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PENSION FUNDING, SHARE PRICES AND NATIONAL SAVING

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ABSTRACT

This paper examines empirically the effect of unfunded pension obligations on corporate share prices and discusses the implications of these estimates for national saving, the decline of the stock market in recent years, and the rationality of corporate financial behavior. The analysis uses the information on inflation-adjusted income and assets that large firms were required to provide for 1976 and subsequent years.

The evidence for a sample of nearly 200 manufacturing firms is consistent with the conclusion that share prices fully reflect the value of unfunded pension obligations. Since the conventional accounting measure of the unfunded pension liability has a number of problems (which we examine in the paper), it would be more accurate to say that the data are consistent with the conclusion that shareholders accept the conventional measure as the best available information and reduce share prices by a corresponding amount.

The most important implication of the share price response is that the existence of unfunded private pension liabilities does not necessarily entail a reduction in total private saving. Because the pension liability reduces the equity value of the firm, shareholders are given notice of its existence and an incentive to save more themselves. For this reason, unfunded private pensions differ fundamentally from the unfunded Social Security pension and the other unfunded federal government civilian and military pensions.

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Pension Funding, Share Prices, and National Saving

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Pensions have become a major factor in the process of capital formation. Pension assets at the end of 1979 exceeded $540 billion.[1] The increase in private pension coverage and the funding requirements imposed by the 1974 Employee Retirement Income Security Act (ERISA) imply that pension assets are likely to continue to represent a growing share of national wealth. There is, however, substantial uncertainty and debate about the future role of private pensions and their relation to the Social Security program.[2] An understanding of the impact of private pensions on aggregate saving is therefore potentially very important.[3]

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1 This includes private pension funds, pension reserves of life insurance companies, and state and local government employee retirement funds. The data are presented in Federal Reserve Board (1980).

2 See, for example, the Preliminary Report of the President's Commission on Pension Policy (1980), Greenough and King (1976), and Ehrbar (1977).

3 For a general discussion of the relation between private pensions and aggregate saving, see Feldstein (1978).

The present paper examines one aspect of the relation between private pensions and aggregate saving: the significance of unfunded corporate pensions. As we explain below, the impact of private pensions on aggregate saving may depend on the extent to which pension promises remain unfunded and unambiguously does depend on the extent to which share prices reflect this form of corporate liability.[1] The share price response also has implications for corporate financial policy and for understanding the poor performance of the stock market in recent years.

The typical pension plan is a corporate promise to pay retirement benefits based on the retiree's number of years of employment and his level of earnings during his immediate preretirement years.[2] Although an employee generally forfeits any claim to benefits if he leaves the company after only a few years of employment, the benefits of an employee who stays with the firm for some minimum number of years become "vested", i.e., the employee is entitled to benefits even if he subsequently leaves the company before retirement age.[3] Firms can set aside tax-deductible funds to meet these vested

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1 The relation between unfunded pension liabilities and aggregate savings is discussed in Feldstein (1978) but no empirical investigation of this particular issue is presented there.

2 This type of pension is called a "defined benefit plan". In contrast, a "defined contribution plan" is a corporate promise to contribute some amount each year on behalf of current employees; retirees then receive an annuity based on the accumulated value of these contributions. McGill (1975) is a standard reference on private pensions. Trowbridge and Farr (1976) and Treynor (1977) focus on pension funding.

3 Since 1974, the ERISA rules mandate that all private pensions provide vesting of any employee who meets certain conditions of age and/or years of service.

future benefit obligations and the income on these assets is not taxed to either the corporation or the pension plan itself.

Some firms fund all of their vested pension obligation, but many do not.[1] The unfunded pension benefits are similar in many ways to outstanding corporate bonds. But unlike corporate bonds, the unfunded pension benefits are not recorded in the corporate balance sheets.[2] Official accounting rules only require firms to indicate the extent of their unfunded vested pensions in the notes that accompany the balance sheet; although this information must be provided in the annual 10-K report to the Securities and Exchange Commission, there is no requirement to include it in the firm's annual report to shareholders.

The economic effects of unfunded pension obligations depend critically on the ability of the stock market to pierce this accounting veil. To see why the share price response is particularly important as a determinant of the effect of pensions or aggregate saving, it is useful to consider first the simple quesion of what would happen if a fully-funded private pension plan replaced an equal amount of saving that employees would otherwise have done for their own retirement. Such a pension would obviously have no effect on aggregate saving; the additional corporate saving in the pension plan would just offset the reduced saving by employees. More generally, a fully-funded private

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1 The ERISA rules require that firms follow a policy of funding all new pension obligations within 30 years and all previous pension obligations within 40 years. The reasons that firms do not fund are discussed briefly in Section 6 of this paper.

2 There are also important tax differences between bonds and unfunded pensions which will be described below.

pension would increase national saving if pension benefits exceed the amount that individuals would otherwise provide for their own retirement. Conversely, if benefits merely replace individual saving, a less than fully funded pension could actually depress total saving.

To see how an unfunded pension could reduce national saving, consider the following case: Employees accept a promise of future pension benefits in exchange for a current wage reduction (or smaller wage increase than they would otherwise obtain). The employees recognize that this is just a change in the timing of their lifetime income with no change in its present value; they therefore do not change their current or future consumption but reduce their current saving by the reduction in their current wage. If this substitution of promised benefits for current wages is not funded, accounting profits rise. If shareholders do not recognize the future obligation, they will incorrectly interpret the rise in current income as an increase in permanent income and will raise their own consumption. The combined consumption of shareholders and employees thus rises and national saving falls.

This example makes it clear that the extent of funding matters only if shareholders do not change their own saving to offset any underfunding by the firms. An unfunded private pension will not differ from a funded one if the firm's shareholders recognize that the extra accounting profits that result from substituting an unfunded pension for higher wages are just balanced by the pension benefits that must be paid in the future.[1] If the share price is reduced

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[1] This assumes that employees correctly substitute between wages and pension promises; see Feldstein (1978) for a more precise statement of the conditions.

by the extent of the unfunded pension obligation, the shareholders will have both the correct information and the correct incentive to increase their saving by the increase in the unfunded pension liability.[1]

This paper examines empirically the effect of unfunded pension obligations on corporate share prices and discusses the implication of these estimates for national saving, the relative decline of the stock market in recent years, and the rationality of corporate financial behavior. The analysis uses the information on inflation-adjusted income and assets that large firms were required to provide for 1976 and subsequent years. Although there are still many problems with these data, they represent a significant improvement over previous conventional accounts.

The evidence for a sample of nearly 200 firms is consistent with the conclusion that share prices fully reflect the value of unfunded pension obligations. Since the conventional accounting measure of the unfunded pension liability has a number of problems, it would be more accurate to say that the data are consistent with the conclusion that shareholders accept the conventional measure as the best available information and reduce share prices by a corresponding amount. Although the standard errors are large enough to admit a more powerful effect on share prices, the hypothesis that unfunded liabilities do not reduce the corporation's market value can be unambiguously rejected by conventional criteria.

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[1] Some of the unfunded "shareholder" saving may take the form of corporate retained earnings.

Section 1 discusses the theory of pension liability evaluation from the point of view of the shareholder, i.e., the expected impact of unfunded vested pensions on share prices. The second section develops the specification of market value equations while section three describes the data and sample. The fourth and fifth section present the results of the statistical analysis. There is a brief concluding section that comments on the implications of this research.

1. The Theory of Pension Liability Valuation

Consider a firm that incurs a new obligation to pay future pension benefits. What effect should that have now on the equity value of the firm? Calculating the correct answer depends on dealing appropriately with five issues: (1) the tax deductibility of pension expenses; (2) the discount rate used for combining benefits at different dates; (3) the distinction between vested and unvested benefits; (4) the impact of inflation; and (5) the uncertainty of benefits and asset yields. This section discusses the correct treatment of each of these issues and the type of bias that is introduced by the conventional measure.

The tax deductibility of pension payments by the firm implies that every dollar of contribution reduces the equity value of the firm by only $\$(1-t_c)$ where t_c is the marginal tax rate on corporate profits.[1] Since t_c

[1] This implicitly assumes that an extra dollar of retained earnings raises the the firm's value by one dollar. Auerbach (1979), Bradford (1979) and King (1977) discuss conditions under which the tax on dividend income implies that the share value should rise less than one dollar per dollar of retained earnings. Feldstein and Green (1979) generalize their argument and show that the value could be more or less than dollar for dollar. All of the calculations in the present paper can therefore be regarded as indicating the change in equity value up to a multiple equal to the marginal valuation of equity.

is the combined federal and state marginal tax rate, a one dollar benefit that is paid out of current corporate income reduces the firm's equity by about 50 cents. A one dollar contribution to the pension fund to meet future benefit obligations also reduces the firm's tax by about 50 cents and therefore only reduces equity earnings by about 50 cents. It is wrong therefore to regard pension liabilities as exactly equivalent to bonds or loan balances; indeed, it may be more accurate to treat each dollar of ordinary debt obligation as equivalent to two dollars of pension obligation.

The tax deductibility of pension contributions is logically different from the nontaxability of the earnings of pension fund assets. The fact that these earnings are not taxed has important implications for calculating the present value of future benefit obligations. In general, the present value of future benefit obligations cannot be calculated by discounting benefits at either the pretax or aftertax rate of return but depends on the extent (or speed) these benefit obligations are funded. Let i be the nominal rate of interest that the firm earns on assets in its pension fund and that the firm pays on its outstanding debt.[1] The net cost of funds to the firm is $(1-t_c)i$ and this is the rate that it should use to calculate the present value of its future net pension contributions. But once a dollar has been contributed, it accumulates at rate i inside the pension fund. A benefit in year T of BEN_T can be financed by a contribution in year t of $CON_t = (1 + i)^{t-T} BEN_T$. The present value of that contribution is $V = [1 + (1-t_c)i]^{-t} CON_t$. Thus the present value of the benefit obligation is $V = [1 + (1-t_c)i]^{-t} (1+i)^{t-T} BEN_T$ and

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[1] The argument here assumes that the firm's marginal source of finance is debt and that the pension fund also invests only in debt. A more general rule with debt and equity is stated below.

the impact on the equity value of this benefit obligation and funding schedule is $(1-t_c)\ V = (1-t_c)\ [1 + (1-t_c)i]^{-t}\ (1+i)^{t-T}\ BEN_T$. More generally, if equity as well as debt is used in both corporate finance and pension fund investment, the impact on the equity value is $(1-t_c)V = (1-t_c)\ [(1 + r_n)^{-t}\ (1+r)^{t-T}\ BEN_T)]$ where r is the gross pretax return that the pension fund earns and r_n is the firm's net cost of marginal funds.

The two special cases of complete funding and no funding (pay-as-you-go finance) can help to clarify the application of this principle. If the firm chooses to fund its new obligation immediately, a contribution of $BEN_T\ (1+i)^{-T}$ is sufficient. Since the fund earns a return of i and pays no tax on its income, this contribution will grow to exactly BEN at the end of T years. At the moment before the contribution is made, the unfunded liability is thus $BEN\ (1+i)^{-T}$. Because the contribution is tax deductible, the net impact of this obligation on the equity value of the firm is $(1-t_c)\ BEN\ (1+i)^{-T}$. In contrast, if the firm does no funding, it must pay BEN dollars at time T for a net cost to the shareholders of $(1-t_c)BEN$. Like other certain costs, this must be discounted at the firm's net interest rate to give a present value of $(1-t_c)\ BEN\ [\ 1 + (1-t_c)i]^{-T}$.[1]

Since the calculation shows that the cost of the pay-as-you-go method has a higher present value than the cost of the immediate funding method,

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1 It is useful to consider the analogy between pension costs and future bond interest. Assume that the firm has a current debt of D which it plans never to repay but continually to rollover at interest rate i. The annual interest payments are iD and their net of tax costs are $(1-t_c)iD$. The present value of these costs, discounting at the net-of-tax interest rate $(1-t_c)i$ is then just $(1-t_c)iD/(1-t_c)i = D$, as it should be. Similarly, if the firm plans to repay the debt at the end of one year, the net cost will be $D + (1-t_c)iD$ and the present value is $[D+(1-t_c)iD]/[1+(1-t_c)]=D$. The key difference between the debt and the pension obligation is that the principal repayment of debt is not tax deductible.

it is optimal for the firm to fund its pension as soon as possible. The fact that firms do not fund their pension obligations fully may reflect constraints[1], errors, or nonconstant borrowing costs. Whatever the reason, the effect of future benefit obligations on the firm's equity value should reflect the timing of the contributions and the difference between the untaxed yield earned on the portfolio and the firm's net of tax cost of funds.[2]

In practice, firms calculate the present value of their vested pensions by discounting the future actuarially-expected vested benefit obligations by an estimate of the yield that they will obtain on their pension portfolio.[3] The value of the unfunded vested pension obligation is then calculated by subtracting the value of their pension assets from this measure of the pension obligation. For the funded portion of the benefits, this is an appropriate comparison; the discount rate is conceptually correct, and there is no need to adjust the funded benefits for their tax deductibility since no further tax deduction will be allowed. But for the unfunded benefits, the usual method of calculation overstates the true value. To see this, note that the usual method of evaluation defines the firm's liablity as:

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1 The tax law limits the speed with which unfunded benefit obligations can be funded.

2 If firms do not fund fully because additional funding raises the cost of borrowing, the net marginal cost of funds may equal the return on the pension portfolio; i.e., in the notation used above, $r_n = r$. In that special case, a marginal change in the timing of funding is irrelevant. The effect of borrowing on the cost of funds can be decisive only if the market does not regard unfunded liabilities as equivalent to ordinary debt, e.g., because of seniority differences or the ERISA rules.

3 In many cases, this is not even a realistic estimate but only a conventional assumption designed to be conservative.

$$(1) \quad L_1 = \sum_{t=1}^{T} \frac{BEN_t}{(1+i)^t}$$

If these benefits were funded immediately, the correct value of the liability would be

$$(2) \quad L_2 = (1-t_c) \sum_{t=1}^{T} \frac{BEN_t}{(1+i)^t}$$

since the contribution would be tax deductible and the pension portfolio would earn i.[1] Since L_2 is less than L_1, the usual method overstates the true value of the obligations that are about to be vested. However, if the benefits would never be funded, the correct value of the liability would be[2]

$$(3) \quad L_3 = \sum_{t=1}^{T} \frac{(1-t_c)\ BEN_t}{[1+(1-t_c)i]^t}$$

Comparing L_3 and L_1 shows that their relative value depends in general on the interest rate and tax rate and on the time pattern of the benefits. Thus if BEN_t is a constant perpetuity, $L_1 = L_3$. If T is finite and BEN_T is constant, $L_1 > L_3$. But if benefits grow sufficiently fast, the higher rate of discount in L_1 outweighs the multiplicative $(1-t_c)$ factor in L_3 and $L_1 < L_3$. The usual method of discounting may therefore understate or overstate the correct value of the vested pension obligations.

Moreover, in thinking about future benefit obligations it is important to distinguish between vested benefits and actuarially expected benefits. The narrow focus on vested benefits may understate the true value of the firm's

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1 Note that L_2 is equivalent to the amount of debt that the firm would have to use in order to fund the entire future benefit obligation.

2 Note that L_3 is equivalent to the amount of debt the servicing of which would be equivalent to the cost of meeting the pension obligation on a concurrent (pay-as-you-go) basis.

obligations. Accounting reports focus on the vested benefits because a future pension benefit does not become a legal liability of a firm until it is vested, i.e., until the worker is entitled to the benefit even if he quits the firm or is fired. A typical plan might provide that an employee with 10 years or more of employment has vested benefits of two percent of his final year's earnings per year of service; e.g., a 20-year employee gets 40 percent of his final year's earnings. In this case, the vested pension obligation completely ignores the employee with 9 years of service even though he is very likely to stay long enough to become vested. Similarly, the vested benefits of the 64 year old employee with 20 years of service make no allowance for the fact that he is very likely to wait until he is 65 before retiring. The calculation of vested benefits is intentionally myopic. Should it be?

The purpose of evaluating pension liabilities is to assess the firm's future expenses in excess of the value of the services that it will receive for those payments. The vested benefits of a retired worker is the clearest case to consider. Since the worker is already retired, he will provide no further services; the present actuarial value of his pension rights is a net liability of the firm. Consider next the 64 year old worker with 20 years of experience who will get 40 percent of his terminal wage if he retires at age 64 and 42 percent if he waits another year. Bulow (1979) has pointed out that the employee's opportunity to obtain higher benefits by working an extra year is irrelevant if the firm and the worker take this into account in setting the wage for work until age 65. More specifically, if the wage is set so that the wage plus the increased value of pension benefits equals the marginal value product of labor, there is no excess cost to the firm asociated with the employee's postponed retirement. The same argument applies to the individual

who has had 9 years of service with the firm and is just about to become vested. If his wage during his tenth year of employment is set so that the sum of the wage and the initial value of the vested pension are equal to the marginal value product of his labor, there is no excess compensation in the prospective benefits.

Although Bulow's analysis is logically sound, it is not clear how relevant it is in practice. I know of no empirical evidence that wages are adjusted to offset unusually large accruals of vested benefits in particular years or during the years just before retirement. Union contracts make no provisions for such changes and "age discrimination" laws probably may make doing so illegal. Since the required adjustment amounts are quite large, such changes would be easily detected if they actually existed. Consider, for example, a 39 year old worker with 9 years of experience. If he stays with the firm for exactly one extra year, he will have a vested right to a pension at age 65 equal to 0.20E where E is his earnings during his tenth year of employment. With a discount rate of 6 percent, a life annuity of $1 per year beginning at age 65 has an actuarial present value of $9.67.[1] An annuity of 0.20E therefore has an actuarial present value of 1.9E. Discounting this back from age 65 to age 40 implies that the value in the tenth year of employment of the newly vested rights is $(1.06)^{-25}$ (1.9E) = 0.451E. Thus the marginal value product of the worker must be 45 percent higher than the wage in the tenth

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[1] This value is based on the latest 1971 Individual Annuity Table with Projection Scale B. The projection scale B refers to an adjustment made to basic data to reflect future mortality differences. The annuity tables appear in Transactions of the Society of Actuaries, 1972, Vol. 23, p. 527.

year even though the two are equal in the ninth year. It is obviously not true that wages (or wage growth) falls by so much or that worker productivity rises by so much.[1]

A similar calculation for the worker at age 64 with 20 years of experience also indicates an implausible compensating wage adjustment. If E_{64} is the earnings on which benefits would be based if the individual retired at age 64, the value of the pension is $(1.06)^{-1}$ [9.67 (.40)E_{64}] = 3.65 E_{64}.[2] At age 65, this pension is worth $1.06(3.65)E_{64} = 3.87E_{64}$. Waiting an additional year to retire raises the value of the pension to $9.67(.42)E_{65} = 4.06\ E_{65}$. Even if $E_{65} = E_{64}$, this would imply a 5 percent increase in productivity between ages 64 and 65. Alternatively, with productivity constant, the wage must fall by about 5 percent. In practice, wages of older workers do not fall in this way while supervisor's evaluations indicate that their productivity is actually declining.[3]

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1 By comparison, between the tenth and eleventh year, the value of the vested benefit increases from $.451(1.06)E$ to $(1.06)^{-24}$ [$9.67(.22)\ E\ (1 + g)$] = $0.525E\ (1 + g)$ where g is the growth of earnings between the two years. If g is 0.05, the value of the vested benefits rises by about 16 percent of the wage. Thus, the wage should rebound between the tenth and eleventh year by about 16 percent plus the growth of productivity.

2 Recall that 20 years of service implies an annuity of 0.40 E_{64} and that each dollar of annuity has a present value of $9.76 as of its starting date. This nominal amount is then discounted for one year at 6 percent.

3 On this see Medoff and Abrams (1978). More generally, see Hall (1980) for a discussion of the view that wage payments over the worker's lifetime are not related to annual productivity. This view implies that the value of corporate equity depends on the age structure of the labor force, retirement practices, age-earnings profiles, etc.

If the Bulow compensating-wage conditions are not satisfied, the legally vested benefits will understate the actuarial value of future benefits in excess of the value of labor services. The potential benefits of the worker with 9 years of experience should not be ignored and at least some fraction of the expected increased benefit of the older worker should be taken into account. A complete and accurate examination of future pension benefits should in principle be based on estimates of compensating wage changes as well as the accrual of vested benefit rights.

Extending the analysis from vested pensions to include a portion of actuarially expected benefits makes the value of the firm's pension obligations depend on the future level of prices. Because pension benefits are based on earnings, particularly earnings during the immediate preretirement years, the nominal value of the pension tends to vary in proportion to the price level at the time of retirement, i.e., the real value of an individual's pension is independent of the price level when he retires. Moreover, since postretirement pension benefits are generally not indexed,[1] the real value of the pension varies inversely with the rate of inflation during the retirement period. All of this can be reflected in the pension valuation by correctly forecasting nominal benefits and using the corresponding nominal rates of return or by forecasting real benefits and using the real rates of return.

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1 Some firms make voluntary increases in the pension benefits of retirees but these increases are significantly less than full indexing.

But even a correct treatment of future inflation does not eliminate the uncertainty involved in the calculation of future pension obligations. The real pension benefits in future years are uncertain because real postretirement benefits depend on inflation. The size of the currently unvested pension benefits depends also on uncertain turnover rates and rates of relative wage growth. Moreover, the real yield on the pension fund is uncertain and would be so even if the price level were stable. The common procedure of using the expected (mean) return to discount future benefits would not be appropriate even if the firm were risk-neutral because the mean of the accumulated asset values at different rates of return is not the same as the accumulated value at the mean return.[1] The correct procedure (for a risk-neutral firm) is to calculate for each future date the expected value of the net contributions that would be required at different rates of return and then discount these amounts at a risk-free borrowing rate for bonds of that maturity.[2]

A quite different aspect of pension uncertainty is the possibility of the failure of the pension plan or bankruptcy of the company. Under such circumstances, the benefit obligations become the responsibility of the federally-financed Pension Benefits Guarantee Corporation (PBGC) which has recourse to the firm only to the extent of 30 percent of its equity. The

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[1] One dollar invested at 10 percent for 10 years becomes $2.59. The expected accumulated value if there is an even chance of a zero return and a 10 percent return is therefore (1.00 + 2.59)/2 = 1.80. In contrast, the accumulated value at the expected yield of 5 percent is $1.63.

[2] This assumes that the future contributions will be made with certainty.

conventional measure of the unfunded pension obligation ignores this re-insurance feature and, to that extent, overstates the expected liability of the equity owners of the firm.[1]

On balance, it is not possible to say whether the conventional measure of pension fund liability underestimates or overestimates the corresponding true value. In considering the effect of unfunded pension obligations on share prices and on shareholder saving, it is therefore important to recognize that shareholders do not have either an accurate published estimate or the detailed information with which to make the calculation for themselves. Moreover, since the unfunded vested pension liability that firms publish [2] is the difference between the total liability and the total assets, relatively small differences in the estimate of the total liability imply much larger proportional estimates of the net unfunded liability. Nevertheless, the published estimate of the unfunded vested pension liability is the only information on which shareholders could base their estimate and it is therefore of interest to examine the effect on the share price of the obligation measured in this way.[3]

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1 This aspect of pension valuation is stressed by Treynor et. al. (1976) and Gersovitz (1980).

2 Firms are currently required to publish only the unfunded obligation. Some firms also provide information on their pension assets and therefore on their total liability.

3 The estimates presented in this paper refer to share prices in 1976 and 1977. More recently, investors have had access to more detailed information about pension calculations that are filed with the Department of Labor pursuant to ERISA requirements. It would be of interest to repeat the present analysis for a later year in order to investigate whether these data influenced shareholder evaluation of the pension liabilities.

2. Specification of Market Value Equations

We have estimated the impact of unfunded vested pension liabilities on the market value of companies by analyzing data for a large sample of manufacturing firms for 1976 and 1977, the first years for which inflation-adjusted income statements and balance sheets are available. Our basic data include information on: the replacement cost of plant, equipment and inventories; the market value of corporate equity and debt;[1] accounting earnings with depreciation and inventory gains adjusted for inflation; and the reported values of pension liabilities and assets. The data are derived primarily from the Standard and Poors Compustat file and augmented with other information described below.

2.1 Total Market Value

The general specification of the market valuation equation combines the capital valuation and earnings valuation approaches. We thus build on earlier work by Gordon (1962), Modigliani and Miller (1958), Oldfield (1977), Tobin and Brainard (1977), and others.[2] The starting point of the specification is the view that the total market value of the corporation (including the value of both debt and equity) is proportional to the replacement value of the underlying assets: $V=qA$.[3]

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1 The method of estimating the market value of the corporation's debt is described below.

2 Of these, only Oldfield specifically examines the effect of private pensions. His model is based on a net earnings evaluation model of the equity value of the firm. His estimates were for 1974, before data on inflation-adjusted accounts became available.

3 Precise definitions of the variables are presented in the next section.

Although the marginal value of q would be equal to one in equilibrium under certain conditions,[1] the average value of q will depend also on the firm's ability to provide above-average earnings. This stream of future earnings reflects such things as market position, patents and other know-how, etc. The equations in this paper represent future earnings by three variables: (1) the current ratio of earnings to physical assets, E/A, where E includes interest payments as well as equity profits; (2) the growth of profits over the past decade, GROW; and (3) the relative expenditure on research and development as a proportion of the firm's asset value, RD/A. Thus the preliminary specification is:

$$(4) \qquad \frac{V}{A} = \alpha 0 + \alpha 1 \frac{E}{A} + \alpha 2 \ \text{GROW} + \alpha 3 \frac{RD}{A} + \varepsilon$$

Where ε represents a random error.

The value of q may depend also on the perceived riskiness of the firm. Since all of the firms in the present study are relatively large manufacturing firms, the variation in risk is more limited than it would be in a fully representative sample of firms. Two measures of risk are added to the specification of equation 4: a beta coefficient and a measure of corporate leverage. A variety of different beta coefficients are conceptually possible, differing in the portfolio of assets with respect to which the beta is calculated and in the time interval used to define the regression (daily, monthly, etc.). The current study uses a widely available equity market beta

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[1] If retained earnings are part of the marginal source of finance, the tax system may make even the marginal value of q not equal to one; see footnote 1 page 6.

based on monthly values that is calculated by Merrill, Lynch, Pierce, Fenner and Smith.[1] Although corporate leverage would have no effect on the firm's market value under the strict conditions specified by Modigliani and Miller a higher ratio of debt to total capital could increase the market value of the firm because of tax advantages or reduce it by increasing the risk of bankruptcy or by limiting the investment activities of the firm.[2] The expanded specification is thus

$$(5) \quad \frac{V}{A} = \alpha 0 + \alpha 1 \frac{E}{A} + \alpha 2 \text{ GROW} + \alpha 3 \frac{RD}{A} + \alpha 4 \text{ BETA} + \alpha 5 \frac{DEBT}{A} + \varepsilon$$

where DEBT is the market value of the firm's net debt.

We come finally to the value of pension obligations. If the unfunded vested pension liabilities were accurately measured, they would be equivalent to an equal value of debt or a corresponding reduction in the firm's net equity value. In this case, the unfunded vested pension liability (UVPL) could be added to the other components of the firm's market value or, equivalently, it would appear on the right hand side of equation 5 with a coefficient of minus one. Thus 5 would become

$$(6) \quad \frac{V}{A} = \alpha 0 + \alpha 1 + \alpha 2 \text{ GROW} + \alpha 3 \frac{RD}{A} + \alpha 4 \text{ BETA} + \alpha 5 \frac{DEBT}{A} + \alpha 6 \frac{UVPL}{A} + \varepsilon$$

with $\alpha 6$ equal to minus one. More generally, as we emphasized in Section 1, there are errors in the measurement of unfunded pension liabilities that make

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[1] The beta values used in the current study are reported in Merrill, Lynch Pierce, Fenner and Smith (1976).

[2] On the substantial costs of bankruptcy, see the useful and extensive discussion in Gordon and Malkiel (1979). Meyers ( ) discusses the way in which debt may limit the firms activities. There is of course the possibility firms differ in their optimal debt-equity ratios and that firms have chosen their ratios to maximize V, thus making the least squares estimates of equation 6 an inadequate way of estimating the effect of exogeneous changes in debt.

it inappropriate to specify a priori how the market is likely to respond to this variable.

For many firms, it is also possible to estimate the value of the assets held by the pension fund. The unfunded vested pension liabilities can therefore be decomposed into the difference between total vested pension liabilities (VPL) and pension assets (PA), i.e., UVPL = VPL - PA. The market might consider the vested pension liabilities to be mismeasured and might therefore value VPL at a more or less than dollar-for-dollar rate. But if the market value of pension assets were known with certainty, the market might value these assets dollar-for-dollar. This suggests including VPL and PA as separate regressors and testing whether the coefficient of PA is one.

There are, however, two problems with this procedure. First, the information on pension assets is available only with a substantial lag and is subject to serious ambiguities and measurement problems.[1] Second, investors may regard information about pension assets as an indication of the likely magnitude of vested liabilities or of some other unobserved attribute of the firm (e.g. the ease with which it can raise funds or the management's expectations about future growth).[2] The PA variable is included separately in some of the regression equations reported below to eliminate the restrictions that VPL and

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1 These data are published in annual volumes of the Money Market Directory.

2 In the extreme, investors might regard the official estimates of vested liabilities to contain no information about true liabilities while believing that the firm's pension assets were some fraction of true liabilities. In this case the coefficient of the PA variable would be negative and the coefficient of the VPL variable would not be significantly different from zero. By a similar argument, investors may regard the reported level of UVPL as an indication of some other unobserved characteristic of the firm and, to that extent, the effect on share-prices of reported differences in UVPL cannot be regarded as an indication of the effect of a general change in funding policy or of the current existence of unfunded liabilities as such.

PA have equal and opposite coefficients but a theory of rational market valuation cannot be tested with these coefficients.

For some firms, it is also possible to obtain information on what are known as unfunded past and prior service pension liabilities (UPPSL).[1] Unlike the regular vested benefit liabilities, the past and prior service liabilities represent a projection rather than a current legal liability. More specifically, the past and prior service liability at any time is the present value of all projected benefits minus the present value of the future contributions that would be made under a normal schedule of funding. This difference reflects the funds that would already have accumulated if the future projected benefits were being funded continuously on a normal schedule of funding.[2] The difference between this past and prior service liability and total pension assets represents the unfunded past and prior service liability.

Although firms are required to provide information about their unfunded vested pension liabilities, providing information about past and prior service liabilities is optional. For the large manufacturing firms that did provide this information, the value of unfunded past and prior liabilities substantially exceeds the value of unfunded vested pension liabilities. We have therefore limited the sample to the firms that provided this additional information. Unfortunately, there are wide discrepancies in the way that these liabilities are defined and market participants might rightly give much less weight to these estimates than to the measure of vested liabilities. Separate equations are therefore estimated with and without this variable.

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[1] This is also sometimes called the unfunded accrued pension liability.

[2] The past and prior service liability thus includes vested as well as unvested benefits.

2.2 Equity Value

Our discussion until now has been about the total market value of the firm, including both the equity and debt components. It is interesting also to examine the market value of the firm's common stock equity and the way in which it is influenced by pension liabilities. The distinction between the total market value approach and the equity value approach could be important if, primarily because of tax or risk factors, it is inappropriate to assume the same q value for debt and equity.

An alternative to the total market valuation model relates the value of common stock equity (VE) to the net equity assets, i.e., the replacement value of the firm's physical assets minus the market value of the debt and the market value of the preferred stock (PS): i.e., $VE = q^e$ (A-DEBT-PS). Proceeding as before, the asset valuation ratio q^e will depend on the firm's future equity earnings. We define the firm's current equity earnings (EE) as total after-tax earnings (E) minus interest payments and preferred dividends plus the gain that equity owners make at the expense of their creditors because of inflation; i.e., equity earnings are defined by subtracting real interest payments and preferred dividends from the total after-tax earnings that were used for the total market value equation. The ten-year growth of equity earnings (GROWE) and the expenditure on research and development are also included to represent the relation between current and future earnings. The specification also includes the market beta coefficient and a measure of leverage.

A correctly measured value of unfunded pension liabilities should reduce the net equity value dollar-for-dollar. Again, the measurement problems imply that a coefficent of unity on the actual UVPL variable is not a requirement for rational share valuation.

The complete specification of the equity value equation is thus:

$$(7)\ \frac{VE}{AE} = \beta 0 + \beta 1\ \frac{EE}{AE} + \beta 2\ GROWE + \beta 3\ \frac{RP}{AE} + \beta 4\ BETA + \beta 5\ \frac{DEBT}{AE} + \beta 6\ \frac{UVPL}{AE} + \varepsilon$$

when AE = A - DEBT - PS, the net asset value of the corporation's equity. Other specifications with pension assets and past and prior service liabilities are also estimated.

These specifications make no explicit allowance for the role of the Pension Benefit Guarantee Corporation (PBGC), a government agency that reinsures pension obligations.[1] Gersovitz (1980) has emphasized the role of the PBGC and suggested that a marginal dollar of unfunded pension liability should not depress the firm's equity value to the same extent (if at all) when the total liability exceeds 30 percent of the firm's current equity value. However, the relevant effect of the PBGC does not depend on the current ratio of benefits to market value but on the possiblity that the firm might at any time be in a position where the 30 percent reinsurance limit would come into effect. All things equal, a higher ratio of UVPL to equity capital would involve a smaller marginal effect of UVPL on the firm's equity value. Although this could in principle be

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[1] Under current law, a corporation is responsible for its unfunded pension liabilities only to the extent of 30 percent of its equity value; any further obligation is met by the BGC.

approximated by extending the specification of equation 4 to include a quadratic term in the ratio of UVPL to net equity capital, the inadequacies of the data suggest that such an estimate might be attempting to learn too much from the data. Some estimates of this effect are presented in Section 5.

3. The Data

This section reviews the operational definitions of the variables that are required to estimate equations 6 and 7 and then presents the means and standard deviations of the variables for 1976 and 1977.

The construction of most of the variables uses the income statement, balance sheet, and other data that are provided in the Standard and Poors Compustat file. The market value of each firm's common stock (VE) is calculated as the product of the number of shares outstanding and the market price per share on the last day of the year. Since price information is not provided for the firm's preferred stock, the market value of the preferred stock (PS) is estimated by dividing the annual preferred stock dividends by the Standard and Poor preferred dividend yield for the current year.[1] The market value of the firm's debt (DEBT) is calculated by subtracting the firm's short-term financial assets from the sum of short-term liabilities and an estimated value of long-term debt. The data provide information on the book value of long-term debt and the amount of the annual interest payment. We assume that all

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[1] This ignores the role of convertible preferred stock. The assumed yields for 1976 and 1977 were 7.66 percent and 7.87 percent.

long-term debt has ten years until maturity and then calculate the present value of the interest stream and final redemption, using the Baa interest rate.

Each firm's balance sheet provides information on the replacement value of the firm's plant and equipment and the book value of land. To this we add the market value of the firm's inventories.[1] The sum is the real value of the firm's capital stock, A.[2]

Total earnings (E) are the sum of : (1) the net profits available for common stockholders as reported in the firm's accounts, (2) the value of preferred dividends, (3) the interest payments, (4) the difference between accounting depreciation and depreciation at replacement cost, and (5) the difference between LIFO inventory gains and FIFO inventory gains for those firms that report on a FIFO basis. Total earnings are thus equivalent to the real return to debt and equity capital.

Although the growth of earnings variable (GROW) should measure the increase in <u>real</u> earnings, neither we nor the market participants had accurate information about inflation-adjusted earnings for years before 1976. The earnings growth variable therefore must be constructed in terms of conventional earnings.[3] More specifically, we define GROW as the difference between the average accounting earnings (including interest) in the most recent five years and the average earnings in the previous five years, divided by the current capital stock (A).

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1 For LIFO firms, the accounting formulas are meaningless and inventory value is estimated by using data on the replacement cost of inventories.

2 The value of A thus excludes intangible assets like patents, brand-loyalty, etc. If this measurement error is correlated with the other variables it will bias the coefficients.

3 Investors might, of course, have made their own approximate corrections for the difference between real and nominal earnings.

The remaining variables in the total market value equation have already been described.[1] The corresponding variables for the equity value equation are similar except that they are divided by the value of property, plant and equipment minus the market value of the firm's net debt and preferred shares (AE). The equity earnings variable (EE) has already been defined as the difference between total earnings and the real interest payments on the firm's debt. The growth of equity earnings (GROWE) is the ten-year difference in accounting after-tax equity earnings (the sum of dividends and retained earnings as conventionally defined) divided by the value of equity assets (AE).

The sample of firms for each of the two years (1976 and 1977) consists of all those manufacturing firms in the Compustat file for which the required information was provided about inflation-adjusted accounts and about pension liabilities and assets. The inflation-adjusted accounts were required by the Securities Exchange Commission only for firms above a certain size. Since Standard and Poors only included this information in the Compustat file if it was reported by a certain date, reporting delays further limited the number of firms for which such information is available. Although the value of unfunded vested pension obligations must be reported on each firms 10-K form, the information about past service liabilities and about the value of pension assets is provided at the firm's discretion. Restricting our sample to firms that provided all of this information significantly limited the size of the sample. The resulting samples contained 117 firms for 1976 and 193 firms for 1977.

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[1] These are research and development (RD/A), the Merrill-Lynch beta coefficent (BETA), the market value of net debt (DEBT), and the three pension variables (UVPL/A, UPPSL/A, and PA/A).

Table 1 presents the mean values and standard deviations for the key variables in 1976 and 1977. A few features deserve comment. Note first that the mean values of q and q^e (i.e, V/A and VE/AE) are both approximately one and that for both years q exceeds q^e.[1] The gross earnings after tax (E/A) averaged 6 percent of the real capital while the corresponding net earnings (EE/AE) averaged about 3 percent of equity capital in 1976 and 4 percent in 1977.[2]

Unfunded vested pension liabilities (UVPL/A) averaged about 5 percent of assets. The gross pension assets of the firms were about 13 percent of the corresponding physical assets, implying that (for this sample of firms) the unfunded vested pensions averaged less than one-third of total vested pensions. The unfunded past and prior service liabilities average about 10 percent of assets and are therefore about twice as large as the unfunded vested liabilities. The ratio of total gross pension liabilities to corporate assets is therefore about 25 percent.[3]

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1 This inequality is consistent with the view that taxes cause the market value of equity to be less than unity. See above, footnote 1 page 6.

2 These figures are consistent with the aggregate estimates for all non-financial corporations reported in Feldstein and Summers (1979) and Feldstein and Poterba (1980).

3 This is the sum of pension assets (PA/A = 0.135) and unfunded past and prior service liabilities (UPPL/A = 0.110). Total pension liabilities are thus about 1.8 times pension assets. If this ratio could be extrapolated to all private pensions, it would imply that the $549 billion of private pension assets reported in the flow of funds account for 1979 (excluding the $68 billion assets of state and local pension funds) correspond to a private pension "wealth" of employees of $988.2 billion. The corresponding figure for vested pension "wealth" is approximately half this amount.

Table 1

Means and Standard Deviations of Basic Variables

		Total Value					Equity Value			
		1976		1977			1976		1977	
		Mean	S.D.	Mean	S.D.		Mean	S.D.	Mean	S.D.
Market Value	(V/A)	1.231	1.006	1.074	0.654	(VE/AE)	0.871	0.694	0.748	0.506
Earnings	(E/A)	0.059	0.079	0.064	0.067	(EE/AE)	0.028	0.080	0.040	0.069
Growth	(GROW)	0.051	0.049	0.058	0.052	(GROWE)	0.049	0.044	0.062	0.064
Research and Development	(RD/A)	0.026	0.035	.029	.034	(RD/AE)	0.026	0.032	0.020	0.035
Debt Asset Ratio	(D/A)	0.011	0.234	.034	.247	(D/AE)	0.065	0.255	0.119	0.377
Beta Coefficient	(Beta)	1.090	0.284	1.171	0.330	(Beta)	1.090	0.284	1.171	0.330
Unfunded Vested Pension Liability	(UVPL/A)	0.047	0.056	0.049	0.058	$\frac{UVPL}{AE}$	0.051	0.059	0.055	0.069
Pension Assets	(PA/A)	0.123	0.116	0.135	0.112	$\frac{PA}{AE}$	0.129	0.129	0.144	0.110
Unfunded Past Service Liability	(UPSL/A)	0.108	0.093	0.110	0.095	$\frac{UPSL}{AE}$	0.117	0.100	0.110	0.095
Sample Size	(N)	117	-	193	-	N	119	-	193	-

The net debt to capital ratios for both years are quite low, reflecting the offsetting effects of trade credit and other nominal assets. There is very substantial variation in the ratio among firms.

4. Parameter Estimates for the Total Market Value Equation

The parameter estimates presented in this section indicate that unfunded vested pension liabilities reduce the market value of firms. Although the standard errors of the coefficients and the measurement problems referred to earlier are too large to draw precise conclusions, the estimates are compatible with the conclusion that each dollar of unfunded vested pension liability reduces the firm's market value by one dollar. The specific point estimates suggest a greater than one-for-one effect and generally differ in a statistically significant way from zero.

Table 2 presents estimates of three alternative specifications of the total market value equation. Each specification is estimated for 1976 and 1977. The results are generally similar for the two years but differ in a number of details. We begin by commenting on the 1977 results since the sample is much larger and likely to be more representative.

Before discussing the coefficents of the pension variables, it is useful to examine briefly the coefficients of the other variables. The coefficient of the earnings variable in equation 2.1 implies that an extra dollar of after-tax earnings raises the market value of the firm by $5.23. It is important to emphasize that this coefficient should not be misinterpreted as a low capitalization coefficient in an earnings valuation model: since the

Table 2

Determinants of Total Market Value of Corporate Securities

	Year	Constant	Earnings (E/A)	Earnings Growth (GROW)	Research (RD/A)	Beta Coefficient (BETA)	Leverage (DEBT/A)	Vested Liability (UVPL/A)	Past Service Liability (UPSL/A)	Pension Assets (PA/A)	R^2	SSR
2.1	1977	0.61 (0.11)	5.23 (0.65)	1.92 (0.75)	1.38 (0.91)	0.05 (0.08)	-0.49 (0.12)	-1.44 (0.47)			0.69	25.230
2.2	1977	0.67 (0.12)	5.37 (0.65)	1.69 (0.76)	1.70 (0.92)	0.04 (0.08)	-0.53 (0.13)	-1.12 (0.51)		-0.45 (0.28)	0.70	24.874
2.3	1977	0.67 (0.12)	5.35 (0.65)	1.74 (0.77)	1.71 (0.93)	0.03 (0.08)	-0.54 (0.13)	-1.62 (0.85)	0.38 (0.54)	-0.51 (0.29)	0.70	24.806
2.4	1976	0.58 (0.19)	4.61 (0.85)	8.35 (1.31)	4.14 (1.57)	-0.05 (0.16)	-0.48 (0.23)	-1.97 (0.79)			0.80	23.297
2.5	1976	0.57 (0.21)	4.60 (0.86)	8.41 (1.35)	4.05 (1.65)	-0.05 (0.16)	-0.48 (0.24)	-2.02 (0.83)		0.08 (0.43)	0.80	23.290
2.6	1976	0.57 (0.21)	3.90 (1.66)	8.43 (1.35)	4.61 (0.86)	-0.03 (0.16)	-0.50 (0.24)	-0.99 (1.36)	-0.86 (0.90)	0.30 (0.49)	0.80	23.095

The dependent variable in each equation is the market value of debt and equity per dollar of capital stock (i.e., property plus plant, equipment and inventories at replacement cost). All of the other variables except Beta are deflated by the capital stock. The constant term is also divided by the net capital stock. Standard errors are shown in parentheses.

underlying specification is basically an asset valuation model,[1] the coefficient of the earnings variable indicates how the firm's q value is increased by a higher current level of earnings.

The positive growth variable also has the expected sign, indicating that firms that have experienced basic growth during the past decade have a high market value. The positive coefficient on the research and development variable indicates that firms that do more research are expected to have relatively higher future earnings. It would, of course, be wrong to infer that any firm could raise its market value by increasing its spending on research. The market is presumably able to judge (even if imperfectly) between potentially productive research and wasted research spending. The coefficient therefore reflects the relation between the market's valuation of different companies and the amount of their research spending rather than the market's valuation of incremental research spending as such.

A higher ratio of debt to total capital reduces the market valuation of the firm, presumably reflecting the increased risk of bankruptcy or the restrictions on the firm's activities that are implied by the debt service obligation. The beta coefficient does not have a statistically significant effect. This may reflect the particular choice of beta coefficient variable[1] or the lack of a more complete specification of the firm's risk characteristics.

The coefficient of the unfunded vested pension liability variable is -1.44 with a standard error of 0.47. The point estimate implies that each dollar of unfunded liability reduces the firm's value by $1.44. Such an effect

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[1] See above, page 18.

would imply that the market regards the firms' reports as an understatement of the true liability (for the types of reasons discussed in Section 1). The standard error implies, however, that a two-thirds confidence interval reaches from -1.03 to -1.91. The data are thus compatible with the possibility of a one-for-one substitution as well as of a more substantial effect.

Equation 2.2 adds the value of pension assets to the set of explanatory variables. The coefficients of all of the variables except the unfunded pension liability variable remain almost exactly as in equation 2.1. The coefficient of the unfunded liability variable shrinks (in absolute value) to -1.12 with a standard error of 0.51. The pension asset variable itself has a coefficient of -0.45 with a standard error of 0.28. These point estimates imply that each dollar of reported pension assets increases the market value of the firm by 67 cents (i.e., the difference between 1.12 an 0.45) while each dollar of reported liability decreases the value by $1.12. The standard error of 0.28 implies that the difference between these two effects is barely statistically significant at the 10 percent level.

Equation 2.3 adds the value of the unfunded liabilities based on past and prior service to the set of regressors. The estimated coefficient (0.38) is smaller than its standard error (0.54), implying that the market appears to ignore unvested liabilities. Deleting the value of pension assets from this equation only makes the coefficient of the past service liability smaller (reducing it from 0.38 to 0.13).

The results for 1976 are qualitatively similar but some differences should be noted. Although the coefficient of the earnings variable is quite similar in both years, the coefficients of the earnings growth variable and the research-and-development variable are both substantially larger in 1976. The coefficient of the unfunded liability variable is absolutely larger (-1.87) but also has a larger standard error (0.79). The unfunded liability effect therefore again differs in a statistically significant way from zero but is compatible with minus one as well as with values that are absolutely much larger.

When the value of pension assets is added to the set of regressors (in equation 2.5), the value of its coefficient is very much less than its standard error and the coefficients of the other variables remain essentially unchanged. The data thus imply that the market looks only at the net unfunded liability and not at its components.

Finally, the unfunded past and prior service liability variable in equaton 2.6 is also smaller than its standard error, confirming the 1977 estimate that the market appears to ignore this variable and focuses exclusively on the vested liabilities.

5. Parameter Estimates for the Equity Value Equations

The parameter estimates for the equity value equations support the conclusions of the total market value equations presented in the previous section. There are, however, some differences between the two sets of results as well as between 1976 and 1977 that deserve comment.

All of the equations in Table 3 show that the market value of common

stock per dollar of "equity capital"[1] is positively related to current earnings, the growth of earnings and the intensity of research effort. The growth and research effects are stronger in the 1976 equations. The beta coefficient is again insignificant in both years.

The coefficient of the unfunded vested liability variable in equation 3.1 equals -1.23 with a standard error of 0.40. This is clearly consistent with the view that the equity owners regard the stated value of unfunded vested liabilities as the most likely value and reduce their demand price (or offer price) for the stock by the stated value of the unfunded vested liability.

When the value of pension assets is added as an additional variable in equation 3.2, the other coefficents remain essentially unchanged. The coefficient of the pension assets variable is -0.40 with a standard error of 0.27. The point estimates imply that a dollar of pension assets adds only 58 cents to the equity value of the company, about half of the negative effect of a dollar of pension liabilities. But the size of the standard error implies that the difference between the pension asset effect and the pension liability effect is only statistically significant at about the 15 percent level. Conventional tests of statistical significance imply that equation 3.2 does not dominate equation 3.1.

The unfunded past and prior service liability has a small coefficent (equation 3.3) that is only a small fraction of its standard error. Its introduction raises the standard errors of the other coefficients, especially that of

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[1] Recall that equity capital (A) is defined as the difference between the real value of tangible assets and the sum of debt and preferred stock liabilities.

Table 3

Determinants of The Market Value of Corporate Equity

	Year	Constant	Earnings (EE/AE)	Earnings Growth (GROWE)	Research (RD/AE)	Beta Coefficient (BETA)	Leverage (DEBT/AE)	Vested Liability (UVPL/AE)	Nonlinear Liability $(UVPL/AE)^2$	Past Service Liability (UPSL/AE)	Pension Assets (PA/A)	R^2	SSR
3.1	1977	0.50	2.54	2.02	3.00	0.02	-0.14	-1.23				0.49	25.089
		(0.11)	(0.54)	(0.58)	(0.85)	(0.08)	(0.08)	(0.40)					
3.2	1977	0.55	2.64	1.88	3.30	0.01	-0.13	-0.99			-0.41	0.50	24.783
		(0.11)	(0.54)	(0.59)	(0.87)	(0.08)	(0.08)	(0.43)			(0.27)		
3.3	1977	0.54	2.65	1.88	3.32	0.01	-0.12	-1.20		0.20	-0.44	0.50	24.762
		(0.12)	(0.54)	(0.59)	(0.87)	(0.08)	(0.08)	(0.69)		(0.51)	(0.28)		
3.4	1977	0.54	2.53	1.99	2.73	0.03	0.14	-2.63	5.01			0.50	24.687
		(0.11)	(0.53)	(0.58)	(0.86)	(0.08)	(0.08)	(0.90)	(2.89)				
3.5	1976	0.52	2.26	7.17	4.75	-0.06	-0.29	-1.84				0.63	20.649
		(0.18)	(0.61)	(1.05)	(1.38)	(0.15)	(0.17)	(0.69)					
3.6	1976	0.45	2.29	7.35	4.29	-0.03	-0.30	-1.96			0.28	0.64	20.540
		(0.20)	(0.62)	(1.08)	(1.51)	(0.15)	(0.17)	(0.71)			(0.36)		
3.7	1976	0.45	2.30	7.35	4.25	-0.02	-0.30	-1.64		-0.25	0.33	0.64	20.520
		(0.20)	(0.62)	(1.09)	(1.52)	(0.16)	(0.17)	(1.23)		(0.78)	(0.40)		
3.8	1976	0.46	2.28	7.33	4.22	-0.03	-0.30	-2.40	2.18		0.29	0.64	20.528
		(0.20)	(0.62)	(1.09)	(1.54)	(0.15)	(0.17)	(1.87)	(8.51)		(0.37)		

The dependent variable in each equation is the market value of corporate common stock per dollar of net capital stock (i.e., plant, equipment and inventories at replacement cost net of the market value of debt and preferred stock). All of the other variables (except the Beta coefficient) are also divided by the net capital stock. Standard errors are shown in parentheses.

the unfunded vested pensions variable. But equation 3.3 is clearly not preferable to the specification of equation 3.1.

Equation 3.4 introduces a second order term in the unfunded vested pension liability variable. Its positive coefficient implies that the depressing effect on equity value of an extra dollar of unfunded liability decreases as the relative size of the unfunded liability increases. This is consistent with the role of the Pension Benefit Guarantee Corporation in limiting the corporate pension obligation to no more than 30 percent of the firm's equity value.[1] The point estimates of the two pension coefficients (-2.63 for the linear term and 5.01 for the quadratic term) imply very substantial effects of unfunded liabilities on share prices at all relevant levels of the UVPL variable. At its mean value (0.049), the effect of a further increase in UVPL is -2.63 + 2 (5.01) (0.049) = -2.14. At one standard deviation above the mean value of UVPL (i.e. at UVPL = 0.107), the effect of a further increase in UVPL is still -1.53. Although the substantial standard error indicates that these point estimates are subject to a sizable margin of error, the results clearly confirm the implication of equation 3.1 that unfunded vested pension liabilities significantly depress the equity value of the firm.[2]

The results for 1976 are similar but not identical. The earnings growth and research variables had a more powerful effect on equity value in

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[1] Very few firms currently have unfunded vested liabilities in excess of 30 percent of the firm's equity value (only 8 of the 193 sample firms in 1977 and 5 of the 117 sample firms in 1976).

[2] Adding the value of pension assets or the unfunded past and service liabilities does not alter the other coefficients in the equation. Neither of these coefficients is itself significantly different from zero.

the 1976 equation. The leverage variable is again negative and its effect is stronger for 1976 than for 1977. The unfunded vested liability variable in equation 3.5 has a coefficent of -1.84 and a standard error of 0.69. The coefficient is thus different from zero at any conventional significance level.

The pension assets variable is included in the next three equations where it has a coefficient of about 0.30 and smaller than its 0.75 standard error.

Equations 3.7 and 3.8 show that neither the unfunded past and prior service liabilities nor the coefficients of the quadratic term in vested liabilities is statistically significant. Including these variables has very little effect on the other coefficients.

Some Implications

Although the problems of statistical measurement imply that the parameter estimates must be treated with caution, the current finding that unfunded vested pension liabilities cause an approximately equal reduction in the market value of the firm, if supported by future research, has important implications about the relation between private pensions and national saving, about the poor performance of the stock market in recent years, and about optimal corporate financial policy. This final section considers each of these.

6.1 Private Pensions and National Saving

The most important implication of the share price response is that the existence of unfunded private pension liabilities does not necessarily entail a reduction in total private saving. Because the pension liability reduces the equity value of the firm, shareholders are given notice of its existence and an incentive to save more themselves. For this reason, unfunded private

pensions differ fundamentally from the unfunded Social Security pension and the other unfunded federal government civilian and military pensions.

The net effect of private pensions on total private saving also depends on a number of other factors. How well do the firms' vested pension liabilities correspond to what the employees perceive as their accrued pension wealth? How does this accrued pension wealth or other aspects of anticipated pension benefits influence direct saving by employees? And how does the time pattern of increased shareholder (and corporate) saving compare to the time pattern of reduction in employee saving?

Although there has been some work on the second of these questions, the analyses were forced to use quite inadequate data. On balance, the evidence indicates that anticipated benefits reduce individual saving but the link between vested pension liabilities and perceived benefits remains completely unexplored. The availability of improved data should make it possible to pursue these questions more effectively in the coming years.

6.2 The Level of Share Prices

The poor performance of the stock market has been one of the most striking economic facts of the 1970's. The Standard and Poor composite index of common stock prices fell 47 percent in real terms between 1969 and 1979. A number of explanations of this dramatic decline have been offered and there may well be some truth in all of them: Feldstein (1980a, 1980b) has emphasized the interaction of inflation and tax rules; Malkiel (1977) has emphasized increasing risk; and Modigliani and Cohn (1979) have emphasized the investors' failure to distinguish correctly between nominal and real yields.

The growth of unfunded pension liabilities is another contributor to the poor performance of share prices. The evidence for the current sample of firms implies that the unfunded vested pension liabilities were seven percent of the market value of the firms' equities in 1977. If the equity value of the firm is reduced dollar-for-dollar by its unfunded liability, the recognition of these liabilities has lowered the average share value by about seven percent.[1]

6.3 The Pension Funding Puzzle

In Section 1, we noted that it should be optimal for firms to fund their vested pension obligations as quickly as possible. A firm that borrows and invests the proceeds in the pension fund has the advantage of earning tax exempt interest (on the assets in the pension fund) while paying tax deductible interest on the borrowed money used to finance the pension fund. It is a puzzle therefore that all firms do not fund their vested obligations fully and that an average of about 25 percent of the vested liabilities in the sample firms were unfunded.

One potential explanation of such apparently irrational behavior by firms is that they believe that the securities market is irrational: i.e., that investors would recognize debt that appears on the balance sheet but not the

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[1] There are several reasons to believe that the corresponding effect of pensions on share prices at the end of the 1960's was either very small or non-existent. First, without the ERISA rules the future benefits were not as strong a binding obligation. Second, although the extent of the unfunded vested liability at that time cannot be estimated, it is noteworthy that the ratio of pension fund reserves to corporate equity has more then doubled in the 1970's. Finally, investors have undoubtedly become much more aware of private pension obligations because of the attention focused by ERISA and because of the growth of these liabilities. In addition to the reduced value of V/A caused by the UVPL, the substitution of pension promises for current wages causes earnings to be overstated; to the extent that the market recognizes this, the price-earnings ratio will be reduced. Note that this price-earnings effect would be present even for a firm that just begins to substitute pension promises for wages while the effect of UVPL would persist for a firm that stops using unfunded liabilities.

unfunded pension liabilities. If that were true, it would be in the interest of current shareholders to leave the pension liability unfunded. However, the evidence in this paper indicates that securities investors do not make this type of mistake.

Why then do firms not fund their pension obligations more completely? It is, of course, possible that some firms do not understand the advantage of funding or that they believe (contrary to the evidence in this paper) that the securities market is irrational in valuing unfunded pension obligations. Alternatively, some firms may not be more completely funded because they are already contributing the maximum annual tax deductible amount. Firms may also be reluctant to fund more rapidly because the pension contribution would reduce the year's reported earnings (even if financed by borrowing) which in turn would reduce the firm's market value.[1] Finally, the Pension Benefit Guarantee Corporation may encourage firms to remain less than fully funded in order to take potential advantage of the insurance protection that it gives. Because of the substantial importance of pension assets and the potential interest in changing the pension funding options available to firms, a more thorough understanding of firms' current funding behavior would clearly be desirable.

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[1] It is not clear whether the market is irrational in this way. Investors can in principle correct annual earnings by the change in the vested pension obligations but we know of no evidence that this is done by securities analysts. But even if investors now have too little information to distinguish between expenditures on pension contributions and accruals of pension liabilities, a firm should be able to provide such information to shareholders if it wanted to undertake an accelerated funding of pension liabilities.

The conclusions of this paper reflect the experience of manufacturing firms in 1976 and 1977. The equations developed here should be reestimated with data for more recent years and for a wider range of firms. The growing availability of a richer array of data on firms' pension rules, employee coverage, and pension fund assets will not only make possible new analytic studies but will also permit securities analysts to reflect the value of unfunded pension obligations more accurately. This in turn will strengthen the ability of unfunded as well as funded pensions to contribute to national saving.

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