Volume Title: Issues in Pension Economics

Volume Author/Editor: Zvi Bodie, John B. Shoven, and David A. Wise, eds.

Volume Publisher: University of Chicago Press

Volume ISBN: 0-226-06284-8

Volume URL: http://www.nber.org/books/bodi87-1

Publication Date: 1987

Chapter Title: Funding and Asset Allocation in Corporate Pension Plans: An Empirical Investigation

Chapter Author: Zvi Bodie, Jay O.. Light, Randall Morck

Chapter URL: http://www.nber.org/chapters/c6852

Chapter pages in book: (p. 15 - 48)

2 Funding and Asset Allocation in Corporate Pension Plans: An Empirical Investigation

Zvi Bodie, Jay O. Light, Randall Mørck, and
Robert A. Taggart, Jr.

2.1 Introduction

Financial aspects of corporate pension funds have increasingly attracted the attention of corporate managers, government officials, and academics. For example, practitioners have been debating such topics as corporations' right to terminate overfunded plans and retrieve surplus assets (Hawthorne 1983; Louis 1983; Smith 1983), the contribution of corporate securities and leaseholds to pension funds in lieu of cash (Webman 1983), and the burden of unfunded liabilities on the Pension Benefit Guaranty Corporation (PBGC) (Colvin 1982; Munnell 1982). Among academics, interest has centered on the tax and incentive aspects of corporate pensions. Models of optimal capital structure have yielded new implications for plan funding and investment (Black 1980; Tepper 1981), while advances in option pricing theory have illuminated the perverse incentives created by PBGC insurance (Sharpe 1976; Treynor 1977).

As yet, however, there has been relatively little empirical work done on corporate pension funding and asset allocation. Studies by Friedman (1983) and Westerfield and Marshall (1983) have produced interesting findings, but many details remain to be filled in before a clear picture

Zvi Bodie is professor of finance, Boston University, and research associate, National Bureau of Economic Research. Jay O. Light is professor of business administration, Harvard University, and research associate, National Bureau of Economic Research. Randall Mørck is assistant professor of finance, Boston University, and consultant, National Bureau of Economic Research. Robert A. Taggart, Jr., is professor of finance, Boston University, and research associate, National Bureau of Economic Research.

We are grateful to Roger Ibbotson, Krishna Palepu, and Myron Scholes for helpful suggestions on an earlier draft. Funding from the United States Department of Health and Human Services is gratefully acknowledged.

of these decisions can emerge. Our purpose in this study is to add to the stock of empirical knowledge and to pay particular attention to the ability of current theory to explain our findings.

In section 2.2 we outline two different perspectives on corporate pension decisions, the traditional perspective and the corporate financial perspective, the latter of which includes the recent theoretical work on corporate pensions mentioned above. In section 2.3, we review the small body of previous empirical evidence. In section 2.4, we discuss a significant empirical problem, namely, that firms have considerable latitude in reporting their pension liabilities and may thus obscure the true cross-sectional relationship between funding status and financial condition.

In section 2.5 we discuss our data sources and present our results. We find that there is indeed a significant inverse relationship between firms' profitability and the discount rates they choose to report their pension liabilities. In view of this we adjust all reported pension liabilities to a common discount rate assumption. We then find a significant positive relationship between firm profitability and the degree of pension funding, as is consistent with the corporate financial perspective. We also find some evidence that firms facing higher risk and lower tax liabilities are less inclined to fully fund their pension plans. On the asset allocation question, we find that the distribution of plan assets invested in bonds is bimodal, but that it does not tend to cluster around extreme portfolio configurations to the extent predicted by the corporate financial perspective. We also find that the percentage of plan assets invested in bonds is negatively related to both total size of plan and the proportion of unfunded liabilities. The latter relationship shows up particularly among the riskiest firms, and is consistent with the corporate financial perspective on pension decisions.

2.2 Alternative Perspectives on Pension Funds

2.2.1 The Traditional Perspective

Defined benefit pension funds are segregated pools of capital that collateralize the future liabilities explicit (and perhaps implicit) in defined benefit plans. Viewed from what we shall call the "traditional perspective," pension funds are entirely separate from the corporation and its shareholders and should be managed without regard to either corporate financial policy or the interests of the corporation and its shareholders.

From this perspective, funding decisions should be based solely upon the expected future stream of employee pension liabilities, irrespective of corporate financial condition and/or policy. Likewise, asset allocation decisions within the fund should be made solely in the best interests of the beneficiaries. Unfortunately, it is quite unclear what asset allocation policy would be best for beneficiaries. For example, if the defined benefit liabilities were really fixed such that beneficiaries would not not and could not share in any surplus of pension assets over liabilities, then the beneficiaries would want a well-funded plan to be invested in the least risky assets, presumably fixed income securities. If, on the other hand, the beneficiaries were able to participate in the ownership of such a surplus, as Miller and Scholes (1981) and Bulow and Scholes (1983) have argued, then the optimal asset allocation would be much less clear and, in principle, could include virtually any mix of stocks and bonds.

2.2.2 The Corporate Financial Perspective

In recent years, academic theorists have built an alternative perspective from which pension decisions are viewed as an integral part of overall corporate financial policy. From this perspective, defined benefit liabilities are just one more set of fixed financial liabilities of the firm. Pension assets, while collateral for these liabilities, are really just assets of the firm in that the surplus/deficit belongs to the firm's shareholders. This integrated perspective is then concerned with how to manage the firm's extended balance sheet, including both its normal assets and liabilities and its pension assets and liabilities, in the best interests of the shareholders. This view explicitly ignores the interests of the beneficiaries, in part because their defined benefits are insured by the PBGC anyway. From the corporate financial perspective, then, the beneficiaries are protected by the government, and the corporate pension decisions become what amount to a game between the corporation and various government agencies and interests, a game that can be and should be thought of as an integral part of corporate financial policy.

The tax effects are the first, and for most companies the most important, part of this game. In closely related papers, Black (1980) and Tepper (1981) argued that the unique feature of pension funds from this integrated perspective is their role as a tax shelter. Because firms can effectively earn a pre-tax rate of return on any assets held in the pension fund and pass these returns through to shareholders much as if the pension fund were an IRA or Keogh plan, the comparative advantage of a pension fund lies in its ability to be invested in the most heavily taxed assets.

Presumably this means that pension funds should be invested entirely in taxable bonds, as opposed to common stock, real estate, or other assets that are in effect taxed at lower marginal tax rates for most shareholders. Black and Tepper further point out that if (and, by the way, only if) the pension fund is invested in more heavily taxed assets such as bonds, the corporation should fund its pension plan to the maximum extent allowed by the IRS so as to maximize the value of this tax shelter to shareholders. The tax effects of pensions should therefore induce corporations to follow extreme policies. Fully funded or overfunded pension plans should place their assets entirely in taxable bonds.

A second effect, which we label the "pension put" effect, is associated with the work of Sharpe (1976) and Treynor (1977). Briefly, the PBGC's insurance of pension benefits gives the firm a put option—it can shed its pension liabilities by giving the PBGC the assets in the pension plan plus 30% of the market value of its net worth. As with any option, the value of this put increases with the risk of the underlying asset. Thus, as long as the PBGC neither regulates pension fund risk nor accelerates its own claim at the first sign of financial distress, the firm has an incentive to undermine the PBGC's claim. It can do so and maximize the value of its put option by funding its pension plan only to the minimum permissible extent and investing the pension assets in the riskiest possible securities. These are, of course, the exact opposite policies from those suggested by the tax effects described above.

It is possible to combine these two effects, the tax effect and the PBGC put, in a joint model, as discussed by Harrison and Sharpe (1983), Bulow (1983), Chen (1983), and Westerfield and Marshall (1983). Thus the firm can be viewed as facing a trade-off—by overfunding and investing in bonds it maximizes tax benefits, but by underfunding and investing in risky assets it maximizes the value of the pension put. However, it can be shown that this trade-off does not produce a set of unique interior optimal policies, but rather implies that each firm should be following one of two very different extreme policies. If the firm is profitable and relatively safe, the pension put will probably have negligible value. Hence the firm should fully fund its pension plan and invest entirely in the most heavily taxed securities. On the other hand, if the firm is both unprofitable and risky, the tax shelter may be superfluous, and the pension put may be quite valuable. In order to maximize its value, the firm should underfund its plan to the greatest extent possible and invest entirely in the riskiest securities.

A third effect, which we label the "financial slack" effect, has emphasized the pension fund's usefulness as a source of corporate liquidity or as a store of temporarily excess corporate funds. The view that firms will maintain some financial slack has a long informal history based on the notion that they do not wish to be caught having to rely on external financing at "unfavorable" times. A more formal version of this idea has recently been developed by Myers and Majluf (1983), who posit that a firm's managers are likely to have better information about its prospects than outside investors. In that event, there is an adverse selection problem, since managers have an incentive to issue more stock when they believe that it is overpriced, and consequently, investors will react negatively to news of a stock issue. Managers therefore maintain some financial slack in order to avoid the necessity of a stock issue.

Such slack could be kept in the form of either liquid assets and unused debt capacity or pension assets. The latter is advantageous from a tax standpoint, but liquid assets and unused debt capacity are presumably substantially more accessible, particularly in the short run. While firms have increasingly attempted to tap their excess pension assets in recent years (Hawthorne 1983; Louis 1983; Smith 1983), the legality and regulatory status of these attempts has yet to be clearly defined. One might therefore expect firms to trade tax benefits against accessibility in deciding how much of their financial slack to keep in the pension fund. As Tepper (1983) has shown, this can, in principle at least, lead to an interior optimum with partial funding. The stronger are a firm's earnings and the greater its need for tax shelter, the greater will be its tendency to build financial slack in the form of additional pension assets, and vice versa.

Together, these different aspects of corporate pensions (the tax shelter, the PBGC put, and the accessibility of financial slack) form what we shall call a corporate financial perspective on pension policy.

2.2.3 Distinguishing among the Perspectives

The two perspectives discussed above are not, of course, mutually exclusive theories or prescriptions for pension fund policies. The traditional perspective emphasizes the separate and segregated role of pension funds and their relationship to the beneficiaries' interests. The corporate financial perspective emphasizes instead the integral role of pension decisions in overall corporate financial policy and its relationship to the shareholders' interests. Clearly, both sets of interests could be determinants of actual corporate pension decisions.

In addition, it is difficult to develop meaningful empirical tests that would distinguish clearly between the two different perspectives. We can, however, make some generalizations in that regard. Suppose, for example, that our cross-sectional tests reveal that companies' pension funding seems to be importantly determined by variables describing the companies' past and present financial condition and/or their tax-paying status. We would interpret this as evidence that funding was being determined in part by the corporate financial perspective, particularly if a stronger financial condition and tax-paying status appeared to be associated with greater funding. If, on the other hand, the degree of funding seemed to be independent of corporate financial condition (or if weaker financial companies actually funded more), we would interpret this as evidence that funding was being determined by the interests of beneficiaries, as in the traditional perspective on pension decisions.

Distinguishing between the two perspectives on the basis of empirical tests of asset allocation is more difficult, particularly because it is not at all clear what asset allocation policy or sets of policies would be consistent with our traditional perspective. Roughly speaking, if the observed frequency distribution of asset allocation across firms is quite bimodal with most firms at one extreme or another, we would interpret this as evidence that the corporate financial perspective is driving asset allocation decisions. In addition, if risky firms with underfunded plans tend to invest in stocks and safe firms with overfunded plans in bonds, we would interpret this as evidence that the corporate financial perspective was influencing asset allocation decisions. We will discuss these alternative interpretations in more detail in section 2.5.

2.3 Existing Evidence

Before proceeding to our own empirical work, it is useful to review the small body of evidence on corporate pensions that currently exists. Friedman (1983) has conducted the most extensive empirical study to date, using IRS Form 5500 data for a broad sample of firms for the year 1977. This source provides data on pension funding and pension asset allocation for the firms in the sample, and Friedman supplemented it with finanical data from the Standard and Poor's Compustat tape.

One of the primary questions that Friedman addressed was whether corporate pension plans can be viewed as an integral part of the overall corporate financing decision. In the terminology of section 2.2 above, he looked for evidence that the corporate financial perspective is an appropriate one from which to view pension decisions. Accordingly, he estimated a number of relationships of the following form: on the left-hand side of the equation appeared some aspect of the pension decision such as unfunded liabilities or the proportion of pension assets invested in bonds; on the right-hand side appeared some measure of conventional financing, such as ordinary balance sheet liabilities, plus one other control variable. Among the control variables used were a number of measures of firm profitability, risk, and tax-paying status.

Friedman concluded that pension decisions are indeed related to other aspects of the corporate financing decision. He found that unfunded pension liabilities and the proportion of pension assets invested in bonds are both positively related to ordinary balance sheet liabilities. He also found that a reverse relationship holds, with balance sheet leverage depending positively on unfunded pension liabilities, regardless of the control variable used.

Such interrelationships would be predicted by the corporate financial perspective. From that perspective, the channels through which pension fund decisions affect firm value are also conditioned by the overall financing decision. Balance sheet leverage affects the firm's tax-paying status, the risk borne by both the PBGC and the firm's employees, and the firm's available borrowing power. Hence the pension and capital structure decisions are tied to the same set of underlying factors. Viewed from the corporate financial perspective, the results that we report below, therefore, concerning the linkages between pension decisions and the firm's tax-paying status, profitability, and risk, should be thought of as reduced-form relationships from a larger system.

While there is some evidence of the related nature of pension and other financing decisions in Friedman's results, the picture becomes clouded when we attempt to identify different effects. The positive relationship between unfunded pension liabilities and ordinary debt, for example, suggests that whatever financial risk firms assume through their pension funds is magnified by their financing decisions. This could be interpreted as an indication that firms with unfunded pension liabilities try to maximize the value of the pension put through balance sheet leverage. However, Friedman's asset allocation results appear to contradict this conclusion. There, greater balance sheet leverage seems to be offset by more conservative investment of pension assets.

The picture that emerges from Friedman's control variables is also clouded. Higher risk, as measured by earnings variability, is associated with pension investment strategies that are more heavily weighted toward bonds. This is consistent with the relationship between leverage and pension asset allocation and could be interpreted as evidence that pension portfolios are managed to protect the beneficiaries, as predicted by the traditional perspective. However, Friedman also found a positive relationship between firm profitability and unfunded pension liabilities, which is hard to reconcile with the traditional perspective. In addition, he could find no relationship between firms' tax-paying status and either their funding or pension investment decisions. Overall, then, Friedman's results do not strongly favor one perspective to the exclusion of the other and indeed convey the feeling that corporate pension decisions are not well understood.

The only other extensive empirical work on the subject that we are aware of is by Westerfield and Marshall (1983). Using quarterly SEC data for approximately 400 corporations over the period from 1972 through 1977, they studied pension asset allocation. They could not attribute any significant change in asset allocation to passage of the Employee Retirement Income Security Act (ERISA) in September of 1974, nor could they find a significant link between the asset mix and the variability of the PBGC's claim on the firm. They did find that the proportion of pension assets invested in stock was positively related to unfunded liabilities in the post-ERISA period, which is consistent with the pension put effect. However, this relationship was not statistically significant.

In summary, existing results do not clearly identify the appropriate perspective from which to view corporate pension decisions. Nevertheless, other avenues of inquiry have yet to be explored. There are additional sources of data that can be examined, and the data can also be adjusted in different ways. One such adjustment concerns the discretion that firms currently have to choose a discount rate for reporting their pension liabilities.[1]

2.4 The Choice of a Discount Rate for Reporting Pension Liabilities

Suppose, as current theory suggests, that there is a relationship between firms' financial condition and their optimal funding decisions. In order to report the funding levels they have chosen, firms must select discount rates pursuant to Financial Accounting Standards Board (FASB) Rules 35 and 36. But suppose further that they choose these rates in a manner that varies systematically with their financial condition. If empirical work is conducted using reported funding measures, the true cross-sectional relationship between financial condition and uniformly calculated measures of funding status could be obscured.

Firms must choose a discount rate for both funding purposes and reporting purposes, and there is reason to believe that both of these rates may vary inversely with firm profitability. Changes in the rate used for funding purposes may allow the firm to loosen the Internal Revenue Service's constraint on maximum funding. A decrease in the assumed rate, for example, increases the pension liability measure and allows further funding to take place. The IRS would presumably impose limits on this practice, but it is clear that it is not forbidden altogether. Unfortunately, it is not possible to trace this effect empirically, since the rates used for funding purposes and for FASB 35 and 36 reporting purposes may differ and data are available only for the latter rates. To the extent that the two rates are correlated, however, as they seem to be, reductions in reported rates may reflect reductions in funding rates that are made to achieve tax savings.

At the opposite end of the funding spectrum, increases in assumed discount rates will reduce reported pension liabilities, and this may allow firms to loosen the Department of Labor's constraint on underfunding. Such an effect, of course, depends on the presumption that the DOL either is deceived by or reacts passively to these discount rate changes.

Firms may also wish to change their assumed discount rates in order to manage the flow of information to shareholders and/or employees.

By altering the discount rate chosen for funding purposes, a firm can effectively smooth its reported earnings over time, a practice that was evident in Friedman's (1983) empirical results. Furthermore, by altering the discount rate chosen for reporting purposes, a firm can attempt to obscure its management over time of financial slack, reported earnings per share, and/or the value of its unfunded liabilities. It might hope, for example, to obscure this process from investors who might otherwise interpret reduced funding as negative information on the firm's current or prospective financial condition. It might also hope to obscure this process from employees, for example, to limit labor unions' efforts to bargain for the financial slack being held in the form of overfunding.

Whether changes in the discount rate are aimed at real funding constraints, or simply at investors' and/or employees' perceptions of the firm, we might expect an inverse relationship between the rate chosen and the firm's profitability. When earnings are strong, the firm might want to build up financial slack without making that fact too obvious, so there should be a tendency to choose lower discount rates. When earnings are weak, the reverse might be true. In the empirical work that follows, we test this proposition and also adjust reported pension liabilities to a common discount rate to correct for any systematic biases.

2.5 Empirical Tests

2.5.1 The Data

The aim of our empirical work was to seek regularities in the funding and asset allocation of pension plans across a broad spectrum of U.S. corporations. In particular, we wanted to see if pension fund decisions were related to various measures of firms' financial condition, as suggested by the corporate financial perspective. Thus we were looking for significant relationships between firms' funding levels and their profitability, tax-paying status, and risk, as well as between their allocation of pension assets and their risk. It was our hope that this would allow us to assess not only the plausibility of the corporate financial perspective as a whole but also the strength of the tax, pension put, and financial slack effects.

The first group of variables for which we needed data consisted of pension fund characteristics for a sample of firms. We chose to take the bulk of these data from FASB Statement 36 filings for the year 1980. Figures were available for 939 corporations, ensuring a fairly broad cross-section, and, of particular importance for our purposes, this source included data on the interest rate assumptions used by these firms in reporting their pension liabilities.

To measure the levels of pension funding for these firms, we first took reported pension liabilities and adjusted them to a common discount rate to correct for any systematic tendencies toward over- or underreporting. We chose 10% for our common rate, since this was approximately the rate used by the PBGC around this time to value the liabilities of terminated plans (Munnell 1982). In the absence of detailed information on the time profile of different firms' pension liabilities, we made the adjustment simply by multiplying each firm's reported liabilities by the ratio of the assumed discount rate to 10%. We used two measures of pension liabilities, adjusting both in the same manner. These were the present value of vested pension benefits and total accrued (that is, vested plus unvested) benefits. We then divided total pension assets (reported in the FASB 36 filings) by each of these liability measures to arrive at two measures of the level of pension funding.

The FASB 36 data did not include a breakdown of pension assets by security type. We were able to obtain asset allocation data from Greenwich Research Associates for a sample of firms, 369 of which overlapped with our FASB 36 sample. As our measure of asset allocation we used the proportion of total pension assets invested in fixed income securities, which include cash and short-term investments, bonds, guaranteed investment contracts, and insured pension plans.[2] We also obtained Greenwich data on the proportion of pension plan participants already retired for each firm. Under the traditional perspective, the allocation of pension assets might be affected by demographic characteristics of the participant pool, and we wished to test this possibility.

The second type of variable for which we needed data was firm profitability. We chose to measure this as 1980 inflation-adjusted return on net assets, or inflation-adjusted operating profits divided by the replacement cost of the firm's assets. These inflation-adjusted data for 1980 were available from FASB Statement 33 filings, but only for 508 of the 939 firms in our original sample.

The choice of this profitability measure was dictated primarily by two considerations. First, if we interpret our equations as reduced-form equations from a larger system, it is appropriate to consider the profitability measure that is driving the full system. Presumably the overall financial structure decision is affected by real profitability rather than some profitability concept that is subject to inflationary distortions. In addition, the reduced-form notion suggests that operating profit, which does not already reflect the firm's leverage choice, is the most appropriate profitability measure.[3] Second, the financial slack effect would seem to depend on a real profitability measure. Inflationary distortions, such as those stemming from inventory profits or understated depreciation, do not truly add to the firm's capacity to build financial slack. While the inflation-adjusted data have these advantages, however, one cost should also be noted. Ideally, several years worth of data might be used to smooth out short-run profitability fluctuations that may have little impact on the firm's decisions. Unfortunately the FASB 33 data are not available for years prior to 1979.

The third type of data we needed was measures of tax-paying status. The chief difficulty here is that taxes reported on firms' financial statements may differ markedly from the taxes they actually pay. However, only the reported figures are available, since the IRS does not disclose actual payments on a disaggregated basis. We decided to try two, admittedly imperfect, measures.

The first of these is the firm's tax loss carry-forward (divided by inflation-adjusted assets as a scaling factor). This variable is reported on the Standard and Poor's Compustat tape for 502 of the firms in our original sample, and it reflects their actual ability to make use of additional tax shields. The larger is the size of the carry-forward, the less likely is the firm to be in a tax-paying position in the immediate future, and hence the less valuable is the tax advantage from pension funding.

A second measure of tax-paying status is the firm's total reported taxes minus the change in deferred taxes over the previous year (again, scaled by inflation-adjusted assets).[4] Substracting the change in deferred tax liabilities provides an approximate adjustment for such practices as using straight-line depreciation for reporting purposes and accelerated depreciation for tax purposes. The data needed to construct this measure were also available on the Compustat tape, this time for 490 of the firms in our original sample.

The fourth variable that we needed to measure was risk. The same argument could be made here that we are really estimating a reduced-form relationship and that we are thus interested in an exogenous, or operating risk, measure. However, the value of the pension put option depends on the firm's total risk, including financial as well as operating risk and unsystematic as well as systematic risk. Since we were particularly interested in trying to isolate any pension put effect that might exist, we chose as our primary risk measure the firm's 1980 Standard and Poor's bond rating. This reflects an assessment of risk based on a composite of historical data and future expectations. Data were collected for 457 of our firms, and the ratings were coded from 1 to 10, with lower numbers representing lower ratings and presumably greater risk.

Since risk is a notoriously difficult concept to measure we also tried three other risk variables. The first of these is the firm's unlevered beta, which reflects the systematic risk of its assets. Levered beta estimates were collected for 439 of our firms from data provided by Merrill Lynch, and these were then adjusted for firms' market value debt/equity ratios.[5] The value of common stock was obtained from stock market data, while the market value of preferred stock was estimated by capitalizing each firm's preferred dividends for 1980 at the Standard and Poor's preferred dividend yield. The market value of debt was estimated using the current Baa bond rate.[6] An alternative measure of operating risk can be based on total, rather than systematic, variability. For this, we used a standard deviation of detrended return on net assets over a 10-year period. Since we did not have inflation-adjusted data for such a lengthy period, it was necessary to use book figures from the Compustat tape to measure this variable. In addition, the requirement of 10 consecutive years of data reduced the available subsample for this variable to 221 firms. Our final risk measure, which reflects financial as well as operating risk, is the standard deviation of monthly returns on the firm's stock, computed over the period of January 1979–December 1980. Data were available from the Center for Research in Security Prices for 506 of our firms.

The names and definitions of all of these variables are listed in table 2.1. We also show some summary statistics for the different variables to indicate the range of values represented in our sample. We turn now to our estimation.

Table 2.1 **Summary Characteristics of the Data**

Variable	Mean	Standard Deviation	Minimum Value	Maximum Value	Sample Size for this Variable
PA/TPL	1.480	.431	.554	2.956	908
PA/VPL	1.687	.601	.578	6.230	908
R	.071	.012	.040	.130	908
FI	.536	.239	0.0	1.0	369
PRET	.173	.095	0.0	.500	297
RONA	.069	.063	−.293	.402	492
CFWD/A	.003	.020	0.0	.280	502
T/A	.050	.058	−.154	.603	490
BETAU	.953	.444	.068	4.260	439
SDRONA	.032	.021	.004	.148	234
BRAT	7.797	1.311	1.0	10.0	457
SDMR	.140	.066	.034	.469	506

Note: PA = Reported pension assets; TPL = Total pension liabilities, adjusted to common 10% discount rate; VPL = Vested pension liabilities, adjusted to common 10% discount rate; R = Discount rate assumed by firm in reporting pension liabilities; FI = Fraction of pension assets invested in fixed income securities; PRET = Percentage of pension plan participants who have already retired; A = Nonpension corporate assets, valued at replacement cost; RONA = Inflation-adjusted return on net assets (inflation-adjusted operating earnings divided by A); CFWD = End-of-year magnitude of tax loss carry-forwards; T = Reported total taxes minus the change during 1980 in deferred tax liabilities; BETAU = Unlevered beta; SDRONA = Standard deviation around trend of book return on net assets; BRAT = Standard & Poor's Bond Rating (10 = AAA, 1 = D); SDMR = Standard deviation of market return on firm's stock.

2.5.2 The Assumed Discount Rate

The first hypothesis we tested concerns the relationship between firm profitability and the discount rate chosen for reporting pension liabilities. A simple regression of the assumed discount rate against inflation-adjusted return on net assets, as reported in table 2.2, indicates a strong negative correlation between the two variables. That is, more profitable firms tend to choose lower discount rates and thus, in relative terms, to overstate their pension liabilities. This result suggests that it may be important to adjust reported liabilities to a common basis if the true relationships between pension funding and other variables are to be uncovered.

We also tested the constancy of the relationship between R and RONA. In particular, as the value of the put to the PBGC increases, one might expect firms to increase their assumed values of R at an even faster rate in order to conceal the PBGC's true exposure. To examine this possibility, we created a dummy variable, PBGC, which takes on a value of one if the pension put is "in the money" and zero otherwise. The pension put is deemed to be in the money if a firm's unfunded vested pension liabilities, calculated at reported discount rates, exceed 30% of the firm's market value of equity. The results of this experiment are also reported in table 2.2. The dummy variable has a significant coefficient, and the effect is in the hypothesized direction:

Table 2.2 Assumed Discount Rate Regressions

Independent Variables	Dependent Variable: R	Dependent Variable: R
CONSTANT	0.07 (.0007)[a] t = 100.0	0.07 (.0007) t = 100.0
RONA	−0.025 (.007) t = −3.6	−0.017 (.007) t = −2.4
PBGC[b]		0.017 (.006) t = 2.8
R^2	.02	.05
No. of observations	515	515

[a]Standard errors and t-statistics in these and other regressions have been corrected for heteroscedasticity using White's (1980) procedure.

[b]PBGC = 1 if vested pension liabilities, valued at reported discount rate, exceed 30% of market value of firm's equity; 0 otherwise.

companies that have the PBGC in the riskiest position tend to increase their assumed discount rates by even greater amounts than other firms.

2.5.3 Pension Funding

Next, we investigated the relationship between pension funding (calculated on a uniform basis) and profitability, tax-paying status, and risk. As a preliminary step, we computed the simple correlation coefficients reported in table 2.3. The limitations of this measure are well known. However, it does allow us to examine relationships between the variables using as much of our sample as possible, in contrast to the regression analysis, in which data requirements forced considerable cuts in sample size.

One of the stronger results in the table is the positive correlation between funding and RONA. This is consistent with the corporate financial perspective under which pension decisions are related to firm profitability. Also of note is the strong negative correlation between funding and the percentage of plan participants retired. As mentioned in section 2.4.1, we collected data on this variable with an eye toward

Table 2.3 Simple Correlations between Funding and Explanatory Variables

	$\frac{PA}{VPL}$ (Vested Funding)	RONA (Profitability)	PRET (% Retired)	$\frac{CFWD}{A}$ (Carry-forwards)	$\frac{T}{A}$ (Taxes Paid)	BRAT (Bond Rating)
$\frac{PA}{TPL}$	.868 $\Pi = .0001$ $N = 908$	.203 $\Pi = .0001$ $N = 492$	−.238 $\Pi = .0001$ $N = 297$	−.104 $\Pi = .020$ $N = 502$	.197 $\Pi = .0001$ $N = 490$	.123 $\Pi = .009$ $N = 457$
$\frac{PA}{VPL}$		.192 $\Pi = .0001$ $N = 492$	−.331 $\Pi = .0001$ $N = 297$	−.096 $\Pi = .032$ $N = 502$	.184 $\Pi = .0001$ $N = 490$	.090 $\Pi = .056$ $N = 457$
RONA			−.359 $\Pi = .0001$ $N = 195$	−.123 $\Pi = .006$ $N = 492$	.693 $\Pi = .0001$ $N = 458$	.173 $\Pi = .007$ $N = 240$
PRET				.019 $\Pi = .792$ $N = 199$	−.180 $\Pi = .013$ $N = 191$	.085 $\Pi = .251$ $N = 183$
$\frac{CFWD}{A}$					−.076 $\Pi = .101$ $N = 467$	−.151 $\Pi = .018$ $N = 247$
$\frac{T}{A}$						.296 $\Pi = .0001$ $N = 243$

NOTE: Π = Probability of finding a sample correlation greater than that reported under the null hypotheses that the true correlation is zero. N = Number of observations used in computing this correlation.

its possible influence on asset allocation, and thus its strong correlation with pension funding came as a surprise. We believe, as will be discussed in further detail below, that this variable is serving as a proxy for the firm's long-run profitability.

Pension funding also appears to be strongly related to tax-paying status, particularly the T/A variable. The results for both CFWD/A and T/A are in the directions predicted by the tax and financial slack effects: that is, heavier tax burdens are associated with higher funding levels.

Finally, the bond rating variable is positively correlated with funding, which is consistent with the pension put effect. Riskier firms, as indicated by lower bond ratings, tend to exhibit lower funding levels. Correlations among the different risk measures are shown in table 2.4, and in general all four measures tend in the same direction (low values of BRAT denote higher risk, and thus BRAT should be negatively correlated with the alternative measures). The relation between bond rating and unlevered beta, however, is quite weak.

With an eye toward multicollinearity problems in the regression analysis, it is also worth noting in table 2.3 the correlations among the explanatory variables. As might be expected, RONA is related to both bond rating and the measures of tax-paying status, while bond rating and tax-paying status are in turn related to one another. These relationships suggest that it may be difficult to separate the different effects on funding.

We next regressed the level of pension funding against profitability, tax-paying status, and risk. The results when funding is measured as pension assets over vested pension liabilities are reported in table 2.5.

Table 2.4 Correlation Matrix of Risk Measures

	BETAU (Unlevered Beta)	SDRONA (S. D. Book Return)	SDMR (S.D. Mkt. Return)
BRAT (bond rating)	−.048 Π = .477 N = 224	−.347 Π = .0001 N = 260	−.254 Π = .003 N = 140
BETAU		.176 Π = .0006 N = 382	.198 Π = .003 N = 224
SDRONA			.266 Π = .0001 N = 206

NOTE: Π = Probability of finding a sample correlation greater than that reported under the null hypotheses that the true correlation is zero. N = Number of observations used in computing this correlation.

Table 2.5 **Pension Funding Regressions**

Independent Variables	Equation (1)	(2)	(3)	(4)
Constant	1.279 (0.160) t = 8.0	1.352 (0.068) t = 19.8	1.282 (0.172) t = 7.5	1.304 (0.065) t = 20.1
RONA (profitability)	1.704 (0.481) t = 3.5	1.739 (0.348) t = 5.0	1.323 (0.554) t = 2.4	1.714 (0.523) t = 3.3
$\frac{\text{CFWD}}{\text{A}}$ (carry-forwards)	−0.504 (0.514) t = −1.0	−1.635 (0.938) t = −1.7		
$\frac{\text{T}}{\text{A}}$ (taxes paid)			1.177 (0.767) t = 1.5	0.370 (0.662) t = 0.6
BRAT (bond rating)	0.020 (0.020) t = 1.0		0.016 (0.022) t = 0.7	
BETAU (unlevered beta)		0.097 (0.064) t = 1.5		0.100 (0.064) t = 1.6
R^2	.04	.07	.05	.08
No. of observations	240	360	226	338

Note: Dependent variable = PA/VPL (vested funding). Numbers in parentheses are standard errors, calculated according to White (1980).

We obtained very similar results when funding was measured in terms of total accrued liabilities, and these results are not reported. Both measures of tax-paying status are used in table 2.5, and risk is measured in terms of both bond rating and unlevered beta. The results using SDRONA and SDMR were qualitatively similar and are not reported.

The strongest effect that emerges in table 2.5 is that of profitability. Inflation-adjusted return on net assets has a uniformly positive and significant association with the level of pension funding. This is consistent with the corporate financial perspective on pension decisions, and the direction of the effect is simultaneously consistent with the tax, pension put, and financial slack effects.

This finding is also in contrast to Friedman's (1983) results, which showed a negative relationship between profitability and funding. As discussed in section 2.3, Friedman used a different data source, a different year, reported instead of uniformly calculated measures of pension liabilities and a different specification, so it is difficult to attribute the difference in results to any one factor. We did, however, run the same regressions using reported pension liabilities to calculate our funding measures, and we found that the positive relationship persisted between funding and profitability.[7]

The tax effect in table 2.5 is consistently in the direction predicted by both the tax arbitrage and financial slack theories, but its statistical significance is generally much lower than that of the profitability effect. Whether tax-paying status is measured in terms of carry-forwards or reported tax payments adjusted for the change in deferred tax liabilities, an increase in the tax burden is associated with an increase in funding. In view of the correlations between profitability and tax-paying status reported in table 2.3, it is not surprising that the tax effect is difficult to distinguish.

Finally, the effect of risk in table 2.5 is neither consistent across equations nor very significant statistically. When risk is measured by bond rating, greater risk is associated with less funding, consistent with the pension put effect. When risk is measured by unlevered beta, on the other hand, higher risk is associated with higher funding levels. Since neither of these effects is statistically significant, no clear picture emerges of the true influence of risk on pension funding.

Perhaps, however, it is unreasonable to expect the pension put and tax effects to leave strong traces across the entire sample of firms. As pointed out in section 2.2.2, for example, the influence of risk on the value of the pension put might be expected to appear strongly only for the riskiest firms. To examine this possibility, we split our sample and performed the same regression for those firms whose bond rating was below average relative to the sample as a whole. This regression, using T/A as the tax variable, is reported in the first column of table 2.6. Lower bond ratings (higher risk) are still associated with lower funding levels, this time in a more significant fashion. To the extent that there is an identifiable pension put effect, it appears to be very nonlinear, as theory would suggest. The fact that the explanatory power of the equation increases substantially relative to the full sample regression also indicates that the effects we are seeking to identify do not fall along a single straight line for a broad cross-section of firms.[8]

In the same vein, we split our sample by values of T/A to see if the tax effect would make a stronger showing among firms facing the heaviest tax burdens. Results from the same regression performed over those firms having above-average values of T/A are reported in the second column of table 2.6. For this subsample, the estimated coefficient of T/A is quite large and more statistically significant than those reported in table 2.5.

Table 2.6 **Pension Funding Regressions for Subsamples**

Independent Variables	Subsample: Firms with Below-Average Bond Rating	Subsample: Firms with Above-Average T/A
Constant	0.684 (0.347) t = 2.0	1.049 (0.291) t = 3.6
RONA (profitability)	1.221 (0.684) t = 1.8	0.359 (1.004) t = 0.4
$\frac{T}{A}$ (taxes paid)	1.792 (1.277) t = 1.4	2.925 (1.367) t = 2.1
BRAT (bond rating)	0.122 (0.061) t = 2.0	0.031 (0.032) t = 1.0
R^2	.09	.07
No. of observations	74	81

NOTE: Dependent variable = PA/VPL (vested funding). Numbers in parentheses are standard errors calculated according to White (1980).

Looking at tables 2.5 and 2.6 together, the profitability variable appears to be doing most of the work in the full sample regression. The tax and risk variable have relatively insignificant effects. However, when the sample is split into pieces, these latter effects show up more strongly among firms that deviate from the average. The pension put effect appears to have some plausibility for the high-risk subsample, while the tax effect is more pronounced for the high tax-paying subsample. In addition, the effect of profitability is attenuated in these subsamples. It may be that profitability is simply a proxy for some combination of tax and risk effects that best explains variations in funding for the sample as a whole. At the edges of the sample, however, where the tax and risk effects become separated, the explanatory power of profitability declines, and the tax and risk effects are more readily identifiable.

The suspicion that our RONA measure of profitability may be acting as a proxy for other variables receives further support when we add PRET, the percentage of plan participants retired, to our list of explanatory variables. The results of this experiment (performed over the largest sample of firms for which data on all the variables was available) are reported in table 2.7. Comparing these results with equation (3) in table 2.5, we see that the estimated coefficients of T/A and BRAT remain very similar in size and significance. However, in the presence of PRET, the effect of RONA virtually disappears. At the same time the explanatory power of the equation triples (although the sample size is cut in half).

Taken together, then, the smaller-sample results of tables 2.6 and 2.7 convey the strong impression that RONA is a very noisy measure of firms' financial condition. In addition, the results in table 2.7 raise the question of how PRET's apparently strong effect should be interpreted. Our feeling is that this variable is a measure of firm or industry life cycle and hence of long-run financial condition. Firms with the highest ratios of retired to active workers are most likely to be in a phase of maturity or even decline. They are likely to exhibit slower growth and lower profitability than other firms, and thus the finding that higher values of PRET are associated with lower levels of pension funding is consistent with the corporate financial perspective.[9]

The results thus far suggest that the corporate financial perspective is a plausible one from which to view pension funding decisions. A

Table 2.7 Percentage of Plan Participants Retired as a Determinant of Pension Funding

Independent Variables	Dependent Variable: PA/VPL (Vested Funding)
Constant	1.685 (0.334) $t = 5.0$
RONA (profitability)	0.016 (0.893) $t = 0.02$
PRET (% retired)	−1.980 (0.626) $t = -3.2$
$\frac{T}{A}$ (taxes paid)	1.190 (1.030) $t = 1.2$
BRAT (bond rating)	0.018 (0.036) $t = 0.5$
R^2	.17
No. of observations	108

NOTE: Numbers in parentheses are standard errors calculated according to White (1980).

potential weakness of the tests conducted, however, is that pension variables have been measured on a firmwide basis, whereas many firms administer more than one plan. It is possible that different perspectives should be applied in analyzing the funding levels of different pension plans within the same firm.

For example, one of the rationales offered in section 2.2 for the corporate financial perspective was that promised benefits are insured by the PBGC and thus firms need not feel constrained to adopt funding levels that the beneficiaries would prefer in the absence of insurance. In fact, however, the extent of the insurance coverage is limited.[10] Different pension plans within the same firm, then, might be funded differently depending on the degrees of insurance coverage for their respective participants. Plans for hourly workers, who are more likely to have complete insurance coverage, might be managed from a corporate financial perspective. On the other hand, plans for salaried workers, who are more likely to have promised benefits in excess of insurance limits, might be managed from the traditional perspective.

To perform a rough examination of this possibility, we obtained funding data on over 10,000 different pension plans (each with more than 100 participants) from the IRS Form 5500 for 1980.[11] For each plan, we had data on pension assets, the present value of vested benefits, and the discount rate assumption, so we were able to compute vested funding (PA/VPL), where total pension liabilities have been adjusted to a 10% discount rate as in the company-wide data above. Unfortunately, it was not possible to determine with complete accuracy whether a given plan was for hourly workers, salaried workers, or both. Rather, the plans had been grouped into four mutually exclusive categories, corresponding to the formula used in calculating benefits. The first of these is the fixed benefit plans which pay a fixed percentage of final compensation. The second is the unit benefit plans which pay some percentage of final compensation times years of service. The third category is the flat benefit plans, which simply pay a stated dollar amount, while the fourth category consists of all other plans.

A simple test for differences in funding behavior is an analysis of variance, which tests for differences in mean funding across the four categories. This test is reported in the form of a dummy variable regression in table 2.8. The F-statistic value overwhelmingly rejects the hypothesis that there are no significant differences in funding across plan types. In addition, flat benefit plans appear to be significantly less funded than other types of plans. While not all hourly workers' plans are flat benefit plans, it is our understanding that flat benefit plans have hourly workers as their predominant participants. Thus there is some evidence that plans for workers whose benefits are more likely to be fully insured also tend to be less well funded on the average. This in turn suggests that whether the traditional or the corporate financial

Table 2.8 Differences in Funding by Plan Type

Independent Variables	Estimated Coefficient (Standard Error)
Constant	1.793 (0.045) $t = 39.8$
FIXED[a]	0.106 (0.053) $t = 2.0$
UNIT	0.025 (0.046) $t = 0.5$
FLAT	−0.335 (0.055) $t = -6.1$
R^2	.012
F	40.83
No. of observations	10,124

NOTE: Dependent variable = PA/VPL (vested funding).
[a]FIXED = 1 if fixed benefit plan, 0 otherwise; UNIT = 1 if unit benefit plan, 0 otherwise; FLAT = 1 if flat benefit plan, 0 otherwise.

perspective is a more accurate description of pension decisions may vary by type of plan. Further investigation of this issue would be worthwhile if a more accurate breakdown of plans by type of participant could be obtained.

2.5.4 Pension Asset Allocation

Finally, we investigated the asset allocation among our sample of corporate pension funds and its dependence upon various characteristics of the firm and the pension plan.

Figure 2.1 shows the frequency distribution for our asset allocation variable, the percentage of pension fund assets invested in fixed income securities (FI), for all 539 firms for which data was available. Recall that the corporate financial perspective on asset allocation implies that pension funds should be invested at either one of two extremes. In particular, because the vast majority of the plans in this sample are considerably overfunded, this perspective implies that most funds should be invested entirely in fixed income securities (because these securities are presumably more heavily taxed).

The data in figure 2.1 show that the distribution of asset allocation across firms is, in fact, bimodal. On the one hand, these data do hint that firms divide into two groups, much as the corporate financial per-

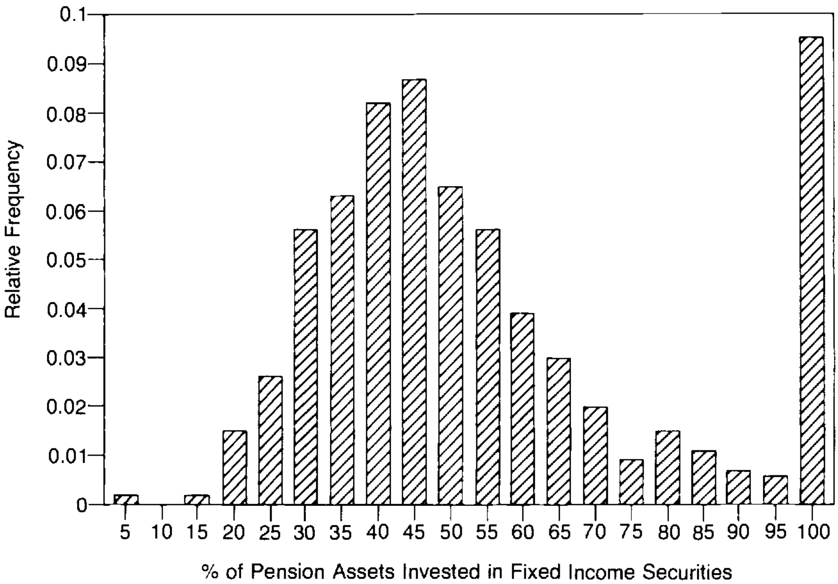

Fig. 2.1 Frequency distribution of pension portfolio allocation, 539 firms. (Source: Greenwich Research Associates data.)

spective suggests they should. And 10% do invest entirely in fixed income, the extreme allocation that should be chosen by most firms.[12] Unfortunately, however, the remaining 90% hold decidedly mixed portfolios with a mode of 45% of their pension assets invested in fixed income securities. These interior or nonextremal asset allocations cannot be explained by the corporate financial perspective on pension fund decisions.

To glean some insight into the possible determinants of asset allocation, we computed the correlation coefficients reported in table 2.9. To simplify and condense the presentation of our results in this section, we will report using only one measure of funding, the ratio of assets to vested liabilities (PA/VPL); one measure of risk, the bond rating (BRAT); and one measure of tax status (T/A).[13] While, again, the problems with simple correlation coefficients are well known, the values in table 2.9 are interesting. Surprisingly, the asset allocation does not depend upon the tax variable (T/A). Nor does it depend upon the percentage of pension plan members who are retired (PRET), our proxy for the demographics of the plan members and thus the shape of the future pension liability stream. Equally surprising, the asset allocation does depend upon the dollar value of vested liabilities, our proxy for the *size* of the company's pension plan and fund.[14] Also, the asset allocation appears to depend upon the degree of funding (PA/VPL).

Table 2.9 **Simple Correlations between Asset Allocation (FI) and Explanatory Variables**

	PA/VPL (Vested Funding)	T/A (Taxes Paid)	BRAT (Bond Rating)	VPL (Vested Liabilities)	PRET (% Retired)
FI (% invested in fixed income)	.139 Π = .007 N = 369	−.025 Π = .700 N = 243	−.107 Π = .119 N = 215	−.136 Π = .009 N = 369	−.082 Π = .160 N = 292
PA/VPL		.184 Π = .0001 N = 490	.090 Π = .056 N = 457	−.096 Π = .004 N = 908	−.331 Π = .0001 N = 297
T/A			.296 Π = .0001 N = 243	−.108 Π = .017 N = 490	−.180 Π = .013 N = 191
BRAT				.162 Π = .0005 N = 457	.085 Π = .251 N = 183
VPL					.091 Π = .118 N = 297

NOTE: Π = Probability of finding a sample correlation greater than that reported under the null hypotheses that the true population correlation is zero. N = Number of observations used.

While at first glance the dependence upon size is surprising, we believe it can be explained by an important difference between the implicit character of large and small pension plans. Other studies, particularly Clark et al. (1983) and Greenwich Research Associates (1983), have shown that large defined benefit pension plans have given frequent and sizable post-retirement benefit increases to their participants. It appears that large corporations tend to treat the "defined benefits" of their pension plans as contractually stipulated minimums or floors for the benefits paid to retirees, but they voluntarily and regularly increase benefits beyond these floors. To some extent this may reflect their efforts to award real dollar as opposed to nominal dollar benefits to their retired employees. To some extent it may reflect an attitude of sharing the surplus of pension assets (over liabilities) with retired employees, as if their plans were more like defined contribution plans. In any case, though, the pension benefits of large corporations are clearly not fixed in practice in the nominal dollar terms that the legal language of most pension contracts would imply.

The smaller pension plans associated with smaller companies, in contrast, have only given very infrequent post-retirement benefit increases, and many of them have never given any increase. For example, in a typical year in the mid-1970s fewer than 10% of the retirees of small pension plans received post-retirement increases, whereas more than three-quarters of the retirees of large plans received such increases (Clark el al. 1983). Apparently, small firms treat their pension claims much more as fixed nominal dollar liabilities of the corporation, as the corporate financial perspective on pensions assumes. We believe that this may well explain why small companies tend to invest a larger percentage of their pension funds in fixed income assets.

Perhaps more important, the corporate financial perspective on pension funds would suggest that asset allocation should be related to funding and risk. For that small fraction of companies where the value of the PBGC put is appreciable, the plans should hold a larger fraction of their assets in stocks; otherwise they should invest in bonds. Companies with low bond ratings that are underfunded might thus be expected to hold more stocks and less bonds, and vice versa.

Table 2.10 reports some of the regression results which attempt to explain asset allocation as a function of these different variables. In equation (1) with two explanatory variables, funding has a statistically significant effect in the hypothesized direction. That is, underfunded companies do indeed hold fewer bonds. Surprisingly, though, when bond rating is introduced as an independent variable in equations (2)

Table 2.10 **Asset Allocation Regressions** (Full Sample)

Independent Variables	Equation (1)	Equation (2)	Equation (3)
Constant	.440 (.041) $t = 10.7$	.556 (.101) $t = 5.5$	.539 (.100) $t = 5.4$
VPL (vested liabilities)	-3.58×10^{-5} (2.01×10^{-5}) $t = -1.8$		-2.25×10^{-5} (1.49×10^{-5}) $t = -1.5$
PA/VPL (vested funding)	.064 (.025) $t = 2.6$	.054 (.035) $t = 1.5$	.051 (.0351) $t = 1.5$
BRAT (bond rating)		$-.0187$ (.0117) $t = -1.6$	$-.0151$ (.0119) $t = -1.3$
R^2	.04	.02	.04
No. of observations	369	215	215

NOTE: Dependent variable = FI (% invested in fixed income). Numbers in parentheses are standard errors calculated according to White (1980).

and (3), it enters with a negative sign. Riskier companies hold fewer bonds and more stocks, the opposite of what we might expect if companies were exploiting the PBGC put. This is the same dependence that Friedman (1983) found, a "risk-offsetting effect" between the asset mix of the pension fund and the risk of the company.

Table 2.11 reports the results of a similar regression for that subsample of 30 higher-risk firms whose bond ratings were BB+ or lower. For this group of companies the PBGC put effect and its dependence upon funding might be more clearly observed. As the coefficients and R^2 demonstrate, funding (PA/VPL) is an even more important determinant of asset allocation within this subsample, as we would expect.[15] The measures of statistical significance for both size and funding have an adjusted t-ratio of just about 2.

Table 2.12 presents an alternative look at this same data. Confirming the results of table 2.11, among all higher-risk firms the underfunded plans hold riskier portfolios (fewer bonds and more stocks). Furthermore, among all underfunded plans, the higher-risk firms own riskier portfolios. In our entire sample there were actually only three firms that were credible candidates for having a valuable PBGC put in that they had both underfunded pension plans and a bond rating less than BBB−. Interestingly, these firms tended to hold rather risky portfolios, just as the corporate financial perspective suggests they should.

The significance of these data are questionable, however, for both the obvious reason that three is not an overwhelming sample size and because of the subsequent history of these three firms. Upon looking

Table 2.11 **Asset Allocation Regressions for a Sample of Thirty Higher-Risk Firms with Bond Ratings of BB+ or Lower**

Independent Variables	Estimated Coefficient (Standard Error)
Intercept	.272 (.188) $t = 1.4$
VPL (vested liabilities)	-1.74×10^{-5} $(.89 \times 10^{-5})$ $t = -2.0$
PA/VPL	.214 (.114) $t = 1.9$
R^2	.14
No. of observations	30

NOTE: Dependent Variable = FI (% invested in fixed income).

Table 2.12 **Average Percentage of Plan Assets Invested in Fixed Income Securities for Different Regions of Funding and Bond Rating**

	Funding	
	Overfunded (PA/TPL > 1.0)	Underfunded (PA/TPL < 1.0)
Bond rating:		
BBB− or above	.48 $N = 172$	.50 $N = 13$
BB+ or below	.61 $N = 27$	.34 $N = 3$

closely at these firms, we discovered that two of the three firms have subsequently switched their pension asset mixes to virtually 100% bonds using a bond dedication framework. Moreover, they did so in circumstances in which the probabilities of financial distress were clearly increasing not decreasing. Their subsequent asset mix decisions, then, were quite inconsistent with attempting to exploit the value of the PBGC put.

To summarize the empirical findings on asset allocation, there is an interesting dependence upon size which we believe can be explained by the quite different ways in which large and small firms seem to regard their employees' "defined benefits." In addition, underfunded plans tend to hold more equities and less fixed income securities. Finally, we found some very sketchy evidence that the extreme subset of companies with both lower ratings and unfunded pension plans tend to hold more of their pension assets in equities, exactly what the corporate financial perspective on pension decisions would suggest. The subsequent history of these firms, however, makes us reluctant to conclude we have found solid evidence of such behavior.

2.6 Conclusion

When we look at our results in their entirety, we believe that we have found several pieces of evidence supporting the corporate financial perspective on pension fund decisions. There appears to be a real sense, then, in which corporations manage their pension funds as an integral part of overall financial policy.

First, the reporting of pension fund liabilities is systematically linked to company profitability through the choice of a discount rate. More profitable firms tend to choose lower discount rates and thus to report greater pension liabilities. Second, the level of pension funding is positively related to companies' long-run profitability. This may be a combined reflection of tax, risk, and financial slack effects. Third, a significant fraction of firms invest their pension assets entirely in fixed income securities, and the proportion of assets allocated to fixed income securities is positively related to the level of funding.

However, the individual effects comprising the corporate financial perspective are more elusive. In our full sample of firms, the tax effect and the pension put effect do not leave strong traces. Rather, these effects are more clearly discernible only at the edges of our sample: a significant positive relationship between tax-paying status and funding shows up among firms with the heaviest tax burdens; a negative relationship between risk and funding shows up among the riskiest firms; and there is sketchy evidence of a tendency for the firms with the most valuable PBGC puts to invest their pension funds in riskier assets.

Our results also indicate that the traditional and corporate financial perspectives on pension decisions are far from mutually exclusive. Across firms, our asset allocation findings suggest that the corporate financial perspective may be more appropriate in describing small pension plans, while larger plans appear to take on some of the characteristics of the traditional perspective. Moreover, even within the same firm, different plans may be more appropriately viewed from one perspective or the other depending on their level of PBGC insurance coverage.

Clearly, the present study represents only an initial attempt to gain a working empirical knowledge of corporate pension funds. As more years of data become available, it would be desirable to check the robustness of our results across different periods and to examine the determinants of changes in pension funding and asset allocation over time. On the theoretical front, it is apparent that much remains to be understood about the underlying labor contracts of which pension plans are a part. A better understanding of the differences in these contracts across firms of different size or across categories of employees within the same firm may shed considerable further light on corporate pension decisions.

Notes

1. Friedman (1983) discussed the potential difficulties resulting from the discount rate choice, but he did not have the data to make any adjustments.

2. The measure of pension assets in the denominator of this fraction is not the same as the figure for total pension assets in the FASB 36 filings. In measuring asset allocation we deleted "real estate investments" and "miscellaneous assets," because it was not clear whether these were more like fixed income investments or more like common stock. The real estate category, for example, could include real property but could also include mortgages. We also deleted investments in the sponsoring company's stock, since these might be related to factors other than the desired risk and return position of the pension portfolio. The denominator of our asset allocation variable, then, is fixed income securities (as defined in the text) plus investments in the stock of other companies.

3. Unfortunately, our earnings measure is not entirely purged of leverage effects. Our measure is equal to inflation-adjusted, after-tax net income plus interest payments. Without further data, we were unable to adjust taxes to the levels that would have been paid in the absence of any debt.

4. This measure of tax-paying status has been used by Zimmerman (in press).

5. The adjustment we used was to multiply levered betas by the ratio of preferred plus common stock to debt plus preferred plus common stock. This adjustment treats preferred stock as equity. We did not include corporate taxes in our adjustment, as would be consistent with a Miller (1977) model of capital structure equilibrium.

6. More specifically, short-term liabilities (net of financial assets) were taken at book value. The market value of long-term debt was estimated from the book value by assuming a 10% average coupon rate and a 10-year average maturity. Estimated debt service payments were then discounted at the current Baa rate. This is similar to the procedure followed in Feldstein and Mørck (1983).

7. In view of the relationship between profitability and assumed discount rates reported in table 2.2, it might have been argued that we induced a correlation between funding and RONA through our adjustment to a common discount rate. The fact that the same correlation persists in the unadjusted data provides evidence against this argument.

8. Even further sample splitting may be justified. When we confined our sample to firms whose bond ratings were lower than BBB− (that is, lower than investment grade), we obtained an R^2 of .22 for a regression using PA/VPL as a dependent variable over a subsample of 32 firms. The estimated coefficient of BRAT in this regression was 0.110 with a t-statistic of 2.5.

9. PRET could of course be subject to alternative interpretations. One possiblity is that firms with greater proportions of retired workers simply have less flexibility to alter their actuarial assumptions and thus fewer possibilities for effectively overfunding their pension plans. Since this interpretation implicitly rests on the notion that firms are managing their financial slack, it too is consistent with the corporate financial perspective. There may be other possible interpretations of PRET as well, but it is difficult to see how the findings in table 2.7 could be said to favor the traditional perspective over the corporate financial perspective. Although the traditional perspective might predict that demographic characteristics of the participant pool are important to firms' pension decisions, it is not clear under that view why greater proportions of retired workers should be associated with lower funding levels.

10. As of 1982, vested pension benefits were guaranteed by the PBGC up to a maximum of $16,568 per year.

11. We thank David Kennell of ICF, Inc., for his help in obtaining these data.

12. We did investigate the character of the firms that invested entirely in fixed income. They tended to be somewhat smaller, somewhat safer (as mea-

sured by their unlevered betas), and somewhat better funded, but they were not extraordinarily different from the full sample of firms on any of these dimensions. "Insured funds" accounted for 13.7% of their fixed income assets, as opposed to 9.2% of the fixed income assets in the full sample.

13. Other versions of these same basic variables were tested and yielded quite similar results, though often with less statistical significance.

14. Other potential proxies for size (for example, the dollar value of pension assets) produce the same results, confirming that *size* really is the important thing being captured by this variable.

15. There is an alternative explanation for this dependence upon funding. Conversations with corporate financial officers in the field suggest that at least some of them may believe that underfunded plans should "reach" for greater expected returns, while overfunded plans, in contrast, should minimize risks and focus on preserving their capital. Indeed, several pension consulting firms recommend such policies explicitly as part of their overall asset allocation service. In more formal terms, such behavior would be consistent with a preference or utility function for net pension wealth (assets minus liabilities) that is unusually sharply bent around zero, a behavior analogous to some observations of individual behavior in other quite different decision-making contexts.

References

Black, Fischer. 1980. The tax consequences of long-run pension policy. *Financial Analysts Journal* 36:25–31.

Bulow, Jeremy I. 1983. Pension funding and investment policy. Paper presented at the American Finance Association Annual Meetings, San Francisco.

Bulow, Jeremy I., and Scholes, Myron. 1983. Who owns the assets in a defined benefit pension plan? In *Financial aspects of the United States pension system*, ed. Zvi Bodie and John Shoven. Chicago: University of Chicago Press.

Chen, Andrew H. 1983. Taxes, insurance and corporate pension policy. Paper presented at the Johnson Symposium on Taxes and Finance, University of Wisconsin—Madison.

Clark, Robert L.; Allen, Steven G.; and Sumner, Daniel A. 1983. Inflation and pension benefits. Final report for the Department of Labor Contract no. J-9-P-1-0074.

Colvin, Geoffrey. 1982. How sick companies are endangering the pension system. *Fortune* 106:72–78.

Feldstein, Martin, and Mørck, Randall. 1983. Pension funding decisions, interest rate assumptions, and share prices. In *Financial aspects of the United States pension system*, ed. Zvi Bodie and John Shoven. Chicago: University of Chicago Press.

Friedman, Benjamin M. 1983. Pension funding, pension asset allocation, and corporation finance: Evidence from individual company data. In *Financial aspects of the United States pension system*, ed. Zvi Bodie and John Shoven. Chicago: University of Chicago Press.

Greenwich Research Associates. 1983. Large corporate pensions: 1983.

Harrison, Michael J., and Sharpe, William F. 1983. Optimal funding and asset allocation rules for defined benefit pension plans. In *Financial aspects of the United States pension system*, ed. Zvi Bodie and John Shoven. Chicago: University of Chicago Press.

Hawthorne, Fran. 1983. Raiding the corporate pension fund. *Institutional Investor* 17:101–13.
Louis, Arthur M. 1983. Tapping the riches in corporate pension plans. *Fortune* 108:129–34.
Miller, Merton H. 1977. Debt and taxes. *Journal of Finance* 32:261–75.
Miller, Merton H., and Scholes, Myron S. 1981. Pension funding and corporate valuation. Unpublished paper. University of Chicago.
Munnell, Alicia H. 1982. Guaranteeing private pension benefits: A potentially expensive business. *New England Economic Review:* 24–47.
Myers, Stewart C., and Majluf, Nicholas S. 1983. Corporate financing and investment decisions when firms have information that investors do not have. Unpublished paper. Sloan School of Management, M.I.T.
Sharpe, William F. 1976. Corporate pension funding policy. *Journal of Financial Economics* 3:183–93.
Smith, Randall. 1983. Firms increasingly tap their pension assets to use excess funds. *Wall Street Journal* 202:1.
Tepper, Irwin, 1981. Taxation and corporate pension policy. *Journal of Finance* 36:1–13.
———. 1983. Pension funding strategies and the management of corporate capital. Paper presented at the American Finance Association Annual Meetings, San Francisco.
Treynor, Jack. 1977. The principles of corporate pension finance. *Journal of Finance* 32:627–38.
Webman, Nancy. 1983. Funds play a growing role as corporate financing aid. *Pensions and Investment Age* 11:3.
Westerfield, Randolph, and Marshall, William. 1983. Pension plan funding decisions and corporate shareholder value: A new model and some empirical results. Unpublished paper. University of Pennsylvania.
White, Halbert. 1980. A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica* 48:817–38.
Zimmerman, Jerold L. In press. Taxes and firm size. *Journal of Accounting and Economics.*

Comment André F. Perold

This empirical work is aimed at uncovering relationships among on-balance-sheet corporate financial characteristics and off-balance-sheet levels of pension funding and asset mix. The study differs somewhat from a closely related earlier paper by Friedman (1983) in that it is more clearly focused (e.g., by the choice of regression variables) on interpreting the data in the light of extant pension theory. The results involving pension funding are also more credible than Friedman's since the pension liability data were taken from filings of FASB Statement 36 instead of Form 5500. (FASB 36 imposes a uniform reporting standard up to the choice of discount rate, which is also reported.)

André F. Perold is associate professor of finance, Harvard Business School.

I will comment first on certain problems associated with adjusting the reported liabilities to a common discount rate, and then critically examine some of the paper's findings. Before doing so, let me say that I am generally in agreement with the authors' interpretation of the data, with the obvious caveat that the findings of any such cross-sectional study fixed in time (1980) should be treated with caution.

2.C.1 Adjusting reported pension liabilities to a common discount rate

Bodie et al. adjusted the pension liabilities to a common discount rate of 10% (the then-prevailing rate used by the PBGC) by multiplying the reported pension liability by a factor of $R/10\%$ where R is the reported discount rate.[1] This is an approximation and assumes that the accrued liability stream is a constant perpetuity. Since we do not live forever, and since currently employed beneficiaries only begin to receive benefits at some later date (i.e., retirement), the age distribution of the plan beneficiaries will be the single most important source of error in this approximation. If we let the percentage retired (called PRET in the paper) be a proxy for the age distribution, then the following simple model will illustrate the relationship of the exact adjustment to the above approximation.

Suppose that existing retirees are all paid \$1 n years from now and that current employees will receive \$1 m years from now, $m > n$. If R is the reported discount rate, the reported liability will be

$$L(R, \text{PRET}) = \frac{\text{PRET}}{(1 + R)^n} + \frac{(1 - \text{PRET})}{(1 + R)^m}$$

The exact[2] adjustment factor for a common rate of 10% is thus $L(10,\text{PRET}) \div L(R,\text{PRET})$. The following table gives values for the exact factor when $n = 10$, and $m = 40$, for the range of values of R and PRET encountered in the data.

R (Reported discount rate)	PRET (% retired) 0%	10%	25%	50%	Approximate factor $R/10\%$
4%	.11	.23	.35	.46	.40
7%	.33	.53	.64	.71	.70
10%	1.00	1.00	1.00	1.00	1.00
13%	2.93	1.61	1.42	1.35	1.30

Notice that for any given reported rate R less than 10%, there is a positive relationship between the exact adjustment factor and PRET. For reported rates in excess of the common rate (10%), there is a *negative* relationship. This will clearly be true more generally.

2.C.2 Implications for the study

One of the main regression results of the study is a strong negative relationship between funding and PRET. Since by far the majority of the firms reported discount rates below 10%, this means that this relationship would have been even more strongly negative had the exact adjustment factors been used. This analysis therefore strengthens that particular result.

However, if the assumed common discount rate is lower, for example, the average reported rate of 7%, then this regression result will quite possibly be significantly weakened, at the very least for the firms reporting discount rates above 7%.

This then leads to the question, what is the correct common discount rate? Feldstein and Mørck (1983) used the prevailing Baa rate on the assumption that the accrued liabilities are a fixed nominal cash flow stream. However, they also gave evidence that investors use something closer to the average reported rate to value pension liabilities. This is consistent with a view that accrued liabilities are partially inflation indexed, perhaps because of some implicit contract in which the firm shares inflation risk with the beneficiaries. While Bulow (1982) casts doubt on why such an implicit contract should exist in the first place, it cannot be ruled out in an empirical study of this nature.

2.C.3 The findings of the paper

There is one aspect of the data that is particularly troublesome to me, and that is the fact that only about 10% of the firms have underfunded pension plans. For example, with funding as the dependent variable, what does it mean to have a positive coefficient on bond rating, as predicted by the corporate financial perspective, in such a sample when the R^2 in addition is only in the range .04–.09? Because so many plans are overfunded, I see this as weak evidence for the financial slack effect, but not the pension put effect. Moreover, the discussion of the data in table 2.12 by Bodie et al. makes it difficult to make *any* case for the pension put effect.

Alternatively, it could be that corporations manage their pension plans with a different view of the true nature of their pension liabilities. If an average rate of 7% is the more appropriate one at which to discount the liabilities, then about half the plans will be underfunded, and there may then be some evidence for the pension put effect. It is then difficult to reinterpret the regressions in the paper, however, in view of my earlier comments on possible sources of error in the discount rate adjustment factor.

As to the strong relationship between asset mix and size (VPL), I would be much happier if the independent variable had been log (VPL) since Friedman's data clearly shows a big asymmetry in the distribution of pension plan assets. The largest pension plans are therefore outlying observations, and the regressions in tables 2.10 and 2.11 could just be telling us that a few of the very large pension plans have a higher proportion invested in stocks.

2.C.4 Conclusion

This paper shows that corporate pension plans are in part managed from an integrated corporate financial perspective. In my view it gives strong evidence of the tax effect, weaker evidence for the financial slack effect, and little if any evidence for the pension put effect. It also points out very clearly that we still have a lot explaining to do. I would like to see an analysis that more carefully takes into account the discount rate adjustment factor, since the effects could potentially alter the nature of the findings of the paper.

Overall, this is an important and thought-provoking study that will affect future work in this area both empirically and theoretically.

Notes

1. This is the approach as taken by Feldstein and Mørck (1983).
2. That is, exact for this model.

References

Bulow, Jeremy I. 1982. What are corporate pension liabilities? *Quarterly Journal of Economics* 97 (August): 435–52.

Feldstein, Martin and Randall Mørck. 1983. Pension Funding Decisions, Interest Rate Assumptions and Share Prices. In *Financial Aspects of the United States Pension System*, ed. Z. Bodie and J. Shoven. Chicago: University of Chicago Press.

Friedman, Benjamin M. 1983. Pension Funding, Pension Asset Allocation and Corporation Finance: Evidence from Individual Company Data. In *Financial Aspects of the United States Pension System*, ed. Z. Bodie and J. Shoven. Chicago: University of Chicago Press.

This Page Intentionally Left Blank