Pension Insurance*

By Zvi Bodie

Revised October 31, 2005

ABSTRACT

Around the world today there are striking differences in pension systems. The roles played by families, employers, trade unions, financial intermediaries, community organizations, affiliation groups, and governmental agencies vary tremendously. Yet despite these differences, in almost every country the government is ultimately the pension insurer of last resort, either explicitly or implicitly. If designed well and managed well, a system of government pension insurance can enhance the wellbeing of the individuals served by it and even contribute towards the resilience of the financial system at large. But if designed or managed poorly, it can undermine economic security at both the micro and macro level. This paper explores the principles for the successful management of pension insurance and draws some lessons from the mistakes made by the U.S. government in managing its Pension Benefit Guarantee Corporation.

---

* Presented at 8th DNB Research Conference "Pensions in an Ageing Society," November 11, 2005. The author gratefully acknowledges the helpful comments of Dirk Broeders, Jeremy Gold, Jared Gross, Deborah Lucas, Robert C. Merton, Theo Nijman, and Jonathan Treussard.

1. Introduction

Around the world today there are striking differences in the structure of pension systems. The roles played by families, employers, trade unions, financial intermediaries, community organizations, affiliation groups, and governmental agencies vary tremendously. Yet despite these differences, in almost every industrialized society people regard some minimum level of old-age income and health benefits as necessary, and therefore make coverage mandatory. Contributions to the mandatory system are generally regarded as a tax, and government is expected to either provide or guarantee those benefits as part of the social safety net. On top of this mandatory level is a layer of occupational pension benefits designed to replace one's earnings from employment after a specified normal retirement age. There are large cross-country differences with regard to the systems for insuring these occupational pensions.

In the U.S., only about half of the working population is covered by an occupational pension plan. About half of the plans are of the defined-benefit type, and the benefits are explicitly guaranteed (up to specified limits) through a federal government corporation called the Pension Benefit Guaranty Corporation (PBGC). In the Netherlands, almost the entire working population is covered by occupational pension plans. These plans are mandatory, yet there is no *explicit* government guarantee program for them. Nevertheless, there is almost surely an *implicit* one. It is hard to imagine that if there were a widespread failure of the country's pension funds, the Dutch government would not bail them out.

A common objection to having government provide guarantees is that once people have them, the discipline of the market is lost. There are limits, however, to relying on market discipline in the case of pensions. Perhaps the most important of those limits is imposed by the problem of *time inconsistency*. The essence of time inconsistency is that despite a commitment that is optimal *ex ante*, it is sometimes optimal *ex post* to renege. Everyone knows that since government makes the rules, it can change them too. The government, therefore, is caught in a *paradox of power*. For market discipline to work, the government must bind itself convincingly not to bail out institutions that get into trouble. But the government is too powerful to not intervene.

The evidence for the existence of implicit government guarantees is clearest in the case of deposit insurance. In countries facing widespread bank defaults, the government almost always bails out depositors, even when there is no explicit deposit insurance. Surely in a democratic country like the Netherlands, the same principle would apply to occupational pensions, especially since they are mandatory.

The paper is organized as follows. Section 2 lays out the principles for the management of a system of pension guarantees. Section 3 draws some lessons from the mistakes made by the U.S. government in managing its Pension Benefit Guarantee Corporation. Section 4 explores the policy alternatives for dealing with the risk that arises from a mismatch between insured pension liabilities and the assets securing them. Finally, Section 5 draws some policy conclusions.

2. Principles for Managing Pension Guarantees

Regardless of whether it is run by a private corporation or a government agency, there are certain principles that must be followed if a system of guarantees is to remain viable. Functionally, guarantees are insurance policies that oblige the guarantor to make the promised payment if the insured institution fails to do so. The economic loss to the guarantor is equal to the difference between the promised payment and the price received from the sale of the assets that are available from the insured institution as collateral for this obligation. This difference is called the "shortfall." All assets of the liability issuer that the guarantor has recourse to seize will be called "collateral" assets, even if they are not formally pledged and segregated. For the guarantee activity to be sustainable without recourse to subsidies from other sources, premiums charged for the guarantees must be large enough to cover both actuarial loss experience and operating costs.

The basic methods that any guarantor (whether private-sector or government) has to manage its business on a sound basis are:

- *Funding Restrictions:* Set standards for the full funding of promised benefits (i.e., "capital adequacy," and act swiftly to limit losses when these funding standards are violated (i.e., avoid "forbearance").
- *Matching Restrictions:* Require the insured entity to hedge its insured liabilities by matching the market-risk exposure of its assets to its insured liabilities.

- *Pricing:* Set a premium schedule for the guarantee commensurate with the guarantor's exposure to the risk of a shortfall.
- *Transparency:* Require disclosure of information about the insured institution's assets and liabilities in a format that is relevant to evaluating the guarantor's exposure to shortfall risk.

The methods substitute for each other in varying degrees; hence, there is room for tradeoffs among them. With all methods, the guarantor must monitor the market values of the insured liabilities and the assets securing them on a regular basis. The length of time permitted for making up a funding deficit is a key parameter to be set in determining the optimal tradeoff among methods.

For example, let us set the premium equal to the cost of a single guarantee. For simplicity, assume that there are no operating costs. If the value of collateral assets, V, exceeds the promised payments, B, the guarantor keeps the premium and pays nothing. But if the value of assets is less than the promised payments, the guarantor must pay the difference, $B - V$. The guarantor's maximum profit is equal to the premium plus interest earned from investing the premium prior to payment of losses or expiration of the guarantee. This maximum profit is diminished by the shortfall or loss experience from issuer defaults. The guarantor's profit function is thus given by:

$$P(1+r) - max\ [0, B - V]$$

where P is the premium and r is the interest rate.

The guarantor bears the full downside risk of the collateral assets. It does not, however, participate in the upside gains that an owner of those assets would receive. Because of this asymmetry, the guarantor's expected loss is an increasing function of the volatility (i.e., standard deviation) of the difference between the promised payment B and the asset value V. Therefore to sustain themselves as viable economic entities without cross-subsidies from other insured institutions or from taxpayer funds, the guarantor must charge a premium that is directly related to the magnitude of the potential shortfall. This magnitude depends directly on the length of time permitted to make up a funding deficit.

Note that P has an alternative interpretation which is relevant to a country such as the Netherlands, which has no formal system of government pension insurance, but relies instead on regulating funding requirements. In that context, P represents the smallest

amount of surplus required to ensure that pensioners will receive their promised benefits regardless of the performance of the pension assets.[1] The size of this buffer depends on how much time is permitted for making up a funding deficit.[2]

There appears to be a widespread belief among policymakers that a well-diversified portfolio of equity securities provides an effective long-run hedge against the liabilities of defined-benefit pension plans, so that there is no mismatch problem. But equities are not a hedge against fixed-income liabilities even in the long run. Exactly the opposite is the case: When a pension plan sponsor invests the pension assets in equities, the actuarial present value cost to the entity providing a guarantee against a shortfall *increases* rather than decreases with the length of the time horizon, even for plans that start out fully funded.

4. The PBGC Experience

The PBGC insures the pension benefits of the 44 million Americans covered by private defined-benefit pension plans. Traditional pension plans of the defined-benefit type have been declining in relative importance in recent years. Companies are (legally) terminating them and replacing them with "defined-contribution" plans such as 401(k) plans that amount to tax-deferred private savings plans. The number of private defined-benefit plans peaked in the mid-1980s at 112,000. At that time, about 40 percent of American workers were covered by them. Over the past two decades, the number of plans has fallen to just over 31,000 plans, which cover only one worker in five. No large companies have started defined-benefit plans in recent years.

When a PBGC-insured pension plan is terminated with insufficient assets to pay the benefits promised to employees – typically, by an employer bankruptcy -- the PBGC takes it over and makes up the shortfall. There is a cap on the insured benefit, however, which is currently $45,000 per year.

The expressed purpose of establishing the PBGC was to insure a minimum level of promised defined benefit pensions against default risk of the plan sponsor. However, if firms can transfer their pension obligations to the PBGC, then the government effectively

[1] This corresponds to the definition of "risk capital" in Merton and Perold (1993).
[2] Note that the minimum size of buffer depends on pursuing an investment strategy that hedges the liability. As we show in section 3, this strategy is delta hedging and its cost is given by the Black-Scholes formula, or the binomial formula for the price of a put option.

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 has served as a less visible way to guarantee the debt of financially troubled firms than guaranteeing the bonds issued by these firms.

By law, the PBGC is supposed to finance all of its operations from three sources: (1) the premiums it collects from companies that still sponsor defined-benefit plans, (2) the assets it recovers from terminated underfunded plans, and (3) from the interest, dividends and capital gains it earns on its accumulated reserves. Premiums come from a charge to plan sponsors of $19 dollars per single-employer plan participant and $2.60 for multi-employer participants. There is also a variable premium charged to single-employer sponsors with significant underfunding. The charge is $9 per $1000 of unfunded vested benefits.

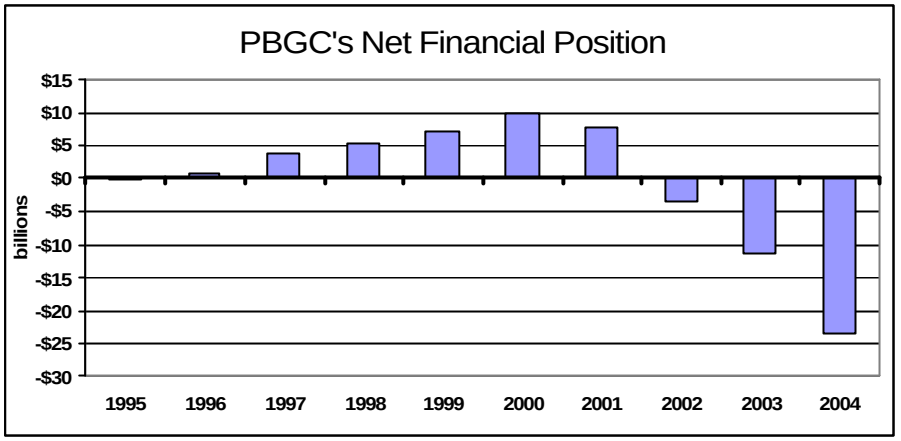
Significantly, the funding requirements and premiums charged by the PBGC are completely unrelated to the way pension assets are invested. A plan sponsor with 100% invested in equities has the same funding requirement and pays the same premium as a sponsor with 100% in fixed income securities.

The PBGC now has a big deficit to cover. In its annual report, the PBGC presents a balance-sheet measure called "net position," which amounts to its assets minus its liabilities evaluated at current market prices. The liability figure is the present value of the future benefits that have already become or are about to become an obligation of the PBGC as a result of bankrupt underfunded plans. If this net position is negative, it is a rough estimate of the extra money the PBGC would have to set aside today in the form of income-producing assets to satisfy all claims.

On November 15, 2004 the PBGC released its annual report for fiscal year 2004, which ended on September 30. It contains a financial summary showing the net position for each program – single employer and multi-employer-- going back to 1995. (see the figure below).

Figure 1. PBGC's Net Financial Position

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Single employer	-0.315	0.869	3.481	5.012	7.038	9.704	7.732	-3.638	-11.238	-23.305
Multi-employer	0.192	0.124	0.219	0.341	0.199	0.267	0.116	0.158	-0.261	-0.236
Both combined	-0.123	0.993	3.7	5.353	7.237	9.971	7.848	-3.48	-11.499	-23.541



The trend is negative in both the single-employer program and the multi-employer program, but the magnitude of the problem is much larger in the former. In 1996 the single employer program's net position was positive – i.e., in surplus -- and it stayed positive until 2001 when it reached $7.7 billion. But in the last three years, the ink has turned decidedly red: the deficit now stands at $23.3 billion.

This deficit could get much bigger. As of the end of the 2004 fiscal year, the PBGC's estimate of the underfunding in plans sponsored by companies with credit ratings below "investment grade" – that is, at significant risk of default -- was $96 billion. But even the $96 billion figure for struggling companies is not the upper limit on the possible deficit. The PBGC estimates that the total underfunding in single-employer plans exceeded $450 billion, while multi-employer plans were under water to the tune of $150 billion. [3]

Those who created the present mess are blaming a perfect storm of stagnant stock prices, low interest rates and industrial restructuring for the PBGC's problems, as if nothing could have been done to prepare. But the current crisis did not follow from some unforeseeable perfect storm. I know this from personal experience: In the early 1990s I was hired by the Department of Labor to analyze the financial health of defined-benefit pension plans. I concluded that there was a fundamental mismatch between the

[3] In a report published by the U.S. Congressional Budget Office in April 2005, "Estimating and Controlling PBGC's Risk Exposure," the CBO estimates that the cost exposure of the government for federal pension insurance provided through the Pension Benefit Guaranty Corporation is currently about $135 billion.

liabilities of these plans – future pension payouts -- and the assets in which they were investing their reserves. This mismatch meant that even plans that were fully funded at the time could quickly become underfunded as a result of changes in interest rates or stock prices.

I submitted my report to the Department of Labor's Pension and Welfare Benefits Administration, and briefed the executive director of the PBGC on my findings. I also made my conclusions known in the professional community. In an article published in the *Journal of Financial Services Research* in 1996 -- a time when the PBGC and most of the plans it insures had comfortable surpluses -- I warned:

> The possible "doomsday" scenario for the defined-benefit pension system would be an event such as a sharp and prolonged drop in stock prices that causes a sharp decline in the market value of pension asset portfolios. Underfunding becomes much more prevalent. Several major defaults of underfunded pension plans lead the PBGC to significantly raise premiums on the remaining plans in the system.
>
> Expectations of even higher premiums in the future lead sponsors of the well-funded plans to terminate their defined-benefit plans to avoid the PBGC "tax." They buy annuities to settle all benefits accrued under the terminated plans and replace them with generous defined-contribution plans, thus avoiding criticism from their employees or from the public. Ultimately, the United States could be left only with bankrupt defined-benefit plans with the benefits financed directly by taxpayers.

It is worth noting that many of the pension plans that are weak today were fully funded in the late 1990s. Had they hedged their exposure to a decline in interest rates at that time, they would have easily survived the subsequent storm intact.

There are important similarities between the PBGC's current situation and the situation faced by FSLIC in the 1980s. FSLIC's problems began in the 1970s when interest rates became high and volatile. Even S&Ls that held well-diversified portfolios of mortgages became insolvent in the environment of rising interest rates of the 1970s because the mortgages were long term and fixed-rate while their deposit liabilities were short-term and rolled over at increasingly higher market rates.

Still more S&Ls became insolvent in the late 1980s because the real estate market collapsed. Thus *both* of the market risks to which S&Ls were exposed -- interest rate risk and real estate risk-- took their toll. The biggest losses to FSLIC were incurred not as a

result of fraud or even of poorly diversified asset portfolios, but rather as a result of failure on the part of regulators to act quickly to stem the losses resulting from the asset-liability mismatch.

In the case of the PBGC, the nature of the liabilities of private defined-benefit pension plans is very different from the short-term deposit liabilities that were insured by FSLIC. Therefore, the type of assets which match those liabilities is different. The similarity is that in both cases, there is a mismatch between the market-risk of the assets and liabilities that exposes the government guarantor to substantial shortfall risk.

Today, the PBGC appears to have been sucked into that doomsday scenario. In April 2005, the U.S. Congressional Budget Office estimated that the cost exposure of the government for federal pension insurance was about $135 billion and growing. Why was my warning, which was solicited by the government itself, completely ignored then, and why is it still being ignored by Congress in its proposed pension reform legislation?

The answer has its roots in a fundamentally flawed belief about the nature of stock-market risk and reward, a belief that still guides the thinking and the practices of the vast majority of professional pension actuaries and investment advisors. It is the proposition that although stocks are a risky investment in the short run, they are a safe bet in the long run. As we will demonstrate in the next section of this paper, the exact opposite is the case from the perspective of a guarantor like the PBGC.

This mistaken proposition leads financial professionals to advise their corporate clients that they can significantly reduce the cost of funding their long-term obligations to defined-benefit plans by investing in diversified portfolios of stocks instead of matching the liabilities with a portfolio of bonds that deliver specified sums of cash at specified times.

The accounting profession has codified this fallacy in the way it treats pension expenses in company statements of profit and loss. Indeed, under current rules, if a company should choose to invest pension assets in bonds whose future cash inflows exactly match the pension benefits, the company would have to report higher pension expenses and lower profits than would an identical company that invested in stocks. For example, in 2003 General Motors reported a net pension expense of $2.6 billion on its United States pension plans assuming a 9 percent rate of return on assets. Had it used 6.75 percent as

the rate of return on pension assets – what it might plausibly have expected to earn on bonds – its net pension expense would have been approximately $4.2 billion.

Since the creation of the PBGC in 1974 many companies have terminated their defined-benefit plans and replaced them with less expensive defined-contribution plans, thereby shifting the risk that retirement portfolios will produce disappointing returns to retirees. In the U.S. this is possible because offering any kind of occupational pension plan to employees is voluntary. For the PBGC, this creates a problem of *adverse selection.* The current system overcharges sponsors of healthy plans in order to subsidize the ailing ones. However, it is doubtful that sponsors of well-funded plans will voluntarily tolerate being "taxed" through high actuarially unfair premiums to bail out underfunded plans of financially weak sponsors. The defined benefit system thus is vulnerable to a "stampede" that is analogous to a bank run, in which the depositors rush to withdraw their deposits before everyone else does. The result of such a stampede is that only sick and undercharged firms will be left in the insurance pool. Thus we have a classic case of the Law of Unintended Consequences: Insurance designed to strengthen the traditional pension system winds up accelerating its demise.

3. Dealing with Mismatch Risk in Pension Insurance

It is important to understand why the guarantor's market-risk exposure is great even when pension fund equity portfolios are well-diversified across industry groups and consist entirely of "blue chip" stocks. Contrary to the view that a stock portfolio is an effective hedge against the pension liability when the investment horizon is long-term, this section shows that the cost of insuring a pension liability collateralized with equities actually *increases* with the length of time required to make up a funding deficit.[4]

Assume a defined-benefit plan sponsor is faced with the obligation to pay a fixed amount as a pension benefit T years from now, and it will not have to make up any funding deficits until then. It fully funds its obligation by contributing to the pension fund an amount equal to the present value of the promised benefit. It can invest in an *immunized* default-free bond portfolio maturing in T years earning a certain risk-free rate of interest. If instead the sponsor invests in a stock portfolio then there is a risk of a shortfall at time T.

[4] For a more complete development of the material in this section see Bodie (1995).

The basis for the proposition that stocks are less risky in the long run appears to be the observation that the longer the time horizon, the smaller the *probability* of a shortfall. If the *ex ante* mean rate of return on stocks exceeds the risk-free rate of interest, it is indeed true that the probability of a shortfall declines with the length of the investment time horizon. For example, suppose the rate of return on stocks is lognormally distributed with a risk premium of 8% per year and an annualized standard deviation of 20%. With a time horizon of only 1 year, the probability of a shortfall is 34%, whereas at 20 years that probability is only 4%.

But the probability of a shortfall is a flawed measure of risk because it ignores how large the potential shortfall might be. It is easy to see this point if we assume that stock returns follow a simple "random walk." In any 1-year period, assume the rate of return on stocks can take only one of two values -- either +20% or – 20%, independent of its past history. Consider the worst possible outcome for time horizons of increasing length. For a 1-year horizon one can lose 20% of the initial investment, for a 2-year period 36%, and for a 20-year period as much as 99%. Using the probability of a shortfall as the measure of risk, no distinction is made between a loss of 20% or a loss of 99%.[5]

If it were true that stocks are less risky in the long run, then the cost of insuring against earning less than the risk-free rate of interest should decline as the maturity of the pension obligation increases. But the opposite is true.

To see this, define the cost of shortfall insurance, *P*, as the additional amount of money one has to add at the investment starting date to assure that at the maturity date the pension portfolio will have a value at least as great as it would have earning the risk-free interest rate. Thus, for each dollar insured against a shortfall, the total amount actually invested at the starting date is $\$1 + P$.

To find *P*, we use modern option pricing methodology.[6] Insurance against shortfall risk is effectively a *put* option. The put is of the European type (i.e., it can only be exercised at the expiration date), and it expires in *T* years. The put's exercise price is the insured value of the portfolio. If at the expiration date *T* years from now the

[5] Using expected shortfall as the measure of risk does not solve the problem. See Treussard (2005).
[6] The reference here is to the option-pricing theory originally developed by Black and Scholes (1973), and Merton (1973). There is an extensive literature on using option-pricing models to estimate the value of financial guarantees. For a comprehensive list of references, see Merton and Bodie (1992).

portfolio's value exceeds its insured value, then the put expires worthless. If, however, there is a shortfall, then the put's payoff is equal to the shortfall.

Because we are insuring a pension obligation that grows at the risk-free interest rate, the exercise price of the put equals the price of the underlying stock portfolio compounded at the risk-free *T*-year interest rate.[7] Therefore the *put-call parity theorem* tells us that the price of the put equals the price of the corresponding call.[8]

To show that the value of the put increases with *T*, we could use any option pricing model based on the condition that the financial markets do not allow anyone to earn risk-free arbitrage profits. Because it is so compact and so widely used in practice, we will use the Black-Scholes formula. In our special case, the formula reduces to a relatively simple form. Moreover, with no loss of generality, we can express the price of the put as a fraction of the price of the stock:

$$\frac{P}{S} = N(d_1) - N(d_2)$$

$$d_1 = \frac{\sigma\sqrt{T}}{2}$$

$$d_2 = \frac{-\sigma\sqrt{T}}{2}$$

where:

S = price of the stock
T = time to expiration of the option in years
σ *= standard deviation of the annualized continuously compounded rate of return on the stock*
N(*d*) *= the probability that a random draw from a standard normal distribution is less than d.*

Note that *P/S* is independent of the risk-free interest rate; it depends only on σ and *T*. Table 1 and Figure 1 show the result of applying the formula to compute *P/S* assuming the annualized standard deviation of stock returns is .2. The cost of the insurance rises with *T*, the term of the insurance. For a one-year term, the cost is 8% of the investment. For a 10-year term, it is 25%, and for a 50-year term it is 52%. As the term grows without limit, the cost of the insurance approaches 100% of the investment.[9]

---

[7] Another way to state this is that the exercise price of the put equals the forward price of the underlying stock.

[8] The put-call parity theorem for European options says that:

$$P + S = C + E\,e^{-rT}$$

where P is the price of the put, S is the price of the underlying stock, C is the price of the corresponding call, E is the exercise price, and r is the risk-free interest rate. In our case: $E = S\,e^{rT}$
By substituting into the put-call parity relation we get: $P = C$

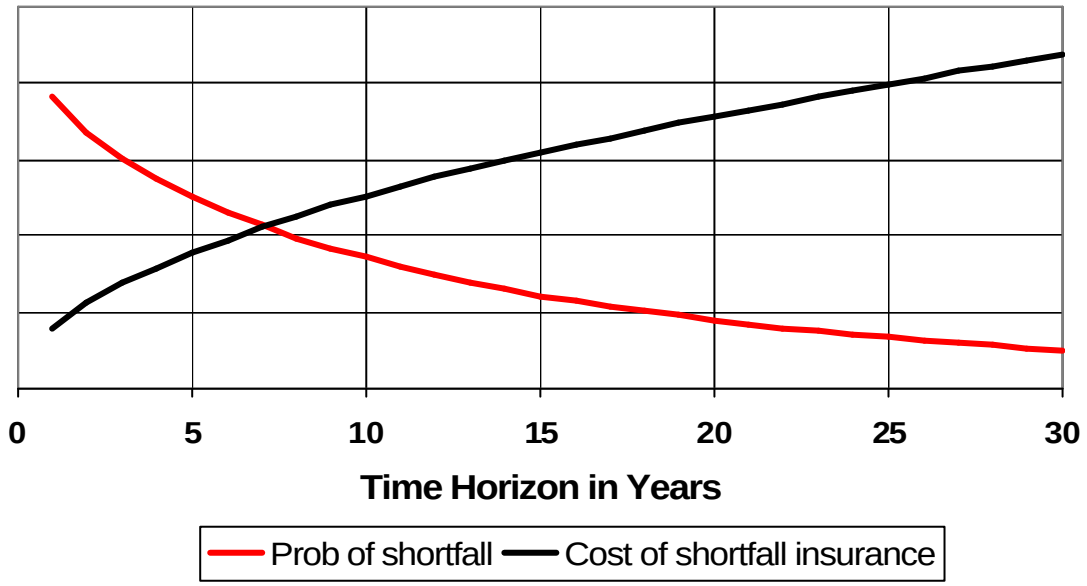
[9] Note that P is *not* equal to the expected value of the shortfall. However, if risk-neutral probabilities are substituted for actual probabilities, then one arrives at P. See Treussard (2005) for a proof.

Table 1. Cost of Shortfall Insurance as a Function of Time Horizon

Length of Time Horizon in Years	*Cost of Insurance as Percentage of Investment*
0	0
1	7.98
5	17.72
10	24.84

NOTES:
The table was derived using the Black-Scholes formula with $\sigma = .2$ *per year. The cost of the insurance is independent of the risk-free rate.*

Figure 1. Probability of a Shortfall and Cost of Insurance as a Function of Time



Some economists and other observers of the stock market have claimed that stock returns do not follow a random walk in the long run. Rather, they argue, the behavior of stock returns is best characterized as a mean-reverting process. It is mean reversion in stock returns, some say, that is the reason stocks are less risky for investors with a long time horizon.

But *Figure 1* is valid for mean-reverting processes too. The reason is that arbitrage-based option pricing models, such as the Black-Scholes or binomial models, are valid regardless of the process for the mean. They are based on the law of one price and the condition of no-arbitrage profits. Investors who disagree about the mean rate of return on stocks, but agree about the variance, will therefore agree about the option price. This is a feature of these models that may at first seem counterintutitive, but is nonetheless true.

For the relation depicted in *Figure 1* to be invalid, mean reversion is not enough. Stock prices would have to behave just like the price of a *T*-period zero-coupon bond that converges towards the bond's face value as the horizon date approaches. In other words, stocks would have to be indistinguishable from the risk-free asset for a *T*-period horizon.

4. Policy Alternatives

The policy parameters that a guarantor can in principle control are: (1) the required funding ratio, (2) the speed with which a pension fund must make up for a shortfall below the required funding ratio, (3) the required degree of matching between the pension liabilities and the assets backing them, and (4) the premium charged for the insurance. Table 1 and Figure 1 are relevant to assessing the relationship among these parameters.

T is the time interval permitted to make up a funding shortfall. For a given T and asset-liability mismatch, the cost of the guarantee P represents the minimum required buffer. Thus, the shorter the time interval and the better the match, the lower the required buffer. If the pension sponsor invests the pension assets in common stocks or other types of equity securities rather than in fixed-income securities that immunize the guaranteed benefits, then the exposure of the government to a potential shortfall is increased. The required funding ratio must therefore be increased.

For the guarantee system to be viable, volatility 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. If the insured pension-plan sponsor can unilaterally change the composition of the asset portfolio, then the government faces a problem of moral hazard since some sponsors will have an incentive to increase the risk of their assets.

The US Congress is now wrestling with these issues as several pension reform bills are making their way through the Senate and the House of Representatives. All of them include raising premiums, tightening the pension funding rules, improving the measurement and reporting of pension liabilities, and attempting to increase the discipline of private sponsors' funding decisions. Higher premiums—in particular, ones linked to PBGC's risk exposure — would offset losses on future claims. More accurate measurement of plans' liabilities would make the existing funding rules and premium schedule more effective. But none of the pension reform bills before Congress has a provision to take account of the asset-liability mismatch in setting PBGC premiums or to restrict the exposure of the PBGC by requiring closer matching.

There are two basic ways to achieve this end. The first is for pension funds to invest directly in fixed-income instruments that match their pension liabilities. A less intrusive and often a less costly way is to do it by means of swap contracts.

Swaps are used either to hedge risks, as in the case of interest-rate swaps or to insure against risks, as in the case of credit-default swaps. A swap contract consists of two parties exchanging (or "swapping") a series of payments at specified intervals (say, every 6 months) over a specified period of time (say, 10 years). The payments are based upon an agreed principal amount (called the "notional" amount), and there is no immediate payment of money between the parties. Thus, the swap contract itself provides no new funds to either party.

Around the world today banks and investment companies use swaps extensively to manage their exposures to currency, interest-rate, credit-default, and equity-market risks and to lower their transaction costs. Pension funds have so far made relatively little use of swaps.[10]

[10] See Bodie and Merton (2002).

The advantage of the swap contract is that it is non-invasive. Company pension plans can continue to hold their equity portfolios, but eliminate the mismatch with their liabilities with a debt-for-equity swap. Consider a company with large pension liabilities, which are fixed in nominal terms and have long durations. The company could enter in a swap that exchanged returns on a stock market index for a fixed interest rate. If the company (or its designated fund managers) is particularly good at managing the equity portfolio, the swap would allow the firm to retain that value added. In this way, it could eliminate the market risk of the portfolio but retain the value-adding risk of the superior fund-management performance. There is no shortage of potential counterparties for such a transaction; any professional investor seeking to increase its exposure to equity returns would be interested.

As a longer run solution to the problem, it might be best to get the government out of the business of managing guarantees of private pensions. Economic reasoning establishes a rationale for insuring defined-benefit pensions against the risk that the plan sponsor will default on its promise to provide benefits. It does *not* establish a rationale for the *government* to provide such insurance. The federal government is probably not in the best position to carry out such a task.

When the PBGC was created in 1974, it was argued that no private insurer could provide the kind of shortfall-risk insurance required by beneficiaries of private defined-benefit plans. If that was ever true, it certainly is no longer true today. In the 1980s a whole new industry devoted to offering such risk-management products developed in the United States and has become a large global business. In this new financial environment it is enough for the government to provide the basic hedging instruments necessary for private-sector firms to fashion financial products to match the market exposures of pension plans.

5. Policy Conclusions and Recommendations

So what general conclusions can one draw about the regulation of pension funds from the experiences summarized in this paper?

1. The science of finance (rather than folklore) should guide professional standards for prudent investing.

2. To maintain a reliable pension safety net the government must require and enforce transparent reporting of the market value of liabilities and the assets backing them.
3. Careful attention must be paid to the degree of matching between the liabilities and the assets backing them. The greater the mismatch risk, the greater the required buffer and the more quickly a funding shortfall must be eliminated.
4. Government can help by providing default-free "building block" securities to serve as hedges and to facilitate correct pricing of guarantees.

References

Bodie, Z., 1995, "On the Risk of Stocks in the Long Run," *Financial Analysts Journal*, May/June.

_____, 1996, "What the Pension Benefit Guaranty Corporation Can Learn from the Federal Savings and Loan Insurance Corporation," *Journal of Financial Services Research*, Vol. 10, No. 1, (January).

Bodie, Z., and Merton, R.C., 1993, "Pension Benefit Guarantees in the United States: A Functional Analysis," (chapter 5 in R. Schmitt, ed., *The Future of Pensions in the United States*, University of Pennsylvania Press, 1993.

_____, 2002, "International Pension Swaps," Journal *of Pension Economics and Finance* Vol. 1, No. 1, (March).

Congressional Budget Office, September 2005, *The Risk Exposure of the Pension Benefit Guaranty Corporation* http://www.cbo.gov/ftpdocs/66xx/doc6646/09-15-PBGC.pdf

Merton, R.C., and Bodie, Z., "On the Management of Financial Guarantees," *Financial Management*, Winter 1992.

Merton, R.C., and Perold, A., "Management of Risk Capital in Financial Firms," Chapter 8 in *Financial Services: Perspectives and Challenges*, Ed. S.L. Hayes III, Harvard Business School Press, Cambridge, MA, 1993, pp. 215-245.

Treussard, Jonathan, 2005, "On the Validity of Risk Measures over Time," Boston University Working Paper http://papers.ssrn.com/sol3/papers.cfm?abstract_id=776651