This month's agenda: Changing corporate pension funds

Evaluation of Companies with Under-funded Retirement Benefits Under FAS 87

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Summary

In addition to accrued retirement benefit costs (pension liabilities) reported in financial statements (balance sheets and profit and loss statements), under-funded PBOs (projected benefit obligations) in the footnotes of financial statements have an increasing bearing, independent of other micro financial factors, on the evaluation of the stocks of the 24 Japanese companies adopting FAS 87 (US Financial Accounting Standard 87).

There are two possible reasons under-funded PBOs have attracted the attention of investors:

(1) Under-funded PBOs are, by nature, different from other liabilities on financial statements.
(2) Under-funded PBOs can be considered a convenient substitute for all factors peculiar to retirement benefits which are not clearly reflected on financial statements even under FAS 87.

From fiscal 2000 (ending March 2001), the new accounting standards, which will give investors a better understanding of details of retirement benefits, will be introduced to Japan. If the second reason above is valid, then it is likely that in evaluating stocks investors will pay more attention to details related to retirement benefits which are not recorded on balance sheets and profit and loss statements than under-funded PBOs, some portion of which should be revealed on balance sheets.

1. New accounting standard and stock prices

The Business Accounting Deliberation Council published *Proposal on Retirement Benefit Accounting* in June 1998, according to which Japanese companies will be required to disclose actual retirement benefits, whether pension or lump-sum payments, beginning from fiscal 2000 (ending March 2001).

Two questions arise about the impact of the new accounting standard on company evaluation, especially stock valuation:

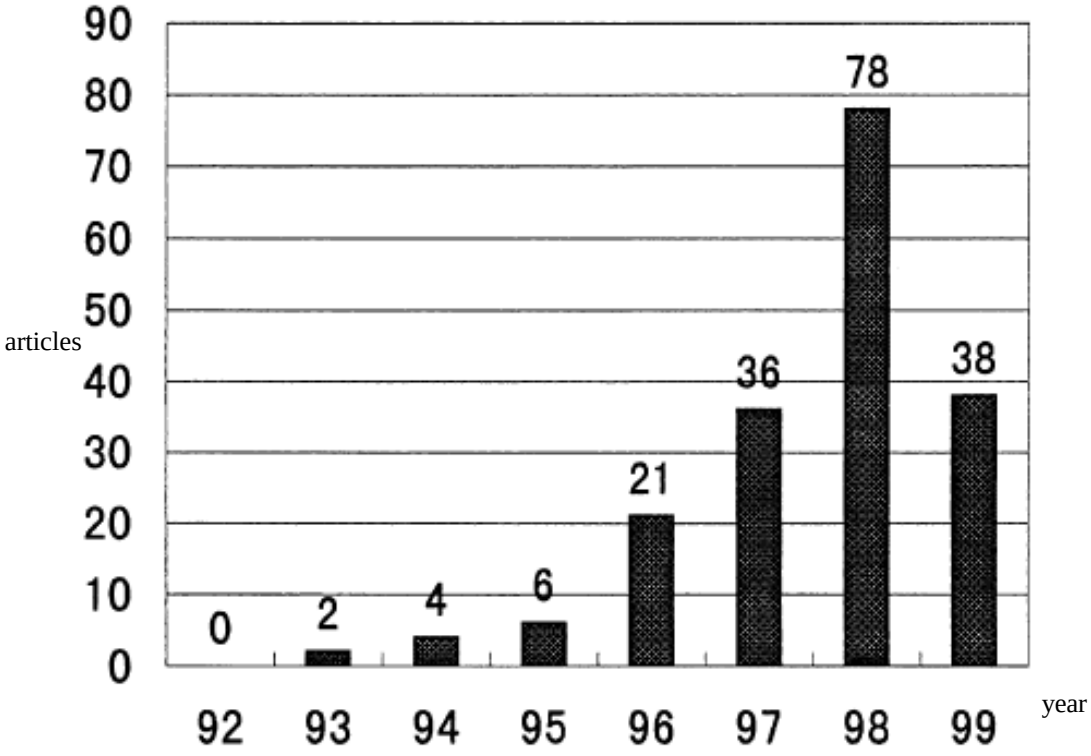
(1) How will stocks price change before the first disclosure of retirement benefits in accordance with the new accounting standard?
(2) After the introduction of the new accounting standard, what impact (and through

what channel) will the disclosure of retirement benefits have on stock evaluation?

The answer to the first question depends on whether stock prices before disclosure already reflect the actual situation. If stock prices accurately reflect the retirement benefit situation, there will be no change after initial disclosure. The reality is that up to 1995 or 1996, there were few analyst reports that estimated the size of retirement benefit obligations. Also, in our search for newspaper articles on the underfunding of corporate pension benefit obligations, we found very few before 1995. It was only in 1996 that we began to see a substantial increase in articles on the subject (Chart 1).

Data so far available on all listed companies are limited to those disclosed in accordance with the current accounting standard. Hence, data on retirement benefits are available only for the limited number of companies which submit reports in accordance with FAS

Chart 1 Number of newspaper articles discussing under-funded retirement benefits



Articles in four Nikkei publications

Two articles in 1993 and four in 1994 focus on US companies.

The 1999 articles were published between January and March.

Source: Nikkei Telecom.

87, or from specialist journals that estimate pension fund size, etc.

When we consider that at present very limited information is available on retirement benefits, it is unlikely that the stock prices of individual companies under current Japanese accounting standards accurately reflect the actual situation of respective retirement benefits, even if we assume that the 'semi-strong efficient market hypothesis' is valid, meaning that all publicly available information is reflected in stock prices. If more accurate information is disclosed, therefore, stock prices will be affected, at least to some extent.

That said, in face of the introduction of the new accounting standard from fiscal 2000, discounting of the actual state of retirement benefit funding is already underway. For instance, we now often see articles on retirement benefits, not only in analyst reports but also in media reports, based on management interviews, etc. Some companies have begun disclosing estimates of their retirement benefit obligations together with amortization plans. Hence, it is thought that analysts will focus on this subject with respect to business results for fiscal 1998 (ended March 1999) as well as the half year ending September 1999, prompting still-reluctant companies to follow suit.

Thus, over the next six months or so, the stock prices of major listed companies will discount the actual state of retirement benefits without waiting for the announcement of results for fiscal 2000 (ending March 2001).

2. Objectives

1) B/S approach and retirement benefit approach

The main purpose of this paper is to analyze whether retirement benefits, including related changes, will begin to impact stock prices after the introduction of the new accounting standard, independent of other factors.

Under the new accounting standard, under-funded PBOs (after deducting unrecognized obligations), defined as the difference between PBOs and retirement benefit assets, are, in principle, to be reported on the balance sheet (B/S), and the retirement benefit cost of the current term based on PBOs included in the profit and loss (P/L) statement.

Once under-funded PBOs are shown on financial statements proper (B/S, P/L and cash flow statements, but not figures in footnotes), it will be unnecessary to employ factors

related to retirement benefits which appear in footnotes (retirement benefit factors) to evaluate stock prices. The view that financial statements proper are sufficient source data for evaluation is termed the 'B/S approach' in this paper.

If an investor adopts the B/S approach, there is no improvement in stock evaluation even if a company contributes cash to the pension fund to reduce under-funded PBOs, because the impact on the B/S is only to reduce cash and under-funded PBOs by the same amount[1].

However, it should be noted that the economic nature of assets and liabilities related to retirement benefits is not the same as that of other assets and liabilities stated on the B/S.

For instance, they are different from a tax viewpoint. Profit earned from other assets is liable to corporate tax, though tax on returns on pensions fund assets is deferred. However, since this increases the pension fund by the amount of exempted tax, and reduces future company tax-exempt contributions to the pension fund, such tax-saving is set off in the long run. Nevertheless, it is still favorable in terms of economic value due to the time lag in tax payments (see Appendix 1). Thus, cash contributions to the pension fund should have a positive impact on company evaluation.

As can be seen in the instance cited above, even after the new accounting standard is introduced and under-funded PBOs posted as an employee retirement benefit item on the B/S, not all of the economic impact stemming from changes in retirement benefit factors are accurately reflected in financial statements. From this viewpoint, the analysis of financial statements proper is insufficient to accurately measure a company's economic value.

Bulow et al. [1987] discusses the impact on company stock evaluation of retirement benefit factors which are not reflected on the B/S. The work looks at US companies before the introduction of FAS 87 and concludes that retirement benefit factors are likely to have an impact on company stock evaluation independent of factors stated in financial statements proper. This conclusion is based on the following assumptions: (1) tax-saving effect, (2) guaranty from PBGC (Pension Benefit Guaranty Corporation) and effect as a put option, (3) 'implicit contracting', under which retirement benefits, though seemingly fixed, are similar to profit sharing subject to change by negotiation, (4) relation with other compensation such as wages, and (5) market irrationality and inefficiency.

Bulow's view, which insists it is necessary to analyze retirement benefit factors separately from factors revealed on financial statements even under US FAS 87 or the new Japanese accounting standard, is termed the 'retirement benefit approach' in this paper.

Yoshida [1998] empirically analyzes the issue from a similar perspective and shows that the tax-saving effect and others exist.

2) Objectives of analysis; testing three hypotheses

The retirement benefit approach is more precise than the B/S approach in appraising economic value. However, investors do not always accurately analyze all information available. It is also possible that investors omit analyzing detailed retirement benefit factors and prefer the B/S approach depending on the balance between associated costs and importance of such analysis. This paper examines which approach is likely to be adopted by investors.

Needless to say, it is impossible to analyze an investor's behavior under the new accounting standard which is yet to be introduced. Therefore, we will analyze companies adopting FAS 87, whose retirement benefits are disclosed in financial statements.

As a first step, we selected the following three retirement benefit factors for stock evaluation purposes independent of figures revealed in the B/S: those related to (1) retirement benefit assets, (2) the difference between PBOs and ABOs (accumulated retirement benefit obligations), and (3) PBOs and under-funded PBOs (difference between PBOs and retirement benefit assets).

These three factors affect corporate value which cannot be detected by analyzing figures in financial statements. Firstly, factors under (1) above have a tax-saving effect and those under (2) reflect the existence of prior service costs, which are not yet recognized (amortized) on financial statements, even under FAS 87[2] .

The reason for selecting factor (3) is that the economic nature of PBOs and under-funded PBOs is not the same as that of other liabilities, such as bank loans, on the B/S.

For instance, if actual payment under a seemingly fixed or defined benefits scheme is increased or decreased in line with the business results of a company, the real nature of the retirement benefit obligation is similar to that of profit sharing. In another case,

whenever retirement benefit assets fall below the minimum required level, a company has to make an additional one-time contribution, hence PBOs and under-funded PBOs put more strain on cash flow than debt such as borrowing or bonds[3].

From this viewpoint, it is possible that PBOs and under-funded PBOs influence stock evaluation as a retirement benefit factor independent of figures on financial statements. It can also be the case that under-funded PBOs are taken up as a convenient substitute for retirement benefit factors.

In the following section, we test three hypotheses A, B, and C (Chart 2), which respectively assume that retirement benefit factors (under (1), (2), and (3) above) have an effect on company stock evaluation independent of factors reflected on the B/S and P/L.

Chart 2 Three hypotheses to be tested

	Outline	Basis
Hypothesis A	The larger retirement benefit assets, the higher the stock price.	The assets have tax-saving effects.
Hypothesis B	The larger the difference between under-funded PBOs and retirement benefit costs on the B/S, the greater the reduction in stock prices.	Investors evaluate retirement benefit obligations with great accuracy, including the unrecognized portion.
Hypothesis C	The greater under-funded PBOs, the greater the reduction in stock prices.	Investors (1) evaluate companies employing under-funded PBOs as a convenient substitute or (2) recognize that under-funded PBOs are different from other liabilities in their economic nature.

3. Methods

1) Samples

At present, there are 26 Japanese companies which prepare consolidated financial statements in accordance with the SEC standard, and 24 of them adopt FAS 87[4]. These 24 companies are analyzed here. The sources of financial data including retirement benefit factors are consolidated financial statements for fiscal terms ending in December 1990 to March 1998, except for the following two firms which are excluded from analysis due to a change in account closing term (Fuji Photo Film, for fiscal year ended March 1995, and Sanyo Electric, for fiscal year ended March 1996).

As for stock prices, total return on stocks (including dividends) is calculated by NLI

Research Institute using the Nikkei NEEDS database. The number of samples is 166 (24 x 7 - 2).

2) Selection of variables

To test the three hypotheses, annual excess return[5] (total return of each company minus the market value weighted average total return of 24 companies) is selected as a dependent variable. The reason for this selection is that excess return reflects investor evaluation more precisely than Tobin's q, which was selected by Bulow et al. (1987). (In theory, Tobin's q is based on market value, but in actual analysis it is usually based on accounting figures as it is difficult to obtain information about the market value of assets.)

In the next step, 13 retirement benefit factors are selected as explanatory (independent) variables (Chart 3). For example, the rate of increase in retirement benefit assets for testing Hypothesis A was selected, while the rate of increase in unrecognized obligations for Hypothesis B was chosen, and the rate of increase in under-funded PBOs for Hypothesis C.

Chart 3 Candidates for retirement benefit factors (explanatroy variables)

Hypothesis A
• Rate of increase in retirement benefit assets • Ratio of retirement benefit assets to equity capital • Ratio of retirement benefit assets to market capitalization
Hypothesis B
• Rate of increase in unrecognized obligations (= PBOs – Accrued retirement benefit costs - Retirement benefit assets) • Ratio of unrecognized obligations to equity capital • Ratio of unrecognized obligations to market capitalization
Hypothesis C
• Rate of increase in under-funded PBOs • Ratio of under-funded PBOs to equity capital • Ratio of under-funded PBOs to market capitalization • Ratio of PBOs to equity capital • Ratio of PBOs to market capitalization • Ratio of cash flow to under-funded PBOs • Ratio of cash flow to PBOs

Here we assume that the stock price is stated by the following function:

$S_t = f(a_t\ b_t)$ (3-1)

where,

S_t = stock price at term t

a_t = factors related to stock price evaluation at term t, except the retirement benefit factor

b_t = retirement benefit factor at term t

The rate of change in stock price is stated in another function:

$R_t = \triangle S / S_{t-1} = g(\triangle a / a_{t-1,}\ \triangle b / b_{t-1})$ (3-2)

where,

R_t = rate of change in stock price from term t-1 to t (return on stock)

$\triangle S$ = increment in the stock price from term t-1 to t (excluding dividends)

$\triangle a$ = increment in factor 'a' from term t-1 to t

$\triangle b$ = increment in factor 'b' from term t-1 to t

If a significant correlation is recognized between excess return on stocks and the rate of increase in the retirement benefit factor, hypotheses A through C will be sustained.

Together with the rate of change in each retirement benefit factor for hypotheses A, B, and C, absolute values at standard points are also selected as explanatory (independent) variables. In sum, as shown in Chart 3, the following 13 ratios are selected as explanatory (independent) variables of retirement benefit factors:

*Rate of growth in (1) retirement benefit assets, (2) unrecognized obligations, (3) PBOs, and (4) under-funded PBOs;
*Ratios of (1) to (4) above to equity capital and market capitalization; and
*Ratios of PBOs and under-funded PBOs to cash flow (= Net income for the current term + Depreciation: cash flow henceforth)

The reason for selecting absolute values of the factors as explanatory (independent)

variables is because if any retirement benefit factor which has not been reflected in the stock price until term t-1 is reflected for the first time at term t, it is probably the level of the factor at term t that shows the effect on return on stocks. This is stated mathematically as follows:

Stock price at term t-1:

$$S_{t-1} = f(a_{t-1}) \quad (3\text{-}3)$$

When the stock price function changes to a new function as investors take a new factor 'b' into consideration for the first time at term t, the stock price at term t is:

$$S_t = f'(a_t, b_t) \quad (3\text{-}4)$$

Then,

$$R_t = g'(\triangle a / a_{t-1}, b_t) \quad (3\text{-}5)$$

The equation above indicates that the absolute value of retirement benefit factor b_t has an effect on stock return.

Even when a statistically significant relationship exists between return on stock and the absolute value of a retirement benefit factor, it can be the case that hypothesis A, B, or C has not been consistently sustained throughout the seven-year sample period, but from some other time during the period. In other words, investors may have changed their way of stock price evaluation at some time during the period, gradually affecting the stock price since then until the factor is fully reflected in the stock price.

In addition to the analysis with PBOs as an explanatory (independent) variable, analysis with adjusted PBOs is performed, where PBOs are adjusted on the assumption that the discount rate is equal to the yield to maturity on a 20-year government bond (compound yield for the least seasoned issue) and that duration of PBOs is 15 years at account closing time. Basic statistics for variables before standardization are shown in the chart in Appendix 2 at the end of this paper.

3) Analytical steps

The hypothesis is tested in three steps[6], where excess return on each company stock (dependent variable) is analyzed by:

(1) One factor regression analysis with retirement benefit factors
(2) Multi-factor regression analysis with retirement benefit factors
(3) Multi-factor regression analysis with combinations of selected retirement benefit factors and other factors stated on the B/S and P/L

In the first step of simple one factor regression analysis using the ordinary least squares method, a regression model called the 'pool method' is employed, where equation (3-6) is estimated using （I ×T ）pieces of data, available by pooling the structure of a cross section of data (i = 1,2,...I) and respective time series (t = 1,2,...T)[7]:

$$R_{it} = \beta F_{it} + \varepsilon_{it} \qquad (3\text{-}6)$$

where,

R_{it} = excess return in the previous one year for company i at term t

F_{it} = retirement benefit factor for company i at term t

β = regression coefficient

ε_{it} = residual error

As far as regression coefficient β is statistically significant, it is affirmed that the retirement benefit factor has explanatory power for excess stock return.

The second step is a multi-factor regression analysis of equation (3-7) by using the ordinary least squares method with explanatory variables of multi-factor retirement benefit factors, which are proven to affect total stock return by one factor regression analysis made in the first step. It is possible that the retirement benefit factor proven significant in one factor regression analysis loses significance in multi-factor regression analysis. In such a case, the hypothesis sustained by one factor regression analysis may be rejected.

$$R_{it} = \beta_1 F_{it,1} + \cdots + \beta_j F_{it,j} \varepsilon_{it} \qquad (3\text{-}7)$$

where,

R_{it} = excess return in the last one year for company i at term t

F_{itj} = retirement benefit factor j for company i at term t

β_j = regression coefficient of retirement benefit factor j

ε_{it} = residual error

The third step is to construct a multi-factor model with a combination of a retirement benefit factor proven significant by one factor regression analysis and other financial factors, and to test whether retirement benefit factors have an independent influence on stock prices.

As far as the retirement benefit factor has a significant effect on stock return through all of these three steps, one of hypotheses A, B, or C dependent on that factor's significance can be considered to be valid (including the case where the hypothesis is sustained not from the beginning but from some time during the period from 1989 to 1998).

4. Results of analysis: 1. Test by retirement benefit factors

1) One factor regression analysis

One factor regression analysis based on equation (3-6) resulted in the figures shown in Chart 4.

Chart 4 Results of one-factor regression analysis by the pool method of excess stock return (1)

Retirement benefit factor (explanatory variable)	Regression coefficient β	Standard error	t value	Adjusted R^2
Test of Hypothesis A				
Rate of increase in retirement benefit assets	0.158	0.077	2.051 *	0.019
Ratio of retirement benefit assets to equity capital	-0.077	0.078	-0.984	0.000
Ratio of retirement benefit assets to market capitalization	-0.215	0.076	-2.823**	0.041
Test of Hypothesis B				
Rate of increase in unrecognized obligations	-0.030	0.078	-0.389	-0.005
Same as above, after adjustment for discount rate	-0.036	0.078	-0.468	-0.005
Ratio of unrecognized obligations to equity capital	-0.018	0.078	-0.237	-0.006

Same as above, after adjustment for discount rate	-0.101	0.078	-1.300	0.004
Ratio of unrecognized obligations to market capitalization	-0.112	0.078	-1.445	0.007
Same as above, after adjustment for discount rate	-0.165	0.077	-2.144 *	0.021
Test of Hypothesis C				
Rate of increase in under-funded PBOs	-0.081	0.078	-1.042	0.001
Same as above, after adjustment for discount rate	-0.086	0.078	-1.112	0.001
Ratio of under-funded PBOs to equity capital	-0.141	0.077	-1.830	0.014
Same as above, after adjustment for discount rate	-0.145	0.077	-1.875	0.015
Ratio of under-funded PBOs to market capitalization	-0.216	0.076	-2.830**	0.041
Same as above, after adjustment for discount rate	-0.214	0.076	-2.810**	0.040
Ratio of PBOs to equity capital	-0.113	0.078	-1.454	0.007
Same as above, after adjustment for discount rate	-0.120	0.078	-1.548	0.008
Ratio of PBOs to market capitalization	-0.227	0.076	-2.983**	0.046
Same as above, after adjustment for discount rate	-0.226	0.076	-2.977**	0.045
Ratio of cash flow to under-funded PBOs	0.000	0.078	0.006	-0.006
Same as above, after adjustment for discount rate	0.056	0.078	0.716	-0.003
Ratio of cash flow to PBOs	0.179	0.077	2.326 *	0.026
Same as above, after adjustment for discount rate	0.177	0.077	2.300 *	0.025

* Significant at the 5% level. ** Significant at the 1% level.

As for Hypothesis A in Chart 2, the rate of increase in retirement benefit assets and ratio of retirement benefit assets to total market capitalization proves statistically significant. However, the regression coefficient β for the ratio of retirement benefit assets to total market capitalization is negative. This contradicts Hypothesis A which assumes that the greater the retirement benefit assets, the greater the tax-saving effect and hence the more favorable to stock price.

As for Hypothesis B, the ratio of unrecognized obligations to market capitalization after adjustment for the discount rate shows statistical significance. This means that the market evaluates unrecognized obligations not reflected on the B/S, after adjustment for a discount rate, in relation to market capitalization. However, the unrecognized obligation factor before adjustment for the discount rate is not significant. Therefore, it is ambiguous as to whether the unrecognized obligation is taken into consideration in the market evaluation.

As for Hypothesis C, PBOs prove statistically significant in terms of the ratio to total market capitalization as well as ratio to cash flow. Also, under-funded PBOs are significant in terms of the ratio to market capitalization, but the rate of increase in under-funded PBOs is not significant. The question is thus how we can reconcile these contradictory results regarding under-funded PBOs.

2) Multi-factor regression analysis

These one factor regression analyses for the three hypotheses all adopt retirement benefit assets and/or PBOs as explanatory variables. In this sense, explanatory variables for the three hypotheses are correlated to each other. Therefore, there is a possibility that we obtain results of statistical significance for more than one hypothesis even when only one of them is valid.

To avoid such erroneous results, the following steps are taken. First, we calculate the correlation coefficient between each of the eight retirement benefit factors, which are proven significant by one factor regression analysis in 1) above.

The eight retirement benefit factors of statistical significance are:

- Rate of increase in retirement benefit assets,
- Ratio of unrecognized obligations to market capitalization after adjustment for the discount rate
- Ratio of under-funded PBOs to market capitalization
- Same as above, after adjustment for the discount rate
- Ratio of PBOs to market capitalization
- Same as above, after adjustment for the discount rate
- Ratio of cash flow to PBOs
- Same as above, after adjustment for the discount rate

Correlation coefficients among these eight are shown in Chart 5.

Chart 5 Correlation coefficients among major retirement benefit factors

	①	②	③	④	⑤	⑥	⑦	⑧
(1) Rate of increase in retirement benefit assets	1							
(2) Ratio of unrecognized	-0.037	1						

obligations to market capitalization, after adjustment for discount rate								
(3) Ratio of under-funded PBOs to market capitalization	-0.097	0.852	1					
(4) Same as above, after adjustment for discount rate	-0.101	0.895	0.987	1				
(5) Ratio of PBOs to market capitalization	-0.087	0.895	0.926	0.943	1			
(6) Same as above, after adjustment for discount rate	-0.091	0.904	0.918	0.946	0.997	1		
(7) Ratio of cash flow to PBO	0.155	-0.532	-0.513	-0.528	-0.615	-0.608	1	
(8) Same as above, after adjustment for discount rate	0.170	-0.544	-0.512	-0.533	-0.618	-0.614	0.997	1

Note: Shaded figures indicate that the correlation coefficient is 0.8 or higher.

Based on the above results, combinations of factors with a high mutual correlation coefficient and factors after adjustment for the discount rate are excluded from analysis. Then, multi-factor regression analyses with two or three retirement benefit factors are made based on equation (3-7), the results of which are shown in Chart 6.

Chart 6 Results of multi-factor regression analysis of excess stock return by the pool method (1)

Combination of retirement benefit factors	Regression coefficient β	Standard error	t value	Adjusted R^2	Multicollinearity coefficient
Regression 1				0.052	0.719
(1) Rate of increase in retirement benefit assets	0.131	0.077	1.703		
(3) Ratio of under-funded PBOs to market capitalization	-0.165	0.088	-1.872		
(7) Ratio of cash flow to PBOs	0.074	0.089	0.827		
Regression 2				0.055	0.607
(1) Rate of increase in retirement benefit assets	0.135	0.077	1.766		
(5) Ratio of PBOs to market capitalization	-0.190	0.096	-1.979*		
(7) Ratio of cash flow to PBOs	0.041	0.097	0.423		
Regression 3				0.038	0.976
(1) Rate of increase in retirement benefit assets	0.134	0.077	1.729		
(7) Ratio of cash flow to PBOs	0.158	0.077	2.044*		

Regression 4				0.054	0.991
(1) Rate of increase in retirement benefit assets	0.138	0.076	1.820		
(3) Ratio of under-funded PBOs to market capitalization	-0.202	0.076	-2.660**		
Regression 5				0.041	0.737
(3) Ratio of under-funded PBOs to market capitalization	-0.168	0.089	-1.897		
(7) Ratio of cash flow to PBOs	0.092	0.089	1.039		
Regression 6				0.059	0.993
(1) Rate of increase in retirement benefit assets	0.140	0.076	1.841		
(5) Ratio of PBOs to market capitalization	-0.215	0.076	-2.834**		
Regression 7				0.042	0.622
(5) Ratio of PBOs to market capitalization	-0.188	0.097	-1.947		
(7) Ratio of cash flow to PBOs	0.063	0.097	0.652		

* Significant at the 5% level. **Significant at the 1% level.

Note: The multicollinearity coefficient indicates the extent of multicollinearity between factors. It ranges between 0 and 1, and the closer the index is to 0, the higher multicollinearity. Multicollinearity is a product of multi-factor regression analysis, meaning that when factors selected as explanatory variables for analysis are highly correlated to each other, the regression coefficient obtained as a result of the analysis lacks robustness.

Chart 6 indicates firstly that the rate of increase in retirement benefit assets is not a significant factor in any combination with other factors.

Secondly, in multi-factor regression analyses with two explanatory variables, the ratio of under-funded PBOs to market capitalization, the ratio of PBOs to market capitalization, and the ratio of cash flow to PBOs are significant in combination with the rate of increase in retirement benefit assets (regressions 3, 4, and 6). On the other hand, in the combination of the ratio of cash flow to PBOs on one side and the ratio of under-funded PBOs to market capitalization (Regression 5), or the ratio of PBOs to market capitalization on the other (Regression 7), all factors turn out to be insignificant.

Thirdly, in multi-factor regression analyses with three explanatory variables (regressions 1 and 2), only the ratio of PBOs to market capitalization is significant.

3) Summary of one-factor regression

Among retirement benefit factors, those related to the absolute value of PBOs and the ratio of under-funded PBOs to market capitalization or cash flow are recognized to have a significant correlation with excess return on stock, as they are significant (1) in one factor regression analysis (1% significance level) and also (2) in multi-factor regression analysis in combination with some other retirement benefit factors. On the other hand, all other retirement benefit factors (whether the rate of increase or absolute values) fail to show a clearly significant correlation with excess return on stock.

5. Results of analysis: 2. Tests using a multi-factor model

The next step is to confirm the results of the previous analysis using a multi-factor stock price model. As far as retirement benefit factors prove significant in explaining excess stock return by a multi-factor model including both retirement benefit factors and factors calculated from financial statements, it is confirmed that investors take the retirement benefit approach.

1) Selection of factors based on financial statements

Factors usually selected for multi-factor stock valuation model include macro factors, micro factors, technical factors, and sector (industry) factors. However, only six micro factors related to the B/S and P/L are selected here, because our purpose is to check whether investors take the retirement benefit approach or not, and not to construct a stock price model with strong explanatory power[8]. The six selected factors are:

- Natural logarithm of market capitalization
- Earnings yield (ratio of earnings per share to stock price)
- Net assets to stock price ratio (ratio of book value per share to stock price)
- Cash flow to stock price ratio (based on actual cash flow per share for the current term)
- Debt ratio (= Debt/Shareholders' equity)
- Return on equity (ratio of actual net income for the current term to book value of equity)

A multi-factor model is constructed using these factors in accordance with the method described in *3. 3) Steps of analysis.*

Before proceeding to the next step, we conducted one factor regression analysis of these

six factors based on equation (3-6), the results of which are shown in Chart 7. Factors of statistical significance are the natural logarithm of market capitalization, the net assets to stock price ratio, the debt ratio, and return on equity. In particular, the net assets to stock price ratio[9] (reciprocal of PBR) has strong explanatory power for excess stock return.

Chart 7 Results of one factor regression analysis by the pool method of excess stock return (2)

Micro factor	Regression coefficient β	Standard error	t value	Adjusted R^2
Natural logarithm numeric of market capitalization	0.251	0.076	3.323**	0.057
Earnings yield (ratio of earnings per share to stock price)	0.085	0.078	1.096	0.001
Net assets to stock price ratio	-0.447	0.070	-6.408**	0.195
Cash flow to stock price ratio (based on actual cash flow per share for the current term)	-0.144	0.077	-1.870	0.015
Debt ratio (= Debt/Shareholders' equity)	-0.168	0.077	-2.186*	0.022
Return on equity (ratio of actual net income for the current term to book value of equity)	0.217	0.076	2.845**	0.041

* Significant at the 5% level. ** Significant at the 1% level.

Chart 7 indicates that among the 24 companies, large cap, growth, lower leverage[10], and higher return on equity stocks generated higher total return in the sample period.

Based on results of the one factor regression analysis above, where the net assets to stock price ratio is the most significant, combinations of the net assets to stock price ratio with other factors are used for multi-factor regression analysis based on equation (3-7). The results are shown in Chart 8. Only in a test using a combination of the net assets to stock price ratio and the debt ratio, do both variables prove to be statistically significant.

Chart 8 Results of multi-factor regression analysis by the pool method of excess stock return (2)

Combination of micro factors	Regression coefficient β	Standard error	t value	Adjusted R^2	Multicollinearity coefficient

Net assets to stock price ratio Natural logarithm numeric of market capitalization	-0.431 0.033	0.081 0.081	-5.305** 0.401	0.191	0.743
Net assets to stock price ratio Return on equity	-0.429 0.048	0.076 0.076	-5.629** 0.624	0.192	0.844
Net assets to stock price ratio Debt ratio	-0.451 -0.178	0.069 0.069	-6.573** -2.591*	0.222	0.999

* Significant at the 5% level. ** Significant at the 1% level.

Regarding the multicollinearity coefficient, see Chart 6.

2) Incorporation of retirement benefit factors into the multi-factor model

After the preparatory steps above, a multi-factor model of equation (5-1) is constructed to test the significance of each retirement benefit factor.

$$R_{it} = \beta_1 F_{it,1} + \beta_2 F_{it,2} + \beta_3 F_{it,3} + \varepsilon_{it} \quad (5\text{-}1)$$

where,

R_{it} = excess return in the previous year for company i at term t

$F_{it,1}$ = net assets to stock price ratio for company i at term t

$F_{it,2}$ = debt ratio of issue i at term t

$F_{it,3}$ = retirement benefit factor of issue i at term t

$\beta 1, \beta 2, \beta 3$ = regression coefficient of each factor

ε_{it} = residual error

Factors significant in one factor regression analysis are incorporated into the term for retirement-benefit factors in the equation to test their significance[11], namely, the rate of increase in retirement benefit assets, the ratio of under-funded PBOs to market capitalization, the ratio of PBOs to market capitalization, and the ratio of cash flow to PBOs. Results are shown in Chart 9.

Chart 9 Test of significance of retirement benefit factors using a multi-factor model

Combination of factors	Regression coefficient β	Standard error	t value	Adjusted R^2	Multicollinearity coefficient
Regression 8				0.221	0.917

Net assets to stock price ratio	-0.443	0.069	-6.386**		
Debt ratio	-0.163	0.071	-2.288*		
Rate of increase in retirement benefit assets	0.059	0.072	0.825		
Regression 9				0.241	0.979
Net assets to stock price ratio	-0.434	0.068	-6.359**		
Debt ratio	-0.164	0.068	-2.401*		
Ratio of under-funded PBOs to market capitalization	-0.153	0.069	-2.232*		
Regression 10				0.234	0.954
Net assets to stock price ratio	-0.426	0.069	-6.142**		
Debt ratio	-0.165	0.069	-2.404*		
Ratio of PBOs to market capitalization	-0.130	0.070	-1.869		
Regression 11				0.221	0.748
Net assets to stock price ratio	-0.475	0.075	-6.334**		
Debt ratio	-0.199	0.074	-2.696**		
Ratio of cash flow to PBOs	-0.062	0.079	-0.785		
Regression 12				0.233	0.991
Net assets to stock price ratio	-0.440	0.068	-6.420**		
Debt ratio	-0.178	0.068	-2.614**		
Ratio of unrecognized obligations to market capitalization, after adjustment for discount rate	-0.125	0.068	-1.823		
Regression 13				0.239	0.975
Net assets to stock price ratio	-0.433	0.068	-6.322**		
Debt ratio	-0.164	0.068	-2.397*		
Ratio of under-funded PBOs to market capitalization, after adjustment for discount rate	-0.145	0.069	-2.108*		
Regression 14				0.234	0.953
Net assets to stock price ratio	-0.426	0.069	-6.137**		
Debt ratio	-0.165	0.069	-2.403*		
Ratio of PBOs to market capitalization, after adjustment for discount rate	-0.129	0.070	-1.844		
Regression 15				0.221	0.747
Net assets to stock price ratio	-0.477	0.075	-6.350**		
Debt ratio	-0.200	0.074	-2.716**		
Ratio of cash flow to PBOs after adjustment for discount rate	-0.067	0.079	-0.837		

* Significant at the 5% level. ** Significant at the 1% level.

Regarding the multicollinearity coefficient, see Chart 6.

According to test results shown in Chart 9 above, when used with the two micro factors only the ratio of under-funded PBOs to market capitalization shows statistical significance as an explanatory factor for excess stork return (Regression 9). The ratio of PBOs to market capitalization does not have sufficient significance, i.e. at the 5%

level (Regression 10). The ratio of cash flow to PBOs is not significant at the 5% level, and, further, its multicollinearity coefficient is much less than 1, which indicates a high correlation with the net assets to stock price ratio and/or the debt ratio (Regression 11).

Finally, it is confirmed that only the ratio of under-funded PBOs to market capitalization is significant in explaining stock return, while there is no significant correlation between the rate of increase in under-funded PBOs and the stock return, as noted in *4. 1) One factor regression analysis.*

Combining these two results, we face another problem. If under-funded PBOs are perceived as a risk factor by investors, at least 'expected' stock return should be heightened However, the ratio of under-funded PBOs to market capitalization has a negative relationship to excess stock return. How can this be explained? It is possible that the nature of under-funded PBOs has changed from being an insignificant stock evaluation factor to a significant one some time during the seven-year sample period. (See *3. 2) Selection of variables.*) If this assumption is valid, under-funded PBOs have started to have a negative effect on stock return from the time investors started to discount this factor in stock evaluation[12].

If so, the next issue is to identify the period when under-funded PBOs were first considered by investors and began influencing stock prices accordingly. For this purpose, equation (5-1) is modified to equation (5-2) with a dummy variable for each fiscal term as shown below:

$$R_{it} = \beta_1 F_{it,1} + \beta_2 F_{it,2} + \Sigma\, \gamma_j d_j F_{it,3} + \varepsilon_{it} \qquad (5\text{-}2)$$

where,

R_{it} = excess return in the previous year for company i at term t

$F_{it,1}$ = net assets to stock price ratio for company i at term t

$F_{it,2}$ = debt ratio of company i at term t

$F_{it,3}$ = ratio of under-funded PBOs to market capitalization for company i at term t

d_j = dummy variable of term j (1 for relevant fiscal term and 0 for other fiscal terms)

$\beta_1, \beta_2, \gamma_j$ = regression coefficient of each factor

ε_{it} = residual error

Results of analysis based on the modified equation above indicate that under-funded PBOs have no significant effect on excess stock return in any fiscal term. (See Regression 16 in Chart 10.) However, it is found that t values for fiscal periods ended March 1997 and March 1998 are higher than those for preceding fiscal periods. With attention to this finding, analysis in a time series of two years as one term is performed to find that under-funded PBOs have a significant correlation with excess stock return, as far as the latest two terms are concerned. (Regression 17.)

This means that under-funded PBOs have come to be taken into consideration by investors since 1996 and 1997 to have a very gradual, negative influence on stock prices.

Chart 10 Test of significance of the under-funded PBO factor using a dummy variable for each fiscal term

Combination of factors		Regression coefficient β	Standard error	t value	Adjusted R^2
Regression 16					0.224
Net assets to stock price ratio		-0.422	0.070	-6.041**	
Debt ratio		-0.158	0.069	-2.287*	
Ratio of under-funded PBOs to market capitalization	FY98 03	-0.290	0.184	-1.579	
Same as above	FY97 03	-0.286	0.181	-1.583	
Same as above	FY96 03	-0.195	0.180	-1.081	
Same as above	FY95 03	0.011	0.180	0.061	
Same as above	FY94 03	-0.129	0.180	-0.715	
Same as above	FY93 03	-0.023	0.180	-0.126	
Same as above	FY92 03	-0.174	0.189	-0.918	
Regression 17					0.235
Net assets to stock price ratio		-0.423	0.069	-6.105**	
Debt ratio		-0.158	0.069	-2.309*	
Ratio of under-funded PBOs to market capitalization	FYs 97 03, 98 03	-0.288	0.129	-2.234*	
Same as above	FYs 95 03, 96 03	-0.092	0.127	-0.725	
Same as above	FYs 93 03, 94 03	-0.076	0.127	-0.598	
Same as above	FY92 03	-0.173	0.188	-0.924	

* Significant at the 5% level. ** Significant at the 1% level.

6. Conclusion

Firstly, as far as Japanese companies adopting FAS 87 are concerned, under-funded PBOs is the only factor which is possibly considered in stock evaluation independent of the factors stated on financial statements. (Hypothesis C in Chart 2 is sustained.) Explanatory power of other retirement benefit factors, i.e. the tax-saving effects of retirement benefit assets and unrecognized obligations under FAS 87 balance sheets, are not proven to be of statistical significance. (Hypotheses A and B are not sustained.)

Secondly, it is likely that under-funded PBOs were gradually considered as a stock valuation factor between 1991 to 1997. This happened in the latter half of the seven-year sample period.

The question is why do investors take the retirement benefit approach and pay attention to under-funded PBOs instead of taking the simple B/S approach ?

The first possible answer is that while under-funded PBOs themselves are partially reflected on the B/S, they will probably place more burden on the company than other liabilities stated on the B/S. For instance, (1) under-funded PBOs cannot be rolled over, (2) in the case of bankruptcy, a portion of under-funded PBOs is classified as a labor-related claim subject to preferential payment, and (3) under-funded PBOs are a negative factor restraining corporate cash flow for a long time. As long as under-funded PBOs are regarded a heavier burden than borrowing or bonds due to these reasons, they may be analyzed independent of the B/S and P/L.

Secondly, the accounting process of FAS 87 is so complex that it takes time to analyze each factor. However, investors who recognize that the analysis of figures revealed on the B/S and P/L is not enough will look for further analysis. All factors related to hypotheses A and B include and are related to either PBO or retirement benefit assets. For this reason, under-funded PBOs appear as one convenient substitute for all these factors.

The tendency of investors to avoid complexity is also recognized with respect to usage of the discount rate. For instance, as noted in *5. Results of analysis: 2*, the regression analysis of the multi-factor return model proves that, among factors after adjustment for the discount rate, only the ratio of under-funded PBOs to market capitalization is significant. This means that investors do not adjust the discount rate used by a company

to the prevailing market rate. (See Chart 9, regressions 9 and 13.)

Depending on which of the two reasons explaining why investors take under-funded PBOs into account is valid, the response of companies in the future will differ.

If investors consider under-funded PBOs because they are different from other liabilities in nature and the stock price has been falling accordingly, reducing under-funded PBOs could become a rational aim for companies. For instance, a current issue focuses on the direct placing of cross-held stocks in pension fund assets. While this plan has no tax-saving advantage, it still has a positive effect on the stock price of the company concerned as it reduces under-funded PBOs.

On the other hand, if investors select under-funded PBOs as a substitute for several retirement benefit factors due to their convenience, action to decrease under-funded PBOs on the B/S will have little effect on stock prices if investors become more knowledgeable and begin analyzing retirement benefits more precisely.

Which is a correct understanding? At this moment it is not clear that retirement benefit obligations put a heavier burden on a company than other liabilities, because the legal status of the corporate pension is not established yet. Also, it is not clear that investors precisely analyze factors peculiar to each retirement benefit, because our analyses reveal that under-funded PBOs have been gradually considered by investors over the seven-year sample period. When all matters are considered, it is likely that just because of convenience investors have selected under-funded PBOs as an evaluation factor.

If so, it is likely that with the introduction of the new accounting standard to all Japanese companies, which will give investors a better understanding of retirement benefits, the economic impact of each retirement benefit factor, rather than under-funded PBOs, will have an increasing bearing in analysis[13]. In the last two to three years, a company adopting FAS 87 suffers from its stock price being inaccurately estimated due to investors' double consideration of accrued retirement benefit costs and under-funded PBOs (stated on the B/S as an obligation). Due to that double consideration, the stock price of an FAS 87 company with a large amount of accrued retirement benefit costs on the B/S has tended to be underestimated in comparison with a company with less. Companies with larger under-funded PBOs will be relieved from such a problem parallel with a shift of investor interest from under-funded PBOs to the respective retirement benefit factors noted above. (Companies with larger unpaid retirement costs an the B/S tend to be undevalned compared to other companies.)

Appendix 1

Influence of tax-saving effects on company evaluation

(Refer to Bulow et al [1987])

Assume that in one pension fund, the investment yield for one term is r, and the corporate income tax rate is t. When additional funding F is made at the beginning of the term, the tax saving due to such funding is F x t. Therefore, the net contribution (expenditure) in this case is F(1-t).

On the other hand, if the contribution is made at the end of the term, the equivalent amount to F contributed at the beginning of the term is F (1+r). The tax saving in this case is F(1+r) × t. Therefore, the net contribution in this case is F(1+r)(1-t), and its present value at the beginning of the term is

$$\frac{F\,(1+r)\,(1-t)}{1+r\,(1-t\,)}$$

Then, the saving in contribution (= increment in company value) due to the timing difference at the beginning of the term is

$$\frac{F\,(1+r\,)\,(1-t)}{1+r\,(1-t)} - F(1-t) = \frac{F\,(1-t)\,rt}{1+r\,(1-t)}$$

If additional funding F continues for n terms, the increment in company value is:

$$\sum_{k=1}^{n} \frac{F(1-t)\,rt}{\{1+r\,(1-t)\}^{k}} = Ft \left[1- \left\{ \frac{1}{1+r\,(1-t)} \right\}^{n+1} \right]$$

If additional funding F continues forever, the increment in company value is Ft.

($r>0$ and $0<t<1$, $n \rightarrow \infty$)

Take the 24 companies applying FAS 87 for example. Their retirement benefit assets were equivalent to 18.1 % of their market capitalization (in the term from December 1997 to March 1998). If 10% additional funding should be continued, company value would increase by 1.8%.

(This paper has been greatly improved by the introduction of reference papers and suggestions extended by Yukihiro Asano, Head Office Manager, Sumitomo Trust and Banking Co., Ltd. We are very grateful for his cooperation, while acknowledging that all responsibility lies with us.)

Appendix 2: Basic statistics of excess stock return and retirement benefit factors

(%)

	Excess return in the previous fiscal term	Rate of increase in retirement benefit assets	Ratio of retirement benefit assets to equity capital	Ratio of retirement benefit assets to market capitalization	Rate of increase in unrecognized obligation	Ratio of unrecognized obligations to equity capital	Ratio of unrecognized obligations to market capitalization	Rate of increase in under-funded PBOs	Ratio of under-funded PBOs to equity capital	Ratio of under-funded PBOs to market capitalization	Ratio of PBOs to equity capital	Ratio of PBOs to market capitalization	Ratio of cash flow to under-funded PBOs	Ratio of cash flow to PBOs
Mean	-0.6	10.8	22.6	13.5	2.9	4.7	2.7	9.9	14.3	8.6	36.8	22.0	235.5	60.9
Standard deviation	19.2	11.7	14.9	9.8	6.0	5.1	3.0	13.3	15.3	10.5	28.8	19.4	748.7	42.5
FY98 03 mean	-4.6	8.5	27.1	18.1	2.6	6.7	4.3	14.4	22.0	15.4	49.0	33.5	120.3	44.6
Standard deviation	24.7	5.9	19.2	16.5	3.1	5.8	4.4	10.1	23.0	20.5	41.0	36.4	128.9	27.9
FY97 03 Mean	-3.4	10.0	24.8	12.6	2.1	5.8	2.9	11.7	17.8	9.2	42.6	21.8	147.8	49.6
Standard deviation	19.8	5.4	16.1	8.2	4.7	4.7	2.3	11.5	16.5	9.1	31.4	16.8	139.7	23.5
FY96 03 mean	-1.0	18.1	23.9	11.8	7.4	5.6	2.7	23.3	15.7	7.7	39.6	19.5	477.9	52.2
Standard deviation	22.6	26.2	15.4	7.1	8.9	4.9	2.2	20.0	13.6	6.4	27.9	12.9	1695.5	32.1
FY95 03 mean	-0.1	7.4	22.5	15.4	2.1	4.2	2.9	5.5	12.2	8.2	34.7	23.6	209.0	60.7
Standard deviation	10.8	5.1	14.5	9.4	2.8	5.0	3.2	5.0	12.7	7.7	25.8	15.8	386.4	40.4
FY94 03 mean	-0.5	11.6	21.8	11.0	-0.9	3.8	1.9	1.2	11.5	5.8	33.4	16.8	283.1	63.5
Standard deviation	15.0	4.7	13.9	6.7	4.6	5.1	2.3	9.0	12.4	5.7	24.7	11.5	593.0	44.1
FY93 03 mean	5.7	8.0	19.3	12.4	3.4	3.7	2.4	5.8	10.9	6.9	30.2	19.3	243.3	71.7
Standard deviation	22.9	8.9	12.2	7.9	7.1	5.0	2.7	11.9	12.0	6.8	22.5	13.3	451.6	50.5
FY92 03 mean	-0.2	12.3	18.1	13.1	3.3	2.9	2.0	7.0	9.3	6.7	27.4	19.8	161.0	86.4
Standard deviation	14.2	4.5	11.1	8.8	5.6	4.7	2.9	8.1	11.3	7.1	20.5	14.2	586.0	59.7

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Notes:

1. We use 'retirement benefit assets' rather than 'pension assets' since in Japan retirement benefits are more often paid in the form of lump-sum benefits rather than as installment pension payments.

2. Precisely, both assets and liabilities will decrease by a(1-t), where a=contribution, t=tax rate, taking into account the effect of prepaid tax.

3. Even under FAS 87 which requires recognition of ABOs as the minimum liability, there remain unrecognized prior service costs.

4. The March 15, 1995 issue of the *Nikkei Kinyu Shinbun* which reported the situation General Motors was facing at that time.

5. The 26 Japanese companies adopting SEC standards under Clause 2 of Supplement to Consolidated Financial Statements Rule (Ministry of Finance) are:

Nippon Meat Packers, Wacoal, Fuji Photo Film, Komatsu, Kubota, Hitachi, Toshiba, Mitsubishi Electric, Makita, Omron, NEC, Matsushita Electric Industrial, Sony, TDK, Sanyo Electric, Pioneer, Kyocera, Murata Manufacturing, Honda Motor, Canon, Ricoh, Itochu, Marubeni, Mitsui & Co., Mitsubishi Coprporation, and Ito-Yokado. (Note that annual reports are used for Mitsubishi Coprporation as the company shifted to Japanese standards as of the March 1998 term). Tahese companies, 24, excluding Hitachi and Matsushita Electric Industrial which do not report according to FAS 87, were adopted as samples.

6. To adjust for the time before the announcement of business results, we calculated stock returns for a 12-month period ending three months after the end of each term as excess return in this analysis. These returns were dependent variables while retirement benefit factors at the end of each term (the rate of increase was on a year-to-year basis) were explanatory variables. The reason for adopting not absolute return but excess return was to eliminate the effect of market fluctuation. Although it is common to use YTPOIX as representative of the market, we made market-value weighted average total return the benchmark given that the universe in this analysis was a group of 24 companies.

7. In each of the three steps, both explanatory and dependent variables were (by cross section data, i.e. data for each term) standardized so that the mean=0 and standard deviation=1.

8. Attention should be paid to the time-series stability of data in exercising pool regression using the ordinary least squares method. In fact, where the assumption of errors of the ordinary least squares method are not completely met (e.g. existence of the auto-correlation of errors or instability in variance of errors), the robustness of statistical tests is not very strong.

9. For convenience, some of the factors typically employed in multi-factor stock valuation models are selected.

10. This is a factor which often appears in value/growth style classification.

11. Negative values for financial leverage (debt ratio) were probably because the equity market preferred low credit risk companies over the past seven years.

12. As can be seen from the result of *4. 2) Multi-factor regression analysis*, correlation coefficients between variables likely to be significant (ratio of under-funded PBOs to market capitalization, ratio of PBOs to market capitalization, and ratio of cash flow to PBOs) are relatively high. We therefore included only one of the three variables in each regression to avoid the effect of multicollinearity.

13. We believe the results of the analysis here suggests that awareness and understanding of retirement benefit accounting is increasing among investors due to increased press coverage, etc.