Washington University Law Review

Volume 82 | Issue 4

2004

Bankruptcy and Workers: Risks, Compensation and Pension Contracts

Richard A. Ippolito
George Mason University School of Law

Washington University
Law Quarterly

VOLUME 82 NUMBER 4 2004

F. HODGE O'NEAL CORPORATE AND SECURITIES LAW SYMPOSIUM

BANKRUPTCY AND WORKERS: RISKS, COMPENSATION AND PENSION CONTRACTS

RICHARD A. IPPOLITO*

ABSTRACT

One can view workers from the perspective of the portfolios they hold. For most workers, this portfolio, broadly defined, evinces a heavy concentration of assets in the firm that employs them. They stand to incur wage reductions if they move to some other company midway in the contract because much of the human capital that they hold is not fully transferable. In many cases, they also stand to lose substantial pension value, and may lose other benefits as well, such as health insurance, longer vacation periods earned through seniority and so on. This just means that they are party to a risky venture, where the downside outcome poses substantial losses. It turns out that the broad implications of bankruptcy for workers are well indexed by pension losses, which means that an understanding of the pension implications of bankruptcy also conveys the thrust of non-pension losses as well.

Risk is not a free good. As in standard models of finance, firms are expected to pay for the risks they impose on workers, and indeed, are expected to pay premia in excess of those implied in financial models if they

* Professor of Law and Economics (retired), George Mason University School of Law.

expose workers to non-diversified risks. The latter premium makes sense only if firms believe that heavily exposed workers are more likely to work hard to ensure the continued viability of their employer. If this incentive is sufficiently strong then higher productivity finances the additional risk premia. Workers can choose jobs among employers that pose different levels of bankruptcy risks, and those least willing to undertake risk take jobs with relatively low levels of it, and receive commensurately lower pay.

As such, there is no reason to believe that workers' losses in some bankrupt companies raise special public policy concerns. Most workers at risk experience the upside potential; a small percentage experiences the downside. There is no reason to believe that the contracts *ex ante* are inefficient. But if the government may have to assume responsibility for near destitute older workers, then this prospect might give rise to various mandatory insurance schemes. Even if these insurances are not market priced, the participants at least have to pay some of the costs of the exposure they incur. This may be one reason why institutions like unemployment compensation and pension insurance arise.

The compensating differential model used to explain the risk-reward tradeoff inherent in defined benefit pension plans also can explain their demise. Beginning in the mid 1980s, the federal government altered its traditional bonding role in the contract and, instead, permitted firms to unilaterally terminate defined benefit plans and take excess assets (those in excess of termination benefits) into corporate profits. This had the result of exogenously increasing the probability of termination far greater than bankruptcy risks. Workers were (justifiably) more leery of the pension promise, which reduced the amount that they were willing to pay for it. The plans, therefore, are valued by less than it cost the companies to provide them, which creates the incentive to move towards pension plans that are self bonded, such as 401k plans.

401k plans have dominated pension growth for the past twenty years and are fast becoming the pension plan of choice in the (non-union) private sector. While they eliminate the bankruptcy risks inherent in defined benefit plans, they create their own set of bankruptcy exposures. While most workers covered by these plans do not invest in company stock, about one in ten have at least half their account balances concentrated in the securities issued by the firm that employs them. In many large companies, 401k plans are heavily invested in company stock. These investment patterns can give rise to the potential for catastrophic losses for workers late in their career. In order to protect themselves from ex post bailouts, taxpayers may want to give some thought to enforcing some set of minimum diversification rules in these plans.

I. INTRODUCTION

The cost of bankruptcy can be large and can affect a wide assortment of stakeholders. Owing to the principle of diversification, however, most stakeholders do not view the bankruptcy of a single firm as a watershed event. Its effect on most stockholders' and bondholders' portfolio returns is small. Similarly, banks, suppliers and other creditors are only slightly affected by the few customers that default on outstanding credit. Indeed, the malaise of most stakeholders in firm performance is at the core of discussions of so-called agency problems inherent in the concept of diversification.

Workers are an important exception. The typical worker's asset portfolio is more heavily impacted by bankruptcy of his employer. Some of these assets are not directly affected by the financial condition of their employer: for example, home equity and the present value of their acquired rights to collect social security payouts. For the most part, the returns on these assets are independent of the idiosyncratic performance of their employer.

Beyond these assets, the typical employee does not maintain large diversified holdings of financial assets.[1] Indeed, his principle holdings take the form of the equivalent of company-issued securities, the return on which depends mostly (or completely) on the financial success of his employer. These assets can be characterized as "employment assets," and "pension wealth."

II. EMPLOYMENT AS AN ASSET

Lifetime job security in current employment is a valuable asset. The asset value equals the present value of current compensation minus the present value of the next best alternative. To illustrate, imagine a randomly chosen fifty-year-old employee with twenty years of service in some firm. Let *C* denote the present value of his future compensation in his current job until retirement age (including future wages, pension accruals and the value of all other fringe benefits).

Imagine that he becomes unemployed. Suppose that he considers all available employment opportunities in all geographic locations. He calculates the present value of future compensation from each of these alternatives, inclusive of pension, vacation time, health benefits and so on. He then subtracts the cost of moving to his hypothetical new firm.

---

1. *See, e.g.*, DAVID WISE & STEPHEN F. VENTI, THE WEALTH OF COHORTS: RETIREMENT SAVING AND THE CHANGING ASSETS OF OLDER AMERICANS (Nat'l Bureau of Econ. Research, Working Paper No. 4600, 1993).

In some cases, moving costs are small. In others, it may involve moving geographical location, which gives rise to out-of-pocket costs and opportunity costs in the form of lost intimacy with family and friends. He also subtracts the lost wages and out-of-pocket expenses incurred in his job search. Call these "adjustment costs" and denote these as *A*. Let him choose the alternative which gives him the greatest net benefit, denoted by *D*. The value of employment in the current job is *E*, where $E = C – (D – A)$.

This asset value cannot be negative; if it were, employees would be better off moving to a new job, and therefore would do so voluntarily. Since they did not, presumably there is a net positive asset value in the current job. There are several reasons why alternative wages might be lower than the wage in current employment. One is that employees sometimes gain an expertise in working in a particular firm. For example, Jane has worked with the same people for a long time, and really knows how to create teams that work best together for different types of jobs. The firm may highly value her gift and pays her accordingly, so as to encourage her continued employment. But this value completely evaporates once she moves to a new firm populated with strangers. If she involuntarily leaves this job, she may have no particular advantage in motivating workers she knows nothing about. Similarly, firms in bankruptcy often are in industries that generally evince poor performance, and all may be shedding workers. In this case, workers may have difficulty finding jobs that utilize a skill they have in working particular machines and so forth.

Moreover, the labor market is beset with information problems. Firms know that of all job seekers, some may not be as productive as their prior wage level suggests. Jane's firm-specific knowledge is one reason. Another is that many firms offer a kind of wage insurance, meaning that over a lifetime of work in the firm, some members of a cohort may become relatively less productive than their peers as they age (perhaps owing to health problems or inability to assimilate new technology and the like).

The notion of wage insurance means that, up front, everyone agrees that those who become less productive when older may get paid less than those that are more productive, but the difference does not fully reflect their productivity differential. This means that some unemployed workers who were earning high wages are not worthy of these amounts in an ex post sense. Fearing getting stuck with high-paid unproductive employees, firms hiring in the job market protect themselves from these outcomes by offering relatively low wages for new entrants until sufficient time elapses for firms themselves to make an informed determination.

For all these reasons, if bankruptcy results in unemployment then workers absorb this capital loss. One would expect that these employment losses are largest in firms and industries where tenure tends to be long. That is, if long tenure is valuable to the production process then firms will tend to erect compensation schemes (like defined benefit pension plans) that discourage quitting. So, employment losses and pension losses are expected to be positively correlated.

For this reason, discussion of pension losses may take on disproportionate importance. These losses are larger in some plans than others. I will concentrate my attention on defined benefit pensions, which are fairly common in most large bankruptcies. In cases where the firm is dissolved then pension termination is automatic. If reorganization is attempted then the pension also can be terminated if the bankruptcy judge deems pension termination necessary to the success of a reorganization plan. Termination triggers immediate losses for covered workers. Some of these benefits are insured. The uninsured pension benefits are "pension capital losses." I will discuss the notion of losses in defined contribution plans below, but for now I will develop the losses inherent in defined benefit plans, and highlight the nature of the defined benefit contract.

III. DEFAULT EXPOSURE: THE ESSENCE OF DEFINED BENEFIT PENSION CONTRACTS

Contingent benefits are the core of defined benefit plans. If the plan does not terminate then workers at retirement are entitled to a benefit that is indexed to *final* wage.[2] This is called an "ongoing" benefit. But if termination occurs earlier than retirement then workers are entitled to a "termination" or "legal" benefit, which is payable at retirement but is indexed to the wage on the date of termination. The difference between these calculations is called the contingent benefit, or default exposure.

This exposure is easy to model, but more difficult to rationalize in an employee contract. It also is non-trivial to value, owing to its peculiar loss structure and imposition of undiversified exposure on workers. Whatever price workers pay for this asset, however, they are willing to pay less the greater their estimate that the plan will terminate prior to their retirement date.

---

2. In many plans, the final wage is the average of the "high-3" or "high-5," but in pension nomenclature, these are known as "final salary" plans, and are usually modeled as though the benefit was indexed to the last wage.

A. The Defined Benefit Pension Contract

Consider a simple two-period model. There is one period of work followed by a period of retirement. Bankruptcies occur at the end of period one. Workers receive their cash wage at the beginning of period one. They receive their pension at the beginning of period two. The pension award is $L(1+i)$ if the firm survives, where L is the present value of the pension award at the beginning of period one, and i is the interest rate. If the firm does not survive then workers receive the portion of the pension that is guaranteed. The guarantee takes the form of the *nominal* pension benefit, L (it is not adjusted for the time value of money). This guarantee mimics the insurance offered by the Pension Benefit Guaranty Corporation ("PBGC").

Ongoing versus Termination Pensions. In actuarial parlance, the amount $L(1+i)$ is the projected benefit amount payable in period two. The amount L is the termination value, also payable in period two. It is useful to express these amounts as of the beginning of period one because we are looking at the value of the pension in an ex ante sense. The present value of *ongoing* pension, L, is written as follows:

$$(1)\ L = \frac{(1+i)\,L}{1+i}.$$

The present value of the termination pension (or equivalently the insured value) equals some percent Ω of the projected pension, which is entirely dependent on the interest rate:

$$(1a)\ L^* = \Omega\, L, \quad where \quad \Omega = \frac{1}{1+i}.$$

Contingent Benefits. This PBGC charges a premium to cover some of the costs of the insurance, but there is a large implied federal subsidy that covers most of its cost. For simplicity, assume that the federal subsidy represents a sufficiently large portion of pension insurance that workers can ignore its cost. All bankruptcies occur at the end of period one. If probability of bankruptcy is p, then the expected present value of the pension at the beginning of period one is described as follows:

$$(2)\ EV = L^* + (1-p)\left[L - L^*\right].$$

The first term is the guaranteed pension. The term in square brackets is the contingent pension benefit. It is collectable if the firm avoids bankruptcy. Hence, this term is multiplied by the probability that the firm survives, $1-p$.

Compensating Differential. The natural question arises: How much less valuable is this pension amount compared to the ongoing pension benefit? To obtain the answer, and to express the answer in percentage terms, subtract (2) from (1), and divide by ongoing pension value:

$$(3)\ x = \frac{L - EV}{L}.$$

The parameter, *x,* is the discount factor that accounts for the uncertainty of collecting the pension (as a percent of the ongoing pension value). Substituting (2) into (3) gives the expression in terms of the underlying parameters in the model:

$$(4)\ x = p(1 - \Omega)\ .$$

Workers do not obtain pensions for free. They sacrifice cash wages in exchange for the pension promise. How much they are willing to sacrifice depends on the probability of bankruptcy and the portion of pensions that are insured. If either the probability of bankruptcy is zero ($p = 0$) or the insurance is complete ($\Omega = 1$), then the discount factor, *x,* is zero. The discount factor increases with the probability of bankruptcy and decreases with the portion of pension that is insured (which is inversely related to the interest rate).

If one starts with the assumption that workers sacrifice wages in the amount, L, to obtain a pension with certainty, then they require a rebate in the amount, xL, in consideration of accepting the risk that they might receive a lesser amount upon a bankruptcy, which occurs with probability, p, which just says that workers require compensation for accepting risk.

Risk Aversion. If workers are risk averse then the expression in (4) is an understatement of the compensation they require to accept a pension of uncertain value. Bondholders looking at the same probability of bankruptcy require no more compensation than implied in (4) because they are widely diversified across many bond issues. In contrast, contingent pension benefits represent an important component of workers' asset positions, which they cannot diversify away. They therefore discount the uncertain pension by an amount larger than implied in (4). The reason is risk aversion. As long as the marginal utility of wealth is diminishing, then the cost of the downside outcome is higher than the benefit of the upside outcome.

Suppose that workers all have utility functions that increase with the square root of wealth. Assume that they have no other wealth in retirement. Ask the question: What is the certainty equivalent pension, say L^C, that gives the worker the same expected utility from receiving pension L with

probability p and a pension L^* with probability p? I write this equality as follows:

$$(4a)\ \sqrt{L^C} \;=\; p\sqrt{L^*} + (1-p)\sqrt{L}\ .$$

Express L^C in terms of ongoing benefits, hence, $L^C = (1\text{-}y)L$, where y is the percent discount that accounts for bankruptcy *and* risk aversion. Also express L^* in terms of L from (1a), and solve for y to obtain:

$$(5)\ y \;=\; 1-[\,p\sqrt{\Omega} + (1-p)\,]^2\ .$$

The discount factor y accommodates both the reduction in expected pension wealth generated by uncertainty and risk aversion, which has the effect of leveraging the required discount for uncertainty.

The latter effect is easiest to see if I suppose that the insured portion of the pension approximates zero (which is akin to assuming a very high interest rate). In this case (5) reduces to the following expression:

$$(6)\ y = x + p(1-p)\ ,\text{if}\ \Omega \sim 0.$$

The first component of y is the regular discount for expected losses from bankruptcy, x. The second component, $p(1\text{-}p)$, is the added compensation for risk aversion. Unless bankruptcy risk is exceptionally large, the risk aversion premium is increasing with the probability of bankruptcy.[3]

B. The Economics of Default Risk in the Employee Contract

Default risk is not a "natural" extension of a defined benefit plan. The firm can eliminate workers' exposure to pension default risk by funding the plan for ongoing liabilities and writing the contract in a way that awards workers the property rights to pension assets up to ongoing benefits. If firms preferred this approach then the PBGC would never receive a claim.

Virtually all firms elect to limit workers' property rights to termination benefits. Firms explicitly expose workers to default risk in the event that they encounter serious financial difficulty. Put differently, workers are secured bondholders in the firm up to the amount of termination pension liabilities, L^*. They are unsecured bondholders up to the amount, $L - L^*$. The value of

3. As long at the probability of bankruptcy is less than one-half, then the premium is increasing in p. But if p exceeds .5 then the premium is decreasing in p. The reason is that at either extreme (p=0 or p=1) there is no uncertainty. The maximum amount of uncertainty (meaning that the variance of outcomes is highest) when $p = ½$.

the unsecured debt instrument is payable if the firm avoids serious financial difficulty.[4]

This is a somewhat puzzling phenomenon. The firm can obtain unsecured credit at market interest rates that are appropriate for their level of default risk. Since idiosyncratic default risk is diversifiable, the market interest rate equals the riskless rate plus expected default losses.[5] But workers do not have lots of jobs, nor do they have the opportunity to hold shares in a diversified portfolio of pensions in different firms. Workers are extraordinarily exposed to non-diversified risks in the firm that employs them.[6]

In the context of my simple two-period model, the extra compensation that the firm must pay workers to accept non-diversified default risk is given in the second term in expression (6). Why do firms pay this premium?

One obvious explanation is that the firm calculates that at-risk workers are less likely to pose agency risk on the firm. It is apparent how the bond makes sense when workers are unionized; because in this instance, workers can act in concert and may find it optimal to hold up stockholders midway in the contract. The prospect of large losses upon bankruptcy discourages this calculus. I have made this argument elsewhere.[7]

Even if workers are not unionized, the impact of the bond on workers' productivity is not zero. If workers as a group have a common stake in the financial success of the firm then presumably they will create an environment in which either shirking or an "anti-management" attitude is frowned upon. If workers' risk exposure can reduce default risks sufficiently, then the higher expected value of the firm's financial performance can more than pay for the extra risk exposure. In effect, the impending bankruptcy losses bond workers

---

4. Perhaps, we could think of workers as either "super" unsecured bondholders, in the sense that the bond can be made valueless upon the firm encountering a condition short of bankruptcy, or alternatively as workers selling a call option to the firm that comes into the money upon the firm encountering a serious financial condition. In a continuous model, options are not typically offered for more than a year or two in the future; longer term protection is not available.

5. In the context of the Capital Asset Pricing Model then if it is more likely for bankruptcies to occur in poor economic conditions then the beta value on these securities is positive, and thus, there is some additional compensation paid to investors to accept the risk of losses when the market portfolio is "down."

6. One could imagine workers purchasing options that come into the money when the firm enters bankruptcy, but these options unlikely would trade at rates that merely reflect expected default losses, because the existence of the widespread use of options creates a moral hazard. Moreover, in a multi-period model, the market in options only goes out a couple years, and so it is not possible to buy protection against the possibility that the firm will enter bankruptcy many years in the future. Options are more like term life insurance. Workers want a product akin to term-renewable life insurance.

7. Richard A. Ippolito, *The Economic Function of Underfunded Pension Plans*, 28 J.L. & ECON. 611 (1985).

to work harder to help the firm attain long-term success. This prospect in turn reduces the probability that the firm experiences the downside outcome.

IV. SUMMARY OF CONTRACTUAL ISSUES

Workers are under long-term contract with the firm. The contract makes workers part owners by virtue of the fact that their lifetime compensation depends on the firm's success. Compensation levels must be sufficiently high to accommodate both expected default losses and non-diversifiable risk. The latter cost is offset by higher expected productivity of workers whose commitment to the firm is bonded by large losses imposed by firm failure.

Workers can opt to work in an environment in which default risk is either zero or close to zero; that is, they could work for a local, state or federal government, all of which are virtually immune from bankruptcy risk and pension default. One expects pay in the public sector to be commensurately lower. In short, there is a risk-reward tradeoff in the labor market, one that is almost a perfect parallel to the risk principles in standard models of finance.

In financial markets, Treasury issues are the standards of comparison. They are default-free investments. Corporate bonds carry default risks, and thus, pay higher interest rates. Similarly, one expects a higher overall compensation level in firms that promise uncertain pension benefits. Indeed, one expects compensation differentials to exceed the expected default amounts because workers are forced to hold undiversified risk. Workers are intensely invested in the firm that employs them, and must be compensated accordingly.

Workers not only are exposed to pension risk, but also to the employment risk that I discussed at the beginning of this Article. Workers expect to be paid a lower wage if they involuntarily change jobs mid career. In short, workers stand to lose substantial amounts of their overall lifetime wealth if bankruptcy visits the firm that employs them. But exposure to this risk is the price that workers pay in exchange for higher pay; or, viewed the other way, workers are compensated for the bankruptcy risks they face.

Upon bankruptcy, we observe workers who experience the downside outcome of the contract. Most workers at risk avoid this fate. Workers in general are compensated ex ante for their exposures, and thus, it is not apparent that special public policy implications arise for those who experience the downside. The outcome is parallel to an investor who chooses to hold an all-stock portfolio and experiences the downside outcome. Ex ante, the investor chooses a higher risk exposure and expects a higher return. Large losses are a potential outcome of this strategy.

The outcome is parallel to contract solutions in jobs where workers are exposed to health hazards. One can work in a job environment that is mostly free of potential harm owing to health hazards. If workers are unaware of the hazards (say, it is not obvious that fumes pose long-term risks of harm) then one can argue that tort remedies can be useful to encourage efficient harm reduction. If workers are aware of hazards on the job then pay differentials are expected to develop to compensate workers for accepting this risk. If harm visits them later on, then a tort remedy effectively compensates workers twice: once in the form of a risk premium, and again upon insuring the event that they were paid to be exposed to in the first place.[8]

Bankruptcies are not common in firms that offer defined benefit plans. Over the period 1980 to 1997, the typical worker in a firm that sponsored at least one defined benefit plan had about twenty-eight chances in one thousand that the sponsor entered bankruptcy in any single year.[9] Over a thirty-year career, this amounts to about eight chances in one hundred. As I show below, workers who stand to suffer the largest pension losses upon termination lose an amount equal to about two years of wages.[10] While this is a relatively large amount for most workers, it is substantially smaller than it would be if defined benefit plans were uninsured. Without insurance, if firms had no pension funding, losses for older workers could reach five or six times their annual wage. Worst still, these losses would be most severe for older workers with lots of accumulated benefits.

One can reasonably speculate that like victims of natural disasters, big pension losers in bankrupt firms pose an ex post threat to taxpayers as a whole. Even though they enter a risky contract with commensurately higher pay, they may have an incentive to renege ex post. As large "innocent" losers in a bankruptcy, they perhaps are sympathetic petitioners for a bailout from Congress. The prospect of their success may be one reason why mandatory pension insurance exists. As I show below, taxpayers implicitly underwrite a substantial portion of the cost of the insurance, but at least they are successful in getting the beneficiaries of the insurance to pay some of the expected costs. Similar arguments can be made for the case of unemployment insurance.

---

8. In the longer run, the prospects of tort remedies eliminate the pay differential up front—even if workers are fully informed about risks.

9. This is the average bankruptcy rate among publicly-traded firms in the Compustat database that sponsored at least one defined benefit plan, weighted by employment.

10. Loss amount also depends on the interest rate as shown below.

To limit their losses ex post, taxpayers may want to impose minimum quality restrictions on the employment contract. Effectively, they require tie-in contracts that pair pensions with pension insurance and employment with unemployment insurance. Because the uninsured risk profile is inherently unstable upon the arrival of downside events, the amount of risks that workers can undertake is regulated. In a market that has the benefit of full information and is free of government bailouts, it is not clear that there is any rationale to interfere with workers' free choice of the risk profiles in their jobs. But since taxpayers bear hidden underwriting risks in contracts with large downside potential, they may have an interest in effectively participating in contract conditions ex ante.

V. LOSSES IN A MULTI-PERIOD MODEL

A two-period model adequately demonstrates the concept of contingent benefits, but misses the exposure profile over various ages for covered workers. It turns out that the multi-period model is only slightly more complex. Consider a defined benefit pension that pays a pension that has a lump sum valuation at retirement equal to α percent of the final wage, multiplied by years of service, S. Suppose I normalize age so that all workers start at age and service zero and retire after R periods. This allows me to represent age and service by a single variable, notably service, S. Thus, a worker with S years of service also is S years of age. Also assume that wage growth equals the interest rate. This simplifies the exposition of ongoing benefits and reasonably reflects growth rates in reality.[11] At service level S, ongoing benefits are proportional to years of service accrued to date and current wage:[12]

$$(8)\ L = \alpha S W_S$$

where W_S is the current wage and α is the pension's generosity parameter.

Termination benefits do not incorporate wage growth, and thus, equal some fraction, Ω, of ongoing benefits. In a two-period model, Ω is a function solely of the interest rate. In a multi-period model, it also depends on the age/service of the covered worker, specifically,

11. Nominal wage growth reflects inflation just as interest rates do. Wages also increase by a real component of a magnitude that is not much different than the real interest rate.

12. If wages grow at rate g then projected wages at retirement are $W_S(1+g)^{R-S}$, where R is retirement age, S is current age, and W_S is current wage. To discount this wage to the present, divide by the factor $(1+i)^{R-S}$, where i is the interest rate. If $i=g$ then the growth and discount factors cancel, leaving only W_S.

$$(9)\ L^* = \Omega_S L, \qquad \Omega_S = \left(\frac{1}{1+i}\right)^{R-S}.$$

The factor, Ω_S, carries a subscript, S, to denote that the fraction of the benefit that is contingent depends on the worker's age/service level. Since retirement age, R, is a constant, the fraction of benefits insured, Ω_S, is smallest at the start of tenure (when $S \sim 0$), and increases towards unity as the worker approaches retirement (when $S \sim R$).

To obtain contingent pension benefits, C_S, at age and service level S, expressed as a percent of the current wage, subtract (9) from (8), and divide by the wage rate:

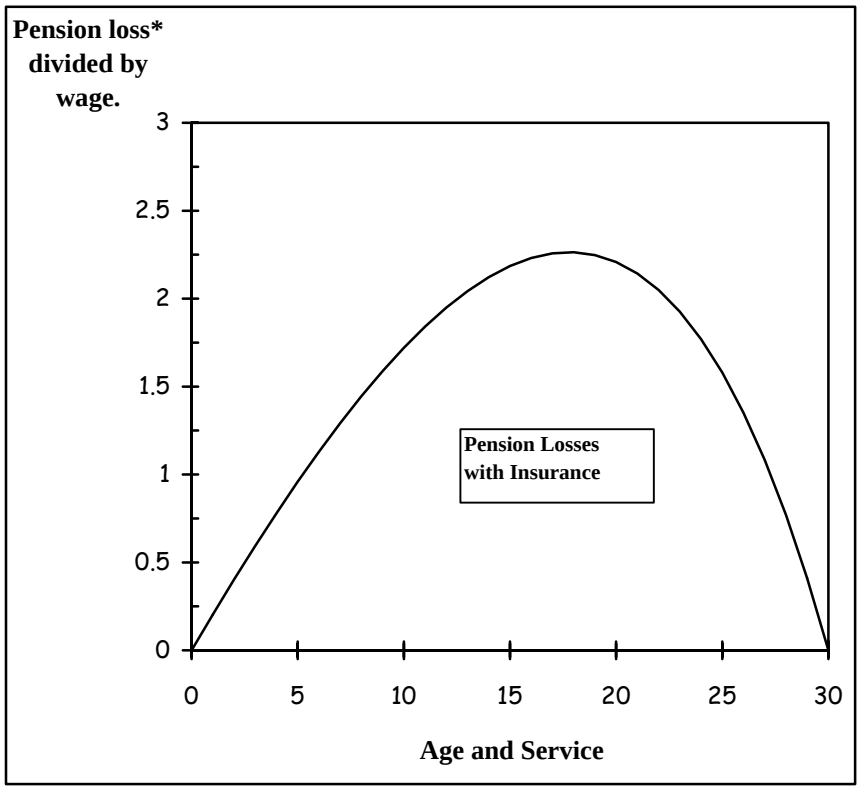
$$(10)\ C_S = \left(1 - \Omega_S\right)\alpha S\ .$$

This expression shows that losses over tenure are affected by two equally important terms, which are multiplicative: the share of benefits that is *uninsured*, $1 - \Omega_S$, decreases with age/service, which works to reduce losses with service. In contrast, the value of the ongoing pension benefits, αS, increases with age/service, which works to increase losses. At the two extremes of service, one term or the other is small, and hence, losses are close to zero.

Workers in mid career suffer the highest losses. These workers have a substantial level of service in the firm but are sufficiently far from retirement that termination benefits are substantially discounted relative to ongoing benefits. **Figure 1** shows the contingent benefits described in (10) assuming that the interest rate is six percent, the pension awards a lump sum equal to twenty-five percent for each year of service (times final wage), and workers retire after thirty years of service.[13] The schedule figure reveals the familiar hill-like pension losses that workers absorb from pension termination at various levels of service.

13. Normally, benefits are paid as an annuity. Using a lump-sum equivalent yields the same answer as long as the pension awards ad hoc cost of living increases to retain the same level of real benefit regardless of the level of inflation. The twenty-five percent generosity factor is equivalent to a two percent annuity for a worker who will collect benefits with no cost of living adjustments, discounted at six percent.

Figure 1
Pension Capital Losses From Firm Failure: A Defined Benefit Plan



* Losses based on a 6% interest rate and wage growth rate; lump sum payoff at retirement using a typical generosity factor.

These losses are non-trivial. Workers midstream in the contract stand to absorb pension losses in excess of two years of wage income. These losses increase with the interest rate.

The hill-shape pension loss function likely mimics the qualitative nature of employment losses from bankruptcy. Workers with little service at the time of bankruptcy have not invested much in the firm, and thus, do not have much firm-specific capital to lose. Older workers nearing retirement have lots of specific human capital, but they have only a few years over which to incur wage losses. Those in the middle of the contract incur disproportionate exposure: they have lots of firm specific capital that generates high wages in their current job but stand to earn lower wages throughout the remainder of

their career. Total losses are the vertical summation of pension losses and all other employment losses from bankruptcy (not shown).

VI. THE STOCK BONUS ALTERNATIVE

The discussion above suggests that termination losses from an insured (or funded) defined benefit plan can be replicated by a stock bonus plan that permits diversification out of company stock. Expressing losses in the context of a stock bonus plan highlights the nature of losses in a defined benefit plan and also helps us think about exposure to bankruptcy losses in pensions other than defined benefit.

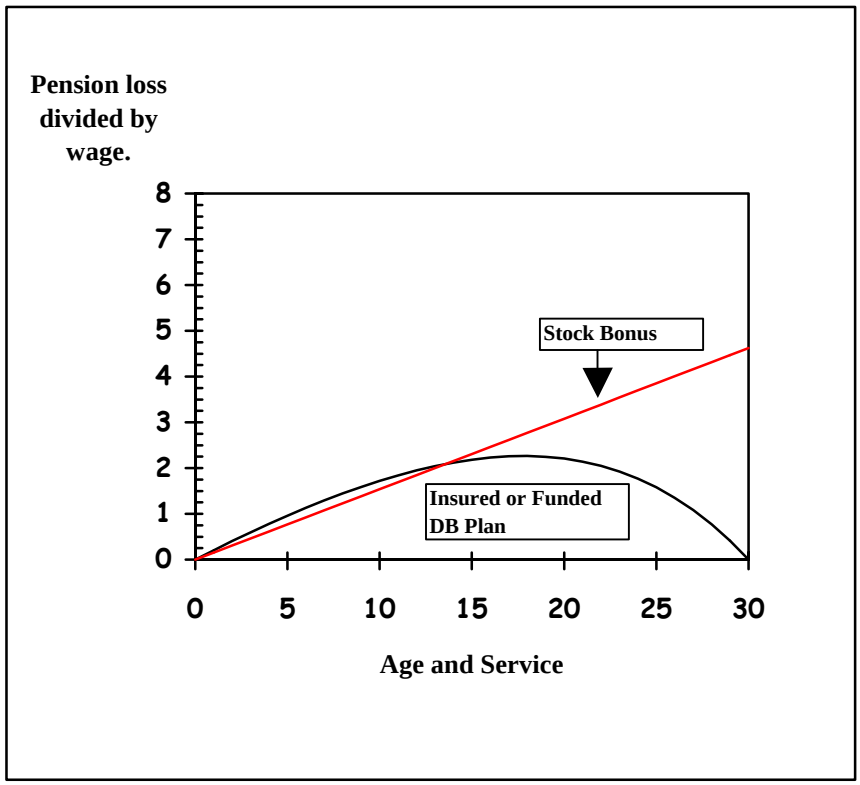
A. Traditional Stock Bonus Plan

In a stock bonus defined contribution plan, the firm deposits some portion of the wage into the worker's pension account, which must be used to purchase company stock. I assume that the firm awards the worker a percent, γ, of wage each year, where I deliberately set this parameter to generate the same expected losses in a defined benefit plan midway in the contract. I assume in the illustration that stock value grows at the same rate as the interest rate.

In reality, one would suppose that the asset position would increase at a rate that includes the equity premium, but I suppress this element of the model so as to be comparable with my treatment of defined benefit plans, which also should be discounted by something more than the interest rate. Indeed, as I show below, the contingent benefits in defined benefit plans ought to be discounted by something close to the expected stock return.

The asset position in the stock bonus plan as a percent of wages grows linearly with service, which I depict in **Figure 2**. If the firm fails, I assume that the stock is worthless, and so, the worker loses the balance in his stock bonus account. Thus, the linear segment in the figure gives the capital loss from firm failure. For comparison, I juxtapose this exposure against potential losses in a defined benefit pension plan that is protected by PBGC insurance (hill-shaped schedule).

Figure 2
Pension Losses: Defined Benefit Plan Versus Stock Bonus Plan



Notice that over the first half of tenure, my choice of the stock bonus savings parameter is such that the potential losses in the stock bonus plan from bankruptcy fairly well replicate those in the defined benefit plan. After this point, however, potential losses in the stock account implied by firm failure continue to escalate, and indeed, they swamp the capital losses in the defined benefit plans late in tenure.

This comparison makes apparent that, in effect, workers in defined benefit plans gradually exchange their portfolio of unsecured bonds for one that has a progressively higher proportion of secured bonds. As workers approach retirement, their entire pension portfolio is secured. This changing pension portfolio composition, which is implicit in defined benefit plans, acts to temper losses for older workers in the event of firm failure. In contrast, losses from a stock bonus plan put the entirety of the pension value at risk late in tenure. In comparison to a defined benefit plan, the stock bonus plan

not only imposes more non-diversified risk on workers, but also concentrates it late in tenure, when workers might be least inclined to accept it; they are more like a defined benefit plan with no insurance and no funding. Thus, workers would demand additional risk premia to accept the stock bonus arrangement over as compared to their defined benefit plan.

B. Stock Bonus Plan with Diversification

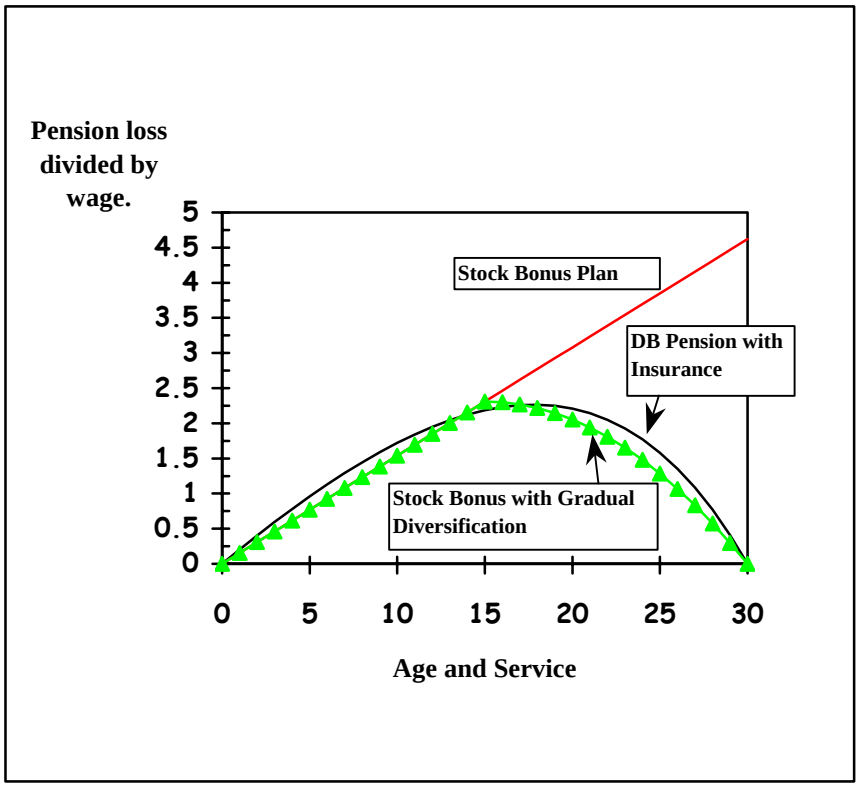
The firm can alter the stock bonus plan so that it essentially replicates capital losses in the defined benefit plan. It can do this by permitting workers to gradually diversify their portfolio out of company stock. For example, the pension might provide that one hundred percent of a worker's account must be invested in company stock until midway in the contract. Beyond this point, the plan allows higher-tenure workers to have a progressively higher portion invested in Treasury Bills.

To illustrate, consider the stock bonus plan I portray in **Figure 2.** By choosing a contribution rate to the stock bonus plan equal to one-fifteenth of the wage, I generate bankruptcy losses in year fifteen so as to be equal to bankruptcy losses in the defined benefit plan. Now suppose that for any service level, *S*, greater than fifteen, the firm permits the worker to diversify the proportion (*S*/15) - 1 into Treasury bills. Until year fifteen, the worker's pension is completely undiversified. But, by the time his service level reaches twenty, the worker can diversify one-third of his account into Treasury Bills; after service level twenty-five, he can have two-thirds in Bills, reaching 100 percent by age and service level thirty.

The schedule marked by closed triangles in **Figure 3** portrays the diversifiable stock bonus plan. For comparison, I show the capital loss function for the defined benefit plan it replaces as a light hill-like solid line. The stock bonus plan essentially mimics the default losses in the defined benefit plan. In this sense, the diversifiable stock bonus plan imposes the same exposure to workers as the defined benefit alternative.[14] Both pensions imply the same compensating differential from workers (in the form of foregone wages), regardless of these parameters.

14. For more detail on the relationship between these two loss functions, see Richard A. Ippolito, *Replicating Default Risk in a Defined-Benefit Plan*, 58 FIN. ANALYSTS J. 31 (2002).

Figure 3
Pension Capital Losses From Firm Failure:
A Stock Bonus DC Plan With Gradual Diversification



In short, a defined benefit pension is similar to a compensation scheme that gives workers a stake in a risk-free bond plus company stock, where the shares of these securities change over tenure according to a contractual formula. The equivalence of these contracts suggests that the appropriate term structure of discount rates to value pension promises is a vector of weighted mix of riskless rates and expected stock returns that accounts for changing weights over the career and for the extra risk premium for non-diversifiable risk.

C. When the Non-Diversification Premium Is Not Paid

Compensating differentials for non-diversifiable risks are expected only when the firm *requires* workers to hold it. Suppose that workers have a defined contribution plan, like a 401k plan. The company matches employee contributions on an x to 1 basis, where its contributions take the form of company stock. In this case, workers are expected to discount the value of these contributions more than they would if they were cash matches. But if the workers themselves opt to invest their contributions into company stock as well, then the market does not award compensation to workers who select themselves into a portfolio unusually concentrated in company stock. Workers who *choose* to be non-diversified do so without any compensating reward.

VII. THE COSTS OF PENSION INSURANCE

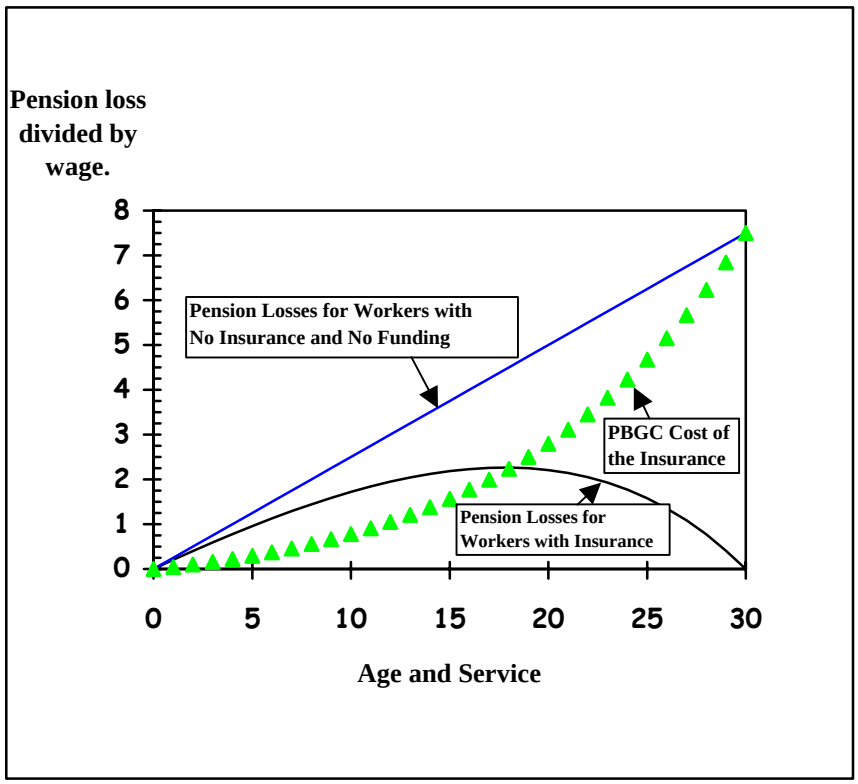
PBGC pension insurance is a substitute for funding. If pensions maintain sufficient assets to cover termination liabilities then pension insurance adds no value. Exposure is created when firms either maintain funding levels below termination benefits, or have a pension portfolio that has sufficient volatility to generate underfunding over a short period of time. If the private insurance market sold PBGC-like pension insurance, what factors would drive price? The differences between this hypothetical price schedule and the one actually assessed by the PBGC represents the various subsidies in the current system.

A. The Role of Age/Service

As suggested by Figure 1, the cost of insurance depends upon their age and service. **Figure 4** reproduces pension losses with insurance. It also shows a linear schedule that represents the value of ongoing pension benefits. This schedule describes pension bankruptcy losses to covered workers if the plan is completely unfunded and there is no insurance.[15]

15. Losses in "top-hat" plans resemble this schedule. These plans are exempt from regulations and have no special tax-exempt status. They cover only the highest paid workers in the firm. Often benefits in these plans vest only at retirement and have no funding.

Figure 4
Pension Capital Losses From Firm Failure:
Maximum Losses Versus Losses with Insurance



The vertical distance between the linear schedule and the hill-shaped schedule is the *maximum* value of the insurance. It is apparent that the value of PBGC insurance is highest for older workers. For the typical covered worker with 15 years of service, losses with insurance depicted in the figure amount to 2.3 times his annual wage (a not unreasonable estimate of actual losses in many cases). Without insurance and without funding then upon a bankruptcy, the same worker stands to lose the entirety of his pension, or 3.8 times his annual wage. For workers approaching thirty years of service, bankruptcy with neither insurance nor funding imposes losses equal to 7.5 times a typical worker's annual wage. Either insurance or full funding for termination benefits virtually eliminates these losses.

The *maximum* cost of the insurance to the PBGC equals the vertical difference between these schedules. Clearly, the cost of the insurance is higher for firms with lots of older workers. The cost would of course shift down vertically as the plan's funding ratio increased.

B. Interest Rates

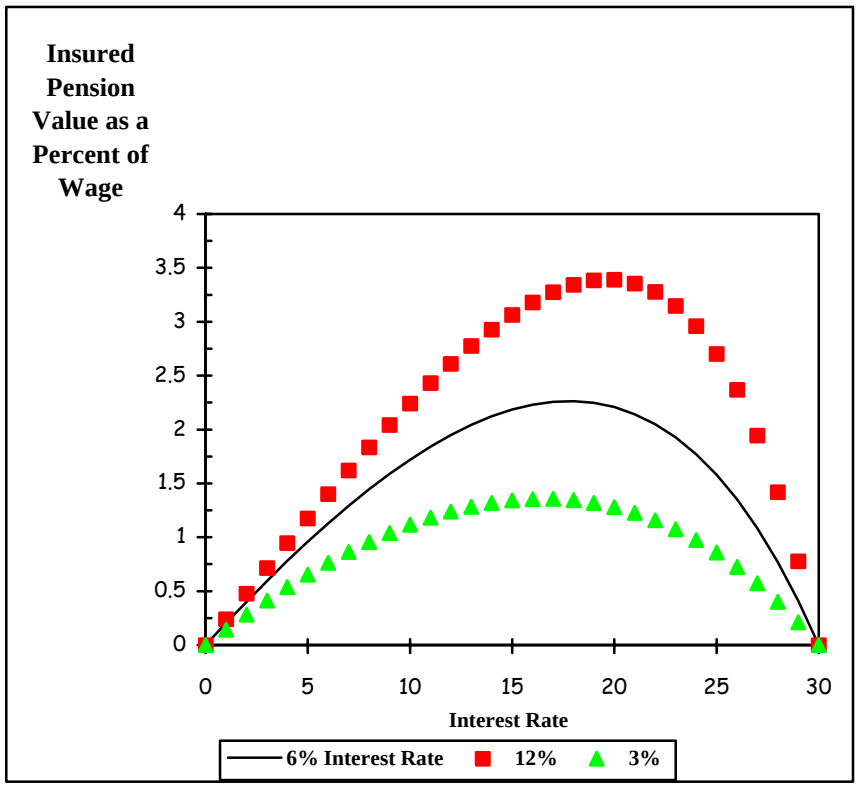
The interest rate also is an important parameter of the value of pension insurance. At very high interest rates, termination benefits are virtually worthless, and thus, the cost of supplying the insurance is low. In contrast, if the interest rate is very low then the termination benefit is almost as high as ongoing benefits.[16] In this case, the cost of insuring workers is high. **Figure 5** starkly demonstrates this point. It reproduces pension losses from Figure 1, which are based on a six percent interest rate (solid-line schedule). For comparison, it shows the losses recomputed assuming that the interest rate (and wage growth) are three percent (diamond-marker schedule) and twelve percent (solid-box-marker schedule). The higher the interest rate, the higher the pension capital losses from termination (and the lower the cost of providing the insurance).

Intuitively, since termination pensions are frozen in nominal terms, but often payable many years in the future, their present value is low if the discount rate is high. Since projected benefits keep pace with wage growth, and wage growth usually is highly correlated with nominal interest rates, projected benefits are more or less insulated from interest rate changes. Thus, the difference between the ongoing benefit and the termination benefit (the capital pension losses) is highest when interest rates are very high and vice versa.

---

16. *See* expression (1a): $L^* = \Omega L, \quad where \quad \Omega = \frac{1}{1+i}$.

Figure 5
Pension Losses with Insurance as a Function of the Interest Rate



C. Other Determinants of Market Pension Insurance Prices

While it is intuitively obvious that the value of pension insurance depends on the funding ratio, it is also importantly dependent on the pension plan's portfolio composition. At any given funding ratio, a portfolio comprised of stocks presents more risks to the PBGC than a portfolio of Treasury bonds. To understand the role of asset composition, one needs an important piece of information; namely, that bankruptcy probability depends on the overall performance of the economy. Some firms enter bankruptcy during high-growth periods in the economy, but it is far more likely that the bankruptcy occurs during or following an economic downturn in the economy as a whole.

Now consider a pension plan that holds all stock in its portfolio. In good times, the value of the portfolio is high. But this is of no concern to the PBGC because in good times bankruptcy risks are small. In bad times, the portfolio value falls, *and* bankruptcy risks increase. The correlation of bankruptcy risks with poor performance of the economy as a whole generates important downside exposure to the PBGC. A pension that is fully funded for insured benefits and has an all-stock portfolio deservedly owes the insurer compensation for the exposure it creates.

A plan presents essentially zero exposure to the PBGC if it is fully funded, *and* it holds a portfolio of high-grade corporate bonds (or Treasuries) of the same duration as its pension liabilities. Duration is a measure of the sensitivity of the value of some security to changes in the interest rate. If a pension plan's termination liabilities fall by ten percent for each one percentage point increase in the interest rate, then the liabilities are said to have a duration of ten. If it also holds bonds in its asset portfolio that have duration ten, then the difference between liabilities and assets is invariant to the interest rate. It is said to be immunized against interest rate risk. A plan funded with Treasuries also is insulated from stock market risks and default risks.

In contrast, suppose that the plan holds only equity in its portfolio. In this case, it is exposed to interest rate risks, and it is exposed to adverse stock returns. In this case, a plan poses zero risk to the PBGC only if it maintains sufficient overfunding to accommodate potential negative equity returns (and significant reductions in the interest rate).

D. The Two-Period Model

To illustrate the role of equity exposure, I reconsider the two-period model used above. Suppose that there are only two investment choices, Treasuries (of equal duration to liabilities), and a stock index fund. In my simple model, bankruptcies occur at the end of the first period (after everyone learns whether the economy is up or down during the period).

Thinking about termination liabilities, recall that the sponsor must pay the nominal amount L in period two. If the sponsor purchases only Treasury bonds, it can guarantee funding of liabilities L by purchasing the amount of bonds, B_0, equal to $L/(1+i)$. At the end of period one, it will have earned the interest iB_0 and thus have the amount $B = B_0(1+i)$ to pay off termination liabilities. There is neither default risk nor equity market risk. The PBGC has no exposure.

Suppose instead that the sponsor buys some Treasury bonds that are valued at the amount B in period two. It also buys some stock valued at S_0 at

the beginning of period one and $S_0(1+r)$ at the end of period one, where r is the excess rate of return on stock (that is, the return after adjusting for the time value of money). On the upside the return is positive, and on the downside it is negative. The present value of expected losses as of the beginning of period one, EL, is written as follows:

$$(10)\ EL = p(r)\left[L^* - \left(B_0 + (1+r)S_0\right)\right] \geq 0$$

where p is the probability of bankruptcy, which itself depends on the stock return. If the stock return is high then the bankruptcy rate is low and vice versa. The term inside the square brackets is underfunding *at the end* of period one, which can be different than underfunding at the start of the period owing to performance in the equity market. The insurer receives no benefits if the plan becomes more than fully funded, and thus, expected losses are positive or zero.

Dividing and multiplying by L^* gives expected losses as a function of initial funding ratio, f, initial stock share in the portfolio, α, and the rate of return on stocks, r:

$$(11)\ EL = p(r)\, L^*\left[(1-f) - \alpha r f\right] \geq 0$$

This expression tells us that the economic price of pension insurance is a product of three factors: the probability of bankruptcy, p, termination liabilities, L^*, and the funding ratio upon termination in a downside (the term inside the square brackets). The first term inside brackets, $1\text{-}f$, captures the role of initial underfunding on exposure. The second term, $\alpha r f$, captures the subsequent effect of equity performance on exposure. If the economy performs poorly then r is negative and $p(r)$ is high.

If there is no stock in the portfolio ($\alpha = 0$) then the potential underfunding ratio is completely captured by the initial underfunding ratio. To the extent that it holds stocks ($\alpha > 0$) then underfunding also depends on the share of stock and the return on stock during the period. While it is tempting to think that the insurer benefits if stock returns are high, in reality, it does not. The reason is that bankruptcy risks are low when markets perform well. Bankruptcy risks are high precisely when returns are low, and especially when they are negative. Thus, there is an asymmetry in which the backers of the insurance "participate" in the benefits or costs of good or bad stock market performance.

If the term in brackets is positive then the economic price for pension insurance is zero. For a plan that holds stocks, the initial funding ratio must exceed unity to generate zero expected costs. For example, suppose that the downside stock return is minus fifty percent, and the plan's stock share is .5. Then the firm poses no risk to the PBGC if the starting funding ratio is at

least 133 percent. In other words, plans that hold stock must have a sufficiently large funding cushion to accommodate the potential for downside returns.

The expression makes it apparent that the cost of pension insurance depends on the probability that a claim occurs, the starting funding ratio, the share of plan assets in stock, and the return on stocks when the downside occurs. In a continuous model that has many possible upside and downside returns, the expression becomes complex, but the character of the results remain the same.

VIII. THE BETA COMPONENT IN PENSION INSURANCE

Under normal conditions, ignoring the administrative costs of operating the insurance, the economic premium equals expected losses in (11). In the case of pension insurance, however, the market price is higher. Why? The answer lies in the correlation of claims with downturns in the economy. Put somewhat differently, the backers of the insurance (in this case the taxpayers ultimately) require a higher return to invest in the insurance for the same reason that stockholders require a higher expected return than bondholders. If all stocks moved randomly and independently then holding a diversified portfolio of individual stocks would yield an average return that had a miniscule variance. In this case, stock investors expect a return commensurate with a bond. In reality, a diversified portfolio of stocks has a very large variance because returns are correlated across stocks. This is the so-called market risk, which cannot be diversified away.

While stockholders can diversify away idiosyncratic risk, they cannot eliminate market risk. Stock returns typically move in tandem, which creates nondiversifiable risks. Hence, they earn a so-called equity premium (vis a vis the bondholders). Put somewhat differently, holders of high-quality bonds accept a lower return than stockholders because it allows them to avoid volatility in portfolio value.[17] This is the main implication of the Capital Asset Pricing Model ("CAPM"), in which securities earn risk premiums only if they pose risks that cannot be diversified away.[18] Stocks whose returns increase more than proportionally with the market (high-beta stocks) are expected to have higher returns than those whose returns increase less than

17. There is of course inflation risk in bonds, but one can imagine holding I-bonds issued by the U.S. Treasury, which pay a real interest rate plus inflation. These bonds have no inflation risks. As such, one expects a lower return on these securities.

18. The original article that presents CAPM is William Sharpe, *Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk*, 19 J. FIN. 425 (1964).

proportionally with the market (low-beta stocks). No one wants to lose a substantial portion of their portfolio in down times, and thus, stockholders must earn a higher premium relative to bondholders to obtain equilibrium in the financial markets.

The same principle applies to insurance markets. When insurable events are mostly unrelated (for example, auto accident claims), average claims experience is characterized by a trivial variance, so long as the insurer covers many units of exposure. Even if exposure is correlated, as say in flood damage along the Mississippi River, the insurer can offer flood damage over many different areas of the country and indeed the world, and thus, diversify away these risks across a large number of insureds. Pension insurance claims not only are susceptible to bunching, but also are correlated (negatively) with the market return. The backers of the insurance are asked to pay out large claims precisely at times in which their portfolios are falling. Investors require a premium to underwrite this risk compared to underwriting risks that carry no market risk. Since the idea is directly related to the CAPM, it is said that pension insurance carries "beta" risk.[19]

There are two components of beta risk in pension insurance. One arises because funding is a function of stock performance in all plans that hold stock investments, and the second arises because the probability of bankruptcy itself increases in down markets. Even if a plan holds only bonds but is underfunded, the probability that this underfunding becomes a PBGC claim is higher in down markets than up markets, and thus, the insurer's loss exposure is negatively correlated with stock market returns.

The beta risk itself gives rise to the possibility of catastrophic events. In periods in which economic performance is poor, the PBGC runs the risk that many bankruptcies can occur within a short period, each characterized by abnormally low funding levels. Even under normal economic conditions, the insurer is vulnerable to a few large claims arriving by chance, or to the downturn of an entire industry. Catastrophic exposure is characterized by the possibility of severe "tail" events, meaning a small probability of very large claims. These kinds of coverages are hard to offer because catastrophic

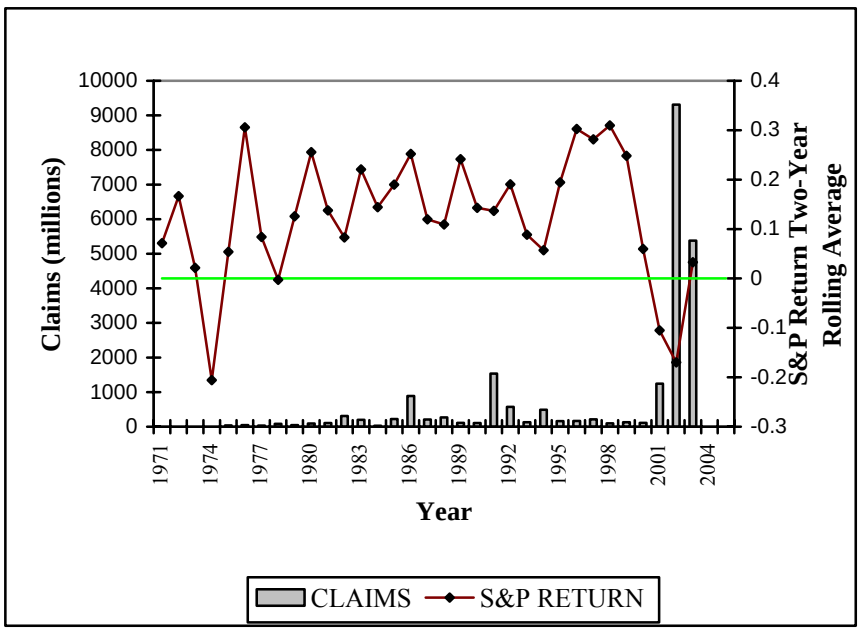
19. The notion of beta risk can be found, for example, in Stewart Myers & Richard Cohn, *A Discounted Cash Flow Approach to Property-Liability Insurance Rate Regulation*, *in* FAIR RATE OF RETURN IN PROPERTY-LIABILITY INSURANCE (J. David Cummins & Scott E. Harrington eds., 1987); J. David Cummins, *Statistical and Financial Models of Insurance Pricing and the Insurance Firm*, 58 J. RISK & INS. 261 (1991); William B. Farley, *Investment Income and Profit Margins in Property Liability Insurance: Theory and Empirical Results*, 10 BELL J. ECON. 192 (1979); and Alan Kraus & Stephen A. Ross, *The Determination of Fair Profits for the Property Liability Insurance Firm*, 37 J. FIN. 1015 (1982).

events by definition are rare, which restricts the usefulness of historic data for projecting claims.

A. Illustration of the Catastrophic/Beta Event

The claims experience over the brief history of the PBGC illustrates both the catastrophic and beta risk inherent in the insurance. **Figure 6** shows claims taken by the insurer through 2003.[20] The bar columns show nominal claims (measured along the left vertical axis). The line distribution shows the two-year rolling-average equity return on the S&P 500 Index (right vertical axis).

Figure 6
PBGC Claims Versus Stock Market Returns



20. Historical PBGC data is found in the Pension Insurance Data Book, 2002, which is issued annually by the PBGC. *See* PENSION BENEFIT GUARANTY CORP., PBGC PENSION INS. DATA BOOK 2002, at 10 (2003).

Since 1970, there have been only two periods in which equity returns were sufficiently poor and persistent so as to generate a negative two-year return. The first was 1974, which captures the stock market crash of 1973/1974 (the average returns in these two years was minus twenty percent per annum). I have argued elsewhere that the underfunding created by this event and the corresponding increase in bankruptcy rates were an important stimulus for the enactment of the insurance on Labor Day 1974.[21]

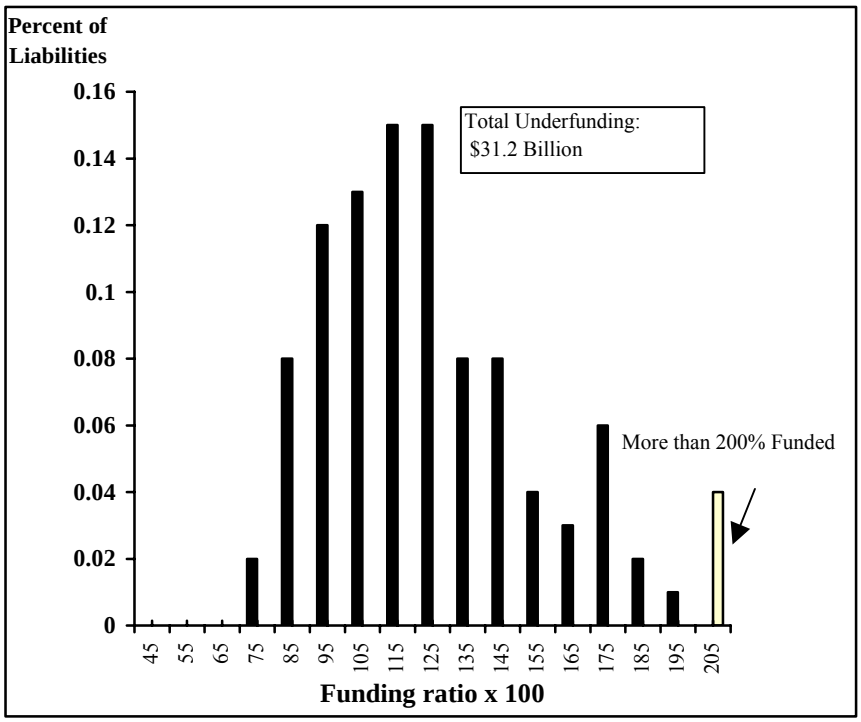
Notably, the legislation creating the PBGC was not retroactive. It offered the insurance against claims arising in the *future*, which fortuitously, was characterized by a dramatic reversal in equity performance following the inauguration of the insurance. Indeed, stock returns generally were quite favorable for the insurance throughout the 1980s and 1990s, creating the impression that perhaps the insurance was not especially costly. Though premium rates were increased occasionally, total premiums rarely exceeded $1 billion per annum, and as of year-end 2000, the PBGC enjoyed a $9.7 billion surplus position. It had not yet experienced the conditions that give rise to the catastrophic nature of the insurance, notably, a substantial downturn in the economy.

Indeed, **Figure 7** shows the distribution of insured pension liabilities by plan funding ratio as of the start of 2001, just prior to the downturn. The figure depicts little cause for alarm. Total underfunding amounted to only $31.2 billion. The figure adequately demonstrates the pitfall of gauging exposure by relying on spot funding ratios because they do not account for the protection of negative investment returns. Beginning in 2000, equity returns fell by almost forty percent through 2002, virtually reproducing the stock market crash of 1973/1974. **Figure 8** demonstrates the effect of this downturn on plan underfunding. The chart shows two series of underfunding, one based on Form 5500 Annual Report Data and the other (since 1996) based on submissions to the PBGC which are required by plans with more than $50 million in underfunding. The "5500" data are as of the first of the year and measure vested liabilities only. The PBGC series pertains to measures as of September 30th of the year and include all liabilities, including unvested benefits. The PBGC series has the benefit that it is almost four years more current than 5500 data.

---

21. *See* Richard A. Ippolito, *A Study of the Regulatory Effect of the Employee Retirement Income Security Act*, 31 J.L. & ECON. 85 (1988). The history surrounding the enactment of pension insurance can be found in James Wooten, "*The Most Glorious Story of Failure in the Business": The Studebaker-Packard Corporation and the Origins of ERISA*, 49 BUFF. L. REV. 683 (2001).

Figure 7
Funding Ratios Prior to Market Drop (January 1, 2001)



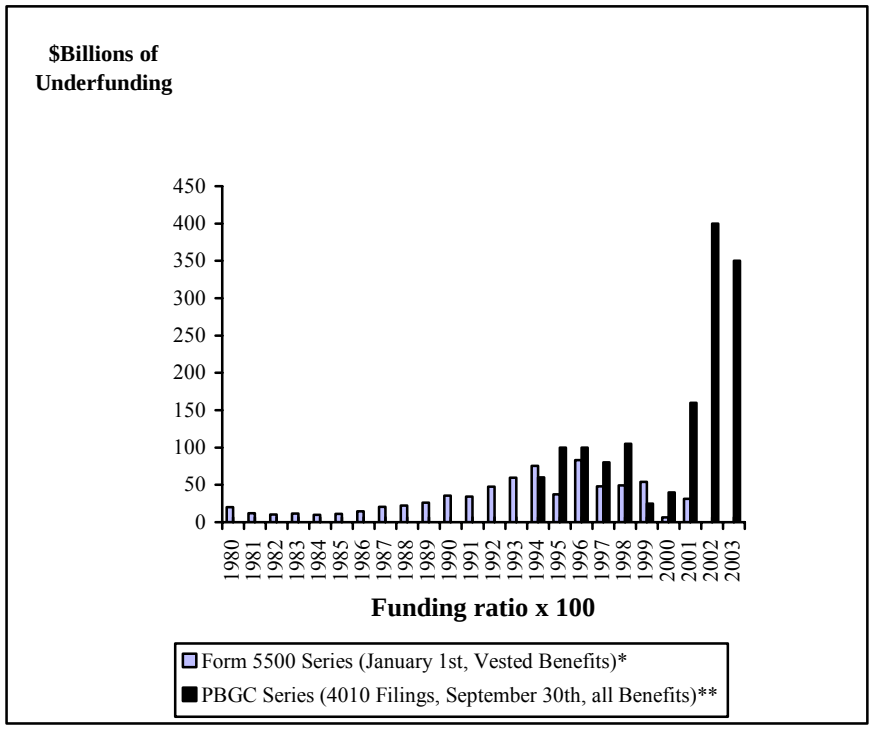
[Source: 2001 Form 5500 Annual Reports (Schedule B).]

While the series evince some differences, it is apparent that pension plan underfunding ballooned starting in 2001, reaching a high of about $400 billion in 2002.

Unlike its inaugural experience, in which the PBGC escaped with relatively few claims following the economic downturn in the early 1970s, the agency did not escape the consequences of the negative equity returns starting in 2001. This time, it absorbed the full brunt of the bankruptcies and underfunding that accompanied the downside event.[22] The PBGC quickly accumulated $15.9 billion in claims, more than twice as much as the $6.1 billion it assumed over the period 1980–1999 ($9.5 billion in 2003 dollars). In real terms, per annum claims during the last three years were more than fifteen times the per annum claims over all prior years.

22. *See supra* fig.6.

Figure 8
Pension Underfunding, 1980–2003



* The Form 5500 series funding ratios are as of January 1 of the year, and count vested liabilities only. Data are taken from Schedule B attachments.
** The PBGC series pertain to September 30 of the year, and include all accrued liabilities. It obtains its data from firms who by law must divulge underfunding beyond $50 million (so-called 4010 filings).
Both series are adjusted to a common mortality table and both adjust to a common PBGC rate (though the interest rates for the same year can differ because the series are calculated at two different times of the year.

The downside event erased the heretofore mentioned $9.7 billion surplus and replaced it with a deficit of $11.2 billion as of year end 2003, a reversal of positions amounting to $20.3 billion over the span of three years. More claims may yet materialize from this period. As of the end of 2003, underfunding stood at $350 billion and, of this, $83 billion was in plans sponsored by firms whose bonds were rated as "junk."[23]

23. The numbers in this paragraph are found in the 2003 PBGC Annual Report. *See* PENSION BENEFIT GUARANTY CORP., 2003 PBGC ANN. REP. 4–5 (2004) [hereinafter PBGC ANN. REP.].

B. Future Possible Net Financial Positions

The future PBGC position depends importantly on future economic conditions. Like most other insurers of catastrophic events, the PBGC uses a stochastic simulation model to capture the distribution of potential net financial outcomes. Essentially, because it lacks a large numbers of observations, the insurer of infrequent events uses information about what is known to affect losses to simulate future conditions. For example, insurance companies that cover hurricane damage use weather models to simulate thousands of possible spring hurricane seasons to determine the distribution of possible claims outcomes.

The PBGC uses a complex model that accommodates stochastic movement in stock returns, interest rates, employment changes, bankruptcy rates and the like to create various scenarios that could affect the agency. Typically, they base their projections on 5,000 simulations. Obviously, under some conditions, the agency will take on very few claims; in others it takes on significant claims.[24]

Figure 9 shows the distribution of projected possible outcomes in 2013 as reported in the PBGC's 2003 annual report.[25] All projections are expressed in present value terms as of 2003. The expected net position is a $18.7 billion deficit. In other words, future premiums are not sufficient to pay for future claims let alone reduce the accumulated deficit. The projected deficit (expressed in present value terms) is about eighteen times higher than annual premiums. Clearly, the variable premium rate is too low to pay for the insurance.

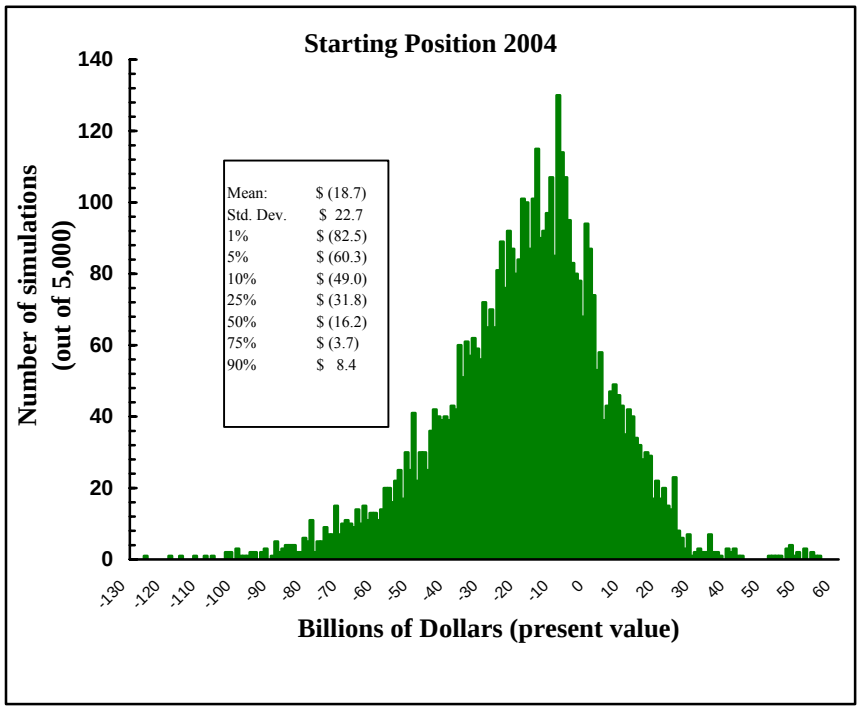
The expected deficit, of course, is merely the average of all the positions that are possible ten years hence. There is a nineteen percent probability that the PBGC will have a sufficiently favorable experience to accumulate a surplus position in ten years. There is a larger probability that the deficit will grow far beyond the current deficit. There is a ten percent chance that the deficit will be at least $49 billion, a five percent chance it will be at least $60.3 billion and a one percent chance of being at least $82.5 billion in the red. By way of comparison, total assets in insured defined benefit plans at start of 2003 (following the equity downturn) amounted to an estimated $1 trillion. Thus, a one-percent event would require about an eight percent tax on pension assets to eliminate the deficit, a prospect that may invite a congressional bailout of the insurance.

---

24. The model is described in detail in Steven Boyce & Richard A. Ippolito, *The Cost of Pension Insurance*, 69 J. RISK & INS. 121 (2002).

25. PBGC ANN. REP., *supra* note 23, at 11.

Figure 9
Distribution of PBGC's Potential 2013 Financial Position



[Source: 2003 PBGC Annual Report.]

C. Market Premiums vs. PBGC Assessments

In reality, the PBGC does not price according to the formula displayed at (11). In terms of a two-period model, the PBGC price can be written as follows:

$$(12)\ P^{PBGC} = K + \overline{p}(1-\hat{f})\,L^*,$$

where K is a constant. One notable difference in (12) compared to (11) is that the PBGC price ignores pension asset composition; only the beginning-year funding ratio enters the formula. I denote this funding ratio as $\hat{f}$ because if the plan's actuary declares that the plan is at the "full funding limit," the plan is exempt from paying the premium, no matter how much the plan is underfunded.

It also is notable that the PBGC sets the variable rate parameter to a constant, $\bar{p}$, rather than reassessing this probability each pricing period. This is an important omission. Even if $\bar{p}$ is equal to the average probability of bankruptcy over many years, it effectively transfers all the beta risk to the backers of the insurance (presumably taxpayers), who receive no risk premium to accept this burden. The rate also is set too low.

In a study of pension insurance, Steven Boyce and I show that taking account of loopholes in the law, the PBGC effectively charges about $5 per $1,000 of underfunding, whereas the market cost of the insurance is about $25 per $1,000 of underfunding.[26] About half of the market price is compensation for beta risk absorbed by the backers of the insurance. The PBGC makes up for some of this deficiency by assessing fixed assessments against all pensions, regardless of funding level. The K-factor in the expression above takes the form of a $19 assessment against each participant in the plan.

D. Market Pricing Through a Self-Insurance Pool

To understand better the risk that is offloaded to the taxpayers, suppose that the government terminated its role in the PBGC, and required all pensions to belong to a self-insurance pool. To obtain a clean start, suppose that the federal government handed over sufficient monies to eliminate the projected mean expected $18.7 billion deficit implied by its current starting conditions (Figure 9). The governing board of the pool would set policy and premiums (board members in a pool arrangement presumably are elected by pension plans, where votes are proportional to pension participants in each plan).

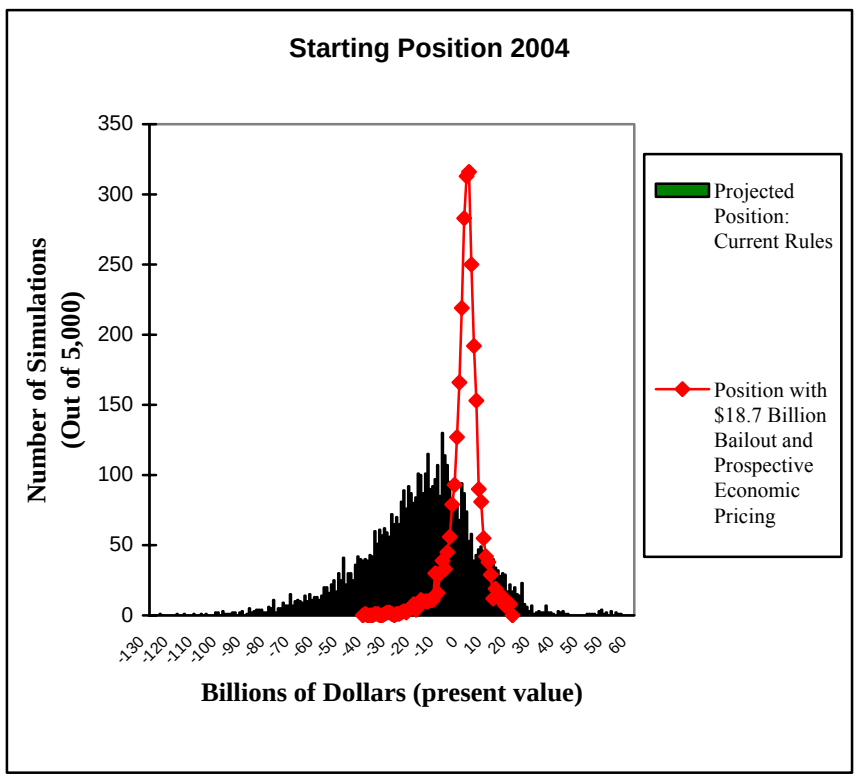
To ensure its survival, the Board either assesses a charge against members to reflect actual claims, or resets the variable rate premium each year to reflect current economic conditions. In periods following poor economic performance, rates increase to reflect high expected rates of bankruptcy. The insureds themselves absorb market volatility rather than offloading it to a third party (namely the taxpayer). In short, they absorb the beta risk. Thus, on average, premiums move in tandem with economic conditions. This policy dramatically increases volatility of aggregate premiums but commensurately reduces the volatility of possible economic conditions. The only variation in outcome is attributable to idiosyncratic risk. In periods of below-average

26. *See* Boyce & Ippolito, *supra* note 24.

claims, a fund builds up to accommodate claims in periods of above-average claims.

Figure 10 shows the difference that this change makes to the insurer's projected net financial position. The bar distribution depicts the projected PBGC financial position ten years out under current conditions. The line distribution captures the outcomes when the insurance is operated like a self-insurance pool, and the pool resets the variable rate each period to accommodate current market conditions. The reduction in volatility brought about by aggregate economic pricing is dramatic. The outcomes under this policy have no beta risk and evince a distribution that is more compatible with a private-sector insurance solution to the insurance.

Figure 10
Distribution of PBGC's Potential 2013 Financial Position



Of course, if the pool actually were put in place then one can imagine the Board enacting numerous other policies to reduce the ex ante cross-subsidies in the current system. It is likely that pension plans that had more underfunding and a higher proportion of stocks would pay an appropriately higher price for the insurance. Those truly presenting little or no insurance risk would pay only nominal premiums, and so on. In other words, the pool itself would likely drift towards a solution that would characterize the insurance if it were offered in the private market.

IX. THE UNRAVELING OF DEFINED BENEFIT PENSIONS: TERMINATIONS FOR REVERSION

The unraveling of defined benefit pensions had its roots in changes in law that occurred in the 1980s, and the spurt of terminations for reversions that characterized the period. In a nutshell, bankruptcy (or severe financial difficulty) historically was the only way for firms to obtain reversions from terminated plans. The rules changed in the mid 1980s, giving rise to the possibility that firms could unilaterally terminate plans, and take excess assets into corporate profits. These actions ultimately led to the unraveling of the defined-benefit system.[27] I will show below that the two-period model of compensating wage differentials used above can be slightly extended to explain the phenomenon.

A. Terminations for Reversion

Plan termination traditionally signaled dire financial circumstances in the firm. Beginning in the early 1980s, sponsors discovered a new twist on termination, one seemingly designed to obtain access to excess assets for corporate profits. Normally, the plan sponsor is not permitted to use pension assets. But by terminating a plan and then recreating essentially the same plan, some sponsors argued that they could effectively do just that by the two-step termination-reestablishment process. These events became known as "terminations for reversions."

In a typical event, the firm would terminate the plan, purchasing annuities for their employees equal to the present value of termination benefits, L^*, then establish an identical pension with past service credit, which recreated the full ongoing obligation, L. So as to not to overpay workers, they

27. A longer version of this argument is found in Richard A. Ippolito, *Tenuous Property Rights: The Unraveling of Defined Benefit Contracts in the US*, *in* PENSION POLICY IN AN INTEGRATING EUROPE 175 (Onorato Castellino & Elsa Fornero eds., 2003).

stipulated that the annuities paid in the new plan were offset dollar for dollar by the annuities purchased from the insurance company. This stipulation reduces the liabilities in the new plan to the amount, *L-L**. Thus, by intertwining the two plans, the firm recreated the same liabilities it had prior to the termination. In effect, the firm effected a reversion *without* imposing capital losses on workers. Many "terminations for reversion" occurred in conjunction with corporate events during the 1980s. For example, excess assets sometimes were used to finance a leveraged buyout.

B. Breaking the Promise

The problem that arose for the market for defined benefit plans was that firms that engaged in terminations sometimes did not recreate the plan after termination, and instead created a defined contribution plan, effectively breaking the implicit pension contract. Indeed, Shleifer and Summers advanced the theory that the premiums affiliated with leveraged buyouts ("LBOs") were attributable to the breaking of implicit contracts like pensions, effecting large transfers from workers and other stakeholders to stock holders.[28]

In a study of 169 LBOs over the period 1980–1987, William James and I found that these firms terminated eighty-nine pensions within one year of the LBO. Only twenty-two were re-establishments; twenty-seven had a new contribution benefit plan and forty had no new plan. Consistent with other studies, we found that many firms in the latter group could be explained by plant closings and poor financial ratios.[29] But we could not explain the defined contribution replacement events in this way, and these accounted for one in every three terminations. Moreover, in a control (non-LBO) sample, we found that one in four terminations resulted in a defined contribution follow-on plan. It was not obvious from looking at financial data that these terminations were precipitated by financial problems.[30]

---

28. Andrei Shleifer & Lawrence H. Summers, *Breach of Trust in Hostile Takeovers*, *in* CORPORATE TAKEOVERS: CAUSES AND CONSEQUENCES 33 (Alan J. Auerbach ed., 1988).

29. Most studies have shown a relation between reversion events and the financial condition of the plan sponsor. *See, e.g.*, Mark L. Mitchell & J. Harold Mulherin, *The Stock Price Response to Pension Terminations and the Relation of Terminations with Corporate Takeovers*, 18 FIN. MGMT. 41 (1989); H. Fred Mittelstaedt, *An Empirical Analysis of the Factors Underlying the Decision to Remove Excess Assets from Overfunded Pension Plans*, 11 J. ACCT. & ECON. 399 (1989); Mitchell A. Petersen, *Pension Reversions and Worker-Shareholder Wealth Transfers*, 107 Q. J. ECON. 1033 (1992); Mary Stone, *A Financing Explanation for Overfunded Pension Plan Terminations*, 25 J. ACCT. RES. 317 (1987); Jacob K. Thomas, *Why Do Firms Terminate Their Overfunded Pension Plans?*, 11 J. ACCT. & ECON. 361 (1989); Jack L. VanDerhei, *The Effect of Voluntary Terminations of Overfunded Pension Plans on Shareholder Wealth*, 54 J. RISK & INS. 131 (1987).

30. Richard A. Ippolito & William H. James, *LBOs, Reversions and Implicit Contracts*, 47 J.

C. The Internal Revenue Service Ruling

The tax rules dating to 1938 seemingly do not allow sponsors to access excess assets unless there is some evidence of errors by actuaries that cause the firm to contribute incorrect amounts to the fund.[31] Presumably, the intent of the language was to ensure that the pension trust fund, which was exempt from corporate taxation, not be used for purposes other than paying pension benefits.[32]

While many pension terminations occurred during the 1960s and 1970s, they were predominantly underfunded pensions affiliated with business failures.[33] In 1971, the IRS issued a ruling in the context of a plan that terminated for "business necessity."[34] The IRS apparently allowed excess funds beyond those required to satisfy legal obligations to be considered as though they were attributable to actuarial error and eligible for reversion to the sponsor. This ruling had little practical importance for distress terminations, because typically, firms in financial difficulty often defunded the plan of excess assets (through lower contributions) long before bankruptcy was encountered. Thus, prior to the 1980s, the law covering reversions was interpreted quite strictly, with an exception granted to firms in financial distress.

In the early 1980s, the IRS issued a new ruling that dramatically altered the defined benefit pension contract. It announced that upon any termination, the plan sponsor could take excess assets into corporate profits, as long as the plan paid off termination benefits to workers (in the form of annuities purchased from an insurance company). The ruling did not appear to be concerned that the tax-exempt pension trust seemingly was created by Congress to support accumulations for the purpose of paying pension benefits.[35] Moreover, the ruling made it clear that the reversions were legal even if the only purpose of the termination was to capture a reversion.

FIN. 139 (1992).

31. The common understanding about reversions stems from Section 401(a)(2) of the Internal Revenue Code, and Section 1.401-2(b)(1) of the regulations that interpret the Code. *See* 26 U.S.C. § 401(a)(2) (2000). These regulations "permit the employer . . . to recover at the termination of the trust, and only at such termination, any balance . . . *which is due to erroneous actuarial computations*." 26 C.F.R. § 401–2(b)(1) (2003) (emphasis added).

32. For a full history of reversion law, see Norman P. Stein, *Reversions from Pension Plans: History, Policies, and Prospects*, 44 N.Y.U. TAX L. REV. 259 (1989).

33. S. REP. NO. 93–127 (1973), *reprinted in* 1974 U.S.C.C.A.N. 4838.

34. *See* Rev. Rul. 71-152, 1971–1 C.B. 126 (1971).

35. *See* Rev. Rul. 83-52, 1983–1 C.B. 87 (1983).

This ruling substantially altered the economics of the implicit pension contract. An implicit contract requires a bonding mechanism for both parties. Workers are bonded by virtue of the fact that if the firm encounters severe financial difficulty, then workers automatically absorb the downside default risk. If workers tried to escape default risk by quitting then they automatically forfeited the ongoing value of the pension and instead collected the termination value.

For their part, firms were precluded from arbitrarily terminating the pension by a fairly strict tax code that prescribed the use of pension assets for the purpose of paying benefits. The new ruling, however, stripped the latter protection from the contract, and explicitly permitted a unilateral termination of the contract, regardless of the financial condition of the sponsor.

D. Congressional Reaction

Congressional reaction to the new IRS tax policy was predictable, and ultimately led to the enactment of a series of reversion taxes. In 1986, Congress enacted landmark legislation changing the corporate tax treatment of excess pension assets: It levied a ten percent (non-deductible) excise tax on reversions from defined benefit plans (known as "the reversion tax"). While the tax rate was modest, it signaled a major alteration in congressional interpretation on the ownership of excess pension assets, a signal that was reenforced in 1988 when the tax was increased to fifteen percent. In 1990, Congress affirmed the new ownership paradigm by increasing the reversion tax to fifty percent.[36] These taxes ended the "termination-for-reversion" phenomenon, but spawned an even more tumultuous period for defined benefit plans.

Ostensibly, the Congress was trying to recreate the "old" environment in which reversions effectively were precluded, but did not perfectly replicate the old law. The problem it created was that reversion taxes applied even if the firm encountered financial difficulty. Firms reacted in two ways. First, they reduced target funding ratios, which reduced the flows of monies into defined benefit plans.[37] Second, they discovered a way effectively to switch to a defined contribution plan without triggering the reversion tax, which

36. If the sponsor gives twenty-five percent of the reversion to the participants (in the form of contributions to some other plan), the excise tax is reduced to twenty percent. The reversion also is subject to the normal thirty-four percent corporate tax, potentially leaving the firm only sixteen cents for each dollar of reversion.

37. For more detail on reversion taxes, see Richard A. Ippolito, *Reversion Taxes, Contingent Benefits and the Decline in Pension Funding*, 44 J.L. & ECON. 199 (2001).

came in the form of a new product: the so-called cash balance plan (also called a hybrid plan).

The cash balance plan is created by a plan amendment to the existing defined benefit plan. It has the effect of awarding each participant an individual "account."[38] Typically, a worker's account is credited with the value of the termination benefit (legally-mandated ERISA[39] benefit) as of the date of the amendment.[40] The plan guarantees a particular investment return on these monies that often is tied to a market instrument (for example, a Treasury bill rate).[41] This guarantee maintains the plan's legal status as "defined benefit." Future accruals are very much like traditional defined contribution plans; for example, the plan might award each account *x* percent of pay for each year of service subsequent to the date of the amendment. Importantly, at the time of the switch to cash balance, pension assets in excess of the legal benefits in the old version of the plan are used to fund future contributions.

In effect, the cash balance conversion allows a plan sponsor to terminate its defined benefit plan, and reestablish a defined contribution plan in its place, without triggering the reversion tax on the excess assets that result from the termination. The available evidence suggests that the conversions are an important part of what we label the "defined benefit universe." Data for the 1999 Form 5500 submissions show that about twenty-two percent of

---

38. The account is a bookkeeping entry, which records the opening balance, plus new contributions made by the employer plus interest, but the assets backing the accounts are still held in a pool managed by the sponsor. The earnings credited to each account typically do not reflect actual earnings in the fund, but are guaranteed the interest rate as stated in the plan document. Thus, there is some chance that the overall fund could have less money than the sum of the "accounts."

39. ERISA, or the Employee Retirement Income Security Act of 1974, is the basis for much regulation of private pensions; it includes oversight of fiduciary, vesting, disclosure and funding issues, and authorizes the Pension Benefit Guaranty Corporation to provide mandatory pension insurance to all defined benefit plans. Termination benefits are regulated in non-forfeiture rules. Employee Retirement Income Security Act, 29 U.S.C. §§ 1001–1461 (2000).

40. The ERISA benefit is that amount that is owed workers if the plan terminated immediately. Sometimes, the plan credits some participants' accounts with something less than this amount, but if the employee quits, he cannot receive a benefit with a value less than his accrued benefit at the time of his departure. Legally, the plan does not set up individual accounts for the participants, but instead maintains a pooled asset account that may hold investment instruments entirely different than the guaranteed return stated in the plan. But the plan reports "account values" to participants as though they have individually owned accounts.

41. When the amendment is made, the sponsor calculates the present value of legal pension liabilities; and creates individual account balances usually in these amounts. Assets beyond these amounts ("excess assets") are retained in the plan. The firm awards future contributions to each worker's account on the basis of some formula (often a percent of pay). The key feature of the cash balance plan is that it requires only an amendment to the plan, not termination, and thus, does not trigger the reversion tax on excess assets in the plan. The firm can make future contributions to employees' accounts from excess assets.

all workers covered by a defined benefit plan are in a cash-balance variety.[42] While some firms make some accommodations for older workers so as to diminish the magnitude of their losses, for the most part, cash balance conversions mimic the effect of straightforward terminations on workers' pension wealth.

X. USING THE SAME MODEL TO EXPLAIN THE DEMISE OF DEFINED BENEFIT PENSIONS

The cumulative effect of terminations for reversion, and conversions to cash balance plans have increased the cost of the implicit pension contract.[43] The essence of this idea can be demonstrated using the simple two-period model from the first part of this paper. In other words, the same model that can explain the compensating differential for bankruptcy risks can explain the unraveling of the system.

For simplicity, assume away the non-diversification risk premium. This means that workers reduce their willingness to pay for the pension in an amount equal to expected losses from bankruptcy and termination. I rewrite (2) here for convenience:

$$(2)\ EV = L^* + (1-p)[L - L^*].$$

EV is the expected value of the pension to workers and the expected cost to the firm of providing the pension. Recall that *L* is the value of ongoing benefits, *L** is the value of termination (and insured) benefits, and *p* is the probability of bankruptcy (and thus, termination). But this expression assumes that the principal cause of termination is bankruptcy.

The alternation in pension rules in the 1980s created the specter that some firms will unilaterally terminate (or convert to cash balance) for purposes of exploiting the value of contingent benefits. Suppose that there are two kinds of firms: those that are trustworthy and those that are not. We might think of those in the first category as those who fear that termination might be unprofitable owing to negative reputation effects in the labor market and those in the second as firms who find it profitable to exploit the contingent value of workers' pensions. Suppose that workers have a hard time knowing

42. This estimate is based on about fifty percent of records received for that year. The 1999 cycle is the first in which the questions asked whether defined benefit plans in fact are cash balance. Cash balance conversions are concentrated in larger plans.

43. This section contains numerous terms of art such as "lemons market" and "corner solution." All of these concepts can be found in RICHARD A. IPPOLITO, ECONOMICS FOR LAWYERS (forthcoming 2005).

which firms are trustworthy and which are not, and so they form some expectation based on termination/cash balance activity they learn about.

Let q denote workers' collective assessment of the probability that the firm will renege on the contract. Call this "contract risk." In order for workers to collect their contingent benefits, they must survive both bankruptcy risks, captured by the parameter, p, *and* contract risks, captured by the parameter q. Workers' evaluation of q depends upon their estimate of the portion of employers that are good guys and bad guys. The expected value of the pension is now less than before, specifically, we have:

$$(13)\ EV_{NEW} = L^* + (1-p)(1-q)[L - L^*].$$

This new calculation would not affect firms' calculus *if* firms also saw the cost of providing the pension as EV_{NEW}. But they do not. Trustworthy firms will discover that they have to pay a contract risk premium even though they have no intention of terminating. Oddly, untrustworthy firms benefit from the uncertainty. Even though a dishonest firm intends on reneging, its workers do not fully discount for this eventuality because they do not know if their employer is a "good guy" or a "bad guy," and hence, they pay something in the form of lower cash wages for a pension that the firm knows will not be delivered.

To make this concept concrete, consider the trustworthy firm. The cost of the pension is as follows:

$$(14)\ EV_{TRUSTWORTHY} = L^* + (1-p)[L - L^*].$$

Since it has no intention of reneging on the contract, it does not discount the cost for the possibility of unilaterally terminating (so $q = 0$). But workers are only willing to pay the amount in (13) for the pension. This means that the trustworthy firm is stuck paying the difference between what the pension actually costs and the amount that its workers are willing to pay. Subtract (13) from (14) to find the "contract risk tax" on trustworthy firms:

$$(15)\ CR_{TRUSTWORTHY} = q\,(1-p)[L - L^*] \ > \ 0.$$

Now consider an untrustworthy firm. It fully intends on reneging, and thus, sets the value of q in (13) to unity. In this case, its expected cost of providing the pension is simply L^*:

$$(16)\ EV_{UNTRUSTWORTHY} = L^*\ .$$

Calculate the contract risk premium for this firm the same way as above, namely, subtract the amount workers are willing to pay for the pension (13) from the cost to the untrustworthy firm (16). The result is as follows:

$$(17)\ CR_{UNTTRUSTWORTHY} = -(1-q)(1-p)[L-L^*] \ < \ 0,$$

which is a *negative* number. In other words, the untrustworthy firm receives a sort of contract risk subsidy. They benefit from the fact that some plan sponsors are honest, which causes workers to reduce their assessment that their own employer will renege. In contrast, the existence of untrustworthy firms penalizes the trustworthy firms. We have the makings of a lemons market.

For firms that are least trustworthy, the cost of offering defined benefit plans is low because workers understate the true probability of unilateral default. These are the most likely sponsors to continue offering the defined benefit plan. For firms that are most trustworthy, the cost of offering their defined benefit plan is high because workers overstate the true probability of unilateral termination, and therefore understate the true value of the plan. These firms are least likely to continue offering a defined benefit plan.

As the most-trustworthy firms either terminate or convert to cash balance, the pool gradually becomes disproportionately populated with firms more likely to renege on the contract. As this process plays out, workers covered by defined benefit plans in the aggregate increase their collective estimate of q, a process that pushes the market closer to a corner solution.

To a trustworthy firm, the problem manifests itself in a growing perception that the generous pension plan it is offering seems to be heavily discounted by its covered workers. Workers, it will seem, attach more value to defined contribution pensions. As this wedge grows, the net benefits of offering the defined benefit variety become smaller. Put simply, if workers act as though the firm is less trustworthy than it really is, then the only profitable option for the firm is to fulfill its workers' expectations, by simply reneging on the promise. Once the firm defaults on its implicit contract, it has only one option: namely to offer a defined contribution or cash balance plan, which effectively are bonded. In other words, if workers believe that the firm is not trustworthy, then it will be.

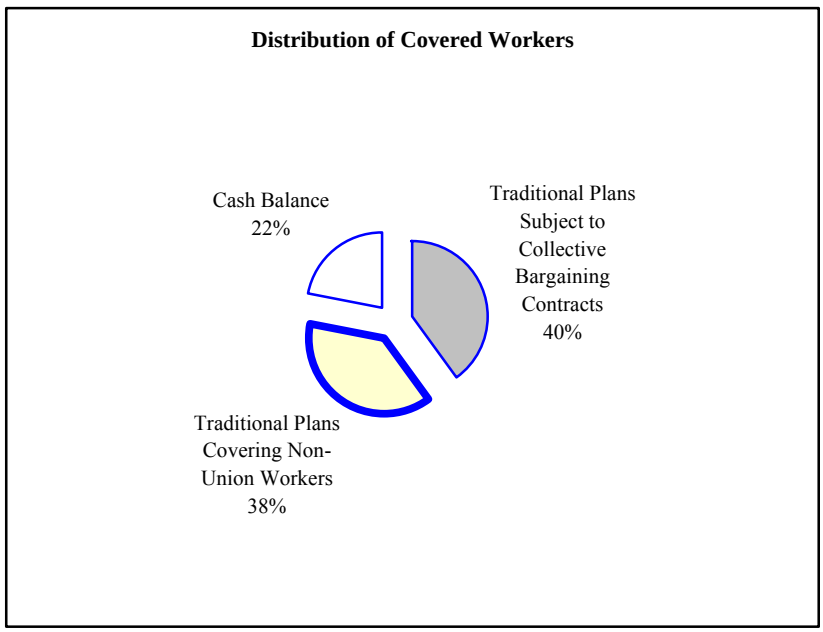
A. Factors that Can Preserve Some Coverage

The only way in which the unraveling process can find equilibrium with a positive share of defined benefit coverage is for plan sponsors that are trustworthy to be able to convey their unusually high trustworthiness to employees, which is problematic if other firms with similar characteristics have either terminated their plans or converted to cash balance. Additionally, even if the firm is trustworthy, the question naturally arises whether the firm

will be subject to a change in corporate ownership in which case it might not be trustworthy next period.

Some bond is required to enforce the sponsor's part of the contract. There are two obvious ways in which this can be done. First, unions can maintain their pensions because they are protected by explicit collective bargaining agreements, making it costly for the firm to renege.[44] **Figure 11** gives the composition of covered workers under defined benefit plans in 2001 (estimated). About twenty-two percent of these workers are in the cash balance variety. Among those still covered by the traditional variety of defined benefit plans, about half are in plans subject to collective bargaining agreements.[45]

Figure 11
Defined Benefit Plans: 2001



[Source: 2001 Form 5500 Annual Reports.]

44. Absent binding language, if the firm and union allow an agreement to expire, without replacing it in the interim, then technically, the firm might be able to terminate the pension. Presumably, the union could react in ways that could make this action costly for the firm. These events are exceedingly rare.

45. These counts include coverage in multiemployer plans.

Second, in the public sector, defined benefit plans could be terminated, but presumably, if sufficient numbers of voters are public employees, and if they care intensely about the pension issue, a mechanism exists to effectively bond the pension. Defined benefit plans continue to dominate coverage of public employees at all levels of government.[46]

A third group presumably is comprised of firms that either have found ways to communicate their trustworthiness to workers, or they tolerate the contract risk "tax" because defined benefit plans are unusually valuable to them.

The most effective way to create a bond is simply to use a defined contribution plan. In these plans, vesting can be immediate (and often is). Workers effectively own their accounts, which means that they own all contributions plus earnings; and often, workers are given discretion on the portfolio composition of their accounts. When they depart the firm, workers usually take the lump sum in their accounts (which can be rolled over into an Individual Retirement Account). Put simply, the main attribute of defined contribution plans that distinguishes them from their defined benefit counterparts is that workers own the pension assets. In effect, defined contribution plans are the ultimate solution to the unraveling of the implicit pension contract, because they offer perfect bonding of the pension promise.

If firms want to continue exposing workers to adverse downside financial experience, it could install a stock bonus plan with provisions for diversification with accumulating service. This option reproduces worker losses as shown in Figure 3. Importantly, however, while this option still poses non-diversifiable risk on workers, it is free of contract risk. Workers absorb losses only if the market price of the stock falls. They are immune from ex post reneging problems that beset defined benefit plans. This means that workers' required differential for accepting this plan is smaller than for a defined benefit plan with the same loss profile over service.

XI. IMPORTANT DEVELOPMENTS IN PENSIONS, AND IMPLICATIONS FOR BANKRUPTCY LOSSES

What is the future of bankruptcy losses for workers? For the foreseeable future, the kinds of pension losses depicted above will be pertinent for workers who continue to be covered by defined benefit plans. But these workers represent a far smaller portion of covered workers than they did twenty years ago. In the early 1980s, more than eighty percent of covered

46. BUREAU OF LABOR STATISTICS, U.S. DEP'T OF LABOR EMPLOYEE BENEFITS IN STATE AND LOCAL GOVERNMENTS, 1998 (2000).

workers in the private sector were covered solely by a defined benefit plan. Since then, there has been a dramatic shift towards defined contribution plans, most notably the 401k variety. These plans allow workers to voluntarily contribute to their accounts. Employers often match these contributions on x-to-one basis up to some predetermined limit.

A. Pension Coverage Patterns

Figure 12 shows the distribution of coverage in the private workforce in 1980 versus 1998. The overall pension coverage rate is a little less than fifty percent in both periods.[47] In 1980, defined benefit plans cover thirty-eight percent of private workers and eighty-two percent of covered workers. By 1998, the picture is dramatically different. Traditional defined benefit plans cover only about sixteen percent of private workers, and only about one-third of covered workers. Traditional (non-401k) defined contribution plans cover eight-to-nine percent of private workers in both periods. 401k plans and cash balance plans, both of which did not exist in 1980, cover almost half of all pension-covered workers in 1998.[48] Virtually all defined contribution plans are portable and free of contract risk. They are not, however, necessarily free of bankruptcy risk.

Bankruptcy-risk exposure does not come primarily from stock bonus plans, which are not widely used,[49] but instead from employee ownership of company stock in their 401k pensions. Sometimes, employer matches to employee contributions are paid in the form of company stock, but participants in some plans also can choose to purchase company stock with their own contributions.

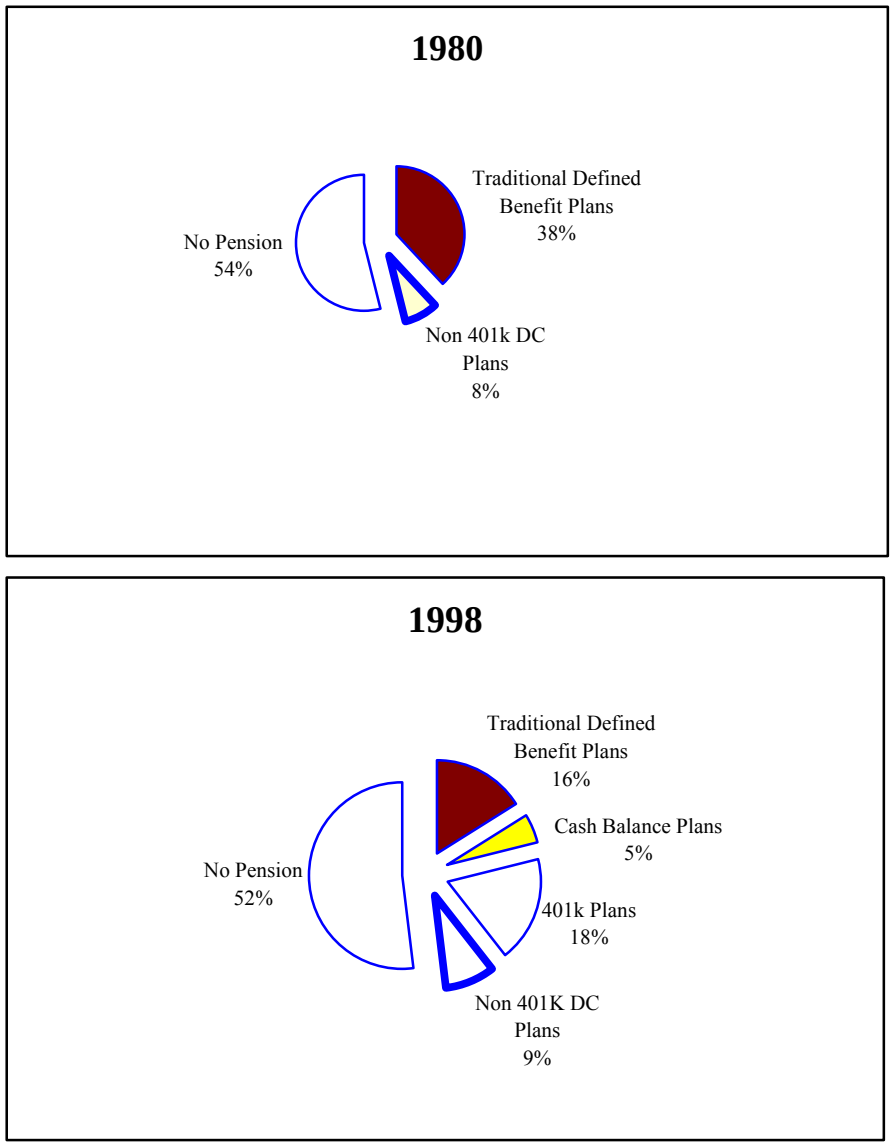
---

47. More than fifty percent of workers ultimately obtain pension coverage, but cross section observations include young workers who often opt for jobs that do not offer pensions. As they age, workers tend to gravitate towards pension-covered jobs.

48. These data are found in PENSION & WELFARE BENEFITS ADMIN., U.S. DEP'T OF LABOR, PRIVATE PENSION PLAN BULLETIN, ABSTRACT OF 1998 FORM 5500 ANNUAL REPORTS (2001–2002).

49. Only two or three percent of workers have a stock bonus plan or an employee stock ownership plan. *See* BUREAU OF LABOR STATISTICS, U.S. DEP'T OF LABOR, NATIONAL COMPENSATION SURVEY: EMPLOYEE BENEFITS IN PRIVATE INDUSTRY IN THE U.S., 2000 (2003).

Figure 12
Primary Pension Plan Coverage In The Private Sector, 1980 vs. 1998*



* The charts reflect primary coverage only. About thirty-five percent of covered workers have a second pension plan.
[Source: PENSION & WELFARE BENEFIT ADMIN., PRIVATE PENSION PLAN BULLETIN, U.S. DEPT OF LABOR, ABSTRACT OF 1998 FORM 5500 ANNUAL REPORTS (2001–2002).]

B. Company Stock Holdings in 401k Plans

Overall, about forty-one percent of participants in 401k plans have either the opportunity to purchase company stock in their plans, or the employer matches their contributions in the form of company stock (or both). Within these accounts, company stock comprises about thirty percent of the portfolios on average (including both employee contributions and company matches).[50]

Figure 13 gives the overall distribution of participants in 401k plans. Fifty-nine percent of employees do not have a plan that provides for company stock. Another fourteen percent of covered workers have the option to purchase company stock, but hold none. Thus, seventy-three percent of 401k accounts have no company stock. Another eight percent have less than twenty percent of their holdings in this form. This leaves about one in five 401k plans that have more than twenty percent of their accounts exposed to bankruptcy risk, and about half of these stand to lose from fifty to one hundred percent of their balances if their employer enters bankruptcy.

In short, while most 401k accounts have little or no bankruptcy risk, a non-trivial portion of the 401k universe is substantially invested in the stock of their own employer. Given the variance is a single stock holding, some of the workers with concentrated accounts will gain unusual retirement wealth; and some may encounter a serious downside event, including the possibility that their employer will enter bankruptcy.

In the Enron Corporation, which entered bankruptcy in 2001, about sixty percent of 401k assets were invested in company stock, but only about eleven percent stemmed from company match amounts in the form of Enron stock. The rest were employee-directed investments in the stock.[51] Enron employees lost almost ninety-nine percent of the value of their portfolios.

Enron is not the only company to sponsor a 401k plan that is heavily invested in company stock. The Congressional Research Service ("CRS") recently compiled a list of twenty-five companies in which the 401k plans were comprised of more than fifty percent invested in company stock.[52] I reproduce the list in **Table 1**. Four of these companies have no defined benefit plan, implying that the 401k plan is the major source of retirement funds for covered employees.

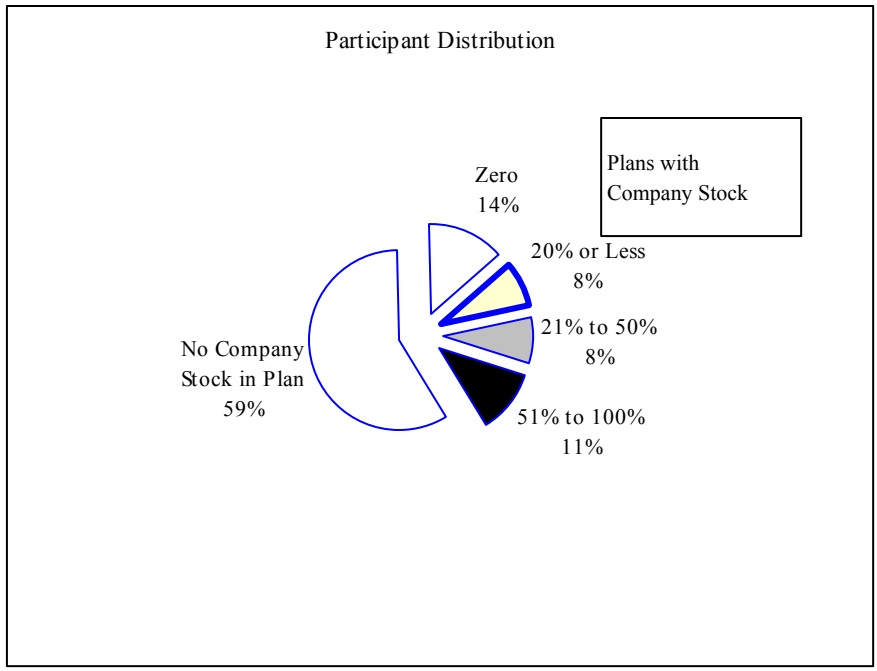
---

50. All the 401k information is taken from Jack L. VanDerhei, *The Role of Company Stock in 401k Plans*, 5 RISK MGMT. & INS. REV. 1 (2002).

51. *See* PATRICK J. PURCELL, CONG. RES. SERVICE, THE ENRON BANKRUPTCY AND EMPLOYER STOCK IN RETIREMENT PLANS (2002).

52. *Id*.

Figure 13
401k Accounts by Share of Company Stock, 2000



[Source: Jack VanDerhei, *The Role of Company Stock in 401k Plans*, 5 RISK MGMT. & INS. REV., 1 (2002).]

Equally interesting, however, the numbers suggest that my portrayal of bankruptcy risks among employees covered by defined benefit plans could in some cases be substantially underestimated. If employees covered by defined benefit plans also have a diversified 401k plan then their overall bankruptcy risk is somewhat attenuated. But if their secondary 401k plan is heavily invested in company stock, as are those in the CRS list, the effects of bankruptcy are leveraged by impending losses in the 401k accounts.

C. Magnitude of Potential Losses in Non-Diversified 401k Plans

It is useful to put these statistics in perspective. Sixteen percent of workers were exposed to bankruptcy risk owing to termination of their defined benefit plans in 1998.[53] While the data in Figure 13 refer to all 401k

53. *See supra* fig.12 (bottom chart).

plans, and not just to those that are the primary plan, suppose that the distribution of company stock is reasonably representative of primary plans. In this case, since eighteen percent of workers are covered primarily by a 401k plan in 1998[54] then we can say that about twenty percent of these, or about four percent of workers are exposed to significant bankruptcy risk because they are heavily invested in company stock in their 401k plans. This is only one-fourth the number potentially affected by bankruptcy in companies that sponsor defined benefit plans, though some workers covered by defined benefit plans are exposed to bankruptcy risks in their secondary 401k plans.

While the overall exposure levels attributable to 401k company stock holdings may not affect as many participants as those covered by defined benefit plans, the loss profile in any plan with holdings concentrated in company stock is more severe for older workers. In defined benefit plans, a progressively larger share of workers' ongoing benefits are insured once workers get beyond their middle service years. In 401k plans concentrated in company stock, the losses continue to accumulate with years of service (as in Figure 2). Thus, while older workers in defined benefit plans are more or less insulated from bankruptcy risk, they are vulnerable to a catastrophic loss in a plan fully invested in company stock. There is no evidence that workers in their fifties are any less concentrated in company stock in their 401k plans than younger workers.[55]

The amounts at stake in 401k plans are non-trivial. For workers in their fifties who have at least twenty years of tenure, average 401k balances were about $125,000 in 2002. Since 401k plans were not in operation until 1981, balances for future cohorts in this age range likely will be higher. Thus, 401k balances can approximate the amount required to support the typical defined benefit pension.[56] And clearly, the magnitude of 401k losses in bankruptcy can substantially exceed those in defined benefit plans for older workers.

One attenuating factor is that 401k plans that have large portions of company stock tend to be concentrated in large companies. Most of the companies in Table 1, for example, are large well-known companies that have survived over long periods. The list is not anomalous. VanDerhei

54. *See supra* fig.12.

55. *See* VanDerhei, *supra* note 50.

56. The average new retiree for male beneficiaries paid by the PBGC is about $625 per month. At a six percent interest rate, one needs about $100,000 to purchase this annuity. Alternatively, consider a relatively generous defined benefit plan that pays 1.5 percent of final wage times years of service. Then a worker earning $40,000 with twenty-five years of service earns an annual annuity of $15,000. At six percent, the amount required to support these payments is about $200,000. Actual and projected 401k balances are easily within this range.

reports that even though forty-one percent of all 401k participants have the opportunity to invest in company stock, only three percent of all 401k plans have any company stock. This implies that, for the most part, only very large companies match in company stock and/or permit company stock as an option. Bankruptcy risks in large firms are not zero, but they are dramatically lower than those that characterize small firms.[57]

D. Employment Risks

Whether employment risks will be lower for future cohorts is a larger unknown. If workers become more mobile in future periods, meaning that their skills are more freely transferable across firms, then not only will pension losses fall for participants holding diversified portfolios in their 401k plans, so too will employment losses. Transferable skills essentially mean that wages in alternative jobs that displaced workers might find are not necessarily lower than in their current jobs.

Workers that remain diversified in their 401k plans and accumulate skills that are transferable to other firms do not have the non-diversifiable risk that has characterized past cohorts. To the extent that future workers will have less firm-specific investments of all kinds, they will look more like all other stakeholders in the firm. They will have some small stake in current employment, but they are not seriously harmed by the bankruptcy of one particular employer.

This development, if it happens, does not come free. If workers' lifetime wage income does not importantly depend on the success of their employer then the agency problem that now characterizes most stockholders will now also characterize workers and firm productivity may fall. In the extreme, workers will have about as much interest in the success of the firm as does the typical holder of a stock index fund that holds a small percentage in a large number of firms. It also remains to be seen whether the amount of retirement income delivered by defined benefit plans will be replicated in future cohorts who depend increasingly on the management of their own monies.

---

57. Bankruptcy risks by size are reported in Boyce & Ippolito, *supra* note 24.

XII. CONCLUDING REMARKS

Owing to the principle of diversification, most stakeholders in firms are not importantly affected by bankruptcy of a particular firm. Workers are an important exception. Upon the bankruptcy of their employer, most workers cannot match their current pay in a new firm, and likely will suffer some bout of unemployment. Even if the firm survives, future wage projections likely will be lower. In addition, workers covered by defined benefit plans stand to lose substantial pension wealth. Chapter Seven bankruptcies almost always trigger a pension termination. They often occur in Chapter Eleven events as well.

Workers will not choose employment in a firm that promises substantial losses upon the event of firm failure without adequate compensation. The firm must pay a risk premium to attract labor from a more secure vocation, for example in the government sector. In this sense, the possibility that these workers might encounter the downside of their concentrated investment in one particular firm does not pose any special public policy issue. If the taxpayers think, however, that poor older workers will be successful in obtaining bailouts ex post then it might be prudent to institute an insurance system up front that requires the stakeholders to pay at least part of the costs.

Presumably, the ex post prospects are the genesis for some federal insurance programs that limit bankruptcy losses for workers. Federal unemployment insurance provides some cushion against employment loss. Mandatory federal pension insurance offered by the Pension Benefit Guaranty Corporation reduces pension losses in defined benefit plans. While the financing of the PBGC is inadequate and requires reform, from the workers' perspective, it more or less insulates them from loss of pension wealth late in their career. Workers mid career absorb losses that are substantial, perhaps on the order of two times annual wage, but this loss can be amortized over a reasonably long remaining work life.

Future bankruptcy risks might be considerably different than those that have affected workers in the past. There has been a sharp movement away from defined benefit plans in favor of pensions that confer ownership of assets to workers themselves. 401k plans in particular and cash balance plans to a lesser extent have come to dominate the pension market. While most employees maintain diversified 401k plans, some do not. To the extent that workers choose to invest heavily in the stock of their employer, they not only will reproduce the bankruptcy risks inherent in defined benefit plans, they will dramatically increase them, especially in the case of older workers. A fifty-five-year-old worker with a 401k portfolio concentrated in employer stock can encounter catastrophic losses with only a short future work career

to offset them, a prospect made more daunting by employment losses that often accompany bankruptcies.

Moreover, since the risks generated by employees' own decisions to over invest in company stock is self-imposed, there is no reason to believe that the market will compensate them for holding it. If the government is willing to let these individuals suffer the consequences of their acts then there are no implications for public policy. If not, one might think that some minimum amount of diversification in the 401k accounts might be prudent to control the magnitude of bankruptcy losses affecting older workers.[58]

Table 1: Employer Stock in Selected 401k Plans

Company Name	**Company Stock as a % or 401k assets**	**Does company have a defined benefit plan?**
Procter & Gamble	91.5	**No**
Anheuser-Busch	81.6	Yes
Coca-Cola	81.0	Yes
Abbott Laboratories	80.0	Yes
General Electric	77.4	Yes
William Wrigley, Jr.	75.0	Yes
Pfizer	74.8	Yes
Home Depot	72.0	**No**
BB&T (Branch Banking and Trust)	69.6	Yes
Texas Instruments	69.0	Yes
Duke Energy	67.9	Yes
Textron	65.0	Yes
Reliant Energy	64.5	Yes
Kroger	63.6	Yes
Southern Company	62.8	Yes
ExxonMobil	62.0	Yes
Household International	61.4	Yes
Sherwin-Williams	59.1	Yes
BellSouth	57.9	Yes
Merck	57.5	Yes
Williams	57.0	Yes

58. A restriction that can affect 401k plans in no way prevents workers from purchasing company stock outside the pension in their non-pension portfolios.

Company Name	**Company Stock as a % or 401k assets**	**Does company have a defined benefit plan?**
McDonald's	56.8	**No**
TXU (Texas Utilities)	56.3	Yes
Dell Computer	53.4	**No**
Ford Motor Company	50.2	Yes

[Source: PURCELL, *supra* note 51, at 4.]