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DETERMINANTS OF OTHER POST-EMPLOYMENT BENEFIT PLAN REDUCTIONS AND TERMINATIONS IN THE POST-SFAS NO. 106 ADOPTION ERA

by

Bruce K. Johnson, M.B.A.

A Dissertation Presented in Partial Fulfillment
of the Requirements for the Degree
Doctor of Business Administration

COLLEGE OF ADMINISTRATION AND BUSINESS
LOUISIANA TECH UNIVERSITY

February 2000

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We hereby recommend that the dissertation prepared under our supervision by Bruce Kinloch Johnson

entitled Determinants of Other Post-Employment Benefit Plan Benefit Plan Reductions and Terminations in the Post-SFAS No. 106 Adoption Era

be accepted in partial fulfillment of the requirements for the Degree of **Doctor of Business Administration**

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Recommendation concurred in:

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Approved:
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Approved:
Director of the Graduate School

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ABSTRACT

The purpose of this research was to determine which variables help identify firms that have reduced or eliminated postretirement benefits other than pensions (OPEBs). Mittelstaedt et al. (1995) found that the adoption of SFAS No. 106 was one of the major determinants in OPEB reduction decisions. Those authors also found that financial weakness was a determinant in such reductions. This study attempts to determine the possible factors involved in such decisions, including both financial weakness and the OPEB liability, now that its disclosure is mandated by SFAS No. 106.

The theoretical backbone of this study was traced back to the work of Myers and Majluf (1984) and Myers (1984), who discovered that firms generally restrict dividends or take other steps to maintain financial slack. Stone (1987), Mittelstaedt (1989), and Thomas (1989) found financial weakness to be a determinant in pension plan reduction decisions.

Two-group discriminant analysis was used since the dependent variable was categorical while the independent variables were continuous. Sample firms fell into two groups: 1. No-change firms (firms that did not reduce or eliminate OPEBs), 2. Change firms (firms that did reduce or eliminate OPEBs). Financial weakness variables and OPEB liability variables were used in the model. Six hypotheses were tested.

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The full sample consisted of 588 firms, but the very small proportion of change firms to no-change firms confounded the results. A reduced and more balanced sample was used in the final analysis. The final model had a classificatory accuracy of about 75 percent.

These results indicate that the relationship between financial weakness and OPEB plan reductions may have changed since the adoption of SFAS No. 106 and that this relationship is considerably weaker than that found in prior research. This study's findings also provide little evidence that there is a long-term negative effect associated with the OPEB liability.

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Responsibility for any defects in the argument or presentation remain entirely with the author.

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CHAPTER 1

INTRODUCTION

Prior to the issuance of SFAS No. 106, postretirement employee benefits other than pensions (OPEBs) generally were accounted for by employers on a "pay-as-you-go" (i.e., cash) basis, despite contractual promises to provide future benefits for current service.[1] The disclosure of the liability from this type of deferred compensation was not required under generally accepted accounting principles (GAAP).[2] As premiums or claims were paid, companies simply recorded them and disclosed these amounts as the expense. These benefits had long been treated as if they were immaterial; but with the rising cost of health care, an increasing number of retirees, and greater life expectancy among retirees, this was increasingly being viewed by critics of accounting as nondisclosure of relevant financial statement information concerning future cash flows. The need to rectify this situation was formally acknowledged by the Financial Accounting Standards Board

[1]"OPEBs" is the acronym for "other (than pensions) postretirement employee benefits." OPEBs is used in this study, and its use is consistent with nonpension retirement benefits literature.

[2]Statement of Financial Accounting Standards No. 81, *Disclosure of Postretirement Health Care and Life Insurance Benefits*, only required disclosure of: (1) the benefits provided and the employee groups covered, (2) the employer's current accounting and funding policies for those benefits, and (3) the cost of those benefits recognized for the period (FASB 1984).

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(FASB) as early as 1979 but it would take eleven years before SFAS No. 106 would make accrual accounting for OPEBs part of GAAP.

Some of the major concerns surrounding SFAS No. 106 were that its implementation would create a significant negative effect on companies' financial statements, cause negative market effects, and cause many companies to reduce or terminate nonpension postretirement plans (Grossman, Flory, and Phillips 1989), (Newell 1989). As mentioned in the next section, there is evidence that there were negative financial statement and market effects, and evidence was found that suggests the adoption of this standard motivated many firms to reduce or terminate OPEBs.

Now that the OPEB liability is being recorded, as mandated by SFAS No. 106, can the level of this liability help predict whether firms will reduce or terminate such plans, now that we are in the post-SFAS 106 adoption period?

Definition of OPEBs

Nonpension postretirement employee benefits include, but are not limited to, life insurance provided outside a pension plan to retirees; postretirement health care; and other so-called "welfare" benefits such as day care, legal services, and housing subsidies. SFAS No. 106 is applicable to all postretirement benefits (other than pensions) expected to be provided by the employer to current and former employees.

Health care benefits are becoming increasingly significant in terms of cost and recurrence, and the rapid increase in the costs of these benefits has helped fuel the push to accrue postretirement benefits' costs.

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Health care benefits first were provided to employees as compensation for the effects of price and wage freezes during World War II (Van Remortel 1988). With the introduction of Medicare in 1965, the government began paying a significant portion of retirees' health care costs. Companies increased promised retiree health care benefits. They promised to provide retiree health care benefits that would cover the small gap between actual costs and what Medicare covered (Van Remortel 1988). This resulted in a rapid increase in employer-provided health care insurance benefits for retirees. Companies increasingly used such benefits to attract and keep employees. By 1988, health care benefits were being provided to retirees by 82 percent of U.S. companies with 1,000 or more employees, and by 91 percent of the companies with more than 5,000 employees (Light, Treece, and Driscoll 1991; Amir, 1993). This alone had made OPEBs an increasingly important accounting issue.

Fundamental Issue

A substantial amount of pension research has been conducted in recent years. For example, Stone (1987), Mittelstaedt (1989), and Thomas (1989) examined determinants of pension plan reductions and terminations. There were many more pension-related studies conducted during this time but they are not directly related to this study. Despite the large number of pension studies, OPEB research was extremely limited until the advent of SFAS No. 106. As will be mentioned in greater detail later, OPEBs were originally considered immaterial in their cost, which was probably the main reason for the lack of interest in studying the subject.

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In 1979, when the first Exposure Draft on postretirement benefits was issued, it signaled the FASB's concerns about such costs. Were they material and should they be accrued? In 1989, when the Exposure Draft that would become SFAS No. 106 was issued, it created immediate interest in OPEBs because the proposal mandated the accrual of a liability for postretirement benefits. Firms had been treating these costs as immaterial so one of the first research questions was to determine whether, since these firms had previously understated both liabilities and expenses, there would be any negative effects on such firms' securities in the financial markets once these costs were recorded properly.

In the early 1990s, a number of studies examined stock market effects due to the creation of, for many firms, a large unfunded liability along with a transition obligation, which would either be expensed or amortized over a period of 20 years. This will be explained in greater detail later. Major studies included those by Espahbodi, Strock, and Tehranian (1991), Amir (1993), Mittelstaedt and Warshawsky (1993), and Young (1993). In 1994, Smith examined the relationship of financial strength to early adoption of SFAS No. 106. Amir and Livnat (1996) and Amir (1997) also examined firms' timing of the adoption of SFAS No.106.

In 1995, the issue of OPEB reductions was examined by Mittelstaedt, Nichols, and Regier (1995), who tested the hypothesis that the adoption of SFAS No. 106 was a major factor in such reductions. They found a significant statistical relationship between the adoption of SFAS No. 106 and OPEB reductions. However, the adoption of the standard was not the only factor in OPEB reductions. Financial weakness also appeared to be a significant factor according to the study. This research will be covered later in this paper.

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The next logical step in OPEB research is to identify the determinants of reductions in these benefits, now that the direct and immediate effects of SFAS No. 106 adoption are past. Unlike pension research, OPEB research did not focus on plan reductions or terminations prior to the existence of SFAS No. 106. It appears that all such research has included the adoption of SFAS No. 106 as an independent variable in the analysis of these benefit reductions.

Also, in this study the SFAS No. 106 liability will be used as an independent variable in each of the years being examined. During the literature review, no studies were found that used this liability as an independent variable in an attempt to determine OPEB reduction decisions. The question is whether the changes in this liability correlate strongly with OPEB reductions. Recent research, such as Mittelstaedt et al. (1995), found evidence supporting the assertion that increased contracting costs caused by the adoption of SFAS No. 106, along with financial weakness independent of it were the primary determinants of such benefit reductions. To a lesser extent, firm-specific changes in retiree health care costs were found to influence benefit reduction decisions.

Now, with the SFAS No. 106 liability established, the relationships among the variables, which prior research found to have a statistically significant correlation with OPEB reductions, almost certainly have changed. It is possible that some of the variables, particularly the increased contracting cost variables, might be less significant, now that the adoption of SFAS No. 106 is no longer a variable. Other variables, particularly those relating to financial weakness, may be more significant. These relationships, as they apply

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to OPEB reductions and terminations, apparently were not studied prior to the FASB's 1989 Exposure Draft, which would become SFAS No. 106.

Studies examining pension plan reductions and terminations have found that financial weakness is a determinant in the liquidation of assets of overfunded pension plans and in the termination of overfunded plans (Stone 1987; Mittelstaedt 1989; Thomas 1989). Specifically, these studies have examined the determinants of firms' decisions to contract or terminate overfunded pension plans. The studies found that both contractors (those who reduce benefits) and terminators were financially weak prior to the decision to take these actions. These findings are consistent with two hypotheses. First, Myers and Majluf (1984) suggested that financially weak firms liquidated financial slack when internally generated cash flows were insufficient and that these liquidations were done in an orderly fashion, using the least costly sources of financing first. Secondly, Mittelstaedt and Reiger (1993) hypothesized that the value of upholding an implicit contract diminishes as a firm's financial health deteriorates, suggesting that financially weak firms are expected to terminate plans. Also, the weakest firms generally eliminate defined benefit plans.

Although these findings alone might suggest that financial weakness would be a determinant in OPEB reductions, such a direct comparison is generally not applicable. Few OPEBs are funded, often making liquidation of fund assets unlikely. However, the fact that financial weakness was a major factor in pension fund liquidations suggests that it might be a significant factor in OPEB reduction decisions. Mittelstaedt, et al. (1995) found financial weakness to be a major factor along with the adoption of SFAS No. 106 in OPEB reduction decisions.

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Objective of the Study

This study seeks to determine which variables help identify firms that have reduced or eliminated postretirement benefits other than pensions. Mittelstaedt et al. (1995) found that the adoption of SFAS No. 106 could be cited as one of the major contributing factors in the reduction and elimination of postretirement health benefits made by firms in the past several years. However, Mittelstaedt et al. found that the adoption of SFAS No. 106 was not the only determinant in such reductions. This study attempts to determine the possible factors involved in these decisions, including the OPEB liability itself, now that it is disclosed according to the requirements of SFAS No. 106. Since the period being studied includes only years in which this was in effect, the actual adoption of this statement is not used as a variable. No studies have been found that use the OPEB liability as an independent variable in attempting to identify determinants of benefit reductions or terminations. The OPEB research that has been conducted (e.g., Mittelstaedt et al.) has concentrated on the actual or anticipated adoption of SFAS No. 106 by firms as a factor contributing to the reduction of postretirement benefits.

The results of this study will be useful to practitioners, researchers, and the general public, as it will provide evidence regarding relationships between key independent variables and reductions or terminations of OPEBs (the dependent variable). This study may help determine the need and direction of future research in this area. It is intended to fill a gap in current OPEB research. Pension research has found that financial weakness is the most significant factor in explaining firms' liquidation of excess plan assets. Prior

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research suggests (e.g., Stone 1987) that firms tend to liquidate assets of overfunded pension plans when other forms of financing were unavailable.

Accounting for OPEBs Prior to SFAS No. 106

Prior to the adoption of SFAS No. 106, OPEBs were reported by employers on a "pay-as-you-go" (i.e., cash) basis, despite contractual promises to provide future benefits for current service. This was due to the fact that these costs were felt to be immaterial at one time (FASB 1981, ¶ 2). However, this practice continued long after such costs became material (FASB 1981, ¶ 3). The fact that these costs had become material persuaded the FASB to make changes in the way firms accounted for them.

Why Change Was Needed

Since the benefits of current employees' services are being received now, it is consistent with generally accepted accounting principles (GAAP) that the future expenditures on OPEBs be matched with the revenue currently being generated from the employees' work. When amounts are immaterial, accrual accounting is unnecessary. This was the case for OPEBs at one point. However, the amounts spent on these benefits increased dramatically over time, and, by the late 1970s, were no longer considered immaterial by the FASB (FASB 1979, ¶ 2). The upward trend in OPEB expenditures has continued, so accounting for them using the pay-as-you-go (cash) method would be even more likely to lead to material misstatements in the financial statements of companies offering these benefits.

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The Long Journey of SFAS No. 106

1. Exposure Draft – 1979
2. Discussion Memorandum – 1981
3. Preliminary Reviews Document – 1982
4. Discussion Memorandum – 1983
5. Comments/Letters in Response to 1983 Discussion Memorandum
6. Exposure Draft – 1984
7. Responses to 1984 Exposure Draft
8. SFAS No. 81 – 1984
9. Technical Bulletin – 1987
10. Exposure Draft – 1989
11. SFAS No. 106 – December, 1990

Purpose and Requirements of SFAS No. 106

The main purpose of SFAS No. 106 was to increase the accuracy and usefulness of financial statements of those firms offering postretirement benefits other than pensions. SFAS No. 106 requires the accrual of the expected cost of nonpension postretirement benefits over the years the employee renders the service necessary to become eligible for them. The employer must recognize in its statement of financial position its obligation for OPEBs over the service life of its employees. This standard prohibits the practice of accounting for OPEBs on a cash basis.

SFAS No. 106 focused largely on retiree medical (health) benefits. These benefits generally comprise the largest part of postretirement benefits. The medical benefits also are the fastest growing in total dollars. Under SFAS No. 106, the present value of postretirement benefits should be accrued at the date an employee is fully eligible to receive them. The employer must measure two obligations in deferring these benefits: (1) the Expected Postretirement Benefit Obligation (EPBO), which is the actuarial present

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value of postretirement benefits expected to be paid after retirement to the employees and their dependents, and (2) the Accumulated Postretirement Benefit Obligation (APBO), which is the actuarial present value of all future benefits based on employees' service rendered.

Firms offering OPEBs were required to adopt SFAS No. 106 for the fiscal years beginning after December 15, 1992. However, for firms outside the United States and certain small, nonpublic employers, the application of the statement was delayed until fiscal years beginning after December 15, 1994 (FASB 1990, ¶ 108).

Also, employers were allowed alternatives in recognizing the *transition obligation*, the amount of the unfunded and previously unrecognized postretirement benefit obligation. An employer could have either recognized the transition and the associated cost immediately or amortized it on a straight-line basis over the average remaining service period of active plan participants. However, if the average remaining service period was less than 20 years, the employer could have elected to use a 20-year period. Additionally, if all or almost all of the plan participants were inactive, the employer was required to use the average remaining life expectancy period of those plan participants (FASB 1990, ¶ 112).

Concerns Regarding Accounting Under SFAS No. 106

Market Reactions

SFAS No. 106 was a very controversial standard partially because of the perceived negative effects it would have on the financial statements of companies adopting it. In

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addition, others thought that the negative effects on financial statements would translate into negative market effects for those adopting firms. Research such as that done by Espahbodi, et al. (1991) and Young (1993) did find a statistically significant market effect, giving evidence that these concerns were valid.

Benefit Reductions

Another related concern was that the negative financial statement and market effects would cause firms to reduce or eliminate other postretirement benefits. Evidence from the Espahbodi, et al. (1991) and Young (1993) studies as well as that provided by Smith (1994) supports the assertion that this was valid. Studies examining pension plan reductions such as Stone (1987), Mittelstaedt (1989), and Thomas (1989) give further evidence that this was a valid concern. Mittelstaedt et al. (1995) provides the strongest support for this assertion, as this study found a statistically significant relationship between the adoption of SFAS No. 106 and OPEB plan reductions.

Long-term Effects

There is concern that since companies now have to record an accrued liability for their OPEB obligations, companies will continue to reduce or terminate such plans at an accelerated rate. The Mittelstaedt et al. (1995) study provides evidence that these fears are well founded. There appears to be no research in this area to date, however, due partially to the fact that only a few years have passed since companies adopted SFAS No. 106, making sufficient data unavailable until now. Sufficient data now exist, allowing work to

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proceed in this area. As more data become available, further studies will likely be done, some of which will incorporate methodologies not yet possible because of insufficient data.

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CHAPTER 2

REVIEW OF RELATED LITERATURE

Capital Structure Research

Myers and Majluf (1984)

Myers and Majluf examined corporate financing and investment decisions. The authors found that firms generally found it better to issue safe securities than risky ones. They also perceived that external financing employing debt is better than financing by equity. In addition, firms whose investment opportunities exceeded cash flows, and who had used up their ability to issue low-risk debt have sometimes decided to forego solid investments rather than issue risky securities to finance them. Additionally, the authors found that firms tended to build up financial slack by restricting dividends when investment requirements were modest.

This study appears to be the first to describe what Myers (1984) called a "pecking order" regarding financing decisions. Although the Myers inquiry did not include the study of pensions or postretirement benefits, future studies on these topics drew upon their findings.

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Myers (1984)

Myers examined the question of how companies choose their capital structures. He came to the following conclusions:

First, firms have good reasons for avoiding issuing common stock and other risky securities to finance capital investments. They do not want to fall into the dilemma of either passing up positive-NPV projects[3] or issuing stock at a price they perceive as too low. In addition, firms set target dividend payout ratios so that internally generated funds will be sufficient to cover normal capital expenditures. The author also found that firms also restrain themselves in the issuance of debt, so that these levels will remain at a level deemed safe, thus avoiding material costs associated with financial distress, while allowing the existence of financial slack in the form of reserve borrowing power.

Since investment opportunities fluctuate relative to internal cash flow, there are times when the firm exhausts its ability to issue safe debt. When this occurs, such a firm turns to the least risky securities first. Under such a "pecking order," observed debt ratios reflect the cumulative requirement for external financing.

Myers concluded that the higher up the pecking order a firm goes, the greater the likelihood of incurring costs related to financial distress, thus increasing the likelihood that positive-NPV investments would be avoided. Accordingly, financial slack (in the form of borrowing power) can be regarded as valuable, and firms will take steps to acquire it. Myers has mentioned the issuance of stock as one way to acquire slack. He did not

[3] NPV refers to net present value. Net present value projects are those that are expected to provide a rate of return on invested funds that exceeds the cost of the invested funds.

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mention pension plan asset liquidation as a source of financial slack but this possibility has been addressed in some of the pension related research. This will be reviewed in the next section.

Pension Research

Stone (1987)

Drawing upon the analytical framework of Myers and Majluf (1984), Stone addressed the question of whether overfunded pension plan terminations could be explained as financing decisions. At the time of her study, the tax laws encouraged overfunding, and there were few legal restrictions on plan terminations. In fact, there were no tax penalties on them during the period studied (1982-1984).

In her study, Stone examined 214 firms, and using multivariate statistical analysis, found the model to be significant at the .001 level. The design had a classificatory accuracy of 81.25 percent, suggesting that pension plan terminations were, at least to a large extent, financing decisions.

These findings support the assertion that management has the flexibility of accumulating financial slack in the form of pension fund assets, and that this restraint is more likely to be drawn upon when (1) the firm generates a smaller proportion of its resources internally, (2) the market assigns a lower value to its cash flows, and (3) the firm has incentives to avoid additional debt financing. The results are consistent with a financing explanation for overfunded plan terminations.

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Mittelstaedt (1989)

Mittelstaedt attempted to explain firms' decisions to reduce overfunding of defined benefit pension plans, either quickly through legal terminations or more slowly through actuarial adjustments. He hypothesized that:

> Both terminators and contractors experience financial weakness prior to reducing pension funding. Terminators experience greater financial weakening than contractors.

His premise was based upon the above mentioned studies by Myers (1984) and Myers and Majluf (1984), which found evidence suggesting that when a firm's cash needs exceed those generated from operations, the firm follows a "pecking order" in choosing the means of financing.

Mittelstaedt's final sample consisted of 52 terminator firms, 47 contractor firms, and 59 maintainers. Using univariate analysis, he found evidence that terminators were significantly weaker financially than maintainers and that terminators were financially weaker three years prior to termination. Terminators were also found to be more susceptible to takeover, and terminators exhibited declines in marginal tax rates (suggesting a significant decrease in earnings or increased losses). Contractors were also financially weaker than maintainers three years prior to plan reductions. These contractors were also significantly more likely to have declines in marginal tax rates than maintainers. As expected, values for contractors fell between those for terminators and maintainers.

Logit model analysis results were consistent with those he found by univariate analysis. Overall, the evidence suggested that contractor and terminator firms were financially weaker than maintainers. In addition, the marginal tax rate variable indicated

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that contractors and terminators were more likely to have declines in marginal tax rates prior to contractions or terminations.

Mittelstaedt's results provide evidence that firms reduce pension assets to meet cash needs after experiencing capital constraints. Based upon Mittelstaedt's study as well as prior ones, it does appear that when cash requirements are high and firms experience severe financial weakening, they are much more likely to terminate plans. But when cash needs and financial weakening are less serious, they are more likely to reduce their plans.

Thomas (1989)

Thomas also sought to understand why firms terminate overfunded pension plans. He discussed three alternative explanations. First, excess pension plan assets represent a source of financial slack and are withdrawn by firms facing an unexpected decline in available funds. Second, reversions expropriate wealth from workers since firms renege on an implicit promise to pay pension benefits that vest later in a worker's career. Third, for firms anticipating financial distress, asset reversions allow wealth transfers to stockholders from lenders and the Pension Benefit Guaranty Corporation (PBGC).

Based upon the work of Myers (1984) and Myers and Majluf (1984), Thomas developed a financial slack hypothesis. He predicted that both slow withdrawals and plan terminations would follow unexpected declines in funds from operations and/or increases in profitable investment opportunities.

Thomas obtained a sample of 611 plans, which represented 514 completed terminations and 97 proposed terminations. Thomas found evidence that terminating firms

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fell into three general groups: (1) terminations unassociated with control changes, (2) terminations followed by hostile attempts to change control, and (3) terminations following friendly control changes.

The financial slack explanation appeared to be the most likely rationale for all terminations (with and without control changes). Excess pension assets represent financial slack, and slow withdrawals and terminations represent liquidation of such slack. Continued declines in available funds that exhaust the stock of preferred sources of slack were found to be associated with terminations.

OPEB Research

Askren (1991)

Askren sought to estimate the unobservable OPEBs obligation for a sample of 100 firms for the years 1987, 1988, and 1989. This obligation is considered unobservable, since the market values of assets and liabilities are unobservable and because book values are recorded at historical cost rather than at market value. The author developed three models: one attempted to identify the components of the market value of assets (MVA), one tried to identify the elements that define the market value of liabilities (MVL), and one that endeavored to identify the variables closely associated with the level of the OPEBs obligation. The OPEBs obligation is one of the components of MVL.

Askren hypothesized that an increase in the OPEBs obligation would, in turn, increase the market's assessment of the liabilities of the firm, as the OPEBs obligation represents off-balance sheet debt and should have a direct effect on the market value of

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the firm's liabilities. Through the use of a two-stage least squares regression, Askren determined that, as expected, the OPEBs obligation was positively and significantly associated with the market value of liabilities for all three years of her study. These results were consistent with the market's assessment of the OPEBs obligation as a financial responsibility of the firm, despite its absence from the balance sheet.

Askren also found that the OPEBs obligation coefficients increased during the period examined, which she suggested might have been caused by the increased awareness of them. During 1988, the press reported the FASB proposal to accrue other postemployment benefits. This drew attention to the extremely large potential liability firms had accumulated but had left unrecorded. Askren felt that if this unrecorded liability was incorporated into stock prices, it could explain the increased size of the OPEBs coefficient.

Espahbodi, Strock, and Tehranian (1991)

This paper examined the impact of nine pronouncements on equity prices as they related to the (then) proposed SFAS No. 106. The theories used by the authors in formulating their hypotheses were presented by Watts and Zimmerman (1986): (1) the contracting cost hypothesis, which maintains that stock prices may decline as a proposed accounting standard increases the probability that debt covenants will be violated and thus increases the anticipated cost of a technical default and (2) the political cost hypothesis, which asserts that the announcement of such an accounting change might result in stock price increases, especially for larger firms, due to the reduction of political costs. Based

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upon previous studies, [e.g., Collins, Rozeff, and Dhaliwal (1981) and Lys (1984)], Espahbodi et al., expected a positive impact from the reduction of political costs which would be outweighed, on average, by the negative effect of increased contracting costs.

A total of 143 firms were examined. Using Pearson correlation, the authors found support for the suggestion that the pre-SFAS No. 106 accounting procedure was related to firm size, a point consistent with the assertion that large firms use income-reducing alternatives [Watts and Zimmerman (1986)]. They also found support for the claim that the proposal to force accrual of OPEBs obligations would have a significant impact on firm's financial statements. Furthermore, they suggested a negative stock price impact with the issuance of the Exposure Draft, which would be more significant for firms with high debt-ratios. These findings support their contracting cost hypothesis.

Amir (1993)

Amir analyzed the valuation implications of firms' OPEBs obligations. The study examined investors' assessments of disclosed postretirement benefit (PRB) cash payments prior to SFAS No. 106. He also inquired as to whether a measure of the PRB obligation[4] is regarded as value-relevant by investors in addition to the disclosed cash payments.

Amir used 1990 COMPUSTAT data for the period of 1984-1990. Sample sizes ranged from 243 in 1984 to 313 in 1990. This study used a valuation model that relates the value of a firm to the information provided in its income statement and balance sheet. Amir adopted the model derived by Ohlson (1991) that relates equity value to both

[4] PRB obligation is synonymous with OPEB obligation.

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accounting earnings and book value of equity. This analysis was conducted in two stages. First, a measure of the PRB liability was examined to see if it was value-relevant. This was done in addition to cash payments information. Second, accounting numbers were adjusted so that earnings and book values included the estimated present values of the PRB obligation. The cash information was examined to see if it was value-relevant to investors in addition to extant liability information.

Amir's results indicate that, over the period of 1987-1990, there was a change in investors' assessment of the PRB obligation. His observation is consistent with that of Askren (1991) who found a similar change in the OPEBs coefficient.

The results from this study suggest that investors had changed their assessment of the PRB obligation over the period of 1984-1990 from a position of underestimation during 1984-1986 to realization of the large size of the present value of the expected PRB liability during 1987-1990. The PRB obligation was found to be value-relevant to investors in addition to the cash payments which were found not to be value-relevant when the accounting numbers were adjusted to reflect the estimated PRB obligation. His findings indicate that a measure of the PRB obligation based upon publicly available information prior to the implementation of SFAS No. 106 was more informative than the cash information. This finding supports the FASB's position that accrual of the postretirement liability (as mandated by SFAS No. 106) is necessary.

As mentioned by the author, the study was limited because, at the time of the study, very few firms had adopted SFAS No. 106. This made it virtually impossible to fully validate the estimates of the PRB liability.

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Leauby, Ugras, and Welsh (1993)

The aim of this study was to determine whether the early adoption of SFAS No. 106 by sample firms represented earnings management. The authors examined 64 firms that had adopted SFAS No. 106 early.

Firms that elected to adopt SFAS No.106 early had significantly lower earnings in the year of adoption than in the prior year. That finding is consistent with the "big bath" theory, which maintains that companies will "take a bath" in order to get the bad news out all at once.

In addition, most firms (59 of 64) elected immediate recognition of the cumulative effect of the accounting change. Also, some firms chose to record other nonrecurring charges, which further reduced their profitability in the year of adoption. Altogether, these accounting charges help substantiate the assertion that those firms that adopted SFAS No. 106 early intended to show as much bad news as possible during a period of declining profits.

Smith (1994)

Smith examined whether previous academic research could have been used by the FASB *ex ante* to the issuance of SFAS No. 106 in order to predict the extent to which the management of financially weak firms might defer recognition of the OPEB expense and the related transition obligation. Smith sought to establish whether a firm's financial condition could be statistically associated with a decision to adopt an income-reducing accounting standard before the mandatory adoption date. The author also examined

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whether a given firm's financial position was statistically related to management's choice regarding the transition alternative (i.e., choosing immediate or deferred expensing of the transition obligation).

Smith's sample consisted of 200 firms, distributed over 38 two-digit SIC codes. Rate-regulated and capital-regulated industries were excluded, due to fixed return on investment and minimum capital requirements, which would bias observed ratios.

Using Fisher's exact probability test, he also found support for the assertion that the probability of the early adoption of SFAS No. 106 was significantly higher for financially strong firms (based on profitability) than for financially weak ones. In addition, he found that the likelihood of management choosing immediate recognition of the transition obligation was significantly higher for more profitable firms than for the less profitable companies. The probability, however, of management choosing immediate recognition of the transition obligation was insignificantly higher for more solvent firms than for less solvent ones.

This study provides further evidence that financial weakness motivates management decisions.

Mittelstaedt, Nichols, and Regier (1995)

The purpose of this inquiry was to determine the prevalence, magnitude, and timing of retiree health care benefit reductions and to identify their determinants. The authors explored three explanations for such benefit reductions: (1) increased contracting costs due

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to the adoption of SFAS No. 106, (2) financial weakness independent of the standard and (3) firm-specific increases in retiree health care costs.

Mittelstaedt et al. developed and tested three hypotheses. The first one was based upon the assertions of the contracting cost hypothesis, which maintains that stock prices may decline as proposed accounting standards increase the probability that debt covenants will be violated.

> H1: Firms which reduce retiree health care coverage have higher leverage before considering the effects of SFAS No. 106 and/or experience greater increases in leverage from SFAS No. 106 than other firms prior to reducing it.

The second hypothesis was based upon prior research [Majluf (1984)] that found that financially weak firms liquidate financial slack when internally generated cash flows are less than needed. Furthermore, [Mittelstaedt (1989) and Thomas (1989)] have shown that overfunded pension plans can be viewed as sources of such slack. These studies found that only financially weak firms draw on overfunded pension plans (when other sources of capital have been exhausted). The second hypothesis stated:

> H2: Firms that reduce retiree health care coverage are financially weaker than other firms prior to reducing it.

The third hypothesis was based upon the fact that although health care costs have risen due to demographic factors, increases in health care cost inflation rates and decreases in Medicare coverage, some firms have been impacted more than others (Rappaport and Malone 1993, 25). The third hypothesis stated:

> H3: Firms which reduce retiree health care coverage experience greater specific increases in health care costs than other firms prior to reduction of coverage.

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The sample consisted of 202 firms, 71 of which reduced health care benefits, and 131 of which did not. Most of those that had reduced benefits did so either by capping expenditures or increasing copayments. The authors did not find a clear ordinal relationship between the type and severity of benefits cut.

After performing a univariate analysis, Mittelstaedt et al. found indications that benefit-cut firms had significantly higher interaction variable values than no-cut firms. These observations support the contracting cost hypothesis (which was the basis for Hypothesis 1), as they suggest that managers cut health care benefits partly because of the adverse financial reporting effect of SFAS No. 106 on debt covenants.

The authors found support for the financial weakness hypothesis, and, therefore, Hypothesis 2. The support, however, was not as strong as it was with the pension terminators or pension contractors reported by Mittelstaedt (1989) and Thomas (1989).

Logit models were used to test the third hypothesis. The results of the multivariate analysis were consistent with those found with the univariate analysis. The results also indicated that financial weakness influences the benefit-cut decisions. Firm-specific increases in health care costs appear not to play a significant role in explaining such benefit-cut decisions.

Overall, the results suggest that there is a strong associative relationship between the decision to cut retiree health care benefits and increased contracting cost created by the requirement to adopt SFAS No. 106. This, the authors maintain, suggests that SFAS No. 106 provoked managerial actions regarding the timing of cuts in retiree health care benefits. The authors' results also suggest that the adoption (or anticipated adoption) of

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SFAS No. 106 is a major factor in OPEB reduction decisions. But adoption of SFAS No. 106 was not the only factor. Mittelstaedt et al. found support for the financial weakness hypothesis, suggesting that firms in weakened financial condition were more likely to liquidate pension assets or reduce other postretirement benefits when less costly sources of capital became unavailable.

Summary

This study is an extension of the research outlined above. The studies by Askren (1991) and Amir (1993) provide evidence of the importance of accruing the OPEB obligation. Both determined that the market considered the OPEB obligation as a responsibility of the firm even before it was on the balance sheet. Additionally, the fact that value-relevance of the OPEB obligation appeared to increase dramatically when accrual of this liability became imminent indicated the importance of this issue for investors.

A financial weakness hypothesis will be used in this study since there is considerable support for the use of financial weakness as a variable. This can be related to Myers and Majluf (1984) and Myers (1984), who discovered that firms generally restrict dividends or take other steps to maintain financial slack. A firm with ample financial slack will be able to acquire funds more cheaply and avoid costs associated with financial weakness. Thus, it is considered valuable for the firm. Furthermore, support for the use of a financial weakness variable is found in the study done by Stone (1987). This investigation found that pension plan reductions were financing decisions, and she also noted that the liquidation of excess pension assets was one way to acquire financial slack.

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Mittelstaedt (1989) discovered that firms terminating pension plans generally were weaker financially than those that maintained them. And Thomas (1989) found that financial slack was the most likely reason for all pension plan terminations. Such pension plan research is relevant to the current study. With pensions there are assets used to fund such plans. When firms have an increased need for financial slack, but have exhausted cheaper forms of it, they may liquidate pension plan assets. If their financial strength decreases further, they may now elect to reduce or terminate them. Since most postretirement benefit obligations are unfunded, there are no assets to liquidate, so the first step would be to reduce these benefits. Mittelstaedt et al. (1995) extended this assertion regarding postretirement benefits and discovered that financial weakness was related to reductions and terminations of OPEBs. This provides considerable support for the use of financial weakness as a variable.

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CHAPTER 3

METHODOLOGY

Pilot Study

This investigation was undertaken to determine whether data would be both readily available and accessible and to determine the optimal sample size to be used in the final study. Additionally, defects were worked out of statistical formulas and error detection methods were developed to aid in minimizing data errors. This pilot study will be referred to throughout Chapter 3 and will be discussed in more detail in Chapter 4.

The source for financial statement data for this inquiry (and for the final study as well) was the SEC's Edgar Database which contains financial statements from all publicly held firms since they must report this information to the SEC. The Edgar database provides full disclosure of information for publicly held firms in the United States. The data were taken from the 10-K reports. Using a random number generator, firms were drawn using the SEC's company ID numbers. Then, the number was matched with the SEC record bearing it. Data for the fiscal years 1993, 1994, 1995, and 1996 were taken from those 10-K filings. Since there might be some variation from year to year, it was advisable to examine several years' data. For example, the effect of the OPEB liability

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might change over several years, particularly since for most firms, 1994 was the first year this liability appeared on the balance sheet.

Description and Justification of Variables

Dependent Variable:

CHG = Dependent variable. Indicator variable coded 0 for no change and 1 for change (reduction or termination of OPEBs).

Independent Variables:

TD/TA = Total Debt/Total Assets—financial weakness variable.

NI/TA = After-Tax Net Income/Total Assets—financial weakness variable.

OCF/TA = Operating Cash Flows/Total Assets—financial weakness variable.

TL/TA = Total Liabilities/Total Assets—alternative financial weakness variable.

APBO/TA = Accumulated Postretirement Benefit Obligation (APBO)/Total Assets Measures the OPEB liability relative to total assets.

CAP/TA = Change in the OPEB liability (APBO/TA) from the previous year to the current year.

INT1 = Interaction variable—(TD/TA) * (APBO/TA)—interaction between total debt and the OPEB liability.

INT2 = Interaction variable—[Inverse of (NI/TA) * (APBO/TA)]—interaction between the level of net income and the OPEB liability.

INT3 = Interaction variable—[Inverse of (OCF/TA) * APBO/TA]—interaction between the levels of cash flow and the OPEB liability.

INT4 = Interaction variable—(TL/TA) * (APBO/TA)—interaction between the relationship of liabilities to assets and the OPEB liability.

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Three variables are used to measure financial weakness: Total debt to total assets, after-tax income from continuing operations to total assets, and cash flow from operations to total assets.

An alternative weakness variable is being used to compare the predictive ability of the TD/TA with that of TL/TA. The TD/TA variable is specifically defined as total debt plus capital lease payments divided by total assets. It should be a better predictor of changes in OPEBs than the TL/TA variable since the total debt variable more directly measures a firm's ability to obtain relatively inexpensive sources of capital. Additionally, since the OPEB liability is included in total liabilities, the TD/TA is a better variable as it prevents them from overlapping.

All sample firms have adopted SFAS No. 106. Accordingly, the information now extant allows one to examine the relationship between the postretirement benefit obligation and OPEB plan reductions. APBO/TA, a continuous variable, is used to measure the obligation mandated by this accounting standard. And while Mittelstaedt et al. (1995) used the adoption of SFAS No. 106 as a variable, this inquiry will instead employ the OPEB liability that the adoption of this standard created.

The interaction variables were developed to determine whether the interaction between the OPEB liability and any of the financial weakness variables has a stronger predictive ability than any of these variables do individually. Although each individual financial weakness variable may have some predictive ability, the predictive ability may be better if that financial weakness variable is combined with the OPEB liability, which may itself have predictive ability. The justification for including interaction variables is based

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upon the postulation that the effects of the variables are multiplicative and not simply additive. For instance, assume one variable would increase the probability of OPEB reductions by 10 percent, while another variable would increase this probability by 12 percent. However, if the two were combined, the probability of OPEB reductions might be 60 percent, which is clearly far above the sum of the effects of the individual variables.

The first interaction variable, INT1, attempts to determine if the interaction between the debt ratio (TD/TA) and the OPEB liability helps explain the differences in the group means better than either variable would individually. As Mittelstaedt et al. (1995) determined, there was a relationship between the debt ratio and OPEB plan reductions. Additionally, there was a relationship between the SFAS No. 106 adoption and the OPEB plan reductions. In this study, the OPEB liability is used in place of the SFAS No. 106 adoption. It is logical, therefore, to assume that there might be a statistically significant relationship between the debt ratio and OPEB reductions and that there also might be a significant relationship between the OPEB liability and these reductions. For instance, a firm may consider reducing coverage if their debt ratio increases. The firm may also consider reducing coverage if the OPEB liability increases. If the debt ratio increases and the OPEB liability increases, this combination of events may be enough to trigger the decision to reduce postretirement benefits. Therefore, an interaction variable was created to help determine whether these two variables taken together have a stronger predictive ability than the two variables would individually.

INT2 represents the interaction between profitability (NI/TA) and the OPEB liability. It is logical to assume that there might be a statistically significant relationship

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between profitability and OPEB reductions and, furthermore, that there might also be a significant relationship between the OPEB liability and those reductions. A firm may consider reducing coverage if profitability declines. The firm may also consider reducing coverage if the OPEB liability increases. If profitability declines and the OPEB liability increases, this combination of events may be enough to trigger the decision to reduce postretirement benefits. Thus, a second interaction variable was created.

INT3 demonstrates the interaction between operating cash flows (OCF/TA) and OPEB liability. It is logical to assume that there might be a statistically significant relationship between cash flow and OPEB reductions. It also is reasonable to suspect that there is an important relationship between OPEB liability and those reductions. A firm may consider reducing coverage if cash flow declines. The firm may also consider reducing coverage if the OPEB liability increases. If cash flow declines and the OPEB liability increases, this combination of events may be enough to trigger the decision to reduce postretirement benefits. Accordingly, a third interaction variable was created.

INT4 is the same as INT1 except that it uses TL/TA in lieu of TD/TA. It is probable that this variable is less strong than INT1. The TD/TA variable specifically considers debt and capital lease payments and not total liabilities. This variable was included so that this assumption could be investigated.

All variables were lagged one year in the pilot study and in the final one as well. There was a very significant difference in the classificatory power of the lagged versus non-lagged variables. Firms are likely to make decisions based upon the results of the previous period so it is not surprising to find that lagging variables often enhances their

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predictive ability, as was the case with the Mittelstaedt et al. study. Additionally, the Mittelstaedt et al. research found increased statistical significance when interactions were used.

Statement of Hypotheses

Discriminant analysis was used in this pilot study to determine the relationship between OPEB reduction decisions and several groups of independent variables. These latter included the OPEB liability variables, financial weakness variables, and the funding level of OPEB plans, dividend level variables, firm age, and firm size. Data were collected for five years (1993, 1994, 1995, 1996, and 1997). In the final study, the period 1994-97 was analyzed though not all the 1997 data were available at the time the pilot study was done. This period (1993-96) represents the first four-year period in which SFAS No. 106 had been in effect for all adopters of that statement. The period of 1994-1996 also was analyzed, but 1993 data were necessary to create lagged variables for 1994. The following hypotheses were tested in the pilot study and in the final study.

Hypothesis 1 is as follows:

Ho: There is no significant statistical relationship between any of the financial weakness variables and OPEB reductions among sample firms.

Ha: There is a significant statistical relationship between at least one of the financial weakness variables and OPEB reductions among sample firms.

Hypothesis 2 is as follows:

Ho: There is no significant statistical relationship between the level of the OPEB liability and OPEB reductions among sample firms.

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Ha: There is a significant statistical relationship between the level of the OPEB liability and OPEB reductions among sample firms.

Hypothesis 3 is as follows:

Ho: There is no significant statistical relationship between the change in the level of the OPEB liability and OPEB reductions among sample firms.

Ha: There is a significant statistical relationship between the change in the level of the OPEB liability and OPEB reductions among sample firms.

Hypothesis 4 is as follows:

Ho: There is no significant statistical relationship between any of the interaction variables and OPEB reductions among sample firms.

Ha: There is a significant statistical relationship between at least one of the interaction variables and OPEB reductions among sample firms.

The first hypothesis is similar to the first one used by Mittelstaedt et al. (1995). The second one is similar to the SFAS No. 106 adoption hypothesis used by Mittelstaedt et al. except that it examines the relationship between OPEB reductions and the OPEB liability under SFAS No. 106 instead of adoption of the standard. The third hypothesis is an extension of the second one and is used to determine whether a change in the OPEB liability from one year to the next is related to OPEB plan reductions. The fourth and final hypothesis explores the possibility of interactions between several key variables (see variable description section).

Use of Discriminant Analysis

Two-group discriminant analysis was used in this study since the dependent variable is categorical while the independent variables are continuous. There are two groups into which firms may fall: (1) No-change firms (firms which did not reduce

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OPEBs), (2) Change firms (firms that did reduce OPEBs). Two group discriminant analysis involves derivation of the linear combination of independent variables that can best discriminate between observations in these defined groups. Discriminant analysis multiplies each independent variable by an appropriate weight and adds these products together. The analysis results in a single composite discriminant score for each firm in the analysis. By averaging the discriminant scores for all the firms, it is possible to obtain a group mean (called a centroid). The centroids indicate the most typical location of a firm within a particular group, and a comparison of the group centroids tells how far apart these are along the dimension being tested.

The test for statistical significance of the discriminant function is a generalized measure of the distance between the two group centroids. This is calculated by comparing the distribution of the discriminant scores for the two groups. If the overlap is small, the discriminant function separates them well. If, however, the overlap is large, then the function only poorly discriminates between these groups.

Assumptions for derivation of the discriminant function are multivariate normality of the populations and unknown (but equal) dispersion and covariance structures for the groups. When classification accuracies are determined, one may also assume equal costs of misclassification, equal a priori group probabilities, and known dispersion and covariation structures. Discriminant analysis is not so sensitive to violations of these assumptions unless, of course, such violations are extreme. Discriminant analysis is even less sensitive to such violations when a large sample size is used.

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The main objectives of discriminant analysis are as follows:

1. To establish procedures for classifying statistical units (firms) into groups on the basis of their scores on several independent variables, and

2. To determine which of the independent variables account for most of the differences in the average score profiles of the two groups.

Accordingly, discriminant analysis is the most appropriate technique for use in this study, which attempts to classify firms into two groups (change and no-change).

Two software packages were employed in this analysis. Those same packages were used in the main study. The first was Minitab for Windows and the second was NCSS. They both gave the same results, although NCSS allowed for the use of stepwise discriminant analysis. Accordingly, this is the package from which these findings have been printed. The stepwise feature also allows one to automate the procedure of adding and deleting independent variables from the model. Variables are entered into the model when they are significant. If a variable becomes insignificant in the presence of the other variables in the model, however, it is removed. This method maximizes the F-value of the entire model and thereby provides the most efficient group of variables for purposes of classification.

Summary

The complete model used for the pilot study may be specified as follows:

$$CHG = C0 + C1*TD/TA + C2*NI/TA + C3*OCF/TA + C4*TL/TA + C5*APBO/TA + C6*CAP/TA + C7*INT1 + C8*INT2 + C9*INT3 + C10*INT4$$

Where:

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Dependent Variable:

CHG = Indicator variable coded 0 for no change and 1 for change (reduction or termination of OPEBs).

Independent Variables:

TD/TA = Total Debt/Total Assets—financial weakness variable.

NI/TA = After-Tax Net Income/Total Assets—financial weakness variable.

OCF/TA = Operating Cash Flows/Total Assets—financial weakness variable.

TL/TA = Total Liabilities/Total Assets—alternative financial weakness variable.

APBO/TA = Accumulated Postretirement Benefit Obligation (APBO)/Total Assets Measures the OPEB liability relative to total assets.

CAP/TA = Change in the OPEB liability (APBO/TA) from the previous year to the current year.

INT1 = Interaction variable—(TD/TA) * (APBO/TA)—interaction between total debt and the OPEB liability.

INT2 = Interaction variable—[Inverse of (NI/TA) * (APBO/TA)]—interaction between the level of net income and the OPEB liability.

INT3 = Interaction variable—[Inverse of (OCF/TA) * APBO/TA]—interaction between the levels of cash flow and the OPEB liability.

INT4 = Interaction variable—(TL/TA) * (APBO/TA)—interaction between the relationship of liabilities to assets and the OPEB liability.

Sample Selection

The sample used in the pilot study consisted of 125 firms which remained after those in rate regulated industries were eliminated. As described by Smith (1994) and Mittelstaedt, et al. (1995), the treatment of utilities' health care costs is regulated by state commissions. Their rates are also regulated and this, in turn, greatly narrows the possible

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earnings range, which violates the underlying assumption that the firms operate in a free market. Additionally, the financial ratios of utilities and financial institutions are much different from those of firms in other industries. Since financial weakness is believed to be highly correlated with OPEB reductions, it was necessary to discard these firms from the sample.

After excluding utilities and financial institutions, firms not offering OPEBs were discarded, thus reducing the final sample size to 42, 45, and 45 for 1994, 1995, and 1996 respectively. For three of those firms, there were no data available for 1993. This made lagging of variables impossible for 1994. Accordingly, these three were dropped from the analysis for that year. Of the sampled firms, however, 6 had benefit reductions with 2 occurring in each year. The fact that out of 125 firms only 45 offered OPEBs is consistent with research which found that the adoption of SFAS No. 106 was statistically significant in explaining OPEB reductions and terminations. Earlier information suggested that a much higher percentage of firms offered OPEBs.

Given the small proportion of change firms found in the holdout sample, a collection of 1,632 firms will be used for the final study. This is based upon the following formula for computing necessary sample size:

$$n = \frac{Z^2 p(1-p)}{E^2}$$

Where:

Z = z score based upon a significance level of .05

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p = proportion of change firms to total firms

E = error

The calculation is as follows: $$\frac{(1.96)^2 .044444(.955556)}{(.01)^2}$$

Which yields: $$\frac{(3.8416)(.042469)}{.0001}$$

This gives us n: $$1631.492 = \frac{.1631492}{.0001}$$

The error (E) is set at 1 percent. If this had been 2 percent, the necessary sample size would be only 408 firms. Changing the error to 1 percent, however, requires instead a sample size of 1,632 firms. Given the accuracy of a 1 percent error compared with that of a 2 percent error, it appears that the increased sample size is needed. If the current proportion of change firms to total firms holds for the larger sample, one would expect that the number of change firms would be approximately 72 for each year. On the other hand, if the sample were only 408 firms, the number of change firms instead would be 18, which would be quite small. The final sample, however, did not consist of 1,632 firms. The reasons for this are stated below.

The proportion of change to total firms was extremely small in the sample used for the pilot study. It was assumed that this same proportion existed in the large sample. The small proportion of change firms could have been responsible for some of the decreased classificatory power of the discriminant analysis used in the pilot study. In the pilot study sample, only two change firms were found in the sample of 45 (2 out of 42 for 1994). Therefore, someone could simply assume that all firms were no-change firms, and he or

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she would be more than 95 percent accurate! When the prior probabilities are so skewed, it could cause the discriminant analysis to lose some of its ability to separate individual observations into groups. To combat this potential problem, the sample of non-change firms was systematically reduced. This would have resulted in a final sample of approximately 450 to 500 firms. The proportion of change to no-change firms would have been approximately 15 percent, which would be somewhat less skewed than the proportion in the sample used in the pilot study. As explained in Chapter 5, the final sample was much smaller than the proposed 450 to 500 firms.

All firms in the utility and financial services industries were eliminated from the sample in the pilot study. They were, of course, removed from the main sample as well. As was the case in the pilot study, firms were selected which do not offer postretirement benefits at all, and they were eliminated. Thus, they were not considered in the size of the total sample.

Since financial statement data are often restated in subsequent years, the most recent data will be used for all years. For example, both 1997 and 1996 data will be taken from the 1997 comparative financial statements, while 1995 data will be taken from the 1996 comparative financial statements, and so on. Not all of the fiscal years end simultaneously (e.g., December 31). This, however, should not be a problem here, as there were no major economic shifts during the period examined. The data were not stratified by industry since there were so few change firms during this time frame.

A random sample of firms was taken from the SEC's Edgar database using a random number generator. The sample size of 125 was used for the pilot study. It was

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inevitable, of course, that some of the firms do (or did not) offer OPEBs. These observations would be automatically eliminated. Similar sampling procedures were used in the final study.

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CHAPTER 4

RESULTS FROM THE PILOT STUDY

Significance of the Preliminary Findings

Since discriminant analysis is used to classify data into groups, the first step is to determine if the means of the two groups are statistically significantly different. If they are not, discriminant analysis will be unable to determine accurately the group into which a particular observation fits.

Therefore, means tests were performed on all independent variables for the two groups for each year. The variables for which the means were significantly different were also determined to have explanatory power in the final models for each year, as shown below.

Analysis was done using prior probabilities that were determined based upon the sample used in the pilot study. First, the probability of a firm being represented in group 0 (no change) was assumed to be .95 and the probability of a firm being represented in group 1 (change) was assumed to be .05. The justification for the use of these prior probability figures was the proportion of change firms to total firms in the sample. There were only two change firms out of a total of 45 firms (42 firms for 1994). This proportion was rounded to .05, providing the prior probability of a firm being in group 1.

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Preliminary findings support the assertion that, for 1994, there is a statistically significant relationship between INT1 and OPEB reductions.

Hypothesis 1 is as follows:

Ho: There is no significant statistical relationship between any of the financial weakness variables and OPEB reductions among sample firms.

Ha: There is a significant statistical relationship between at least one of the financial weakness variables and OPEB reductions among sample firms.

The cash flow variable is not significant at the .05 level, but the interaction variable measuring the interaction of after-tax income and OPEB liability is significant at this confidence level. The OPEB liability variable by itself is not significant, nor is the NI/TA variable. Using .05 as the critical level of confidence, we fail to reject the null hypothesis for hypothesis 1.

Hypothesis 2 is as follows:

Ho: There is no significant statistical relationship between the level of the OPEB liability and OPEB reductions among sample firms.

Ha: There is a significant statistical relationship between the level of the OPEB liability and OPEB reductions among sample firms.

For hypothesis 2, we also fail to reject the null hypothesis, since the OPEB liability is, by itself, not significant.

Hypothesis 3 is as follows:

Ho: There is no significant statistical relationship between the change in the level of the OPEB liability and OPEB reductions among sample firms.

Ha: There is a significant statistical relationship between the change in the level of the OPEB liability and OPEB reductions among sample firms.

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The null hypothesis for hypothesis 3 is not rejected since the change in the OPEB liability does not appear to have a statistically significant relationship with OPEB reduction decisions.

Hypothesis 4 is as follows:

Ho: There is no significant statistical relationship between any of the interaction variables and OPEB reductions among sample firms.

Ha: There is a significant statistical relationship between at least one of the interaction variables and OPEB reductions among sample firms.

The null hypothesis is rejected in the case of hypothesis 4 since one of the interaction variables is significant at the .05 level (see Table 2). In fact, this suggests that there may be a significant relationship between the interaction of cash flow level and both OPEB liability level and OPEB reductions. The cash flow variable by itself was not significant at the .05 level (see Table 2). On the other hand, there might be a significant relationship between after-tax income and OPEB liability levels when the interaction of both variables is considered. Overall, the predictive ability of the significant variables is accurate, as 41 of the 42 observations were classified correctly (see Table 1). The one firm that was misclassified (observation 3) had values for all variables that were statistically insignificantly different from the means for group 0, so discriminant analysis was unable to classify it correctly as a member of group 1. This may be attributable to the small sample size.

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TABLE 1
CONFUSION MATRIX - 1994

		PREDICTED 0	PREDICTED 1	
ACTUAL	0	40	0	40
	1	1	1	2
		41	1	42

TABLE 2
VARIABLES RETAINED IN THE MODEL - 1994

VARIABLE	F-VALUE	PROB. > F
OCF/TA	3.30	.0755
INT1	6.10	.0181

There appears to be a much stronger statistical relationship between several variables and the OPEB reductions for 1995. In fact, all the interaction variables as well as the OPEB liability variables are significant at the .05 level (see Table 4). None of the financial weakness variables, however, are significant by themselves. Given these results, it would appear that the OPEB liability was the trigger for such reductions. Certainly when combined with financial weakness variables, the statistical relationship appears even more significant. Since none of the financial weakness variables are significant by themselves, we fail to reject the null hypothesis for hypothesis 1. All OPEB variables and all interaction variables appear to be significant, so we can reject the null hypothesis for hypotheses 2,

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3, and 4. The significant variables for 1995 classified all 45 observations correctly (see Table 3).

TABLE 3
CONFUSION MATRIX - 1995

		PREDICTED 0	PREDICTED 1	
ACTUAL	0	43	0	43
	1	0	2	2
		43	2	45

TABLE 4
VARIABLES RETAINED IN THE MODEL - 1995

VARIABLE	F-VALUE	PROB. > F
INT1	5.0	.0315
INT2	605.7	<.0000
INT3	504.8	<.0000
CAP/TA	11.4	.0017
APBO/TA	13.4	.0008

For 1996, however, relationships were considerably weaker. There does appear to be a weak relationship between cash flows and OPEB reductions though it was not strong enough to be significant at the .05 level. Accordingly, we fail to reject the null hypothesis for hypothesis 1. Furthermore, since there are no other variables with statistically significant relationships, we also fail to reject the null hypothesis for hypotheses 2, 3, and 4. The classificatory power of the cash flow variable was not particularly strong. This may

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be attributable to the small size of the sample. Both firms in group 1 were mis-classified. Analysis of the data revealed that the values of all variables for these two firms were statistically insignificantly different from the means for group 0, so discriminant analysis was unable to classify them correctly as members of group 1.

TABLE 5
CONFUSION MATRIX - 1996

		PREDICTED 0	PREDICTED 1	
ACTUAL	0	43	0	43
	1	2	0	2
		45	0	45

TABLE 6
VARIABLES RETAINED IN THE MODEL - 1996

VARIABLE	F-VALUE	PROB. > F
OCF/TA	3.80	.0568

Overall, there does appear to be a relationship between OPEB liability levels and OPEB reductions as well as a relationship between some of the financial weakness variables and OPEB reductions. At this juncture, it would be logical to conclude that the wide variation in predictive ability and the exact variables that are related to the reductions is partially due to the small sample size. Although the sample size of 45 firms (42 for 1994) is not especially small itself, there were only two change firms for each year in this

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sub-sample. In the final study, the larger sample size was expected to reduce these wide variations between years. However, since the sample contained a very small percentage of change firms, the sample had to be reduced by eliminating many of the no-change firms. This systematic reduction of the sample did reduce the prior probabilities to .50 and .50, so the results were still more reliable than those from the pilot study where the prior probabilities were approximately .95 and .05. It appears that the wide variations between years were largely eliminated in the final study, but it was probably the dramatic reduction in the prior probabilities that reduced these variations. The primary justification for stratifying the sample by year was to explore the possibility that the significance of the OPEB liability had changed over time, especially since the adoption of SFAS No. 106 itself was no longer an issue.

During the pilot study, some variables were removed. Originally, there was a variable comparing the degree of postretirement benefit plan funding to reductions in those plans. Although there should have been a negative correlation between plan funding and reductions in those plans, so few of them were funded that the variable was not meaningful. This variable was excluded from the final study. Firm size, another variable, was found to be insignificant since most of the smaller companies appear not to offer postretirement benefits. The size variable was not expected to be significant and the findings support that assertion. Additionally, and as expected, the variable TL/TA had a significantly weaker classificatory power than TD/TA. Similarly, INT4 was much weaker than INT1. For example, in 1995, all the interaction variables were significant except INT4.

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The fact that so few firms (45 of 125) actually offered postretirement benefits was a significant finding by itself. Pre-SFAS No. 106 research suggested that a much higher percentage of firms offered such benefits than was found in the data search post-SFAS No. 106. This is consistent with the findings of Mittelstaedt et al. (1995) and others who found that the adoption of this financial accounting standard was a significant factor in OPEB reductions in periods prior to the one being studied here. Furthermore, a study by the consulting firm William M. Mercer found that in1998, the percentage of companies with at least 500 employees that provide OPEBs has dropped to 36 percent, down from 46 percent in 1993.[5] These figures show that OPEB plan reductions continued after the adoption of SFAS No. 106. One goal of this study was to determine what might have caused the reductions during this time period.

In addition to the above findings, the pilot study has provided the proportion of change forms to the total number of firms, greatly simplifying the determination of sample size needed for the final study.

Limitations of the Pilot Study

The most significant limitation has been the small sample size. Although this has proven to be a significant restriction in the analysis of the results, it has been instrumental in determining the sample size to be used in the final study. Another problem is the time period. At this juncture, it would appear that other methodologies such as those used by

[5] "Enrollment in Employee-Sponsored HMO/POS Plans Drops, While Health Plan Costs Jump 6.1%." Mercer USA Resource Center, January 26, 1999.

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Mittelstaedt et al. (1995) cannot be utilized here. Those authors lagged some of the financial weakness variables three years. Since lagging 1994 would mean using 1991 data, there would be a considerable problem because SFAS No. 106 had not yet been adopted by all firms. The required date of adoption was for financial statements with periods ending after December 15, 1992. Lagging variables one year increased the model's classificatory power, but it will be several years before the three-year lagging can be used.

Discussion of the Main Study

The major difference between the main study and the pilot study was sample size. Two variables that were used in the pilot study were not put to use in the final study. These were "weeded out" during the pilot study because of their insignificance. In fact, they were never included in the model. First, the plan assets (OPEB funding) variable was nonrelevant due to the extremely small number of firms funding their postretirement benefit plans. Second, the size variable was insignificant due to the fact that all the firms in the sample were rather similar in size. Accordingly, the size and plan assets variables were not used in the main study.

Since the variable TL/TA has shown some classificatory power, it was retained as will INT4. It is not anticipated that these variables will be kept in the final model, but they will not be discarded at this time. It is likely that they will be dropped in favor of TD/TA and INT1. The methodology to be used in the main study will be the same as that employed in the pilot study except for sample size and the elimination of variables found

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to be irrelevant. The model to be used in the final study is identical to the one used in the pilot study except that the new prior probabilities are expected to be .85 and .15.

Summary of the Pilot Study's Findings

The pilot study has shown some evidence supporting the assertion that financial weakness and the level of OPEB liability are related to a firm's decision to reduce the level of postretirement benefits it offers its employees. There, however, is a considerable degree of variability between years though this may be attributable, at least in part, to the small sample size of change firms. Actually, the small number of change firms makes it quite difficult to draw inferences from the pilot study's findings.

The small number of firms offering OPEBs relative to the total number of firms set aside for the pilot study is in itself a significant finding. It supports the expectation that the adoption of SFAS No. 106 did have an effect on the decision to reduce or eliminate postretirement benefits. It also required an increase in the necessary sample size to be used in the final study.

Preliminary Conclusions Based Upon Pilot Study

There appears to be a weak relationship between both financial weakness and the level of the OPEB liability in the reduction of postretirement benefits. It may be possible, of course, to define these relationships more clearly using a larger sample.

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Implementation of the Pilot Study Revelations into the Final Study

The results from the pilot study indicated that a number of issues required further inquiry. First, the variability between years was unlikely to be completely due to the small sample size in the pilot study, but it may have been the primary cause of such variations. The prior probabilities were quite extreme in the pilot study, which could have caused much of the variability as well. Both issues were addressed in the final study, and the variability between years was found to be considerably smaller. In fact, the variations were too small to affect the model's classificatory power significantly.

Second, in the next few years, enough post-SFAS No. 106 adoption data will be available to allow one to explore other methodologies, including those requiring significant lagging of variables. In fact, the ability to lag variables more than one year might be able to help determine whether OPEB reduction decisions are based on long-term or short-term trends. For example, if the variables lose explanatory power as they are lagged by more periods, we might be able to conclude that these decisions are made using only recent developments rather than from the analysis of a trend that covers several years. This could not be addressed in the final study since the data were not available at the time the study was conducted.

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CHAPTER 5

RESULTS FROM THE FINAL STUDY

Introduction

This chapter presents the results of a discriminant analysis of sample data to determine whether firms can be classified into one of two groups based on financial weakness and the level of the OPEB liability that must be disclosed in accordance with SFAS No. 106. Four stages of analysis were performed. First, the full sample was analyzed. The model exhibited very weak classificatory power, as it classified nearly every firm in the sample as a no-change firm. The prior probabilities (the probability of an observation in the actual sample belonging to one group versus the other) were extreme in the full sample with 97 percent of the firms being no-change firms (98 percent for 1994). Because of this, discriminant analysis may have lost much of its ability to separate firms and place them into the proper group. Thus, many of the firms could have been "forced" into group 0 due to the overwhelming probability that a sample firm would belong to this group. The fact that several variables were significant at the .05 level despite the model having very little classificatory power would suggest that either the variables should not have been significant, or that the model should have possessed better classificatory power. Therefore, a second analysis was necessary.

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In the second analysis, the no-change firms were systematically removed from the sample so that the prior probabilities would be less extreme. With the reduction of no-change firms, this was lowered to 85 percent for all years except 1994, when they were 90 percent. The results from this second analysis were nearly identical to what was discovered in the first run of the data. Again, the model classified nearly every firm as a no-change firm. In addition, several variables again were found to be significant, despite the model's lack of classificatory power. This persistent inconsistency in the empirical results again raised the suspicion that the prior probabilities were causing many of the firms to be misclassified as no-change firms. Accordingly, steps were taken to force the prior probabilities into a more reasonable range to see if this indeed was the case.

As a result, a third analysis was performed. In this analysis, each change firm was taken and matched with a no-change firm of similar size (based on the level of total assets). This reduced the prior probabilities to exactly .50 and .50, since in this smaller sample, there was an equal number of change and no-change firms for each year. The results of this analysis showed that many more firms were being classified as change firms, and the classificatory power of the model was significantly better than that found in the first two analyses. Again, several of the variables were found to be significant at the .05 level. This time, the model's classificatory ability was consistent with expectations. The model still misclassified some of the firms, but it was no longer misclassifying a large number of change firms as no-change ones. It appears that most of the misclassifications were now due to a somewhat weak relationship between the independent variables and OPEB plan reductions.

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Finally, since no clearly identifiable year-to-year trends had been discovered, the data set used in the third analysis was rerun without regard to the year of change. The results were similar to those found in the third analysis, but the model's classificatory power was somewhat diminished. This suggests that the year of change may have some limited significance, and that there is justification for performing the analysis on a year-by-year basis.

The results of this investigation are somewhat inconsistent with the findings of prior OPEB and pension research. The results obtained in this study suggest that the relationships between financial weakness and OPEB plan reductions might have changed since the adoption of SFAS No. 106. At this point, it appears that both the degree of financial weakness and the level of the OPEB liability are associated with increased plan reduction decisions, but not as strongly as they were prior to the adoption of SFAS No. 106. However, further research is necessary to confirm or refute these findings.

Sample Selection in the Final Study

The total number of firms offering OPEBs at the end of fiscal 1993 was only 588 after deleting rate regulated firms, so this entire group was used in the first stage of the analysis. All but four of these firms contain data for all five years (1993-1997). There were 585 usable observations for 1997, 588 observations for 1996, and 587 for both 1995 and 1994. There were 18 change firms in both 1997 and 1996, 19 in 1995, and 12 in 1994. The ratio of change firms to the total number of firms is smaller than it was in the pilot study. The data were gathered from the SEC's Edgar database.

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For the second analysis, the sample size was reduced to 120 firms in an effort to bring prior probabilities into a less extreme range. After the second analysis failed to show any improvement in discriminant analysis' ability to classify firms, the sample was further downsized to include only change firms matched with no-change firms of similar size. In the third analysis, the total sample size was 36 in 1997 and 1996, 38 in 1995, and 24 in 1994.

Variables Used in the Final Study

From the results of the pilot study, the variables TL/TA and the associated interaction variable, INT4, which was defined as (TL/TA)*(APBO/TA), were dropped from the model. In the place of these deleted variables, OI/TA (operating income/total assets) and a new INT4, defined as (inverse of OI/TA)*(APBO/TA), were added. The operating income/total assets variable was added to determine if the classificatory power of a pre-tax income figure would be stronger than that of net income, which is an after-tax figure. In addition, net income can be affected by extraordinary items along with gains and losses from discontinued operations and adjustments caused by changes in accounting methods.

During the data gathering process in this final study, several other variables were added. During the pilot study, a change variable (CAP/TA) was employed. This variable was added to determine if a statistically significant relationship existed between the change in the OPEB liability level from one year to the next and OPEB reduction decisions. Because there are changes from year-to-year in all the financial weakness variables as well

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as in the OPEB liability, the change variables were expanded to include the year-to-year changes in the financial weakness variables. Additionally, four new interaction variables were developed. These new interaction variables are similar to the original four interaction variables except that the new ones are related to the newly created change variables. Accordingly, the full model used in this final study was defined as follows:

$$CHG = C0 + C1*TD/TA + C2*NI/TA + C3*OCF/TA + C4*OI/TA + C5*APBO/TA + C6*CTD/TA + C7*CNI/TA + C8*COCF/TA + C9*COI/TA + C10*CAP/TA + C11*INT1 + C12*INT2 + C13*INT3 + C14*INT4 + C15*INT5 + C16*INT6 + C17*INT7 + C18*INT8$$

Where:

Dependent Variable:

CHG = Indicator variable coded 0 for no change and 1 for change (reduction or termination of OPEBs).

Independent Variables:

TD/TA = Total Debt/Total Assets—financial weakness variable.

NI/TA = After-Tax Net Income/Total Assets—financial weakness variable.

OCF/TA = Operating Cash Flows/Total Assets—financial weakness variable.

OI/TA = Total Liabilities/Total Assets—alternative financial weakness variable.

APBO/TA = Accumulated Postretirement Benefit Obligation (APBO)/Total Assets Measures the OPEB liability relative to total assets.

CTD/TA = Change in the first financial weakness variable (TD/TA) from the previous year to the current year.

CNI/TA = Change in the second financial weakness variable (NI/TA) from the previous year to the current year.

COCF/TA = Change in the third financial weakness variable (OCF/TA) from the previous year to the current year.

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COI/TA = Change in the fourth financial weakness variable (OI/TA) from the previous year to the current year.

CAP/TA = Change in the OPEB liability (APBO/TA) from the previous year to the current year.

INT1 = Interaction variable—(TD/TA) * (APBO/TA)—interaction between total debt and the OPEB liability.

INT2 = Interaction variable—[Inverse of (NI/TA) * (APBO/TA)]—interaction between the level of net income and the OPEB liability.

INT3 = Interaction variable—[Inverse of (OCF/TA) * APBO/TA]—interaction between the levels of cash flow and the OPEB liability.

INT4 = Interaction variable—(Inverse of OI/TA) * (APBO/TA)—interaction between the relationship of operating income to assets and the OPEB liability.

INT5 = Interaction variable—(CTD/TA) * (CAP/TA)—interaction between the change in total debt and the change in the OPEB liability.

INT6 = Interaction variable—[Inverse of (CNI/TA) * (CAP/TA)]—interaction between the change in net income and the change in the OPEB liability.

INT7 = Interaction variable—[Inverse of (COCF/TA) * CAP/TA]—interaction between the change in cash flow and the change in the OPEB liability.

INT8 = Interaction variable—(Inverse of COI/TA) * (CAP/TA)—interaction between the change in operating income to assets and the change in the OPEB liability.

Hypotheses Used in the Final Study

For this final study, two additional hypotheses were introduced. The first, which was an extension of the third hypothesis from the pilot study, was used to determine whether the year-to-year changes in the financial weakness variables were related to OPEB plan reductions. The second new hypothesis would test for a possible statistical

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relationship between interaction variables 5 through 8 and OPEB reductions noted among sample firms.

As a consequence of these changes, the hypotheses used in this final study could be stated as:

Hypothesis 1 is as follows:

1. Ho: There is no significant statistical relationship between any of the financial weakness variables and OPEB reductions among sample firms.

   Ha: There is a significant statistical relationship between at least one of the financial weakness variables and OPEB reductions among sample firms.

Hypothesis 2 is as follows:

2. Ho: There is no significant statistical relationship between the level of the OPEB liability and OPEB reductions among sample firms.

   Ha: There is a significant statistical relationship between the level of the OPEB liability and OPEB reductions among sample firms.

Hypothesis 3 is as follows:

3. Ho: There is no significant statistical relationship between the change in the level of the OPEB liability and OPEB reductions among sample firms.

   Ha: There is a significant statistical relationship between the change in the level of the OPEB liability and OPEB reductions among sample firms.

Hypothesis 4 is as follows:

4. Ho: There is no significant statistical relationship between the change in the financial weakness variables and OPEB reductions among sample firms.

   Ha: There is a significant statistical relationship between the change in the financial weakness variables and OPEB reductions among sample firms.

Hypothesis 5 is as follows:

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5. Ho: There is no significant statistical relationship between any of the first four interaction variables and OPEB reductions among sample firms.

   Ha: There is a significant statistical relationship between at least one of the first four interaction variables and OPEB reductions among sample firms.

Hypothesis 6 is as follows:

6. Ho: There is no significant statistical relationship between any of the second four interaction variables and OPEB reductions among sample firms.

   Ha: There is a significant statistical relationship between at least one of the second four interaction variables and OPEB reductions among sample firms.

Means Tests

As was the case in the pilot study, the first step in using discriminant analysis was to determine if the means of the two groups (change versus no-change) were significantly different. If they were not, discriminant analysis could not accurately define whether a given observation would fit into a particular group. Accordingly, MANOVA tests were now employed for the two groups for each year. These means tests again showed that the variables for which there were differences between group means had statistical significance in the final models for each year. For 1995, however, means tests did not find any of these variables to be statistically different between these two groups, which suggests that discriminant analysis would be useless for that year.

Results from the First Stage of Data Analysis

The first analysis performed used prior probabilities that were determined by the sample used in the final study. First, the probability of a firm being represented in group

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0 (no change) was assumed to be .97 for all years except 1994, and the probability of a firm being represented in group 1 (change) was assumed to be .03 for the same period. For 1994, on the other hand, the probabilities were .98 and .02 for group 0 and group 1, respectively. Justification for use of these prior probability figures was based upon the proportion of change firms to total firms in the sample studied. For the second stage of the analysis, the sample size was systematically reduced to 120 firms to bring the prior probabilities into a less extreme range.

Summary of Results Using the Full Sample

1994 Results. For 1994, the null hypothesis was rejected for hypothesis 5, since both INT193 and INT493 were significant at the .05 level. The null hypothesis was also rejected for hypothesis 6, as INT594 was found to be significant at the .05 level. For all other hypotheses, we could not reject the null hypothesis. Since the model was unable to classify many of the firms correctly, these results appear not to be particularly meaningful.

Overall, the results for 1994 indicated that the predictive ability of the model was very poor since only 574 of the 587 observations were classified correctly (see Table 7 and Table 8). Nearly all of the misclassified firms were change firms that were placed into group 0 (no-change). The classificatory accuracy of the model was 97.6 percent, but given the fact that 98 percent of the firms in the sample were no-change firms, one could actually do slightly better by positing that all the firms in the sample were no-change firms. Since three variables were significant at the .05 level, it would be normal to expect the model to

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have reasonably good classificatory power. Since it did not, it is likely that the extreme prior probabilities caused discriminant analysis to "force" observations into the dominant group, which in this case is group 0.

TABLE 7
CONFUSION MATRIX
FIRST STAGE OF ANALYSIS - 1994

		PREDICTED 0	PREDICTED 1	
ACTUAL	0	573	2	575
	1	11	1	12
		584	3	587

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TABLE 8 MISCLASSIFIED FIRMS - FIRST STAGE OF ANALYSIS - 1994				
Row	Act	Pred	P(0)	P(1)
38	1	0	0.997	0.003
133	0	1	0.301	0.699
138	1	0	0.997	0.003
169	1	0	0.997	0.003
180	1	0	0.997	0.003
249	1	0	0.997	0.003
267	1	0	0.993	0.007
297	1	0	0.997	0.003
308	1	0	1.000	0.000
323	1	0	0.997	0.003
338	0	1	0.019	0.981
350	1	0	0.976	0.024
386	1	0	0.997	0.003

The results for 1994 suggested that some of the OPEB reduction decisions might be related both to debt levels and to OPEB liability levels experienced in the prior year of 1993. However, since the model's classificatory power was poor, this could not be confirmed by the results obtained in the first analysis.

1995 Results. As the results from the means tests indicated, the relationships were weaker in 1995. None of the 6 hypotheses were rejected, since none of the variables were significant at the .05 level. The discriminant analysis failed to classify correctly any

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of the change firms, but all the no-change firms were classified correctly. It appears that there is no statistically significant relationship between any of the independent variables and OPEB reduction decisions during 1995. Again, the problems caused by extreme prior probabilities probably make these results rather meaningless.

TABLE 9
CONFUSION MATRIX
FIRST STAGE OF ANALYSIS - 1995

		PREDICTED 0	PREDICTED 1	
ACTUAL	0	568	0	568
	1	19	0	19
		587	0	587

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TABLE 10 MISCLASSIFIED FIRMS - FIRST STAGE OF ANALYSIS - 1995				
Row	Act	Pred	P(0)	P(1)
1	1	0	0.972	0.028
96	1	0	0.967	0.033
112	1	0	0.970	0.030
135	1	0	0.971	0.029
145	1	0	0.975	0.025
158	1	0	0.973	0.027
210	1	0	0.971	0.029
252	1	0	0.968	0.032
259	1	0	0.968	0.032
285	1	0	0.840	0.160
321	1	0	0.938	0.062
428	1	0	0.975	0.025
436	1	0	0.973	0.027
441	1	0	0.965	0.035
463	1	0	0.972	0.028
501	1	0	0.975	0.025
511	1	0	0.975	0.025
545	1	0	0.966	0.034
570	1	0	0.979	0.021

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As shown in Table 9 and Table 10, the data for 1995 show no evidence that any of the OPEB reductions were related to any of the variables in the full model. For 1995, the model again classified firms about as accurately as a random selection.

1996 Results. The TD/TA95 variable was statistically significant at the .05 level and, accordingly, the null hypothesis was rejected for hypothesis 1. Again, however, since the model did not have strong classificatory power, this may have little meaning.

The null hypothesis could not be rejected for hypothesis 2, but it was rejected for hypothesis 3 since the change in OPEB liability did appear to have a statistically significant relationship with OPEB reductions. Once again, this may be considered insignificant given the weakness of the model as a whole.

For hypothesis 4, the null hypothesis was rejected since the CTD/TA96 variable was significant at the .05 level. Due to the model's lack of classificatory power, the significance of the variable loses its meaning.

The null hypothesis for hypothesis 5 was also rejected because both INT395 and INT495 were significant at the .05 level. Again, due to the classificatory weakness of the overall model, the rejection of the hypothesis loses its meaningfulness.

Finally, the null hypothesis was not rejected for hypothesis 6 because none of the second group of interaction variables were significant at the .05 level.

As a group, the ability of the model to predict was very weak since only 567 of the 588 observations were classified correctly (see Table 11 and Table 12). This gives a classificatory accuracy of 96.4 percent, which is less precise than a postulation that all

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firms belonged in group 0. Moreover, most of the misclassified firms were change firms that were erroneously placed into the no-change group. This provides further evidence that discriminant analysis might have been reacting negatively to the extreme prior probabilities, especially since several variables were statistically significant in 1996.

TABLE 11
CONFUSION MATRIX
FIRST STAGE OF ANALYSIS - 1996

		PREDICTED 0	PREDICTED 1	
ACTUAL	0	565	5	570
	1	16	2	18
		581	7	588

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TABLE 12 MISCLASSIFIED FIRMS - FIRST STAGE OF ANALYSIS - 1996				
Row	Act	Pred	P(0)	P(1)
7	1	0	0.921	0.079
15	1	0	0.774	0.226
26	1	0	0.994	0.006
49	0	1	0.030	0.970
133	0	1	0.189	0.811
154	1	0	0.997	0.003
174	1	0	0.954	0.046
187	1	0	0.989	0.011
189	1	0	0.978	0.022
195	0	1	0.273	0.727
204	1	0	0.984	0.016
267	1	0	0.815	0.185
270	1	0	0.707	0.293
297	1	0	0.975	0.025
321	0	1	0.476	0.524
340	1	0	0.985	0.015
347	1	0	0.977	0.023
387	1	0	0.992	0.008
448	1	0	0.984	0.016
487	0	1	0.362	0.638
492	1	0	0.908	0.092

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In 1996, results once again suggested that some of the OPEB reduction decisions were based upon both levels of and changes in several key variables, but since the model lacked classificatory power, these relationships are unlikely to be meaningful.

1997 Results. For 1997, the financial weakness variables were found to be insignificant, so using .05 as the critical confidence level, it was impossible to reject the null hypothesis for the first hypothesis. There did not appear to be a significant relationship between financial weakness variables and OPEB reduction decisions during 1997.

The null hypothesis could not be rejected for hypothesis 2 or hypothesis 3. With hypothesis 4, however, the null hypothesis was rejected since the variable CTD/TA97 was significant at the .05 level. Since the model lacked classificatory power once again, the relevance of this statistical significance is lost. The null hypothesis was not rejected for hypotheses 5 or 6.

Altogether, the classificatory accuracy of the model was quite weak with only 568 of 585 being classified correctly (see Table 13 and Table 14). Again, the model's classificatory power resembled that of a biased guess that all firms were no-change firms. As was the case for the other years, most of the misclassified firms were change firms misidentified as no-change firms, further strengthening the assertion that discriminant analysis was losing much of its power to an extreme set of prior probabilities.

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TABLE 13
CONFUSION MATRIX
FIRST STAGE OF ANALYSIS - 1997

		PREDICTED 0	PREDICTED 1	
ACTUAL	0	565	2	567
	1	17	1	18
		582	3	585

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TABLE 14 MISCLASSIFIED FIRMS - FIRST STAGE OF ANALYSIS - 1997				
Row	Act	Pred	P(0)	P(1)
47	1	0	0.977	0.023
173	1	0	0.978	0.022
179	0	1	0.211	0.789
273	1	0	0.946	0.054
282	0	2	0.255	0.845
290	1	0	0.986	0.014
303	1	0	0.956	0.044
320	1	0	0.982	0.018
324	1	0	0.963	0.037
333	1	0	0.979	0.021
403	1	0	0.978	0.022
410	1	0	0.811	0.189
444	1	0	0.965	0.035
456	1	0	0.985	0.015
478	1	0	0.975	0.025
495	1	0	0.897	0.103
507	1	0	0.983	0.017
527	1	0	0.944	0.056
576	1	0	0.985	0.015

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The results for 1997 found only one variable to be of consequence. Of course, with the poor performance of the model, the variable's significance is not particularly relevant at this point.

The fact that nearly all the firms were being classified as no-change firms in each year raised the question as to whether discriminant analysis was trying to "force" observations into group 0, since almost all the observations in the full sample belong to that group. For each year, the model classified nearly all the firms as no-change firms (group 0), which would tend to support this assertion. If this were to change in the second stage of analysis where the sample size was systematically reduced, it might provide further evidence that the prior probabilities were causing discriminant analysis to inappropriately classify change firms (group1) as no-change firms (group 0). However, if this were to occur with the reduced sample, it could suggest that either the prior probabilities were still too extreme or that the classification errors were due mainly to the variables' poor classificatory power. If the results from the second analysis again showed several variables to be significant while the model still misclassified nearly all the change firms, it would suggest that the model's classificatory limitations were most likely due to the still rather extreme prior probabilities. Obviously, no direct comparison can be made between an analysis of the full sample with one of a reduced sample.

Results from the Second Stage of Data Analysis

The sample was reduced for the second analysis to determine whether the extreme prior probabilities were causing the discriminant analysis to classify change firms

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incorrectly as no-change firms. Since the prior probabilities with the full sample were even more extreme than those in the pilot study, the systematic reduction of the sample of no-change firms proposed in Chapter 3 was necessary. The total sample was reduced from 588 firms to 120, which changed the prior probabilities to .85 and .15 for 1997 and 1996, .84 and .16 for 1995, and .90 and .10 for 1994. These figures are similar to those proposed in Chapter 3. The reduced sample was originally expected to contain between 450 and 500 firms, but since the total number of firms offering OPEBs during the period of study was less than the proposed sample of 1,632 firms, the reduced sample had to be reduced to 120 to obtain the prior probabilities proposed in Chapter 3. The justification for this reduction is that when prior probabilities are really extreme, discriminant analysis tends to lose some of its ability to separate individual observations into groups. With the prior probabilities in the full sample, one would be 97 percent to 98 percent accurate by guessing that all firms in the sample were no-change firms. As can be seen by the results of the analysis of the full sample, the model did not classify observations any more accurately than such a postulation.

From the analysis of the full sample, the model's classificatory power was very weak in each year, despite some of the variables being statistically significant. The results of the second analysis showed that the classificatory power of the model again was very weak. In addition, several variables were statistically significant at the .05 level. Discriminant analysis still classified very few of the firms as members of group 1, which was consistent with the findings in the first stage of the analysis. It appears that the results in the second stage of the analysis were confounded by the effects of extreme prior

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probabilities or a poor model. Although the prior probabilities were less extreme than those in the first analysis, they still appear to be causing the same statistical problem. Despite the statistical significance of several variables, the model's classificatory power again resembled that of a guess that all firms were no-change firms.

1994 Results. The results for 1994 indicate that most of the firms were classified as group 0 firms (no-change). In addition, 11 firms were misclassified, so the model's classificatory power of 90.8 percent is just slightly better than the 90.0 percent accuracy of a guess (based on prior probabilities) that all firms would belong to group 0.

TABLE 15
CONFUSION MATRIX SECOND STAGE OF ANALYSIS - 1994

		PREDICTED 0	PREDICTED 1	
ACTUAL	0	106	2	108
	1	9	3	12
		115	5	120

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TABLE 16 MISCLASSIFIED FIRMS - SECOND STAGE OF ANALYSIS - 1994				
Row	Act	Pred	P(0)	P(1)
8	1	0	0.942	0.058
12	0	1	0.410	0.590
21	1	0	0.977	0.023
28	0	1	0.440	0.560
29	1	0	0.955	0.045
34	1	0	0.981	0.019
45	1	0	0.970	0.030
50	1	0	0.782	0.218
61	1	0	0.971	0.029
70	1	0	0.967	0.033
79	1	0	0.957	0.043

1995 Results. The results for 1995 show that nearly all firms were classified as group 0 (no-change) firms and that almost all the misclassified firms were group 1 firms erroneously placed into group 0. The classificatory accuracy of 85 percent for 1995 was approximately equal to that of a guess based on prior probabilities, just as it was for 1994.

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TABLE 17
CONFUSION MATRIX
SECOND STAGE OF ANALYSIS - 1995

		PREDICTED 0	PREDICTED 1	
ACTUAL	0	102	1	103
	1	17	0	17
		119	1	120

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TABLE 18 MISCLASSIFIED FIRMS - SECOND STAGE OF ANALYSIS - 1995				
Row	Act	Pred	P(0)	P(1)
1	1	0	0.869	0.131
14	1	0	0.884	0.116
17	1	0	0.856	0.144
19	1	0	0.878	0.122
23	1	0	0.855	0.145
27	1	0	0.879	0.121
43	1	0	0.865	0.135
46	1	0	0.887	0.113
48	1	0	0.890	0.110
50	0	1	0.482	0.518
56	1	0	0.706	0.294
86	1	0	0.872	0.128
88	1	0	0.844	0.156
90	1	0	0.934	0.066
98	1	0	0.896	0.104
106	1	0	0.851	0.149
111	1	0	0.854	0.146
115	1	0	0.837	0.163

1996 Results. The model did not perform much better in 1996, as shown in Table 19 and Table 20. The model misclassified 16 firms, most of which were group 1 firms misidentified as belonging to group 0. This represents a classificatory accuracy of

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86.7 percent, which is slightly better than the 85.0 percent an educated speculation (based on prior probabilities) would yield.

TABLE 19
CONFUSION MATRIX
SECOND STAGE OF ANALYSIS - 1996

		PREDICTED 0	PREDICTED 1	
ACTUAL	0	101	2	103
	1	14	3	17
		115	5	120

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TABLE 20 MISCLASSIFIED FIRMS - SECOND STAGE OF ANALYSIS - 1996				
Row	Act	Pred	P(0)	P(1)
3	1	0	0.676	0.324
4	1	0	0.597	0.403
6	1	0	0.947	0.053
25	1	0	0.972	0.028
32	1	0	0.734	0.266
36	1	0	0.915	0.085
38	1	0	0.863	0.137
41	1	0	0.888	0.112
52	1	0	0.606	0.394
61	1	0	0.847	0.153
63	0	1	0.415	0.585
69	0	1	0.265	0.735
74	1	0	0.900	0.100
76	1	0	0.859	0.141
80	1	0	0.929	0.071
94	1	0	0.918	0.082

1997 Results. In 1997, the model misclassified 14 firms, with most being group 1 firms placed into group 0 by mistake. This was a slight improvement over the results in the first analysis. The classificatory accuracy of 88.2 percent is a little better than the 84.9

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percent accuracy that would be achieved by simply assuming that all the firms were no-change firms, based on prior probabilities.

TABLE 21
CONFUSION MATRIX
SECOND STAGE OF ANALYSIS - 1997

		PREDICTED 0	PREDICTED 1	
ACTUAL	0	103	2	105
	1	12	2	14
		115	4	119

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TABLE 22 MISCLASSIFIED FIRMS - SECOND STAGE OF ANALYSIS - 1997				
Row	Act	Pred	P(0)	P(1)
10	1	0	0.955	0.045
28	0	1	0.021	0.979
31	1	0	0.921	0.079
52	0	1	0.480	0.520
54	1	0	0.806	0.194
58	1	0	0.945	0.055
64	1	0	0.950	0.050
72	1	0	0.936	0.064
82	1	0	0.947	0.053
92	1	0	0.948	0.052
101	1	0	0.809	0.191
108	1	0	0.829	0.171
113	1	0	0.950	0.050
119	1	0	0.934	0.066

These findings, just as those obtained using the full sample imply that there is no statistically significant relationship between financial weakness and OPEB reductions, nor is there one between the level of the OPEB liability and plan reductions. However, since individual variables in the model were found to have a statistically significant relationship with OPEB plan reductions, these results are questionable. Probably the most significant discovery in the second analysis was the slight improvement in the overall classificatory

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accuracy of the model when compared to that of a knowledgeable postulation that all firms belong to group 0. This is consistent with the slight decrease in the prior probabilities over those present in the first analysis. Still, given the significance of several variables, logic would dictate that there should be a larger gap between model's accuracy and that of a biased selection than existed in either the first or second analysis. If the prior probabilities have been causing this inconsistency, a greater reduction in prior probabilities should widen the gap between the accuracy of a guess and that of the model. At this point, further analysis was deemed necessary. Accordingly, a third analysis was performed.

Results from the Third Stage of Data Analysis

In this third analysis, the entire group of change firms was taken and each change firm was matched to one of the no-change firms of similar size, using total assets as the proxy for size. By performing this analysis in such a manner, the prior probabilities were reduced to exactly .50 and .50, meaning that any firm taken at random from the sample had an equal chance of being from group 0 or group 1. So, by having prior probabilities resembling those of a coin toss, the results should not be confounded by an unbalanced data set. If the model still lacks classificatory power, it would help confirm what was found in the first two analyses. Conversely, if the model has considerably better classificatory ability than it did in the previous analyses, it would probably indicate that in both the full and systematically reduced samples, the prior probabilities were too extreme and had caused discriminant analysis to force observations into the dominant group.

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MANOVA tests were run for the two groups for each year. These means tests again showed that the variables for which there were differences between group means had statistical significance in the final models for each year.

Group means are shown for all variables in the model, including the lagged variables. The means tests for 1994 were as follows:

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TABLE 23
GROUP MEANS - MATCHED SAMPLE - 1994

VARIABLE	GROUP 0 (No-Change)	GROUP 1 (Change)
TD/TA94	0.2718475	0.3242922
NI/TA94	0.0469300	-0.0063800
OI/TA94	0.0823800	0.0410700
OCF/TA94	0.0964900	0.0634700
AP/TA94	0.0416200	0.0766300
CTD/TA94	-0.0216000	-0.0148000
CNI/TA94	0.0303400	0.0824600
COI/TA94	0.0232300	0.0265798
CCF/TA94	-0.0144000	-0.0111000
CAP/TA94	0.0018500	-0.1781697
INT194	0.0091490	0.0243500
INT294	1.0788860	2.1703890
INT394	0.5081432	1.9554040
INT494	0.7681257	1.2296800
INT594	0.0000761	0.0131000
INT694	0.1878021	-1.6241830
INT794	-0.0777000	-5.5966960
INT894	0.0052980	-1.8711020
LAGGED VARIABLES	**GROUP 0 (No-Change)**	**GROUP 1 (Change)**
TD/TA93	0.2934923	0.3391601
NI/TA93	0.0165900	-0.0888000
OI/TA93	0.0591400	0.0144900
OCF/TA93	0.1109234	0.0746400
APBO/TA93	0.0397700	0.2548060
INT193	0.0098330	0.1284548
INT293	0.4185559	-1.5203980
INT393*	1.0282240	-0.4533161
INT493	0.5885269	2.9597150

* Indicates a variable that was statistically significant in the model

Source: MANOVA Procedure

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For 1995, the group means were as follows:

TABLE 24 GROUP MEANS - MATCHED SAMPLE - 1995		
VARIABLE	**GROUP 0 (No-Change)**	**GROUP 1 (Change)**
TD/TA95*	0.2094904	0.3299622
NI/TA95*	0.0720500	-0.0087800
OI/TA95	0.1013514	0.0325100
OCF/TA95	0.0979800	0.0764900
APBO/TA95	0.0435300	0.0584728
CTD/TA95	-0.0126000	-0.0067600
CNI/TA95	-0.0006830	-0.0313000
COI/TA95	-0.0069700	-0.0270000
CCF/TA95	-0.0051100	0.0048900
CAP/TA95	-0.0012000	0.0141400
INT195	0.0079740	0.0104582
INT295	0.6320230	0.9704812
INT395	0.3659950	1.2066320
INT495	0.4004364	-0.0773000
INT595	-0.0000375	-0.0010700
INT695	0.2589340	-1.9209480
INT795	-0.6968790	-1.4458150
INT895	-0.6387340	0.0677000
LAGGED VARIABLES	**GROUP 0 (No-Change)**	**GROUP 1 (Change)**
TD/TA94	0.2718475	0.3242922
NI/TA94	0.0469300	-0.0063800
OI/TA94	0.0823800	0.0410700
OCF/TA94	0.0964900	0.0634700
APBO/TA94	0.0416200	0.0766300
INT194	0.0091490	0.0243500
INT294	1.0788860	2.1703890
INT394	0.5081432	1.9554040
INT494	0.7681257	1.2296800
* Indicates a variable that was statistically significant in the model		
Source: MANOVA Procedure		

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For 1996, the group means were as follows:

TABLE 25 GROUP MEANS - MATCHED SAMPLE - 1996		
VARIABLE	**GROUP 0 (No-Change)**	**GROUP 1 (Change)**
TD/TA96	0.2761801	0.4939735
NI/TA96	0.0599100	0.0097600
OI/TA96	0.0967700	0.0412800
OCF/TA96	0.1000350	0.0683700
APBO/TA96	0.0243900	0.0406700
CTD/TA96	-0.0262000	0.0297700
CNI/TA96	-0.0042100	-0.0071800
COI/TA96	-0.0096600	0.0097530
CCF/TA96	0.0078610	0.0448900
CAP/TA96	-0.0023300	-0.0057200
INT196*	0.0050280	0.0135400
INT296	0.4443824	0.1255991
INT396	0.1924495	-0.2780344
INT496	0.5213550	0.7796025
INT596	0.0007463	0.0009684
INT696	-0.0404000	0.0525300
INT796	-0.1128174	0.0678300
INT896	0.1494852	0.0035100
LAGGED VARIABLES	**GROUP 0 (No-Change)**	**GROUP 1 (Change)**
TD/TA95	0.2094904	0.3299622
NI/TA95	0.0720500	-0.0087800
OI/TA95*	0.1013514	0.0325100
OCF/TA95	0.0979800	0.0764900
APBO/TA95	0.0435300	0.0584728
INT195	0.0079740	0.0104582
INT295	0.6320230	0.9704812
INT395	0.3659950	1.2066320
INT495	0.4004364	-0.0773000
* Indicates a variable that was statistically significant in the model		
Source: MANOVA Procedure		

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For 1997, the group means were as follows:

TABLE 26
GROUP MEANS - MATCHED SAMPLE - 1997

VARIABLE	GROUP 0 (No-Change)	GROUP 1 (Change)
TD/TA97	0.2761801	0.2616107
NI/TA97	0.0599100	0.0586300
OI/TA97	0.0967700	0.0704900
OCF/TA97	0.1000350	0.0726400
APBO/TA97	0.0243900	0.0551900
CTD/TA97*	0.0062310	-0.0783000
CNI/TA97	-0.0212000	0.0332200
COI/TA97	-0.0190000	0.0102800
CCF/TA97	-0.0242233	-0.0137000
CAP/TA97	-0.0022500	-0.0197000
INT197	0.0096440	0.0123500
INT297	-1.0681010	2.1231280
INT397	0.3582375	0.3028621
INT497	-0.3392735	0.7806534
INT597*	-0.0000839	0.0045700
INT697	-1.0960050	0.3747548
INT797	0.0546900	0.5048344
INT897	-0.0302000	0.1767520
LAGGED VARIABLES	**GROUP 0 (No-Change)**	**GROUP 1 (Change)**
TD/TA96	0.2742061	0.4939735
NI/TA96	0.0529400	0.0097600
OI/TA96	0.0885100	0.0412800
OCF/TA96	0.1079660	0.0683700
APBO/TA96*	0.0832400	0.0406700
INT196	0.0050280	0.0135400
INT296	0.4443824	0.1255991
INT396	0.1924495	-0.2780344
INT496	0.5213550	0.7796025

* Indicates a variable that was statistically significant in the model

Source: MANOVA Procedure

1994 Results. For 1994, the results were stronger than they were in the first two analyses. Five firms were misclassified (as shown in Table 29), so the model has a

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classificatory accuracy of 79.17 percent. This is considerably better than the accuracy of a guess, which in this case, would be exactly 50 percent. These results provide evidence that some of the model's previous inability to classify firms in the first two analyses was due to extreme prior probabilities. In the third analysis, as in the first two, several variables were significant. This is consistent with the model possessing a significantly better classificatory accuracy than a mere guess.

The financial weakness variables were found not to be statistically significant at the .05 level, so we fail to reject the null hypothesis for hypothesis 1. There appears not to be a statistical relationship between the financial weakness variables and OPEB reduction decisions in 1994.

For hypothesis 2, we also fail to reject the null hypothesis, since the OPEB liability does not appear to have a statistically significant relationship with OPEB reduction decisions.

The null hypothesis for hypothesis 3 is not rejected, since the change in the OPEB liability appears not to have a statistically significant relationship with OPEB reduction decisions.

The null hypothesis for hypothesis 4 is not rejected since the change in the financial weakness variables does not appear to have a statistically significant relationship with OPEB reduction decisions.

However, the null hypothesis for hypothesis 5 is rejected, since the variable INT3 is significant at the .05 level. The significance of INT3 provides evidence that the

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interaction between the level of cash flows in 1994 and the level of the OPEB liability (in the same year) may have influenced decisions to reduce OPEB plans in 1994.

The null hypothesis is not rejected in the case of hypothesis 6, since none of the second group of interaction variables is significant at the .05 level.

TABLE 27
HYPOTHESIS TESTS
THIRD STAGE OF ANALYSIS
1994

	Ho Rejected? Yes	No
H1		X
H2		X
H3		X
H4		X
H5	X	
H6		X

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TABLE 28
CONFUSION MATRIX
THIRD STAGE OF ANALYSIS - 1994

		PREDICTED 0	PREDICTED 1	
ACTUAL	0	11	1	12
	1	4	8	12
		15	9	24

TABLE 29
MISCLASSIFIED FIRMS - THIRD STAGE OF ANALYSIS - 1994

Row	Act	Pred	P(0)	P(1)
2	1	0	0.687	0.313
3	1	0	0.776	0.224
8	1	0	0.850	0.150
14	1	0	0.711	0.289
17	0	1	0.427	0.573

1995 Results. For 1995, the null hypothesis for hypothesis 1 is rejected, as there appears to be a statistical relationship between at least one of the financial weakness variables and OPEB reduction decisions. Specifically, NI/TA95 and TD/TA95 were statistically significant at the .05 level. The significance of NI/TA95 indicates that the level of net income in 1995 had some influence on OPEB reduction decisions made during that

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year. Since TD/TA95 was also significant, the debt level in 1995 appears to have had some influence on OPEB reduction decisions during the year.

For hypothesis 2, the null hypothesis is not rejected, since the OPEB liability appears not to have a statistically significant relationship with OPEB reduction decisions.

The null hypothesis is not rejected for hypothesis 3, since the change in the OPEB liability appears not to have a statistically significant relationship with OPEB reduction decisions.

The null hypothesis for hypothesis 4 is not rejected since the change in the financial weakness variables does not appear to have a statistically significant relationship with OPEB reduction decisions.

The null hypothesis for hypothesis 5 is also not rejected, since none of the first group of interaction variables are significant at the .05 level.

The null hypothesis is not rejected in the case of hypothesis 6, since none of the second group of interaction variables are significant at the .05 level

For 1995, the model's classificatory accuracy was 75.0 percent, which is fairly good. There were eleven misclassified firms (see Table 32), but in contrast to the results obtained in the first two analyses, not all the misclassified firms were change firms misidentified as no-change firms.

Overall, the classificatory power of the model was slightly weaker for 1995. Although there were no variables found to be significant for 1995 in the first two analyses, two variables were significant in the third analysis.

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TABLE 30
HYPOTHESIS TESTS
THIRD STAGE OF ANALYSIS 1995

	Ho Rejected?	
	Yes	No
H1	X	
H2		X
H3		X
H4		X
H5		X
H6		X

TABLE 31
CONFUSION MATRIX
THIRD STAGE OF ANALYSIS - 1995

		PREDICTED 0	PREDICTED 1	
ACTUAL	0	15	4	19
	1	7	12	19
		22	16	38

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TABLE 32 MISCLASSIFIED FIRMS - THIRD STAGE OF ANALYSIS - 1995				
Row	Act	Pred	P(0)	P(1)
1	1	0	0.534	0.466
9	1	0	0.545	0.455
12	1	0	0.692	0.308
18	0	1	0.374	0.626
24	0	1	0.471	0.529
27	1	0	0.742	0.258
29	1	0	0.655	0.345
32	1	0	0.700	0.300
33	1	0	0.613	0.387
35	0	1	0.407	0.593
38	0	1	0.464	0.536

1996 Results. For 1996, the null hypothesis for hypothesis 1 is rejected, as there appears to be a statistical relationship between at least one of the financial weakness variables and OPEB reduction decisions. Specifically, OI/TA95 was statistically significant at the .05 level, which suggests that the level of operating income in 1995 had some influence on OPEB reduction decisions made in 1996.

For hypothesis 2, the null hypothesis is not rejected, since the OPEB liability appears not to have a statistically significant relationship with OPEB reduction decisions.

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The null hypothesis is not rejected for hypothesis 3, since the change in the OPEB liability appears not to have a statistically significant relationship with OPEB reduction decisions.

The null hypothesis for hypothesis 4 is not rejected since the change in the financial weakness variables does not appear to have a statistically significant relationship with OPEB reduction decisions.

The null hypothesis for hypothesis 5 was rejected since at least one of the first four interaction variables is significant at the .05 level. The significance of INT196 indicates that the interaction between the level of total debt to assets and the level of the OPEB liability had an influence on the decisions to reduce OPEB plans during the year.

The null hypothesis is not rejected in the case of hypothesis 6, since none of the second group of interaction variables is significant at the .05 level

Overall, the results for 1996 were slightly stronger. The model's classificatory accuracy was 77.78 percent. There were eight misclassified firms (see Table 35).

TABLE 33
HYPOTHESIS TESTS
THIRD STAGE OF
ANALYSIS 1996

	Ho Rejected?	
	Yes	No
H1	X	
H2		X
H3		X
H4		X
H5	X	
H6		X

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TABLE 34
CONFUSION MATRIX
THIRD STAGE OF ANALYSIS - 1996

		PREDICTED 0	PREDICTED 1	
ACTUAL	0	15	3	18
	1	5	13	18
		20	16	36

TABLE 35
MISCLASSIFIED FIRMS - THIRD STAGE OF ANALYSIS - 1996

Row	Act	Pred	P(0)	P(1)
3	1	0	0.829	0.171
4	0	1	0.305	0.695
9	1	0	0.697	0.303
12	1	0	0.581	0.419
24	1	0	0.581	0.419
16	0	1	0.495	0.505
30	0	1	0.215	0.785
31	1	0	0.901	0.099

1997 Results. For 1997, the null hypothesis for hypothesis 1 is not rejected since none of the financial weakness variables were statistically significant at the .05 level. There

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appears not to be a statistical relationship between the financial weakness variables and OPEB reduction decisions.

For hypothesis 2, the null hypothesis is not rejected, since the OPEB liability appears to have a statistically significant relationship with OPEB reduction decisions.

The significance of the APBO/TA96 variable indicates that the level of the OPEB liability as a percentage of total assets during 1996 appears to have had an influence on OPEB plan reduction decisions in 1997.

The null hypothesis is not rejected for hypothesis 3, since the change in the OPEB liability appears not to have a statistically significant relationship with OPEB reduction decisions.

The null hypothesis for hypothesis 4 is rejected since the change in at least one of the financial weakness variables appears to have a statistically significant relationship with OPEB reduction decisions. Since the CTD/TA97 variable was significant, there is evidence that the change in the total debt level between 1996 and 1997 may have influenced OPEB reduction decisions made in 1997.

The null hypothesis for hypothesis 5 is also not rejected, since none of the first group of interaction variables is significant at the .05 level.

The null hypothesis is rejected for hypothesis 6, since at least one of the second group of interaction variables is significant at the .05 level. The statistical significance of INT597 suggests that the interaction between the change in total debt between 1996 and

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1997 and the change in the OPEB liability during the same period influenced OPEB plan reductions during 1997.

Overall, the results for 1997 were similar to those in 1996 except for the fact that different variables were significant. The model's classificatory accuracy again was 77.78 percent, which is fairly good. There were eight misclassified firms (see Table 38). Interestingly, the model classified more firms as change firms than no-change firms. This is in stark contrast with the results in the first two analyses. This provides further evidence that the extreme prior probabilities that existed with the first two stages of the analysis caused discriminant analysis to classify too many firms as no-change firms, based upon the unbalanced nature of the sample in both cases.

TABLE 36
HYPOTHESIS TESTS
THIRD STAGE OF ANALYSIS
1997

	Ho Rejected?	
	Yes	No
H1		X
H2	X	
H3		X
H4	X	
H5		X
H6	X	

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TABLE 37
CONFUSION MATRIX
THIRD STAGE OF ANALYSIS - 1997

		PREDICTED 0	PREDICTED 1	
ACTUAL	0	14	4	18
	1	4	14	18
		18	18	36

TABLE 38
MISCLASSIFIED FIRMS - THIRD STAGE OF ANALYSIS - 1997

Row	Act	Pred	P(0)	P(1)
2	1	0	0.906	0.094
3	0	1	0.313	0.687
11	1	0	0.539	0.461
16	0	1	0.481	0.519
20	0	1	0.420	0.580
23	1	0	0.577	0.423
24	1	0	0.724	0.276
25	0	1	0.430	0.570

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Summary of Results from the Third Stage of Data Analysis

The overall findings in the third analysis were inconsistent with the first two steps in the data analysis. The discriminant analysis classified many more firms into the change group than it did in the first two analyses. This appears to indicate that the extreme prior probabilities in the first two stages of analysis rendered the model useless. In the third analysis, the model was found to have considerably better classificatory power. The results of this third analysis are much more reliable than those in the first two, so the conclusions in this study will be made based upon the findings in the third stage of analysis.

Based upon the results obtained in the third analysis, there appears to be a significant relationship between some of the financial weakness variables and OPEB plan reductions. Therefore, it appears that some of the OPEB plan reduction decisions during the 1994-97 period were influenced to some extent either by the level of some of these key variables or the changes in the levels of the variables from one year to the next. Also, it appears that there is a relationship between the level of the OPEB liability and plan reductions. This also provides evidence that there is at least a slight long-term effect associated with SFAS No. 106. One of the major concerns surrounding the passage of this statement was that disclosure of this liability might increase the likelihood that companies would reduce or terminate OPEB plans. Although evidence suggests strongly that this occurred with the adoption of SFAS No. 106, the statistical analysis in this study indicates that it has not been a particularly significant factor to date in the post-adoption period.

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However, the OPEB liability was most significant in 1997, the most recent year available. Future research should be able to determine whether this is the beginning of a pattern.

Another finding that was consistent in the three steps of data analysis was the lack of a clearly defined trend over the period examined. However, some year-to-year differences were found. The most interesting of these differences was the increased importance of the OPEB liability variables in 1997. Since no data after 1997 were available, it is uncertain whether this represents the beginning of a pattern. The justification for analyzing firms in separate years was that such separation was necessary to determine whether significant year-to-year differences existed or if a trend was evident. The existence of a trend or significant year-to-year differences would have a negative effect on the classificatory power of the model if all the changes were examined without regard to year. One last analysis was performed to test for this.

Results from the Fourth Stage of Data Analysis

In the fourth and final analysis, all the change firms were combined without regard to year and matched to the no-change firms identified in the third analysis. This yielded a sample of 131, of which 64 were change firms and 67 were no-change firms. For one firm, data were not available for one year. The analysis showed that two firms changed benefits in both 1994 and 1996. These facts explain the existence of only 64 change firms compared with 67 no-change firms. This brought the prior probabilities to .51 and .49 for groups 0 and 1, respectively. The results appear in Table 39.

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TABLE 39
CONFUSION MATRIX WITHOUT REGARD TO YEAR OF CHANGE

		PREDICTED 0	PREDICTED 1	
ACTUAL	0	52	15	67
	1	25	39	64
		77	54	131

The results showed that the model had somewhat weaker classificatory power than that found in the third analysis. Although 54 firms were identified as change firms, a total of 40 firms (consisting of both change and no-change firms) were misclassified. This indicates that the model's classificatory power is slightly less accurate when the year of change is not considered. Since 91 of the 131 firms were classified correctly, the model's classificatory power was 69.5 percent, compared with 75.0 to 79.2 percent in the third analysis. Since the differences in classificatory accuracy were quite small, the results indicate that taking the different years into account failed to improve the model's classificatory power significantly. The specific differences between years were not readily discernable, so it can be concluded that stratification by year, at least for the period covered in this study, was not necessary.

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Summary of Results

Here, aggregate findings suggested that there is a connection between OPEB liability levels and at least some of the OPEB reductions during the 1994-97 period. Statistical analysis appears to show a relationship between several of the financial weakness variables and some of the OPEB reductions experienced during this time.

These results, however, provide only limited evidence for a relationship between financial weakness and OPEB reductions. Such observations also provide only limited evidence for any connection between the levels of OPEB liability and subsequent OPEB reductions. Clearly the evidence is too weak to allow highly accurate classification of firms as either change or no-change firms using the variables examined in this study. However, since the model's classificatory accuracy was better than chance, there appears to be some evidence linking financial weakness and the OPEB liability to some of the decisions to reduce postretirement benefits in the post-SFAS No. 106 adoption period. The results of this investigation also are somewhat inconsistent with those of prior studies of OPEB reductions and of those concerning pension plan reductions. These other inquiries, as found in Table 40, suggest that there was a significant connection between financial weakness and OPEB reductions as well as with pension plan reductions. For example, Mittelstaedt et al. (1995) determined that there was a statistically significant relationship between financial weakness and OPEB reduction decisions. In addition, Mittelstaedt (1989), Thomas (1989), and Stone (1987), all found financial weakness to be a key variable in explaining pension plan reductions. However, in this study these relationships

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were considerably weaker. The current research appears to be the first to examine OPEB reductions since the adoption of SFAS No. 106 and, therefore, no direct comparison between this investigation and others can be made.

TABLE 40
STUDIES FINDING FINANCIAL WEAKNESS AS AN INDICATOR OF PENSION PLAN OR OPEB PLAN REDUCTIONS

STUDY	AUTHOR	YEAR	FINDINGS
"A Financing Explanation for Overfunded Pension Plan Terminations."	Stone, Mary	1987	Stone found evidence that financial slack in the form of pension fund assets was more likely to be used when a firm is financially weaker.
"An Empirical Analysis of the Factors Underlying the Decision to Remove Excess Assets from Overfunded Pension Plans."	Mittelstaedt, H. Fred	1989	Mittelstaedt determined that terminators tended to be significantly weaker financially than maintainers and that terminators were financially weaker three years prior to termination. Also, contractors (firms that reduced benefits rather than terminating them) were weaker than maintainers, but stronger than terminators.
"Why Do Firms Terminate Their Overfunded Pension Plans?"	Thomas, Jacob K.	1989	Thomas found that continued declines in available funds that exhaust the stock of preferred sources of slack were associated with pension plan terminations.
"SFAS No. 106 and benefit reductions in employer-sponsored retiree health care plans."	Mittelstaedt, H Fred, William D. Nichols, and Philip R. Regier.	1995	In examining OPEB reduction and termination decisions, the authors found support for the financial weakness hypothesis. The support, however, was not as strong as it was with the pension terminators or pension contractors reported by Mittelstaedt (1989) and Thomas (1989).

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In any case, results of this study show what would be logically expected. After all, there has been a tremendous reduction in the number of firms continuing to offer post retirement benefits since the adoption of SFAS No. 106. In fact, Mittelstaedt et al. (1995) found that many of them dropped OPEB coverage once this standard was adopted. It certainly would appear, therefore, that this circumstance "weeded out" many of the weaker firms, an assertion quite consistent with this study's findings. In fact, if the majority of the weak firms had already stopped their OPEB coverage, it follows that by the end of 1993, relatively few of those weak firms were now still offering postretirement benefits.

This finding alone could help in explaining the small number of firms still offering such coverage. Furthermore, the tiny number of such weak firms might have had an effect on the explanatory power of the financial weakness variables used in this investigation. Also, the unusually strong economy during the period examined by this study could have contributed to the relative insignificance of the financial weakness variables. It does seem likely that, out of the sample of firms investigated, there were fewer financially weak companies than might have been present under weaker economic conditions. Inasmuch as the adoption of SFAS No. 106 demanded a major change in the accounting of postretirement benefits, it certainly is possible that the fundamental connection between these benefits and predictors of plan reductions could have changed. Many of the weak firms in the Mittelstaedt et al. (1995) study were not included in this study, since they had terminated OPEB benefits prior to 1994. This might help explain why financial weakness had a poorer predictive ability in this study than that found by Mittelstaedt et al. (1995). It is also possible that during the period Mittelstaedt et al. examined there was an

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interaction between financial weakness and the adoption of SFAS No. 106, which represents a relationship that does not exist in the post-adoption period. However, because systematic analysis revealed no other SFAS No. 106 studies in the post-adoption period that examined OPEB reductions, one cannot affirm these conclusions with other independent studies.

The relative weakness of the explanatory power of OPEB liability is not especially surprising since, as previously mentioned, the adoption of SFAS No. 106 greatly reduced the number of firms offering OPEBs. One of the concerns surrounding SFAS No. 106 was the possibility of a long-term effect. One of the questions concerned whether having to record OPEB liability might have led to increased OPEB reductions. It is quite possible, of course, that the results of this study indicate, simply, that the level of this liability has a small negative long-term effect on OPEB coverage. In other words, the level of the liability may be associated with a slightly increased likelihood of OPEB plan reductions. However, the period 1994-1997 represented the very first period occurring after the adoption of SFAS No. 106. In view of this, it would be premature to conclude that there is a long-term effect from use of this new accounting standard. Accordingly, further study will be necessary before such an assertion can be validated.

Limitations of the Final Study

One of the constraints of the pilot study was its small sample size. By using the entire group of firms offering postretirement benefits during the 1994-1997 period in the final study, that problem was addressed. However, due to the extremely small proportion

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of change firms to no-change firms in the sample, the prior probabilities were so extreme that the results from the first two stages of the analysis were invalidated. As a result, the sample had to be reduced to the point where there was a one-to-one ratio of change to no-change firms. Therefore, the conclusions in this study were based on the results obtained with a smaller sample than anticipated. Another limitation was the time period being used. Other methodologies, such as that used by Mittelstaedt et al. (1995) could not be used here, since they lagged some of the financial weakness variables three years. Nevertheless, as an experiment, the variables were lagged for three years for 1996 and 1997 in this study but they were found not to be statistically significant. Of course, fundamental relationships could have changed since the adoption of SFAS No. 106.

It seems apparent, however, that the small number of firms offering OPEB benefits in comparison with the total number is significant by itself. This supports the assumption that adoption of SFAS No. 106 did have an effect on subsequent decisions to reduce or eliminate postretirement benefits.

Conclusions Based Upon Results of Final Study

There does appear to be a relationship between financial weakness and levels of OPEB liability and the subsequent reduction of postretirement benefits. At this juncture, connections found in this inquiry were too weak to be of great classificatory value, but the results obtained do suggest the need for further research. It is, of course, quite possible that the relationship between financial weakness and OPEB reductions changed from what they were prior to as well as during the adoption of SFAS No. 106. Nevertheless, the

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findings presented here are clearly at variance with those developed by prior investigations. In this regard, it is significantly relevant to point out that prior research occurred during either the pre-adoption or the adoption period of SFAS No. 106. Since the adoption of that standard produced such a radical change in the accounting of postretirement benefits, it would not be unreasonable to suggest that the fundamental relationship between OPEB reductions and key variables might have changed. In any case, it is clear that further study is needed.

Recommendations for Future Research

This study has revealed several issues which appear appropriate for further inquiry. Several have already become apparent. Ultimately, the somewhat inconclusive results offered here imply that other methodologies ought to be explored. Some further possibilities have become evident as a result. For example, does a relationship really exist between the adoption date, the adoption method, and the benefit cuts which subsequently occurred? Smith, in 1994, did find that the early adoption of SFAS No. 106 was associated with financial weakness. It is possible, therefore, that later adoption, i.e., adoption in the fiscal year following December 15, 1992, could be used as a proxy for pre-SFAS No. 106 financial weakness.

The results of the current study certainly have provided evidence that post-SFAS No. 106 adoption financial weakness and the OPEB liability level may not be as strong predictors of OPEB reductions as they were prior to the adoption of the accounting standard.

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It is possible that the widely varying health care cost rate increases have led to diminished OPEB liability predictive power. Although SFAS No. 106 does require firms to predict rates at which they feel health care costs will increase, they give no specific parameters within which such estimates must fall. Understandably, then, there is a wide variation in the assumptions about cost increases by these firms. Furthermore, since OPEB liability recorded on the company's balance sheets is predicated upon health care cost assumptions, such potential liabilities could be significantly under- or over-stated. Thus, if all the OPEB liability figures now are recalculated for each firm using one standard rate, e.g., 6 percent, the OPEB liability figures might be considerably better predictors of benefit plan reductions. Finally, if, after recalculating such figures, the variable still fails to predict benefit cuts accurately, the suggestion that there is no long-term effect of SFAS No. 106 would be reinforced considerably. Since SFAS No. 106 requires firms to disclose how much a one percentage point would increase or decrease the health care cost of OPEB liability, such recalculations can be made.

Another option might be to conduct surveys to determine why firms that reduced OPEB plans did so in the first place. With so few firms actually making reduction decisions, however, the response rate would have to be unusually high in order to obtain truly meaningful results.

Final Comments

One of the major contributions provided by this study is the development of the groundwork for the future study of postretirement benefits in the post-SFAS No. 106

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adoption era. Furthermore, this inquiry seems to represent the first attempt to have been made to both identify and examine the relationship between the OPEB liability and postretirement benefit cuts. Additionally, it would appear to be the first one to investigate the relationship between financial weakness and postretirement benefit cuts experienced in this same post-SFAS No. 106 adoption period.

Sample of Firms

AAR CORP*
ABBOTT LABORATORIES
ACME METALS INC
AFLAC INC
AGWAY INC
AH MANSON H F & CO
AIR & WATER TECHNOLOGIES CORP*
AIR PRODUCTS & CHEMICALS INC
AIRBORNE FREIGHT CORP
AIRTOUCH COMMUNICATIONS INC
ALASKA AIR GROUP INC
ALBANY INTERNATIONAL CORP
ALBERTSONS INC
ALEXANDER & BALDWIN INC
ALEXANDERS INC*
ALLEGHANY CORP
ALLERGAN INC
ALLIED PRODUCTS CORP
ALLIED SIGNAL INC
ALLTEL CORP
AMAX GOLD INC
AMC ENTERTAINMENT INC
AMCAST INDUSTRIAL CORP
AMERCO
AMERICAN AIRLINES INC
AMERICAN BUSINESS PRODUCTS INC*
AMERICAN EXPRESS CO
AMERICAN GENERAL CORP
AMERICAN GREETINGS CORP
AMERICAN HOME PRODUCTS CORP
AMERICAN INTERNATIONAL GROUP INC*
AMERICAN STANDARD INC
AMERICAN STORES CO
AMERITECH CORP
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ARMCO INC
ARMSTRONG WORLD INDUSTRIES INC
ARVIN INDUSTRIES INC
ASARCO INC
ASHLAND OIL INC
ASSOCIATES CORPORATION OF NORTH AMERICA
ASTEC INDUSTRIES INC
ATLANTIC RICHFIELD CO
ATMOS ENERGY CO
AVATAR HOLDINGS INC
AVCO FINANCIAL SERVICES INC
AVERY DENNISON CORP
AVON PRODUCTS INC
BAKER HUGHES INC
BALDWIN TECHNOLOGY CO INC
BALL CORP
BANDAG INC
BARD C R INC
BARNES GROUP INC
BATTLE MOUNTAIN GOLD CO
BAXTER INTERNATIONAL INC
BECKMAN INSTRUMENTS INC
BECTON DICKINSON & CO
BELL ATLANTIC CORP
BELLSOUTH CORP
BEMIS CO INC
BERLITZ INTERNATIONAL INC
BETHLEHEM STEEL CORP
BLACK & DECKER CORP
BLOCK DRUG CO INC
BLOUNT INC
BMC INDUSTRIES INC
BOISE CASCADE CORP
BORDEN INC
BOWATER INC
BRADY W H INC
BRIGGS & STRATTON CORP
BRISTOL MYERS SQUIBB CO
BROWN FORMAN CORP
BROWN GROUP INC
BRUNSWICK CORP
BRUSH WELLMAN INC
BULOVA CORP*
BUREAU OF NATIONAL AFFAIRS INC
BURLINGTON NORTHERN RAILROAD CO
CABOT CORP
CABOT OIL & GAS CORP*
CADMUS COMMUNICATIONS CORP
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CARTER WALLACE INC
CASCADE CORP

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CRANE CO
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CROWN CENTRAL PETROLEUM CORP
CROWN CORK & SEAL CO INC
CTS CORP
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CURTISS WRIGHT CORP*
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*** Decreased or terminated OPEBs during the period examined**

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