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Choice of Pension Discount Rate in Financial Accounting and Stock Prices

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Abstract

Under present financial accounting standards, in Japan and in U.S., firms can choose pension discount rates, which they use for earnings measurement, at their discretion. First, this paper investigates, what factors affect their choice of pension discount rates. The sample firms in this paper reduced their discount rates, when market interest rate declined in 1990s, more slowly than the tendency in the market. We analyze the causes of this delay by logit model. Regression results show that, given declining interest rate, the significant factor affecting the firms' choice is not leverage, but profitability (return on equity: ROE). Second, this research investigates empirically how stock prices reflect the size of pension discount rate. Both unamortized pension obligations and pension expenses in the year are positively associated with stock prices. However, the coefficients for the firms, whose discount rates are higher than median, are smaller than those for the firms choosing lower rates. Those coefficients are not significantly different from zero. These results indicate that the firms, which chose lower pension discount rates, are valued higher. This asymmetric result is consistent with the first point in this paper, concerning the firms' motives for pension discount rate choice.

Key Words: pension accounting, discount rate, earnings response coefficients (ERC), capital market, Japan

1. Introduction

The accounting standard for a defined benefits pension plan was revised in Japan in 1998. By this revision, pension expenses will be measured by the method like as U.S. standard (*SFAS No.87*). The pension expenses in the year consists of two components. One is the allocated amount to each period, discounting future pension benefits by the discount rate that a firm chooses. Another is operating profits (and losses) from pension assets, and this is deducted from pension expenses. The actuarial method, which uses discount calculation in allocating future benefits to each fiscal year, is drawn neither deductively nor consistently from the existing body of accounting standards. Moreover, there is not theoretical necessity that it should be specified so. Although a slight difference in discount rate would change dramatically pension expenses and pension liabilities on the balance sheet, the accounting standard vaguely specifies the discount rate. That is, a firm can choose a discount rate arbitrarily, referring to the interest rate of a long-term government bond or a long-term superior corporate bond. At this point, there is no essential difference between the Japanese and the U.S. accounting standards.

Since discounting is neither intuitive nor natural, and not conceptually obvious, we cannot determine the pension discount rate uniquely. Nevertheless, firms can discretionally choose their pension discount rates. Under this condition, what criterion will firms base on in choosing discount rates? It is the first subject in this paper. Of course, even if firms chose pension discount rates for the purpose of earnings management, investors would not be misleaded systematically. If the capital market is efficient and investors are sophisticated, as far as pension discount rates are disclosed and the motives of earnings management are publicly known, investors could see through the manipulated numbers and evaluate the firms, assuming the possibility of earnings management. Then, the second and main subject in this paper is to confirm how firms' choice of pension discount rates is evaluated in the capital market. We investigate the relation between the size of pension discount rate and stock prices based on a fundamental-link model.

The sample in this study consists of 24 Japanese companies, which prepare the consolidated financial statements based on SEC rule and disclose them in Japan. The sample period starts in the 1990 fiscal year when the application of *SFAS No.87* started, and ends in the 1998 fiscal year (March, 1999). Since the size of sample is quite small, this empirical analysis may have serious restrictions. However, even in the U.S., only a few studies are directing its attention to the choice of pension discount rate, or its evaluation in the capital market. Therefore, even if the size of sample is small, the importance of analyzing for Japanese companies is by no means small.

This paper investigated, first, what factors affected their choice of pension discount rates. The sample firms reduced their discount rates, when market interest rate declined in 1990s, more slowly than the tendency in the market. We analyzed the causes of this delay by logit model. Regression results show that, given declining interest rate, the significant factor affecting the firms' choice was not leverage, but profitability (return on equity: ROE). Second, this research investigated empirically how stock prices reflect the size of pension discount rate. Both unamortized pension obligations and pension expenses in the year are positively associated with stock prices. However, the coefficients for the firms, whose discount rates are higher than median, are smaller than those for the firms choosing the lower rates. Those coefficients are not significantly different from zero. These results indicate that the firms, which chose lower pension discount rates, are valued higher. This asymmetric result is consistent with the first point in this paper, concerning the firms' motives for pension discount rate choice.

This paper is organized as follows. Section 2 describes current conditions in respect of discount rates in pension accounting and reviews related accounting literature to provide a context for our study and a basis for the empirical model we test. Section 3 analyzes the motives to choose a pension discount rate, using logit model. In Sections 4 and 5, we investigate how stock prices reflect the discount rate by OLS regression. In Section 4, the book value of equity model is examined. On the other hand, in Section 5, the earnings model is examined. Section 6 investigates the robustness of regression results in foregoing two Sections. Conclusions follow in Section 7.

2. Current Conditions and Prior Studies

2.1 U.S. SITUATIONS AND SITUATION IN JAPAN

The pension accounting standard prescribes that firms can choose pension discount rates with referring to a market interest rate. As for the reference rate, however, the accounting standard *SFAS No. 87* only illustrates two or more examples: a government bond rate, a superior corporate bond rate, and an official announcement rate of Pension Benefit Guaranty Corporation (PBGC). In choosing pension discount rates, some discretion is given to firms. According to AICPA's investigation, there is remarkable variation in discount rate among companies as shown in Panel A of Table 1. Although the range decreased in 1994 and afterwards, there will still be a difference by 2.5% between highest and lowest in 1996. Of course, if the kinds of market interest rate referred to differ, it is natural that discount rates differ, but the range of variation is not the question here.

In this period, what level were the market interest rates that the accounting standard

illustrates? CM10 in Panel B of Table 1 denotes the yield of the government bond for ten years, and CM30 is the yield of the government bond for 30 years. AAA denotes the yield of corporate bond of AAA rank by Moody's and AUTL is the yield of the public utility bond of A rank. Rate 1 in Panel C is the PBGC rate which calculates VBO (vested benefit obligations) of the pension plan, and Rate 2 is the liquidation rate by PBGC. When a firm stops a pension program and hands over pension obligations and pension assets to PBGC, Rate 2 said here will be used for calculation of pension obligations. Besides, the information on Rate 1 before 1987 has not come to hand.

At the time the interest rate declined in 1993, the pension discount rates were also reduced in response to it as presented in Panels A, B and C. It seems that, however, pension discount rates were downward rigid a little, and the reduction width in discount rate was smaller whereas various kinds of interest rates declined sharply. Although the same tendency as above was observed also in 1996, it is noticeable that the trend of liquidation rate of PBGC has deviated from the trend of bond interests. While the yield of the U.S. government bond declined 0.5% or more and reached 6% in 1996, the liquidation rate of PBGC rose 1.5% reversely in the meantime, and reached 8% in 1996. Thus, when the interest rate in bond market declined, neither cases where a firm did not reduce the pension discount rate, nor cases where a firm pulled up it on the contrary were against the accounting standard. The situation, which did not agree with common sense, has arisen.

On the other hand, how was the situation of Japanese firms? Table 2 is the situations of those companies prepare the consolidated financial statements based on U.S. SEC rules, and end fiscal year at March 31. In Japan, a contracted interest rate in pension plan has been fixed to 5.5% for many years by law. Although in financial accounting a firm can choose the different discount rate form the contracted rate, many firms have chosen 5.5% as a discount rate at the application start time of *SFAS No.87*. GBI in Table 2 is the yield of the government bond for ten years, and all numbers are results at the end of March (source from Bank of Japan). In Japan, since there is very little reliable data on a long-term interest rate, we will compare this yield with pension discount rates. The firms were reluctant to reduce discount rates, although a market interest rate declined in this period. After a long-term interest rate in the market declined considerably, the firms have reduced their discount rates at last.

Table 2 provides the evidence that, even as the interest rate declined, many firms hesitated to reduce discount rates. At this point, there is no essential difference between Japan and U.S. Since the present condition became clear, we need to examine why firms are unwilling to reduce discount rates. That is, the motive of a firm is the question. Furthermore, we need to examine how sock prices reflect the size of pension discount rate.

The purpose of this study is to examine above two subjects.

2.2 PRIOR STUDIES

In the earlier empirical study, analysis has been concentrated on the issue whether pension obligations on actuarial basis are the same obligations as usual (legal) ones, the issued corporate bond or the borrowing from bank, etc. For example, Martin and Henderson [1983], Maher [1987], Reiter [1991, 1992], and Maher and Ketz [1993] investigated the valuation of pension obligations in corporate bond market by analyzing bond ratings or bond premiums. Moreover, the influence that underfoundings (unfounded pension obligations) had on firm value has been also research subject. Feldstein and Seligman [1981], Livnat [1984], Dhaliwal [1986], Landsman [1986], Bulow, Mϕrck and Summers [1987], Kemp [1987], Gopalakrishnan and Sugrue [1990, 1992, 1993, 1995], and Barth [1991] analyzed the valuation of pension obligations on actuarial basis or the valuation of pension liabilities on accounting basis in the stock market. Furthermore, Barth, Beaver and Landsman [1992] investigated the relation between pension expenses and stock prices.

Among the studies analyzing the influence that pension obligations have on stock prices, there are a few studies that directed its attention especially to the variation in pension discount rate; Feldstein and Mϕrck [1983], Ippolito [1986], Reiter [1991], Gopalakrishnan and Sugrue [1990, 1992], and Kwon [1994]. In those studies, the "constructive pension obligations," which could be computed by using the average actuarial assumptions, was chosen as an independent variable. Those studies investigated whether investors would adjust the pension liability information on accounting basis in such a manner for firm valuation. However, why should investors use such a unique method? The adjusting method is not supported in theory yet.[1]

On the other hand, research on selection of accounting policy --- so-called positive accounting theory --- is another main research domain. By analyzing managers' interests prescribed by the contracts, the motives for accounting policy choice and their changes have been investigated in various phases. The debt covenants hypothesis, the managerial compensation hypothesis, and the regulation evasion hypothesis are the well-known behavioral hypotheses. Although there are not so many empirical studies focusing on the motives underlying pension discount rate choice, the following studies belong to the school of those research series. Ghicas [1990], Kwon [1994], and Godwin, Goldberg and Duchac [1996] are

[1] Francis and Reiter [1987] investigated the motive of pension founding policy by regression analysis that chose, as a dependent variable, the pension obligations standardized by the official announcement rate of PBGC. The problem remains on the choice of a dependent variable. And Thomas [1988] includes the same problem.

as such studies. In addition, Amir and Gordon [1996] analyzed the discount rate in measuring post retirement benefits other than pensions.[2]

In Ghicas [1990], the motives to change the calculation method of pension expenses, before *SFAS No.87* era, was analyzed by logit model. According to Ghicas [1990], the tendency was observed, that the firms whose profitability got worse changed the calculation method into the new one, which would cut down pension expenses, and chose higher pension discount rates and made pension obligations smaller nominally. However, many of independent variables in his research are the results (*ex post*) brought by changes in pension discount rate. The conditions (*ex ante*) at the time of decision-making whether to change are not chosen as independent variables. Therefore, in exploring the motives for changes in discount rate, his model has a miss-specification.

Kwon [1994] chose the discount rates the dependent variable, and analyzed the motives for discount rate choice by OLS regression. Independent variables are the size of total assets, the debt to equity ratio, the interest coverage ratio, the manager's stock holding ratio, and the founding ratio. After *SFAS No.87* era, the debt to equity ratio and the founding ratio were statistically significant. However, this research did not choose a market interest rate the independent variable, thus other conditions could not be sufficiently controlled. Since firms are obliged to choose pension discount rates with referring to a market interest rate by the accounting standard, a market interest rate should be chosen as an independent variable as a control factor in empirical study. Moreover, in Kwon [1994] it is ambiguous whether interest coverage ratio is a proxy for profitability or for financial condition. As a result, his conclusion is not clear.

On the other hand, Godwin, Goldberg and Duchac [1996] (GGD hereafter) chose six variables as the independent variables: the changes in market interest rate, the rate of return, the financial margin of funds for dividends, cash flows, the debt to equity ratio, the existence of corporate tax payments. The fact that the discount rate was not changed and the magnitude of the effect on earnings by the changes in discount rate were transformed into an order measure, and it was chosen as the dependent variable of Ordered Logit Regression. They reported that the rate of return, the financial margin of funds for dividends, the debt to equity

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[2] Francis [1987] analyzed the characteristics of the firms that lobbied against the proposal of new pension accounting standard in 1982. Stone and Ingram [1988], Sami and Lipka [1989], Senteney and Strawser [1990], Scott [1991], Ali and Kumar [1993, 1994], Brozovsky, Murray and Selto [1993], Harper and Strawser [1993], Langer and Lev [1993], and Espahbodi and Hamer [1996] analyzed the relation between the starting year of application of *SFAS No.87* and the firm characteristics. The case where the firms can choose the application starting time of a new accounting standard is the situation that flexibility is high, in the meaning that past selection is not restrained, compared with the case where the firm would change the once adopted discount rate. Therefore, it is a suitable material to investigate the incentives of the firm. Besides, there are studies treating the change of actuarial assumptions, for example, Morris and Nichols [1984], Rollins [1993], and Blankley and Swanson [1995].

ratio, and the existence of corporate tax payments were significant. Although the official announcement rate of PBGC was chosen as a market interest rate, it is reported that changes in interest rate was not significant statistically. However, the market interest rates, such as a government bond yield, are not included in independent variables. Therefore, this research does not necessarily show whether firms had completely ignored the market interest rate movement when they chose pension discount rates.

The independent variables, which GGD chose, consisted of not only what was given (*ex ante*) in choosing a discount rate, but also the variable realized as a result (*ex post*). The problem exists in the choice of independent variables. Moreover, the dependent variable GGD chose was, not the discount rates, but the effect brought by the choice of discount rate. Therefore, GGD has not clarified the motives to choose the discount rate. In order to analyze the motives, we need to choose the firms' choice itself the dependent variable and choose the variables, which firms would face and took into consideration in choosing discount rates, as the independent variables. We will pay careful attention to this point in Section 3.

Amir and Gordon [1996] (AG hereafter), although it is treating post retirement benefits other than pensions (*SFAS No.106*), analyzed the motives to choose two factors, the increasing rate of benefits and the discount rate. AG applied OLS regression, transforming the combination of two factors into the standardized present value of obligations, and chose this present value the dependent variable. In their result, only the debt to equity ratio was significant. However, there is no theoretical conclusive method for standardizing pension obligations. Moreover, the nominal measure, which the combinations of firm size (total amount of market value of equity) and price-earnings ratio (PER) were transformed into, was chosen as the independent variable. The experiential meaning of this variable is very questionable. Consequently, in AG, it is not clear what hypothesis they assumed.

Furthermore, in AG, the "constructive benefit obligations" of each firm was computed by the median of increasing rate of benefits and the median of discount rates in the sample. Using stock prices as the dependent variable and using the estimated constructive obligations as an independent variable, AG analyzed whether investors would correct and value the reported benefit obligations. However, the meaningful result was not obtained. Two issues are included in this kind of research. The first issue on the correction method was explained earlier. The second issue is the stock valuation model. The causal relation between the amount of benefits and stock prices was not sufficiently discussed in AG.

In this paper, we emphasize and reconfirm the traditional paradigm in accounting theory: earnings information in financial accounting would be used for the prediction of future cash flows by investors, and investors would translate it into the present value using the cost of

capital and then use it for firm valuation. Considering this paradigm, in this paper, we will build a simple model and use it consistently as a framework. Based on it, this paper examines how investors value the pension discount rates chosen by firms. This paper focuses especially on the foundation of stock valuation model, i.e. the theoretical relation (fundamental -link) between accounting information and stock prices. Unlike precedence studies, we place heavy weight on fundamentals in this paper, and pay careful attention to transposing the theoretical relation to a linear regression model. It is expected by doing so that a more precious result will be obtained rather than choosing the assets and liabilities on the balance sheet as independent variables arbitrarily.

3. Motives for Pension Discount Rate Choice

3.1 SAMPLES AND DATA

A firm can choose a pension discount rate, used when calculating pension obligations (projected benefit obligations: PBO) and pension expenses, at the firm's discretion, as already mentioned. This paper does not investigate how the level of a discount rate is decided, but what criterion firms base on when they change their discount rates. Sample consists of 24 Japanese companies, which are preparing the consolidated financial statements with the application of SEC standards in Japan. They adopted *SFAS No.87* from 1990.[3] The firms that did not disclose pension discount rates continuously were eliminated. In addition, the first application year of *SFAS No.87*, and the irregular fiscal year in which the accounting period was changed were eliminated. Finally, the total sample is 199 firm-years from February 1990 to March 1999. We will test this sample throughout this paper.

All accounting data was hand-collected from the financial statements in legal form (YOUKASHOUKEN-HOUKOKUSYO-SOURAN), and pension-related data was taken out from the footnotes in financial statements. Since the amount of pension expenses in the year is not clear in the main part of financial statements, it is assumed that the disclosed amount in footnote would be the pension expenses in the year.

3.2 EFFECTS BY REDUCTION OF DISCOUNT RATE

A firm would choose a pension discount rate, after considering the effect on accounting numbers. In general, a firm compares the situation where the discount rate would be changed and the situation not changed, and will choose the more favorable one. If so, the question on the motives for discount rate choice would be explained only after clarifying the anticipated

[3] However, three companies have applied *SFAS No.87* from 1991.

unfavorable influences. Since the observable phenomena actually are the results and the effects that the firm permitted, it is difficult to guess, from the realized accounting numbers, the anticipated unfavorable influences that were avoided in fact. However, it will be still useful to confirm the effects *ex post* by the reduction of discount rate, before solving the motives.

In this paper, we compared the various kinds of fundamental financial ratios from two angles. One is the comparison between the preceding years and the changed years of the firms that reduced their discount rates. Another is the comparison, in the pooled data, between the firm-years that changed discount rates and the firm-years not changed. The compared financial ratios are divided roughly into three groups, group I is debt concern, group II is earnings concern, and group III is cash flows concern. The debt-related ratios are (1) long-term debt (including pension liabilities) to equity (net-assets) ratio, (2) total debt (including pension liabilities) to equity ratio, (3) pension liabilities to equity ratio, (4) off-balanced pension obligations to equity ratio. Earnings-related ratios are (5) net income to equity ratio, (6) earnings before interests and taxes (EBIT) to equity ratio, (7) pension expenses to EBIT ratio, and (8) EBIT to interest payments ratio. Cash flows-related ratios are (9) cash flows form operating activities to equity in the previous year ratio, (10) cash flows form investing activities to equity in the previous year ratio.

Table 3 summarizes the results by comparative analyses. Panel A is the results when comparing the financial ratios in the preceding year with those in the changed year when firms reduced discount rates. The *Z* value in the right end column is Wilcoxon's statistics of signed rank sum test (***p***-value in parenthesis). Only two variables, (3) pension liabilities to equity ratio and (4) off-balanced pension obligations to equity ratio, show the statistically significant change. Although pension liabilities and pension obligations increase when the pension discount rates decrease, the financial condition and profitability of the firms are not getting worse significantly. However, this result does not necessarily suggest that the reduction of discount rate generally has only small effect on accounting numbers. Possibly the firms, which reduced discount rates, might have taken in advance the protective actions so that each ratio would not be worse.

Panel B is the results when comparing the firm-years that reduced discount rates with the firm-years not reduced. The *Z* value in the right end column is the statistics of Mann-Whitney's U test (***p***-value in the parenthesis). The cash flows (index (9)) from operating activities in the firm-years, which reduced discount rates, were more plentiful. This suggests that the firms reduced discount rates when their profitability was good. However, partly because the pension expenses increases as discount rates decrease, the good performance at the

time may not be appearing in earnings (index (5)).

On the other hand, it seems that the reduction of discount rate was unrelated to the level of debt to equity ratio. Although the reduction brings a steep increase in pension obligations (indices (3) and (4) in Panels A and B), its effect on leverage is small (indices (1) and (2) in Panel A). Moreover, it seems that there is no causal relation between the debt to equity ratio and the reduction of discount rate (indices (1) and (2) in Panel B). Public media in Japan are reporting pessimistically, the expected situation at the start time of new pension accounting standard, especially the effect, which pension liabilities will have on the financial condition of the firm. However, in the phase of the change of discount rate, as above-mentioned analysis results show, the issues on financial conditions seem to be not relevant questions. We need to examine what condition firms are considering when they change their pension discount rates. We will proceed to this subject in the next clause.

3.3 LOGIT MODEL

If a firm follows the pension accounting standard mechanically, when a market interest rate declines, according to it, the firm should reduce the pension discount rate quickly. However, the kind of reference rate is not defined uniquely, thus the firm's discretion in choosing the discount rate is allowed in the accounting standard. In addition, firms should *not necessarily* refer to the interest rate of the same kind every year.[4] Therefore, it is also possible for a firm *not* to reduce the pension discount rate, even if various kinds of market interest rates decline, excusing that the firm has changed the reference rate to the higher one.

Probably, it may be a superior plan that a firm does not reduce the discount rate at discretion, even if a market interest rate would decline, because both pension expenses and pension liabilities would increase when a discount rate would decreases. However, firms may reduce pension discount rates inevitably, if the difference between the market interest rate and the pension discount rate exceeds a certain threshold. If a firm does not reduce the discount rate, only considering accounting performance even when a market interest rate declines, those cosmetic activities may be negatively valued and the firm value may decrease in the capital market. If the market discipline would function, no firm may have unrestricted freedom in choosing the discount rate.

When analyzing the factors affecting the binary choice, the logit model is used in many cases.[5] Logit model analysis is the method of estimating the coefficients on a factor by the

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[4] In pension accounting standard, a firm is not obliged to disclose the kind of market interest rate that it refer.

[5] Maddala [1991], Stone and Rasp [1991], Kennedy [1992], and Barniv and McDonald [1999] explain the application and its controversial point of the logit model in accounting research.

maximum-likelihood estimation, assigning a discrete nominal measure to the choice of a firm, and using as a dependent variable the ratio of the probability in which each choice occurs (Log Odds Ratio, *LR*). In this paper, the firm-years that did not reduce pension discount rates are set to 0 (*N*= 121), the firm-years that reduced discount rates 0.5% or less in a fiscal year are set to 1 (*N*= 52), and the firm-years that reduced discount rates more than 0.5% in a fiscal year are set to 2 (*N*= 26). The reason for setting 0.5% as the boundary line is that 0.5% is the median and the mode of reduction width.

In our logit analysis, the following model is estimated:

$$LR = \alpha + \beta_1 \Delta Interest + \beta_2 Leverage + \beta_3 Profitability + u \quad (1)$$

where $\Delta Interest$ is changes in market interest rate in the year. From a definition of the dependent variable above-mentioned, if the declined size of market interest rate is larger and a firm reduces the discount rate so more greatly, then β_1 will be negative. In addition, if a firm chooses the pension discount rate only in consideration of the market interest rate principally, and the firm is not taking into consideration at all the effects, which changes in discount rate has on accounting numbers, then both β_2 and β_3 in equation (1) will be zero. Therefore, the following hypothesis can be assumed.

H_1 A firm chooses a pension discount rate only in consideration of the changes in market interest rate. When the market interest rate declines, a firm reduces the pension discount rate according to it. $(\beta_1 < 0,\ \beta_2 = \beta_3 = 0)$

On the other hand, in the research domain concerning the accounting policy, two hypotheses, which are not mutually exclusive, have been discussed and examined repeatedly. One hypothesis is that firms avoid the state that worsens the debt to equity ratio (leverage). In many cases, maintaining the debt to equity ratio imposed under debt covenants is seemed as an important incentive. If the restrictive financial covenant is broken, the cost of capital will rise in the future. Then, in order to make the possibility of technical default lower and to make the cost of capital lower, firms avoid the actions that would raise the debt to equity ratio. Another hypothesis is that firms act in order to increase earnings or raise the rate of return on equity. As for the direct motive, the managerial compensation plan linked with accounting earnings has often been studied. Moreover, maintaining the retained earnings for smoothing the dividends is said as an indirect motive. Of course, existence of the restrictive financial covenant above-mentioned may also serve as the motive for nominal increase in earnings.

However, our research does not specify the motives of firms any more. The reason for adopting this research plan is that the main status was not yet given in disclosure system to the consolidated financial statements in this sample period. Thus, it is not clear how the consolidated financial statements were used in a private contract. Below, this study concentrates on presuming the motives of a firm in the dimension of accounting indices principally, not directly specifying the motives. We examine in this paper whether firms has chosen their discount rates in consideration of either leverage or profitability. Specifically, we will examine the following two hypotheses that are not mutually exclusive.

H_{2a} The firm whose debt to equity ratio is relatively high does *not* reduce the discount rate, in order to avoid the much more deterioration. Conversely, the firm whose debt to equity ratio is low reduces the discount rate without considering it. ($\beta_2 < 0$)

H_{2b} The firm whose profitability (return on equity; ROE) is relatively low does *not* reduce the discount rate, in order to avoid the much more deterioration. Conversely, the firm whose profitability is high reduces the discount rate without considering it. ($\beta_3 > 0$)

Besides, in order to reserve the cash that a firm can use for business and maintain the pension-founding ratio, when cash flows in the year are not plentiful, the firm may not reduce the discount rate as to control the level of pension obligations. On the contrary, if cash flows are so plentiful that a firm can increase the pension contribution corresponding to the increase in pension obligations, the firm can reduce the pension discount rate. To test this cash reservation hypothesis, it is necessary to know the amount of contribution to the pension fund each year. However, before 1997, they were not disclosed. Therefore, we cannot test this hypothesis in our sample period. We concentrate on examining above three hypotheses.

3.4 DEFINITION OF INDEPENDENT VARIABLES

First issue is what kind of rate we should adopt as a market interest rate in the above-shown equation (1). In general, which market interest rate that firms would refer to in choosing pension discount rates? In financial accounting theory, the answer is not obvious yet. Moreover, in Japan, the interest rate of various kinds is used as an index for a long-term interest rate in the field of empirical research. In this paper, we chose the yield of the government bond for ten years that are traded most actively as the proxy for a market interest rate. Data was hand-collected from *Financial and Economic Statistics Monthly* issued by

Institute for Monetary and Economic Studies, Bank of Japan.

The following ratios are used in this paper as the debt to equity ratio. The numerator is three variables respectively, short-term debt (*SL*), long-term debt (*not* including pension liabilities) (*LL*), and the sum totals of *SL* and *LL* (*TL*). The deflator is the "adjusted equity," which we will explain later in more detail. The numerator of profitability index is earnings (net income) computed as if there has been no pension expenses (*ADJNI*), EBIT computed as if there has been no pension expenses (*ADJEBIT*), and other earnings (*OTHER*), respectively. The deflator is the "adjusted equity." All variables other than *OTHER* are defined as positive value. As for *OTHER*, profits and gains are defined as positive value and expenses and losses are defined as negative value. Earnings on "as if" basis is computed in consideration of tax effect, assuming that an effective tax rate is 50%. The "adjusted equity" here is the equity computed as if there has been no pension expenses in the year and the other comprehensive income has not been gained in the year.[6] In short, all independent variables are created, not by the numbers influenced by choice of discount rate, but by the numbers given at the time when firms chose their discount rates.

The descriptive statistics of each variable are summarized in Panel A of Table 4, and the correlation coefficients are summarized in Panel B. Although the correlation between *ADJEBIT* and *OTHER* is high, since these are obtained by dividing net income linearly, we will put them together into regression. However, cautions are required for the high correlation between the debts and *OTHER*. The high correlation may be caused by the fact that interest payments are included in *OTHER*. We should judge carefully whether the result is stable, since there is a doubt of multicolinearlity.

3.5 ANALYSIS RESULTS

The coefficients of the firm-years that reduced discount rates 0.5% or less are presented in Panel A1 of Table 5 and the coefficients of the firm-years that reduced discount rates more than 0.5% are presented in Panel A2. Both are estimated at the same time by logit regression. *GBI* in the table is the absolute level (%) of government bond yield at end-of-year, and ΔGBI is its change in the year.

As shown in Panels A1 and A2, the coefficient on ΔGBI is not statistically significant. It is hard to say that the firms reduced pension discount rates with following the decline of market interest rate in the year. The hitting ratio (percentage of correct estimation) when the model predicting the state 1 is at most about 30%. On the other hand, the coefficient on *GBI*

[6] The "other comprehensive income" here is only the part of the "minimum pension liabilities". The holding gains and losses of securities (available for sale) and the foreign currency translation adjustment account are as it is.

is statistically significant at 1%, and the hitting ratio is about 79%. It seems that the firms had chosen their discount rates in consideration of only market interest level, not the change in interest rate, especially in the cases where the discount rates were reduced more than 0.5% at once. The result suggests that after the market interest rate had declined considerably, the firms reduced pension discount rates reluctantly. Since the firms reacted the interest rate movement in the market neither mechanically nor timely, the hypothesis H_1 is not supported.

When the debt to equity ratio together with *ADJEBIT* and *OTHER* is included in independent variables, since the correlation coefficients between the debt to equity ratio and *OTHER* were quite high, the regression result is quite unstable. Although there are a few cases in which significant results were obtained ((7), (9) and (11) in Panel A1), in those cases, the sign of coefficients is contrary to predicted in hypothesis H_{2a}. Generally, the hypothesis H_{2a} is not supported. The firms, when the debt to equity ratio was high, did not reduce their discount rates not to worsen leverage. The firms might have reduced discount rates regardless of the debt to equity ratio.[7]

In contrast, in many cases, the coefficients on the rate of return on equity are significant and the sign is the same as predicted in hypothesis H_{2b}. As for profitability, the predicted results are observed significantly at 5% ((4) and (6) in Panel A1). When EBIT and others are separated, the significant results are obtained at 5% level ((7), (9), (10) and (11) in Panel A1). These results are supporting hypothesis H_{2b}. That is, while the firms did not reduce discount rates when the rate of return on equity was low, they had reduced discount rates when it was high. These results indicate that firms had chosen pension discount rates, attaching greater importance to the rate of return on equity more than to the debt to equity ratio.

However, we can say that firms chose discount rates in consideration of the rate of return on equity only if we compare the firm-years where the discount rates were not reduced with the firm-years reduced 0.5% or less. As shown in the column of *Fitness*, it seems that analysis by logit model was not necessarily successful. Then, we assigned measure 1 to the firm-years where the discount rates were reduced and measure 0 to the firm-years not reduced, and we tried the logit regression once again. The results (not reported here) did not differ from those in Panel A2 of Table 5. The firm-years that have reduced discount rates more than 0.5% at a stretch might be quite noisy samples.

Thus, we eliminated the firm-years that have reduced discount rates more than 0.5% and tried logit analysis again. The result is Panel B of Table 5. In order to concentrate on verification of hypothesis H_{2a} and H_{2b}, it shows only the results, choosing the level of market

[7] Even if the pension liabilities at the end of the previous year was chosen as the independent variable, the result was unaffected.

interest rate as the independent variable.[8] First, it turns out that limitation of a sample has contributed to the rise of the fitness greatly. Second, the results reject hypothesis H_{2a} and supports hypothesis H_{2b} here too. In sum, the firms reduced pension discount rates, considering the rate of return on equity instead of the debt to equity ratio.

We can get from above results the answer to the issue on fundamental concept. It seems an error to see that choosing a pension discount rate is an issue of valuing pension liabilities on the balance sheet from asset-liability view. From the traditional matching concept or revenue-expensive view, choosing a pension discount rate is just the issue on income measurement, including the method of making the discount rate zero --- the method of allocation *without* discounting. In fact, the firms had chosen the allocation pattern that could avoid a sharp decline of profitability through manipulating pension discount rates. However, as mentioned earlier, by the research design in this paper, we cannot clarify the contents of motives why firms think profitability as important. An investigation of economic incentives is the subject left behind to future research.

4. Evaluation in the Capital Market --- Part One: Book Value of Equity Model

4.1 CONTROVERSIAL POINTS OF PRIOR STUDIES

In many prior studies, it has been often discussed whether pension liabilities on the balance sheet is negatively associated with firm value, assuming that the assets and liabilities on the balance sheet is the proxy for economic worth of capital stock of a firm. We should check the controversial point that prior discussion holds, before explaining the model we test.

Suppose, the total amount of market value of common equity at the end of year *t* is MVE_t, and the firm value (total worth of the invested projects in the firm) is V_t, and the total amount of market value of the debt D_t. The relation among these three variables in the following equation is well known.

$$V_t = D_t + MVE_t \tag{2}$$

In the prior research, it is assumed that the firm value V_t can be expressed using assets value A_t in accounting, and in the same manner, the aggregated market value of debt D_t can be expressed using debt value L_t in accounting. Specifically, we can express exclusively each relation as follows.

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[8] The hitting ratio was about 35%, when the change in interest rate was chosen as an independent variable, and when the level of the interest rate was chosen as an independent variable, it was about 77%.

$$V_t = \alpha + \beta A_t \qquad (\beta > 0) \tag{3}$$

$$D_t = \alpha' + \beta' L_t \qquad (\beta' > 0) \tag{4}$$

If these equations (3) and (4) are substituted for equation (2), we can get the following equation.

$$MVE_t = (\alpha - \alpha') + \beta A_t - \beta' L_t \tag{5}$$

It has been investigated based on this equation (5) whether the coefficient on debt L_t is negative. In this way, if the coefficient on pension liabilities on accounting basis is negative, some researchers assume that investors would regard pension liabilities and other debts (legal obligations) in the same rank, and investors would negatively value pension liabilities on accounting basis for firm valuation.

However, the valuation models like as equations (3) and (4) are very questionable conceptually. The first controversial point is here. Suppose the following equations in the form that is more general.

$$V_t = a + bA_t + cL_t \tag{3'}$$

$$D_t = a' + b'A_t + c'L_t \tag{4'}$$

If above two equations are true, then equation (5) should be transformed as follows.

$$MVE_t = (a - a') + (b - b')A_t + (c - c')L_t \tag{5'}$$

At this time, there is nothing to be able to say beforehand with regard to the sign and size of coefficient on accounting debt L_t. It is obvious that the hypothesis of (5') is so-called joint hypothesis of (3') and (4').

Since the assets value in accounting generally is not equal to the capitalized worth of future cash flows, it is an error to assume that $b - b' = 1$ in equation (5'). At the same time, since debt is not usually valued by fair values in financial accounting, it is also an error to assume that $c - c' = -1$.[9] Originally, income measurement is the main object in financial accounting; therefore, the amount of assets and liabilities is not necessarily determined based

[9] However, when the great portion of assets and liabilities consist of the so-called financial instruments and the goodwill of a firm can be ignored statistically (for example, a part of financial industry), analysis by equation (5') may have some validity.

on economic worth statically. Both assets and liabilities are just the dynamic results by income measurement, and investors would use the disclosed *earnings* information for firm valuation. The model, which connects the assets and liabilities on the balance sheet to the firm value directly, does not have the conceptual and theoretical background based on the traditional paradigm, because it ignores the goodwill that is the source of future excess earnings.

Nevertheless, in the prior research, equation (5) is handled more intricately. The assets and liabilities are usually divided into some blocks. Here, we will divide into two parts, 1 and 2, for convenience. Then equation (5) is rewritten into the following equation (6).

$$MVE_t = (\alpha - \alpha') + (\beta_1 A_{1t} - \beta_1' L_{1t}) + (\beta_2 A_{2t} - \beta_2' L_{2t}) \tag{6}$$

Suppose that in part 1, net debt $NL_{1t} (= L_{1t} - A_{1t} > 0)$ is calculated on accounting basis, while net-assets $NA_{2t} (= A_{2t} - L_{2t} > 0)$ is calculated on accounting basis in part 2. The main purpose for condensing into net amount by each part is to avoid the problem of multicolinearlity in regression analysis. By these arrangements, equation (6) is further transformed into the following strange equation (7).

$$MVE_t = \gamma_0 + \gamma_1 NL_{1t} + \gamma_2 NA_{2t} \tag{7}$$

Typically, pension liabilities on the balance sheet would be substituted for the net debt NL_{1t}, the book value of other net-assets will be substituted for NA_{2t}, then it has been tested whether the coefficient γ_1 on pension liabilities is negative or not.[10]

The second controversial point exists here and it is comparatively clear. The question is how the projects in the firm can be divided *linearly* like equation (6). Consider a firm has two investment projects; one is the *financial* investment (investment of free cash) and the other is *business* investment. Since two projects are independent (separable) mutually, when valuing the firm, what is necessary is just to evaluate two projects independently and to sum them simply. However, the contribution to the pension fund and the investment in pension assets are, for a firm, not a pure financial investment. Pension contributions and pension investments are connected with two or more business investments closely indivisible; thus, we cannot linearly divide into pension liabilities and other net-assets. In addition, if net worth (present value) of a certain investment project is negative, there is primarily no economic

[10] For example, Landsman [1986], Barth [1991], Gopalakrishnan and Sugrue [1993, 1995].

rationality to continue it. Therefore, to assume that the coefficient on any project in equation (7) will be negative lacks economic rationality. There remains a serious problem in discussing the obligation nature of pension liabilities on accounting basis by testing the sign of coefficients in equation (7). It is important to note the linearity and economic rationality of the regression model.

4.2 HYOPOTHESES AND MODEL

Many of prior studies have not necessarily placed enough weight on the economical meaning of above-mentioned traditional paradigm, but built regression models rather easily, and the prior studies have directed attention only to statistical interpretations of regression results. If empirical analysis would be attempted without conceptual background, common work with theoretical and empirical study would not be attained. From such a viewpoint, Ohlson [1995] model attracts great concern in recent years. Ohlson divided the stream of accounting earnings into normal earnings and excess earnings, and he noticed especially that the former could be expressed as a function of the book value of equity. Moreover, giving the proof that the cash flow discount model, the dividend discount model, and the excess earnings (residual income) discount model are equivalent, Ohlson formulated the firm valuation model using the book value of equity.[11]

This paper builds a regression model by referring to the essence of Ohlson model. First, we begin with the discount model of permanent earnings. Permanent earnings is defined as the constant earnings that a firm could produce perpetually. Below, we denote it as π_p. It is assumed in the traditional paradigm that investors will predict permanent earnings from accounting information disclosed every year and evaluate common equity, discounting permanent earnings by the cost of capital *r*. Thus, the following equation (8) can be assumed.

$$MVE_t = \frac{E_t(\pi_p)}{r} \tag{8}$$

The cost of capital *r* is given and not the question here.

Second, we assume the relation between permanent earnings and the book value of Equity. According to Ohlson, normal earnings is equal to the product of the book value of equity and the cost of capital. If an assumption analogous to it is applied here, we can express permanent earnings as follows:

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[11] See Ohlson [1995], Feltham and Ohlson [1995], Penman [1998], Penman and Sugiannis [1998].

$$E_t(\pi_p) = r \cdot BVE^* \tag{9}$$

where BVE^* is the expected capital stock that could produce permanent earnings by annual rate *r*. This capital stock BVE^* does not always agree with the actual book value of equity BVE_t. The actual book value of equity could be influenced by various accounting allocation methods of cash flows and managerial assumption and discretion. Then a certain kind of noise is included in actual book value. Therefore, when investors actually use accounting information, they would assume in the following form.

$$BVE^* = a + bBVE_t \tag{10}$$

Third, we formulate the regression model. If above equation (10) is substituted for equation (9) and is further substituted for equation (8), the following equation (11) will be obtained.

$$MVE_t = \frac{1}{r} \cdot r(a + bBVE_t) = a + bBVE_t \tag{11}$$

This equation (11) is the foundation of the model in this paper. It is important to note that coefficient *b* on the book value of equity is independently determined from the size of the cost of capital *r* here. Coefficient *b* implies the ratio of the capital stock, which is expected to produce permanent earnings, to the actual book value of equity. Of course, in the state where a firm always produces earnings equal to the multiplied amount of the book value of equity by the cost of capital, neither the noise nor the deviation of book value exists and so the coefficient *b* will be one. However, there is no guarantee that the regression coefficient will be one, actually. The coefficient may exceeds one or not, so both cases cannot be logically denied either. [12]

Finally, we introduce the target variable related with pension accounting into equation (11). Since *unamortized* pension obligations UPO_t is potentially the adjusting item to the book value of equity, it can be included in equation (11). Then, we can estimate the following regression model.

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[12] One of the reasons is because the goodwill exists in business investment of the firm and excess earnings will be produced.

$$MVE_t = \alpha + \beta_1 BVE_t + \beta_2 UPO_t + u \quad (12)$$

It is important point that the linear relation assumption that $\beta_2 = -\beta_1$ is not rejected formally here as a calculation rule. If all pension obligations were amortized at once, the book value of equity would decrease necessarily as much amount as UPO_t additionally. However, we do not suppose that a firm should amortize pension obligations quickly as soon as possible; because it is repeatedly confirmed in empirical studies that leveling-amortization (smoothing) is generally useful for investors to predict future cash flows. Rather, on the assumption that UPO_t will not be amortized at once, this paper investigates the difference in the information contents between the book value of equity and unamortized pension obligations.

In this paper, while unamortized pension obligations is chosen as the independent variable, the total amounts of pension obligations, the underfoundings amount, and pension liabilities on the balance sheet are all *not* chosen as independent variables. It is the distinctive point where this model differs from that of the prior study. As mentioned above, the basic structure of accounting gives the basis for the linear combination in equation (12). On the contrary, neither the total amount of pension obligations nor pension liabilities on the balance sheet can be included in independent variables of a linear regression model like equation (12). There is no necessity that it will be a linear model when they and the book value of equity are at the same time included in independent variables. If they are the same as that of legal obligations, such as borrowing, it is still more so as explained earlier. In this way, the greatest feature of our model is the point of including only unamortized pension obligations.

Next, let us consider the sign of coefficient β_2 on unamortized pension obligations UPO_t in equation (12). It is a wrong expectation that the sign will be negative only by the reason that the payments would occur in the future. From the premise of our model, the sign would be determined depending on the relation between UPO_t and permanent earnings. Originally, pension obligations has two aspects. One is the unpaid wages for labor services consumed *in the past*, so this aspect has no relation with *future* permanent earnings. Another is the incentive cost for buttonholing the competent employee to the firm and pulling out much more ability. The latter is an investment in human resources that is usually off-balanced in financial accounting, and it will be reasonable to suppose that cash inflows will exceed the investment. This aspect may have the meaningful relation with permanent earnings. Therefore, the coefficient β_2 will be positive.

H_{3a} When stock price is chosen as a dependent variable and the book value of equity and unamortized pension obligations are chosen as independent variables, the latter

coefficient will *not* be negative. ($\beta_2 \geq 0$)

Unamortized pension obligations can be divided into two elements. The first element is the off-balanced obligations as follows.

Off-balanced net obligations = Pension obligations (PBO) － Fair value of pension assets
－ Pension liabilities on the balance sheet

We denote these off-balanced net obligations as *OFF* hereafter. The second element is the unamortized obligations included in pension liabilities on the balance sheet. Below, we denote this second element as *MIN*.[13] Furthermore, we divide this *MIN* into the part treated as a deduction item (other comprehensive income) from equity *OCI*, and the part treated as the intangible asset *ITG*.[14] In this Section, all of the variables of pension obligations are defined as positive variables.

We estimate the following regression model and expect the sign of coefficients as shown in parenthesis.

$$\frac{P_t}{P_{t-1}} = \alpha + \beta_1 \frac{BVE_t}{P_{t-1}} + \beta_2 \frac{MIN_t}{P_{t-1}} + \beta_3 \frac{OFF_t}{P_{t-1}} + u \qquad (\beta_1 > 0, \beta_2 \geq 0, \beta_3 \geq 0) \tag{13}$$

Here, P_t is stock price at the end of year *t*. In this paper, the stock price at the time of an official announcement of accounting information is not chosen as the dependent variable. Indeed, the stock price at the time of accounting information disclosed can be a candidate for a dependent variable. However, when accounting information is officially announced in media, not only the accounting performance but also the dividend policy and the performance prospect by managers are released often at the same time. Therefore, it is not easy to control the effect which information other than accounting performance has on stock prices, and how to choose the stock price at which time as a dependent variable is not conclusive theoretically. Then, according to the convention in precedence study, this study also chooses the year-end stock price the dependent variable.[15] Besides, we collected stock price data from Nikkei NEEDS.

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[13] This is the on-balanced amount of the "minimum pension liabilities" forced by *SFAS No.87*. This compulsive regulation does not exist in Japanese accounting standard.

[14] Both part of the intangible assets as prior service costs and the deferred income taxes originated from *OCI* are included in *ITG*.

[15] Although it is not as sensitive a problem as the so-called event study, also in ERC study, the time of a stock price level and the selection of the calculation period (window) of a return, which are chosen as the dependent variable, are one point at issue.

The next subject is the relation between pension discount rates and stock prices. As confirmed in Section 3, though discount rates followed the decline of market interest rate, firms have chosen discount rates so that the fall of profitability (ROE) might be avoided. However, other things being equal, making unamortized pension obligations smaller only on appearance by using higher discount rates should lower the firm value. If investors observed those behaviors, investors might suspect that the firm's profitability would decline. In such a case, investors would expect that the investment in human resources would produce smaller future cash flows. Therefore, the following hypothesis can be assumed.

H_{3b} When stock price is chosen as a dependent variable and the book value of equity and unamortized pension obligations are chosen as independent variables, the latter coefficient for the firms, whose pension discount rates are higher, is smaller.

When applying regression analysis, after correcting all variables to the number per share, we deflated all variables by stock price at the beginning of the year except for a constant term. The purpose of this deflation is for relieving the heteroscedasticity resulting from size. Of course, although there is no necessity to choose deflator the stock price at the beginning of the year, the purpose of the choice is just to contrast with the earnings discount model, which we will explain in the next Section.

4.3 ANALYSIS RESULTS

The descriptive statistics of each variables (Panel A) and the correlation coefficients between variables (Panel B) are presented in Table 6. Since the variables *MIN*, *OCI*, and *ITG* relevant to the "minimum pension liabilities" by *SFAS No. 87* are produced only when pension discount rates are reduced and the underfoundings on accounting exceeds a threshold, those distributions are skewed and all have a large variance compared with a small mean. In addition, since the correlation between *OCI* and *ITG* is very strong, if they are included in independent variables, the problem of multicolinearlity will occur. However, since the information contents of *OCI* and *ITG* are not directly related to the main subject in this study, below this paper does not pry into the point any more.

The basic results by OLS regression analysis are shown in columns (1) to (5) of Table 7. These results show that no significant relation exists statistically between each unamortized pension obligations and stock prices. However, as presented in columns (6), (7), and (8), when on-balanced pension obligations (pension liabilities) and off-balanced pension obligations are included in independent variables, the former coefficient is negative and the

latter is positive and all are significant at 5%. However, since the correlation coefficients between on- and off-variables are over 0.5, the problem of multicolinearlity may have occurred. With regard to the robustness of regression results, the further investigation will be required. We will reexamine this point in Section 6.

The second subject here is to confirm how the regression coefficient on unamortized pension obligations reflects the size of pension discount rate, i.e. whether investors take the size of discount rate into consideration when evaluating the firms. Then, we calculated the mean of pension discount rates of each firm in the sample period, and divided samples into two groups, the firms that chose higher discount rates above the median (N= 101), and the firms that chose lower discount rates below the median (N= 98). The reason for dividing into firm groups is that a firm does not choose the pension discount rate independently every year, but a firm chooses the discount rate based on its history till then and a serial correlation between discount rates may exist. If samples are divided by the size of pension discount rate, or the size of difference between the market interest rate and the discount rate, the bias of sample year will occur among subgroups. In such a case, even if the gap between subgroups is detected, it is undistinguishable whether the size of pension discount rate or the bias of sample year is the cause of that gap.

The results of regression when dividing into two subgroups are summarized in Table 8. For example, (1H) is the result for the firm group that chose the higher discount rate, and (1L) is the result for the lower group. When (1H) are compared with (1L), it turns out that no significant difference exists between subgroups in the information content of the book value of equity. We can confirm this point from results by Chow Test in the rightmost column. On the other hand, when unamortized pension obligations *MIN*, *OCI*, and *OFF* are included in independent variables, except for *ITG*, the coefficients are significantly positive for the firms choosing lower rates. Especially, as for *OFF*, when it is included in independent variables with on-balanced unamortized pension obligations, the similar results are obtained consistently ((6L), (7L), (8L)). From these regression results, it seems that, investors would value unamortized pension obligations according to the size of pension discount rate of each firm.

In order to investigate above inference in more detail, the difference in coefficients on unamortized pension obligations between subgroups was verified through the slope dummy variable D_{MIN} and so on, which are 1 for the higher rate group. The results are shown in Table 9. For example, the coefficient on *MIN* for the higher rate group is -0.3538=2.8313-3.1851 (see (1)). Thereby, the significant difference in coefficients between subgroups becomes clear explicitly.

The results in Tables 7, 8, and 9 show that, when *MIN* and *OCI* are included in

independent variables respectively, only for the firm group of the lower discount rate, the coefficients are significantly positive and are not significant in other cases. The coefficient on *ITG* is not significant. In contrast, it turns out that the coefficient on *OFF* is positive significantly. After all, hypothesis H_{3b} is not rejected. That is, the size of unamortized pension obligations may have the relation with positive expectation of permanent earnings or future cash flows. These results are consistent with intuition: firms are valued higher in the capital market when they choose lower rates and when they reduce their discount rates earlier according to the fall of market interest rate.

Even then, regression results are significant only at the conventional level and ***t*** value (white's t) is not so high. Test of robustness should be carried out again. We will turn to this point in Section 6.

5. Evaluation in the Capital Market --- Part Two: Earnings Model

5.1 HYPOTHESES AND MODEL

In prior studies, it is assumed usually that investors forecast permanent earnings π_p by using earnings information rather than using the equity (net-assets) information. That is, supposing that earnings in year *t* is π_t, we can express the following equation.

$$E_t(\pi_p) = a + b\pi_t \tag{14}$$

The following equation can be obtained if equation (14) is substituted for equation (8).

$$MVE_t = \frac{a}{r} + \frac{b}{r}\pi_t \tag{15}$$

This is the basic equation for regression analysis below. Unlike the case in the foregoing Section, the size of coefficients based on equation (15) depends not only on the relation between actual earnings each year and expected permanent earnings, but also on the size of the cost of capital. Therefore, when comparing the coefficients between different equations, we should judge carefully which factor is producing the difference.

Here we will divide earnings into composition elements, noting 1 and 2 for convenience here. The following famous regression model will be obtained.[16]

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[16] The model here is similar to models in ERC (Earnings Response Coefficients) studies. See, for example, Easton [1985], Kormendi and Lipe [1987], Collins and Kothari [1989], Easton and Zmijewski [1989], Easton and Harris [1991], Ari and Zarowin [1992a, b], Easton, Harris and Ohlson [1992], Ball, Kothari and Watts [1993],

$$MVE_t = \alpha + \beta_1 \pi_{1t} + \beta_2 \pi_{2t} + u \qquad (\text{Where } \pi_t = \pi_{1t} + \pi_{2t}) \tag{16}$$

No problem may exist in dividing independent variables *linearly* into pension expenses *PCOST* and other earnings *ADJNI*. In this paper, we chose deflator the stock price at the beginning of the year, and analyzed by the following regression.

$$\frac{P_t}{P_{t-1}} = \alpha + \beta_1 \frac{ADJNI_t}{P_{t-1}} + \beta_2 \frac{PCOST_t}{P_{t-1}} + u \tag{17}$$

Now, the question is how to predict the sign and size of coefficient β_2 on pension expenses here. In general, since the ordinary element that occurs repeatedly and continuously differs in the size of coefficients (ERC: Earnings Response Coefficients) from the unordinary element that occurs rarely, it is natural to divide earnings into composition elements. By the same logic, it is often assumed that the size of coefficient on positive earnings differs from that on negative earnings (losses). However, it is not clear what difference exists in the persistence between pension expenses and other earnings elements.[17] That is, it is difficult to predict the size comparison between β_1 and β_2 from the viewpoint of the persistence of earnings. Of course, it is out of question to expect that the coefficient will be negative by reason that it is expense. Especially there is no theoretical foundation to assume that $\beta_1 = -\beta_2$. As explained in Section 4, the size and sign of coefficients will be determined by the relation between independent variables and expected permanent earnings, and are not determined by accounting treatment or position of the variable.

In our presumption, as long as the investment in human resources would produce positive cash flows in the future, the coefficient β_2 would be positive. The essence of contribution to the pension fund is, for a firm, not only the cost for already consumed labor service, but also the incentive cost that has an effect over an employee's whole service period until retirement. The latter is the important factor that determines the sign and size of coefficient β_2. Therefore, the hypothesis in this chapter is as follows.

H_{4a} When stock price is chosen as a dependent variable, and pension expenses and other composition elements of earnings are chosen as independent variables, the

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Ramesh and Thiagarajan [1993], Kothari and Zimmerman [1995], Ramakrishnan and Thomas [1998].

[17] As this kind of study, Barth and Beaver and Landsman [1992] is famous study. However, the issue why coefficients (ERC) differ for every element of pension expenses is not sufficiently explained.

former coefficient will *not* be negative. ($\beta_2 \geq 0$)

Furthermore, in respect of the relation between the size of discount rate and stock prices, we investigate the following hypothesis like in Section 4.

H_{4b} When stock price is chosen as a dependent variable, and pension expenses and other composition elements of earnings are chosen as independent variables, the former regression coefficient for the firms, whose pension discount rates are higher, is smaller.

In the rest of this paper, we will divide earnings into "earnings before interests and taxes" (EBIT) and other earnings *OTHER*, the amount added back pension expenses *PCOST* to EBIT is set to *ADJEBIT*. The combinations of independent variables are two sets; (*PCOST*, *ADJNI*) and (*PCOST*, *ADJEBIT* and *OTHER*). The pension expenses *PCOST* and *OTHER* are defined by positive values here. It will be clarified by comparing the sign of *PCOST* and that of *OTHER* whether the coefficient on expense or loss would be negative. Of course, we predict that the sign of coefficient on *OTHER* will be negative, since this *OTHER* implies unproductive cash outflows and it will also occur repeatedly in the future.

5.2 ANALYSIS RSULTS

The descriptive statistics of each variables and correlation coefficients are summarized in Table 10. Although mean and median of *PCOST* are not so large compared with EBIT, but compared with earnings (net income; *NI*), *PCOST* are 50% (40%) or more of *NI* in mean (median). However, the correlation coefficients between pension expenses and other composition elements of earnings are not so high level as earnings smoothing is assumed. In addition, the standard deviation of pension expenses is very small compared with other variables. The correlation coefficient between pension expenses and stock prices is low. According to these statistical facts, pension expenses may not have the information value that influences stock prices.

Table 11 provides basic results by regression analysis. First, the coefficients on all variables other than pension expenses are the same sign as predicted, and are significant at 1%. However, the coefficient on pension expenses is not significant. When samples are pooled, it seems that pension expenses do not have the information contents explaining the variation in stock prices. Of course, this is the result when not dividing into calculation elements, i.e. pension expenses are handled in block. In fact, pension expenses can be divided into

calculation elements, such as service cost and interest cost and so on. However, it is not the subject in this study. Anyway, from this regression result, it turns out that it is an error to assume in short circuit that the coefficient on expense will be negative.

Second, the relation between pension discount rates and stock prices was analyzed by the same procedure as in the foregoing Section. The results are presented in Table 12. The samples are divided into two groups, the firms that chose higher discount rates (N= 101), and the firms that chose lower discount rates (N= 98), here too. The preparatory step is to check any structural difference between subgroups through the basic model in which pension expenses is not separated as an independent variable (Panel A). This is for checking simply whether the difference in the cost of capital would produce a decisive difference in coefficients between subgroups. According to Chow Test, there is no significant structural difference between two subgroups. Therefore, we can neglect the possibility that the cost of capital would cause a difference in coefficients here.

Next step is to separate pension expenses as an independent variable. A significant difference exists between two subgroups. These results are shown in Panel B. For the firm group of the lower rate, the coefficient on pension expenses is significantly positive at 1%. The difference between two groups can be analyzed by the slope dummy variable D_{PCOST}, which is 1 for the firms that chose higher rates (Panel C). For the lower rate group, larger pension expenses is associated with expectation of larger future cash flows and therefore stock prices of those firms are so higher. On the contrary, the size of pension expenses is *not reflected* in stock prices for the firms that chose higher rates.

These results suggest that the firms, which chose lower rates, are valued relatively higher in the capital market. This interpretation is also consistent with results in Section 4. In addition, when Tables 7, 8, and 9 and Tables 11 and 12 are compared in respect of adjusted R^2, there is no large difference between the book value of equity model and the earnings model. In this scope, one model is not necessarily superior in explanatory power of variations in stock prices than another. Here, we emphasize that both unamortized pension obligations and pension expenses has positive relation with stock prices for the firms choosing higher rates. This is the original discovery by this study.

However, as well as the foregoing Section, since ***t***-value (white's t) of coefficient on pension expenses is not so large, we will check the robustness of results later in more detail. Moreover, above results do not mean that investors have received the information on distinctive nature between firms only from disclosed pension discount rates. Rather, it is natural to think that investors can distinguish between firms by the knowledge from various information sources, and make them reflected in stock prices. Probably, the size of discount

rate may be functioning as a proxy for distinction here.

Furthermore, the above-mentioned result does not justify the accounting standard that permits firms' discretion in choosing pension discount rates. In fact, as empirical results in this paper shows, even if a firm would manipulate pension expenses through adjusting the discount rate, investors could evaluate the firm considering the incentive of firms without being deceived. However, while the market discipline functions, the variation in discount rate may remain without converging. This indicates that some firms take the merit by using higher discount rates. It is well known that, under such a situation, investors may over-value a firm and, in the counter part, some firms may receive the information rent.[18] In short, the noise is included in accounting information.

The problem will be formally solved at least, if the accounting standard prescribes that a firm cannot choose a discount rate discretionally. However, there is no conclusive factor conceptually with regard to what should be the discount rate. It may be a too much rude argument that what is necessary is just to eliminate discretion of a firm. Primarily, the question is why discount calculation is required when allocating expenses to each year. The relation between discounting and allocation should be reexamined. It is not theoretically obvious whether the calculation method of pension expenses in present accounting standard is consistent with the traditional body of allocation. The empirical results suggest the need for further investigation.

6. Robustness of Results

6.1 THE DIFFERENCE MODEL

In this Section, we will check the robustness of results in Sections 4 and 5. First, we will reexamine the book value of equity model and the earnings model by interchanging all of independent variables and dependent variables into the changes in the year (hereafter we call them the difference model). It is sometimes pointed out that the noise of serial correlations included in panel data will be removed when applying a difference model. In general, if the increase or decrease in the year would be forecasted in advance in the capital market, they may not be significant explaining variables. In addition, the change in the variable is often seemed as the unexpected change by the well-known naïve expectation model. Therefore, the regression analysis by the difference model will give a certain key, in guessing whether investors would react unexpected changes in variables used in Sections 4 and 5.

The book value of equity model using first difference variables is as follows.

[18] For example, investors can distinguish only *uncertainly* the firm that has no intention of earnings management and accidentally uses the higher discount rate from the firm that manipulates earnings using the higher discount rate.

$$\frac{\Delta P_t}{P_{t-1}} = \alpha + \beta_1 \frac{\Delta BVE_t}{P_{t-1}} + \beta_2 \frac{\Delta MIN_t}{P_{t-1}} + \beta_3 \frac{\Delta OFF_t}{P_{t-1}} + u \tag{18}$$

Table 13 is the results by this regression. We divide pension obligations *MIN* corresponding to the "minimum pension liabilities" into two parts, *OCI* and *ITG* as defined in Section 4. While the coefficient on pension obligations corresponding to the "minimum pension liabilities" is significantly positive at 1% for the firms that chose lower discount rates, the coefficient is not significant for the firms choosing higher rates. The result provides the evidence that the firms, which chose lower rates, are valued higher. On the other hand, the coefficient on off-balanced pension obligations *OFF* is not significant in both subgroups.

These asymmetric results can be interpreted as follows. In Section 4, so great noise may be included in variables that the significance level of coefficients on pension obligations corresponding to the "minimum pension liabilities" was low, because the amount of its obligations is generally determined by discretionary contribution policy of each firm. In contrast, in the difference model, the noise may be removed. On the other hand, as for variable *OFF*, its increase or decrease would be predicted in advance in the market. The size of these off-balanced pension obligations is determined by amortization policy (smoothing policy) of pension obligations, the size of accumulated benefits obligations (ABO), the increasing rate of salary, etc. Since the two latter factors are not changed so frequently, investors can forecast them in advance. We will discuss this puzzle once again later.

Next, the difference model of earnings is applied. Regression equation is as follows.

$$\frac{\Delta P_t}{P_{t-1}} = \alpha + \beta_1 \frac{\Delta ADJNI_t}{P_{t-1}} + \beta_2 \frac{\Delta PCOST_t}{P_{t-1}} + u \tag{19}$$

Table 14 shows the results by regression analysis. In this model too, the same results as in Section 5 are obtained. For the firms choosing lower discount rates, the coefficient on changes in pension expenses is positive significantly at 5%. That is, the stock price would rise so much when pension expenses would increase in the year. On the other hand, the firms choosing higher rates are valued lower. Although the significance level of the difference between two subgroups is not so high as about 10% level, we can say that the results in Section 5 is robust.

6.2 INTEGRATED MODEL OF BOOK VALUE OF EQUITY AND EARNINGS

Since the year-end book value of equity includes earnings in the year, we can integrate the book value of the equity model in Section 4 and the earnings model in Section 5 into a single model. A starting point is the following equation.

$$MVE_t = \alpha + \beta(ADJBVE_t + NI_t) + \varepsilon \tag{20}$$

This equation (20) can be transformed into the following equation (21).

$$MVE_t = \alpha + \gamma_1 ADJBVE_t + \gamma_2 NI_t + \varepsilon' \tag{21}$$

Here, *ADJBVE* is equal to the year-end book value of equity minus earnings in the year. As compared with equation (21), it is clear that the restricted condition as $\gamma_1 = \gamma_2$ is imposed on the regression by equation (20). In general, it will be natural to conjecture that the memory of stock prices is different between for the previous year data and for current year data.

Then, in order to check the robustness of results in the foregoing Section, the regression analysis by the following equation (22) was estimated.[19]

$$\frac{P_t}{P_{t-1}} = \delta_0 + \delta_1 \frac{BVE_t}{P_{t-1}} + \delta_2 \frac{NI_t}{P_{t-1}} + \delta_3 \frac{X_t}{P_{t-1}} + u \tag{22}$$

Pension expenses and pension obligations are respectively substituted for independent variable X_t in above equation (22).[20]

Table 15 shows the correlation coefficients between variables. Lower left numbers are the correlation coefficients between the variables used in regression analysis, i.e., the variables which are deflated by stock price at the beginning of the year. Upper right numbers are the correlation coefficients between the raw values not deflated. The correlation coefficients between the book value of equity and the variables of earnings (*NI* and *ADJNI*) and the correlation coefficient between the book value of equity and pension expenses are very high in

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[19] Though basing another model, Gopalakrishnan [1994] examined the post retirement benefits other than pension (*SFAS No. 106*) using the similar model to this.

[20] If a capital transaction is ignored, this model will be transformed to the following difference model.

$$\frac{\Delta P_t}{P_{t-1}} = \delta + \gamma_1 \frac{NI_t}{P_{t-1}} + \gamma_2 \frac{\Delta NI_t}{P_{t-1}} + \varepsilon$$

This is the model in Easton and Harris [1991]. However, the strong correlation exists, between the amount of changes in the year and the level at the end of the year. The correlation coefficients, *NI*, *ADJNI*, *PCOST*, *MIN*, and *OFF* respectively are, 0.6334, 0.6605, 0.6555, 0.855 and 0.4027. Therefore, the above-mentioned model has the problem of multicolinearlity and is not applicable to our sample.

upper right. From this result, in order to avoid the problem of multicolinearlity, deflating by stock price at the beginning of the year would be very effective. Even so, when deflated, the coefficients between three variables *PCOST*, *MIN*, and *OFF* are very high. Then, those variables will be included in the independent variable one by one below.

The results of regression are summarized in Table 16. First, the coefficient on pension expenses is not statistically significant. However, when the slope dummy D_{PCOST} that is 1 for the firms choosing higher rates is included in independent variables, although at 10% level, the same result as in Section 5 is obtained. The firms, which chose lower rates, are valued higher in the capital market. Second, pension obligations corresponding to the "minimum pension liabilities" are positively associated with stock prices significantly at 10%. With regard to the difference between subgroups in the size of pension discount rate, although the sign is the same as the result in Section 4, the coefficients on slope dummy are not statistically significant. It seems that most part of the information contents of changes in *PCOST* and *MIN* may overlap that of the book value of equity and earnings, thus they have no peculiar contents.

Finally, it seems that off-balanced pension obligations *OFF* has the still more inherent information contents even if earnings information is given. The coefficient is significant at 5%, but there is no significant difference in coefficients between subgroups. Taking the results in Section 4 into consideration, *OFF* may be a proxy for some fixed ability of a firm existing for a long time. However, our analysis cannot show its substance concretely.

6.3 ADDITION THE MARKET INTEREST RATE TO INDEPENDENT VARIABLE

In this paper, the number of sample is limited, and we place weight on fundamental-link. Thus, the technique of including a control variable in independent variables is not adopted. Consequently, there may be a problem that other conditions are not sufficiently controlled. In this Section, we will add the year-end market interest rate (or its change in the year) to the independent variable in each model. The purpose is for checking the possibility that pension discount rates serve as a proxy for interest rate. Since the pooled data is used, a serial change in interest rate may be an omitted variable, which explains variations or changes in stock prices.

It may be contradictory that while we consider changes in market interest rate, we assume that the cost of capital does not change and the coefficient on earnings (ERC) is fixed.[21] If the interest rate would change in the sample period, the effect that changes in

[21] However, this problem will not occur if we do cross-section analysis. That is, a model does not have a problem and it comes from the *pooled* regression.

market interest rate has on stock prices should be checked. The following equation (23) may be appropriate, if we transform the earnings discount model into the linear regression equation and choose the interest rate the independent variable, denoting the market interest rate as *GBI*.

$$\ln P_t = \alpha + \beta \ln NI_t + \gamma GBI_t + \eta \tag{23}$$

However, in equation (23), we cannot divide *linearly* net income *NI* into components. Since this point was an obstacle when analyzing ERC, we did not add the market interest rate to the independent variables in Section 5. Here, in order to concentrate on checking the robustness of analysis results, we will disregard the linearity of regression, and add the market interest rate to independent variables simply.

Table 17 shows the regression results. The results of analysis, when added the interest rate to the earnings model, are summarized in Panel A. On the other hand, Panel B shows the results when adding changes in interest rate to the difference model. Although the significance level of coefficient on pension expenses declines a little, all of the sign are the same as predicted. In respect of the coefficient on slope dummy for the firms, which chose higher discount rates, the sign is the same as the cases where the market interest rate is not included, although the significance level becomes lower. In sum, the analysis results of coefficients on pension expenses and slope dummy of the firm group are so robust that are not influenced by whether the market interest rate is included in the independent variable or not.[22]

7. Conclusions and Implications

The first subject in this paper is the firms' motives to choose their pension discount rates. Although the firms' discount rates followed the fall of market interest rate, the firms had reduced them after the market interest rate declined considerably: the firms reduced discount rates reluctantly. By logit model we analyzed what the factors have imposed restrictions on the reduction of discount rate. It seems that firms considered not the deterioration of the debt to equity ratio but the rate of return on equity (ROE). The second subject is how the size of discount rate chosen by the firm is evaluated in the capital market. For the firms, which chose lower pension discount rate than median, both unamortized pension obligations and pension expenses are positively associated with stock prices. On the contrary, for the firm group choosing the higher rate, the coefficients do not differ significantly from zero, and the

[22] Results here are the cases where the market interest rate is not deflated by stock price at the beginning of the year. Besides, when the interest rate level is deflated, the interest rate was not a significant independent variable. In addition, in the difference model, when the change in interest rate is deflated, except that the significance level of coefficient on slope dummy fell a little, the result did not change dramatically.

firms are valued relatively lower in the capital market. The asymmetric results concerning the size of discount rate are consistent with the motives for discount rate choice.

However, even if firms behave rationally and investors react rationally to it, it does not mean that there is no theoretical issue in measurement of pension expenses. The allocation method using discount calculation cannot be drawn uniquely and deductively from cost allocation principle. Nevertheless, the discount calculation, which is not obvious conceptually, has been introduced into income measurement, and the discretion is unnecessarily given to firms in choosing their pension discount rates. After all, the unnecessary noise is brought into earnings information by present accounting standards. From the viewpoint of income measurement, we should reexamine the validity of discount calculation.

Furthermore, we should reexamine the validity of on-balancing the “minimum pension liabilities” peculiar in the U.S. accounting standard, and the validity of classifying its part into “other comprehensive income” and deducting from equity. If pension expenses is caught as the incentive cost during employee's whole service --- an investment in human resources for pulling out employee's much more will to work ---, it would be clear that pension expenses is not the expenditure which will not produce cash inflows in the future. It is an important question whether pension liabilities on the balance sheet is the same as the unpaid expenses. We should emphasize that pension liabilities on the balance sheet is just the results of allocation based on the various fictions in financial accounting.

The main purpose in this paper is to investigate positively the subject pointed in theoretical study, thinking a fundamental relation as important. As long as we attained this purpose, the restricted sample was sufficient. Of course, the problem on statistical accuracy and the persuasive power of empirical results are left behind, and the justice of the result itself should wait for verification by large sample in the future. Although there is such a limit, this study has given much suggestion at present to conceptual and theoretical study of pension expense measurement.

Table 1 Discount Rate and Interest Rate(%)

Panel A	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
5.0											
5.5								1			
6.0							1	4		3	2
6.5		1	3	3	2	2	7	15	4	10	5
7.0	7	2	7	8	6	12	21	179	24	188	67
7.5	25	18	13	25	16	25	34	163	61	155	256
8.0	103	81	74	96	88	117	165	64	168	75	113
8.5	62	113	118	137	137	182	165	32	187	30	10
9.0	61	134	167	152	154	107	75	15	27	5	
9.5	13	61	73	44	54	23	7		1		
10.0	11	25	31	12	17	4	2				
10.5		4	2	1			1				
11.0	1	1	1								
11.5				1	1	1					
NA.	2		12	9	8	8	4	4	5	5	7
Total	285	440	501	488	483	481	482	477	477	471	460

Panel B	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
CM10											
Jan.	9.19	7.08	8.67	9.09	8.21	8.09	7.03	6.60	5.75	7.78	5.65
Feb.	8.70	7.25	8.21	9.17	8.47	7.85	7.34	6.26	5.97	7.47	5.81
Mar.	7.78	7.25	8.37	9.36	8.59	8.11	7.54	5.98	6.48	7.20	6.27
Apr.	7.30	8.02	8.72	9.18	8.79	8.04	7.48	5.97	6.97	7.06	6.51
May	7.71	8.61	9.09	8.86	8.76	8.07	7.39	6.04	7.18	6.63	6.74
Jun	7.80	8.40	8.92	8.28	8.48	8.28	7.26	5.96	7.10	6.17	6.91
July	7.30	8.45	9.06	8.02	8.47	8.27	6.84	5.81	7.30	6.28	6.87
Aug.	7.17	8.76	9.26	8.11	8.75	7.90	6.59	5.68	7.24	6.49	6.64
Sep.	7.45	9.42	8.98	8.19	8.89	7.65	6.42	5.36	7.46	6.20	6.83
Oct.	7.43	9.52	8.80	8.01	8.72	7.53	6.59	5.33	7.74	6.04	6.53
Nov.	7.25	8.86	8.96	7.87	8.39	7.42	6.87	5.72	7.96	5.93	6.20
Dec.	7.11	8.99	9.11	7.84	8.08	7.09	6.77	5.77	7.81	5.71	6.30
Ave.	7.68	8.38	8.85	8.50	8.55	7.86	7.01	5.87	7.08	6.58	6.44
CM30											
Jan.	9.40	7.39	8.83	8.93	8.26	8.27	7.58	7.34	6.29	7.85	6.05
Feb.	8.93	7.54	8.43	9.01	8.50	8.03	7.85	7.09	6.49	7.61	6.24
Mar.	7.96	7.55	8.63	9.17	8.56	8.29	7.97	6.82	6.91	7.45	6.60
Apr.	7.39	8.25	8.95	9.03	8.76	8.21	7.96	6.85	7.27	7.36	6.79
May	7.52	8.78	9.23	8.83	8.73	8.27	7.89	6.92	7.41	6.95	6.93
Jun	7.57	8.57	9.00	8.27	8.46	8.47	7.84	6.81	7.40	6.57	7.06
July	7.27	8.64	9.14	8.08	8.50	8.45	7.60	6.63	7.58	6.72	7.03
Aug.	7.33	8.97	9.32	8.12	8.86	8.14	7.39	6.32	7.49	6.86	6.84
Sep.	7.62	9.59	9.06	8.15	9.03	7.95	7.34	6.00	7.71	6.55	7.03
Oct.	7.70	9.61	8.89	8.00	8.86	7.93	7.53	5.94	7.94	6.37	6.81
Nov.	7.52	8.95	9.02	7.90	8.54	7.92	7.61	6.21	8.08	6.26	6.48
Dec.	7.37	9.12	9.01	7.90	8.24	7.70	7.44	6.25	7.87	6.06	6.55
Ave.	7.80	8.58	8.96	8.45	8.61	8.14	7.67	6.60	7.37	6.88	6.70
AAA	9.01	9.39	9.71	9.26	9.32	8.77	8.14	7.21	7.97	7.59	7.37
AUTL	9.58	9.98	10.20	9.78	10.02	9.32	8.51	7.45	8.30	7.85	7.77

Table 1 (*continued*)

Panel C	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Rate 1											
Jan.			7.30	7.21	6.32	6.59	6.16	5.95	5.00	6.30	4.85
Feb.			7.06	7.14	6.61	6.62	6.06	5.87	5.03	6.28	4.84
Mar.			6.74	7.21	6.80	6.42	6.28	5.67	5.19	6.09	4.99
Apr.			6.90	7.34	6.85	6.63	6.38	5.46	5.53	5.96	5.28
May			7.16	7.22	7.01	6.57	6.37	5.48	5.82	5.89	5.43
Jun			7.38	7.06	6.98	6.62	6.31	5.54	5.93	5.56	5.54
July			7.20	6.62	6.77	6.78	6.27	5.45	5.92	5.26	5.65
Aug.			7.31	6.46	6.8	6.76	6.08	5.30	6.06	5.38	5.62
Sep.			7.46	6.50	7.09	6.51	5.91	5.06	5.99	5.49	5.47
Oct.			7.25	6.52	7.22	6.36	5.87	4.80	6.17	5.24	5.62
Nov.			7.11	6.40	7.09	6.34	6.02	4.75	6.35	5.10	5.45
Dec.			7.22	6.32	6.83	6.34	6.09	4.97	6.46	5.01	5.18
Ave.			7.17	6.83	6.86	6.55	6.15	5.36	5.79	5.63	5.33
Rate 2											
1Q	9.50	7.50	8.75	10.50	10.50	10.00	7.50	6.00	6.00	8.50	8.75
2Q	9.00	7.50	8.50	11.50	10.00	9.00	6.50	6.00	6.00	9.00	8.25
3Q	8.50	8.25	9.00	11.00	10.00	8.50	6.50	6.00	7.25	9.00	8.25
4Q	7.50	8.75	10.00	10.50	10.00	8.00	6.00	6.00	7.75	8.75	8.25
Ave.	8.63	8.00	9.06	10.88	10.13	8.88	6.63	6.00	6.75	8.81	8.38

Panel A; Assumed Discount Rate (Source: *Accounting Trends and Techniques*, AICPA)
Panel B: Monthly Treasury Constant Maturity Rates, CM10 = 10 Year Treasury Constant Maturity Rate, CM30=30 Year Treasury Constant Maturity Rate, AAA = Moodys Seasoned AAA, AUTIL = A-Utility, estimate of the yield on a recently offered (A-Rated utility bond with a maturity of 30 years and call protection of 5 years). All "Ave." is that of calendar year. (Source: Federal Reserve Bank of Chicago)
Panel C: Rate 1 = Interest Rates for Valuing Vested Benefits for PBGC's Variable Rate Premium, Rate 2 = Interest rates for Under- and Overpayments of Multiemployer Plan Withdrawal Liability (Source: Pension Benefit Guaranty Corporation)

Table 2 Distributions of Discount Rate in Japan

	1991	1992	1993	1994	1995	1996	1997	1998	1999
2.5-									1
3.0-								1	7
3.5-							2	9	11
4.0-						4	8	7	1
4.5-				1	1	10	10	4	1
5.0-			1	1	4	3			
5.5-	11	14	16	16	14	2			
6.0-	2	4	2	1	1				
6.5-		1							
7.0-	2								
Total	15	19	19	19	20	19	20	21	21
GBI(%)	6.610	5.320	4.210	3.900	3.595	3.110	2.265	1.580	1.598

This table consists of the only restricted samples that adopt SEC rules and whose fiscal year ends on March 31st.
GBI = Interest rate of government bond (10 years).

Table 3 Comparison of Basic Financial Ratios

	Panel A	**Previous Year**		**Changed Year**		***t***	***z***
	Changed Sample (***N***=78)	Mean	Median	Mean	Median	(***p***-value)	(***p***-value)
	I Liabilities						
(1)	Long Term liabilities / Equity	1.1344	0.5942	1.2453	0.6358	0.430 (0.668)	1.825 (0.068)
(2)	Total Liability / Equity	3.0522	1.9468	3.1534	1.9244	0.162 (0.872)	0.770 (0.442)
(3)	On-balanced Pension Obligation / Equity	0.1829	0.1269	0.2180	0.1715	1.065 (0.288)	4.146 (0.000)
(4)	Off-balanced Pension Obligation / Equity	0.0574	0.0328	0.0698	0.0429	1.356 (0.177)	5.885 (0.000)
	II Earnings						
(5)	Net Income / Equity	0.0455	0.0538	0.1162	0.1156	0.412 (0.680)	0.182 (0.8557)
(6)	EBIT / Equity	0.1796	0.1598	0.1708	0.1573	0.514 (0.304)	1.522 (0.128)
(7)	Pension Expenses / EBIT	0.1476	0.1293	0.2022	0.1306	0.803 (0.423)	2.393 (0.167)
(8)	EBIT / Interest Payments	12.476	5.033	13.376	5.332	0.273 (0.785)	1.791 (0.734)
	III Cash Flows						
(9)	Operating cash flows/ Equity in the previous year	0.1803	0.1467	0.1947	0.1813	0.710 (0.479)	0.353 (0.724)
(10)	Investing cash flows/ Equity in the previous year	0.1937	0.1629	0.1442	0.1268	1.776 (0.078)	1.120 (0.263)

z score is the Wilcoxon's signed rank sum test statistics. All tests are two-tailed.

Table 3 (*continued*)

	Panel B	**Changed (*N*=78)**		**Not Changed (*N*=121)**		***t*** (***p***-value)	***z*** (***p***-value)
		Mean	Median	Mean	Median		
	I Liabilities						
(1)	Long Term liabilities / Equity	1.2453	0.6358	1.2495	0.5643	0.017 (0.986)	0.257 (0.797)
(2)	Total Liability / Equity	3.1534	1.9244	3.7707	1.7662	0.964 (0.336)	0.184 (0.854)
(3)	On-balanced Pension Obligation / Equity	0.2180	0.1715	0.1191	0.0809	3.669 (0.000)	3.790 (0.000)
(4)	Off-balanced Pension Obligation / Equity	0.0698	0.0376	0.0429	0.0217	4.083 (0.000)	5.751 (0.000)
	II Earnings						
(5)	Net Income / Equity	0.0407	0.0497	0.0411	0.0458	0.041 (0.968)	1.190 (0.234)
(6)	EBIT / Equity	0.1708	0.1573	0.2359	0.1610	2.687 (0.008)	0.870 (0.384)
(7)	Pension Expenses / EBIT	0.2022	0.1306	0.1341	0.0814	1.159 (0.248)	2.796 (0.005)
(8)	EBIT / Interest Payments	13.376	5.332	8.647	2.926	1.770 (0.079)	2.042 (0.041)
	III Cash Flows						
(9)	Operating cash flows/ Equity in the previous year	0.1947	0.1813	0.1225	0.1228	3.261 (0.001)	3.090 (0.002)
(10)	Investing cash flows/ Equity in the previous year	0.1442	0.1268	0.1202	0.1394	0.681 (0.496)	0.14 (0.989)

z score is the Mann-Whitney's U-test statistics. All tests are two-tailed.

Table 4 Descriptive Statistics and Correlation Matrix

Panel A	*GBI*	*Δ GBI*	*SL*	*LL*	*TL*	*ADJNI*	*ADJEBIT*	*OTHER*
Mean	3.5026	-0.6373	2.2308	1.1182	3.3491	0.0532	0.2328	-0.1796
St. Dev.	1.5215	0.5172	2.9691	1.5699	4.4715	0.0560	0.1853	0.1854
Max	6.6100	1.5450	13.4480	8.4688	18.4994	0.1870	1.2192	-0.0043
Median	3.5950	-0.6850	1.2232	0.4900	1.6793	0.0580	0.1771	-0.1203
Min	1.5800	-2.0250	0.1408	0.0047	0.1830	-0.3020	-0.0964	-1.1445
Panel B	*GBI*	*Δ GBI*	*SL*	*LL*	*TL*	*ADJNI*	*ADJEBIT*	*OTHER*
GBI	1.0000							
ΔGBI	-0.3345	1.0000						
SL	0.0847	0.0201	1.0000					
LL	-0.0039	0.1076	0.9347	1.0000				
TL	0.0549	-0.0247	0.9922	0.9718	1.0000			
ADJNI	0.1160	-0.1111	-0.3155	-0.4016	-0.3505	1.0000		
ADJEBIT	0.3058	-0.1687	0.8129	0.6931	0.7831	0.1501	1.0000	
OTHER	-0.2707	0.1350	-0.9080	-0.8143	-0.8888	0.1521	-0.9543	1.0000

GBI = Interest Rate of government bond(%), $\triangle GBI = GBI_t - GBI_{t-1}$ *SL* = Short term liabilities, *LL* = Long term liabilities (other than Pension Liabilities), *TL* = *SL* + *LL*, *ADJNI* = Periodic Pension Cost + Net Income, *EBIT* = Earnings Before Interest and Taxes, *ADJEBIT* = Pension Cost + *EBIT*, *OTHER* = *NI* – *EBIT*, All variables (other than *GBI*) are deflated by the end-of-year equity.

Table 5 Results of Logit Regression

Panel A1

	Constant	*△GBI*	*GBI*	*SL*	*LL*	*TL*	*ADJNI*	*ADJEBIT*	*OTHER*	*Fitness*
(1)	-1.169	-0.166		-0.072			6.075			0.025
	(7.087)	(0.247)		(1.113)			(2.015)			9.038
	[0.008]	[0.619]		[0.291]			[0.156]			[0.1714]
(2)	3.626		-1.672	-0.014			9.073			0.276
	(24.352)		(45.695)	(0.021)			(3.937)			101.030
	[0.000]		[0.000]	[0.885]			[0.047]			[0.000]
(3)	-1.374	-0.182			-0.016		7.139			0.019
	(9.389)	(0.293)			(0.016)		(2.690)			7.172
	[0.002]	[0.589]			[0.900]		[0.101]			[0.309]
(4)	3.524		-1.674		0.036		9.789			0.275
	(23.115)		(45.971)		(0.055)		(4.395)			100.468
	[0.000]		[0.000]		[0.814]		[0.036]			[0.000]
(5)	-0.467	1.344				-0.022	8.048			0.061
	(1.285)	(12.650)				(0.224)	(3.342)			22.370
	[0.257]	[0.000]				[0.636]	[0.675]			[0.001]
(6)	3.591		-1.673			-0.001	9.309			0.275
	(23.879)		(45.851)			(0.000)	(4.066)			100.729
	[0.000]		[0.000]			[0.990]	[0.044]			[0.000]
(7)	-0.819	-0.133		0.778				17.051	34.357	0.067
	(2.766)	(0.153)		(9.443)				(8.729)	(11.693)	24.516
	[0.096]	[0.696]		[0.002]				[0.003]	[0.001]	[0.002]
(8)	3.647		-1.692	-0.061				8.907	7.938	0.277
	(24.664)		(44.031)	(0.057)				(3.211)	(0.910)	101.428
	[0.000]		[0.000]	[0.812]				[0.073]	[0.340]	[0.000]
(9)	-0.770	-0.163			1.562			19.739	39.245	0.092
	(2.366)	(0.221)			(15.006)			(11.997)	(15.862)	33.639
	[0.124]	[0.639]			[0.000]			[0.001]	[0.000]	[0.000]
(10)	3.499		-1.617		0.301			11.398	14.852	0.277
	(19.336)		(39.500)		(0.460)			(4.329)	(2.364)	101.173
	[0.000]		[0.000]		[0.497]			[0.038]	[0.124]	[0.000]
(11)	-2.219	1.080				0.544		19.506	37.898	0.103
	(0.237)	(8.048)				(9.675)		(10.287)	(11.951)	37.679
	[0.626]	[0.005]				[0.002]		[0.001]	[0.001]	[0.000]
(12)	3.595		-1.665			0.026		9.771	10.681	0.276
	(23.659)		(41.908)			(0.022)		(3.452)	(1.321)	100.790
	[0.000]		[0.000]			[0.883]		[0.063]	[0.250]	[0.000]

Table 5 (*continued*)

Panel A2

	Constant	*△GBI*	*GBI*	*SL*	*LL*	*TL*	*ADJNI*	*ADJEBIT*	*OTHER*
(1)	-0.966	-0.623		-0.084			-5.015		
	(1.917)	(0.438)		(1.103)			(2.202)		
	[0.166]	[0.508]		[0.314]			[0.138]		
(2)	0.972		-0.623	-0.072			-2.251		
	(1.917)		(10.635)	(0.627)			(0.385)		
	[0.166]		[0.001]	[0.429]			[0.535]		
(3)	-1.156	-0.267			-0.033		-4.094		
	(7.853)	(0.444)			(0.054)		(1.365)		
	[0.005]	[0.505]			[0.817]		[0.243]		
(4)	0.823		-0.629		0.025		-1.311		
	(1.363)		(10.936)		(0.025)		(0.116)		
	[0.243]		[0.001]		[0.874]		[0.733]		
(5)	-0.978	0.330				-0.040	-4.401		
	(4.942)	(0.503)				(0.555)	(1.587)		
	[0.026]	[0.478]				[0.457]	[0.207]		
(6)	0.926		-0.626			-0.34	-1.996		
	(1.737)		(10.762)			(0.336)	(0.290)		
	[0.188]		[0.001]			[0.560]	[0.590]		
(7)	-0.853	0.285		0.073				-3.995	-1.181
	(3.828)	(0.516)		(0.143)				(1.212)	(0.045)
	[0.050]	[0.473]		[0.705]				[0.271]	[0.832]
(8)	1.029		-0.673	-0.183				-2.565	-4.773
	(2.179)		(10.492)	(0.858)				(0.511)	(0.812)
	[0.140]		[0.001]	[0.354]				[0.475]	[0.368]
(9)	-0.893	0.313			0.524			-0.363	5.675
	(3.714)	(0.623)			(2.474)			(0.006)	(0.650)
	[0.054]	[0.430]			[0.116]			[0.937]	[0.420]
(10)	0.732		-0.574		0.149			-0.501	1.494
	(1.011)		(7.695)		(0.215)			(0.014)	(0.058)
	[0.314]		[0.002]		[0.643]			[0.907]	[0.810]
(11)	-0.936	0.179				0.103		-2.708	1.298
	(4.145)	(0.150)				(0.639)		(0.445)	(0.043)
	[0.042]	[0.6981]				[0.424]		[0.505]	[0.836]
(12)	0.942		-0.638			-0.050		-2.125	-2.637
	(1.757)		(9.299)			(0.157)		(0.318)	(0.218)
	[0.185]		[0.002]			[0.692]		[0.573]	[0.641]

Table 5 (*continued*)

Panel B	*Constant*	*GBI*	*SL*	*LL*	*TL*	*ADJNI*	*ADJEBIT*	*OTHER*	*Fitness*
(1)	3.121	-1.550	0.056			9.562			0.423
	(21.290)	(41.628)	(0.309)			(5.000)			89.430
	[0.000]	[0.000]	[0.578]			[0.025]			[0.000]
(2)	3.004	-1.569		0.195		10.929			0.427
	(19.633)	(41.868)		(1.173)		(6.136)			90.304
	[0.000]	[0.000]		[0.279]		[0.013]			[0.000]
(3)	3.078	-1.559			0.050	10.055			0.424
	(20.681)	(41.730)			(0.577)	(5.390)			89.696
	[0.000]	[0.000]			[0.447]	[0.020]			[0.000]
(4)	3.122	-1.552	0.051				9.510	9.400	0.423
	(21.123)	(36.645)	(0.028)				(3.358)	(0.873)	89.431
	[0.000]	[0.000]	[0.868]				[0.067]	[0.350]	[0.000]
(5)	2.984	-1.475		0.643			14.118	20.055	0.432
	(18.279)	(33.723)		(1.650)			(6.296)	(3.499)	91.406
	[0.000]	[0.000]		[0.199]			[0.012]	[0.061]	[0.000]
(6)	3.045	-1.510			0.149		11.788	15.152	0.425
	(19.569)	(34.617)			(0.527)		(4.563)	(1.901)	987.631
	[0.000]	[0.000]			[0.468]		[0.033]	[0.168]	[0.000]

All independent variables are deflated by the equity of the end of the year (see the note of Table 3).

Panel A1 and A2 are the results when samples are divided into three groups and coded 0, 1, 2.

0: Not changed discount rate.(N=121)

1: Changed discount rate downward 0.5 % or less.(*N*=52)

2: Changed discount rate downward more than 0.5 %.(*N*=26)

In Panel A1, dependent variable is Log[P(1)/P(0)], and in Panel A2 dependent variable is Log[P(2)/P(0)].

Top = Estimated Coefficients, Middle = Chi-square, Bottom = *p*-value.

In the column of Fitness, Top = R^2, Middle = Chi-square, Bottom = *p*-value.

Panel B is the results when samples coded 2 are excluded. The dependent variable is Log[P(1)/P(0)].

Table 6 Descriptive Statistics and Correlation Matrix

Panel A	*PRICE*	*BVE*	*MIN*	*OCI*	*ITG*	*OFF*
Mean	1.0108	0.6069	0.0201	0.0075	0.0127	0.0289
St. Dev.	0.2543	0.1735	0.0467	0.0193	0.0281	0.0307
Max	1.8715	1.1060	0.5001	0.2011	0.2990	0.2173
Median	0.9690	0.5950	0.0015	0.0000	0.0005	0.0190
Min	0.5036	0.2454	0.0000	0.0000	-0.0092	-0.0190
Panel B	*PRICE*	*BVE*	*MIN*	*OCI*	*ITG*	*OFF*
PRICE	1.0000					
BVE	0.4059	1.0000				
MIN	0.0068	0.1301	1.0000			
OCI	0.0038	0.1516	0.9812	1.0000		
ITG	0.0088	0.1126	0.9912	0.9471	1.0000	
OFF	0.1751	0.1545	0.5426	0.5150	0.5497	1.0000

MIN = Minimum Pension Liability, *OCI* = Other Comprehensive Income (only for Pension liability Adjustment), *ITG* = Intangible Assets and Deferred Tax Assets = *MIN* – *ITG*, *OFF* = Off-balanced Projected Pension Obligation (PBO), *BVE* = Equity (Net Assets) + *OCI* +(1-effective tax rate)*Periodic Pension Cost, Effective tax rate = 0.5. All variables are deflated by the beginning-of-year stock price.

Table 7 Results of OLS Regression: Book Value of Equity Model

	Constant	*BVE*	*MIN*	*OCI*	*ITG*	*OFF*	*Adj. R^2*
(1)	0.6496	0.5950					0.1606
	(13.18)	(7.407)					
	[0.000]	[0.000]					
(2)	0.6493	0.6039	-0.2544				0.1584
	(13.21)	(7.478)	(-0.728)				
	[0.000]	[0.000]	[0.468]				
(3)	0.6475	0.6081		-0.7808			0.1597
	(13.16)	(7.503)		(-0.913)			
	[0.000]	[0.000]		[0.362]			
(4)	0.6502	0.6012			-0.3384		0.1577
	(13.22)	(7.462)			(-0.590)		
	[0.000]	[0.000]			[0.556]		
(5)	0.6379	0.5689				0.9524	0.1693
	(12.58)	(6.912)				(1.579)	
	[0.000]	[0.000]				[0.116]	
(6)	0.6288	0.5794	-0.8209			1.6203	0.1814
	(12.63)	(7.086)	(-2.309)			(2.595)	
	[0.000]	[0.000]	[0.022]			[0.010]	
(7)	0.6243	0.5859		-2.0707		1.6053	0.1833
	(12.49)	(7.177)		(-2.499)		(2.593)	
	[0.000]	[0.000]		[0.013]		[0.010]	
(8)	0.6322	0.5748			-1.2752	1.5879	0.1791
	(12.70)	(7.006)			(-2.106)	(2.526)	
	[0.000]	[0.000]			[0.036]	[0.012]	

MIN = Minimum Pension Liability, *OCI* = Other Comprehensive Income (only for Pension liability Adjustment), *ITG* = Intangible Assets and Deferred Tax Assets = *MIN* – *ITG*, *OFF* = Off-balanced Projected Pension Obligation (PBO), *BVE* = Equity (Net Assets) + *OCI* +(1-effective tax rate)*Periodic Pension Cost, Effective tax rate = 0.5, DRATE = Discount Rate used in calculating PBO. All variables are deflated by the stock price at the beginning of the year. Top = Estimated Coefficients, (Middle) = *t*-value using heteroskedasticity-consistent covariance matrix (white-t), [Bottom] = *p*-value (two-tailed).

Table 8 Comparison: Higher Rate Group vs. Lower Rate Group (1)

	Constant	*BVE*	*MIN*	*OCI*	*ITG*	*OFF*	*Adj. R^2*	*Chow Test*
(1H)	0.7007 (11.16) [0.000]	0.4783 (4.737) [0.000]					0.1293	
(1L)	0.5554 (6.899) [0.000]	0.7771 (5.825) [0.000]					0.1940	*F*=1.771 *p*=0.173
(2H)	0.6974 (11.15) [0.000]	0.4985 (4.871) [0.000]	-0.3064 (-0.806) [0.422]				0.1262	
(2L)	0.5038 (6.167) [0.000]	0.8021 (6.215) [0.000]	3.1273 (1.984) [0.050]				0.2211	*F*=2.650 *p*=0.050
(3H)	0.6930 (11.05) [0.000]	0.5084 (4.932) [0.000]		-0.9657 (-1.019) [0.311]			0.1301	
(3L)	0.5023 (6.046) [0.000]	0.8097 (6.082) [0.000]		7.6796 (2.104) [0.038]			0.2252	*F*=2.871 *p*=0.038
(4H)	0.6996 (11.19) [0.000]	0.4921 (4.831) [0.000]			-0.3972 (-0.650) [0.517]		0.1240	
(4L)	0.5093 (6.325) [0.000]	0.7952 (6.265) [0.000]			4.8118 (1.807) [0.074]		0.2155	*F*=2.391 *p*=0.070
(5H)	0.6949 (10.86) [0.000]	0.4634 (4.414) [0.000]				0.4424 (0.695) [0.489]	0.1244	
(5L)	0.5265 (7.370) [0.000]	0.7183 (5.711) [0.000]				2.6540 (2.522) [0.013]	0.2448	*F*=2.682 *p*=0.048
(6H)	0.6790 (10.47) [0.000]	0.4853 (4.645) [0.000]	-0.6728 (-1.718) [0.089]			1.1114 (1.541) [0.126]	0.1344	
(6L)	0.5028 (6.562) [0.000]	0.7429 (5.768) [0.000]	1.7524 (1.271) [0.207]			2.1750 (2.177) [0.032]	0.2462	*F*=1.873 *p*=0.117
(7H)	0.6721 (10.26) [0.000]	0.4967 (4.731) [0.000]		-1.7796 (-1.952) [0.054]		1.1048 (1.564) [0.121]	0.1394	
(7L)	0.5043 (6.483) [0.000]	0.7481 (5.607) [0.000]		4.0999 (1.207) [0.230]		2.0941 (2.006) [0.048]	0.2456	*F*=1.889 *p*=0.114
(8H)	0.6841 (10.61) [0.000]	0.4772 (4.570) [0.000]			-1.0002 (-1.509) [0.135]	1.0647 (1.450) [0.150]	0.1301	
(8L)	0.5040 (6.689) [0.000]	0.7372 (5.865) [0.000]			2.7870 (1.239) [0.219]	2.2728 (2.313) [0.023]	0.2457	*F*=1.863 *p*=0.118

Top = Estimated Coefficients, (Middle) = *t*-value using heteroskedasticity-consistent covariance matrix (white-t), [Bottom] = *p*-value (two-tailed).

Table 9 Comparison: Higher Rate Group vs. Lower Rate Group (2)

	Constant	*BVE*	*MIN*	D_{MIN}	*OCI*	D_{OCI}	*ITG*	D_{ITG}	*OFF*	D_{OFF}	*Adj.* R^2
(1)	0.6307	0.6082	2.8313	-3.1851							0.1776
	(12.63)	(7.640)	(2.004)	(-2.229)							
	[0.000]	[0.000]	[0.046]	[0.027]							
(2)	0.6268	0.6182			7.0013	-8.1177					0.1817
	(12.48)	(7.646)			(2.074)	(-2.354)					
	[0.000]	[0.000]			[0.039]	[0.020]					
(3)	0.6338	0.6021					4.4477	-4.9218			0.1738
	(12.75)	(7.628)					(1.888)	(-2.076)			
	[0.000]	[0.000]					[0.060]	[0.039]			
(4)	0.6357	0.5533							2.5798	-2.1032	0.1909
	(12.99)	(6.853)							(2.876)	(-2.408)	
	[0.000]	[0.000]							[0.004]	[0.017]	
(5)	0.6181	0.5746	1.3428	-2.0686					2.1675	-0.9430	0.1960
	(12.20)	(7.056)	(1.025)	(-1.496)					(2.402)	(-0.996)	
	[0.000]	[0.000]	[0.307]	[0.136]					[0.017]	[0.320]	
(6)	0.6135	0.5847			3.1978	-5.1281			2.1338	0.9329	0.1989
	(12.05)	(7.086)			(0.977)	(-1.495)			(2.302)	(-0.979)	
	[0.000]	[0.000]			[0.330]	[0.137]			[0.022]	[0.329]	
(7)	0.6221	0.5670					2.1024	-3.1742	2.2274	-1.0465	0.1933
	(12.34)	(7.014)					(0.992)	(-1.411)	(2.501)	(-1.109)	
	[0.000]	[0.000]					[0.323]	[0.160]	[0.013]	[0.269]	

Top = Estimated Coefficients, (Middle) = *t*-value using heteroskedasticity-consistent covariance matrix (white-t), [Bottom] = *p*-value (two-tailed).

Table 10 Descriptive Statistics and Correlation Matrix

Panel A	*PRICE*	*NI*	*EBIT*	*PCOST*	*ADJNI*	*ADJEBIT*	*OTHER*
Mean	1.0108	0.0225	0.1169	0.0151	0.0376	0.1320	0.0943
St. Dev.	0.2543	0.0326	0.0995	0.0135	0.0308	0.0982	0.1012
Max	1.8715	0.0974	0.5643	0.1198	0.1210	0.5696	0.5316
Median	0.9690	0.0274	0.0887	0.0118	0.0393	0.1061	0.0609
Min	0.5036	-0.2245	-0.0766	0.0008	-0.1959	-0.0419	-0.0041
Panel B	*PRICE*	*NI*	*EBIT*	*PCOST*	*ADJNI*	*ADJEBIT*	*OTHER*
PRICE	1.0000						
NI	0.2684	1.0000					
EBIT	0.2083	0.6962	1.0000				
PCOST	0.1086	-0.2908	-0.1810	1.0000			
ADJNI	0.3135	0.9569	0.6727	-0.0005	1.0000		
ADJEBIT	0.2413	0.6228	0.9611	0.0978	0.6806	1.0000	
OTHER	-0.0633	-0.3403	0.4381	0.1271	-0.3171	0.4791	1.0000

PCOST = Periodic pension Cost, *NI* = Net Income, *ADJNI* = *PCOST* + *NI*, *EBIT* = Earnings Before Interest and Taxes, *ADJEBIT* = *PCOST* + *EBIT*, *OTHER* = *NI* – *EBIT*, All variables are deflated by the stock price at the beginning of the year

Table 11 Results of OLS Regression: Earnings Model

Panel A	*Constant*	*NI*	*EBIT*	*OTHER*	*Adj.* R^2
(1)	0.9556	2.4502			0.0940
	(46.65)	(4.681)			
	[0.000]	[0.000]			
(2)	0.9535		2.4626	-2.4437	0.0894
	(34.84)		(4.579)	(-4.660)	
	[0.000]		[0.000]	[0.000]	
Panel B	*Constant*	*PCOST*	*ADJNI*	*ADJEBIT*	*OTHER*	*Adj.* R^2
(1)	0.8697	1.6106	3.0995			0.1457
	(27.62)	(1.406)	(5.012)			
	[0.000]	[0.161]	[0.000]			
(2)	0.8562	1.6390		3.1842	-3.0791	0.1430
	(23.12)	(1.434)		(5.019)	(-4.933)	
	[0.000]	[0.153]		[0.000]	[0.000]	

Top = Estimated Coefficients, (Middle) = *t*-value using heteroskedasticity-consistent covariance matrix (white-t), [Bottom] = *p*-value (two-tailed).

Table 12 Comparison: Higher Rate Group vs. Lower Rate Group (3)

Panel A	*Constant*	*NI*	*EBIT*	*OTHER*	*Adj. R^2*	*Chow Test*
(1H)	0.9572	1.9062			0.0725	
	(38.42)	(3.311)				
	[0.000]	[0.001]				
(1L)	0.9247	3.6482			0.1059	*F*=1.100
	(21.25)	(3.149)				*p*=0.335
	[0.000]	[0.002]				
(2H)	0.9598		1.8936	-1.9147	0.0631	
	(29.27)		(3.219)	(-3.327)		
	[0.000]		[0.002]	[0.001]		
(2L)	0.9071		3.7290	-3.5273	0.0989	*F*=0.811
	(17.24)		(3.277)	(-3.049)		*p*=0.489
	[0.000]		[0.001]	[0.003]		

Panel B	*Constant*	*PCOST*	*ADJNI*	*ADJEBIT*	*OTHER*	*Adj. R^2*	*Chow Test*
(1H)	0.8783	1.1942	2.4709			0.1199	
	(23.53)	(1.002)	(3.756)				
	[0.000]	[0.319]	[0.000]				
(1L)	0.7565	11.763	3.6955			0.2201	*F*=3.363
	(13.77)	(2.640)	(3.758)				*p*=0.020
	[0.000]	[0.010]	[0.000]				
(2H)	0.8647	1.2640		2.5442	-2.4579	0.1127	
	(19.78)	(1.064)		(3.759)	(-3.687)		
	[0.000]	[0.290]		[0.000]	[0.000]		
(2L)	0.7298	11.820		3.8102	-3.5253	0.2166	*F*=2.597
	(11.61)	(2.698)		(4.016)	(-3.612)		*p*=0.038
	[0.000]	[0.008]		[0.000]	[0.000]		

Panel C	*Constant*	*PCOST*	*D_{PCOST}*	*ADJNI*	*ADJEBIT*	*OTHER*	*Adj. R^2*
(1)	0.8404	8.5068	-6.5981	2.8268			0.1713
	(26.07)	(2.968)	(-2.686)	(4.928)			
	[0.000]	[0.003]	[0.008]	[0.000]			
(2)	0.8174	8.8974	-6.9285		2.9481	-2.7807	0.1712
	(21.63)	(3.130)	(-2.844)		(5.019)	(-4.777)	
	[0.000]	[0.002]	[0.005]		[0.000]	[0.000]	

PCOST = Pension cost, *NI* = Net Income, *ADJNI* = *PCOST* + *NI*, *EBIT* = Earnings Before Interest and Taxes, *ADJEBIT* = *PCOST* + *EBIT*, *OTHER* = *NI* – *EBIT*, All variables are deflated by the stock price at the beginning of the year. Top = Estimated Coefficients, (Middle) = *t*-value using heteroskedasticity-consistent covariance matrix (white-t), [Bottom] = *p*-value (two-tailed).

Table 13 First Difference Model: Book Value of Equity

	Const.	*Δ BVE*	*Δ MIN*	D_{MIN}	*Δ OCI*	D_{OCI}	*Δ ITG*	D_{ITG}	*Δ OFF*	D_{OFF}	*Adj. R^2*
(1)	-0.0383	1.8076	8.2253	-6.7888							0.1542
	(-2.076)	(4.800)	(3.218)	(-2.554)							
	[0.039]	[0.000]	[0.002]	[0.011]							
(2)	-0.0409	1.8782			17.669	-13.595					0.1565
	(-2.170)	(4.847)			(2.865)	(-2.097)					
	[0.031]	[0.000]			[0.005]	[0.037]					
(3)	-0.0341	1.7602					14.073	-12.318			0.1491
	(-1.874)	(4.756)					(3.272)	(-2.796)			
	[0.062]	[0.000]					[0.001]	[0.006]			
(4)	-0.0231	1.7713							4.3711	-4.5125	0.1233
	(-1.248)	(4.719)							(1.823)	(-1.452)	
	[0.214]	[0.000]							[0.070]	[0.148]	
(5)	-0.0364	1.8154	7.8175	-6.0827					0.3965	-2.2484	0.1477
	(-1.943)	(4.754)	(2.425)	(-1.809)					(0.1418)	(-0.628)	
	[0.054]	[0.000]	[0.016]	[0.072]					[0.887]	[0.531]	
(6)	-0.0393	1.8717			16.091	-11.498			0.9137	-2.5724	0.1501
	(-2.056)	(4.756)			(2.221)	(-1.513)			(0.3447)	(-0.761)	
	[0.041]	[0.000]			[0.028]	[0.132]			[0.731]	[0.448]	
(7)	-0.0325	1.7631					13.321	-11.159	0.4694	-2.0069	0.1419
	(-1.748)	(4.713)					(2.377)	(-1.937)	(0.1618)	(-0.551)	
	[0.082]	[0.000]					[0.018]	[0.054]	[0.872]	[0.582]	

Top = Estimated Coefficients, (Middle) = *t*-value using heteroskedasticity-consistent covariance matrix (white-t), [Bottom] = *p*-value (two-tailed).

Table 14 First Difference Model: Earnings

	Constant	*Δ PCOST*	D_{PCOST}	*Δ ADJNI*	*Δ ADJEBIT*	*Δ OTHER*	*Adj. R^2*
(1)	-0.0142	30.031	-22.879	2.1975			0.1265
	(-0.723)	(2.502)	(-1.730)	(4.442)			
	[0.471]	[0.013]	[0.085]	[0.000]			
(2)	-0.0157	30.400	-23.494		2.2330	-2.4078	0.1228
	(-0.796)	(2.518)	(-1.721)		(5.087)	(-5.359)	
	[0.427]	[0.013]	[0.087]		[0.000]	[0.000]	

Top = Estimated Coefficients, (Middle) = *t*-value using heteroskedasticity-consistent covariance matrix (white-t), [Bottom] = *p*-value (two-tailed).

Table 15 Correlation Matrix

	PRICE	*BVE*	*NI*	*ADJNI*	*PCOST*	*MIN*	*OFF*
PRICE		0.9217	0.7440	0.8004	0.7229	0.3281	0.5363
BVE	0.4059		0.6705	0.7291	0.7023	0.2378	0.4944
NI	0.3139	-0.0537		0.9890	0.4477	0.3070	0.4274
ADJNI	0.3835	0.0520	0.9105		0.5753	0.3605	0.5214
PCOST	0.1186	0.2479	-0.3322	0.0875		0.4807	0.7874
MIN	0.0068	0.1301	-0.3800	-0.0912	0.7073		0.4989
OFF	0.1751	0.1545	-0.1082	0.2511	0.8834	0.5426	

Numbers in lower left angle are correlation coefficients when all variables are deflated by the beginning-of-year stock price.

Table 16 Book Value of Equity and Earnings

	Const.	*BVE*	*NI*	*ADJNI*	*PCOST*	D_{PCOST}	*MIN*	D_{MIN}	*OFF*	D_{OFF}	*Adj.* R^2
(1)	0.5743	0.6215	2.6279								0.2705
	(11.34)	(7.884)	(5.309)								
	[0.000]	[0.000]	[0.000]								
(2)	0.5541	0.5709		3.0016	-0.1857						0.2858
	(10.61)	(7.059)		(5.280)	(-0.164)						
	[0.000]	[0.000]		[0.000]	[0.870]						
(3)	0.5526	0.5412		2.8403	4.1164	-4.0269					0.2929
	(10.80)	(6.604)		(5.243)	(1.510)	(-1.774)					
	[0.000]	[0.000]		[0.000]	[0.133]	[0.078]					
(4)	0.5673	0.6063	2.9033				0.5132				0.2744
	(10.91)	(7.653)	(5.094)				(1.486)				
	[0.000]	[0.000]	[0.000]				[0.139]				
(5)	0.5618	0.6083	2.7541				2.0432	-1.6200			0.2764
	(10.87)	(7.727)	(4.900)				(1.800)	(-1.367)			
	[0.000]	[0.000]	[0.000]				[0.073]	[0.173]			
(6)	0.5556	0.5885	2.7461						1.2502		0.2892
	(10.76)	(7.375)	(5.318)						(2.440)		
	[0.000]	[0.000]	[0.000]						[0.016]		
(7)	0.5590	0.5814	2.6029						1.8681	-0.8186	0.2891
	(10.96)	(7.288)	(4.984)						(2.354)	(-1.001)	
	[0.000]	[0.000]	[0.000]						[0.020]	[0.318]	

Top = Estimated Coefficients, (Middle) = *t*-value using heteroskedasticity-consistent covariance matrix (white-t), [Bottom] = *p*-value (two-tailed).

Table 17 Addition of Independent Variable

Panel A	*Constant*	*PCOST*	D_{PCOST}	*ADJNI*	*ADJEBIT*	*OTHER*	*GBI*	*Adj.* R^2
(1)	0.9631	5.6861	-4.9586	2.9028			-0.0282	0.1908
	(17.14)	(1.813)	(-1.881)	(5.239)			(-2.788)	
	[0.000]	[0.071]	[0.061]	[0.000]			[0.006]	
(2)	0.9429	5.9432	-5.2624		3.0925	-2.8426	-0.0315	0.1956
	(16.68)	(1.918)	(-2.023)		(5.446)	(-5.047)	(-3.043)	
	[0.000]	[0.057]	[0.044]		[0.000]	[0.000]	[0.003]	
Panel B	*Constant*	*Δ PCOST*	D_{PCOST}	*Δ ADJNI*	*Δ ADJEBIT*	*Δ OTHER*	*Δ GBI*	*Adj.* R^2
(1)	0.0572	30.241	-26.136	2.1358			0.1072	0.1695
	(1.774)	(2.565)	(-1.989)	(4.470)			(3.267)	
	[0.078]	[0.011]	[0.048]	[0.000]			[0.001]	
(2)	0.0561	30.842	-27.188		2.1921	-2.4751	0.1091	0.1674
	(1.736)	(2.604)	(-2.004)		(5.224)	(-5.699)	(3.312)	
	[0.084]	[0.010]	[0.047]		[0.000]	[0.000]	[0.001]	

Top = Estimated Coefficients, (Middle) = *t*-value using heteroskedasticity-consistent covariance matrix (white-t), [Bottom] = *p*-value (two-tailed).

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