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# Accounting Measures of Unfunded Pension Liabilities and Bond Risk Premiums (Pension Accounting and Bond Risk Premiums)

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# Accounting Measures of Unfunded Pension Liabilities and Bond Risk Premiums (Pension Accounting and Bond Risk Premiums)

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Department of Accountancy

Accounting Measures of Unfunded Pension Liabilities
And Bond Risk Premiums
Abstract

The research issue investigated in this paper is whether accounting information on unfunded pension obligations is associated with bond market risk measures. The study provides further evidence linking pension numbers with bond market risk measures and assesses the usefulness of SFAS 87 pension obligation measures.

The study uses a sample of 209 electric utility new issues between 1981 and 1984. A risk premium model is used to test the incremental explanatory power of net pension obligation measures for bond risk premiums. The association of pension information with bond risk premiums has not previously been investigated. The study introduces bond risk premium methodologies commonly used in studying finance issues into accounting research.

The principal findings of the study are that net pension obligations measured on a termination basis as well as net pension obligation measures which take expected future benefit increases into account are associated with bond market risk measures. The conclusion is that SFAS 87 measures of net pension obligation appear to be an adequate representation of the market's assessment of future cash flow obligations represented by defined benefit pension plans.

Key Words: Risk premiums, pensions.

## 1.0 INTRODUCTION

The research issue investigated in this paper is whether accounting information on unfunded pension obligations is associated with bond risk premiums. Accounting disclosures of unfunded pension obligations are required to assist financial statement users in assessing the risks associated with future cash flows of the firm. It is an important empirical issue whether such disclosures are associated with market risk measures. This study provides further evidence linking pension numbers with bond market risk measures and assesses the usefulness of SFAS 87 pension obligation measures. The study is an extension of the Selling and Stickney (1986) paper which examines the associations of alternative measures of unfunded pension obligations with a measure that best reflects the present value of future expected cash flows. Instead of determining associations with a measure of "true" pension liability, this study examines the association of alternative net pension obligation measures with a bond market risk measure.

In order to understand the contribution of this study, it is necessary to review what is known about the association of pension measures with firm risk and return. Table 1 presents previous studies of the association of net pension liabilities with measures of firm risk and return. The table is organized by issue studied and by pension benefit measure used. In all the studies, it is a maintained hypothesis that true net pension liabilities are associated with the market value of the firm or various risk measures. The issue tested is whether accounting measures of net pension liabilities are sufficiently associated with true pension liabilities to be associated with market return and risk measures. A number of empirical studies have explored the association of unfunded pension liabilities with the market price of a

firm's common stock. Several studies examine the association of unfunded pension benefits with risk measures such as common stock beta and bond ratings. The general conclusion is that unfunded pension benefits are reflected in common equity prices and risk measures such as beta and bond ratings.

insert Table 1 here

This study demonstrates the association of unfunded pension obligations with bond risk premiums. Several of the reasons for extending research to risk premiums as the market risk measure are that risk premiums represent a bond market assessment of risk as opposed to common stock prices or betas and that risk premiums are continuous variables and therefore offer a finer measurement of risk than bond ratings which are categorical variables. Bond risk premium models have been widely used in finance to study a variety of bond pricing issues. The sample consists of 209 new issue electric utility bonds, debentures and long-term notes issued between 1981 and 1984. New issues are used in order to study risk premiums because thin bond market trading and issue characteristics which change over time make modeling of risk premiums on outstanding bonds quite difficult. There are three advantages to the use of utilities. First, an adequate sample size can be attained since there are many more utility straight debt issues than industrial straight debt issues during the early 1980's. Second, since many utilities routinely rely on the credit markets as a source of funds, there is less likelihood of a self-selection bias in terms of the types of firms which come to the credit markets during a period of high interest rates. Finally, electric utilities represent a relatively homogeneous operating risk group and the effects of debt equivalent items, such as unfunded pension

obligations, on the risk premium may be more clearly observed.[1] Unfunded pension obligations should be associated with bond risk premiums since there are definite risks to bondholders associated with the future cash flow commitments represented by unfunded pension promises[2]. The study develops a risk premium model and investigates the association of unfunded pension obligations with risk premiums. Measures of pension obligations using SFAS 87 measurement principles are tested for association with bond market risk measures so that the potential usefulness of SFAS 87 disclosures is evaluated.

One contribution of the study is that it provides further evidence confirming the association of accounting measures of net pension obligations with market measures of risk and return. Cross-sectional studies of the association between accounting disclosures and market risk and return measures are important in validating the relevance of accounting numbers. The association of pension information with bond risk premiums has not previously been investigated. The second contribution is the use of bond market risk measures. This study introduces bond risk premium methodologies commonly used in studying finance issues into accounting research and provides some insights into choice of appropriate models and solutions to methodological problems. The use of a bond market risk measure is an important contribution of this study. There is very little empirical evidence on the association of accounting numbers with bond market parameters despite the importance of the bond markets in new capital generation and the equal status of creditors with investors in The Statement of Financial Accounting Concepts No. 1, "Objectives of Financial Reporting by Business Enterprises" (FASB 1978).

Different measures of pension benefits are explained in Section 2. Measurement of the pension variables is discussed. The research hypothesis is stated and principal implications are introduced. The risk premium model and the sample used in the study are described in Section 3. Model estimation and results are presented in Section 4. Several estimation issues relating to model specification, collinearity and cross-sectional correlations are evaluated. Significant associations are found between risk premiums and each of the measures of net pension obligation. Conclusions and implications are discussed in Section 5.

## 2.0 PENSION MEASUREMENT

### 2.1 Explanation of pension benefit measures

Pension benefits are measured as the present value of future benefits expected to be paid. The estimate of future benefits expected to be paid can reflect plan benefit formulas applied to current salary levels using service accumulated to date or, at the other extreme, can be based on expected salary levels at retirement, expected future service and expected plan amendments. Selling and Stickney (1986) and Schipper and Weil (1982) conclude that a measure based on future salaries and expected future service provides the best information about the future cash flow commitments of the firm. There is a basic trade-off between relevance and reliability in that using future salary and service estimates may decrease the reliability of pension benefit estimates.[3]

The basic research issue in the pension association studies listed in Table 1 is whether reported pension benefit measures are sufficiently relevant and reliable to be reflected in market return and risk measures. Essentially, the issue tested is whether accounting measures of net pension

benefits are sufficiently correlated with "true" net pension benefits to be associated with market risk and return measures. Pension benefit measures used in the studies come from pension disclosures prepared under APB 8, SEC or SFAS 36 requirements. The most recent pension accounting standard, SFAS 87, becomes effective in 1987 for most firms (FASB 1985). No studies to date have used SFAS 87 disclosures, although Selling and Stickney (1986) test SFAS 87 pension measures in a simulation setting. Selling and Stickney (1986) use simulation to test directly which measure of net pension liability is most closely correlated with the "true" net pension liability. They find that although pension benefit measures based on different assumptions are highly correlated with each other, the correlation between net pension benefits is much lower. They find that net pension benefits measured as projected benefit obligations are more highly correlated with "true" net pension liabilities than net pension benefits measured as accumulated benefit obligations. This finding is important because the minimum net obligation to be recognized on the balance sheet under SFAS 87 is based on the accumulated benefit obligation. It may be, however, that the accumulated benefit obligation is not the most relevant measure of pension obligation. This study extends Selling and Stickney by testing the association of various pension benefit measures with a market risk measure rather than a simulated "true" pension liability.

Actual SFAS 87 pension benefit disclosures cannot be used because it is necessary to use a sample of new bond issues to study risk premiums. SFAS 87 disclosures have not been available for a sufficient number of years (firms are not required to adopt SFAS 87 before 1987 annual reports) to develop a new issue sample using actual SFAS 87 numbers. Approximations of SFAS 87

numbers are therefore calculated using conservative transformation techniques and the basic measurement principles underlying SFAS 87. In addition, an estimate of economic pension liability, which takes additional expected future cash flow commitments into account, is calculated.

Two different pension benefit measures are used in SFAS 87 - the accumulated benefit obligation and the projected benefit obligation. The accumulated benefit obligation represents benefits earned to date with no future salary growth discounted at a current annuity settlement rate. In other words, accumulated benefit obligations represent termination benefits. The accumulated benefit obligation forms the basis for determination of whether a minimum pension obligation must be recognized on the balance sheet. The projected benefit obligation takes future salary growth into account. The projected benefit obligation is used in the determination of pension expense and is presented in footnote disclosures. The projected benefit obligation may not fully reflect expected future cash flows since firms do adjust benefits of retired workers and workers with fixed benefit formulas for inflation and it can be argued that pension benefits involve an implicit contract with workers to make such adjustments in the future (Ippolito 1985, 1986a,b). Economic benefits represent pension benefits expected to be paid rather than benefits contractually due to workers and are therefore more representative of expected future cash flows (Selling and Stickney 1986 and Schipper and Weil 1982). An economic benefit measure is included in the study for comparison with the projected benefit measure in order to see if the market regards projected benefits as an adequate representation of future cash flow commitments.

insert Table 2 here

## 2.2 Estimation of pension benefit measures

The pension benefit measures used in this study are (1) pension benefits reported under SFAS 36, pension benefit measures reported under SFAS 87 - (2) the accumulated benefit obligation and (3) the projected benefit obligation and (4) economic pension benefits reflecting the probable future amounts to be paid given implicit contracts with the workers. Table 2 presents a comparison of pension benefit measures in terms of salary and service assumptions, actuarial methods and discount rates. The benefit measures are calculated using the Bulow and Ippolito transformation methods described below.

A simple linear transformation procedure is suggested by Bulow (1979). The underlying rationale is a comparison of pension benefit promises to a consol, which is an infinite series of future cash flows. The discount rate for a consol is one over the interest rate. Since the duration of the pension benefit stream is less sensitive to changes in interest rates than the duration of the consol, the assumption that the change in value of pension benefits with regard to changes in interest rates is proportional to one over the interest rate is a conservative assumption (Bulow, 1979, p.49). The Bulow transformation is a simple linear adjustment with the following formula:

$$L_T = L_R \times (i_R / i_T)$$

where $L_T$ = Transformed liability

$L_R$ = Reported liability

$i_T$ = Transformed interest rate

$i_R$ = Reported interest rate

The Bulow transformation method is employed in the pension studies which use SFAS 36 footnote data (Maher 1987, Feldstein and Morck 1982 and Landsman 1986 (uses a similar method)).

Ippolito (1986b) develops an approximation of the sensitivity of pension benefits to variation in interest rates from empirical data using Department of Labor reports. Ippolito derives a model of pension liabilities and estimates an equation using data from over 4,000 plans in 1978. The results appear to be quite reasonable since values for the constants in his equation conform to realistic assumptions about time to retirement and average retirement period and the sensitivity of pension benefits to changes in interest rates for retired workers is not as great as for active workers. Ippolito uses this transformation to estimate economic liabilities which reflect implicit promises to adjust future benefits for inflation. Ippolito finds that the estimated economic liabilities conform with actual wage-tenure profiles (Ippolito 1985) and with stock market values (Ippolito 1986a). Francis and Reiter (1987) use the Ippolito adjustment to estimate economic pension benefits. The formulas which are used to transform pension benefits are:

for active participants: $L_T/L_R = \exp(-.077(i_T - i_R))$

for retired participants: $L_T/L_R = \exp(-.057(i_T - i_R))$

The Ippolito model assumes that all plans have the same average retirement period for retired workers and the same average time to retirement for active workers. If these assumptions have changed since 1978, it seems likely that retirement periods are longer and that work forces are younger (due to the effects of forced early retirements etc.) so that actual sensitivities to interest rate changes may be greater than the model

indicates. The Ippolito model, therefore, represents a conservative adjustment process.

Total benefits (vested plus nonvested) are used in the calculations since accumulated benefits approximate termination liabilities and all pension benefits are considered vested in a voluntary termination. Benefit measures which assume future salary growth such as projected benefits and economic benefits implicitly assume that benefits will become vested. The discount rates used to determine the SFAS 36 disclosures are reported in footnote disclosures and the average of the high and low rates is used when a range of rates is reported. The appropriate discount rate for SFAS 87 pension measures is the annuity settlement rate. The average settlement rate published by the Pension Benefit Guarantee Corporation (PBGC) is used for determining SFAS 87 benefits and economic benefits. Estimates of the percentages of retired and active workers (20% and 80% respectively) are determined using a sample of utility pension plans from the Blue Book of Pension Funds.

The accumulated benefit obligation is estimated by using the Bulow method and the PBGC annuity settlement rates for each year. The projected benefit obligation and the economic benefit obligation are estimated using the Ippolito method. The projected benefit obligation is basically the same as the accumulated benefit obligation for benefits belonging to retired workers and to workers whose benefits are not tied to final pay. Therefore, the retiree's benefits (20%) are adjusted to the PBGC annuity rate and the benefits of active workers are adjusted to the average of the spread between the discount rate and rate of salary growth and the PBGC rate. This assumes that about 50% of the active workers have benefits tied to final pay. In

order to determine the appropriate spread between the discount rate and assumed salary growth rate, 1986 annual reports available on NAARS for the firms in the sample which use SFAS 87 in 1986 (N=20) are analyzed. The average difference between the discount rate and the compensation growth rate in this sample is about 2%.

The accuracy of the transformation process for projected benefit obligations is verified by comparison with the subsample of actual SFAS 87 benefit measures for 1986. The ratio of actual projected benefits to accumulated benefits is 1.35 to 1 while the ratio of estimated accumulated benefits to estimated projected benefits for the entire sample is 1.48 to 1. Since interest rate levels are higher during 1981 through 1983 than in 1986, a slightly larger spread between accumulated benefits and projected benefits would be expected for the sample period so that the transformation procedure is verified.

Ippolito (1986b) provides a conservative proxy for economic benefits. Benefits for retired workers are adjusted to a rate of 1.5% plus half of inflation to reflect the experience of the 1970's when retired workers received increases in benefits representing about half of inflation. Benefits for active workers are adjusted to a real rate of 3%.[4]

2.3 Comparisons of benefit measures

Table 2 presents descriptive statistics for the pension variables and a correlation matrix of pension measures. The measures of estimated pension benefits from smallest to largest are accumulated benefit obligations, reported benefits, projected benefit obligations and economic benefit obligations. Accumulated benefit obligations represent termination benefits, projected benefit obligations take part of expected future benefit increases

in account and economic benefit obligations reflect expected future benefits assuming that firms adjust benefits for inflation. The average funded status of firms (pension assets divided by pension benefits) is 1.2 using reported benefits, 1.69 using accumulated benefit obligations, 1.14 using projected benefit obligations and .91 using economic benefit obligations. The correlations between the benefit measures are high (ie. .99). Correlations between net pension assets (liabilities) are not as high. For instance, the correlation between net pension assets based on accumulated benefit obligations and net pension assets based on economic benefit obligations is .62. These results coordinate with the simulation results of Selling and Stickney (1986) which show a high correlation between different pension benefit measures and lower correlations between net pension assets (liabilities). Since the ranking of firms by net pension assets (liabilities) differs between measures, there is the possibility that some measures produce cross-sectional rankings which are more highly correlated with market risk measures.

2.4 Research Issue

In studies of the association of unfunded pension benefits with market measures, the real issue is whether accounting measures of pension obligation are sufficiently relevant and reliable to be reflected. The research issue in this study is whether net pension assets (liabilities) reported in SFAS 36 footnote disclosures and net pension assets (liabilities) measured to approximate SFAS 87 pension measures and economic pension liabilities are associated with bond risk premiums. Theoretically, Merton (1974) has shown that liabilities of the firm increase the risk premium required on new debt issues. Risk premiums are measures of the default risk of firms issuing

bonds. Pension obligations represent liabilities of the sponsoring firm. The research issue is whether current accounting measurements of unfunded pension benefits are reflected in bond risk premiums. This is basically a measurement issue. The research hypothesis, stated in the alternate form, is:

> H1: Unfunded pension benefits information is associated with bond risk premiums. Specifically, the coefficient of net pension assets (liabilities) is inversely associated with risk premiums.

The research issue is tested by adding net pension asset (liability) variables to a base or control model and testing for increases in explanatory power.[5] The sign and significance level of the coefficient for the pension variable is also evaluated. Various diagnostics on the proper specification of the model and the validity of the tests are presented in Section 4.

The second research issue, which is addressed only in an exploratory manner, is whether different measures of net pension asset (liability) have different degrees of association with bond risk premiums. No formal tests of differences in association are proposed, however, informal comparisons of F statistics will be made. Selling and Stickney (1986) find that projected net assets (liabilities) are more highly correlated than accumulated net pension assets (liabilities) with "true" net pension liabilities. Furthermore, Schipper and Weil (1982), Selling and Stickney (1986) and Ippolito (1985, 1986a,b) claim that economic pension liabilities are more relevant than termination measures. For these reasons, we would expect that economic net pension assets (liabilities) will be most highly associated with bond risk measures with projected net pension assets (liabilities) next most associated and accumulated net pension assets (liabilities) least associated.[6]

The results of the study may have several policy implications. The association of net pension assets (liabilities) with bond market risk measures provides additional research evidence that the funded position of defined benefit pension plans has an impact on market parameters even before the SFAS 87 requirement to recognize a minimum pension obligation. In addition, conclusions about the usefulness of various SFAS 87 requirements may be possible. Evidence from this study can help evaluate the usefulness of SFAS 87 requirements that (1) pension asset and liability amounts are separately disclosed, (2) a termination liability measure is used in determining the minimum pension liability to be recognized and (3) realization of probable future benefit increases is limited to future salary growth assumptions and excludes probable other future benefit increases.

## 3.0 RISK PREMIUM MODEL AND SAMPLE

### 3.1 Risk Premium Model Development

The risk premium on corporate bonds can be defined as the difference between the yield on a risky security and that on a security that is risk-free but identical in all other respects. The classic study on the determinants of bond yields is Fisher (1959) which hypothesizes that bond risk premiums are a function of the default risk of the firm and of the marketability of the bond issue. Appendix A summarizes a number of models used in various studies to explain bond yields or risk premiums. Factors found important by researchers include indenture provisions (such as term to maturity, sinking funds and secured status), call risk, macroeconomic factors (such as business cycle effects) and marketability.

The dependent variable (DYIELD) is formed by subtracting the yield to maturity of a U.S. Treasury issue from the offering yield (OFYLD) of a new

utility issue. Fung and Rudd (1986) indicate that it is important to use the previous day's treasury issue closing yield to match with the offering yield on new securities. The independent variables are chosen to proxy for maturity and indenture characteristics, call risk, macroeconomic factors and default risk.[7]

Term to maturity is expected to be directly related to risk premiums due to the increased exposure to interest rate risk with increased time to maturity. A variable for the presence of a sinking fund is added to the model since the necessity of entering into complex sinking fund agreements for the enhanced security of the borrower is related to the perceived quality of the issuer.

The period of the study, from 1981 through 1984, is a period of high market interest rates so that call risk is an important factor in pricing the bonds sold. Future refinancing at lower interest rates seems probable for many of these issues and investors are willing to pay extra for call protection to lock in the high yields. Degree of call protection is proxied by the difference between the yield to first call or refunding and the offering yield. Effects from both the length of the deferment period and the amount of the call premium are taken into account by this measure.

It is necessary to control for macroeconomic factors since the sample period spans three years. Previous studies (Jaffee 1975 and Cook and Hendershott 1978) find evidence that risk premiums vary with the business cycle. A number of economic indicators are used in these studies and the variable with the most consistent significant explanatory power is the index of consumer sentiment. The index of consumer sentiment, which is based on data collected by the University of Michigan and is described in detail by

Fair (1971), is used in this model to control for macroeconomic effects. Since the risk premium rises as overall interest rates rise (Cook and Hendershott 1978), the level of interest rates is also included as an independent variable.

Financial ratios are used to proxy for default risk. Evidence of the connection between various financial ratios and default risk of utilities is gathered from Standard & Poor's Rating Guide (1979), Melicher's (1974) factor analysis of utility ratios and Altman and Katz's (1976) bond rating prediction study. The following categories of factors are found to be important: cash flow adequacy, asset protection, capitalization and earning stability. Variables representing cash flow adequacy, capitalization and earnings protection are cash flow to construction expenditures, the debt-equity ratio and the property funding ration (long term debt to property, plant and equipment). The coefficient of variation of return on equity for five years represents earning stability. Pretax interest coverage is one of the most important financial ratios used by bond raters (Standard & Poor's 1979). One potential drawback in using a utility sample is that during the 1980's, factors which are not reflected in the financial ratios of utilities, such as potential problems with bringing new plants on-line, begin to significantly and rapidly alter the risk of several utilities. A dummy variable NUKE is included for utilities which are experiencing problems connected with their nuclear generating facilities at the time of the bond issue.[8]

Table 3 summarizes the risk premium model variables and expected signs. Sample descriptive statistics are presented in Table 4.

insert Tables 3 and 4 here

3.2 Sample

The sample consists of new issues of public utility bonds between February 23, 1981 and February 29, 1984. The starting date of the study coordinates with the earliest availability of pension footnote disclosures mandated by SFAS No. 36. Issues between February 23, 1981 and February 29, 1984 are included in the sample if the issuers are considered to be electric utilities by Moody's Public Utility Manual and a full set of pension and financial information is available. Lack of publicly available pension footnote information causes 22 observations to be dropped. Because it is not comparable with other bond issues, one deep discount issue is not included in the sample. The final sample consists of 209 issues.

The offering date, offering yield and other terms of each issue, including indenture terms, are gathered from Moody's Bond Survey, The Investment Dealer's Digest, and Moody's Public Utility Manual. Descriptive information necessary to code the NUKE variable comes from Standard & Poor's CreditWeek analysis of new issues. Treasury yields are from the Wall Street Journal.

The primary source for financial variables is Standard & Poor's CreditWeek and secondary sources are annual reports and Moody's Public Utility Manual. One advantage of using CreditWeek data is timeliness. In many cases the financial data is reported up to the nearest quarter to the issue date and capitalization data are pro forma. The information used to form the pension variables is collected from the FASB 36 pension data bank (Version2, Columbia University) and from annual reports.

## 4. ESTIMATION AND RESULTS

### 4.1 Estimation Issues

insert Table 5 here

The risk premium model is estimated using Ordinary Least Squares regression. Results are reported in Table 5. The increase in explanatory power for the addition of pension variables is evaluated using the general linear test. The formula is:

$$F^* = \frac{SSE\ (R) - SSE\ (F)}{d.f.R - d.f.F} \Big/ \frac{SSE\ (F)}{d.f.F}$$

Where SSE (R) and SSE (F) and d.f.R and d.f.F are the sum of squared errors and degrees of freedom for the reduced and full models respectively. F* is distributed by the F distribution with ((d.f.F - d.f.R), d.f.F) degrees of freedom (Neter and Wasserman 1974).

There are three potential problems which are important in evaluating results. First, spurious results could arise if the model is not specified properly. Second, results could be influenced by severe collinearity. Finally, cross-sectional correlations could affect the statistical significance of the results. These three potential problems are evaluated and I find that the model appears to be well-specified, that collinearity between pension and other variables is not a problem and that the significance of the results is not generated by cross-sectional correlations.

#### 4.1.1 Model Specification

One facet of model fit is explanatory power. The control model, without the net pension asset (liability), has an adjusted R-squared of 60.5% which is typical for a risk premium model. All variables have the expected signs except for the debt-to-equity ratio and all coefficients except for

coefficient of variation of return on equity are significantly different from zero at a 10% significance level. The unexpected sign of debt-to-equity appears to be due to a collinearity problem between debt-to-equity and the property funding ratio which is discussed further in Section 4.1.2.

Since the sample period spans three years, I test to see if different values of the financial ratios and pension variables would be expected in different years. The financial ratios and pension variables are calculated at December 31, 1980, 1981 and 1982 for the 22 electrical utilities in the Standard & Poor's 40 utilities index. T-tests are performed to see if the levels of the financial ratios and pension variables are different for this group of firms between the three years. No significant differences in financial ratios or pension variables is found. Therefore, no bias is introduced by including financial ratios and pension variables of issues spanning this three year period in the same model.

Ordinary least squares assumptions of normality of the dependent variable and residuals are met. Tests for normality (Stevens 1974) are performed for the dependent variable and residuals. The null hypothesis of normality cannot be rejected in either case. A Goldfeld-Quandt test (Goldfeld and Quandt 1965) is performed to test for heteroscedasticity. The resulting F statistic is not significant (1.25 for degrees of freedom 71, 71). The conclusion is that the model appears to be well-specified and that results are, therefore, not caused by the pension variables proxying for the effects of incorrect model specification.

4.1.2 Collinearity Problems

Another concern when evaluating results is that severe collinear problems may affect the results. Collinearity diagnostics (Belsley, Kuh and

Welsch 1981) indicate that there are strong collinear associations in the sample between three groups of variables: the intercept, the index of consumer sentiment, the level of interest rates and interest coverage; the debt-to-equity ratio and the property funding ratio; and the level of interest rates, the property funding ratio and interest coverage. No strong collinear associations involve the pension variables, however. Another diagnostic for collinear problems, the adjusted R-square of a regression of the pension variable on the other independent variables, is reported in Table 6. The pension variables are not highly associated with the other independent variables. The simple correlations between pension variables and the other independent variables are presented in Table 6. The highest simple correlation is the .29 correlation between the debt-to-equity ratio and the reported net pension asset (liability). This level of correlation is well below the threshold level needed to cause collinearity problems (Belsley, Kuh and Welsch 1981). Collinearity between the pension variables and the other independent variables is not, therefore, biasing the results.

insert Table 6 here

4.1.3 Cross-sectional Correlations

Finally, it is possible that cross-sectional correlations within the sample lead to an overstatement of statistical significance of the coefficients. The sample observations span the time period between February 24, 1981 and February 22, 1984 so that there is no concentration in calendar time. Another problem may arise due to multiple issues by the same firm. The 209 issues included in the sample represent 72 separate issuers. This is because many utilities routinely come to the bond market on a yearly basis. If the model is not well-specified, individual issuer financial condition may

not be well controlled for and correlations between the residuals of issues by the same firm could result in overstatement of the statistical significance of the results. In order to see is this is an important factor, the model is run on a subsample consisting of only one issue per issuer. Significance levels are similar for the subsample and the full sample. This indicates that multiple issues do not lead to overstatement of significance levels. F statistics for the increase in explanatory power in the single issue sample are reported in Table 6.

4.2 Results

The results of the risk premium model tests are presented in Table 5. When the reported net pension asset (liability) is added to the control model, there is a significant increase in explanatory power (F=10.25). In addition, the coefficient is negative and significant as expected. Similar results are obtained when the accumulated net pension asset (liability) (F=6.89), projected net pension asset (liability) (F=7.75) and economic net pension asset (liability) (F=4.17) variables are added to the control model. In conclusion, all the pension measures are significantly associated with risk premiums.

Counter to expectations, economic and projected net assets (liabilities) are not more highly associated with risk premiums than accumulated net assets (liabilities). In fact, it seems that economic net assets (liabilities) are the least closely associated. This result is not consistent with Selling and Stickney (1986), which finds that projected net assets (liabilities) are more highly correlated with "true" net pension assets (liabilities) than accumulated net pension assets (liabilities). Since the economic net asset (liability) measure takes more expected future cash flows into account, it

was expected to be more closely related to a market risk measure than accumulated or projected benefit obligations.

## 5.0 CONCLUSIONS

The principal finding of this study is that accounting measures of net pension asset (liabilities) (or simple transformations of accounting measures) are associated with bond market risk measures. This indicates that market risk and return measures reflect net pension assets (liabilities) even before balance sheet recognition is required. The different pension benefit measures, accumulated, projected and economic benefits, are highly correlated but net pension assets (liabilities) formed with the different measures are less highly correlated. Therefore, the SFAS 87 requirements for separate disclosure of pension assets and liabilities appear to be justified. The use of accumulated net assets (liabilities) as the basis for liability recognition appears to be justified also, since accumulated net assets (liabilities) are as closely associated with bond risk premiums as net asset measures which take future benefit increases into account. Since economic net assets (liabilities) are less closely associated with risk premiums than projected net assets (liabilities), it appears that SFAS 87 pension measures are an adequate representation of the market's assessment of future cash flow obligations despite the fact that the projected benefits measure only takes a portion of expected future benefit increases into account. Therefore, SFAS 87 disclosures appear to provide optimal information to users while taking a conservative position on premature realization of obligations.

One limitation of the study is the use of estimated SFAS 87 pension measures. Results should, therefore, be considered preliminary in nature. The principal qualification of the research methodology is that specification

of an appropriate model is extremely important in achieving internal validity. Although the risk premium modeling approach used is not common in accounting research, it is a widely used methodology in finance studies. Furthermore, diagnostics of model fit do not indicate any problems with misspecification. Finally, results using a utility sample may not be fully generalizable to industrial firms. Creditors may view pension obligations of utilities in a different manner and may not be as interested in evaluating long-term cash flow commitments as when examining non-regulated firms. It is possible, therefore, that creditors might evaluate termination benefits, projected benefits and economic benefits differently for regulated and industrial firms.

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1. Lys (1984) finds that the debt-equity ratio has little power to explain debt default risk unless variables to control for total firm risk are included in the model. In addition, capital structure research indicates that there are different typical debt levels for firms across industry groups (DeAngelo and Masulis 1980 and Bowen, Daley and Huber 1982).

2. The fact that utilities are regulated industries does not invalidate their use in this study. Public utility regulation does not guarantee returns to bondholders or payment of employee pensions. Rate-making is often not particularly timely, a phenomena known as regulatory lag. In times of inflation and rising fuel prices, utilities suffer from problems of attrition (replacement costs of plant and equipment exceed historical costs) and erosion (actual operating expenses exceed those embedded in the rates). In many ways, utilities face an environment not very different from that of competitive firms (Howe and Rasmussen 1982).

3. In addition, accountants may be constrained by the concept of realization from using future service estimates in determining the present value of benefits to be paid in the future.

4. Economic benefits differ from the "true" pension liability in Selling and Stickney (1986) in that the present value of future expected service is not incorporated. The economic benefit measure simply reflects expectations that benefits will be adjusted for expected future inflation.

5. Statistically significant increases in explanatory power do not imply that there is a large economic benefit to be earned by considering the additional factor. It is basically interesting to know that accounting numbers which are designed to be helpful in assessing risk are associated with market measures of risk and return. The bulk of what we know about

accounting numbers is based on association tests. It is not reasonable to expect that addition of an incremental piece of accounting information to any but an extremely misspecified model would result in a dramatically large increase in explanatory power.

6. Gonedes and Dopuch (1974) assert that associations of alternative accounting disclosures with market measures cannot determine which disclosure is "best" because of market imperfections. As Lev and Ohlson (1982) point out, however, there is an intrinsic value in knowing that accounting measures which are designed to be helpful is assessing risk are correlated with market risk and return measures. Therefore, it is of interest to note which measure of pension benefits is most closely associated with bond risk measures.

7. Two factors often mentioned in other studies are not controlled for explicitly in this model: coupon tax effects and marketability. When bonds are purchased at a substantial discount, a portion of the expected return is the capital gain on the difference between maturity value and purchase price and this capital gain advantage is priced by the market. In a study using new issues, coupon tax effects are not important, however. Although marketability does play a role in bond pricing, there has been little support for the marketability proxies used in previous studies.

8. An association between regulatory climate and bond ratings has been demonstrated (Pinches, Singleton and Jahankhani 1978). Various agencies, for example Value Line, provide ratings of regulatory climate by state. Use of these rankings would provide a more objective measure of regulatory climate but because of the speed with which circumstances surrounding the construction of nuclear facilities change within the time period of this study, the more timely CreditWeek information is used.

## REFERENCES


Abdel-khalik, A. R., Thompson, R. B. and Chen, R. D. 1981. Effects on bond pricing and on bond rating. In The Economic Effects on Leases of FASB No. 13, Accounting for Leases (Abdel-khalik, A.R., principal researcher) Stamford, Connecticut: Financial Accounting Standards Board, pp. 163-191.

Altman, E. I. and Katz, S. 1976. Statistical bond rating classification using financial and accounting data. In Proceedings of the Conference on Topical Research in Accounting (Schiff, M. and G. Sorter, eds.) New York: New York University, pp. 205-239.

Barrett, W. B., Heuson, A. J. and Kolb, R. W. March 1986a. The effect of Three Mile Island on utility bond risk premia: A note. The Journal of Finance 41(1): 255-261.

_____. Winter 1986b. The differential effects of sinking funds on bond risk premia. The Journal of Financial Research 9(4): 303-312.

Belsley, D. A., Kuh, E. and Welsch, R. E. 1980. Regression Diagnostics New York: John Wiley & Sons.

Berndt, E. R., Sharp, K. C. and Watkins, G. C. December 1979. Utility bond rates and tax normalization. Journal of Finance 34(5): 1211-1220.

Bowen, R. M., Daley, L. H. and Huber, C. C., Jr. Winter 1982. Evidence on the existence and determinants of inter-industry differences in leverage. Financial Management 11(4): 10-20.

Bulow, J. I. 1979. Analysis of pension funding under ERISA. National Bureau of Economic Research Working Paper No. 402.

Cook, T. Q. and Hendershott, P. H. September 1978. The impact of taxes, risk and relative security supplies on interest rate differentials. The Journal of Finance 33(4): 1173-1186.

Daley, L. A. April 1984. The valuation of reported pension measures for firms sponsoring defined benefit plans. The Accounting Review 59(2): 77-198.

DeAngelo, H. and Masulis, R. W. March 1980. Optimal capital structure under corporate and personal taxation. Journal of Financial Economics 8(1): 3-29.

Dhaliwal, D. S. October 1986. Measurement of financial leverage in the presence of unfunded pension obligations. The Accounting Review 61(4): 651-661.

Ederington, L., Yawitz, J. B. and Roberts, B. H. Fall 1987. The informational content of bond ratings. The Journal of Financial Research 10(3): 211-226.

Fair, R. C. 1971. A Short-run Forecasting Model of the United States Economy Lexington, Massachusetts: Heath.

Feldstein, M. and Morck, R. 1982. Pension funding decisions, interest rate assumptions and share prices. National Bureau of Economic Research Working Paper No. 938.

Feldstein, M. and Seligman, S. September 1981. Pension funding, share prices, and national savings. The Journal of Finance 36(4): 801-824.

Financial Accounting Standards Board. 1978. Statement of Financial Accounting Concepts No. 1: Objectives of Financial Reporting by Business Enterprises. Stamford, Connecticut: Financial Accounting Standards Board.

_____. 1985. Statement of Financial Accounting Standards No. 87: Employers' Accounting for Pensions. Stamford, Connecticut: Financial Accounting Standards Board.

Fisher L. June 1959. Determinants of risk premiums on corporate bonds. The Journal of Political Economy 67(3): 217-237.

Francis, J. R. and Reiter, S. A. April 1987. Determinants of corporate pension funding strategy. Journal of Accounting and Economics 9(1): 35-59.

Fung, W. K. H. and Rudd, A. July 1986. Pricing new corporate bond issues: An analysis of issue cost and seasoning effects. The Journal of Finance 41(3): 633-643.

Goldfeld, S. and Quandt, R. June 1965. Some tests for homoskedasticity. Journal of the American Statistical Association 60(310): 539-547.

Gonedes, N. J. and Dopuch, N. 1974. Capital market equilibrium, information predictions, and selecting accounting techniques: Theoretical framework and review of empirical work. Studies On Financial Accounting Objectives: 1974 Supplement to Journal of Accounting Research 12: 48-129.

Howe, K. M. and Rasmussen, E. F. 1982. Public Utility Economics and Finance. Englewood Cliffs, New Jersey: Prentice-Hall, Inc.

Ippolito, R. A. December 1985. The labor contract and true economic pension liabilities. American Economic Review 75(5): 1031-1043.

_____. January-February 1986a. The economic burden of corporate pension liabilities. Financial Analysts Journal 42(1): 22-34.

_____, 1986b. Pensions, Economics and Public Policy. Homewood, Illinois: Dow-Jones-Irwin.

Jaffee, D. M. July 1975. Cyclical variations in the risk structure of interest rates. Journal of Monetary Economics 1(3): 309-325.

Kidwell, D. S., Marr, M. W. and Thompson, G. R. April 1987. Shelf registration: Competition and market flexibility. Journal of Law and Economics 30(1): 181-206.

Landsman, W. October 1986. An empirical investigation of pension and property rights. The Accounting Review 61(4): 662-691.

Lev, B. and Ohlson, J.A. 1982. Market-based empirical research in accounting: A review, interpretation, and extension. Studies on Current Research Methodologies in Accounting: A Critical Evaluation Supplement to Journal of Accounting Research 20: 249-322.

Lys, T. April 1984. Mandated accounting changes and debt covenants. Journal of Accounting and Economics 6(1): 39-65.

Maher, J. J. October 1987. Pension obligations and the bond credit market: An empirical study. The Accounting Review 62(4): 785-798.

Martin, L. J. and Henderson, G. V., Jr. December 1983. On bond ratings and pension obligations, A note. Journal of Financial and Quantitative Analysis 18(4): 463-470.

Melicher, R. W. March 1974. Financial factors which influence beta variations within an homogeneous industry environment. Journal of Financial and Quantitative Analysis 9(1): 231-242.

Merton, R. C. May 1974. On the pricing of corporate debt: The risk structure of interest rates. The Journal of Finance 29(2): 449-470.

Neter, J. and Wasserman, W. 1974. Applied Linear Statistical Models Homewood, Illinois: Richard D. Irwin, Inc.

Oldfield, G. S. February 1977. Financial aspects of the private pension system. Journal of Money, Credit, and Banking 9(1): 48-54.

Pinches, G. E., Singleton, J. C. and Jahankhani, A. Summer 1978. Fixed coverage as a determinant of electric utility bond ratings. Financial Management 7(2): 45-55.

Rogowski, R. J. and Sorensen, E. H. Spring 1985. Deregulation in investment banking: Shelf registrations, structure, and performance. Financial Management 14(1): 5-15.

Schipper, K. and Weil, R. L. October 1982. Alternative accounting treatments for pensions. The Accounting Review 57(4): 806-824.

Selling, T. I. and Stickney, C. P. Winter 1986. Accounting measures of unfunded pension liabilities and the expected present value of future pension cash flows. Journal of Accounting and Public Policy 5(4): 267-285.

Smith, R. L. July 1987. The choice of issuance procedure and the cost of competitive and negotiated underwriting: An examination of the impact of Rule 50. The Journal of Finance 42(3): 703-720.

Standard & Poor's Rating Guide. 1979. New York: McGraw-Hill, Inc.

Stevens, M. A. September 1974. EDF statistics for goodness of fit and some comparisons. Journal of the American Statistical Association 69(347): 730-737.

Appendix A · Yield Studies

| Author(s) | Sample and data | Issue investigated | Dependent variable | Factors represented by independent variables | R square |
|---|---|---|---|---|---|
| Abdel-khalik, Thompson & Chen [1981] | 1975-79 178 bonds | Association of risk premiums with capitalized lease obligations | Risk premium (log) | Log of coefficient of variation in earnings(+), Log of market value of equity to book value of debt(+), Log of market value of all traded debt(+) | .48 - .90 |
| Barrett, Heuson, Kolb [1986a] | 1977-82 Public Utilities 76 bonds | Effect of Three Mile Island on utility bond risk premiums | Risk premium | Term to maturity(+), First Mortgage(+), Sinking fund(+), Log of issue size, Bond rating dummies(+), Discount factor(+), Level of interest rates(+), Change in industrial production(+), Change in monetary policy(+), Shape of yield curve(+), Three Mile Island variables(+) | .63 |
| Barrett, Heuson & Kolb [1986b] | 1977-83 76 public utility issues | Effect of sinking funds on bond yields | Risk premium | Term to maturity(+), First mortgage(+), Log of issue size, Bond rating dummies(+), Discount factor(+), Call premium(+), Level of interest rates(+), Shape of yield curve(+), Change in industrial production(+), Change in monetary policy(+), Sinking fund variables(+) | .63 |
| Berndt, Sharp, Watkins [1979] | 1962-76 Electric Utilities 90-95 | Effect of rate normalization for deferred taxes | Tax Adjusted Yields | Debt to equity(+), Current assets, Coupon (+), Exchange listing, Rate normalization(+),Change in money supply, Change in GNP growth(+), Market power, Location | .48-.85 |
| Cook & Hendershott [1978] | 1961-75 Yield series Utility Aa | Determinants of the risk premium | Risk premium | Index of consumer sentiment(+), Employment index, Call(+), Level of interest rates(+), Relative supply | |
| Ederington, Yawitz & Roberts [1987] | 2/28/79 & 2/27/81 176 and 180 bonds | Determinants of bond yields | Yield to maturity | Financial ratios(+), Bond ratings(+), Subordinate status(+), Call and capital gain(+), Period of call protection | .80-.87 |
| Fisher [1959] | 1927,1932, 1937,1949 1953 45-88 firms | Determinants of the risk premium | Risk premium (log) | Log of earnings variability(+), Log of period of solvency(+), Log of equity to debt ratio(+), Log of market value of bonds outstanding(+) | .73-.81 |
| Fung & Rudd [1986] | 1983-85 123 new issues | Effects of shelf registration | Risk premium | Level of interest rates(+), Log of term to maturity(+), Log of years to first call, Log of issue size, Quality(+), Industrial sector(+), Financial sector, Shelf registration | .79 |
| Jaffee [1975] | 1954-69 Quarterly | Cyclical variations in the risk structure | Risk spreads between ratings | Index of consumer sentiment(+), Unemployment rate, Growth rate of retained earnings(+), Growth of capital investment(+), Growth of output. Baa interest level(+), Term to maturity(+), Total float, Coupon(+) | .65-.75 |

Appendix A Yield Studies

| | | | | | |
|---|---|---|---|---|---|
| Kidwell, Marr & Thompson [1987] | 1982-83 111 new issues | Effects of shelf registration | Risk premium | Rating dummies(1), Level of rates(1), Interest volatility(1), Sinking fund(1), Call feature, Log of issue size(1), Number of bids(1), Sale method | .78 |
| Rogowski & Sorensen [1985] | 1981-83 307 new issues | Effect of shelf registration | Offering yields | Level of interest rates(1), Trend of rates, Supply of new issues(1), Log of issue size, Bond rating dummies(1), Average maturity(1), Call protection measure, Interaction of call and maturity, Shelf registration(1) | .88 |
| Smith [1987] | 1977-85 380 new issues utilities | Choice of underwriting methods | Yield to issuer | Rating dummies(1), Log of issue size, Log of number of issues by firm(1), Call protection, First call premium, Years to first call, Characteristics of investment banker, Variance in interest rate level, Level of interest rates(1) | |

Table 1

PENSION STUDIES

| Association of unfunded pension obligations with: | Pension Measures Used |
|---|---|
| **Theoretical Pension Liability Measures** | |
| Selling and Stickney (1986) | SFAS 87 - Simulated Benefits |
| **Market Value of Equity and/or Stockholders' Equity** | |
| Landsman (1986) | SFAS 36 disclosures: Total and Standardized |
| Daley (1984) | APB 8 disclosures - Unfunded Vested Benefits and Pension Expense and SEC disclosures - Unfunded Past Service Cost |
| Feldstein and Morck (1982) | SFAS 36 disclosures - Vested and Standardized |
| Feldstein and Seligman (1981) | APB 8 disclosures - Unfunded Vested Benefits and SEC disclosures - Unfunded Past Service Cost |
| Oldfield (1977) | APB 8 disclosures - Unfunded Vested Benefits |
| **Systematic Risk - Common Stock Beta** | |
| Dhaliwal (1986) | APB 8 disclosures - Unfunded Vested Benefits |
| **Bond Ratings** | |
| Maher (1987) | SFAS 36 disclosures - Vested, Total and Standardized |
| Martin and Henderson (1983) | SEC disclosures - Unfunded Past Service Cost |

Table 2

COMPARISON OF PENSION BENEFIT MEASURES

| Benefit measures: | Assumptions: Salary | Service | Actuarial method | Discount rate |
|---|---|---|---|---|
| Reported under SFAS 36 | Current salaries | Accumulated to date | Unit credit | Various |
| Accumulated benefits - SFAS 87 | Current salaries | Accumulated to date | Unit credit | Annuity settlement rates |
| Projected benefits - SFAS 87 | Expected future salaries | Accumulated to date | Unit credit | Annuity settlement rates |
| Economic benefits | Expected future salaries and benefit increases | Accumulated to date | | |
| "True" pension benefits | Expected future salaries and benefit increases | Expected | | |

DEFINITION OF PENSION VARIABLES

| | |
|---|---|
| Reported net asset (liability) | (Fair market value of plan assets - Reported pension benefits) / Permanent capitalization |
| Accumulated net asset (liability) | (Fair market value of plan assets - Accumulated benefit obligation) / Permanent capitalization |
| Projected net asset (liability) | (Fair market value of plan assets - Projected benefit obligation) / Permanent capitalization |
| Economic net asset (liability) | (Fair market value of plan assets - Economic benefit obligation) / Permanent capitalization |

Table 2 - continued

DESCRIPTIVE STATISTICS

| | Mean | Standard Deviation | Minimum | Maximum |
|---|---|---|---|---|
| Reported pension benefits | 173.828 | 197.783 | 5.620 | 1,103.000 |
| Accumulated benefit obligation | 122.412 | 140.705 | 4.738 | 779.899 |
| Projected benefit obligation | 180.263 | 205.192 | 6.539 | 1,143.695 |
| Economic benefit obligation | 226.622 | 259.362 | 7.926 | 1,438.250 |
| Reported funding ratio | 1.193 | .364 | .602 | 2.645 |
| Accumulated funding ratio | 1.698 | .677 | .722 | 5.103 |
| Projected funding ratio | 1.139 | .375 | .580 | 2.769 |
| Economic funding ratio | .908 | .298 | .461 | 2.146 |
| Reported net asset (liability) | .006 | .014 | -.031 | .053 |
| Accumulated net asset (liability) | .020 | .015 | -.020 | .062 |
| Projected net asset (liability) | .004 | .014 | -.039 | .049 |
| Economic net asset (liability) | -.009 | .017 | -.069 | .041 |

PEARSON CORRELATION COEFFICIENTS

| | Reported benefits | Accumulated benefits | Projected benefits | Economic benefits |
|---|---|---|---|---|
| Reported benefits | 1.000 | .987 | .996 | .997 |
| Accumulated benefits | | 1.000 | .997 | .995 |
| Projected benefits | | | 1.000 | .999 |
| Economic benefits | | | | 1.000 |

| | Reported net asset (liability) | Accumulated net asset (liability) | Projected net asset (liability) | Economic net asset (liability) |
|---|---|---|---|---|
| Reported net asset (liability) | 1.000 | .783 | .947 | .859 |
| Accumulated net asset (liability) | | 1.000 | .849 | .617 |
| Projected net asset (liability) | | | 1.000 | .933 |
| Economic net asset (liability) | | | | 1.000 |

Table 3

Risk Premium Model

| Variable | Expected Sign | Description |
|---|---|---|
| | | Dependent Variable |
| DYIELD | | Risk premium |
| | | Maturity and Issue Characteristics |
| MATYR | + | Years to maturity |
| SF | + | Sinking fund |
| | | Political and Regulatory Risk |
| NUKE | + | Trouble with nuclear plant |
| | | Call Risk |
| DFYLD | - | Offering yield - Yield to first call |
| | | Macroeconomic Factors |
| MOOD | - | Index of consumer sentiment |
| TYIELD | + | Level of Treasury yields |
| | | Financial Variables |
| CONST | - | Cash flow to construction expenditure |
| DE | + | Debt-to-equity ratio |
| PROP | + | Property funding ratio |
| ROE | + | Coefficient of variation of return on equity |
| COV | - | Pretax interest coverage |
| | | Pension Variables |
| SUNB | - | (Pension plan assets - reported benefits) to permanent capitalization |
| TUNB | - | (Pension plan assets - accumulated benefits) to permanent capitalization |
| PUNB | | (Pension plan assets - projected benefits) to permanent capitalization |
| EUNB | - | (Pension plan assets - economic benefits) to permanent capitalization |

Table 4

DESCRIPTIVE STATISTICS

Sample Descriptives N=209

| Variable | Mean | Standard deviation | Minimum | Maximum | |
|---|---|---|---|---|---|
| DATE | | | 2/25/81 | 2/29/84 | |
| ISSUE SIZE | 84.4928 | 43.1312 | 10 | 250 | (Million $) |
| COUPON RATE | 14.7992 | 1.9368 | 10.875 | 18.75 | % |
| OFFERING YIELD | 14.8779 | 1.9467 | 10.95 | 18.75 | % |
| TREASURY YIELD | 12.5356 | 1.5238 | 9.45 | 15.78 | % |
| YEARS TO MATURITY | 20.7034 | 10.2304 | 5 | 33 | Years |
| PERIOD OF CALL OR REFUNDING PROTECTION | 5.2895 | 2.0331 | 0 | 30 | Years |

| | Number Coded 1 | Percent in Sample |
|---|---|---|
| NO CALL OR REFUND PROTECTION | 2 | 1.1% |
| CALL PROTECTION | 21 | 10.0% |
| REFUNDING PROTECTION | 186 | 88.9% |
| FIRST MORTGAGE | 201 | 96.2% |

Model Descriptives

| Variable | Mean | Standard Deviation | Minimum | Maximum | Number Coded 1 | Percent in Sample |
|---|---|---|---|---|---|---|
| Dependent Variable | | | | | | |
| DYIELD | 2.3422 | .8879 | .43 | 4.82 | | |
| Independent Variables | | | | | | |
| MATYR | 20.7034 | 10.2304 | 5 | 33 | | |
| SF | | | | | 87 | 41.63 |
| NUKE | | | | | 61 | 29.19 |
| DFYLD | -1.1539 | .6116 | -3.57 | 0 | | |
| MOOD | 74.8584 | 10.3838 | 62 | 100.1 | | |
| TYIELD | 12.5356 | 1.5238 | 9.45 | 15.78 | | |
| CONST | 29.2928 | 28.3328 | -96 | 132 | | |
| DE | 50.1239 | 5.3128 | 31.80 | 67 | | |
| PROP | 45.1029 | 5.7715 | 30.09 | 72.1 | | |
| ROE | .1274 | .0716 | .01 | .46 | | |
| COV | 2.6281 | .6269 | 1.63 | 4.77 | | |

Distribution of Sample Issues by Year

| Year | Number | Percent |
|---|---|---|
| 1981 | 69 | 33.0% |
| 1982 | 78 | 37.3% |
| 1983 | 57 | 27.3% |
| 1984 | 5 | 2.4% |

Table 5

REGRESSION RESULTS
N=209, Dependent variable - DYIELD

| Variable | Predicted sign | Reduced Model Control Model Coefficient | T Stat. | Prob. | Full Model Add Reported net pension asset (liability) Coefficient | T Stat. | Prob. | Full Model Add Accumulated net pension asset (liability) Coefficient | T Stat. | Prob. |
|---|---|---|---|---|---|---|---|---|---|---|
| Intercept | | 3.285 | 3.394 | <.001 | 3.213 | 3.396 | <.001 | 3.579 | 3.727 | <.001 |
| MATYR | + | .039 | 5.937 | <.001 | .039 | 6.129 | <.001 | .039 | 6.146 | <.001 |
| SF | + | .188 | 2.309 | .011 | .173 | 2.162 | .016 | .177 | 2.191 | .015 |
| NUKE | + | .218 | 2.294 | .011 | .189 | 2.024 | .022 | .217 | 2.312 | .011 |
| DFYLD | - | -.241 | -2.455 | .008 | -.232 | -2.422 | .008 | -.236 | -2.438 | .008 |
| MOOD | - | -.035 | -7.779 | <.001 | -.035 | -7.901 | <.001 | -.036 | -8.069 | <.001 |
| TYIELD | + | .176 | 4.999 | <.001 | .175 | 5.097 | <.001 | .173 | 4.981 | <.001 |
| CONST | - | -.009 | -4.875 | <.001 | -.008 | -4.689 | <.001 | -.008 | -4.331 | <.001 |
| DE | + | -.019 | -2.231 | .013 | -.012 | -1.406 | .081 | -.016 | -1.827 | .035 |
| PROP | + | .013 | 1.567 | .059 | .010 | 1.214 | .113 | .010 | 1.211 | .114 |
| ROE | + | .712 | 1.213 | .113 | .619 | 1.079 | .141 | .544 | .935 | .176 |
| COV | - | -.463 | -5.108 | <.001 | -.494 | -5.540 | <.001 | -.500 | -5.530 | <.001 |
| REPORTED NET PENSION ASSET (LIABILITY) | - | | | | -9.293 | -3.201 | <.001. | | | |
| ACCUMULATED NET PENSION ASSET (LIABILITY) | - | | | | | | | -7.206 | -2.626 | .009 |
| Adjusted R-Square | | 60.50 | | | 62.27 | | | 61.65 | | |
| F Statistic * | | | | | 10.248 | | | 6.894 | | |

* The F statistics are from general linear tests of differential explanatory power of the full models over the reduced model (without pension variables). F* at a significance level of .10 is approximately 2.75 for degrees of freedom (1, 196).

Table 5 - continued

| Variable | Predicted sign | Full Model Add Projected net pension asset (liability) Coefficient | T Stat. | Prob. | Full Model Add Economic net pension asset (liability) Coefficient | T Stat. | Prob. |
|---|---|---|---|---|---|---|---|
| Intercept | | 3.297 | 3.464 | <.001 | 3.141 | 3.263 | <.001 |
| MATYR | + | .040 | 6.181 | <.001 | .040 | 6.103 | <.001 |
| SF | + | .169 | 2.101 | .018 | .171 | 2.106 | .018 |
| NUKE | + | .188 | 1.991 | .024 | .180 | 1.876 | .031 |
| DFYLD | - | -.236 | -2.448 | .008 | -.240 | -2.468 | .007 |
| MOOD | - | -.036 | -8.044 | <.001 | -.035 | -7.900 | <.001 |
| TYIELD | + | .175 | 5.047 | <.001 | .178 | 5.101 | <.001 |
| CONST | - | -.008 | -4.858 | <.001 | -.009 | -5.089 | <.001 |
| DE | + | -.014 | -1.572 | .059 | -.015 | -1.712 | .044 |
| PROP | + | .011 | 1.255 | .106 | .012 | 1.371 | .086 |
| ROE | + | .657 | 1.138 | .128 | .744 | 1.278 | .101 |
| COV | - | -.489 | -5.462 | <.001 | -.476 | -5.279 | <.001 |
| PROJECTED NET PENSION ASSET (LIABILITY) | - | -7.794 | -2.784 | .003 | | | |
| ECONOMIC NET PENSION ASSET (LIABILITY) | - | | | | -4.866 | -2.049 | .021 |
| Adjusted R-Square | | 61.81 | | | 61.13 | | |
| F Statistic * | | 7.752 | | | 4.169 | | |

* The F statistics are from general linear tests of differential explanatory power of the full models over the reduced model (without pension variables). F* at a significance level of .10 is approximately 2.75 for degrees of freedom (1, 196).

Table 6

REGRESSION DIAGNOSTICS

CORRELATION BETWEEN PENSION VARIABLES AND OTHER INDEPENDENT VARIABLES
Pearson correlation coefficients -
* significant at .05 level

| | Reported net asset (liability) | Accumulated net asset (liability) | Projected net asset (liability) | Economic net asset (liability) |
|---|---|---|---|---|
| MAT | -.022 | .042 | .024 | .014 |
| SF | -.062 | -.072 | -.072 | -.064 |
| NUKE | -.119 | -.043 | -.132 | -.195* |
| DFYLD | .032 | -.026 | -.014 | -.021 |
| MOOD | .029 | -.015 | -.035 | -.063 |
| TYIELD | .027 | -.020 | .032 | .093 |
| CONST | .107 | .162* | .058 | -.034 |
| DE | .296* | .189* | .259* | .250* |
| PROP | .064 | .008 | .044 | .048 |
| ROE | .022 | -.042 | .022 | .060 |
| COV | -.117 | -.064 | -.109 | -.125 |
| MULTIPLE $R^2$** | .073 | .050 | .057 | .083 |

** Coefficient of determination between each pension variable and all other independent variables.

F STATISTICS - SINGLE ISSUE MODEL

| | Reported net asset (liability) | Accumulated net asset (liability) | Projected net asset (liability) | Economic net asset (liability) |
|---|---|---|---|---|
| One observation per issuer N=71 | 10.438 | 4.938 | 8.944 | 6.389 |

* The F statistics are from general linear tests of differential explanatory power of the full models over the reduced model (without pension variables). F* at a significance level of .10 is approximately 2.79 for (1,59).