

NBER WORKING PAPER SERIES

ANALYSIS OF PENSION FUNDING
UNDER ERISA

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Working Paper No. 402

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge MA 02138

November 1979

An earlier draft of this paper was part of a 1979
Massachusetts Institute of Technology Ph.D. dissertation.
The research reported here is part of the NBER's research
program in Pensions. Any opinions expressed are those of the
author and not those of the National Bureau of Economic
Research.

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ABSTRACT

This paper begins by describing the tax, funding, and insurance aspects of the Pension Reform Act of 1974. Next, the implications of those laws are analyzed from the standpoint of the funding decision of the firm. The tax advantage of early funding appears to be quite small. Because there are insurance and other reasons (related to asymmetries in the pension law) why firms might wish to underfund their plans, there is no good reason to expect all firms to fund to the limit.

The final section discusses the magnitude of the firms' unfunded pension liability, properly defined. This debt is shown to be quite small. A major reason for this is the substantial increase in long-term nominal interest rates, which have decreased the present value of accrued benefits and, equally, unfunded pension obligations.

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The Pension Reform Act of 1974, also known as ERISA (Employee Retirement Income Security Act) substantially revised previous pension fund legislation. Defined benefit plans,¹ which hold the bulk of corporate pension assets,² were especially affected.

This paper has three purposes. The rules regarding pension funds and pension benefits are described so as to emphasize the issues important to economists. These rules are then analyzed so that issues such as the value of pension claims, firm liability, and funding strategy can be discussed. Finally, this analysis is applied to specific pension funds and to defined benefit plans in the aggregate to provide an empirical picture of the financial health of corporate pension plans.

The structure of the paper is that there are two large sections, each divided into subsections. The first section discusses the pension laws relating to benefit accrual, funding, pension insurance, and taxation. At the end of the section the major analytic results are summarized.

The second section first examines some of the large defined benefit plans and the the defined benefit plans population in aggregate, subject to the results of the first section. A rough picture of the financial well-being of corporate pension plans is then drawn from these data.

I. RULES AND ECONOMIC INTERPRETATION OF ERISA

A. Accrual of Benefits

Pension benefits are generally accumulated according to a plan formula based on (perhaps) age, salary history, and length of service. However, some accumulated benefits may be automatically forfeited if the

employee quits or is fired. Vested benefits are those accumulated benefits which would not be forfeited in the event that employment is immediately terminated. The percentage of accumulated benefits which are vested is determined by the firm's vesting schedule. ERISA mandated that a firm's vesting schedule must be at least as generous as one of the three alternatives below:³

- (1) Five to Fifteen year rule:⁴ The employee must be 25 percent vested after five years. This figure increases five percent per year until 50 percent vesting is reached after ten years. Thereafter, the vesting increases by 10 percent per year until 100 percent is reached in 15 years.
- (2) Ten year rule:⁵ A plan may provide that no vesting occurs during the first ten years, but 100 percent vesting occurs after the employee has ten years of covered service.
- (3) Rule of 45:⁶ An employee who begins work at age 35 or later must be 50 percent vested after five years, with linear increments to full vesting in ten years. An employee who begins work between the ages of 25 and 35 becomes 50 percent vested when the sum of his age and service equal 45. Thereafter, the percentage vesting increases by ten per year for five years, when full vesting is achieved. An employee who begins work before age 25 becomes 50 percent vested after ten years of service, with linear increases to full vesting within fifteen years. If a pension plan chooses the rule of 45 it must include employee service before age 22, which may be excluded under either of the other two vesting schedules.⁷

Minimum vesting rules provide that the firm cannot defer the vesting of accrued benefits until late in an employee's career. Rules limiting "backloading" are meant to serve the related purpose of limiting the disproportionate postponement of the accrual of benefits until late in one's working life. There are three alternative excess backloading rules, at least one of which a plan must satisfy:

- (1) Three percent rule:⁸ The minimum rate of accrual is three percent of the maximum benefit per year. That is, if an employee worked 15 years, his benefits would have to be at least 45 percent of the maximum benefit for a person with his level of compensation.
- (2) 133 - 1/3 percent rule:⁹ The annual rate of benefit accrued cannot be more than 4/3 as great in a future year than in the current year. For example, if a plan provides one percent of average compensation for the employee's five highest paying years for each year of participation prior to age 50, it cannot pay more than 1-1/3 percent for each year after 50.
- (3) Allocable portion rule:¹⁰ For example, if an employee joined the firm 35 years before normal retirement age and worked 14 years, he would have a benefit at least 40 percent as great as if he worked until retirement.

Despite these rules, recent rates of inflation (and therefore interest and salary growth) have put substantial de facto backloading into most defined benefit plans. This will be shown for a plan which follows the allocable portion rule, and has immediate full vesting. (In the absence of positive interest and salary growth rates such a plan would permit the worker to accrue a (vested) benefit of equal present value each year and

thus provide no backloading.)

Compare two stylized pension plans - one a "defined contribution" plan similar to TIAA and the other a defined benefit plan with retirement benefits equal to a constant, times the number of years worked, times the average salary earned during the final n years of service (assume $n \leq 10$ for simplicity). For the purposes of example, consider workers who have no chance of dying before retirement age and who would acquire an annuity contract upon retirement from their defined contribution account. For numerical simplicity assume that in either case salary would grow exponentially at rate g and that the riskless rate of interest and the rate earned on all plan assets is i . Further assume that there is no possibility of a failure to pay out vested benefits.

For the defined contribution plan the firm contributes a fixed fraction C of the worker's income to his pension plan. If initial salary is W_0 then after T years of work the fund has accumulated

$$(1) \quad B = W_0 C \int_0^T e^{gt} e^{i(T-t)} dt = \frac{W_0 C e^{iT}}{i-g} (1 - e^{-(i-g)T})$$

where B is accumulated benefits. The term e^{gt} allows for salary growth while $e^{i(T-t)}$ allows for accumulated interest since a contribution has been made.

To calculate the growth of benefits find

$$(2) \quad \frac{dB}{dT} = iB + W_0 C e^{iT} = iB + \frac{(i-g)e^{-(i-g)T}}{1 - e^{-(i-g)T}} B$$

The term iB represents the interest earned on previously accumulated funds while the other right hand term represents current contributions.

In the special case of $i=g$ (2) becomes

$$(2') \quad \frac{dB}{dT} = i + \frac{1}{T}$$

For the defined benefit plan assume that the worker commences employment R years before retirement. Assume benefits upon retirement are worth a constant, k , times years of service times final salary.¹¹ Then the value of accrued benefits is

$$(3) \quad B = k W_0 T e^{gT} e^{-i(R-T)}$$

Growth in benefits is equal to

$$(4) \quad \frac{dB}{dT} = \left[\frac{1}{T} + g + i \right] B$$

where the $\frac{1}{T}$ factor comes from increased service, g from an increased salary base, and i from benefits being one year closer to being received.

With $i=g$ the growth rate of benefits is

$$(4') \quad \frac{dB}{dT} = \left[\frac{1}{T} + 2i \right] B$$

Note that benefit growth rates are unambiguously greater under the defined benefit plan, implying that a larger fraction of total benefits are accumulated in the later years of employment. To illustrate the difference, assume an annual interest rate of $2^{1/10}$, or approximately 7.2 percent with annual compounding. Assume that salary growth is at that same level.

Finally, compare two employees who join their respective firms with 40 years left until retirement. A is a member of a defined contribution plan while B joins a defined benefit plan. Regardless of when they leave the firm, benefits will commence at normal retirement age. Table 1 compares the benefits to be received by each worker if he leaves early, relative to the amount received if employment continued until the normal retirement date:

Table 1

Benefits Received by Employees Who Terminate
After Varying Lengths of Service,
As A Fraction of Normal Retirement Benefits

Years of Service	Defined Contribution	Defined Benefit
10	.250	.031
20	.500	.125
30	.750	.375
40	1.000	1.000

Note that accretions occur at a smooth rate with a defined contribution plan but that 5/8 of all benefits under the defined benefit plan are accrued in the last ten years of work. High salary growth rates due to inflation have exacerbated this differential - were interest and growth rates only half as large (3.6 percent) defined benefit accruals would be .088, .250, and .530 of the maximum after 10, 20, and 30 years of service.

This differential leads to one of the most significant points of contention in determining firm pension liability and the appropriateness of various pension funding techniques. This is the implicit liability concept

discussed by Treynor [23].

Consider an employee of a firm with a defined benefit plan such as the one described above. Assume the worker has a forty year contract to work for the firm, and his nominal productivity grows with his salary at rate g . The worker's total compensation over the life of the contract is equal to his marginal product over that period (in present value terms) so there is no initial gain or loss to the contract signing. What would be the appropriate way for the firm to accrue its pension liability to the worker?

In this case it is clear that the fact that most benefits are accrued late in the worker's career is of little account. The worker agrees to a contract which allows for small benefit accruals in the early years because it also provides a guarantee of high accruals later on. That is, salary plus accrued benefits are less than the worker's marginal product in his early years but greater than his product towards the end of his career. However, it would be inappropriate to say that the firm makes a profit on the worker in his early years and a loss later on, because the only reason low early year benefit accruals are tolerated is because of the contractual right to receive extraordinary benefits in the latter part of the contract. If the employee is certain of working the full forty years then the appropriate accounting would be that the employee's total compensation is proportional to his output (and therefore, by assumption, salary) each year. In that case the firm should consider its pension liability as equivalent to that shown by the defined contribution plan, and the cumulative economic profits of the long term labor contract would always be valued as zero.

Compare the above case with one where a worker's salary is subject to renegotiation numerous times in his working career. This is a more common

situation. For simplicity, consider the extreme case of constant renegotiation. At each point in time the firm should be willing to pay its employees their marginal product, in the form of a combination of salary and benefits. The fact that the employer gives higher pension benefits to older workers should be counterbalanced by older workers in defined benefit plans receiving salaries lower relative to young workers than they would in firms with defined contribution plans. The employer will not be able to pay young workers less than their marginal product in benefits and salary, as did the employer in the long-term contract case above - unless he gives those workers such a contract. Otherwise, there is no reason for these workers to believe that the employer will pay them above-market compensation later on. Similarly, there is no reason for the firm to pay older workers more than their market compensation. With oft-renegotiated wages, then, the most appropriate calculation of an employee's total compensation may indeed be his salary plus accrued pension benefits. In such a case, the firm with a defined benefit plan should only consider pension benefits earned a liability as they accumulate, with most of the employee's pension compensation accruing in his final years of service.

Whether, and to what extent, one believes that there exist implicit contracts between firms and workers regarding pension benefits is the crucial issue in determining how quickly pension benefits accrue to the worker, and how quickly pension liabilities accrue to the firm. This issue is discussed further in the section below dealing with funding methods and actuarial assumptions.

B. Funding Methods, Plan Structure, and Actuarial Assumptions

Firms have a great deal of flexibility in determining their pension

contributions, though not as much as before ERISA.¹² This section considers plan flexibility in terms of (1) funding methods; (2) plan structure; and (3) actuarial assumptions. The logic underlying the different ways of determining firm pension contributions is analyzed, and varying assumptions are compared for their appropriateness.

1. Funding Methods

Funding methods can be categorized as either accrued benefit or projected benefit cost methods. They are further distinguished by whether they are funded with or without supplemental liability, and whether an individual or aggregate method is used. Furthermore, there is some choice as to whether to fund a plan with constant dollar amounts or with a constant fraction of payroll.

Accrued methods are not consistent with the implicit contract assumption. For a plan which immediately vests all workers, the actuarial liability of an individual accrual method would be the sum of the present value of future benefits each worker would have if he left the firm today. Complications arise because, for example, vesting does not generally occur immediately, plan benefits may be raised, and actuarial projections may not be realized.

Consider a plan which uses "cliff" vesting - an employee becomes fully vested after ten years of service, with no earlier vesting. One could conceivably begin funding payments for this worker from the day he enters the firm (his entry age) or from the day his benefits attain nonforfeitable status (his attained age). If funded from the latter date the employee will have some vested benefits before any funding is done on his behalf. These unfunded vested benefits can be paid off with fixed payments (like a mort-

gage) over a given number of years or can be amortized by a proportional increase in the payments needed to fund future benefit payments for the work force. Similarly, plan changes which create additional pension liabilities can be funded either over a fixed period of time or proportionate to future pension costs. If the liability is funded separately it is termed a "supplemental liability." If a pension method amalgamates these additional costs by grossing up "normal costs" than the method is said to be "without supplemental liability."

Projected benefit methods follow the implicit contract logic. The employee's wages are related to his output but the firm has an implicit contract to provide a worker with high accrued pension benefits late in his career to make up for low benefits early on.¹³ Consequently projected benefit methods will fund benefits as either a constant amount or constant percentage of payroll. (One implies that a worker implicitly accrues an equal dollar amount of pension benefits each year worked while the other implies that benefits accrue proportionally to salaries). Again, such plans may be with or without supplemental liability.

Methods are further divided into individual and aggregate cost methods. An individual method will calculate the contribution necessary to fund each individual's pension and sum to find the plan's total cost. An aggregate method will calculate the costs of funding a person with average age, service, and salary characteristics and then multiply by the number of participants. Typically only projected benefit funding methods will aggregate.

Plans which provide salary-adjusted benefits will usually establish normal contributions as a constant percentage of payroll while plans which provide fixed benefits will fund a constant amount each year.

For a detailed analysis of the various funding methods see Winklevoss [26]. The crucial point to remember is that projected benefit methods involve much greater funding requirements and higher actuarial liabilities than do accrued benefit methods. For example, consider a plan such as the one described on page 8. Under the accrued benefit method the actuarial liability of the firm for a given worker is proportional (in constant year dollars¹⁴) to the amounts in the defined benefit column of Table 1.¹⁵ Under an individual projected benefit method where benefits are actuarially projected as a constant percentage of salary the actuarial liability accrues proportionate to the amounts in the defined contribution column of Table 1. If, under such a method, benefits are projected as a constant amount, over 53 percent of the actuarial liability (8/15) accrues in the first decade of service, with 80 percent accruing over 20 years and over 93 percent (14/15) accruing in 30 years. One will be somewhat limited by actuaries and the IRS from choosing a funding method which, combined with other actuarial assumptions, makes pension costs particularly low or high (e.g., if a constant amount funding method were used in a salary plan with sizable projected salary growth) but there is a great deal of variance in firm funding policies.

2. Plan Structure

An important element in determining pension contributions is whether the plan provides benefits related to salary or fixed benefits. That is, General Motors may have one pension plan for its salaried workers, with benefits related to wages in the last several years of employment, and another plan for its UAW members, with benefits fixed in relation to years of service, and not automatically adjusted for salary increases.

For the purposes of example, imagine that the union benefits, though not legally tied to wages, tend to be raised in proportion to wage increases whenever the auto workers negotiate a raise, so that in fact promised benefits always stay in line with those of the salaried employees. Now compare the effects on funding.

Under the salaried plan the benefit formula remains constant and over time any legal funding method used will at least fund all accrued vested benefits (assuming the appropriate actuarial assumptions). The projected benefit methods will create funds with more assets than accrued vested benefits.

However, under a fixed benefit plan the fund may remain perpetually underfunded. Such funds must determine their contributions based on the assumption of no future benefit increases. When benefits are increased, the new unfunded prior service costs are funded gradually over many years. With constant nominal benefit growth (e.g. in an era of inflation) the issue is most pronounced. The reason is that the assumption of no future benefit growth is the equivalent of an actuarial assumption of no salary growth. Such an assumption, combined with a high nominal interest assumption, leads to minimum pension contributions.

Under both accrued and projected cost methods oft-adjusted fixed benefit plans will tend to be less well funded than automatically adjusted salaried plans, unless adjustments do not apply to past service. Examples of the different degree of funding for fixed benefit plans (typically union plans) and salaried plans are given in the empirical section of the paper.

For non-believers in implicit contracts the problem presented here is not large. Any time a union renegotiates its wages and benefits the

total cost of the contract (to a firm fully liable for all promised benefits) the cost of the new contract is equal to the value of wages plus new benefits accrued over the length of the contract. For implicit contract believers the issues are more complex: in the fixed benefit plan does the firm have an implicit contract to increase benefits in the future? If so, then projected cost methods for fixed benefit plans grossly underestimate the present value of future pension benefits.

There is another related question as to who bears the risk on the liability side of the pension balance sheet. That is, if interest rates rise, say with a corresponding increase in inflation and salary growth, the present value of accrued benefits decreases. Without implicit contracts this decrease is a loss to employees, matched by a decrease in employer liability. However, if the employer has an implicit contract to have benefits rise with salary the increased inflation only further tips the accrual of benefits to the end of the employee's career. His loss is accrued benefits due to higher interest rates is compensated for with further increases in the above-market compensation he expects to receive at the end of his career. Questions of pension risk will be discussed more fully after pension insurance is explained.

3. Actuarial Assumptions

The crucial actuarial assumptions of a plan are (1) the interest rate used in discounting liabilities; (2) projected employee termination rates; (3) mortality assumptions, and (4) expected growth in wages and social security. High interest rate, termination, and mortality assumptions all tend to minimize costs. High wage assumptions raise costs, except that a fixed benefit plan integrated with social security would minimize costs by

estimating the largest allowable increase in social security benefits.

Treynor [23] and Sharpe [22] point out that the appropriate rate at which to value pension liabilities is the riskless nominal rate. Typically interest rate assumptions are based on projected portfolio earnings (and thus influenced by the riskiness of the asset portfolio), but clearly the liabilities are independent of the asset side, except to the extent that risky assets may alter the chance of all promised benefits being paid. For a well-funded plan with no chance of benefits not being paid clearly the riskless rate is appropriate. For other plans, benefits discounted at the riskless rate less plan assets equal the amount needed to maintain a fully funded plan. For an underfunded plan that may terminate discounting at the riskless rate gives the analyst the data needed to estimate the value of the pension plan.¹⁶

One important factor involving the interest rate is that changes in interest and salary assumptions that leave either contributions or unfunded prior service costs constant under a projected benefit method may greatly alter the value of vested benefits. Because vested benefits are always calculated with approximately an accrued benefit method, increases in interest assumptions which reduce accrued benefits also reduce vested benefits, even if a salary increase assumption is altered to keep total projected benefits constant.

C. Pension Insurance

For the purposes of this analysis, the single most important aspect of the passage of ERISA was the establishment of the Pension Benefit Guaranty Corporation. With minor exceptions, all defined benefit pension plans of

any size are required to have this insurance.

Technically, the PBGC guarantees something called "guaranteed benefits." These benefits are very similar to vested benefits with several exceptions. The two most notable exceptions are (1) any new benefits which come about from a change in a pension plan do not become fully insured for five years, and (2) there is a maximum benefit that an individual can receive from the PBGC (originally \$750 per month, now approximately \$1000 per month).

There are six other aspects of the PBGC's mandate worthy of attention. These are (1) the ability of the PBGC to attach up to thirty percent of a firm's net worth to pay guaranteed benefits in the event of a plan termination; (2) a mandate to provide insurance against the thirty percent liability; (3) the ability of the PBGC to close down plans when there is danger of failure; (4) the claim of the PBGC against the firm in the event that termination is coincidental with bankruptcy; (5) the method of determining insurance premia to the PBGC, and (6) the priority in claims for the beneficiaries of a pension plan.

The first aspect (the ability to tax firms for up to thirty percent of net worth) has been a source of some confusion. First, there was the question of whether "net worth" meant the book value of the firm, book value of the equity, market value of the firm, or market value of the equity. It appears that thirty percent of the market value of the equity is the relevant number [see opinion letters of the PBGC involving S 4062 (c)]. There have been some problems about the PBGC's ability to get at corporate assets, but for the purposes of this paper it will be assumed that those problems can be resolved, and that generally the PBGC can assess thirty percent of the market value of the equity of the firm to pay

for guaranteed benefits.

While originally the PBGC was to provide insurance against the thirty percent liability, this aspect of ERISA has been indefinitely postponed. The main question is the moral hazard issue that the insurance would create. As will be shown later, even with the thirty percent rule there can be some incentives for a firm to run a large deficit and terminate the plan. However, without the thirty percent coverage, the PBGC may be left with a larger potential liability.

The second provision gives the PBGC the right to shut down plans which appear to be in danger of leaving the PBGC with unfunded guaranteed benefits. This is a provision relied upon heavily by Treynor [23] for some of his results.

Consider a plan which is not fully funded but has a market value of equity sufficiently high that thirty percent of that market value would be more than enough to pay for all unfunded guaranteed benefits. Then, Treynor contends that (1) the PBGC has no net liability and (2) the firm should consider its unfunded guaranteed benefits as riskless debt. The reason is that if the unfunded liabilities rise or the market value of equity falls, the PBGC can supposedly terminate the plan before the liability exceeds thirty percent of the firm's market value, thus preventing the PBGC from ever getting caught with a liability.

Guaranteed benefits are clearly an asset of the employees, worth their face amount discounted at the riskless interest rate, regardless of the amount in the pension fund. To have the net position of the PBGC, employees, and firm equal zero (if the PBGC has no liability), then the liability of the firm must equal the unfunded guaranteed liabilities.

In the event that the plan had unfunded liabilities exceeding thirty percent of the market value of equity, then the liability of the firm would be the thirty percent (at least) with the liability of the PBGC being any excess.

The problem with this analysis is the assumption that the PBGC can really close down any plan with sufficiently large unfunded liabilities. It is hard to believe that the PBGC will be able to close down any plan which is satisfying its minimum funding requirements. For example, in the Treynor scenario plans of companies like Chrysler and Uniroyal (plans with large unfunded liabilities) should have been terminated. Clearly, the chance of involuntary termination, given that those firms stay out of bankruptcy and make their minimum legal pension payments, seems remote.¹⁷ The enforceability of the pension termination provisions seems even more dubious given that the PBGC has even had trouble with the thirty percent rule. For the purposes of the remainder of this paper, the assumption will be made that the PBGC cannot terminate a pension plan which has met and is continuing to meet its minimum legal funding requirements.

The fourth issue is the seniority of the PBGC's claim on the assets of the firm in the event of plan termination. The Pension Reform Act, Section 4068 (c)(2) reads,

In the case of bankruptcy or insolvency proceedings, the lien imposed (if any employer refuses to pay the liability determined by the PBGC) ... shall be treated in the same manner as a tax due and owing to the United States for purposes of the Bankruptcy Act ...

Thus, the initial impression is that the PBGC has a very strong claim on the assets of the firm. However, it is important to remember that the liability of the firm is computed as the lesser of the excess of the plan's guaranteed benefits over its asset value, or, [Act Section 4062 (b)(2)] "30 percent

of the net worth of the employer determined as of a day, chosen by the corporation but not more than 120 days prior to termination, computed without regard to any liability under this section."

Act Section 4062 (c) then states, "For purposes of subsection (b)(2) the net worth of an employer is --

- (i) determined on whatever basis best reflects, in the determination of the corporation, the current status of the employer's operations and prospects at the time chosen for determining the net worth of the employer,"

Combine the above with the interpretation of net worth as being the market value of the equity of the firm. This interpretation is reinforced by the last part of 4062 (b)(2), which says that net worth is calculated without regard to any PBGC liability, implying that net worth is net of other liabilities. Of course, in bankruptcy the market value of the equity is zero, so the PBGC's claim can only be positive if it chooses for valuation some day in the 120 day period prior to termination when the firm was not bankrupt. However, doing so would appear to be inconsistent with 4062 (c), since in bankruptcy an equity value of zero ought to be the one which best reflects firm value.

If it is recognized that bankruptcy courts sometimes throw bones to the equity holders, perhaps it makes sense to issue stock to the PBGC in the event of termination and bankruptcy. In any event, it is difficult to understand on what basis the PBGC claim ranks with a tax liability.

One other issue is also related to the question of the liability being computed without regard to PBGC liability. For example, a firm with assets of \$100,000 and no liabilities other than some large insufficiency due the

PBGC might have a market value of \$70,000 with the assumption that the PBGC will take \$30,000 or might have a market value of \$77,000, with the assumption that the PBGC will take 30 percent of that market value, or \$23,000. The net effect is whether the PBGC will have the ability to assess up to 43 percent of the current market value of the firm net of the PBGC liability or only 30 percent of that figure.

Despite the reading of the law, it appears that the latter number is the relevant one. Opinion letter 76-51 (April 13, 1976) discusses the case of a firm for which a bona fide offer was made to purchase all the common stock for \$15,000. As a result, net worth was determined to be \$15,000, and employer liability was limited to 30 percent of that amount, or \$4,500.

Summarizing, then, the PBGC has a claim which is supposed to have the seniority of a tax lien. Of course, seniority is unimportant for a solvent firm because all claims are paid. However, in the event of bankruptcy the value of the PBGC claim is zero, making seniority also irrelevant. Furthermore, liability appears to be limited to thirty percent of the market value of the equity of the firm, even though that figure may really reflect the expectation of a payment to the PBGC.

The fifth issue is the method of charging PBGC insurance premia. Included here are (1) the question of how aggregate rates should be set so that the PBGC is solvent, and (2) how rates should be set for individual firms.

The Corporation tries to make aggregate premia high enough so that its liabilities are fully funded, rather than operate on a pay-as-you-go system. In this case a pay-as-you-go system would be one where insurance premia were set in each year so that the PBGC had enough money to meet its cash flow requirements for that year. For example, imagine a plan which

terminated with four million dollars (present value) in insured benefits, with the PBGC only able to recover two million from the pension fund and the firm which sponsored it. Because workers usually receive annuity rather than lump sum benefits, the two million dollars collected from the plan could be used to finance several years of benefits. Thus, an immediate termination might not have a cumulative positive effect on insurance premia for several years. The principle of the PBGC system is to be fully funded in the sense that premia in a given year should ideally equal the present value of benefits that will have to be paid as a result of terminations that year. (In the above example, aggregate premia in the year of termination would be increased by two million dollars.) There would be no residual effect on future year's premia from a termination in the current year.

Charging premia on a fully funded basis makes a great deal of sense because sharply increasing future premia would lead to a vicious circle of more terminations and higher premia. That is, having to pay a high insurance premium could itself cause plans to terminate -- thereby causing a further increase in premia and in terminations. However, Congress and the PBGC have yet to prove that they can implement a full-funding system. Premiums started off at a level of one dollar per worker per year in 1974 and the PBGC began running deficits. By 1977, when a proposal to increase the premium rate was made, the system was projected to have a deficit of \$59.4 million.¹⁸ The PBGC proposed raising the premium to \$2.25 to amortize the deficit over the next ten years and to keep the system fully funded from that point on. However, as admitted in the PBGC's report, the assumptions made all tended to be fairly optimistic, with little potential for costs to be below projected levels and a large number

of items with the potential of increasing necessary payments (e.g. the projected \$59.4 million deficit, estimated in September 1977 for the fiscal year ending on the last day of that month turned out to be \$95.3 million).¹⁹

Probably the only way that the PBGC would become fully funded is if variable rates were set each year to cover that year's costs. That way, optimistic projections could not lead to systematic underfunding.

At the current time the money involved in the PBGC running a fully funded operation is simply trivial. However, there are two other problems with the way premia are determined, and the insurance funded, which could involve large stakes.

First, there is the problem of charging all (single-employer) plans, regardless of financial position, an equal premium per employee. This feature provides an incentive to run a poorly funded plan to take advantage of PBGC insurance. In the long run, this feature should lead to an increasing number of plans "cashing in" by terminating.

A second, related problem is that because premia are independent of firm financial position, a system which is fully funded according to the PBGC definition may in a more realistic sense be creating a large unfunded deficit. The best analogy may be to something like malpractice insurance for doctors. The PBGC analog of a solvent malpractice plan would be one which charged sufficiently to pay the expected present value of any claims filed that year. However, there may be other claims to be filed in future years that result from current cases. Similarly, with pension funds, firms may have an incentive to increase their unfunded liabilities with the thought of possibly defaulting in the future. The PBGC, even under its fully funded scenario, would not plan on raising any money to cover for the fact that its potential liability increases as it insures plans underfunded by increasingly large amounts.

For example, reliable sources at the PBGC estimate the cost of a Chrysler termination at \$700 million. Economically, this liability has accrued over the years as the Chrysler plan has become badly underfunded. However, the PBGC will only recognize the cost when and if a termination claim is filed. Also, note that a Chrysler termination would be several times more costly than all previous terminations combined.

Finally, it is important to mention the priority of claims under ERISA, and to distinguish between guaranteed, vested, and forfeitable benefits. Benefits fit into six priority categories.²⁰ Priority category 1 benefits consist of accrued benefits of participants which are derived from voluntary employee contributions. Category 2 benefits include any accumulated mandatory employee contributions as of the date of plan termination, plus interest accrued on all employee contributions (at a rate of five percent) less the value of benefits received. Category 3 benefits include benefits payable as an annuity that has been in pay status for three years as well as benefits payable as an annuity which could have been received beginning three years before (that is, if a person is sixty when the plan terminates, he has as a Category 3 benefit any annuity he could have received had he taken early retirement at age 57). Net Category 3 benefits are the above less the amounts qualifying for a higher (1 or 2) category. Priority Category 4 includes all other guaranteed benefits (vested benefits subject to limitations on individual benefits) not in the first three categories. Category 5 includes all other vested benefits not in the first four categories -- basically, vested benefits in the amount exceeding guaranteed benefits. Finally, Category 6 includes all other benefits provided by a plan, including forfeitable (that is, non-vested) benefits.²

If a plan terminates, the PBGC attaches its assets and pays off benefits in order of priority. There is an asymmetry between well-funded and under-funded plans. With an overfunded plan, benefits in all six categories

are paid, with any remaining money returned to the firm. For an under-funded plan, total benefits paid out will be the maximum of total plan assets and the sum of benefits in Categories 1 through 4 -- the guaranteed benefits. If plan assets are less than guaranteed benefits then the 30 percent of net worth rule only applies up to the amount of guaranteed benefits. Furthermore, the PBGC is also only liable for guaranteed benefits. Thus, benefits in Categories 5 and 6 are paid if a plan is sufficiently well-funded, but otherwise, these categories have no status. Thus, funding above the level of guaranteed benefits first helps those employees who have accrued fairly large (currently above \$1,000 per month) vested benefits.

D. Analysis of ERISA

This section models corporate pension plans and examines the effect of ERISA. A distinction is made between unionized and non-union plans, regarding potential for underfunding. As an approximation, implicit contracts will be assumed not to exist. A regime of constant wage and pension negotiation will be considered so that promised contributions and pension portfolio strategy on pension wealth (analyzed by Sharpe [22]) can be ignored.

Let A = accrued benefits
 E = market value of equity of the firm
 F = funded benefits
 G = guaranteed benefits
 T = termination benefits
 V = vested benefits
 FL = firm liability beyond money in pension fund
 PBGCL = PBGC liability

Before ERISA the value of the employees claim upon termination T was

$$(5) \quad T = \min[F, V]$$

assuming there were no outstanding labor contracts specifying future pension contributions at the time of termination. This is because the firm had the right to terminate the plan and not be liable for any excess liability if $V > F$.^{22, 23.}

A persistent situation of $V > F$ is viable for a union plan but in the pre-ERISA era seems less viable for a non-union plan. In a non-union plan each worker calculates as part of his compensation the accretion in the value of his vested benefits. Assume a plan is underfunded at some point. The firm's liability is no more than F , implying that worker's pension assets are only worth F . Thus vested benefits V must be worth less than face amount. Now consider some worker who leaves the firm. If the plan continues and becomes better funded, or especially if it continues long enough to pay this worker's benefits, then such a worker receives a financial benefit from plan continuation. If additionally the firm had to pay its continuing workforce market wages, total compensation (including the wind-fall to leaving workers) would exceed market levels. In fact, given that there is an incentive to leave wage rates might even have to exceed market levels, to the extent of the employee's potential gain from quitting. Thus the firm is better off with a termination, unless it believes employees place an aggregate value on their pension benefits in excess of the firm's liability.

With a union to negotiate with things are different. The value of the union's pension wealth is clearly defined, and negotiations to continue an underfunded plan proceed from the basis that benefits are worth F . If the union can (a) extract above-market wages or (b) concentrate bargaining power in the hands of older workers, the instability of the non-union case can be explained away. If old workers always control the union, compensation

scales can be consistently set to favor older workers at the expense of young workers. Young workers tolerate this and do not leave because they know they will eventually be old workers (able to benefit equally from the next group of young workers). In this way the financial incentive for leaving early (and thus benefiting from plan continuation at others' expense) is eliminated. The mechanism enabling continuation is a private social security system of the union members, with younger members subsidizing older members. Note that large unfunded liabilities are much more common in union plans (which tend to have benefits fixed rather than automatically salary adjusted) rather than in non-union plans (which tend to be salary-adjusted).

The passage of ERISA made a substantial difference. Now the firm's net liability can be written as

$$(6) \quad FL = \min [A-F, \max [0, \min(G-F, .3E)]]$$

If the plan terminates with funded benefits in excess of accrued benefits ($F > A$) the firm actually has a net surplus in the plan. If funded benefits are greater than guaranteed benefits but less than accrued benefits, the firm takes on no additional liability and whatever money is in the fund is distributed according to the PBGC priority system. If funded benefits are less than guaranteed benefits, the firm is liable up to a maximum of 30 percent of the value of its equity, with the PBGC making up any difference.²⁴

The PBGC's liability is

$$(7) \quad PBGCL = \max(0, G-F-.3E)$$

and the value of termination benefits to the employees is

$$T = PBGCL + FL + F$$

or equivalently

$$(8) \quad T = \min [A, \max(G, F)]$$

In terms of negotiation, if a union plan were very well funded the union's termination position would be worth A , an amount in excess of vested benefits. For a non-union plan the firm could more appropriately consider its liability to be V , because in its salary offers to each individual that person's benefit should he leave would only amount to V .²⁵ Underfunded plans (union and non-union) are partially supported by the PBGC's termination liability. This does not mean such plans will immediately terminate. Minimum funding standards may be sufficiently lenient that the plan's total cost of continuation (costs of pension insurance plus funding costs) may be less than the amount of guaranteed benefits that can be newly accrued via plan continuation.

Grossly underfunded plans are not very stable. For non-union plans the same issues discussed for underfunded pre-ERISA plans reappear. Union plans should terminate unless the discrepancy between guaranteed benefits and funded benefits can grow fast enough to make it worthwhile to postpone exercising the pension put.

Once again, remember that the management of the firm may find continuation of an underfunded plan a good way to shift money from the stockholders to the employees, by honoring the implicit contract to continue the

plan. Even with a management dedicated to working in the stockholders' interest there may be good reason not to terminate an underfunded plan. For example, a large firm will typically have a complex relationship with the federal government, and one might worry that termination of an underfunded pension plan might lead to less favorable treatment in other matters.²⁶

ERISA can also be considered in terms of its shifting of pension fund portfolio risk. Consider three types of risk: (1) risk in the assets of the pension portfolio; (2) risk in the value of pension liabilities due to a change in real interest rates; and (3) risk in the value of pension liabilities due to a change in nominal interest rates, offset by an equal change in inflation (salary growth) rates. With implicit contracts, ERISA makes no difference because the firm is assumed to continue the pension plan. Risks of type (1) are born by the firm, which must increase funding if a loss is suffered on the portfolio. Risks of type (2) exist because changes in real interest rates do not mean changes in nominal benefits under an implicit contract. Thus, a real interest rate increase benefits the firm in terms of lower pension costs, and the firm's gain equals the employees' loss.²⁷ There is very little inflation (type (3)) risk, because the firm is committed to raising benefits if inflation increases. Ignoring gains due to non-indexation of benefits after termination, neither side benefits or loses from inflation.

Without implicit contracts the situation is more complex. Equation (5) helps analyze the pre-ERISA situation while (6), (7) and (8) are useful in examining the current regime. Before ERISA, the workers' position was worth the minimum of F and V . Thus, for an overfunded plan all portfolio risk was born by the firm, and for an underfunded plan by the workers.

(If wages are renegotiated periodically rather than continuously, or if discontinuous jumps are possible in the value of the portfolio then the risk is shared between workers and the firm, with the firm's share increasing as the plan becomes better funded.) All interest rate risk, whether type (2)(real) or type (3)(nominal) can be analyzed in the same way. That is because in calculating the value of accrued vested benefits one only needs to know the benefits the employee would receive if he terminated today (a fixed nominal amount independent of future inflation or salary growth assumptions) and the nominal rate at which to discount such benefits. For a well-funded plan the workers' position would be worth the present value of vested benefits, so changes in nominal interest rates would inversely affect the value of the employees' claim (and thus the firm's liability). For a poorly funded plan, benefits were only worth F , so a change in interest rates, having no direct effect on F , would not affect the value of pension claims.

Since ERISA, the government has become a partner in sharing the pension liability. For a very well funded plan ($F > A$ for a unionized plan) asset risk is absorbed by the firm. If $A > F > G$ asset risk is held by the workers, while if $F < G < F + .3E$ the workers' position is stable at G while the firm reassumes the asset risk. If $F + .3E < G$ then the firm's liability is limited and the government assumes the added risk.

Note that in the pre-ERISA case it is possible to assign risk exactly when there are constantly renegotiated contracts and no jumps in asset prices or interest rates. However, in the post-ERISA case liability cannot be precisely apportioned unless the mandate of the PBGC is taken literally. If so, then the PBGC would bear no risk in a plan where $F > G$ because it could terminate if F dropped to G . If $F < G$ then both the

firm and the PBGC would be in position to terminate the plan, making the PBGC's liability exactly equal to $G - F$. However, if it is assumed that the PBGC has more limited termination power its status is the analytical equivalent of a long-term creditor. In that case the firm's right to terminate is valuable even if $F > G$. Consequently, asset risk is born partially by either the firm or the workers and partially by the PBGC.

Regarding liability risk, roughly speaking the following situation exists: If $F > A$ the value of pension claims equals A , so changes in the value of a liability involve a transfer between the firm and its workers. If $A > F > G$ the value of pension claims equals F , and changes in the value of liabilities have no impact. If $F < G < F + .3E$ the value of pension claims, all to be paid by the firm, is G , and changes in the value of that liability again involve firm/employee transfers. Finally, if $G < F + .3E$ the firm's liability is limited, and changes in G affect the PBGC's payouts to workers. The same issues involving the long term nature of the PBGC position as in the asset risk case make the liability risk situation more complicated. Also, the above analysis is for union plans. For non-union plans if the plan is well funded a consistent analysis applies, but if the plan is poorly funded the plan stability problem makes the situation difficult to analyze.

The results of the last few pages are summarized below in Tables 2a and 2b.

Table 2a

Apportionment of Risk With Implicit Contracts

- (1) Asset Risk: firm
- (2) Real Interest Rates: firm/worker transfers
- (3) Inflation Risk: none (hedged)

Table 2b

Apportionment of Risk Without Implicit Contracts*

	<u>Asset Risk</u>	<u>Liability Risk</u>
F > A	firm	firm/worker transfers
A > F > G	workers	none
F < G < F + .3E	firm	firm/workers transfers
G < F + .3E	PBGC	PBGC/worker transfers

*Figures approximate because of long-term nature of PBGC position.

E. Taxation

Taxation under ERISA can be divided into several subcategories. The issue to be discussed here are (1) the deductibility to the firm of its contributions to a pension plans, (2) the non-taxation when earned of income accrued by investment of a pension plan's assets, and (3) the special tax breaks available to those who are not members of a qualified plan through

the establishment of IRA accounts. Other aspects of pension taxation (e.g. the special treatment of lump sum benefits received by individuals) will not be discussed because they are relatively unimportant for this analysis.

Contributions of the firm to its pension plan are immediately tax deductible so long as the plan is qualified by the IRS. To be qualified, a plan must meet ERISA's funding, vesting, and other (e.g. participation and disclosure) standards. Probably if a firm terminated a vastly underfunded plan, it would have difficulty in getting approval of another defined benefit plan. Though contributions are deductible when paid in, the income received by a beneficiary is not taxable until received. It has been argued that this tax benefit (of corporations gaining an immediate deduction on their contributions rather than only being able to deduct pension benefits paid) is a trivial matter, but actually, this tax advantage is very important.

The argument that the tax break is unimportant obtains from the following line of reasoning: Assume the risk-adjusted discount rate which can be earned in the market is r , and that the corporate tax rate is τ . Under current law a contribution of C to a pension plan yields tax credits of $C\tau$, providing an after-tax cost of $C(1-\tau)$. After n years the fund will have accumulated $C(1+r)^n$, which can be paid out to employees.

Now assume that plans can earn the rate of return r , but that the firm cannot take a tax deduction on any payments until the employee receives the money. Imagine the firm makes an initial payment of $C(1-\tau)$, so that it has the same initial cash flow as under current law. If the plan earns the rate r for n years there will be $C(1-\tau)(1+r)^n$ in the plan. At this time $C(1+r)^n$ could be paid out, financed by the money in the fund plus $C\tau(1+r)^n$ in tax credits. Compared to the current law the same benefits are

paid, generated by an identical stream of after-tax costs to the firm.

The flaw in this reasoning is the assumption that that firm will be in the same tax bracket when it pays its pension benefits as it is now. However, the firm may lose money in the future and accumulate excess tax losses which it cannot use. In the corporate finance literature, tax shields are generally discounted at the firm's debt interest rate. This rate exceeds the riskless rate for all but a few firms, implying that there is a risk which makes these tax benefits less valuable than if it were certain the firm would remain in the same marginal tax bracket. Thus, there is value to receiving the tax break immediately, and with certainty, rather than only if the firm is still paying taxes in the future.

The second tax advantage of establishing a qualified plan is often overstated. This is the advantage of not having the income earned by a pension plan taxed until paid out. Thus, the pension fund is able to accumulate income at a pre-tax rate of return rather than at an after-tax rate. This argument is important if it is assumed that the tax effects of not having a qualified pension plan are very severe. However, there are several reasons to believe that the alternatives available to a qualified plan sharply limit the taxes that would be paid. Effective tax saving options would be:

- (1) non-qualified pension plans whereby the corporation simply ran the pension plan as part of its overall assets but only received deductions upon paying out benefits (rather than upon contributing to the pension plan);

- (2) Corporate investment in regulated investment companies which received 75 percent or more of their income in dividends and avoided net long-term capital gains.

(3) Investment in the corporation's own stock, or additional corporate investments with zero net present value.

(4) Direct cash payments to employees which could be used for consumption (if that is preferable for the worker), ordinary saving, investment in the downpayment for a house (generating an alternative tax shelter), purchase of deferred annuity insurance contracts, and IRA plans.

Finally, ERISA permitted the establishment of Individual Retirement Accounts (IRAs) for individuals who work for companies that do not have qualified pension plans. (For self-employed workers, there exists the more generous Keogh plan.) IRAs allow these workers to contribute fifteen percent of their income up to \$1500 into tax deferred plans (essentially, their own defined contribution plans). For younger workers particularly, retirement savings of \$1500 a year might be quite sufficient. Also, the \$1500 limit has been in effect for close to five years now. Therefore, a possible substantial increase is not out of the question. To the extent that IRAs can satisfy the pension needs of young workers particularly with exactly the same tax benefits as a qualified pension plan, and that IRAs can be integrated with non-qualified plans, the value of establishing an elaborate qualified plan is reduced.

The discussion of the impact of tax law on firm pension strategy can be divided into four parts. First, the efficacy of some more general corporate finance arguments must be discussed and then applied to pension funds. If these arguments hold, then the tax benefit to forming a qualified pension plan is quite large, and one would expect to find a great deal of overfunding. If these arguments do not have much power, there are still tax reasons for overfunding, but none of a comparably large magnitude.

Second, the alternatives to a qualified pension plan are considered. Third, the tax benefits of a qualified plan are enumerated and then compared with the benefits of the alternatives. Fourth, the overall problem faced by the firm, including the tax benefits of pension funds and the effect of pension insurance provisions, are analyzed.

The most interesting tax argument is due to Miller in his Presidential Address to the American Finance Association.²⁸ Miller says that the after-tax expected returns on equally risky stocks and bonds are different because of tax reasons. Since bonds pay taxable interest whereas stocks include preferentially taxed capital gains, expected returns on bonds should be higher than expected returns on equity of similar risk. Expected returns adjust so that there is no incentive for any given firm to issue debt rather than equity, though there is some optimal amount of debt for the corporate sector as a whole to issue. One problem with this argument is that empirically, it appears that zero-beta stocks have a higher expected return than riskless bonds,²⁹ which is the opposite of what Miller's hypothesis would predict.

A second argument states that because of the tax on dividends, a dollar retained in a corporation is only worth one minus the dividend tax rate. This argument assumes that companies (1) cannot repurchase their own stock, and (2) cannot purchase the stock of other corporations. Under these assumptions, establishing a pension plan provides a valuable function for the firm, in that funding a plan is a way for the firm to use part of its equity to buy stock in their own and other corporations. Overfunding becomes a useful way to dispose of extra money, because the pension plan can buy equities which are depressed in price because of future dividend taxes and receive dividends exempt from tax. If the tax on dividends is thought

of as being very high, then this can be a substantial tax benefit. Any money in the fund would earn a return gross of the dividend tax while any money either paid as wages or held among the general corporate funds would, on the margin, only earn the same return of the dividend tax.

There is substantial doubt about both of these arguments. Miller's argument is very controversial. Also, his related paper with Scholes, "Dividends and Taxes", depends on a tax arbitrage argument (an ability to avoid tax on interest payments), which, if true, would conflict with the assumption of substantial personal taxes paid on interest income necessary for the arguments in "Debt and Taxes." Regarding the second argument, large firms can systematically repurchase their own stock (e.g. Teledyne and Tandy) and buy up other firms.

If either of the above arguments hold, pension funds provide tax benefits because they enable the firm to accumulate income tax free. The actual difference between the return earned in those circumstances and in the alternative situation (without a qualified pension plan) is substantial in both cases -- in Miller's case because the fund can earn the high rate of return available on bonds without paying tax, and in the latter case because the fund can invest in stocks (and earn a gross-of-dividend tax yield) while the firm cannot buy its own or anyone else's stock in any other way.

If these arguments are not accepted, then an examination of the alternatives available to the firm (other than establishing a qualified pension plan) indicate that the tax advantages of establishing a plan are not large.

First, the firm has the option of establishing a non-qualified pension plan. By this I mean that the firm could set aside money to pay future pension benefits, for example in a consolidated subsidiary, and invest that money in the stock market. There would be a tax of approximately seven per-

cent on any dividend income (46 percent corporate taxes on the fifteen percent of dividends received that is taxable), and the total tax load could be made negative through the extra borrowing capacity created by having the extra assets on the balance sheet. [If the Miller argument holds, this is an unsatisfactory result, because returns on bonds may exceed expected returns on equivalent risk stocks, and since corporations pay full tax on their interest income the unqualified plan cannot work as well as a qualified plan that can buy bonds. If the second argument holds, the assumption that the company cannot buy stock eliminates the non-qualified plan as a possibility.] This way, there is no net tax paid on pension fund accretions, and the only tax advantage left to a qualified plan is that contributions are deductible immediately while benefits are taxable only when received.

Non-qualified plans are currently used to supplement the retirement benefits of highly paid workers, giving them more than the amount allowed under ERISA. Such plans give the workers the advantage of automatic income averaging (receiving more money when in lower retirement tax brackets), while employers, because of the 85 percent dividend exclusion, are able to do the savings for the employees while paying minimal taxes (or none if accompanied by borrowing).

Alternatively, the firm could invest in shares of a regulated investment company, such as Vanguard Group's QDP I and II. Such companies must receive at least 75 percent of their income (excluding capital gains and losses) in the form of dividends. If they do so all dividends, net short term capital gains, and interest paid out are taxable as dividends and subject to the 85 percent exclusion. In this way some diversification into interest bearing securities can be added.

Another possibility is to simply repurchase stock in the parent company, buy whole other businesses, or invest in various projects available with zero net present value. Effectively, buying up stock causes the corporation to pay dividends to itself which are 100 percent free from taxation. New investment opportunities are only worth taking if they are as profitable as stock repurchase or buying up another firm.

Finally, the firm could pay workers more current income. If workers are in higher tax brackets while working than when retired, this idea does not work so well, but it is not as unrealistic as it seems. First one must consider IRA plans. If there is no qualified pension plan in a firm, the workers are able to deduct 15% of their income up to \$1500 to essentially establish their own (defined contribution) pension plan. Given that the average large firm contributes about 8% of wages and salaries to pay pension costs (see p. 156) and that this implies an average percentage even higher for older employees, the \$1500 limit would be a binding constraint for many workers at firms that do not have pension plans, especially after the limit has not been raised through the last five years of inflation. The question here is to whether Congress will continue to cut the real allowable contributions to IRAs, restore the limits to figures comparable to 1974, or make IRAs as generous as the Keogh plans allowed self-employed workers. Absenting the possibility of increased limits, workers still have the option of investing money in different vehicles which provide tax free accretions. Among the possibilities in this area are tax-deferred annuities and housing. These options are not nearly as attractive as IRAs, deferred compensation, and qualified pension plans,³⁰ but do somewhat mitigate the tax burden.

In contrast, the basic tax benefits of a qualified plan are (1) the immediate deductibility of contributions to a plan, even if benefits are not

paid out for some time, (2) the deferral of taxes paid on benefits until received rather than when accrued, and (3) the fact that income can be accrued at a tax-free rate in a qualified pension fund. Note that IRA plans yield all of these benefits, and that non-qualified plans (deferred compensation plans) provide benefits (2) and (3). Therefore, the true tax advantage of a qualified plan is the deductibility of contributions rather than benefit payouts.

With a perfectly symmetrical tax law (or equivalently, with a firm that was always sure of being in the same corporate tax bracket), this tax advantage would be worthless. Deferred tax benefits now would be made up for with tax benefits of the same present value whenever assets were finally distributed. However, the tax law is not symmetrical, and individual firms are not sure of always remaining in a positive tax bracket. To the extent that tax shields are risky under current law, there is an advantage to getting tax deductions for contributions rather than for benefits. This, then, is the primary tax benefit of establishing a qualified plan. Since most large firms have a fairly low chance of seeing their tax bracket drop (unless there is a change in the general corporate rate), this tax benefit is not huge.

The firm's overall problem involves the tax advantages of overfunding on the one hand, and the insurance advantages of underfunding on the other hand. A third alternative is to do without a qualified pension plan altogether, and use other devices to achieve similar results.

Plans which overfund gain the tax advantage of deducting pension contributions rather than benefit payments. Their loss is that they pay insurance premia which have no value to them. Plans that underfund have the

advantage of getting valuable pension benefit guarantees without having to pay for the insurance. Non-qualified plans of course dispense with pension insurance entirely. Right now, pension insurance premia are so trivial that there is no overriding incentive to have a large non-qualified plan. Furthermore, the non-qualified plan is almost dominated by the defined contribution plan, which is also exempt from pension insurance. However, if pension insurance premia become large, firms may have an incentive to terminate qualified defined benefit plans, even at the risk that the IRS would not allow the establishment of a qualified defined contribution plan, because for a firm sure of always being in the same tax bracket, the non-qualified plan is such a good alternative.

Pension funds do have some tax advantages because funding payments are deductible immediately rather than later. However, these benefits are not huge. For an given plan it is possible that the advantages of underfunding may exceed the advantages of overfunding. For extremely healthy firms there is little to be gained by overfunding, because there is little chance of not being able to use tax deductions later on. However, such healthy firms also cannot derive much benefit from underfunding, since the 30 percent liability rule makes it difficult for them to ever take advantage of pension insurance. By contrast, high variance firms can gain large tax advantage through overfunding (since the deductions are more valuable now than later), but an often superior alternative would be to underfund, so that if the firm went broke its workers could receive guaranteed benefits that cost the company nothing. Mainly, it is important to realize that there is no reason to expect all firms to be funding as quickly as possible.

F. Summary of Issues

Because of vesting provisions and de facto backloading, defined benefit plans tend to provide workers with a disproportionate share of non-forfeitable benefits in the final years of service. Defined contribution plans typically provide benefits proportional to salary. A reason for establishing a defined benefit plan is to skew benefit accruals to older workers, who might desire that a larger fraction of their compensation be in the form of a deferred pension than would younger employees.

An important question, related to both backloading and the estimation of actual corporate pension debt is to what extent is there an implicit contract between the firm and the workers to negotiate salary independent of the amount of pension benefits to be accrued by the worker in the coming year. If there is no such agreement then the pension liability is appropriately calculated by an accrued benefit cost method, while if there is such an implicit contract a projected benefit method should be used. It is difficult to justify implicit contracts of the scale assumed by projected benefit methods.

Pension insurance guarantees most vested benefits, except those added during the past five years and benefits which exceed the maximum guarantee limit. Insurance premia are not adjusted to the financial health of a plan, thus providing an incentive to underfund and take advantage of the PBGC insurance.

A plan should be structured as a fixed benefit plan, funded by an accrued benefit method, if the firm wishes to fund as slowly as possible. This is because such plans contain no actuarial allowance for benefit growth, so any increases may be amortized over a subsequent thirty years. If a firm wishes to overfund, perhaps for tax reasons, it should have benefits auto-

matically tied to salaries and use a projected benefit cost method.

The question of pension risk must be examined from both the asset and liability side of the plan. A summary of the rough distribution of pension risk is given in Tables 2a and 2b. One important point is that nominal interest rates must be used in valuing benefits, even if a plan provides salary-adjusted pensions. Inflation, if accompanied by increased nominal interest rates, thus causes transfers from workers to the firm and government.

The tax law provides for special treatment of pension funds. Probably the most important advantage is that plan contributions are immediately deductible while benefits are taxable only when received. For a firm with little prospect of a change in its marginal tax rate this benefit is small. Sufficient alternatives to a qualified pension plan exist to make the postponement of tax on pension plan income fairly unimportant.

II. THE STATUS OF PENSION FUNDING

A. Evaluating Pension Liabilities

This section of the paper will examine available data to estimate how well funded the corporate defined benefit pension system is. A large number of grossly underfunded plans could cause significant difficulties. If some large underfunded plans terminated PBGC insurance rates would have to rise substantially. Such a rise could cause termination of other unhealthy plans. Furthermore, many firms with healthy plans might decide to terminate, shifting to either defined contribution plans or non-qualified plans, neither of which involve PBGC insurance. Such "sufficient" terminations would yield a smaller plan base from which premia could be collected to pay for an increased amount of underfunded plan insufficiencies. Thus, a vicious cycle could occur, threatening the stability of the insurance program.

The results of this section will indicate that the corporate pension system actually has a net liability of around zero at this time. However, it is important to understand the assumptions made to estimate this result, and the sensitivity of the result to pension asset and liability risk.

First, little allowance is made for implicit contracts. Given that a number of firms have unilaterally increased benefit payments to some already retired workers, it is clear that such an assumption is an overstatement of the truth. Limiting liabilities to little more than termination costs may underestimate "true" liabilities. Second, at this point no termination cost liability data is readily available.³¹ Thus,

only a rough estimate of pension plan liabilities can be made. Conservatism was used in the estimates, but it is difficult to be very confident of guesses made without the availability of detailed plan data.

Third, although the pension system appears to be well funded at the moment, the primary reason is the increase of nominal interest rates in recent years. Since liabilities are discounted at the riskless nominal rate, and because such liabilities have extremely long durations, this interest rate increase has had a substantial modifying effect on the size of pension liabilities. However, future changes in asset prices or interest rates could create large net pension liabilities. Because pension liabilities have the duration of long-term "bullet bonds" and pension assets tend to be combinations of equities and conventional bonds, the correlation between asset and liability growth need not be very good, yielding the potential for substantial pension deficits.

In order to describe the net position of a plan one would ideally desire the six following numbers: F,G,V,A,E and V plus accrued but not vested liabilities times the fraction of such liabilities expected to vest. This last amount, argued in a footnote to be the upper bound of pension liability for a non-union plan, will be termed AL.

Of these numbers F and E are easily measurable. Most plans³² must report a value of vested benefits, and with rough corrections for the interest rate assumption (described below) such numbers can be used to estimate what that value would be under appropriate actuarial assumptions.

Accrued benefits are the equivalent of what vested benefits would be if a plan had immediate vesting. Such a change in vesting standards

would have a relatively small effect on most plans because backloading implies that most most benefits are accrued by the older (vested) workers. However, if a firm tended to hire older workers, few of whom become vested, it is possible that A would be much greater than V. Winklevoss [26] (p. 180) estimates that the increase in pension costs of switching from ERISA-approved vesting methods to immediate vesting would be about six percent for his model plan. He admits to some variance, depending on plan populations, so conservatism may dictate estimating A at 10 percent above V.

The accrued benefit actuarial liability AL is a value somewhere between V and A, the actual numbers depending on vesting percentages. For plans which use accrued benefit cost methods AL is listed on the firm's 5500, and can be compared in size to V. As one might expect given the small difference between V and A, AL is not much larger than V.

Guaranteed benefits, representing the firm's maximum liability in the event of termination, are fairly complex. As explained earlier, certain vested benefits are not guaranteed. However, upon termination of a plan the PBGC calculates the present value of guaranteed benefits based on their own annuity values. For April-June 1979 the figures used in valuing annuities are given in footnote 30.³³ To the extent that these interest rates are below market rates (they are supposed to be comparable to market) the value of guaranteed benefits is overstated. This does not affect the worker of a terminated plan, who receives the same cash flows, but does affect firms terminating with insufficient assets to cover all guaranteed benefits. By overstating guaranteed benefits the PBGC can

force an insufficient terminating firm to ante up a greater percentage of the value of its equity (up to the thirty percent maximum). In this way the advantage to a firm of terminating and having only to pay for guaranteed rather than vested benefits is reduced. Low PBGC interest rates also create a disincentive for well funded plans to terminate, as the low return estimated by the PBGC effectively means that a smaller fraction of accrued benefits will be covered.³⁴

For a non-union plan making termination costs exceed vested benefits implies that a plan has no incentive to terminate. Thus, some of the instability problems of underfunded non-union plans are eliminated.

Regarding unionized plans, increasing termination costs can either help the workers, the firm, or have no effect. Table 3 lists all permutations, giving the added cost to the workers and the firm of immediate termination, and assuming constant renegotiation.

The problem can be discussed analytically by adding the following notation:

- A*, G* - PBGC valuations of accrued and guaranteed liabilities, greater than A and G because of conservative actuarial assumptions.
- F* - Market value of benefits PBGC will provide with assets of F, less than F because of low rate of return projections.
- F+ - $F + .3E$, the maximum firm liability

Then, upon termination workers receive

$$(9) \left\{ \begin{array}{lll} G & \text{if} & F < G^* \\ F^* & \text{if} & G^* < F < A^* \\ A & \text{if} & A^* < F \end{array} \right.$$

The firm

$$(10) \left\{ \begin{array}{lll} \text{pays } .3E = F+ - F & \text{if } F+ < G^* \\ \text{pays } 0 & \text{if } G^* < F < A^* \\ \text{receives } F - A^* & \text{if } F > A^* \end{array} \right.$$

The PBGC pays

$$(11) \left\{ \begin{array}{lll} G^* - F^* & \text{if } F+ < G^* \\ 0 & \text{if } F+ \geq G^* \end{array} \right.$$

and the "insurance company" which sells policies with low interest rate assumptions (an accounting fiction for part of the PBGC's function if policies are not actually bought) profits by

$$(12) \left\{ \begin{array}{lll} G^* - G & \text{if } F < G^* \\ F - F^* & \text{if } G^* < F < A^* \\ A^* - A & \text{if } A^* < F \end{array} \right.$$

The above can be summarized more compactly as:

- (9.1) workers' claim = $\max [G, \min (A, F^*)]$
- (10.1) firm's claim = $\max [F - A^*, \min (0, \max [F - G^*, F - F+])]$
- (11.1) PBGC claim = $\min [0, F+ - G^*]$
- (12.1) "insurance company" profits = $\min [(A^* - A), \max (G^* - G, F - F^*)]$

Of course, the sum of 9.1, 10.1, 11.1, and 12.1 must equal F.

Table 3

Who Benefits from Conservative PBGC Assumptions

Order of Variables	Money Received In Termination		Cost of Actuarial Assumptions		Relative Beneficiary of Assumptions
	Workers	Firm	Workers	Firm	
(1) $F > A^*$	A	F-A*	0	A*-A	workers
(2) $A^* > F > \textcircled{G^*A}$	F*	0	A-F*	F-A	?
(3) $A > F > G^*$	F*	0	F-F*	0	firm
(4) $G > F^+$	G	F-F+	0	0	0
(5) $G^* > F^+ > G > F$	G	F-F+	0	F+-G	workers
(6) $F^+ > G^* > G > F$	G	F-G*	0	G*-G	workers
(7) $\textcircled{G^* A F^+} > F > G$	G	F-F+	F-G	F+-F	?
(8) $G^* > F^+ > F > A$	G	F-F+	A-G	F+-A	?
(9) $F^+ > G^* > F > A$	G	F-G*	A-G	G*-A	?

Results independent of ordering of encircled variables.

Because of these complications guaranteed benefits will generally be assumed to equal vested benefits in this work except in one closely examined case.

Finally, it is necessary to choose the appropriate interest rate to value pension liabilities. Ideally, one would like to have the cash flow pattern of pension liabilities and discount that pattern by riskless nominal rates of interest derived from calculating a term structure. Because the cash flow data is not available, it was decided to attempt a gross correction for all data using a conservative long term interest rate. The yield on 30 year Treasury bonds was 7.30 percent at the end of 1976 (the year for which most data is available), so an interest rate of 7.25 percent was chosen. Actually, 7.25 percent is conservative in several respects. First, the yield curve was rising in December 1976. As pension liabilities have a longer duration than 30 year bonds using the actual cash flows and term structure probably would have decreased the present value of the liability of most plans. Second, interest rates at the end of December 1976 were lower than at any time in the past five years. At the end of 1977 30 year bonds yielded 7.97 percent and by the end of 1978 8.93 percent. Third, the exemption of treasury bond interest from state and local taxes may have a slight impact on the yields of those securities. A case could be made for using the slightly higher AAA bond yields, since the tax advantage is not valuable to tax-exempt pension funds.

Estimating the effect of a change in the interest rate assumption is not easy, though there are some rules of thumb used in the actuarial profession. These rules give estimates of the sensitivity of the present value of benefits to the interest rate assumption. Basically, the approxi-

mation is that a change in the interest rate assumption from five to six percent reduces pension costs by twenty percent. The implication is that the duration of pension debt is slightly longer than the duration of a consol. Furthermore, the timing of pension debt is such that its duration is less sensitive to interest rates than is a consol's duration.

For example, in Figure 1 we see that vested pension benefits (in dollar terms, not adjusted for interest) owed tend to have a distribution which peaks several years in the future.³⁵ A consol has constant payments.

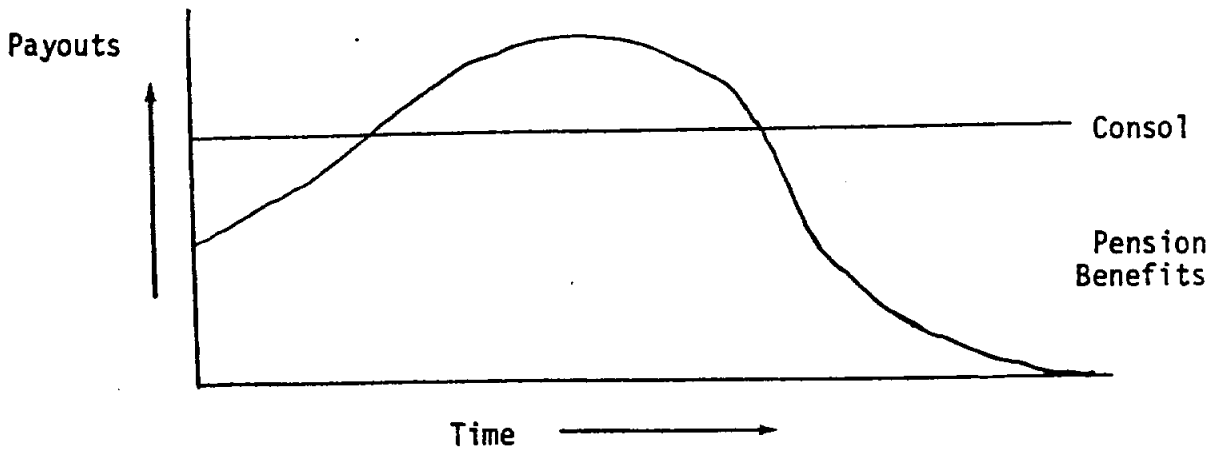


FIGURE 1

Now imagine that the consol and the pension benefits had the same duration. An increase in interest rates will decrease the duration of the pension debt by less than the consol. That is because with an increase in interest rates the consol, with more short term and very long term liabilities, will find the relative weight of its short debt increased relative to the pension case. For example, in the extreme case where all pension debt is due after 20 years, a five percent interest rate would give the consol and pension debt identical durations (and some sensitivities in value to the interest rate). However, if the interest rate rose to

six percent, the duration of the consol would be 16-2/3, while the duration of the pension debt would still be 20. This analysis implies that a conservative estimate of the change in value of pension debts with regard to an interest rate increase is to assume the debt is proportional to one over the interest rate.

Assuming that plans make realistic actuarial assumptions other than for interest rates (and salary growth, which is irrelevant) it is now possible to examine some plans in detail.

B. Examining Specific Pension Plans

In this section the two major pension plans of the Goodyear Tire and Rubber Company will be examined in some detail. Next, other plans of major industrial firms (Dow Jones Industrials about whom I could obtain data and IBM) are discussed. This section provides background for Section C which makes estimates for the defined benefit sector as a whole.

Goodyear has two major pension plans -- the 1950 Pension Plan (for hourly workers) and the Retirement Plan for Salaried Employees. As of the end of 1975, the 1950 plan had assets of \$264 million, and vested benefits of \$527 million. However, of these vested benefits, slightly

over 20 percent were due to a recent plan amendment. Even assuming no prior amendments in the past five years, guaranteed benefits would only be \$420 million. Also, Goodyear uses an interest rate assumption of 6 percent. A more appropriate rate would have been on the order of 7.25 percent or even higher. When data becomes available to make calculations for 1978 (probably in March of 1980), there will be even more dramatic divergences because of long-term interest rates, at that point being approximately 9 percent.

Using this rule (that pension debt is inversely proportional to the interest rate assumption), the use of a 7.25 percent interest assumption would reduce the value of Goodyear's vested benefits to \$436 million and the value of guaranteed benefits to \$349 million.³⁶ With assets of \$264 million in the plan, a termination would cost \$85 million (before tax).

The Goodyear plan for salaried employees had \$468 million in assets and \$537 million in vested liabilities, with about 15 percent of benefits new (not guaranteed). Adjusting for a 7.25 percent interest rate reduces the plan liability to \$444 million. In a termination, non-vested benefits would immediately vest, using up the surplus. Under any circumstances, the firm's net position associated with this plan is approximately zero.

Combining the plans, two terminations would cost the firm \$85 million, plus some extra money because Goodyear would be forced to maintain the plan until the end of its current contract. Also, if PBGC interest rate assumptions are overly conservative guaranteed benefits may be valued more highly by the PBGC than by the market, thus raising termination costs.

It is true that many vested benefits will become guaranteed over the next few years, but this cost can be ascribed to recent labor agreements. Ignoring the implicit contract hypothesis, one must assume that the firm will receive valuable services for providing these benefits. These extra benefits which have been contracted for are thus liabilities in the same respect as future wages are liabilities. It is inappropriate to include them on the balance sheet unless an offsetting entry for the value of future labor services is included.

Note that if current interest rates of nine percent were used that Goodyear, with a relatively poorly-funded plan, would actually have a surplus. As it is, \$332 million in unfunded vested benefits only yield a pre-tax liability for the firm of something less than \$100 million.

One other point worth mentioning is in regard to the plans of General Electric, Woolworth, and Esmark. Each of these plans uses the accrued benefit cost method for calculating the value of prior service costs. For General Electric, the actuarial value of all pension liabilities (vested and unvested) is \$130 million, or three percent, above the value of all vested liabilities. For Woolworth and Esmark the difference is one to two percent.³⁷ Thus, whether or not there is an implicit contract that benefits accumulated prior to vesting are counted as wages in the pre-vesting years only affects total pension costs by a small amount. This is consistent with the Winklevoss estimate that immediate vesting would only add six percent to costs.

One point to note is how much better funded the salaried plan is than the hourly plan. This is because of the implicit zero growth

assumption in the hourly plan, discussed earlier. Each time benefits are increased, a new supplemental liability is created which is funded over many years. With the salaried plan growth in salaries and benefits are both expected. The plan needs to be amended much less frequently, and new supplemental liabilities are created much less often.

Below, data are provided for a number of plans. The first column contains the plan's interest rate assumption, the second the value of plan assets, and the third the book value of vested benefits.³⁸ Column four lists the plan's book unfunded vested benefits. Column five gives the same number adjusted for a 7.25 percent interest assumption. Finally, column six gives an estimate of the firm's net position if the plan immediately terminated, assuming that total benefits are guaranteed, and the thirty percent rule is ignored. [Table follows on next page.]

Note that even with conservative assumptions the net liabilities of these firms were not very large, except for International Harvester and Chrysler. Also, it is virtually impossible to gain any information from only the reported unfunded vested liability number. This information must be combined with the interest rate assumption and the current value of assets in the plan. With these three numbers, however, it is possible to make a rough guess about the net position of the firm. These data are particularly valid for plans involving salaried employees. The reason is that for salaried employees there are typically no long-term wage contracts.

With long-term contracts an extra problem develops. Before a contract is signed, it is true that the value of the union's position is

TABLE 4: Analysis of Plans' Net Pension Liabilities

Date	Interest* Rate Assumption	Value of** Plan Assets	Book Value** of Vested Benefits	Book** Unfunded Vested Benefits	Adjusted** Unfunded Vested Benefits	Net Cost** of Termination
(1) American Brands Retirement Plan 12/31/75	5.00	70	163	93	42	42
(2) AT&T Plan for Employees' Pensions, Disability Benefits and Death (parent company) 12/31/76	5.00	808	836	28	(231)	(173)
(3) Chrysler Corporation Pension Agreement with U.A.W. 12/31/75	6.00	606	1,424	818	573	573
12/31/76	6.00	749	1,499	750	492	492
(4) Chrysler Corporation Pension Plan 12/31/75	6.00	189	348	159	99	99
12/31/76	6.00	230	377	147	82	82
(5) Chrysler Corporation Salaried Employee Retirement Plan 12/31/75	6.00	259	313	54	0	0
12/31/76	6.00	313	356	43	(18)	0
(6) Eastman Kodak Retirement Income Plan 12/31/75	6.25	1,197	1,169	(28)	(189)	(88)
(7) E. I. DuPont Pension and Retirement Plan 12/31/75	6.00	2,102	2,680	578	116	116
6/30/76	6.00	2,408	2,863	455	(39)	0
12/31/76	6.00	2,582	3,059	477	(50)	0
(8) Esmark Pension Plan for Non-Salaried Employees 12/31/76	8.50	130	188	58	90	90
(9) Exxon Corporation, Annuity Plan of 6/30/75	7.50	1,097	947	(150)	(117)	(19)
(10) Exxon Corporation and Participating Affiliates, Annuity Plans of 12/31/76	7.50	1,842	1,700	(142)	(83)	0
(11) F.W. Woolworth Retirement Plan 12/31/75	4.75	127	170	43	(16)	(5)
12/31/76	5.50	147	185	38	(7)	0

equal to its termination benefits. When a new contract is signed, theoretically the present value of wage and benefit payments over the life of the contract should be considered as a liability, with the firm also holding an asset, equal in value, of the present value of future labor services. Absent of a pension plan, accounting simply ignores both this asset and this liability. Net worth is undisturbed by this omission. However, now consider vested pension liabilities and the analyst who tries to value these benefits in determining corporate worth.

A new contract may include some immediate increase in vested benefits (an increase in the benefit formula which applies retroactively to past service). This increase, however, should rightfully be considered part of the wages received over the length of the contract. It is true that each worker could leave his job and keep his higher vested benefits, but to the extent that a union is able to bargain for more than competitive wages for its workers, and the increase in vested benefits is part of that surplus, the problem of extra workers leaving is not very important. (An intra-union "social security" system of the type discussed earlier also eliminates this problem.) Ideally, then, the total value of benefits to be accrued over the length of the wage contract should be expensed over the life of that contract -- rather than primarily at the beginning of the contract. In the case of a plan with a recent amendment, such as Goodyear's 1950 plan, looking at vested benefits may provide an overstatement of a plan's liability. (There is more difficulty in understanding amendments retroactively increasing benefits for salaried employees. One possible reason would be to encourage early retirement. Another possibility must be some sort of implicit arrangement with current and future employees. Finally, it must be

remembered that the managers of the firm are subject to the same pension plan as other salaried workers. As senior employees, any amendment which increases benefits for past service helps those employees the most.)

C. Pension Plan Population as a Whole

Looking at a broader plan population, it becomes even more apparent that the private pension system as a whole is solvent. All plans other than defined benefit plans are, by definition, always fully funded from the point of view of the firm. Total assets of the defined benefits plans included in the 1979 Money Market Directory exceeded \$137 billion for 5,279 plans with assets of one million dollars or more. Fortune Magazine in November of 1977 estimated that unfunded vested benefits exceeded \$25 billion. Ignoring overfunded firms and adding 50 percent to the Fortune number gives a total value of vested benefits of approximately \$175 billion. A survey of firm interest rate assumptions in the May 1977 Institutional Investor (p. 48) yielded an average interest assumption (unweighted by fund assets) of 5.85 percent. A survey by the Financial Executives Research Foundation [in Financial Aspects of Private Pension Plans, by Mario Leo, Preston C. Basselt, and Ernest S. Rachline, Financial Executives Research Foundation, New York] produces an average interest assumption of well under 5.5 percent for 259 firms. The Bell System, with pension funds in excess of \$18 billion, uses an interest assumption of 6 percent. Combining this information, a reasonable assumption appears to be that on average these benefits are computed using no more than a 6 percent interest assumption. (Note that benefits calculated using a rate x percent below the mean summed with equal benefits discounted at rate x percent above the mean would yield a total higher than if all the benefits were discounted at the mean rate. Therefore, assuming all benefits were

discounted at the mean rate overestimates the actual flow of benefits, and leads to an overestimate of the true value of the liability.)

Now combine the "consol approximation" that liabilities are inversely proportional to the interest rate assumption with an average interest rate assumption of six percent. With an interest assumption of 7.25 percent, the liability is reduced to \$145 billion, for a net liability of no more than \$8 billion. An interest assumption of 9 percent would imply a \$20 billion surplus.

There are three caveats to make about this apparently healthy pension fund situation. First, the magnitude of the pension debt is extremely sensitive to the implicit contract issue. Second, the asset and liability sides of the pension balance sheet are both extremely volatile. Thus, even if firms have a positive net pension position at the moment, there is a chance that fluctuations in the stock market and long term interest rates could substantially improve or worsen that position in a short period of time.

Third, the wide variation from plan to plan means that some expensive terminations (like Chrysler) can occur even if the average plan is well funded.

As to the first issue, Winklevoss [26] provides some estimates as to the relative amount of plan assets accumulated under various funding methods. Projected benefit methods can be thought of as funding implicit contract liabilities, while accrued benefit methods only fund specific liabilities. These estimates (p. 213) indicate that under the assumptions used in his book the projected benefit methods would accumulate at least 45 percent more funds than the accrued benefit cost methods. Thus, if there are implicit contracts, possibly 45 percent must be added to pension liabilities. For a firm which has funded two thirds of its accrued liabilities, including the additional projected benefit costs can more than double pension

debt. As an example, American Can had \$126 million in unfunded vested liabilities and \$351 million in unfunded prior service costs (i.e. projected benefit liabilities) at the end of 1977.

For the issue of volatility, one need only note that the stock market has a standard deviation of roughly one percent a day, and that just as the increase in long term interest rates over the last few years has reduced pension debt, a decrease in rates would have the opposite effect. There is some correlation in the changes in value of pension assets and liabilities, but dramatic changes could create unfunded guaranteed benefits for many plans and make termination a viable alternative for more plans.

Another way to estimate unfunded pension liabilities is to use data from [27]. In a survey of 574 firms' annual reports (including the Fortune 500) 511 companies reported total vested liabilities of \$139 billion in 1977. Of these liabilities the funded portion represented 81 percent (over \$112 billion).

According to figures in the 1979 Money Market Directory,³⁹ 61.5 percent of corporate pension funds were in defined benefit plans. For the Fortune 500 this percentage is certain to be higher, but assume that that is the appropriate number. This implies that of the \$112 billion in funded liabilities, \$69 billion were in defined benefit plans. Adding on the total unfunded liabilities of \$27 billion (139 minus 112) yields total vested liabilities for these plans of \$96 billion.

Changing the interest rate assumptions from 6 percent to 7.25 percent would reduce the liability to \$79 billion, for a net deficit of \$10 billion. Allowing that the plans covered represent only half the assets

of all corporate plans leads to a projected total unfunded liability of \$20 billion. With an interest rate assumption of 8 percent⁴⁰ the \$20 billion figure would fall to \$6 billion, and 9 percent interest would imply a \$10 billion surplus. Especially considering that a portion of unfunded vested benefits are due to recent labor contracts (as discussed above), these figures are not terribly imposing. By and large corporate pension plans are fairly healthy.

D. Summary of Pension Funding Status

Though the data presented above are very spotty, they generally imply that corporate defined benefit pension plans are fairly well funded. Both specific plans and aggregate data were analyzed to support this conclusion.

The reason that large unfunded liabilities are often reported is primarily that firms tend to use conservative interest rate assumptions. In converting to current long term rates one substantially reduces the valuation of pension liabilities and makes plans appear to be well funded.

Three caveats must be repeated, however. First, these results ignore the substantial effect of any "implicit contract" pension liabilities the firm might have. Second, pension assets and liabilities are both risky, and changes in interest rates and/or securities prices can quickly alter plans' funding status. The substantial rise in long term nominal interest rates sharply decreased the value of vested benefits, making plans well funded. It is possible that an interest rate decline or a fall in the stock market may substantially worsen firms' pension funding status.

Third, the PBGC uses its own interest rates to value pension liabilities upon termination. These rates, supposedly based on market data, are quite conservative. For some firms this means that termination costs (the cost of paying the PBGC enough to meet all guaranteed benefits, subject to the 30 percent of equity limitation) may exceed the value of vested benefits. Table 3 summarizes the effect of the complex issue of PBGC conservatism, which may make a firm's bargaining position stronger or weaker.

In the near future data for 1977 should be available for improved empirical work in this area. Because of increasing nominal interest rates throughout 1977 and 1978, final returns for those years should also indicate that corporate pension plans have achieved a well funded status.

Footnotes

Note: 'S.' Stands for 'ERISA Section'

1. Defined benefit plans provide a well-defined formula for workers' pension benefits based on various known factors (e.g., years worked, salary history, age at which employee elects to begin receiving benefits). Defined contribution plans maintain a well-defined formula for firm contributions to an employee's retirement fund, with the value of the fund affected by the returns earned through investment. (An example of a defined contribution plan is the TIAA-CREF plan for university professors).
2. \$137 billion out of a total of \$228 billion in assets of large (one million dollars or more) corporate pension plans were held in defined benefit plans (1979 Money Market Directory).
3. S. 203 (a)(1).
4. S. 203 (a)(2)(B)
5. S. 203 (a)(2)(A).
6. S. 203 (a)(2)(C)(i).
7. S. 203 (b)(1).
8. S. 204 (b)(1)(A).
9. S. 204 (b)(1)(B).
10. S. 204 (b)(1)(C).
11. Given that exponential salary growth has been assured, this is no different from saying that benefits are equal to a constant times the average of the final n years' salary, where n is less than the number of years worked.
12. Under ERISA, plan actuaries are more responsible than before for the reasonableness of plan assumptions, causing the actuaries to push for more conservative accounting. See ERISA Sections 103 (a)(4) and
13. The projected benefit method also implies that the worker makes a percentage of his income subject to unsystematic risk. If he leaves the firm early he will not receive his expected share of excess pension benefits when older. This adds uncertainty for the individual but is not a risk for which compensation can be extracted.

302 (C)(3) as well as Internal Revenue Code Section 412 (C)(3) regarding the reasonableness of actuarial assumptions, and ERISA Section 103 (d)(3) regarding the justification of changes in assumptions.

14. That is, the present value of a worker's benefits after 40 years of service would be $16/3$ as great as after 30 years - $4/3$ greater because of more years worked, twice as great because of a higher salary base, and twice as great because the annuity would be starting immediately rather than 10 years in the future. This last doubling would have occurred even if the employee had terminated his employment. Thus, benefits are only $8/3$ as high as if the employee hadn't worked the last 10 years, and this is the number to be captured.
15. Interestingly, if one does not believe in the implicit contract theory, a defined benefit plan which provides the worker with a benefit equal to x percent of his final salary times the number of years worked will be a smaller plan than a defined contribution plan which provides workers of equal annual total compensation a benefit which turns out to equal the same fraction of total salary. If the employee terminates early he gets a smaller pension under a defined benefit plan because of backloading. If he leaves at normal retirement he gets a smaller benefit because in his final year wages are a smaller percentage of total compensation and a pension equal to a fixed percentage of that final wage is also smaller.
16. See Sharpe [22]. The pension put is the value to the firm of being able to terminate its pension plan at the end of a given contract period. If a plan is underfunded it may terminate or, equivalently, get equal value by having the work force agree to lower wages in return for plan continuation.
17. In fact, one of Chrysler's main levers in negotiating with the government is the cost of a Chrysler pension termination. It is the government, rather than the company, which appears to be more interested in maintaining the plan. (This issue is further discussed later in the paper.)
18. "Premium Requirements for the Single Employer Basic Benefits Insurance Program, Part 1," Pension Benefit Guaranty Corporation, Staff Document, p. ii-4.
19. "4th Quarter Bulletin, July 1 - September 30, 1978," Pension Benefit Guaranty Corporation. Unpaged.
20. For a detailed listing of which benefits are in which category see: Federal Register, Wednesday, November 3, 1976, Part IV: Pension Benefit Guaranty Corporation Pension Plans, Benefits, Interim Regulations and Notice of Proposed Rulemaking.

21. The PBGC estimates guaranteed benefits (i.e., categories 1 through 4) to represent 71 percent of accrued benefits (all benefits in categories 1 through 6) for plans which have terminated. Vested benefits (benefits in categories 1 through 5) are estimated to represent 86 percent of accrued benefits. Note that accrued benefits include benefits which would have been forfeited by employees who would have left the firm before vesting. Also, these figures may not be representative of the plans of large corporations. See "Premium Requirements for the Single Employee Basic Benefits Insurance Program, Part 1," PBGC, p. iii-34.
22. $V > F$ does not imply that the plan will terminate, only that if a union is negotiating a new contract part of the cost of the contract will be any new accrual of pension wealth. In these negotiations beginning pension wealth is the lesser of V and F.
23. If funded benefits are less than the vested benefits of already retired workers there is an incentive to terminate, because otherwise current workers will have to sacrifice part of their compensation to maintain benefits to retired workers. This is probably why many plans give priority to the benefits of already retired workers. For a plan to be substantially underfunded in relation to retirees' benefits and still be viable, retired workers must have a say in union matters, as they do in the United Mine Workers union.
24. If a wage contract provides for continuation of a plan and the firm decides to terminate (for example, it closes the plant where the plan was effective), the workers may be able to force the firm to increase termination benefits. (See in Re: Strick Corporation, UAW Pension Plan, PBGC 4th Quarter Bulletin July 1 to September 30, 1978.)
25. This is an extreme anti-implicit contract view stating that a worker who is with a firm with cliff vesting suddenly has a change in his pension wealth from zero to the amount of his accrued benefits. A more realistic assumption is that there is an implicit contract equilibrium in which workers consider the value of their pension wealth before termination to be equal to unvested accrued benefits times the plan's expected vesting probabilities.

This is effectively the view taken by the FASB in its recent Exposure Draft. [27].

Two points should be noted here. First, because such a small percentage of a worker's benefits are accrued in his early years of service whether one includes or excludes the actuarial liability of non-vested workers makes a small percentage difference in calculating a plan's total actuarial liability (see the empirical section for examples). Second, in plans where most workers are not expected to become vested there can be a significant difference between accrued benefits (the pension wealth of a union with a well funded plan) and the actuarial liability referred to above (the pension wealth of non-organized workers in a well-funded plan).

26. For example, Wheeling-Pittsburgh Steel Corp. is notorious for having a vastly underfunded pension plan. However, given that it hopes to receive \$150 million in federal loan guarantees sometime soon (August 1979) it may feel that pension plan termination at this time would be impolitic.

Chrysler, quite clearly, can use the threat of plan termination to increase its leverage with the federal government (and in fact has been very helpful to the PBGC in determining the cost of the termination of its 11 plans if the government does not bail the company out). If there is a bailout and the plans do not terminate, the PBGC may not be charged with the cost but in a realistic sense that is only because the government may choose to pay up in a different manner.

27. Of course, the employees hold pension wealth as an asset but have future consumption needs as a liability. They may be hedged to the extent that an increase in real interest rates reduces the value of both pension wealth and the consumption liability.

28. See Miller [14].

29. See Black, Jensen, and Scholes [4].

30. A tax deferred annuity is purchased with after-tax dollars, and tax is paid on any future accumulations. Thus, a dollar of pre-tax salary devoted to such an annuity payable after T years, with r the rate of return, τ_w the tax rate while working, and τ_R the tax rate after retirement, will eventually yield $(1-\tau_R)(1-\tau_w)(1+r)^T + \tau_R(1-\tau_w)$ while a dollar devoted to one of the superior options would produce $(1-\tau_R)(1+r)^T$, unambiguously more when r is positive and tax rates are between zero and 100 percent.

31. There should be improvement over the next two years as new Labor Department and FASB Standards are adopted.

32. That is, those that do not use an aggregate projected benefit method without supplemental liability (also called the aggregate method).

33. The interest rates used to value annuities in the second quarter of 1979 were: Interest rate for valuing immediate annuities -- 7.50 percent.

Define the value of an immediate annuity for a person aged y as G_y . Then the value of a deferred annuity G_x for a person aged x is given by $G_x = R(x,y) G_y$.

The value of $R(x,y)$ is computed as follows:

- (1) If $n \leq n_1$ then $R(x,y) = \frac{\ell_y}{\ell_x} K_1^{-n}$.
- (2) If $n_1 < n < n_1+n_2$ then $R(x,y) = \frac{\ell_y}{\ell_x} K_1^{-n_1} K_2^{-(n-n_1)}$.
- (3) If $n < n_1+n_2$ then $R(x,y) = \frac{\ell_y}{\ell_x} K_1^{-n_1} K_2^{-n_2} K_3^{-(n-n_1-n_2)}$.

Where $n = y-x$ and $\frac{\ell_y}{\ell_x}$ = the probability of a person aged x living to age y . The values for April-June 1979 were:
 $K_1 = 1.0675$ $K_2 = 1.055$ $K_3 = 1.040$ $n_1 = 7$, $n_2 = 8$. See [17], page 48488.

34. Actually, the PBGC calculates its rates by taking the averages of interest rates used by 10 life insurance companies. It also permits plans to buy contracts to pay their liabilities if they can find insurance companies who will provide rates better than those offered by the PBGC. With this option, combined with the fact that usually at least one firm is going to offer better rates than the PBGC (Banker's Life always has) the PBGC rates would appear unimportant. However, a glance at PBGC rates indicates that the insurance companies tend to use very conservative interest assumptions. A fair amount of money is effectively allocated for administrative and selling expense. Also, since there is relatively little debt of as long a duration as much pension debt, insurance companies need to be cautious in the rates they offer because of difficulties in hedging.
35. Consider a plan in steady state. In the next few years old people with pensions based on small salaries are to be replaced in the retired population by younger people with higher salary bases. The higher salary base means that these workers have already accrued greater annual benefits than the retired workers, even though they have not worked as many years. Of course benefits accrued for payment in 50 or 60 years are extremely small.
36. For the Goodyear Plan this seems particularly conservative, since the firm mentions that a change in interest rate assumption from 5-1/2 to 6 percent reduced the present value of vested benefits by 15 percent.
37. Consider the Esmark, Inc. Pension Plan for Non-Salaried Employees. As of January 1, 1976 the plan had \$188,192,000 in vested benefits and \$190,436,000 in accrued liabilities. The difference of 2,244,000 represents the entire actuarial value of the plan's nonvested accrued benefits. (Esmark employs 10-year "cliff" vesting.)

38. All data are taken from the Schedule B Form 5500 reports of the plans cited.

39. Fitzgerald, T. H. Jr., ed., Money Market Directory 1979. Money Market Directories, Inc., Charlottesville, Va., 1978. This source reports as follows:

Company and eleemosynary (corporation organized for charitable purposes) pension, thrift, and profit-sharing plans over \$1 million--9,587 with assets of \$223.648 billion.

Union member benefit funds, with headquarters and local portfolios over \$5 million--737 with assets of \$21.833 billion.

Government employee benefit funds (state, county, and municipal funds over \$5 million)--597 with assets of \$144.829 billion.

Educational endowment funds (college and private school trusts over \$8 million)--435 with assets of \$18.401 billion.

Private foundation funds (charitable organizations owning over \$20 million)--324 with assets of \$18.890 billion.

Tax Exempt funds (total of above)--11,680 with assets of \$427.601 billion.

40. Long term government bond rates were 7.97 percent at the end of 1977.

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