DISCOUNT RATES

AND

PENSION LIABILITIES

by

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Abstract

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Financial statement disclosures concerning defined benefit pension plans are among the most complex mandated by the Financial Accounting Standards Board. Accounting for these pension liabilities involves a series of complex estimations. One of the most critical elements is the discount rate used to convert the projected stream of benefit payments to a present value. **Standard No. 87: Employers' Accounting for Pensions** describes the specific factors the discount rate should reflect, suggests several benchmarks, and requires disclosure of the rate. However, managers have discretion in the final selection of the discount rate.

Differences in the time horizon for benefit payout are the only factors which should theoretically produce differences in discount rate choice, suggesting that little variation should be observed in practice. However, discount rates during the period from 1986 through 1992 varied from roughly 5% to 11%, which can induce substantial differences in the reported liabilities.

The central research questions in this dissertation focus on investor use of the discount rate in pricing securities and the factors which influence managers in their choice of the discount rate.

The results of the analysis support the conclusion that market valuation of the pension liability reflects the discount rate as well as the reported liability. Market prices adjust for difference in discount rate and weight liabilities accordingly.

The factors hypothesized to influence rate selection were found to be significantly associated with the discount rate choice. The strongest influence was exerted by the pension plan's funded status: managers select discount rates that minimize both overfunding and underfunding. Unionization rates have a negative association with discount rate choice, consistent with a monitoring role for unions, bonding effects, and a desire of unionized firms to exaggerate the cost of providing pension benefits. The firm's debt-equity ratio had a significant positive association with discount rate, consistent with the debt-covenant hypothesis commonly invoked to explain accounting choice. Finally, firms with poor pension fund asset performance (relative to expectations) were found to use higher discount rates. This was consistent with the use of the discount rate to minimize reported underfunding.

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Ne discere cessa, nam sine doctrina
vita est quasi mortis imago.
Ergo docere est animare etiam vivere.

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CHAPTER 1. INTRODUCTION

Pension accounting issues are situated at a nexus of research questions which animate much of the current debate over accounting standard setting and policy issues. Increasingly, accounting standard setters are relying on note disclosure rather than financial statement recognition as the means for conveying complicated information to users. Frequently, key assumptions which form the basis for complex estimates must be disclosed as well. Central to the debate is the question of whether financial statements must reflect specific measurements or whether disclosure in the notes, including supplementary information as to methods of measurement used, is adequate. A second issue concerns the usefulness of these supporting disclosures.

The extent to which differences in estimation parameters may affect measurements and perhaps mislead financial statement users is

a matter of concern to both the Financial Accounting Standards Board (FASB) and the Securities and Exchange Commission (SEC). There is concern that managers may selectively modify reported numbers through adjustment of estimation parameters. However, standard setters have been reluctant to mandate the use of benchmark values. Required disclosure of important measurement variables, such as the discount rate used in accounting for pensions, has been the compromise solution.

Pensions are a particularly meaningful domain in which to examine these issues. Actively implemented public policy has encouraged the provision of retirement income through private savings mechanisms, in particular defined benefit pension plans. Therefore the repercussions of these "accounting" issues may have substantive impacts on individuals and on collective welfare.

Accounting for the liability of a defined benefit pension plan involves a series of complex estimations. One of the most critical elements is management's choice of the discount rate used to convert the projected stream of benefit payments to a present value. **Statement of Financial Accounting Standard No. 87: Employers' Accounting for Pensions** (SFAS 87) describes the specific factors the discount rate should reflect, suggests several benchmarks, and requires

disclosure of the rate. However, managers have discretion in the final selection of the discount rate.

The value relevance of a company's reported pension liability has been established (Landsman 1986, Barth 1991). That is, security prices have consistently been demonstrated to incorporate pension liability disclosures. This reported pension liability is a function of the firm's underlying economic liability for pension benefits and the measurement techniques and assumptions used to estimate that liability. In particular, the discount rate assumption has a major effect on the liability measurement. The relevance and informativeness of the disclosure of this rate assumption, viewed as essential by the standard setters, has not been established.

There are two research questions in this dissertation. The first question is whether investors use the discount rate disclosure in pricing securities. The second investigates the factors which influence managers in their choice of the discount rate.

This dissertation uses a market valuation model based on a disaggregated balance sheet to examine the informativeness of the disclosure of the discount rate assumption. The firm's market value of common equity is the dependent variable in a regression analysis which uses book values of nonpension assets and liabilities and disclosed

pension assets and liabilities as independent variables. The disclosed discount rate is used to partition the pension liability variable in order to examine cross-sectional differences in valuation due to rate selection. The reported pension liabilities are then standardized to a common discount rate and substituted into the regression to assess differences in cross-sectional coefficient variation.

The factors which influence managers in their discount rate choice are also investigated. As discussed subsequently in greater detail, differences in the time horizon for projected benefit payouts are the only factors which should theoretically produce differences in the discount rate choice across firms. In practice, however, we observe a considerable range of rates being disclosed. It is postulated that the underlying funded status of the pension plan is an important determinant of the discount rate choice. Other factors hypothesized to be influential are the firm's debt-equity ratio, the investment return experienced on pension plan assets, unionization rates and utility industry membership. Regression and contingency table analyses are used to test the discount rate determinant hypotheses.

The results of the analysis support the hypothesis that a standardized (i.e., discount rate adjusted) liability most closely reflects market pricing. A clearly significant difference exists between the

security market valuation of reported liabilities measured using higher as opposed to lower discount rates. The use of a discount rate adjusted liability supports the informativeness of the discount rate disclosure since it represents joint utilization of that disclosure and the reported liability.

The factors hypothesized to influence rate selection are found to be significantly associated with the discount rate choice. Funded status is strongly associated with the discount rate choice; the evidence is consistent with managers selecting discount rates that would minimize or obscure underfunding as well as overfunding. Unionization rates are found to have a negative association with discount rate choice, consistent with a monitoring role for unions, a bonding effect from pension fund underfunding and a desire of more heavily unionized firms to exaggerate the costs of providing pension benefits. The firm's debt-equity ratio has a significant positive association with discount rate, consistent with the debt-covenant hypothesis frequently invoked to explain accounting choice. Finally, firms with lower pension fund asset investment performance (relative to the expected rates of return) are found to use higher discount rates. This effect is consistent with managers compensating for poor

investment performance by using the discount rate to minimize reported underfunding.

Examining the choice and informativeness of the discount rate illuminates issues relating to the desirable extent of regulation. Standard setters repeatedly grapple with the question of whether it is adequate to require disclosure of various assumptions as contrasted with the mandate of specific benchmarks or guidelines. This dissertation research is positive rather than normative in its objective. However, insights into the factors influencing managers' discount rate choice and the extent to which this disclosure is utilized by investors are central to resolving the issue of disclosure adequacy.

The dissertation is organized as follows. The institutional context for pension disclosures is summarized in Chapter 2. Chapter 3 reviews relevant prior research on pension accounting, with a focus on studies related to pension asset and liability disclosures. Chapter 4 discusses the hypotheses related to the value relevance of the discount rate disclosure to investors and to the factors influencing managers' choice of rates. A detailed discussion of a major methodological issue, standardization of the reported pension liability, is contained in Chapter 5. Chapter 6 describes the methodology used to test the hypotheses. The sample selection process, data collection and descriptive statistics

are detailed in Chapter 7. The empirical results of the analyses and their interpretations are presented in Chapter 8. Finally, Chapter 9 summarizes and concludes.

CHAPTER 2. INSTITUTIONAL CONTEXT FOR PENSION DISCLOSURES: THE DISCOUNT RATE CHOICE

One important objective of pension disclosures is to facilitate assessment of the plan's funded status (Schipper and Weil 1982, SFAS 87 ¶106). Funded status is the difference between the projected benefit obligation (PBO) and the fair market value of plan assets (FMVPA).[1] The plan's funded status is therefore a function of the projected benefit obligation, which is in turn highly sensitive to the discount rate assumption used to convert the future benefit payments to a present value.

SFAS 87 requires disclosure of the discount rate assumption. The FASB concluded that "information about [this] assumption is

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[1] The projected benefit obligation (PBO) is the present value of benefits earned to date, including the effects of expected future salary increases. Pension plan assets are held in trust, segregated and restricted from other uses; their value is measured at fair market value. Contributions receivable from the employer are not included in the FMVPA. Under SFAS 87, firms must disclose the PBO and the FMVPA and additionally must provide a detailed reconciliation between the funded status and the pension liability or asset actually recorded on the balance sheet. See Appendix A for a more detailed discussion of pension accounting and the related disclosure requirements.

essential," noting that "the discount rate is a significant assumption that materially affects the computation of the pension benefit information and the comparability of that information among employers" (SFAS 87, ¶221). The discount rate is identified by SFAS 87 as the "rate at which the pension obligations could be effectively settled" (SFAS 87, ¶44). While the FASB explicitly rejected mandating a benchmark rate (SFAS 87, ¶196), the Standard mentions two objective proxies which might be used as the basis for the discount rate choice: "rates implicit in current prices of annuity contracts, including rates . . . published by the PBGC[2] . . . [and] rates of return on high quality fixed-income investments" (SFAS 87, ¶44). Outside of this guidance, there is no authoritative restraint on the choice of rates.[3]

In the Implementation Guide to SFAS 87 (FASB 1986), the FASB reiterated that the discount rate choice should be determined by market-specific **not** firm-specific conditions, except insofar as the

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[2] The Pension Benefit Guaranty Corporation (PBGC) is the federal pension insurance agency. The PBGC publishes settlement rates which must be used in plan terminations and curtailments and which are used by the PBGC to evaluate liabilities associated with pension plans the agency has taken over.

[3] Regulatory restraints, on the other hand, may be administered *ex post facto*, as later discussion of the SEC's interventions concerning individual firms' discount rate choice points out.

timing of expected benefit payments affects the implicit rate in a settlement such as a guaranteed insurance contract. "The assumed discount rates . . . [should] not consider anything other than the time value of money . . . [The] intent [of SFAS 87] is not necessarily to arrive at a discounted amount that would be the price an insurance company would charge to assume the same pension benefit promise to employees" (FASB 1986, 48-49). In other words, none of the firm-specific factors causing uncertainty in the estimated **amount** of benefit payments should be incorporated into the discount rate, just those firm-specific factors related to the estimated **timing** of benefit payments.

Differing time horizons for the projected payout of benefits should, therefore, be the only factor causing variation in the settlement rates available to different firms. Other factors causing across-firm variations in obligations, such as mortality and other plan population characteristics, retention rates, and projected length of employment, are considered in determining the benefit payout estimates. It should be noted that most of these factors can be estimated with a great deal of precision.[4] Firm risk, while it may be relevant to the economic substance of pension plan liabilities, is a factor outside the pension

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[4] See discussion in Winklevoss (1993, 214). This does not mean, however, that firms do not act opportunistically in this regard as well.

accounting process, which is explicitly based on the going-concern assumption.

Theoretically, therefore, only the term structure of interest rates should cause the discount rate to vary across firms. But since the yield curve flattens over a shorter time horizon than that of most pension plan obligations, the term structure of interest rates should not have a significant impact on the discount rate choice. This suggests that, empirically, we should observe little variation in firms' discount rates. However, this is not the case.

Table 1 shows the discount rate assumptions, by year, of firms surveyed by the American Institute of Certified Public Accountants (AICPA) in **Accounting Trends and Techniques** from 1987 to 1992 and reveals a range of 4 to 5 percentage points in the rate assumptions. What appear to be small disparities in the discount rate can account for large differences in obligation estimates. The observed dispersion in the discount rate choice is substantial in terms of effect on the resultant reported liabilities and raises questions about their comparability.

Actuarial experts concur that a seemingly small reduction in the discount rate assumption can produce a large increase in the estimated liability. A frequently cited rule of thumb estimates that the projected

TABLE 1

DISCOUNT RATE ASSUMPTIONS

%	1987	1988	1989	1990	1991	1992
6.0	0	0	0	0	0	1
6.5	1	3	3	2	2	7
7.0	2	7	8	6	12	21
7.5	18	13	25	16	25	34
8.0	81	74	96	88	117	165
8.5	113	118	137	137	182	165
9.0	134	167	152	154	107	75
9.5	61	73	44	54	23	7
10.0	25	31	12	17	4	2
10.5	4	2	1	0	0	1
11.0	1	1	0	0	0	0
≥ 11.5	0	0	1	1	1	0
Total Companies	440	489	479	475	473	478

Source: **Accounting Trends and Techniques, 1988-1993.**

benefit obligation is altered by six to seven percent for each quarter of one percent change in the interest rate.[5] Thus, a difference of as little as one-half percent in the discount rate assumption is non-trivial in terms of the effect on reported liabilities. The effects of discount rate changes and issues in standardization of reported liabilities are discussed in more depth in Chapter 5.

Recently, the SEC has been pressuring firms to follow more closely the guidelines for discount rate choice articulated in SFAS 87 and to adjust discount rates to the current interest rate environment, going so far as to communicate formally with the FASB on this issue.[6] "The agency is concerned that many companies have been minimizing their obligations to retirees by using a high assumed interest rate to calculate today's pension liability. To better reflect today's lower-rate climate, the SEC is urging companies to reduce this 'discount rate' to about 7%, roughly the current yield on long-term, high-grade corporate bonds" (Jereski 1993, C1).

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[5] Winklevoss (1993, 212-214) states that this estimation is "used often in connection with pension plans" and adds that "most plans conform reasonably well to this assumption." See also McGill and Grubbs (1989, 258-261). Chapter 5 contains a more detailed discussion of rate effects and restatement methods.

[6] A letter from the SEC expressing concern over firms' discount rate choices and lack of stricter adherence to SFAS 87 was read at a meeting of the Emerging Issues Task Force in September 1993 (FASB 1993).

The discount rate has an impact on the estimated obligation and therefore on the funded status of the plan, which is the difference between plan assets and plan obligations. *The Wall Street Journal* reported that "[t]he SEC's stance will increase the total underfunding of defined-benefit pension plans to $38 billion, from the $18 billion or so that companies currently show on financial statements, according to calculations by the Pension Benefit Guarantee Corp., the government agency that insures private pension plans" (Jereski 1993, C1).

A Goldman, Sachs research report found that in 1992, 307 out of 366 Fortune 500 firms surveyed used a discount rate of 8% or higher to measure their pension liability. The study warned that changes in discount rates might have serious balance sheet effects, suggesting that "some firms ... [as a result of lowering the rate] may experience defaults under existing debt covenant agreements" (Napolitano 1993, 2).

Pension plan funding requirements are based on Internal Revenue Service (IRS) and Employee Retirement Income Security Act (ERISA) guidelines which generally require that, in the aggregate, actuarial assumptions reflect a best estimate of **anticipated experience** for the

plan.[7] This contrasts with SFAS 87 guidelines requiring the discount rate assumption to reflect **current** settlement rates. This difference in statutory versus financial reporting criteria confines the effects of rate assumptions under SFAS 87 to the financial statements. There are no immediate cash flow implications stemming from the choice of the discount rate used to measure pension expense and liabilities for financial reporting purposes. Tax deductibility is limited to the amount of actual contribution made to the pension fund, provided it is below the permissible upper bound.

Despite the absence of direct cash flow effects, the anecdotal and survey evidence discussed above suggests that managers face balance sheet pressures in considering the discount rate choice. These influences may reflect indirect economic impacts resulting from the accounting choice of the discount rate. A variety of sources may

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[7] Although funding requirements have been subject to considerable change over the last fifteen years, currently the US Treasury requires use of a discount rate based on the weighted four-year average of 30 year Treasury bond rates. The discount rate used must be between 90% and 110% of this benchmark. Firms are further constrained in that they may not fund more than 150% of termination liabilities or 100% of ongoing liabilities. The measurement of termination liabilities and ongoing liabilities is also specified differently from the liability measurements used in SFAS 87, but are roughly the same as the vested and projected benefit obligations. Firms may also choose to provide and fund benefits in excess of limits under Federal tax law, which is usually done to provide senior executives with supplemental benefits. For a detailed discussion of funding regulations, see Ippolito (1990, 57-61). Also see Francis and Reiter (1987).

contribute to these effects, including debt-covenant agreements, bond indentures, union bargaining power and contracts.

There are two major objectives of this research. One is to increase awareness of the extent to which the discount rate disclosure is incorporated by financial statement users into security prices. The other is to develop greater understanding of the influences on discount rate selection and their impact on the discount rate choice. Both of these research issues are relevant to standard setters in choosing between reliance on the adequacy of disclosure and the designation of mandated benchmarks for use in estimations.

CHAPTER 3. PRIOR RESEARCH

3.1. Equity Value Relevance of Pension Liabilities

Previous research has examined the relevance of pension assets and liabilities in pricing the sponsoring firm's debt and equity. Early research by economists indicated that the firm's market value incorporates pension liabilities (Oldfield 1977, Feldstein and Seligman 1981, Feldstein and Mørck 1983, Bulow, Mørck and Summers 1987).

Much of the previous accounting research uses disclosures mandated under SFAS 36. These data have some serious limitations due to the level of disclosure required and the variety of actuarial methods permissible prior to the promulgation of SFAS 87. The main research questions addressed concerned the contribution of reported pension liabilities to firm valuation, through the pricing of both debt and equity. Accounting researchers have explored the relationship between firm value and disclosed pension liabilities but have not yet established

whether and how this relationship is affected by the disclosure of supplementary information such as the discount rate assumption.

Daley (1984) and Landsman (1986) both examined the value relevance of pension liabilities disclosed under SFAS 36, using quite different models. Both tried, unsuccessfully, to evaluate the effect of related disclosures concerning discount rate assumptions.

Daley (1984) modelled value as a function of earnings, risk and growth and found that pension costs, unfunded vested benefits, and unfunded prior service costs were reflected in market value. He tried to measure cross-sectional variation in the valuation process attributable to the discount rate choice through the use of indicator variables designating different discount rate categories. None of these categorical variables had significant coefficient estimates and their signs and magnitudes were inconsistent, failing to support a connection between the valuation process and discount rates. However, he used the **net** liability in his analysis, rather than including both the asset and liability, and he considered only vested benefits. He treated net pension assets and net pension liabilities as a continuous variable. In addition, his sample of 128 firms was relatively small to support significant findings when stratified over seven discount rate categories.

Landsman (1986) examined the economic substance of pension plan assets and liabilities modelling market value as a function of a disaggregated balance sheet, with assets and liabilities separated into pension and nonpension components. In addition to assessing whether pension liabilities are valued by the market as a part of corporate net worth, Landsman developed a theoretical basis for the expected coefficient estimates from the regression analysis. He showed that the theoretically correct values of the coefficients on the pension asset and liability should be +1 and -1, respectively. That is, the coefficient estimates should not incorporate anticipated tax benefits related to future contributions nor effects of excise taxes on withdrawals of excess plan assets. Previous researchers used a benchmark valuation for the pension liability which was net of tax effects (Feldstein and Seligman 1981, Feldstein and Mørck 1983, Daley 1984).

One implication of Landsman's work is that only differences in measurement error should affect the consistency between the empirically determined coefficients of pension and non-pension assets and liabilities. Landsman restated the pension liability variable used in his model to reduce the measurement error introduced by firms' selection of differing interest rates. He modelled the liability as an annuity and used a linear transformation to standardize the reported

liability to a common discount rate (after Bulow 1979). His results were consistent with his proposed benchmarks, but his use of the restated variable did not produce qualitatively different results from those obtained using unadjusted liabilities. Specifically, when the restated variable was used, the standard error of the pension liability coefficient estimate was not reduced. As noted in his paper, there were some potentially significant econometric problems which were not fully resolved. In particular, collinearity between the regressors and the presence of a large, statistically significant intercept may affect the conclusions drawn from the results of his study.

Although both Daley (1984) and Landsman (1986) found evidence of the market relevance of the reported pension liability, they were unable to establish the usefulness of the related rate disclosure. However, SFAS 36 permitted diversity in actuarial method as well as actuarial assumption. This limited the inferences that could be drawn from the rate disclosure. Additionally, as discussed above, there were weaknesses in the methodologies used by both researchers.

Barth (1991) compared the value relevance of different asset and liability measures disclosed under SFAS 87. She found that the projected and accumulated benefit obligations (together with the fair market value of plan assets) more closely reflected market values than

did the vested benefit obligation or the pension liability actually recorded on the balance sheet. In general, she also found that, when benefits were based on future salary increases, the projected benefit obligation provided a better mapping to market values than the accumulated benefit obligation.

The value relevance of the reported pension liability has been established, but the usefulness of the discount rate disclosure has only been addressed in passing. An important extension of this research is a more focussed examination of the usefulness of the discount rate disclosure.

3.2. Relevance of Pension Liabilities in the Bond Market

The role of pension liabilities in risk perception and bond pricing has also been explored. Dhaliwal (1986), using SFAS 36 disclosures, found evidence that unfunded vested pension obligations are viewed as contributing to financial leverage in the stock market's assessment of a firm's financial risk. He used a model relating a firm's systematic risk to its financial and business risk. The model included a financial leverage variable. The inclusion of unfunded vested pension liabilities in that variable improved the explanatory power of the model. He further compared the effect on market-perceived risk of this addition to

the leverage variable with its other components and found no statistically significant difference.

The use of pension asset and liability information in the bond rating decision was examined by Maher (1987). Different measures of pension liabilities and assets reported under SFAS 36 were tested in an attempt to determine which, if any, are significant factors in the bond rating process. The overall explanatory power of the rating model was not affected by the inclusion of the pension variable, regardless of its specification. He found statistical significance associated with the variable based on the restated net pension liabilities in two of three sample years analyzed, but no association with variables based on net pension assets and unrestated net liabilities. Maher used a linear transformation, based on the assumption that the pension liability behaves essentially as a perpetuity.

Subsequently, Maher and Ketz (1993) re-examined this issue using SFAS 87 as well as other measures of pension liabilities. They used an N-chotomous probit model, with bond rating as the dependent variable. Consistent with Maher's prior findings, this study found that the addition of pension variables did not significantly increase prediction accuracy. Furthermore, this research indicated that standardization of the liability to a common discount rate (thus

removing the effects of differences in discount rates in liability calculations) did not produce preferable measures of the pension liabilities, from the perspective of both statistical and practical significance.

Reiter (1991) examined the effects of pension liabilities on the determination of bond risk premia, in the utility industry, using SFAS 87 data. She found a statistically significant association between bond risk measures and unfunded pension liabilities. She further showed that these are reflected in bond yields.

3.3. Implications for Research on the Discount Rate Disclosure

One conclusion which can be drawn from this stream of research is that disclosures under SFAS 87 are more useful than those required under the previous standard. Both increased detail of the disclosure required and the imposition of uniformity of actuarial method may contribute to this finding. These factors also warrant renewed investigation into the informativeness of the discount rate disclosure.

The existing body of research on pension accounting supports the finding that reported pension liabilities are value relevant. However, the relevance of disclosures concerning the estimation parameters used in measuring these liabilities has not been established,

despite the fact that both the SEC and the FASB have determined these disclosures to be important. Substantial variation in the reported liabilities may be induced by use of different discount rates. An understanding of the utilization of the rate disclosure as well as the factors influencing the discount rate selection is the central focus of the research in this dissertation. Insights gained thereby are important for the ongoing debate over the optimal extent and nature of required disclosures.

CHAPTER 4. HYPOTHESIS DEVELOPMENT

4.1. Market Valuation Hypothesis

If the FASB is correct in its assertion that discount rate information is needed for meaningful inter-firm comparison of pension liabilities, differences in the rate assumption should have an impact on the market's assessment of the liability. If a high discount rate is used, understating the reported liability, an efficient market price would reflect a compensation for this deflation and weight the liability more heavily. Conversely, if a low discount rate is used, which would result in the reported liability being overstated, an efficient market price would discount the liability further. As a consequence, differences in the discount rates used to measure pension liabilities should produce differences in market valuation of the liabilities.

Landsman (1986) and Barth (1991) used a valuation model constructed by disaggregating assets and liabilities into pension and non-pension components.

$$MV_E = BV_{NPA} - BV_{NPL} + PA - PL \qquad (1)$$

where:

MV_E is the market value of equity
BV_{NPA} is the book value of nonpension assets
BV_{NPL} is the book value of nonpension liabilities
PA is the disclosed market value of pension assets
PL is the disclosed pension liability.

In a regression analysis, with the market value of equity as the dependent variable, the coefficients on the independent variables, reported assets and liabilities, theoretically reflect the weighting with which the market incorporates the reported amounts into market value. If the disclosure of the discount rate provides information used to conditionally value the pension liability, then the coefficient would reflect both the reported liability and the disclosed discount rate.

The projected benefit obligation is explicitly measured using the discounted cash flows approach. The behavior of the coefficient on the pension liability provides insight into measurement and valuation issues related to the discount rate choice. Market efficiency would

suggest that the disclosed discount rate is used in conjunction with the reported liability to produce an assessment of the liability for firm valuation purposes. Therefore, differences in the assessment of the reported liability based on differences in disclosed discount rates should be reflected in the association between the reported liability and market value.

Landsman (1986) and Barth (1991) tested market relevance of reported pension liabilities, the former using data reported under SFAS 36 and the latter using data reported under SFAS 87. Both studies examined the market-relevance of reported pension liabilities. The reported pension obligation is one of two key pieces of information needed to accurately assess the underlying pension liability, the other being the discount rate with which it was measured. The objective of this research effort is to determine whether the market's valuation of the reported liability reflects the discount rate as well as the reported liability.

The first hypothesis predicts that securities prices incorporate the disclosed discount rate assumption as well as the reported liability into firm value. A liability measured using a high discount rate will be weighted more heavily to compensate for the high rate's deflationary effect on the reported liability. Similarly, a reported obligation that is

inflated by use of a low discount rate will be additionally discounted by the market. Thus, the valuation of the pension liability impounded in the market value of the firm is a positive function of the firm's choice of discount rate.

> H_1: The implicit market value of the **reported** pension liability is positively related to the disclosed discount rate.

The market's use of the discount rate disclosure is expected to be observable through a statistically significant difference between the value assigned to pension liabilities measured with low discount rates and those measured with high discount rates. If a low discount rate is used, the market price of the firm's equity will weight the liability less heavily. If a high discount rate is used, the market price of the firm's equity will reflect an additional weighting to compensate for deflation of the liability through the high discount rate choice.

The market's adjustment of reported liabilities to compensate for differing discount rate assumptions produces an effect similar to standardization of the liabilities to a common discount rate. Comparison of two different variable specifications, the reported pension liability and a revised or standardized pension liability, can be made to determine which more closely maps onto security prices.

Using these two liability measures in the regression will provide insight into the discount rate informativeness through examination of differences in the resultant coefficient estimates.

4.2. Accounting Choice Hypotheses

Since the discount rate information is disclosed in the financial statements, there should be no direct security-price benefits from manipulation of the reported liability through opportunistic selection of the discount rate. However, some actions, such as those resulting from contracts, are explicitly based on accounting numbers. In addition, external decision makers may rely on reported financial information as their point of departure for investment decisions, loan agreements, and collective bargaining negotiations. These factors may encourage managers to use the discount rate to adjust the reported liability.

Much of the positive accounting literature suggests that managers are sensitive to the amount of reported liabilities (Watts and Zimmerman 1990). Thus, the funded status of the plan should be of major importance in determining the discount rate choice. Firms have generalized as well as specific incentives to avoid negative funded

status. Therefore, firms with negative underlying funded status will raise their discount rate to minimize the reported underfunding.

Positive funded status is not, however, an unalloyed benefit. Firms with large pension surpluses are viewed as attractive takeover targets.[8] Therefore, if the fair market value of plan assets exceeds liabilities, managers are expected to minimize the reported surplus by lowering the discount rate. The explicit assumption here is that managers act as though they are averse to takeover. An argument can be made that stock-based compensation might induce a takeover preference among managers so compensated. However, previous research suggests that managers do use accounting choices to minimize the likelihood of takeover (DeAngelo 1988, Christie and Zimmerman 1994).

It is hypothesized that managers will try to minimize reported underfunding by selecting higher discount rates and deflating the reported liability and thereby reducing the reported underfunding.

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[8] See Mittelstaedt (1989, 402-406). There is also evidence from individual firm pension footnotes, such as Dial Corporation (1993, 39) which states that "There are restrictions on the use of excess pension plan assets in the event of a defined change in control of Dial." Benefits of overfunding discussed in the finance literature result from the asset side of the plan; thus these benefits are not obtained by altering the reported liability. See Francis and Reiter (1987) for a discussion of the determinants of pension funding strategy.

Conversely, managers will also try to minimize reported overfunding by inflating the reported liability through use of a lower discount rate.

H_2: The discount rate is negatively related to the funded status of the plan.

Negative and positive funded status are not expected to be symmetric in their impact on discount rate choice. The incentives associated with underfunding are expected to have greater effect than those associated with overfunding. Potential effects of increased liabilities (such as default, debt recontracting and bankruptcy) are costly events to shareholders, while takeover may actually benefit existing shareholders. Managers are expected to be more adverse to the former than the latter. In this analysis, therefore, underfunding and overfunding are not treated as negative and positive correlates of the same variable; separate variables are constructed for each status.

Firm-specific characteristics affect the constraints managers face and thereby the impact of funded status on the choice of discount rates is altered. There are a variety of contracts that a firm enters into which contain accounting-based variables that constrain the actions of the firm. The ability to adjust those variables through accounting

choices such as the discount rate provides opportunities for management to relax these constraints.

Debt covenants frequently require that certain accounting-based measures (e.g., debt-equity ratios) be maintained within specified limits as essential to fulfillment of the indentures. These constraints provide incentives for managers to choose accounting procedures which reduce the probability of breaching the contracts (Smith and Warner 1979). The hypothesis that managers use accounting choices to avoid violation of accounting-based debt covenant constraints is well established in the accounting literature (Zmijeski and Hagerman 1981, Watts and Zimmerman 1986, Christie 1990). Accounting procedures which increase reported income and net worth reduce the likelihood of costly debt recontracting or default.

Firm leverage as measured by the debt-equity ratio is frequently used as a proxy for a firm's closeness to violation of debt covenant constraints (Duke and Hunt 1990, Press and Weintrop 1990).

The reported pension liability itself does not enter the balance sheet directly. The recognized liability or asset is built up from the cumulative amount of periodic pension expense less the amount of contributions made to the plan, as well as any liability or asset recorded on the balance sheet when the firm adopted SFAS 87. An exception

occurs when the fair market value of plan assets falls below the accumulated benefit obligation. This level of underfunding requires recognition of this deficiency as a minimum liability to be recorded immediately on the balance sheet. [A more detailed discussion of pension accounting is contained in Appendix A.] Therefore firms which are faced with debt covenant constraints will act to minimize reported underfunding and potentially adverse balance sheet effects. Firms with higher debt-equity ratios are hypothesized to choose higher discount rates in order to minimize the effects of pension liabilities on the balance sheet.

> H_3: The discount rate choice is positively associated with the firm's debt-equity ratio.

Several factors resulting from unionization may also influence the choice of discount rates. Labor economics research suggests that underfunding pension benefits produces a bonding effect with employees, to the firm's benefit (Ippolito 1986). Increasing the reported liability through use of a lower discount rate also increases reported underfunding (or reduces reported overfunding). Unionization provides incentives for management to exaggerate the cost of providing pension benefits to reduce pressure for benefit (or other

compensation) increases from the union. A lower discount rate increases pension costs as well as the reported liability. Finally, unions provide monitoring which may inhibit firms from selecting rates which are too high, possibly minimizing the perceived importance of (and actual) funding of the obligation. All of these effects lead to the hypothesis that higher levels of unionization provide incentives for managers to select lower discount rates.

> H_4: The discount rate choice is inversely associated with the firm's unionization rate.

When the fair market value of plan assets declines, *ceteris paribus*, any unfunded liability increases. Plan assets grow through investment returns as well as through contributions. If investment performance is below expectations, a firm may offset the negative impact on funded status by raising the discount rate and lowering the reported pension liability. This leads to the hypothesis that higher discount rates are associated with poor investment performance, relative to expectations.

> H_5: The discount rate choice is positively associated with poor investment performance of the firm's pension fund assets, relative to expectations.

Workforce characteristics such as employee age, average retirement age, and employee turnover are factors which might legitimately affect the discount rate a company selects. Controlling for these differences is desirable, but firm-specific data is not readily available. To the extent that these factors have industry-specific elements, controlling for industry may provide an adequate proxy. Financial structure, as reflected in the debt-equity ratio, also varies across industries. For these reasons, industry is included as a control variable.

It is hypothesized that rate-regulated firms (e.g., utilities) face incentives which encourage the use of lower discount rates. Utilities can sometimes capitalize a portion of pension costs thereby increasing their rate base. Lower discount rates generally increase the amounts of periodic pension cost recognized, with no increase in cash outflows. Since firms in rate-regulated industries do not face the same price pressures as firms in more competitive industries, such an increase in the rate base would be attractive and does not have strong negative consequences. Khurana and Loudder (1994) found evidence that public utilities responded positively to proposals to accrue non-pension postretirement liabilities and hypothesized a similar rationale for their lobbying behavior.

Utilities can also use the discount rate to increase the liability and to store up slack which can be drawn upon in the future. This is similar to the use of the pension fund itself as a storehouse for financial slack (Bodie et al. 1987), however it involves accounting earnings rather than cash flows.

> H_6: Rate-regulated firms (e.g., utilities) will have lower discount rates, *ceteris paribus*.

In summary, the discount rate determinant hypotheses posit that negative funded status, higher debt-equity ratios, and poor investment performance on plan assets, relative to expectations, are associated with the selection of higher discount rates. Overfunded status, higher unionization rates, and utility industry membership are expected to be associated with the choice of lower discount rates. This suggests that the rate determination is a multidimensional decision, which is affected by a number of potentially conflicting incentives.

CHAPTER 5. METHODOLOGICAL ISSUES IN RESTATING PENSION LIABILITIES

Before introducing the research design used in testing the market valuation and accounting choice hypotheses, it is important to understand the methodological issues involved in restating pension liabilities. Previous studies demonstrating the value-relevance of pension liabilities used as test variables the pension obligations disclosed in financial statement notes (Daley 1984, Landsman 1986, Barth 1991). Research analyzing the determinants and effects of the discount rate choice, however, is complicated by the fact that the reported liability is itself a function of that rate. Any model which uses pension liabilities or plan funded status to test hypotheses about discount rate choice and its effects must distinguish between the underlying economic liability and that reported in the financial statements to provide a basis for reliable inferences.

In the preceding chapter, it was posited that the funded status of the plan is an influential factor in the choice of discount rate. The funded status is the difference between the reported projected benefit obligation and the fair market value of plan assets. Using the funded status of the plan as an explanatory variable, without consideration of the interrelationship between the rate choice and the reported liability, may produce misleading results. The funded status is a function of the reported liability, which is determined in part by the discount rate.

We can infer that there is a "true" economic liability underlying the reported liability disclosed in a firm's financial statements. The economic liability consists of a future series of pension benefit payments made to employees after their retirement. As discussed in Chapter 2, this series of payments is measured using actuarial estimates of expected service lives, retirement dates, and mortality rates. As previously noted, these estimates generally can be made with a high degree of accuracy. To obtain a reportable liability, firms compute the present value of these estimated benefit payments. The discount rate assumption is integral to reportability, and any reported liability already includes the discount rate effect.

In order to separate the reported liability from the discount rate assumption, and to facilitate cross-firm comparisons where different

rates are assumed, it is necessary to standardize all reported liabilities to a common discount rate. However, there is much additional information about the plan which we do not know, making an actual restatement of the liability impossible based on publicly available information. Therefore, several restatement techniques have been used by economists and accounting researchers to estimate the standardized liability.

One method used by a number of accounting researchers was proposed by Bulow (1979). Bulow analyzed **vested** benefit obligations. He developed an argument which posits that the effects on the VBO of a change in discount rate will be less than the effect of such a change on a consol, an annuity in perpetuity. Since the payout of vested benefits peaks several years in the future, while the payout on a consol is constant, an increase in interest rates will decrease the present value of the pension liability by less than that of the consol. The consol has higher amounts of both longer term and shorter term payouts than the VBO. Bulow (1979, 50) concludes that "this analysis implies that a conservative estimate of the change in value of pension debts with regard to an interest rate increase is to assume the debt is proportional to one over the discount rate."

Thus

$$L_{STD} = L_{REP} \cdot \left[\frac{DR_{REP}}{DR_{STD}}\right] \qquad (2)$$

where L_{STD} is the standardized liability
L_{REP} is the reported liability
DR_{REP} is the reported discount rate
DR_{STD} is the standard discount rate.

However, in continuing his analysis, Bulow (1979, 66) applies this formula to a particular firm's VBO and notes that for this plan his approach "seems particularly conservative, since the firm mentions that a change in interest rate assumption from 5½% to 6% reduced the present value of vested benefits by 15%." His formula produces a reduction of only 8%, which suggests that there is substantial conservatism in his approach.

This standardization method is attractive because of its conservatism and tractability. It has been used by several accounting researchers (e.g., Stone 1987, Tinker and Ghicas 1993), primarily in work which focused on terminations and therefore on the vested benefit obligation. However, this paper uses the projected benefit obligation, for which Bulow's method is inappropriate.

A labor economist, Richard Ippolito (1986) used an alternative approach to standardization with the formula

$$L_{STD} = L_{REP} \cdot e^{-.077(DR_{REP} - DR_{STD})}. \qquad (3)$$

Ippolito offered this formula primarily to restate obligations for retired workers.[9] He derived the formula from an empirical examination of termination *versus* ongoing benefits using data reported to the Department of Labor for 1978. The accuracy of the formula in expressing the change in obligation is dependent in part on the level of discount rate. Restatement using this formula closely reflects the effects of a change in discount rate on a twenty-year annuity initially valued at 8%.

Discount rate changes have greater impact on the ABO and PBO than on the VBO. This is because the time horizon of accumulated and projected benefits exceeds that of vested benefits.

There seems to be general acceptance in the actuarial profession that the ABO and PBO conform robustly to restatement formulae that are relatively straightforward. Winklevoss (1993) and McGill and Grubbs (1989) are authors of standard texts in the field of actuarial

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[9] Ippolito used data from plan returns filed with the Department of Labor where he was Director of Policy and Research for Pensions.

science. Both stipulate a 4% rule of thumb for the effects of discount rate changes on the ABO and a 6½% (or 6% to 7%) rule of thumb for effects on the PBO. These formulae are expressed

$$\begin{aligned} ABO_{STD} &= ABO_{REP} \cdot 1.04^{-4\Delta} \\ PBO_{STD} &= PBO_{REP} \cdot 1.065^{-4\Delta} \end{aligned} \qquad (4)$$

where ABO_{STD} and PBO_{STD} (ABO_{REP} and PBO_{REP}) are the standardized (reported) *ABO* and *PBO* and Δ is the difference between the reported and standard discount rates, measured in quarters of percent.

Winklevoss (1993, 213) states that "[this] rule-of-thumb is well known and used often" and McGill and Grubbs (1989, 259) add that "[t]his relationship seems to hold within any reasonable range of interest assumptions."

The 4% rule has been used in several accounting research papers (Francis and Reiter 1987, Reiter and Omer 1992). It is important to recognize the implicit assumptions about plan characteristics or liabilities inherent in the various restatement methods. The researcher must make sure that these are consistent with the objectives of the restatement. That is, an examination of termination values of liabilities should use the vested benefit obligation and the Ippolito restatement method. Research which views the liability under a going concern

assumption should use the accumulated or projected benefit obligation and apply a restatement approach consistent with Winklevoss.

Finally, various professionals use their own approaches to restating liabilities for comparative purposes. A well known actuarial consulting group, Buck Consultants (1993), produces annual studies on the economics of defined benefit pension plans. They restate the accumulated benefit obligation in a more complex manner, based on assumptions about the ratio of retirees to active employees and the average payout and deferral period for each group of beneficiaries.[10]

Table 2 shows the effect on the pension liability of changes in the discount rate under different restatement schemes: Bulow's formula, Ippolito's formula and the 6½% and 4% rules attributed to Winklevoss.

Table 2 provides a basis for comparing the results of the different restatement plans. It should be kept in mind, however, that pension obligations generally do **not** behave as simple annuities. All three liability measures (VBO, ABO, and PBO) may reflect the inclusion of cost of living adjustments in the benefit formula. Additionally, the PBO

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[10] Based on conversation with Larry Wiltse, a senior actuary at Buck Consultants who is responsible for these reports.

TABLE 2

PROJECTED EFFECT ON PENSION LIABILITIES OF CHANGES IN THE DISCOUNT RATE USING DIFFERENT RESTATEMENT FORMULAE

	Percentage Change in the Pension Liability			
Change in the Discount Rate	Bulow Formula †	Ippolito Formula ‡	Winklevoss 6.5% Rule §	Winklevoss 4% Rule
+ 2.00%	-20.00	-14.27	-39.58	-26.93
+ 1.00%	-11.11	-7.41	-22.27	-14.52
+ 0.50%	-5.88	-3.78	-11.83	-7.54
- 0.50%	6.67	3.93	13.42	8.16
- 1.00%	14.29	8.00	28.65	16.99
- 2.00%	33.33	16.65	65.50	36.86

† Assumes initial valuation at 8%.

‡ Essentially equivalent to the effect of a discount rate change on a twenty-year annuity initially valued at 8%.

§ Essentially equivalent to the effect of a discount rate change on a twenty-year annuity deferred for twenty years initially valued at 8%.

incorporates the effects of future salary increases on the benefits. The effect of a discount rate on an annuity will be understated relative to the effect on an escalating payout obligation.

Any restatement method is an estimation itself and to the extent that the estimation is imprecise, the restated liability is mismeasured. The effect of such inaccuracies is almost always more pronounced for nonlinear restatement methods and for restatement of liabilities measured with extremely high or low discount rates. This *caveat* notwithstanding, the Winklevoss restatement is most appropriate for research examining the pension liability on a going-concern basis. In this paper, Winklevoss' 6½ % rule is applied to standardize the PBO. The standard discount rate used is the closest quarter percent to the sample mean disclosed discount rate for that year.

CHAPTER 6. RESEARCH DESIGN

6.1. Market Valuation Hypothesis

The methodology used here follows directly from the disaggregated balance sheet approach used by Barth (1991) and Landsman (1986) in their investigation of pension liabilities. This model, described in Chapter 4, is operationalized as

$$MV_E = \alpha + \beta_1 BV_{NPA} - \beta_2 BV_{NPL} + \beta_3 FMVPA - \beta_4 PBO + \varepsilon \quad (5)$$

where:

MV_E is the market value of equity
BV_{NPA} is the book value of nonpension assets
BV_{NPL} is the book value of nonpension liabilities
FMVPA is the disclosed fair market value of pension assets
PBO is the disclosed projected benefit obligation.

The usual ordinary least squares regression assumptions apply to the error term, ϵ. The expected signs of the assets (positive) and liabilities (negative) have been integrated into the regression equation to

facilitate comparison and discussion of coefficient magnitudes. Regression analysis of this equation relating market value of equity and the disaggregated balance sheet is used to test the market valuation hypothesis.

Previous researchers (Landsman 1986, Barth 1991) have noted the presence of a large, positive and often statistically significant intercept term in regression analysis based on this model as indicative of potentially problematic omitted variables. This suggests that some assets are missing from the balance sheet.

A major source of unrecorded assets are research and development outlays, which are expensed rather than capitalized (White, Sondhi and Fried 1993, 396-406). Shevlin (1991) found evidence that securities markets capitalize R&D expenditures and value them as firm assets. He specifically suggested the inclusion of an R&D variable might mitigate problems noted by researchers using the Landsman model (Shevlin 1991, 17). Furthermore, Sougiannis (1994) estimated the investment value of R&D expenditures and concluded that investors capitalize these outlays into market values.

Following these researchers' findings, a variable representing uncapitalized research and development is included in the equation:

$$MV_E = \alpha + \beta_1 RD + \beta_2 BV_{NPA} - \beta_3 BV_{NPL} + \beta_4 FMVPA - \beta_5 PBO + \varepsilon \quad (6)$$

The variable *RD* is the square root of R&D expenditures during the year. This transformation is used as a result of inspection of the form of the relationship between R&D expenditures and market value of equity. It is theoretically attractive because it mimics the relationship between inputs and value posited in production functions such as Cobb-Douglas.

This valuation equation is used in three different tests of the effects of the discount rate assumption on market value. In the first test, the analysis is performed using the reported benefit obligation and then repeated, using a revised liability, constructed by restating the reported obligation to a standard rate. Differences in the coefficient estimates and standard errors that result from the two different specifications of the variable are examined. Even if the standard rate is not the rate used by the market, cross-sectional variation in the coefficient estimates due to differing discount rate assumptions should be reduced or eliminated. Reduction in the standard error of the coefficient estimates on the different pension liability variables can be evaluated by comparing the t-statistics and their standard errors.

The second test of Hypothesis 1 is based on explicitly including a difference term measuring the difference between the reported and standardized PBO.

$$MV_E = \alpha + \beta_1 RD + \beta_2 BV_{NPA} - \beta_3 BV_{NPL} + \beta_4 FMVPA - \beta_5 PBO + \beta_6 DIFF + \varepsilon \quad (7)$$

DIFF represents the effects of differing discount rate choices on the reported pension liability and is simply the difference between the standardized and the reported projected benefit obligations.

If DIFF is significant, this shows dominance of the standardized pension liability over the reported liability in the valuation process. This is evidence of the informativeness of the discount rate disclosure since the standardized liability is inferred from knowledge of the reported pension liability and the disclosed discount rate.

The third test is a direct test of differential valuation, provided by segmenting the reported pension liability into two variables, on the basis of discount rate choice.

$$MV_E = \alpha + \beta_1 RD + \beta_2 BV_{NPA} - \beta_3 BV_{NPL} + \beta_4 FMVPA - \beta_5 PBO_H - \beta_6 PBO_L + \varepsilon \quad (8)$$

where:

PBO_H is the disclosed projected benefit obligation if the discount rate is above the average; 0 otherwise

PBO_L is the disclosed projected benefit obligation if the discount rate is at or below the average; 0 otherwise.

If differences in discount rate do not affect the valuation process, then the coefficients on PBO_H and PBO_L should be equivalent. If there is adjustment in valuation based on reported discount rate, then liabilities measured using high discount rates should be weighted more heavily than those measured using low discount rates. Hypothesis 1 posits that the coefficient on PBO_H will be greater than that on PBO_L.

6.2. Accounting Choice Hypotheses

The first test of the determinants of the discount rate choice examines the association between that choice and the funded status of the plan. The sample of firms is divided according to reported funded status (into overfunded and underfunded firms) and examined for significant differences in rate assumptions. A contingency table and chi-square test are used to evaluate the hypothesis of independence between the **reported funded status** and the discount rate.

Reported funded status, as previously discussed, is itself a function of the discount rate. To actually investigate the association between the discount rate choice and funded status, a test must be constructed which separates the influence of the discount rate choice on the funded status (and reflexively on the discount rate choice) from the influence of the funded status itself. This is done by repeating the contingency table analysis using the standardized pension liability instead of the reported liability to measure funded status. This tests the association between the plan's true funded status and the discount rate choice, which is hypothesized to be significant.

If the discount rate selected masks underfunding, the hypothesis of independence should be rejected for the reported funded status, but not for the standardized funded status. If discount rates are not selected as a function of funded status, neither test should show significance.

The factors hypothesized to have an impact on choice are evaluated by regressing the discount rate on these variables: over- and underfunded status (based on the standardized pension obligation), unionization rates, pension fund asset investment performance, and debt covenant constraints. Indicator variables for industry membership are also included.

This is modelled as

$$DR = \alpha + \sum_{i=1}^{7} \beta_i IND_i + \beta_8 OVRFS + \beta_9 UNDFS + \beta_{10} UNION + \beta_{11} DEBTEQ + \beta_{12} INVRET + \varepsilon \quad (9)$$

where *DR* is the firm's reported discount rate

IND_i is an indicator for industry membership

OVRFS is a measure of the overfunded status of the firm

$$OVRFS = 1 \text{ if } \frac{FMVPA - PBO_{STD}}{PBO_{STD}} \geq 1$$

UNDFS is a measure of the underfunded status of the firm

$$UNDFS = MAX \left\{ \frac{PBO_{STD} - FMVPA}{PBO_{STD}}, 0 \right\}$$

UNION is a measure of industry based unionization rates, obtained from Becker and Olson (1989)

DEBTEQ is the firm's debt-equity ratio measured using the book value of liabilities and the book value of equity

INVRET is a measure of the firm's investment return on plan assets relative to expectations as proxied by the expected long-term rate of return on plan assets

$$INVRET_t = 1 \text{ if } \frac{\sum_{year=1}^{t} ACTRET}{t} \leq EXPRET$$

Industry classification was based on a system devised by Sharpe (1982). Sharpe categorized firms by output into basic industries, capital goods, construction, consumer goods, energy, finance, transportation and utilities. In this analysis, the consumer goods producers were further divided into pharmaceutical and non-pharmaceutical firms. More specific information on the classification criteria and the resultant distribution of firms across industries are contained in the following section.

The effects posited in Hypotheses 2 through 6 would produce positive coefficients for *UNDFS, DEBTEQ* and *INVRET* (β_9, β_{11} and β_{12}) and negative coefficients for *OVRFS* and *UNION* (β_8 and β_{10}) as well as for the utility industry coefficient, β_7. There are no prior expectations for the other industry indicator variables.

CHAPTER 7. SAMPLE SELECTION AND DATA COLLECTION

7.1. Sample Selection

A threshold of $100 million in pension assets was established to capture firms with pension plans significant to operations. A search of publicly traded firms using the Compustat tapes found 520 firms disclosing total pension assets in excess of the threshold in 1988. Canadian firms, other foreign firms trading as American Depositary Receipts (ADR's) and firms in the financial services industry [SIC codes 6000 through 6999] were eliminated. Firms were also removed from the sample if they did not have publicly traded common stock.[11] The size of each annual sample was further affected by the elimination of firms which had negative book equity, had filed for bankruptcy, were under Chapter 11 reorganization, or had defaulted on loan interest

[11] Firms included in the Compustat data files include those with publicly traded debt or preferred stock but no publicly traded common stock.

payments (as opposed to merely being in technical default on loan agreements). A few firms were eliminated due to lack of data resulting from failure to comply fully with SFAS disclosure requirements. The winnowing process is summarized in Table 3.

Seven years of data are compiled for each firm, from 1986 through 1992. SFAS 87 was mandatory for most firms in 1987; for 1986, only 207 firm observations for early adopters are available. The final sample of firms ranges from 365 to 383 in the following years. The sample for the tests of hypothesized discount rate determinants is reduced by approximately 10 firms each year due to lack of the additional data needed to estimate the unionization rate.

Data on pension assets, liabilities and discount rate and return rate assumptions are obtained from the pension note disclosures in the annual reports. These disclosures are only available from Compustat on a very limited basis. Additional financial information (market value of equity, book value of total assets, book value of total liabilities) and SIC code are taken from the Compustat tapes.

Industry classification is based on Sharpe's classification system (Sharpe 1982). Details concerning industry categorization and a breakdown of the sample firms by industry are in Table 4. Utilities are

TABLE 3

SAMPLE SELECTION PROCESS

	1986	1987	1988	1989	1990	1991	1992
Companies with Pension Plan Assets > $100 MM	520	520	520	520	520	520	520
Eliminated:							
Financial Companies	66	66	66	66	66	66	66
Trading through ADR'S	16	16	16	16	16	16	16
Canadian Companies	20	20	20	20	20	20	20
Negative Book Value of Equity	4	6	13	13	14	13	11
In Chapter 11 or Default	16	16	13	10	10	10	12
No Publicly Traded Common Stock	10	10	10	10	10	10	10
Missing Pension Data	1	1	1	1	1	1	2
Terminated Pension Plan	0	0	0	1	1	1	1
No SFAS 87 Disclosures	180	20	0	0	0	0	0
Companies Used for Market Valuation Tests	207	365	381	383	382	383	382
Missing Other Data	10	10	11	11	13	13	13
Companies Used for Discount Rate Determinant Tests	197	355	370	372	369	370	369

TABLE 4

INDUSTRY CLASSIFICATION
OF SAMPLE FIRMS

	1986	1987	1988	1989	1990	1991	1992
Basic Industries	31	47	47	49	49	49	49
Capital Goods	32	52	54	54	53	54	54
Construction	6	8	8	8	8	8	8
Consumer Goods	64	92	98	98	98	98	98
Pharmaceutical	6	12	13	13	13	13	13
Energy	13	18	19	19	19	19	19
Transportation	17	30	31	31	31	31	31
Utilities	38	106	111	111	111	111	110
Total	207	365	381	383	382	383	382

Industry classification follows that of Sharpe (1982) with the additional segregation of pharmaceutical firms.

The SIC codes are the basis of categorization as follows:

Basic Industries	1000-1299, 1400-1499, 2600-2699, 2800-2829, 2870-2899, 2870-2899, 3300-3399
Capital Goods	3400-3419, 3440-3559, 3620-3629, 3670-3699, 3800-3849, 6090-5089, 5100-5129, 5160-5169, 7300-7399
Construction	1500-1999, 2400-2499, 3220-3299, 3430-3439, 5200-5219
Consumer Goods	0000-0999, 2000-2399, 2500-2599, 2700-2799, 2840-2869, 3000-3219, 3420-3429, 3600-3619, 3630-3669, 3700-3719, 3850-3899, 3900-3999, 4830-4899, 5000-5079, 5090-5099, 5130-5159, 5180-5199, 5220-5999, 7000-7299,7400-9999
Pharmaceuticals	2830-2839
Energy	1300-1399, 2900-2999, 5170-5179
Finance	6000-6999 (None in this sample by construction.)
Transportation	3720-3799, 4000-4799
Utilities	4800-4829, 4900-4999

the most widely represented industry (110 firms in 1992), followed by consumer goods (98), capital goods (49) and transportation (31).

For empirical testing, not every category can be inserted into the model; doing so would induce perfect collinearity which would render the regression equation insoluble. The fragmented and diverse nature of the consumer goods classification led to the decision to make this the omitted indicator variable. That is, any "industry effects" from this classification are incorporated into the intercept term. Analysis of different combinations of the industry indicator variables showed that this was the category with the least significance, perhaps due to the aforementioned eclectic characteristics of this classification.

Information on unionization is taken from Becker and Olson (1989). Becker and Olson used the Form 5500's filed by pension plans (filed with the Department of Labor and the Pension Benefit Guarantee Corporation) to estimate industry unionization rates. These are extended to the firms in this sample based on industry classification using the two digit SIC codes obtained from the Compustat tapes.

SFAS 87 requires disclosure of the expected long-term rate of return on plan assets, as well as the actual return on plan assets. This enables a comparison of actual with expected investment performance.

7.2. Descriptive Statistics

Information on the sample firms' discount rate assumptions is detailed in Table 5. The reported rates are consistent with those found in the **Accounting Trends and Techniques** surveys: the discount rates range from approximately 6.0% to 10.5%. The average rate in 1986 was 8.35% (standard deviation of 0.66%), which increased to 8.78% (standard deviation of 0.71%) in 1988 then declined to 8.22% (standard deviation 0.58%) in 1992.

The discount rates are heavily clustered around the mean, with the concentration becoming more pronounced over time. However, there is significant dispersion, from 4 to 5 percentage points, in all years.

Table 6 provides descriptive statistics of the financial characteristics of the sample firms by year. The mean and standard deviation of the variables, for all years in the sample, are presented in Panel A. Panel B shows the average correlation coefficients between selected variables, as well as the standard deviations of the correlations.

The firms in the sample are large, with an average market value of equity ranging from $3,867 million in 1986 to $5,569 million in 1992. The size of the pension plans is also large: average fair market

TABLE 5

DISCOUNT RATES OF SAMPLE FIRMS

%	1986	1987	1988	1989	1990	1991	1992
5.0 - 5.5	0	0	0	0	0	0	1
5.6 - 6.0	0	0	0	0	0	0	2
6.1 - 6.5	1	3	1	1	2	5	4
6.6 - 7.0	8	7	4	8	6	11	14
7.1 - 7.5	16	22	19	34	23	28	29
7.6 - 8.0	68	71	49	57	50	77	99
8.1 - 8.5	50	77	82	112	110	132	157
8.6 - 9.0	48	99	131	120	123	106	70
9.1 - 9.5	10	45	52	43	53	18	5
9.6 - 10.0	5	28	35	6	11	5	1
10.1 - 10.5	1	7	5	1	2	1	0
10.6 - 11.0	0	4	2	0	1	0	0
11.1 - 11.5	0	1	0	0	0	0	0
11.6 - 12.0	0	1	1	1	1	0	0
# Companies	207	365	381	383	382	383	382
Mean	8.35	8.68	8.78	8.52	8.64	8.39	8.22
Standard Deviation	0.66	0.81	0.71	0.67	0.68	0.62	0.58

TABLE 6
PANEL A

DESCRIPTIVE STATISTICS OF SAMPLE FIRMS
Mean and *Standard Deviation*

	1986	1987	1988	1989	1990	1991	1992
MV_E	3,867	3,604	3,827	4,689	4,395	5,431	5,569
	7,521	*6,282*	*6,557*	*7,821*	*7,871*	*10,002*	*9,798*
BV_E	2,349	2,350	2,366	2,454	2,539	2,569	2,401
	4,551	*4,046*	*4,070*	*4,109*	*4,243*	*4,135*	*3,573*
BV_{NPA}	5,726	5,883	6,952	7,459	7,989	8,176	8,396
	10,614	*9,762*	*14,914*	*16,304*	*17,710*	*18,391*	*18,961*
BV_{NPL}	3,358	3,529	4,593	4,998	5,431	5,583	5,965
	6,404	*6,069*	*11,544*	*12,719*	*14,000*	*14,768*	*16,185*
FMVPA	1,302	1,284	1,331	1,540	1,477	1,693	1,716
	3,813	*3,550*	*3,597*	*4,107*	*3,876*	*4,433*	*4,454*
PBO	1,128	1,092	1,146	1,286	1,376	1,528	1,628
	3,343	*2,902*	*3,078*	*3,381*	*3,695*	*4,135*	*4,456*
REVPBO	1,100	1,155	1,197	1,319	1,399	1,723	1,746
	3,236	*3,490*	*3,526*	*3,740*	*3,853*	*5,053*	*4,995*
DIFF	(28)	63	51	32	23	195	118
	304	*1,032*	*848*	*692*	*251*	*1,126*	*706*
Mkt to Book	1.85	1.68	1.77	2.02	1.73	2.08	2.25
	0.94	*0.80*	*1.05*	*1.41*	*1.36*	*1.83*	*1.68*

MV_E = Market Value of Common Equity
BV_E = Book Value of Equity
BV_{NPA} = Book Value of Non-Pension Assets
BV_{NPL} = Book Value of Non-Pension Liabilities
FMVPA = Fair Market Value of Plan Assets
PBO = Projected Benefit Obligation
REVPBO = Revised (Standardized) Projected Benefit Obligation
DIFF = REVPBO - PBO

(All in millions of dollars)

Mkt to Book is the ratio of MV_E to BV_E.

TABLE 6
PANEL B

CORRELATION COEFFICIENTS
BETWEEN SELECTED VARIABLES
Mean and *Standard Deviation*

	MV_E	BV_{NPA}	BV_{NPL}	FMVPA	PBO	REVPBO	DIFF
BV_{NPA}	0.69						
	0.08						
BV_{NPL}	0.59	0.98					
	0.07	*0.01*					
FMVPA	0.66	0.80	0.76				
	0.07	*0.02*	*0.03*				
PBO	0.63	0.82	0.78	0.98			
	0.09	*0.02*	*0.03*	*0.01*			
REVPBO	0.59	0.82	0.79	0.96	0.99		
	0.08	*0.03*	*0.04*	*0.01*	*0.01*		
DIFF	0.17	0.48	0.49	0.48	0.55	0.64	
	0.12	*0.16*	*0.18*	*0.12*	*0.14*	*0.16*	
DR	0.05	0.08	0.08	0.02	0.03	0.08	0.20
	0.02	*0.03*	*0.03*	*0.03*	*0.03*	*0.04*	*0.25*

Mean and standard deviation are calculated from the correlation coefficients computed for each of the seven years of data analyzed.

MV_E = Market Value of Common Equity
BV_E = Book Value of Equity
BV_{NPA} = Book Value of Non-Pension Assets
BV_{NPL} = Book Value of Non-Pension Liabilities
FMVPA = Fair Market Value of Plan Assets
PBO = Projected Benefit Obligation
REVPBO = Revised (Standardized) Projected Benefit Obligation
DIFF = REVPBO - PBO
DR = Disclosed Discount Rate

(All in millions of dollars.)

Mkt to Book is the ratio of MV_E to BV_E.

value of plan assets was $1,302 million in 1986 ($1,716 in 1992) and the average reported PBO was $1,128 million in 1986 ($1,628 million in 1992).

The effect of restating the pension liability reported in each year to standard rates is also increased as time progresses. In 1986, the restatement actually slightly lowers the mean projected benefit obligation. On average, the effect of restatement on the mean reported projected benefit obligation is less than 5% until 1991 and 1992. In 1991, the restatement increases the average liability by almost 13%; in 1992, by approximately 7%.

Correlation coefficients for selected variables are provided in Table 6, Panel B.

CHAPTER 8. RESULTS

8.1. Market Valuation Hypothesis

The results of the market valuation regression using the reported PBO, without the addition of the R&D variable, are contained in Table 7, Panel A, for comparability with prior research. Confirming previous findings, the pension asset and liability disclosures are found to provide significant value relevant information. The results of the regression using the reported PBO are consistent with Barth (1991). Barth's adjusted R^2 for 1986 was .86; the coefficient estimate on the PBO was 3.21 and was highly significant; however, it is unclear whether the t-statistics on which her significance tests were based used White's correction. Here the adjusted R^2 is .90 for 1986; the coefficient estimate on the PBO is 2.92 and is significant at the .05 level (using White-corrected t-statistics). Additionally, the intercept is

TABLE 7
PANEL A

TEST OF THE MARKET VALUATION HYPOTHESIS
MODEL WITHOUT R&D VARIABLE
USING REPORTED PENSION LIABILITY

$$MV_E = \alpha + \beta_1 BV_{NPA} - \beta_2 BV_{NPL} + \beta_3 FMVPA - \beta_4 PBO + \varepsilon \quad (5)$$

YEAR	N	R^2	α	β_1	β_2	β_3	β_4
1986	207	.90	**358.31**	**1.99**	**2.33**	**2.48**	**2.92**
			1.99	*8.73*	*6.37*	*3.46*	*3.47*
1987	365	.81	**582.03**	**1.86**	**2.22**	**0.99**	**1.24**
			3.10	*8.64*	*6.63*	*2.03*	*1.97*
1988	381	.85	275.36	**1.68**	**1.78**	**1.76**	**2.04**
			1.69	*11.32*	*9.88*	*3.47*	*2.78*
1989	383	.78	**650.07**	**1.88**	**1.92**	**3.39**	**4.35**
			2.11	*7.13*	*6.17*	*5.55*	*5.90*
1990	379	.74	269.78	**2.00**	**2.11**	**2.55**	**3.00**
			1.18	*11.09*	*9.62*	*5.99*	*6.56*
1991	382	.68	446.93	**2.32**	**2.42**	**2.78**	**3.42**
			1.52	*9.86*	*8.47*	*5.90*	*6.66*
1992	378	.68	411.71	**2.03**	**2.00**	**1.82**	**1.89**
			1.27	*9.60*	*7.77*	*3.06*	*3.42*
Aggregate Test Statistics			**427.74**	**1.97**	**2.11**	**2.25**	**2.70**
			3.18	*10.82*	*9.94*	*3.08*	*2.77*

Coefficients in bold face are significant at the .05 level or higher.
White corrected t-statistics are reported in italics under the coefficient estimate.

All R^2 reported are adjusted R^2.

See Table 6 for variable definitions.

significant, as in Barth's results. However, sample selection procedures differed, with Barth using a larger sample.[12]

Table 7, Panel B shows the results of the regression analysis, with the introduction of the R&D variable. This produces an intercept which is statistically indistinguishable from zero throughout.

The overall explanatory power of the improved model, as measured by the adjusted R^2, ranges from 90% (1986) to 68% (1991), averaging 79%. The model performs better in explaining the total value of equity in earlier years. All of the coefficients on asset and liability variables are significant, at confidence levels of 5% or higher. The LaGrange multiplier test for heteroscedasticity indicates that it exists at significant levels. Therefore, White's correction is used to calculate consistent standard errors of the coefficient estimates.

Of interest here are the effects of replacing the reported PBO with the standardized liability in the regression equation, shown in Panel C of Table 7. The substitution results in both a lower (and generally more highly significant) coefficient estimate and a reduction

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[12] For 1987, Barth used all 1,082 firms on the Compustat tape disclosing SFAS 87 information; these firms had an average market value of equity of $1,315 million and an average market-to-book ratio of 1.70. The firms in the 1987 sample used here have an average market value of equity of $3,604 million and an average market-to-book ratio of 1.68.

TABLE 7
PANEL B

TEST OF THE MARKET VALUATION HYPOTHESIS
MODEL WITH R&D VARIABLE
USING REPORTED PENSION LIABILITY

$$MV_E = \alpha + \beta_1 RD + \beta_2 BV_{NPA} - \beta_3 BV_{NPL} + \beta_4 FMVPA - \beta_5 PBO + \varepsilon \quad (6)$$

YEAR	N	R^2	α	β_1	β_2	β_3	β_4	β_5
1986	207	.90	119.40	**71.10**	**1.93**	**2.23**	**2.36**	**2.94**
			0.63	*2.08*	*8.12*	*5.90*	*3.27*	*3.51*
1987	365	.83	-201.52	**129.01**	**1.76**	**2.06**	**0.87**	**1.36**
			-1.10	*3.90*	*8.21*	*6.27*	*1.77*	*2.09*
1988	381	.89	-76.96	**132.92**	**1.64**	**1.72**	**1.72**	**2.25**
			-0.47	*4.88*	*11.08*	*9.70*	*3.59*	*3.22*
1989	383	.79	270.70	**147.19**	**1.81**	**1.83**	**3.44**	**4.69**
			0.85	*3.07*	*6.60*	*5.65*	*6.01*	*6.79*
1990	379	.71	-250.02	**137.47**	**2.08**	**2.26**	**2.24**	**2.74**
			-1.13	*2.48*	*13.41*	*11.96*	*5.59*	*5.53*
1991	382	.68	-338.31	**284.32**	**2.05**	**2.03**	**2.77**	**3.99**
			-1.05	*3.33*	*9.30*	*8.11*	*8.59*	*11.28*
1992	378	.71	-352.29	**213.22**	**2.06**	**2.01**	**2.09**	**2.61**
			-1.39	*3.36*	*11.80*	*10.40*	*3.69*	*3.70*
Aggregate Test Statistics			-118.43	**159.32**	**1.90**	**2.02**	**2.21**	**2.94**
			-0.54	*2.49*	*11.99*	*11.15*	*2.96*	*2.88*

Coefficients in bold face are significant at the .05 level or higher.
White corrected t-statistics are reported in italics under the coefficient estimates.

All R^2 reported are adjusted R^2.
See Table 6 for variable definitions.

TABLE 7
PANEL C

TEST OF THE MARKET VALUATION HYPOTHESIS
MODEL WITH R&D VARIABLE
USING STANDARDIZED PENSION LIABILITY

$$MV_E = \alpha + \beta_1 RD + \beta_2 BV_{NPA} - \beta_3 BV_{NPL} + \beta_4 FMVPA - \beta_5 REVPBO + \varepsilon$$

YEAR	N	R^2	α	β_1	β_2	β_3	β_4	β_5
1986	207	.91	93.00	**79.65**	**1.88**	**2.13**	**1.83**	**2.46**
			0.47	*2.36*	*9.56*	*6.90*	*3.22*	*2.64*
1987	365	.87	-24.27	**148.88**	**1.59**	**1.76**	**1.00**	**1.34**
			-0.17	*4.70*	*12.54*	*10.36*	*4.60*	*7.27*
1988	381	.88	-79.62	**138.02**	**1.50**	**1.54**	**1.00**	**1.25**
			-0.52	*5.07*	*9.80*	*8.72*	*4.24*	*5.75*
1989	383	.79	194.09	**151.94**	**1.67**	**1.70**	**1.81**	**2.38**
			0.57	*3.16*	*5.67*	*4.50*	*4.53*	*6.04*
1990	379	.72	-407.26	**153.54**	**1.92**	**2.04**	**1.20**	**1.41**
			-1.75	*2.74*	*12.07*	*9.63*	*5.85*	*5.63*
1991	382	.67	-382.29	**300.37**	**1.79**	**1.68**	**1.53**	**2.18**
			-1.20	*3.47*	*8.54*	*6.50*	*5.66*	*8.23*
1992	378	.71	-416.02	**230.18**	**1.91**	**1.78**	**1.44**	**1.87**
			-1.58	*3.50*	*11.14*	*9.78*	*3.22*	*3.29*
Aggregate Test Statistics			-146.05	**171.80**	**1.75**	**1.80**	**1.40**	**1.84**
			-0.62	*2.59*	*11.32*	*9.36*	*4.34*	*3.88*

Coefficients in bold face are significant at the .05 level or higher.
White corrected t-statistics are reported in italics under the coefficient estimate.

All R^2 reported are adjusted R^2.

See Table 6 for variable definitions.

in its standard error. The adjusted R^2 is essentially identical with both variable specifications.

One way to assess reduction in measurement error attributable to the use of the standardized (compared with the reported) PBO is to compare the coefficient of variation (or relative standard deviation) of the two coefficient estimates. Variation in the valuation of the reported pension liability induced by variation in the discount rate assumption will be reflected in the standard error of the coefficient estimate. However, the coefficient standard error is an absolute rather than relative expression of variation. The coefficient of variation, which is the standard error of the coefficient estimate divided by the coefficient estimate itself, provides a relative measure of the standard error and permits comparison across the two variable specifications, reported and standardized pension liability. Note, however, that the coefficient of variation is affected by changes in the coefficient estimate as well as by changes in its standard error. Reduction in the coefficient estimate without change in the standard error will result in an increase in the coefficient of variation.

Panel D of Table 7 shows coefficients of variation for the two variable specifications. The average coefficient of variation for the regression coefficient estimate obtained using the reported pension

TABLE 7
PANEL D

TEST OF THE MARKET VALUATION HYPOTHESIS
EFFECT ON COEFFICIENT OF VARIATION AND REGRESSION R^2
FROM SUBSTITUTION OF STANDARDIZED FOR REPORTED PENSION LIABILITY

	Using Reported PBO			Using Standardized PBO		
YEAR	β_5	σ	σ/β_5	β_5	σ	σ/β_5
1986	2.94	0.84	0.29	2.46	0.68	0.27
1987	1.36	0.65	0.48	1.34	0.19	0.14
1988	2.25	0.70	0.31	1.25	0.22	0.17
1989	4.69	0.69	0.15	2.38	0.39	0.17
1990	2.74	0.50	0.18	1.41	0.25	0.18
1991	3.90	0.35	0.09	2.18	0.26	0.12
1992	2.61	0.71	0.27	1.87	0.57	0.30
		Average	0.253		Average	0.193
		Standard Deviation	0.119		Standard Deviation	0.062

PANEL E

EFFECT ON COEFFICIENT ESTIMATE EQUIVALENCE TO ONE
FROM SUBSTITUTION OF STANDARDIZED FOR REPORTED PENSION LIABILITY

	Using Reported PBO		Using Standardized PBO	
YEAR	β_5	t-statistic	β_5	t-statistic
1986	2.94	**2.32**	2.46	2.15
1987	1.36	0.55	1.34	1.86
1988	2.25	1.79	1.25	1.16
1989	4.69	**5.34**	2.38	**3.50**
1990	2.74	**3.51**	1.41	1.65
1991	3.90	**8.39**	2.18	**4.45**
1992	2.61	**2.28**	1.87	1.53
Aggregate	2.93	**3.05**	1.84	2.31

At the .05 level, the critical t-value is 2.32; bold face denotes coefficients significantly different from one. White's correction was used to calculate t-statistics.

liability is .253 (with a standard error of .119). When the variable specification is changed to the standardized pension liability, the coefficient of variation drops to .193 (with a standard error of .062). This supports the conclusion that cross-sectional variation in the coefficient estimate in the regression analysis using the reported pension liability is reflective of differences in the disclosed discount rate.

As discussed earlier, both Landsman (1986) and Barth (1991) employed a disaggregated balance sheet model to examine pension liabilities, using obligations reported under SFAS 36 and SFAS 87 respectively. Both researchers set a benchmark value of one for the pension liability coefficient in similar regression equations. As shown in Panel E of Table 7, the coefficient estimate obtained using the reported liability is significantly different from one in five out of seven years. When the revised liability is used, the coefficient is significantly different from one in only two of the seven years analyzed. Although the relative values of the coefficients themselves cannot be directly compared in a meaningful way, it is worth noting this effect of the substitution, which shows that the coefficient on the standardized rather than the reported pension liability conforms more consistently to the theoretical value.

The model is expanded to test the informativeness of the discount rate disclosure by including the separate term *DIFF*, representing the effects on the reported pension liabilities of the use of differing discount rates. This variable is defined as the difference between the standardized and reported pension liabilities. Table 8 shows the results of these regressions. The coefficient estimates on the difference variable have the expected sign in all years and are significant at the .05 level in four of the seven years. The aggregate test statistic for the seven year period shows significance at the .01 level.

The significance of *DIFF* indicates that the standardized rather than the reported pension liability dominates the firm valuation process. This is further confirmation of the informativeness of the discount rate disclosure, since use of the standardized liability represents joint use of the reported liability and the discount rate disclosure.

Replacing the pension liability variable with a variable partitioned on the basis of the discount rate variable enables tests for differential market valuation of pension liabilities measured using higher versus lower discount rates. The reported pension liability is segmented into two variables, PBO_H and PBO_L, depending on whether the disclosed discount rate is above or below the average rate.

TABLE 8

TEST OF MARKET VALUATION HYPOTHESIS USING REPORTED LIABILITY AND DIFFERENCE TERM

$$MV_E = \alpha + \beta_1 RD + \beta_2 BV_{NPA} - \beta_3 BV_{NPL} + \beta_4 FMVPA - \beta_5 PBO + \beta_6 DIFF + \varepsilon \quad (7)$$

YEAR	N	R^2	α	β_1	β_2	β_3	β_4	β_5	β_6
1986	207	0.91	92.60	**76.94**	**1.90**	**2.17**	**2.10**	**2.73**	-1.62
			0.47	*2.25*	*9.83*	*7.03*	*2.58*	*3.19*	*-0.97*
1987	365	0.87	-21.05	**149.23**	**1.49**	**1.64**	**0.50**	**0.63**	**-1.53**
			-0.15	*4.63*	*9.95*	*8.54*	*1.93*	*1.81*	*-8.35*
1988	381	0.88	-86.84	**138.33**	**1.51**	**1.56**	**1.11**	**1.41**	**-1.16**
			-0.55	*5.11*	*8.83*	*7.96*	*3.21*	*3.13*	*-3.48*
1989	383	0.80	204.28	**153.62**	**1.75**	**1.77**	**2.85**	**3.87**	**-1.18**
			0.62	*3.27*	*6.21*	*5.12*	*4.04*	*4.37*	*-1.65*
1990	379	0.72	**-412.78**	**154.18**	**1.91**	**2.02**	**1.04**	**1.22**	**-1.56**
			-1.69	*2.73*	*10.84*	*8.23*	*1.68*	*1.69*	*-1.96*
1991	382	0.68	-354.74	**288.27**	**2.00**	**1.97**	**2.58**	**3.63**	-0.40
			-1.08	*3.38*	*8.05*	*6.04*	*4.27*	*4.79*	*-0.35*
1992	378	0.71	-379.72	**222.92**	**2.03**	**1.95**	**2.05**	**2.58**	-0.73
			-1.04	*3.40*	*11.50*	*9.42*	*3.52*	*3.63*	*-0.82*
	Aggregate statistics		-136.89	**169.07**	**1.80**	**1.87**	**1.75**	**2.30**	**-1.17**
			-0.60	*2.70*	*8.74*	*9.18*	*2.16*	*2.00*	*-2.75*

All R^2 are adjusted R^2.
White's correction was used to calculate t-statistics.
T-statistics are italicized below coefficient estimates.
Coefficients in bold face are significant at the .05 level or higher.

MV_E = Market Value of Common Equity
RD = Square Root of Research and Development Expenditures
BV_{NPA} = Book Value of Non-Pension Assets
BV_{NPL} = Book Value of Non-Pension Liabilities
$FMVPA$ = Fair Market Value of Plan Assets
PBO = Reported Projected Benefit Obligation
$DIFF$ = Difference between the Standardized and the Projected Benefit Obligation
(All in millions of dollars)

Comparison of the coefficient estimates (reported in Table 9) provides evidence of ordinal differences in the market valuation of the pension liability, differences which reflect the discount rate choice. The directional difference between the two coefficients is as hypothesized. Results from testing the restricted form of the model (i.e., the linear restriction equalizing coefficients on both variables) provide an F-statistic which can be used to test the significance of a differential response. The magnitude of the difference is statistically significant at the .01 level in all of the seven years.

The Winklevoss formula is used to adjust reported liabilities to a common discount rate. Issues pertaining to the restatement of the pension liability and a description of the method used are discussed in detail in an earlier chapter. The mean discount rate for each period is selected as the standardization rate for several reasons. First, benchmark rates such as the PBGC rate tend to be substantially lower than the rates actually observed. In 1991, for example, the PBGC rate was 6.75%; 367 of 383 sample firms disclosed discount rates above 7% that year. Any estimation errors in the liability restatement are more pronounced as the difference between the reported and standard rate increases. The use of the average rate lessens the possibility that measurement error induced by the restatement process will drive

TABLE 9

TEST OF DIFFERENTIAL VALUATION OF LIABILITIES MEASURED USING LOW vs HIGH DISCOUNT RATES

$$MV_E = \alpha + \beta_1 RD + \beta_2 BV_{NPA} - \beta_3 BV_{NPL} + \beta_4 FMVPA - \beta_5 PBO_H - \beta_6 PBO_L + \epsilon \quad (8)$$

YEAR	N	R^2	α	β_1	β_2	β_3	β_4	β_5	β_6	p-value
1986	207	0.91	111.64	**80.42**	**1.84**	**2.10**	**1.91**	**2.52**	**2.21**	
			0.61	*2.15*	*9.62*	*6.76*	*1.79*	*2.37*	*1.65*	0.0084
1987	365	0.84	142.70	**154.38**	**1.59**	**1.79**	**1.04**	**1.73**	**1.14**	
			0.92	*4.23*	*8.82*	*7.08*	*2.12*	*2.73*	*1.82*	0.0000
1988	381	0.88	-40.27	**150.13**	**1.52**	**1.55**	**1.69**	**2.40**	**1.95**	
			-0.24	*5.22*	*8.28*	*7.17*	*3.68*	*3.85*	*3.22*	0.0000
1989	383	0.80	67.36	**183.57**	**1.73**	**1.73**	**3.26**	**4.62**	**3.82**	
			0.24	*3.68*	*6.22*	*5.35*	*4.93*	*6.41*	*4.53*	0.0000
1990	379	0.71	-291.90	**158.33**	**1.99**	**2.16**	**1.98**	**2.55**	**1.98**	
			-1.24	*2.64*	*10.50*	*8.95*	*4.17*	*5.46*	*3.07*	0.0037
1991	382	0.69	**-529.44**	**312.36**	**2.03**	**1.96**	**1.94**	**3.36**	**2.50**	
			-1.65	*3.55*	*10.55*	*8.95*	*4.37*	*9.30*	*4.16*	0.0001
1992	378	0.71	-425.12	**232.60**	**2.00**	**1.91**	**1.82**	**2.61**	**2.06**	
			-1.49	*3.50*	*11.21*	*9.08*	*2.89*	*3.87*	*2.38*	0.0000
	Aggregate statistics		-137.86	**181.68**	**1.81**	**1.88**	**1.95**	**2.83**	**2.24**	
			-0.54	*2.68*	*9.43*	*9.54*	*3.18*	*3.31*	*2.98*	

White's correction was used to calculate t-statistics.
T-statistics are italicized below coefficient estimates.
Coefficients in bold face are significant at the .05 level or higher.
P-value in last column is from F-test of equivalence of coefficients on the two pension liability variables, PBO_H and PBO_L.

MV_E = Market Value of Common Equity
RD = Square Root of Research and Development Expenditures
BV_{NPA} = Book Value of Non-Pension Assets
BV_{NPL} = Book Value of Non-Pension Liabilities
$FMVPA$ = Fair Market Value of Plan Assets
PBO_H = Projected Benefit Obligation (disclosed DR > mean DR)
PBO_L = Projected Benefit Obligation (disclosed DR ≤ mean DR)
(All in millions of dollars)

results. In addition, some tests depend on partitioning the sample based on discount rate. The standard rate used for this purposes must sufficiently distinguish between "high" and "low" discount rate choice.[13]

The nature of these data gives rise to concerns about the effects of collinearity on the analysis. Influence of outliers is more extreme in samples where there is a high degree of collinearity. The leverage criterion discussed in Belsey, Kuh and Welsch (1980) was used to identify observations which are exerting a determining influence on the regression estimates. No such observations were found during the period from 1986 though 1989, but analysis of leverage resulted in removal of 3 observations in 1990, 1 in 1991, and 4 in 1992.

Condition indices estimate the extent to which regression results might be degraded by collinearity. These suggest that the regression results are subject to problems from collinearity. The indices for the full sample range between 20.75 and 32.03 and are reported

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[13] The market valuation regressions were run on a subsample consisting of approximately one-third of the observations using each of the alternative restatement measures mentioned. Use of the different approaches did not alter interpretation of the results. Alternate standardization rates were also assessed, and the conclusions reached are robust to differences in this parameter as well.

in Table 10, Panel A; a cut-off of 20 is generally considered indicative of potential problems (Greene 1990, 35).

One solution to this problem is to reduce the model to net asset form. The book value of non-pension assets and liabilities can be combined to produce a single net-nonpension assets variable; likewise, the fair market value of plan assets and the reported PBO can be netted to form a single net pension assets variable.[14] It is illuminating to examine the effects of the collinearity reduction on the coefficient on the variable of interest, the difference term.

Condition indices and results from a sequence of regression equations netting first nonpension assets and liabilities and then pension assets and liabilities as well are contained in Table 10, Panels A through C. Netting the pairs of variables reduces the effects of collinearity on the variable of interest, the difference term. The condition indices remain at unacceptable levels when only non-pension assets are netted (see Panel B of Table 10); they drop well below the

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[14] Statistical evidence supporting the combination of these pairs of variables can be obtained using F-tests comparing the sum of squared errors from unrestricted and restricted forms of the model. Landsman (1986) rejected this solution on the basis of F-tests applied to his sample. While the results of F-tests in this research are ambiguous, it is important to note that collinearity itself can contaminate the results of the F-test. Covariance between the pairs of variables being combined affects the test results and limits the inferences that can be drawn from the test statistics.

TABLE 10
PANEL A

TEST OF MARKET VALUATION HYPOTHESIS
USING REPORTED LIABILITY AND DIFFERENCE TERM
NO OUTLIERS REMOVED

$$MV_E = \alpha + \beta_1 RD + \beta_2 BV_{NPA} - \beta_3 BV_{NPL} + \beta_4 FMVPA - \beta_5 PBO + \beta_6 DIFF + \varepsilon \quad (7)$$

YEAR	N	Index	R^2	α	β_1	β_2	β_3	β_4	β_5	β_6
1986	207	20.75	0.91	92.60	**76.94**	**1.90**	**2.17**	**2.10**	**2.73**	-1.62
				0.47	*2.25*	*9.83*	*7.03*	*2.58*	*3.19*	*-0.97*
1987	365	26.07	0.87	-21.05	**149.23**	**1.49**	**1.64**	**0.50**	**0.63**	**-1.53**
				-0.15	*4.63*	*9.95*	*8.54*	*1.93*	*1.81*	*-8.35*
1988	381	24.57	0.88	-86.84	**138.33**	**1.51**	**1.56**	**1.11**	**1.41**	**-1.16**
				-0.55	*5.11*	*8.83*	*7.96*	*3.21*	*3.13*	*-3.48*
1989	383	26.11	0.80	204.28	**153.62**	**1.75**	**1.77**	**2.85**	**3.87**	**-1.18**
				0.62	*3.27*	*6.21*	*5.12*	*4.04*	*4.37*	*-1.65*
1990	382	32.03	0.76	-117.27	**140.62**	**1.87**	**1.96**	**2.01**	**2.54**	-0.62
				-0.46	*2.51*	*8.95*	*7.30*	*2.42*	*2.58*	*-0.78*
1991	383	30.17	0.66	-209.61	**254.79**	**2.27**	**2.37**	**3.31**	**4.59**	1.07
				-0.62	*2.99*	*8.61*	*7.27*	*5.04*	*5.34*	*0.99*
1992	382	23.81	0.70	-49.00	**184.60**	**1.94**	**1.91**	**1.87**	**2.27**	0.48
				-0.14	*2.82*	*8.57*	*6.64*	*3.03*	*4.06*	*0.39*
	Aggregate statistics			-26.70	**156.87**	**1.82**	**1.91**	**1.96**	**2.58**	-0.65
				-0.21	*3.14*	*7.31*	*7.18*	*2.21*	*2.06*	*-0.68*

Index is the condition index measuring collinearity (Belsey, Kuh and Welsch 1980, 100).
All R^2 are adjusted R^2.
White's correction was used to calculate t-statistics.
T-statistics are italicized below coefficient estimates.
Coefficients in bold face are significant at the .05 level or higher.

MV_E = Market Value of Common Equity
RD = Square Root of Research and Development Expenditures
BV_{NPA} = Book Value of Non-Pension Assets
BV_{NPL} = Book Value of Non-Pension Liabilities
$FMVPA$ = Fair Market Value of Plan Assets
PBO = Reported Projected Benefit Obligation
$DIFF$ = Difference between Reported and Standardized Projected Benefit Obligation
(All in millions of dollars)

TABLE 10
PANEL B

REDUCED FORM MODEL
USING REPORTED LIABILITY AND DIFFERENCE TERM
NO OUTLIERS REMOVED

$$MV_E = \alpha + \beta_1 RD + \beta_2 NETNPA + \beta_3 FMVPA - \beta_4 PBO + \beta_5 DIFF + \epsilon$$

YEAR	N	Index	R^2	α	β_1	β_2	β_3	β_4	β_5
1986	207	17.98	0.91	-217.39	**123.07**	**1.61**	**1.86**	**2.66**	-2.48
				-0.90	*3.64*	*9.86*	*2.03*	*2.76*	*-1.18*
1987	365	20.60	0.87	-159.81	**165.41**	**1.30**	0.30	0.41	**-1.69**
				-1.07	*5.23*	*9.71*	*1.02*	*1.07*	*-9.72*
1988	381	19.31	0.88	-101.38	**141.02**	**1.51**	**1.07**	**1.46**	**-1.30**
				-0.58	*5.11*	*8.83*	*3.08*	*3.16*	*-4.32*
1989	383	21.63	0.80	203.78	**155.54**	**1.75**	**2.87**	**3.93**	**-1.20**
				0.62	*3.32*	*6.21*	*3.93*	*4.21*	*-1.64*
1990	382	25.37	0.75	-126.46	**148.35**	**1.87**	**1.70**	**2.28**	**-1.03**
				-0.52	*2.62*	*8.95*	*2.56*	*2.81*	*-1.70*
1991	383	20.41	0.66	-190.18	**266.40**	**2.27**	**2.95**	**4.23**	0.37
				-0.57	*3.09*	*8.61*	*6.67*	*6.55*	*0.48*
1992	382	12.79	0.70	-53.71	**181.93**	**1.94**	**1.89**	**2.22**	0.62
				-0.16	*2.86*	*8.57*	*3.21*	*3.68*	*0.64*
	Aggregate statistics			-92.16	**168.82**	**1.82**	**1.81**	**2.46**	-0.96
				-0.70	*3.89*	*7.31*	*2.08*	*1.99*	*-0.94*

Index is the condition index measuring collinearity (Belsey, Kuh and Welsch 1980, 100).
All R^2 are adjusted R^2.
White's correction was used to calculate t-statistics.
T-statistics are italicized below coefficient estimates.
Coefficients in bold face are significant at the .05 level or higher.

MV_E = Market Value of Common Equity
RD = Square Root of Research and Development Expenditures
NETNPA = Book Value of Non-Pension Assets minus Book Value of Non-Pension Liabilities
FMVPA = Fair Market Value of Plan Assets
PBO = Reported Projected Benefit Obligation
DIFF = Difference between Reported and Standardized Projected Benefit Obligation
(All in millions of dollars)

TABLE 10
PANEL C

REDUCED FORM MODEL
USING REPORTED LIABILITY AND DIFFERENCE TERM
NO OUTLIERS REMOVED

$$MV_E = \alpha + \beta_1 RD + \beta_2 NETNPA + \beta_3 NETPA + \beta_4 DIFF + \varepsilon$$

YEAR	N	Index	R^2	α	β_1	β_2	β_3	β_4
1986	207	3.19	0.87	229.08	**32.94**	**1.32**	1.35	-1.76
				0.58	*0.47*	*9.16*	*1.32*	*-0.80*
1987	365	2.83	0.87	-124.71	**159.43**	**1.26**	0.14	**-1.73**
				-0.95	*5.15*	*13.90*	*0.40*	*-11.76*
1988	381	2.77	0.88	28.86	**121.09**	**1.31**	0.64	**-1.66**
				0.20	*3.91*	*10.98*	*1.62*	*-6.72*
1989	383	2.97	0.77	493.67	**105.05**	**1.35**	**1.43**	**-2.60**
				0.14	*1.93*	*6.08*	*2.03*	*-3.45*
1990	382	2.84	0.74	43.47	**119.69**	**1.48**	0.77	**-1.95**
				0.14	*2.11*	*9.09*	*1.24*	*-4.34*
1991	383	2.92	0.62	165.72	**199.92**	**1.63**	**1.58**	**-2.24**
				0.39	*2.36*	*7.41*	*2.18*	*-3.08*
1992	382	2.52	0.70	64.90	**144.14**	**1.84**	**1.93**	-0.26
				0.16	*2.31*	*9.92*	*4.00*	*-0.26*
	Aggregate statistics			128.71	**126.04**	**1.46**	**1.12**	**-1.74**
				0.71	*2.63*	*7.44*	*1.94*	*-2.57*

Index is the condition index measuring collinearity (Belsey, Kuh and Welsch 1980, 100).
All R^2 are adjusted R^2.
White's correction was used to calculate t-statistics.
T-statistics are italicized below coefficient estimates.
Coefficients in bold face are significant at the .05 level or higher.

MV_E = Market Value of Common Equity
RD = Square Root of Research and Development Expenditures
$NETNPA$ = Book Value of Non-Pension Assets minus Book Value of Non-Pension Liabilities
$NETPA$ = Fair Market Value of Plan Assets - Reported Projected Benefit Obligation
$DIFF$ = Difference between Reported and Standardized Projected Benefit Obligation
(All in millions of dollars)

threshold when both non-pension and pension variables are combined. As can be seen in Panel C of Table 10, this produces coefficient estimates as hypothesized in five of seven years, with a significant aggregate test statistic as well.

Taken as a whole, the results of these regressions support the hypothesis that market valuation of the pension obligation is associated with the disclosed discount rate assumption. The evidence substantiates the conclusion that the standardized pension liability provides a more direct association with price than the reported liability. Since this variable is not itself reported but can only be indirectly inferred through use of the disclosed discount rate, this finding provides evidence that the supporting disclosure, the discount rate assumption, is incrementally and significantly value relevant.

These tests all provide confirmation of the first hypothesis, supporting the informativeness and relevance of the discount rate disclosure in the market's valuation of reported pension liabilities.

8.2. Accounting Choice Hypotheses

Results of a precursory confirmation of Hypothesis 2, which tests the association between the discount rate choice and the funded status of the plan, are presented in Table 11. For each year, firms are

classified according to funded status and discount rate choice. Funded status is defined both on the basis of the reported liability and on the basis of the standardized pension liability. Contingency tables are formed and χ^2 statistics used to test the hypothesis of independence between the discount rate and the plan's funded status, measured using the two liability variable specifications.

A statistically significant link between the discount rate and the **reported** funded status is not apparent in five of the seven years tested. Thus, independence between reported funded status and the discount rate is not rejected by the test. The χ^2 statistic is below 2 in 1986 through 1989 and rises to 4.11 in 1990 and 3.02 in 1991 (the significant p-values are .04 and .08 in those years), dropping back to less than 1 in 1992. When standardized funded status and discount rate are examined, however, the hypothesis of independence is strongly rejected. The statistical evidence linking the discount rate choice with the **standardized** funded status is highly significant in all seven years. The analysis shows a χ^2 statistic greater than 25 in every year (the associated p-values are virtually zero). This result supports the conclusion that there is a relationship between the funded status of the plan and the discount rate choice, a relationship which is obscured by the effect of that choice on the reported liability.

TABLE 11

TESTS OF THE HYPOTHESIS OF INDEPENDENCE BETWEEN FUNDED STATUS AND DISCOUNT RATE

	FUNDED STATUS MEASURED USING **REPORTED** LIABILITY		FUNDED STATUS MEASURED USING **STANDARDIZED** LIABILITY	
YEAR	χ^2	p-value	χ^2	p-value
1986	1.51	.22	28.47	.00
1987	0.30	.59	76.17	.00
1988	1.85	.17	59.27	.00
1989	1.45	.23	78.48	.00
1990	4.11	.04	68.10	.00
1991	3.02	.08	50.24	.00
1992	0.52	.47	46.75	.00

The discount rate was classified as high or low relative to the sample mean for that year.

The funded status was classified as positive or negative based on the difference between the projected benefit obligation (PBO) and the fair market value of plan assets. The standardization of the funded status was based on the standardized projected benefit obligation.

Table 12 presents the results of the regression of the discount rate on the variables hypothesized to be influential on the choice. This regression is performed cross-sectionally for each year from 1986 through 1992. The overall explanatory power of the model, as gauged by the (adjusted) R^2, ranges from 27% to 51%.

The intercept term is significant and is very close to (within a quarter percent of) the mean discount rate in every year. This suggests that the model is successfully incorporating all variables contributing to systematic deviations from the mean discount rate choice across firms.

The utility industry indicator variable is significant at the .005 level in six of seven years and is significant at the .10 level in the seventh, supporting Hypothesis 6. No hypotheses were offered concerning the effects of other industry variables. In most cases they are not significant, and for clarity of presentation they are not reported.

Funded status (measured using the **standardized** obligation) has a highly significant association with the discount rate choice in all years. The coefficient estimate for overfunded status is negative, as hypothesized; it is significant at the .005 level in all years except 1986, when it is significant at the .01 level. As hypothesized, a positive coefficient estimate is obtained for the variable measuring underfunded status; the significance is at the .005 level (.01 level in 1986). This

TABLE 12

REGRESSION OF DISCLOSED DISCOUNT RATE ON HYPOTHESIZED EXPLANATORY VARIABLES

$$DR = \alpha + \sum_{i=1}^{7} \beta_i IND_i + \beta_8 OVRFS + \beta_9 UNDFS + \beta_{10} UNION + \beta_{11} DEBTEQ + \beta_{12} INVRET + \varepsilon \quad (9)$$

				HYPOTHESIZED SIGN OF COEFFICIENTS					
				-	-	+	-	+	+
YEAR	R^2	N	α	β_7 UTIL	β_8 OVRFS	β_9 UNDFS	β_{10} UNION	β_{11} DEBTEQ	β_{12} INVRET
1986	.32	197	8.42	**-0.22**	**-0.64**	**4.03**	-0.29	-0.03	
			71.68	*-1.62*	*-2.33*	*9.31*	*-.082*	*-.061*	
1987	.39	355	8.96	**-0.38**	**-1.05**	**4.14**	**-0.80**	-0.03	
			77.98	*-3.94*	*-3.83*	*12.21*	*-2.60*	*0.71*	
1988	.44	370	9.00	**-0.34**	**-1.17**	**3.71**	**-0.66**	-0.02	0.06
			83.13	*-4.09*	*-7.00*	*12.54*	*-2.21*	*-1.08*	*1.07*
1989	.40	372	8.74	**-0.27**	**-1.12**	**3.43**	**-0.82**	**0.06**	**0.14**
			83.43	*-3.40*	*-6.94*	*10.13*	*-2.85*	*1.56*	*1.98*
1990	.51	369	8.70	**-0.30**	**-1.10**	**2.88**	**-0.95**	**0.08**	**0.21**
			87.22	*-4.10*	*-5.99*	*12.69*	*-3.59*	*1.83*	*3.80*
1991	.40	370	8.38	**-0.26**	**-1.16**	**2.31**	**-0.43**	**0.07**	0.08
			82.69	*-3.43*	*-6.15*	*10.06*	*-1.61*	*1.54*	*1.31*
1992	.27	369	8.24	**-0.24**	**-1.12**	**1.46**	**-0.38**	**0.07**	**0.09**
			92.94	*-3.24*	*-3.30*	*4.51*	*-1.66*	*2.44*	*1.54*

When LM test indicated heteroskedasticity, White's correction was used to calculate t-statistics.
T-statiatics are italicized below coefficient estimates.
Hypothesized coefficients in bold face are significant at the .10 level or higher.

DR = reported discount rate
IND_i = an indicator for industry membership
$OVRFS$ = 1 if $(FMVPA-PBO_{STD})/PBO_{STD} > 1$, 0 otherwise
$UNDFS$ = max $\{(PBO_{STD}-FMVPA)/PBO_{STD}, 0\}$
$UNION$ = industry-based unionization rates
$DEBTEQ$ = debt-equity ratio (BV_L/BV_E)
$INVRET$ = 1 if the average annual investment return on plan assets is less than the disclosed expected long-term rate of return, 0 otherwise
$FMVPA$ = Fair Market Value of Plan Assets
PBO_{STD} = Standardized Projected Benefit Obligation
BV_L = Book Value of Liabilities
BV_E = Book Value of Equity

is consistent with the finding of the preliminary contingency table analysis which found a highly significant association between standardized funded status and discount rate choice in all years. Thus, Hypothesis 2, which posits a negative relationship between funded status and discount rate choice is strongly supported. As also hypothesized, the magnitude of the effect of underfunded status on discount rate choice is much greater than that of overfunded status. The coefficient estimate on the latter variable is on average three times the coefficient estimate on the former.

In every year except 1986, the unionization variable is negatively significant at a .10 level or better. It is significant at a .025 level in four of the years. This supports Hypothesis 4, which predicts that unionization is associated with lower discount rates.

The significance of the coefficient on the debt equity ratio follows an interesting pattern. Hypothesis 5 posits a positive relationship between a firm's debt-equity ratio and the discount rate choice. The results of the regression show a negative but insignificant coefficient estimate for 1986 through 1988. For the final four years, 1989 through 1992, the coefficient estimate is positive, and significant at levels ranging from .10 to .01. However, this pattern can be explained in a straightforward manner by noting that the minimum

liability provision in SFAS 87 did not become effective until 1989 and few firms elected to adopt this provision earlier. For 1986 through 1988, underfunding *per se* in the majority of cases did not necessitate balance sheet recognition. The pattern of significance on the debt-equity variable follows the same timetable as the direct balance sheet implications ensuing from the discount rate choice. Thus, the coefficient behavior can be interpreted as providing support for Hypothesis 4, which postulates a positive relationship between the debt-equity ratio and discount rate choice.

The discount rate was also hypothesized to be higher for firms with poor investment performance relative to expectations. Disclosure of the expected long-term rate of return is required under SFAS 87. The variable was constructed to provide a comparison between this disclosed rate and the firm's actual investment return experience over a multiyear period. Therefore this variable is not included until 1988, when its coefficient estimate is directionally consistent with the hypothesis but not significant. This may be due to weakness in the initial operationalization of the variable. (A firm's ongoing investment experience continues to be averaged into the variable over time.) The subsequent four years of analysis all produce a positive coefficient estimate with significance at levels ranging from .10 to .005. This

finding is especially meaningful since a naive expectation might be that the discount rate and the investment return experienced on plan assets would reflect similar underlying market conditions. Were this the case, lower investment returns would be paralleled by lower discount rates. Support for Hypothesis 5 is especially striking in this context.

Thus all of the hypotheses concerning the discount rate choice are supported by the findings of the regression analysis.

CHAPTER 9. CONCLUSION

This research uses a market based model to examine the effects of the discount rate disclosure on the incorporation of the pension liability into firm value. The discount rate assumption has a strong impact on pension liability measurement: a high rate deflates the liability estimate, while a low rate effect overstates it. It is hypothesized that market valuation of the pension liability reflects the discount rate as well as the reported liability. That is, market prices adjust for differences in discount rate and weight the reported liability differently depending on the discount rate used in its measurement. This is tested by using a standard discount rate to restate reported pension liabilities and by comparing the differential valuation of reported liabilities measured with higher as opposed to lower discount rates. A large sample of publicly traded firms is analyzed. The results of the statistical analysis provide strong support for the market

valuation hypothesis, indicating that this disclosure is informative to investors.

There is evidence that the incorporation of the pension liability into firm value is affected by the firm's discount rate. The statistical tests performed indicate that the market places additional value on pension liabilities which are measured using a high discount rate. Conversely, use of a discount rate which is low results in further discounting to reduce the amount of the liability incorporated into firm value.

These findings are of importance to standard setters. Little information has been obtained on the use of supplemental disclosures such as the assumptions used in making accounting estimates. Increasingly, standard setters are mandating disclosure rather than recognition, particularly for complex information which is subject to variation due to differences in estimation procedures and assumptions. The use of the discount rate disclosure in the securities market's assessment of the (market-)relevant pension liability, which is also disclosed rather than recognized, provides important information about the utilization of these layers of disclosed information by financial statement users.

A number of factors are hypothesized to influence managers in their choice of discount rates. While differences in the time horizon for benefit payout are the only factors which should theoretically produce differences in firm discount rate choice, a significant range of rates is displayed by the firms analyzed. The standardized funded status of the firm's pension plan is found to be very strongly associated with the discount rate: underfunding is significantly associated with higher discount rates, while overfunding has the reverse effect.

Other factors hypothesized to be influential are the firm's debt-equity ratio, the investment return experience of plan assets, unionization rates and utility industry membership. These factors are found to be significant as hypothesized, providing evidence that this accounting choice is subject to a number of balance sheet-related pressures. A negative association is found between the discount rate and unionization rates and utility industry membership. The firm's debt-equity ratio is found to be positively associated with the choice, consistent with the debt-covenant hypothesis frequently posited as influential on accounting choice. Poor investment performance on pension plan assets (relative to the expected rates of return) is also found to be associated with higher discount rates. This is consistent with behavior that used the discount rate, again, to minimize reported

underfunding. The hypothesized determinants of the discount rate choice are found to jointly explain a substantial portion of the choice.

An important issue under debate is whether the disclosure of the rate is sufficiently informative or whether the FASB (or SEC) should more precisely specify the discount rates to be used. Thus questions about the informativeness of the rate disclosure and the determinants of this accounting choice are of increasing relevance and importance to both financial statement users and standard setters.

This research supports the conclusion that disclosure of the discount rate is informative. It also raises questions about the influences on rate selection.

APPENDIX A
ACCOUNTING FOR DEFINED BENEFIT PENSIONS

Pension liabilities can be estimated in several ways; SFAS 87 requires that three specific measures be disclosed.

> The **projected benefit obligation (PBO)** is the present value of benefits earned to date. It incorporates the effects of expected future salary increases into the liability estimate.
>
> The **accumulated benefit obligation (ABO)** is based on current salary levels.[15] As with the PBO, some of these benefits may be contingent on continued employment.
>
> The **vested benefit obligation (VBO)** represents the portion of the ABO which is not dependent on future service. It includes only the benefits to which the employee is legally entitled at the measurement date.

Thus PBO $\geq$ ABO $\geq$ VBO.

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[15] When the benefit formula defines payments as a function of future compensation levels, the PBO is based on an assumed rate of compensation increase. When benefits are not affected by progressive increases in salary (when there is a "flat benefit formula"), the ABO and PBO are identical.

Companies must also disclose the **fair market value of plan assets (FMVPA)**. Plan assets are held in trust, segregated and restricted from other uses. Contributions receivable from the employer are not included in the FMVPA.

The pension obligations discussed above are off the balance sheet; they are disclosed in notes. The only book liability or asset is the accumulated difference between recorded costs and contributions. The accrued pension liability (or prepaid pension asset) recognized on the balance sheet is increased (decreased) by the periodic pension cost recorded and decreased (increased) by the amount of contributions made. This may differ substantially from the funded status of the plan, due to the delayed financial statement recognition of certain changes in pension assets and obligations. [See discussion in Barth 1991, 434-437.]

A boundary for the liability recognized on the balance sheet arises from the **minimum liability** provision. This requires companies which are underfunded to immediately recognize a balance sheet liability showing the extent to which the FMVPA is exceeded by the ABO. However, this provision of SFAS 87 was not mandatory until 1989, two years after the adoption date of the Standard.

The Standard also requires companies to provide a detailed reconciliation of the funded status of the plan (the difference between the PBO and the FMVPA) with the plan liability or asset recorded on the balance sheet.

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