Time Series Property of the Value Relevance of Accounting Numbers in Japan [1]

Takashi Yaekura

Assistant Professor, University of Tsukuba, Tokyo

Graduate School of Business Sciences

3-29-1 Otsuka, Bunkyo Tokyo 1120012 JAPAN

Tel: +81-33942-6878 Fax: +81-33942-6829

September 10, 2003

[1]This paper was originally titled as "The Usefulness of Accounting Information and Accounting Big-Bang in Japan." I appreciate insightful suggestions and discussions provided by Yoshitaka Fukui. I also appreciate the inputs provided by the participants of the fifth Kobe Forum (Accounting), especially Hideki Fujii, Masashi Okumura, Kazuyuki Suda, and Hidetoshi Yamaji. The author can be reached at ty57@cornell.edu.

Abstract

This paper examines the long-run relationship of accounting numbers and share prices n Japan. The primary motivation behind this study is the major changes of accounting standards (often called as ”Accounting Big-Bang”) in Japan. This paper tests whether: 1) the relationship between the value of equity and accounting numbers has changed, and 2) the value-relevance of accounting numbers has increased. Another motivation behind this study is the fact that related studies in the U.S. so far provided conflicting evidence over the long-run trend of the change in the usefulness of accounting numbers. Japan provides a unique opportunity for research because the major changes occurred in a short time period.

The first test found that the relationship between the accounting numbers and share prices experienced a structural change during the ’bubble economy era.’ Further analysis showed that the relationship is different before and after the ’bubble.’ The second test suggests that the usefulness of accounting information in Japan has improved recently.

Although the limited availability of the data prohibits us from testing the full effect of the changes in Japanese accounting standards, this study shows that the recent overhaul of accounting standards in Japan is at least partially successful in providing more useful information than before.

1 Introduction

This paper examines two issues related to the possible change in the usefulness of accounting numbers due to the major overhaul of accounting standards in Japan. First, this paper examines whether major changes of accounting standards (so-called Accounting Big-Bang) in Japan affected the usefulness of accounting information. Second, it tests whether the abovementioned change ’improved’ the quality of accounting numbers.

The motivation underlying this study is the mixed results on similar research question reported in the U.S.. In the U.S., it is often criticized that accounting standards are not designed to capture the economic fact of emerging business. Upon such argument, testing whether accounting numbers have lost their relevance over time became a very popular agenda for research. Studies using U.S. data, as reviewed in Section 2, so far provided mixed results over the long-run trend of the change in the usefulness of accounting numbers. For example, Collins et al. (1997), Francis and Schipper (1999), and Ely and Waymire (1999) report that the value relevance of accounting numbers has not declined over time, whereas Brown et al. (1999) and Lev and Zarowin (1999) argue the opposite. It is interesting that these papers do not pay much attention to the fact that U.S. GAAP has been continuously being revised and (hopefully) improved its usefulness over time.

On the other hand, Japan offers a unique situation where major changes of accounting standards occurred in a relatively short time period.[1] This enables us to interpret changes in the relationship between the share prices and accounting numbers are due to the change in accounting rules than the change in overall business environment.

By using statistical tests for a structural change (Chow, 1960), this study shows that the abovementioned relationship had changed at some time between 1987 and 1992, the period often dubbed as ’bubble economy era.’ Further test shows that, before and after the ’bubble,’ the relationship had changed, suggesting the change in accounting standards had affected the relationship. By comparing the value relevance of the accounting numbers, this study offers modest evidence that the accounting numbers gained additional usefulness in Japan in the recent years, possibly by the introduction of new accounting standards.

The remainder of this paper proceeds as follows. Section 2 reviews previous studies. Section 3 describes the data used in this study. Sections 4 and 5 report the

[1]These changes include lease (1993), consolidation and cash flow statement(1997), tax deferral (1998), R and D expense (1998), retirement benefits (1998), financial instruments (1999), and foreign currency exchange (1999). For learning recent development of accounting standards in Japan, refer to Professor Yoshinori Kawamura’s splendid collection of accounting standards and related news translated into English. The URL of his web site is http://www2g.biglobe.ne.jp/~ykawamur/index.htm

results from the first test and second test, respectively. Section 6 concludes this study.

2 Literature Review

Many U.S. researchers are investigating whether accounting numbers have lost their relevance or not over time. Such studies include Brown et al. (1999), Collins et al. (1997), Ely and Waymire (1999), Francis and Schipper (1999), Givoly and Hayn (2000), Lev and Zarowin (1999), Lo and Lys (2000), and Landsman and Maydew (2000).

The common motivation for this impressive list of works is the concern that accounting may have been left behind by the rapidly changing business environment. Because the accounting standards do not change very frequently, it is reasonable to assume that there is a chance that accounting numbers do not fully reflect the economic reality of firm activities. The emergence of 'internet companies' fueled such concern because the business model of Internet companies seemed to be very different from that of traditional companies.

However, the results of these studies are mixed. One of the reasons of this seemingly inconsistent results is that the loss of relevance, if any, should have occurred gradually. This makes it difficult for researches to detect any change even if it had actually occurred.

Gu (2002) argues the common feature of these studies, comparing regression R^2's, is not econometrically sound. His main point is that when the R^2's are not comparable if the dependent variables come from different sample and therefore comparing R^2's across different time periods should not be done. Instead of using R^2's, he recommends comparing residual dispersions, which is equivalent to comparing the 'pricing errors' of valuation models whose multipliers were estimated by regression.

This paper fully shares Gu (2002)'s concern. In examining time-series change of value relevance in Japan, I use residual dispersions as the metric along with traditional R^2's. In addition to these analysis based on regressions, I propose new approach based on simulations. The new approach, discussed in subsection 5.2, does not require valuation multipliers (i.e., regression coefficients) being constant across firms in a given year.

I am not aware of comparable studies to the above using Japanese data[2]This study is the first to examine the long-term change in the usefulness of accounting

[2]Landsman and Maydew (2002) examined change in value relevance in an international context and their analysis included Japan. Because they used Global Vantage as the data source, their sample coverage on Japan (and other countries) was limited in terms of years covered(1987-1999).

numbers in Japan. As was discussed in the previous section, Japanese accounting standards recently experienced a major overhaul in a short period of time. Therefore, detecting any change in the usefulness of accounting numbers will be easier in Japan.

3 Data

The main sources of data used in this study are Nikkei NEEDS (Non-financial) database and PACAP database. The sample firms are the firms that satisfy the following criteria.

1. Firms that were continuously listed in the first section of the Tokyo Stock Exchange between 1976 and 2000.[3]
2. There was no change in fiscal year end during the sample period.
3. Necessary financial statement data is available in Nikkei NEEDS.
4. Share prices are available in PACAP or Pan Rolling.
5. March is the fiscal year end.
6. No negative book value of equity was reported during the sample

[3] Current PACAP database coverage starts from 1975 and ends at 1998. Share prices for the years 1999 and 2000 were obtained from Pan Rolling Database (http://www.panrolling.com). Year 1975 was excluded because many firms used six months as fiscal period until 1975.

period.

This study uses parent-only financial statement data rather than consolidated data for the following reasons. First, the primary financial statements were parent-only for most of the sample period.[4] Second, certain accounting standards(e.g., tax deferral) were adopted in consolidated financial statements before they were (if ever) adopted in parent-only financial statements. Third, the sample size will become much smaller had consolidated financial statements were used.

=====================
Please insert Table 1 about here.
=====================

The final sample consists of 426 firms, which represents roughly 30 percent of the firms listed in the first section of the Tokyo Stock Exchange. Table 1 presents the sample selection of the firms that are used in this study. Among these 426 firms, the following industries share more than 5 percent of the final sample (number of firms in parenthesis); electric(48), construction(46), chemical(42), machinery(39), trading(33), and non-ferrous metal(24).

[4]Consolidated financial statements became the primary financial statements starting fiscal year 2000 in Japan.

=====================
Please insert Table 2 about here.
=====================

Table 2 provides descriptive statistics of the 426 firms selected. All reported numbers are in medians. It is worth mentioning that the median market value of the sample firms (MV in the table) hit its peak in 1990 and three-fourth of MV has been lost since then. At the same time, the total asset (ASSET) and the book value of the equity (BVAL) has changed little. This clearly suggests that the relationship between market value of the firms and accounting numbers has changed in recent years.

4 Tests of Structural Change

As was mentioned in Section 1, this paper conducts two main tests. The first one, discussed in this section, is the test of structural change in the relationship between equity prices and accounting numbers. The second test, to be discussed in the next section, is the test of whether the structural change increased the value relevance of accounting numbers over time.

In testing whether the relationship between equity prices and accounting numbers changed after the implementation of new accounting standards in Japan, Chow test (Chow, 1960) is employed. Because the exact timing of possible structural change is not known *a priori*, Chow tests are conducted by using all possible year as the point of structural change.[5]

Following Ohlson (1995), the following model is used as the basis of Chow test.[6]

$$P_{it} = \alpha_i + \beta_1 BV_{it} + \beta_2 RI_{it} + \varepsilon_i \tag{1}$$

where

P_{it} = Firm i's share price at time t,

BV_{it} = Firm i's book value of equity per share at time t,

RI_{it} = Firm i's residual income for the period t

(= $Net\ Income_{it}$ - $Executive\ Bonus_{it}$ - $\rho * BV_{it}$), and

ρ = Cost of equity.

The underlying assumption (besides the assumptions used in Ohlson (1995)) is that the weight of 'other' information (ν_t in Ohlson (1995)) is constant for each company during the test period and thus captured by the constant (α_i) in equation

[5]CUSUMSQ test (Brown et al., 1975) provided similar result to the ones reported in Panel A of Table 3.

[6]An alternative valuation model which uses the sum of the present values of future stream of residual income (Coopers & Lybrand Academic Advisory Committee, 1997; Yaekura, 2001) was not used in this study because this approach requires reasonably long earnings forecasts, which are not available to many of Japanese firms.

(1).

In addition to the model in equation 1, I use another model which replaces residual income with net income adjusted for executive bonus. The model is;

$$P_{it} = \alpha_i + \beta_1 BV_{it} + \beta_2 (NI_{it} - BN_{it}) + \varepsilon_i \tag{2}$$

where

NI_{it} = Firm i's net income for the period t, and

BN_{it} = Firm i's executive bonus for the period t.

Although this model is not consistent with Ohlson (1995) unless one employs additional assumptions which are restrictive (Lee, 1999), this specification is often used in the literature and I use this model as a compliment.

Following prior studies (Ohta, 2000; Takahashi, 2001), this study uses 10-year yield of Japanese government bond at time t as the proxy for the cost of equity(ρ).[7] Regressions were run using per share numbers.

[7] This study does not use the CAPM and other asset pricing models for estimating the cost of equity capital because the decline of Japanese stock prices for the last ten years makes the use of those models impractical. Having 0.01 yen (per share) as the overall median of estimated residual income (see the bottom right corner of Table 2) suggests the use of government bond yield was not unreasonable.

First, Chow tests which test the null hypothesis of no structural change were conducted by using all 25 years for each firm. Then the significance level of rejecting the null hypothesis was recorded. Panel A of Table 3 summarizes the result.

=====================
Please insert Table 3 about here.
=====================

It is readily seen that the relationship between the equity prices and accounting numbers changed in early 1990's. For example, the null hypothesis that there was no change of the relationship before and after 1992 was rejected for 77 percent of the sample (328 out of 426 firms) at 5 percent level. The median p-value of rejecting the null hypothesis was .001.

The main interest of this study, however, is whether the recent changes in accounting standards in Japan changed the relationship between the equity prices and accounting numbers. In order to test this, I ran another Chow test by using the sample years before and after the bubble economy. The Chow test compared sample years 1976 to 1986 and sample years 1993 to 2000. The result is reported in Panel B of Table 3. The result confirms that the relationship is different between the two samples.

In summary, the Chow tests showed that the relationship between the equity prices and accounting numbers has changed in recent years. The following section examines whether the change resulted in increased value relevance of the accounting numbers.

5 Tests of Value Relevance

In this section, changes (if any) in value relevance of accounting numbers over time are examined. First I apply 'traditional' regression analysis. I compare temporal change of R^2's. In addition, I examine whether residual dispersion has changed or not. The latter tests follows the recommendation by Gu (2002). Second, I conduct simulation analysis.

5.1 Regression Analysis

In this subsection, whether the value relevance of accounting information has increased or not is examined through regression. Regression analysis is based on the valuation model used in the previous section which is replicated below.

$$P_{it} = \alpha_i + \beta_1 BV_{it} + \beta_2 RI_{it} + \varepsilon_i \tag{3}$$

(See notes for equation (1).)

Unlike the analysis in the previous section where regression was run firm by firm, the regression analysis in this section is based on cross-section analysis for each year. As prior literature points out, cross-sectional variance of explanatory variables needs to be addressed. Following prior studies, the following two regressions are used.

$$MVS_{it} = \alpha_i + \beta_1 BVS_{it} + \beta_2 RIS_{it} + \varepsilon_t \tag{4}$$

$$\frac{MVS_{it}}{MVS_{it-1}} = \alpha_i + \beta_1 \frac{BVS_{it}}{MVS_{it-1}} + \beta_2 \frac{RIS_{it}}{MVS_{it-1}} + \varepsilon_t \tag{5}$$

The first model (equation (4)) uses per-share numbers of market value (MVS), book value (BVS), and residual income (RIS) in regression. The result is reported in Table 4. The second model (equation (5)) uses the same variables, but deflated by the share price of the previous years (MVS_{it-1}), as was recommended by Brown et al. (1999). The result is reported in Table 5.

============================
Please insert Tables 4 and 5 about here.
============================

There is no unambiguous trend in R^2 or dispersion of regression residuals

($Resid\ SD$) in either regression results. Regressing these statistics against time (t) confirms this, as shown below.

For regression with undeflated variables,

$$R_t^2 = .5817 - .0033t \tag{6}$$

$$ResidSD_t = 167.38 + 16.36t \tag{7}$$

and for regression with deflated variables,

$$R_t^2 = .1000 - .0017t \tag{8}$$

$$ResidSD_t = .3955 - .0048t. \tag{9}$$

Among the above four coefficients on time (t), only the one in regression (7) was significantly different from zero. One cannot infer whether value relevance of accounting numbers has changes or not from these results.

Possible reason for the failure of regression analysis above is that the valuation model underlying the regression is not compatible with cross-section analysis. This is because the cross sectional regression inevitably assumes that the multipliers to the book value and residual income are constant across firms (or at least the multipliers come from the same probability distribution). It is very clear, however, the valuation model based on Ohlson (1995) requires firm-specific multipliers. Another reason for the failure is that the operationalization of valuation model for regression raised the problem of missing variables.

The following subsection tries to resolve these two problems with regression analysis by using simulation.

5.2 Simulation Analysis

In this subsection, whether the value relevance of accounting information has increased recently is tested through simulation. The valuation model by Ohlson (1995) is used again, but in a different manner. The basic model used in this section is expressed as;

$$P_{it} = BV_{it} + \alpha_1 RI_{it} + \alpha_2 \nu_{it} \tag{10}$$

where ν_{it} = 'Other' information that is not captured by current accounting numbers.

(Other variables were defined in the previous section.)

Ohlson (1995) demonstrates that under the assumption of AR(1) linear information dynamics, the coefficient α_1 in the above equation is equal to $\frac{\omega}{R-\omega}$ where R

is one plus risk free rate (ρ). Although ω is defined as the persistence parameter of residual income in Ohlson (1995), it has been shown to be very difficult to be empirically estimated (Myers, 1999; Takahashi, 2001).

In this study, instead of using historical data for estimation, ω is randomly drawn from uniform distribution (0,1).[8] Then valuation error divided by the share price is calculated by modifying equation (10) as

$$VErr = \frac{P_{it} - BV_{it} - \dfrac{\omega}{1+\rho-\omega} * RI_{it}}{P_{it}}. \tag{11}$$

This procedure was repeated one hundred times for each firm year. The cross sectional median and standard deviation of $VErr$ were calculated for each year across 426 firms. In doing so, bootstrap (Efron, 1982) was used to estimate the cross-sectional median, standard deviation, and their respective 5% confidence intervals from the empirical distribution.[9] Table 6 reports the results of bootstrap.

=====================
Please insert Table 6 about here.
=====================

[8]The inference reported below was not affected by using uniform distribution (0,.8) or uniform distribution(0,.2).

[9]For each year, 426 observations were drawn with repetition and necessary statistics were obtained. This procedure was repeated 1,000 times.

The last three years' median valuation errors were at their lowest in the last twenty-five years. This indicates that the value relevance of accounting numbers has recently improved in Japan.

6 Conclusion

This paper examined two issues. First, whether major changes of accounting standards in Japan changed the relationship between the value of equity and accounting numbers was examined. Second, whether such change increased the usefulness of accounting numbers.

The first test found that the relationship between the accounting numbers and share prices experienced structural change during the 'bubble economy era.' Further analysis showed that the relationship is different before and after the 'bubble.' The second test suggests that the usefulness of accounting information in Japan has recently improved.

Because the most changes in accounting standards had occurred within the last two years, the tests in this study may not have captured the full effect of such changes. Yet, based on the available data, this study shows that the recent overhaul of accounting standards in Japan was at least partially successful in providing more useful information than before.

The simulation approach used in this study can be applied to other valuation models which includes parameters that are difficult to be estimated. Recent valuation studies such as Biddle et al. (2001), Callen and Morel (2000), and Liu and Ohlson (2000) are proposing refinement to the Ohlson (1995) model. These proposed models still contain several parameters that cannot be easily estimated. Simulation would be useful in testing the validity of these models.

References

Biddle, G. C., P. Chen, and G. Zhang (2001) “When Capital Follows Profitability: Non-linear Residual Income Dynamics.” *Review of Accounting Studies.* Vol. 6. No. 2. pp. 229–265.

Brown, R. L., J. Durbin, and J. M. Evans (1975) “Techniques for Testing the Constancy of Regression Relationship over Time.” *Journal of the Royal Statistical Society, Series B.* Vol. 37. pp. 149–192.

Brown, S., K. Lo, and T. Lys (1999) “Use of R^2 in Accounting Research: Measuring Changes in Value Relevance over the Last Four Decades.” *Journal of Accounting and Economics.* Vol. 28. No. 2. pp. 83–115.

Callen, J. L. and M. Morel (2000) “A Lintnerian Linear Accounting Valuation Model.” *Journal of Accounting, Auditing, and Finance.* Vol. 15. No. 3. pp. 301–314.

Chow, G. C. (1960) “Tests for Equality Between Sets of Coefficients in Two Linear Regressions.” *Econometrica.* Vol. 28. No. 3. pp. 591–605.

Collins, D. W., E. L. Maydew, and I. S. Weiss (1997) “Changes in the Value-relevance of Earnings and Book Values over the Past Forty Years.” *Journal of Accounting and Economics.* Vol. 24. No. 1. pp. 39–67.

Coopers & Lybrand Academic Advisory Committee (1997) “Evaluating Financial Reporting Standards.” Working paper Coopers & Lybrand.

Efron, B. (1982) *The Jackknife, the Bootstrap and Other Resampling Plans.* Philadelphia, PA: Society for Industrial and Applied Mathematics.

Ely, K. and G. Waymire (1999) “Accounting Standard-Setting Organizations and Earnings Relevance: Longitudinal Evidence from NYSE Common Stocks, 1927-93.” *Journal of Accounting Research.* Vol. 37. No. 2. pp. 293–317.

Francis, J. and K. Schipper (1999) “Have Financial Statements Lost Their Relevance?” *Journal of Accounting Research.* Vol. 37. No. 2. pp. 319–352.

Givoly, D. and C. Hayn (2000) “The Changing Time-Series Properties of Earnings, Cash Flows and Accruals: Has Financial Reporting Become More Conservative?” *Journal of Accounting and Economics.* Vol. 29. No. 3. pp. 287–320.

Gu, Z. (2002) “Cross-Sample Incomparability of R^2s and Additional Evidence on Value Relevance Changes Over Time.” Working paper Carnegie Mellon University.

Landsman, W. R. and E. L. Maydew (2000) “Beaver (1968) Revisited: Has the Information Content of Annual Earnings Announcements Declined in the Past Three Decades?” Working paper. University of North Calorina.

Landsman, W. R. and E. L. Maydew (2002) “Has the Information Content of Quarterly Earnings Announcements Declined in the Past Three Decades?” *Journal of Accounting Research.* Vol. 40. No. 3. pp. 797–808.

Lee, C. M. C. (1999) “Accounting-Based Valuation: Impact on Business Practices and Research.” *Accounting Horizons.* Vol. 13. No. 4. pp. 413–25.

Lev, B. and P. Zarowin (1999) “The Boundaries of Financial Reporting and How to Extend Them.” *Journal of Accounting Research.* Vol. 37. No. 2. pp. 353–385.

Liu, J. and J. A. Ohlson (2000) “The Feltham-Ohlson (1995) Model: Empirical Implications.” *Journal of Accounting, Auditing, and Finance.* Vol. 15. No. 3. pp. 321–331.

Lo, K. and T. Z. Lys (2000) “Bridging the Gap Between Value Relevance and Information Content.” Working paper. University of British Columbia and Northwestern University.

Myers, J. N. (1999) “Implementing Residual Income Valuation with Linear Information Dynamics.” *The Accounting Review.* Vol. 74. No. 1. pp. 1–28.

Ohlson, J. A. (1995) “Earnings, Book Values, and Dividends in Equity Valuation.” *Contemporary Accounting Research.* Vol. 11. No. 2. pp. 661–87.

Ohta, K. (2000) “Valuation of a Firm by the Ohlson Model.” *Security Analysts Journal.* Vol. 38. No. 4. pp. 62–75.

Takahashi, M. (2001) “Accounting Information and Valuation Model.” *Kaikei.* Vol. 159. No. 5. pp. 797–809.

Yaekura, T. (2001) “Accounting Standard Setting and Accounting-Based Valuation Models.” *Kaikei.* Vol. 160. No. 2. pp. 55–61.

Table 1: Sample Selection

Number of firm-years available in Nikkei NEEDS	86936
Not listed in the TSE 1st section	-36341
Firm-Year before 1976	-18755
Accounting information missing in at least one year	-5893
Share price missing in at least one year	-4337
At least one change of fiscal year end	-8210
March is not the fiscal year end	-2325
At least one negative book value of equity reported	-425
Total firm-years used	10650
(Number of firms = 10650/25 = 426)	

Table 2: Descriptive Statistics

Year	ASSET	MVAL	BVAL	SALES	NI	BN	GR	EP	BM	RE	RI
1976	39985	15984	8094	41680	552	20	NA	.04	.59	.07	-1.70
1977	42810	18491	8797	46628	647	22	.04	.04	.52	.08	-1.21
1978	43792	19131	9607	50919	613	23	.04	.03	.51	.07	0.92
1979	46127	25473	10580	53598	825	27	.07	.04	.44	.08	0.77
1980	50241	24088	11666	61022	1113	30	.09	.05	.51	.10	-0.48
1981	53357	27995	13365	70461	1111	33	.09	.04	.50	.08	1.09
1982	56028	26724	15158	71408	1163	35	.07	.04	.58	.07	-0.33
1983	58212	30483	16315	72505	1029	30	.06	.03	.56	.07	-1.69
1984	64311	43097	17672	76457	1094	34	.05	.03	.45	.06	-1.25
1985	71008	48283	19780	88099	1400	38	.07	.03	.42	.07	-0.09
1986	73477	61608	21100	85236	1171	33	.05	.02	.35	.06	2.92
1987	75925	62384	22166	78921	1037	31	.04	.02	.33	.05	1.14
1988	80672	97399	25688	86164	1390	40	.09	.01	.25	.06	2.40
1989	92193	127456	30600	96929	1968	45	.11	.02	.23	.07	3.85
1990	103482	146982	37665	104240	2399	53	.14	.02	.26	.06	-1.95
1991	115327	127175	40037	117537	2372	55	.06	.02	.33	.06	-0.58
1992	116005	86291	41551	120798	1928	54	.03	.02	.48	.05	-2.11
1993	115036	84730	42250	115325	1439	48	.01	.02	.50	.03	-3.96
1994	117871	90348	44683	111124	1065	40	.01	.01	.47	.03	-4.95
1995	119059	76156	45328	112402	1180	40	.01	.02	.58	.03	-2.73
1996	121928	96102	46178	114435	1497	40	.02	.01	.46	.03	0.20
1997	125024	63179	47428	122237	1758	45	.02	.02	.61	.04	3.73
1998	128369	49024	47743	120973	1251	39	.01	.02	.82	.03	3.69
1999	126278	41884	45584	111878	542	17	.00	.01	.87	.02	0.20
2000	126095	37866	45007	107102	583	16	.02	.01	.97	.02	0.23
Pooled	82917	52342	25012	86217	1168	35	.04	.02	.47	.05	0.01

Table 2 (cont.)

Definition of Variables

ASSET: Total asset as of fiscal year end (in MM Yen)

MVAL: Market capitalization as of fiscal year end (in MM Yen)

BVAL: Book value of equity as of fiscal year end (in MM Yen)

SALES: Sales for the year (in MM Yen)

NI: Net Income for the year (in MM Yen)

BN: Executive bonus paid out of net income (in MM Yen)

GR: Growth of BKVAL

EP: Earnings-to-Price ratio

BM: Book-to-Market ratio

RE: Return on equity

RI: Residual income (discussed in Section 4) (in Yen/Share)

The sample size is 426 for each year and 10,650 for the pooled sample. All reported numbers are the medians of the respective statistics for the year.

Table 3: Result of Chow Tests

Panel A: Analysis using all 25 years

	RI			NI-BN		
Cutoff	Mean	Median	obs.	Mean	Median	obs.
1979	0.748	0.828	7	0.740	0.832	8
1980	0.678	0.737	12	0.665	0.742	15
1981	0.591	0.644	17	0.561	0.611	25
1982	0.495	0.512	29	0.456	0.467	47
1983	0.374	0.324	64	0.325	0.253	97
1984	0.284	0.187	120	0.234	0.117	149
1985	0.233	0.103	166	0.198	0.065	193
1986	0.185	0.046	221	0.154	0.025	245
1987	0.152	0.022	259	0.133	0.013	265
1988	0.125	0.007	292	0.110	0.005	295
1989	0.119	0.006	297	0.108	0.006	298
1990	0.110	0.005	296	0.111	0.007	287
1991	0.088	0.002	317	0.103	0.007	302
1992	0.076	0.001	328	0.101	0.006	304
1993	0.103	0.008	290	0.149	0.032	243
1994	0.130	0.021	261	0.191	0.063	203
1995	0.144	0.026	249	0.215	0.077	183
1996	0.176	0.053	209	0.247	0.118	153
1997	0.182	0.064	200	0.248	0.130	153
1998	0.248	0.141	138	0.309	0.218	105

Panel B: Analysis excluding 1987-92

RI			NI		
Mean	Median	obs.	Mean	Median	obs.
0.153	0.031	240	0.168	0.053	206

Note to Table 3

For each year, Chow tests were conducted on each firm in the sample (426 tests). The columns under RI are the results using residual income as explanatory variable along with book value of equity. The columns under NI-BN are the results using net income adjusted for executive bonus and book value of the equity. Cutoff denotes the first year in the second group. For example, the first row demonstrates the result using 1976-78 as the first group and 1979-2000 as the second. Means and medians denote respective statistics of the probability that the hypothesis of no structural change can be rejected. The column obs. reports the number of sample firms whose hypothesis of no structural change was rejected at 5% level. Panel A used all 25 years in the analysis whereas Panel B used 1976-1986 and 1993-2000 as the first and second group, respectively.

Table 4: Regression Analysis(undeflated)

Year	constant (s.d.)	BVS (s.d.)	RIS (s.d.)	R^2	Resid SD	MVS Mean
1976	4.26	1.86	3.69	0.66	153.75	277.59
	(49.41)	(0.37)	(1.31)			
1977	56.07	1.65	5.92	0.77	119.06	310.15
	(20.00)	(0.15)	(1.47)			
1978	43.92	1.75	4.49	0.72	145.27	332.08
	(34.26)	(0.24)	(1.15)			
1979	96.81	1.72	4.64	0.67	169.78	402.35
	(29.84)	(0.19)	(0.97)			
1980	132.61	1.22	3.62	0.51	172.26	359.03
	(32.52)	(0.18)	(1.19)			
1981	105.78	1.37	7.37	0.64	186.98	404.69
	(33.26)	(0.18)	(1.70)			
1982	106.19	1.23	2.46	0.54	180.17	364.77
	(28.71)	(0.15)	(1.39)			
1983	83.02	1.55	5.34	0.57	226.69	407.35
	(53.21)	(0.27)	(1.73)			
1984	118.24	2.18	13.41	0.52	443.65	610.21
	(41.60)	(0.19)	(3.30)			
1985	91.92	2.24	0.53	0.35	528.44	640.15
	(52.66)	(0.28)	(2.78)			
1986	259.79	1.94	2.92	0.34	505.72	763.12
	(42.07)	(0.22)	(2.49)			
1987	346.77	1.92	5.95	0.27	640.36	864.86
	(63.02)	(0.27)	(2.64)			
1988	468.14	2.26	7.70	0.43	564.57	1136.42
	(59.66)	(0.25)	(2.82)			
1989	880.60	1.30	4.78	0.25	523.29	1317.52
	(52.17)	(0.15)	(1.99)			
1990	673.23	2.12	7.32	0.40	613.62	1421.50
	(79.73)	(0.21)	(3.02)			
1991	491.80	1.85	7.90	0.54	461.19	1195.36
	(53.74)	(0.15)	(1.84)			

Table 4: (continued)

Year	constant (s.d.)	BVS (s.d.)	RIS (s.d.)	R^2	Resid SD	MVS Mean
1992	323.22	1.35	5.00	0.58	328.42	841.18
	(31.10)	(0.08)	(1.28)			
1993	302.85	1.33	5.11	0.63	308.18	804.05
	(37.12)	(0.09)	(0.82)			
1994	289.24	1.50	4.11	0.63	347.82	861.06
	(70.39)	(0.18)	(0.83)			
1995	174.27	1.34	1.96	0.68	276.79	708.55
	(68.86)	(0.18)	(0.81)			
1996	311.24	1.41	2.94	0.61	373.37	902.44
	(61.32)	(0.15)	(1.14)			
1997	174.70	1.18	6.85	0.60	386.63	712.47
	(57.56)	(0.13)	(1.61)			
1998	24.98	1.29	5.64	0.58	427.94	595.39
	(60.12)	(0.15)	(1.55)			
1999	26.04	1.33	2.68	0.54	458.70	564.09
	(54.38)	(0.14)	(0.89)			
2000	-116.66	1.94	8.45	0.45	959.47	668.33
	(228.20)	(0.57)	(2.37)			

Table 5: Regression Analysis(deflated)

Year	Constant (s.d.)	BVSdef (s.d.)	RISdef (s.d.)	R^2	Resid SD	MVSdef Mean
1977	0.79	0.63	1.29	0.21	0.33	1.15
	(0.07)	(0.12)	(0.52)			
1978	0.84	0.47	1.16	0.16	0.28	1.09
	(0.04)	(0.07)	(0.30)			
1979	1.03	0.52	1.71	0.08	0.46	1.32
	(0.08)	(0.13)	(0.67)			
1980	0.84	0.29	0.56	0.02	0.35	0.97
	(0.06)	(0.11)	(0.50)			
1981	0.92	0.33	2.27	0.14	0.29	1.12
	(0.04)	(0.07)	(0.58)			
1982	0.88	0.11	0.00	0.01	0.27	0.94
	(0.04)	(0.06)	(0.43)			
1983	1.10	0.00	0.29	0.00	0.26	1.1
	(0.04)	(0.05)	(0.44)			
1984	1.44	0.02	3.59	0.06	0.60	1.42
	(0.09)	(0.13)	(0.67)			
1985	1.08	0.17	-0.49	0.01	0.43	1.17
	(0.05)	(0.09)	(0.40)			
1986	0.97	0.85	1.55	0.12	0.58	1.37
	(0.06)	(0.12)	(0.81)			
1987	1.17	0.01	0.22	0.00	0.43	1.17
	(0.05)	(0.10)	(0.64)			
1988	1.08	1.02	3.67	0.14	0.56	1.49
	(0.06)	(0.15)	(1.26)			
1989	1.31	0.08	-3.45	0.01	0.49	1.31
	(0.08)	(0.20)	(2.56)			
1990	0.79	1.11	6.10	0.19	0.30	1.09
	(0.04)	(0.12)	(1.99)			
1991	0.73	0.44	1.93	0.10	0.16	0.85
	(0.02)	(0.07)	(0.80)			

Table 5: (continued)

Year	Constant (s.d.)	BVSdef (s.d.)	RISdef (s.d.)	R^2	Resid SD	MVSdef Mean
1992	0.64	0.23	1.74	0.08	0.15	0.71
	(0.02)	(0.05)	(0.41)			
1993	0.85	0.25	0.59	0.08	0.17	0.96
	(0.02)	(0.05)	(0.24)			
1994	0.95	0.28	0.07	0.07	0.20	1.09
	(0.03)	(0.05)	(0.32)			
1995	0.74	0.21	0.37	0.13	0.11	0.83
	(0.02)	(0.03)	(0.05)			
1996	1.26	0.08	0.22	0.00	0.31	1.31
	(0.04)	(0.08)	(0.25)			
1997	0.65	0.21	2.23	0.16	0.18	0.76
	(0.02)	(0.04)	(0.46)			
1998	0.82	-0.06	1.23	0.08	0.22	0.77
	(0.03)	(0.03)	(0.26)			
1999	0.93	-0.01	0.15	0.01	0.31	0.92
	(0.03)	(0.03)	(0.09)			
2000	1.15	-0.07	0.46	0.02	0.62	1.06
	(0.05)	(0.03)	(0.09)			

Table 6: Valuation Errors by Simulation

		5% CI			5% CI	
Year	Median	low	high	S.D.	low	high
1976	0.44	0.33	0.55	0.27	0.12	0.53
1977	0.49	0.38	0.58	0.23	0.11	0.45
1978	0.49	0.39	0.58	0.23	0.12	0.41
1979	0.56	0.47	0.64	0.17	0.10	0.24
1980	0.49	0.36	0.61	0.21	0.13	0.28
1981	0.49	0.37	0.61	0.21	0.12	0.33
1982	0.42	0.30	0.56	0.25	0.15	0.37
1983	0.46	0.32	0.58	0.25	0.15	0.36
1984	0.56	0.42	0.69	0.23	0.14	0.32
1985	0.58	0.43	0.68	0.24	0.13	0.45
1986	0.63	0.53	0.73	0.19	0.11	0.30
1987	0.67	0.54	0.78	0.21	0.12	0.31
1988	0.74	0.66	0.81	0.13	0.08	0.19
1989	0.76	0.68	0.83	0.12	0.08	0.16
1990	0.74	0.68	0.81	0.11	0.07	0.15
1991	0.67	0.60	0.76	0.13	0.09	0.18
1992	0.53	0.43	0.66	0.21	0.13	0.32
1993	0.52	0.40	0.64	0.21	0.13	0.29
1994	0.55	0.44	0.67	0.19	0.11	0.27
1995	0.44	0.33	0.56	0.30	0.13	0.92
1996	0.54	0.44	0.65	0.21	0.12	0.34
1997	0.37	0.20	0.53	0.28	0.17	0.40
1998	0.18	-0.09	0.40	0.50	0.27	0.84
1999	0.22	-0.12	0.49	0.90	0.34	2.42
2000	0.14	-0.36	0.49	1.05	0.44	2.01

Note to Table 6

For each firm year, the valuation error ($VErr$)was calculated as;

$$VErr = \frac{P_{it} - BV_{it} - \dfrac{\omega}{1 + \rho - \omega} * RI_{it}}{P_{it}}$$

where ω was randomly drawn from uniform distribution (0,1).

This was repeated one hundred times for each firm year. Then the median and the standard deviation of $VErr$ was calculated for each firm year. By using bootstrap, the cross-sectional median, the standard deviation, and their respective 5% confidence intervals were estimated for each year. Median, S.D., and associated 5% CI's in the above table report the results.