general claim against the rest of the firm's net worth.


67. Note that a negative NPV does not necessarily imply that it will run out of
money. As with other insurance processes, good fortune might permit the situation to go on for many years even though the guarantor is actually insolvent.

68. This assumes that the pension plan rather than the guarantor bears all operating costs, including the cost of audits.

69. Remember that full funding here means that conventional pension assets plus 30 percent of the sponsoring firm's net worth plus a general claim against the rest of the sponsor's net worth equals the present value of the benefits guaranteed by the PBGC. By this definition, the vast majority of plans are currently overfunded.

70. As a reference point, we made a very rough calculation of the PBGC's current ratio of total premium income to total guaranteed benefits based on figures presented in the PBGC's 1991 Annual Report. The ratio was about 10 cents per $100 of covered pension liabilities.

71. This section is based on Bodie (1990c).

72. See Clark, Allen, and Sumner (1988) for a discussion of these ad hoc increases.

73. Full cost-of-living adjustment of private pension benefits is more common in Europe. See Clark (1990).

74. TIAA-CREF's "graded benefit method" of computing expected retirement benefits is an example of one organization's attempt to move partially in this direction.

75. These plans are known as 401(k) or 403(b) plans, depending on which provision of the IRS code is applicable.

76. For a discussion of the feasibility of such inflation insurance, see Bodie (1990d). One problem under current law hindering organizations such as TIAA-CREF in providing investment advice is the danger of being sued by retirees if the results turn out poorly.

77. This section is based on Merton (1983b).

78. For a discussion of those advantages and disadvantages see Bodie, Marcus, and Merton (1988) and Bodie (1989).

References


---. 1978. "On the Cost of Deposit Insurance When There Are Surveill­

---. 1983a. "On the Role of Social Security as a Means for Efficient Risk-


---. 1993. "On the Management of Deposit Insurance and Other Guaran­


land Economic Review (March/April).


versity of Texas at Dallas, Richardson TX, November.


Smallhout, James. 1991. Unpublished study prepared for the National Tax­
payers Union.